



AMERICAN SOCIETY OF  
OPHTHALMIC PLASTIC &  
RECONSTRUCTIVE SURGERY  
OCULOFACIAL PLASTIC SURGERY®

# CHICAGO

ASOPRS 49<sup>TH</sup> ANNUAL FALL SCIENTIFIC SYMPOSIUM

HILTON CHICAGO • OCTOBER 25-26, 2018

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# SYLLABUS

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The purpose of the American Society of Ophthalmic Plastic and Reconstructive Surgery's Continuing Medical Education (CME) program is to present oculo-facial plastic surgeons with the highest quality learning opportunities in the areas of aesthetics, eyelid, lacrimal, and orbital diseases that promote positive change in physician performance or competence, thus enabling such physicians to maintain or improve the knowledge, skills, and professional performance needed to provide the best possible care for their patients.

Ongoing assessment of the impact of the CME program is important in determining modifications to existing activities and the development of new activities. Specific expected results include increased knowledge across the ASOPRS community, a desire among practicing ophthalmologists to pursue lifelong learning, the refinement of already employed techniques or skills, and the application of new techniques or skills for the improvement of practice and patient care.

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7 - 8 am

Moderators: Jill Melicher-Larson, MD and Behin Barahimi, MD

7 - 7:04 am

## Evaluation of the Lacrimal Sac Using Ultrasound Biomicroscopy

Mai Takagi<sup>1,2</sup>, Masashi Mimura<sup>1,2</sup>, Tsunehiko Ikeda<sup>3</sup>, Bobby Korn<sup>4,5</sup>, Don Kikkawa<sup>4,5</sup>

*<sup>1</sup>Department of Ophthalmology, Osaka Medical College, Osaka, Japan, <sup>2</sup>Department of Ophthalmology, Kaisei Hospital, Osaka, Japan, <sup>3</sup>Department of Ophthalmology, Kaiser Hospital, Osaka, Japan, <sup>4</sup>UC San Diego Department of Ophthalmology, Division of Oculofacial Plastic and Reconstructive Surgery, La Jolla, California, United States of America, <sup>5</sup>Division of Plastic Surgery, UC San Diego, La Jolla, California, United States of America*

**Introduction:** To evaluate lacrimal sac (LS) size and physiological movement using ultrasound biomicroscopy.

**Methods:** This is an interventional observational study of normal sixteen subjects. All subjects underwent evaluation of lacrimal sac using ultrasound biomicroscope. The maximum horizontal diameter of deflated LS, inflated LS by injecting hydroxyethyl cellulose, and coefficient of the inflation of LS calculated from the values were measured as outcome. Statistical analysis using t-test and Spearman's correlation analysis were performed to evaluate the relationship between the outcomes and variables as age, gender, and height.

**Results:** 16 patients including 10 males and 6 females were studied. Average age was  $33.2 \pm 6.4$  years old. Average diameter of inflated and deflated LS was  $1.76 \pm 0.27$ mm and  $1.94 \pm 0.33$ mm. Average coefficient of inflation was  $9.96 \pm 10.2\%$ . Age and the diameters of lacrimal sac tend to correlate negatively (deflated LS:  $R = -0.27$ ,  $P = 0.16$ ; inflated LS:  $R = -0.35$ ,  $P = 0.05$ ). The diameter of LS was significantly larger in males (Average diameter of deflated and inflated LS: 1.90mm and 2.12mm) than in females (Average diameter of deflated and inflated LS: 1.62mm and 1.76mm) ( $P = 0.001$ ). The diameter of LS was also significantly larger in taller subject (deflated LS:  $R = 0.58$ ,  $P = 0.0005$ ; inflated LS:  $R = 0.63$ ,  $P < 0.0001$ ).

**Conclusions:** The UD-8000 is a novel device to study the lacrimal drainage system. The lacrimal diameter tends to be smaller as patients age and is larger in males and taller patients. These findings have implications for lacrimal surgery.

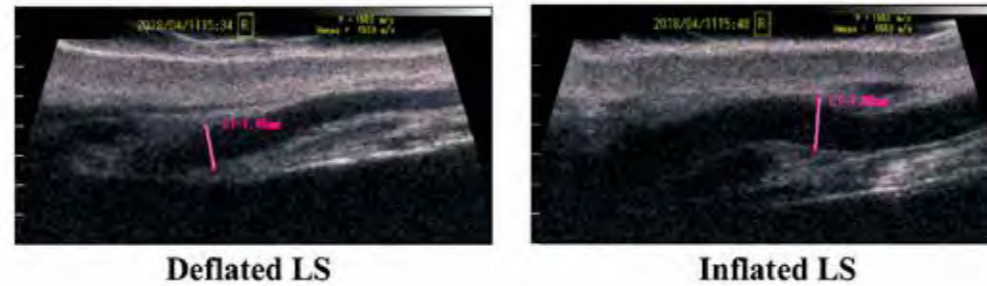
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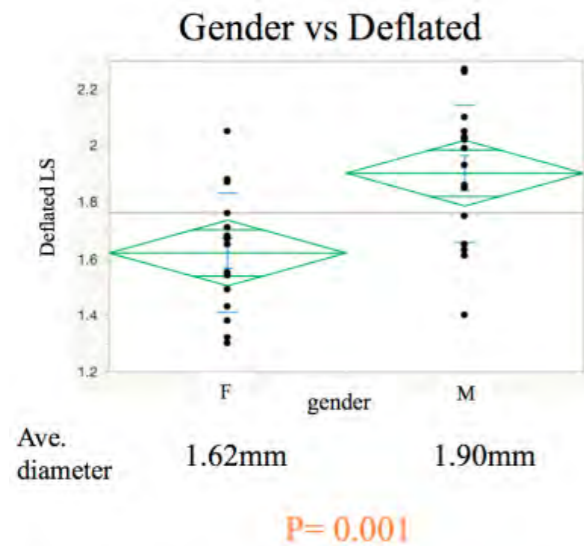
**Figure 1**



**Figure 2**



**Figure 3**



**References:**

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2. Hurwitz JJ. Proximal canicular imaging utilizing ultrasound biomicroscopy B: Canaliculitis. Orbit. 1998 Mar;17(1):31-36.
3. Hai Tao et al. Diagnosis of lacrimal canicular disease using ultrasound biomicroscopy : a preliminary study Int J Ophthalmol. 2014 Aug 18;7(4):659-62.

7:04 - 7:08 am

## Lichenoid Dermatitis Erupting after Excision of Basal Cell Carcinoma

Sruti Akella, Anne Barmettler

*Ophthalmology, Albert Einstein College of Medicine Montefiore Medical Center, Bronx, New York, United States of America*

**Introduction:** To present the first known case of lichenoid dermatitis erupting after excision of basal cell carcinoma (BCC) on the upper eyelid and to highlight a positive immune response to excision.

**Methods:** A case report.

**Results:** An 81-year-old African American female with a past medical history of hypertension presented with a lesion of the right upper eyelid for the past 5 months (Figure 1). Biopsy was consistent with a diagnosis of basal cell carcinoma (Figure 2). Mohs surgery and flap reconstruction followed (Figure 3) and three months postoperatively, she presented for routine follow-up and was found to have elevated hyperpigmented lesions over the area of the flap (Figure 4). Repeat biopsy showed an eruption of lichenoid dermatitis without evidence of BCC (Figure 5).

**Conclusions:** Lichenoid dermatitis refers to a group of histologic findings localized to the interface between dermis and epidermis, characterized by a band-like lymphocytic infiltration. This can be a result of superficial infiltrate, like lichenoid drug eruption, or deeper infiltrate, like lichenoid lupus erythematosus. Lichenoid dermatitis can appear clinically as a solitary or multiple lesions with each lesion being described as sharply demarcated, erythematous, violaceous, tan or brown papules or plaques. On the trunk of the body, these lesions have been described to represent a regressing BCC. In the patient presented herein, excision of the eyelid BCC likely induced an inflammatory response in surrounding tissue which presented clinically as a dermatitis. If this eruption is present, it warrants a closer look at multiple deeper pathology sections, as this inflammatory response can mask a small remaining islet of BCC. To the authors' knowledge, this is the first report of lichenoid dermatitis erupting in response to BCC on the eyelid.

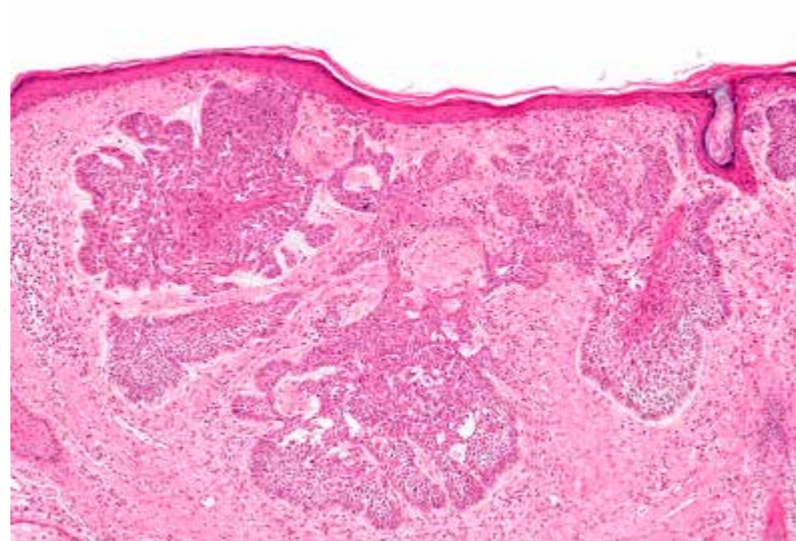
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**Figure 1**



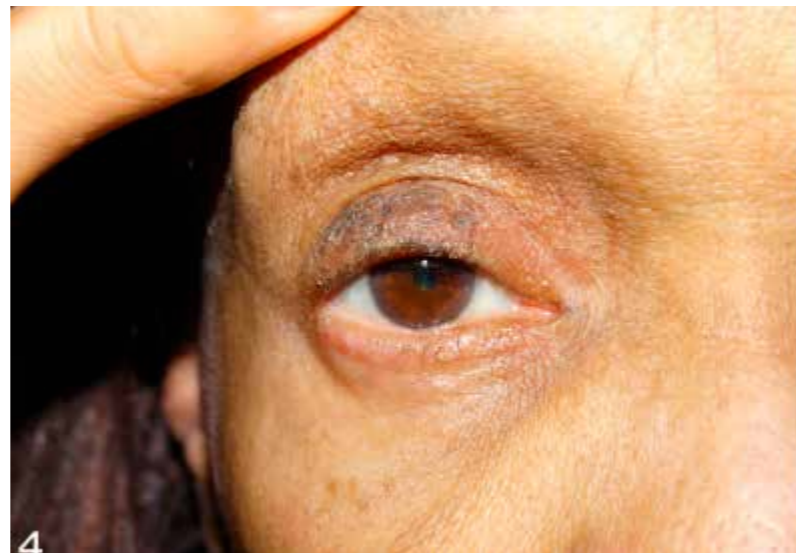
**Figure 2**



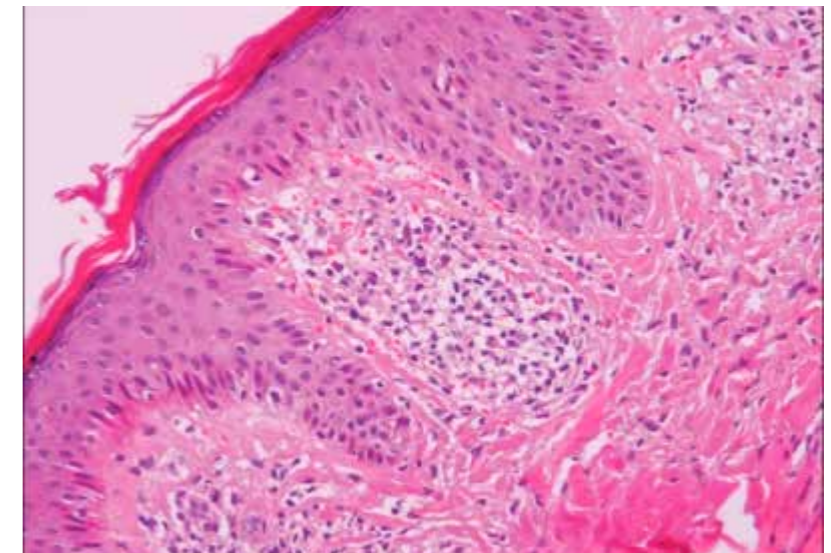
**Figure 3**



**Figure 4**



**Figure 5**



**References:**

1. Fosko SW, Chu MB, Mattox AR, et al. Lichenoid reaction as a potential immune response marker of intratreatment histological response during successful vismodegib treatment for a giant basal cell carcinoma. *Dermatol Ther* 2015; 28(6):359-62.
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3. Spencer JM, Tannenbaum A, Sloan L, Amonette RA. Does inflammation contribute to the eradication of basal cell carcinoma following curettage and electrodesiccation? *Dermatol Surg* 1997; 23(8):625-30.
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7:08 - 7:12 am

## A Rare Case of Eyelid Sebaceous Cell Carcinoma Leading to a Diagnosis of Hereditary Non-Polyposis Colorectal Cancer

Suzanne van Landingham, Cat Burkat

*Department of Ophthalmology and Visual Sciences, University of Wisconsin-Madison, Madison, Wisconsin, United States of America*

**Introduction:** A case of sebaceous cell carcinoma leading to a diagnosis of hereditary non-polyposis colorectal cancer (HNPCC, or Lynch syndrome) is reported, and screening recommendations are reviewed.

**Methods:** Case report.

**Results:** A 45-year-old male former smoker with past medical history of asthma presented with a recurrent "skin tag" of the left lower eyelid. He reported that the lesion had been removed twice before, and he had been told that it was benign. He described it as itchy and irritated, and occasionally noticeable in his visual field. He denied bleeding or ulceration. Examination revealed a 4x3 millimeter papillomatous, red, scaly lesion within the lash line of the lateral lower eyelid. Excisional biopsy was performed, revealing sebaceous cell carcinoma. He underwent Mohs surgery and reconstruction of the 8x6 millimeter defect with canthotomy-cantholysis and margin reapproximation. Microsatellite instability testing of the specimen was normal; immunohistochemistry revealed loss of DNA mismatch repair proteins MSH2 and MSH6. He was referred for genetic counselling. Based these findings and a maternal family history of multiple relatives with colorectal, endometrial, and skin cancers, he was diagnosed with clinical HNPCC. Genetic testing revealed a c.1226-1227 deletion in the MSH2 gene, consistent with HNPCC. He began receiving yearly screening colonoscopies, which identified several adenomatous polyps and no carcinoma. He presented again to the oculoplastics clinic 3 years later with a 2.5x2 millimeter elevated, yellow, round lesion at the eyelid margin of the right lower eyelid margin, similar in appearance to an inspissated Meibomian gland (**Figure 1** a: eyelid in physiologic position, b: manually distracted). The lesion was biopsied and found to be sebaceous cell carcinoma. Mohs surgery followed by eyelid reconstruction is planned.

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**Conclusions:** Sebaceous cell carcinoma is known to be associated with HNPCC, and cases of sebaceous cell carcinoma of the eyelid associated with HNPCC have been reported before. For example, Gaskin et al reported 31 patients with eyelid sebaceous cell carcinoma, of whom 9 had a clinical diagnosis of Muir-Torre syndrome (a type of HNPCC).<sup>1</sup> 8 of these patients already had a diagnosis of visceral malignancy at the time of presentation; one received the diagnosis of HNPCC after he later developed a visceral malignancy. Other authors report that eyelid sebaceous cell carcinoma is only rarely associated with HNPCC.<sup>2</sup> To our knowledge, there have been no other reports of isolated sebaceous cell carcinoma of the eyelid leading to the diagnosis of HNPCC. Consecutive eyelid sebaceous cell carcinomas without other malignancies is also an unusual feature. This case highlights the importance of taking a family history and performing thorough immunohistochemical testing of sebaceous cell carcinoma specimens in order to diagnose patients with HNPCC, as screening these patients regularly for malignancies may be life-saving.

**Figure 1**



**References:**

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7:12 - 7:16 am

## Merkel Cell Carcinoma of the Eyelid after Solid Organ Transplantation

Victoria North<sup>1,2</sup>, Larissa Habib<sup>1,2</sup>, Michael Yoon<sup>1,2</sup>

<sup>1</sup>Ophthalmic Plastic Surgery, Massachusetts Eye and Ear Infirmary, Boston, Massachusetts, United States of America, <sup>2</sup>Department of Ophthalmology, Harvard Medical School, Boston, Massachusetts, United States of America

**Introduction:** Although eyelid Merkel cell carcinoma (MCC) has been described in patients immunosuppressed with HIV and forms of leukemia,<sup>1-2</sup> it has never been described in patients with solid organ transplant recipients. The clinical features, histopathologic findings, and clinical courses of two cases are reported.

**Methods:** A retrospective review of the clinical records of two patients with eyelid MCC treated by a single surgeon (MKY) between 2012 and 2017 is reported. A literature review using the keywords "Merkel cell carcinoma" and "eyelid" was performed using PubMed.

**Results:** Two male patients (ages 63 and 68) were diagnosed with eyelid MCC. Both patients were on immunosuppressive therapy for renal transplants: the first was treated with mycophenolate mofetil and tacrolimus for a transplant one year prior to MCC diagnosis, the second was taking azathioprine and tacrolimus for a transplant 19 years prior to diagnosis. Primary tumor sites were the right upper eyelid (Fig. 1) and the left upper eyelid (Fig. 2), respectively. Both biopsy specimens demonstrated neuroendocrine marker positivity, supportive of a diagnosis of MCC. The first patient underwent wide local excision and sentinel lymph node biopsy (SLNB) that was negative, followed by adjuvant radiation therapy. He initially remained disease-free, but two years after diagnosis was found to have widely metastatic disease and died shortly thereafter from complications of abdominal metastases. The second patient underwent wide local excision and eyelid reconstruction with a Cutler-Beard flap. Radiotherapy was initially deferred, but follow up PET-CT demonstrated parotid lymph node metastasis. Adjuvant radiation therapy was initiated, but he died from a myocardial infarction before treatment was complete.

**Conclusions:** MCC is a rare, aggressive tumor of neuroendocrine origin that most frequently occurs on the sun-exposed skin of older, white patients. This is the first case of eyelid MCC in solid organ transplant recipients. Immunosuppressive medications act synergistically with UV-associated DNA damage to promote malignant transformation.<sup>3</sup> Standard treatment of eyelid MCC includes wide-local excision, sentinel lymph node biopsy, and adjuvant radiotherapy where appropriate. As demonstrated by these cases, prognosis is poor, and immunosuppressed individuals tend to have worse outcomes.<sup>4</sup>

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**Figure 1**



**Figure 2**



**References:**

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2. Sinclair N, Mireskandari K, Forbes J, Crow J. Merkel cell carcinoma of the eyelid in association with chronic lymphocytic leukaemia. *Br J Ophthalmol*. 2003;87(2):240.
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7:16 - 7:20 am

## Refractory Follicular Conjunctival Lesions: Overlook as Just Inflammation or Not?

Ji-Hyun Kim<sup>1</sup>, Suk-Woo Yang<sup>1</sup>, Su-Kyung Jung<sup>2</sup>, Ji-Sun Paik<sup>1</sup>

<sup>1</sup>Ophthalmology, Seoul St. Mary's Hospital, College of Medicine, Catholic University of Korea, Seoul, South Korea, <sup>2</sup>Ophthalmology, Eye clinic, Hospital, National Cancer Center, Gyeonggi-do, South Korea

**Introduction:** To report the clinical manifestations of 199 patients of suspected conjunctival lymphoma, the associations between these features and the pathological diagnoses, and the prognosis of conjunctival lesions during long-term follow-up.

**Methods:** We conducted a retrospective chart review of 199 patients who underwent conjunctival biopsy on suspicion of conjunctival lymphoproliferative disease between January 2008 and June 2015. We focused on slit-lamp findings in the conjunctiva and the pathological diagnoses.

**Results:** In total, 261 specimens of 199 patients were included in this study. The median patient age was 42 years (range, 16-87 years), and patients over 60 years of age constituted 17.1% of all patients. The proportion finally diagnosed with MALT lymphomas was 58.2%. In these patients, the most common slit-lamp findings were the "salmon patch" appearance (73.7%), followed by a follicular appearance (14.5%), and a nodular or subconjunctival mass (6.6%). Bilateral ocular manifestations were more common in patients with disease with the follicular appearance, as compared to patients with the salmon-patch appearance.

**Conclusions:** Conjunctival MALT lymphoma presents in various ways, not only with the salmon-patch appearance. Therefore, biopsy should be considered if suspicion is raised, even though the conjunctival lesion does not exhibit the typical appearance of MALT lymphoma. In cases of follicular lesions responding poorly to topical steroids, a conjunctival MALT lymphoma may be suspected, given that chronic inflammation may precede neoplasia in extranodal marginal zone lymphoma (EMZL) patients.

### References:

1. Kirkegaard MM, Coupland SE, Prause JU, Heegaard S. Malignant lymphoma of the conjunctiva. *Surv Ophthalmol*. 2015;60:444-458.
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7:20 - 7:24 am

## Bilateral Poorly Differentiated Adenocarcinoma of the Lacrimal Gland Treated with Pembrolizumab

Ann Q. Tran, Catherine J. Choi, Zakeya M. Al-Sadah, Xiao Yi Zhou, Sander R. Dubovy, Bradford W. Lee  
*Bascom Palmer Eye Institute/University of Miami, Miami, Florida, United States of America*

**Introduction:** Primary adenocarcinoma of the lacrimal gland is a rare tumor accounting for 10% of malignant epithelial lacrimal gland tumors.<sup>1</sup> Few cases have been reported, and among these, primary ductal adenocarcinoma is the most common.<sup>2-3</sup> We present a rare subtype of poorly differentiated primary adenocarcinoma of the lacrimal gland with bilateral sequential involvement without detectable extension across the midline.

**Methods:** Case Report

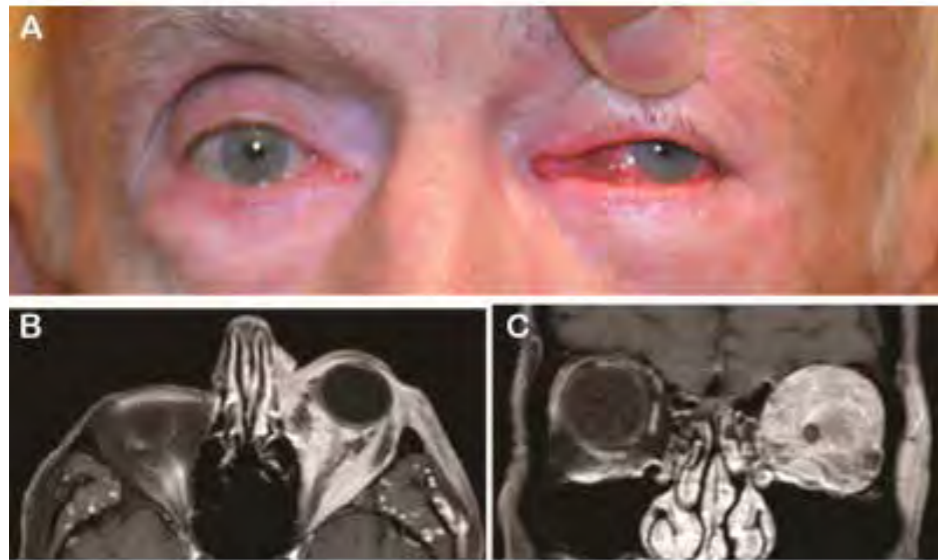
**Results:** An 85 year-old-male presented with a six-month history of left proptosis and ophthalmoplegia without pain or facial paresthesia (Figure 1 A). Gadolinium-enhanced magnetic resonance imaging (MRI) revealed an extensive tumor involving the intraconal and extraconal space extending to the optic foramen and involving the left frontal scalp, cheek and nasal bridge. There was no detectable spread to the cavernous sinus or adjacent paranasal sinuses (Figure 1B/C). An incisional biopsy showed adenocarcinoma with positive staining for cytokeratin, CK7, gata 3, p63, and E-cadherin and negative for SOX 10, synaptophysin, TTF-1, CDX2, CK20, S100, PSA, HER2, ER, CD117, PAX8, Mart-1 and LCA. The patient underwent left orbital exenteration with periocular tumor debulking. Intraoperatively, extensive involvement of the infraorbital nerve, orbital floor, and pterygopalatine fossa (Figure 2A/B) were seen, and cutaneous margins were grossly positive. Pathology showed atypical basophilic cells with a similar immunohistochemical profile as the original biopsy (Figure 3A-F), consistent with "adenocarcinoma of lacrimal gland, salivary gland, or breast origin." A restaging MRI showed intracranial dural enhancement concerning for possible dural extension, but PET/CT imaging showed no other primary tumors and only mild increased metabolic activity in a sub-centimeter cervical lymph node. The patient declined adjuvant radiation but was treated with 5 cycles of pembrolizumab, a PD-1 inhibitor, which was eventually discontinued due to autoimmune colitis. Several months later, the patient developed new right periorbital induration with a superotemporal orbital mass (Figure 4A). Repeat MRI showed an enhancing mass centered on the right lacrimal gland with involvement of the ipsilateral eyelids and cheek (Figure 4B/C). PET/CT imaging showed a single focus of activity along the left lateral nasal wall. Biopsy confirmed adenocarcinoma with an identical immunohistochemical profile as the contralateral tumor. At this point, no radiation therapy was recommended due to potential vision loss in the remaining eye, and induration in the right periocular region improved over the subsequent 2 months. At 24 months following initial onset of disease, the patient remains alive with relatively stable disease.

**Conclusions:** Primary poorly differentiated adenocarcinoma of the lacrimal gland is an extremely rare tumor, and this case shows the potential for bilateral sequential involvement in the setting of possible regional lymph node metastasis but no distant metastasis or direct extension. In the setting of unresectable disease, the patient was treated with 5 cycles of pembrolizumab without adjuvant radiotherapy and remains with surprisingly stable 24 months after initial presentation.

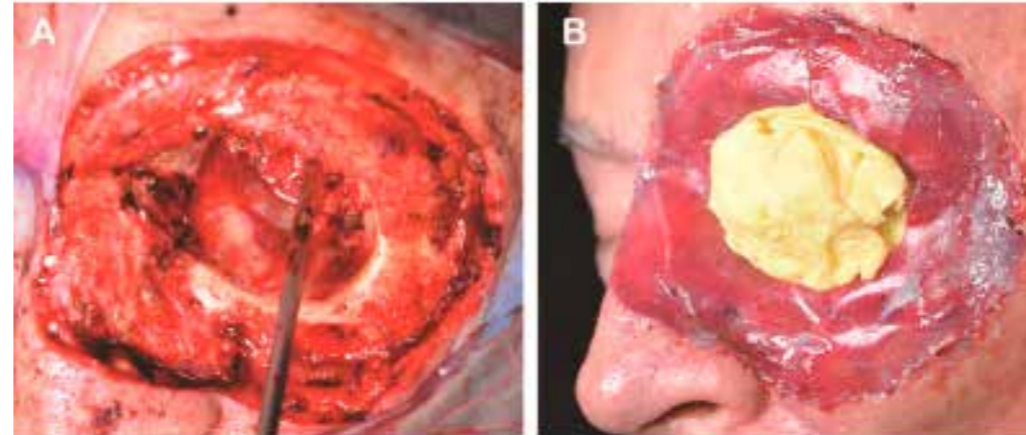
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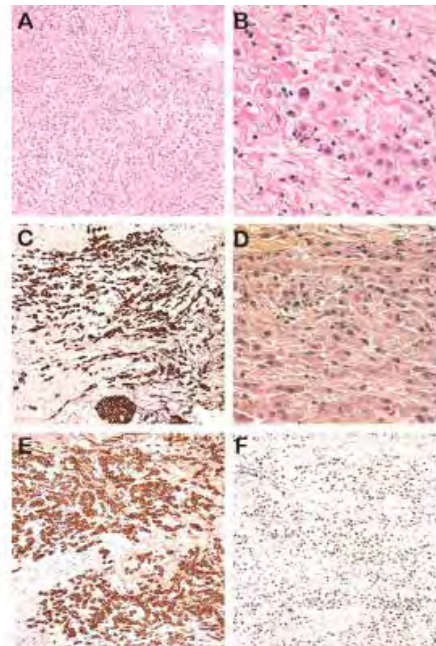
**Figure 1**



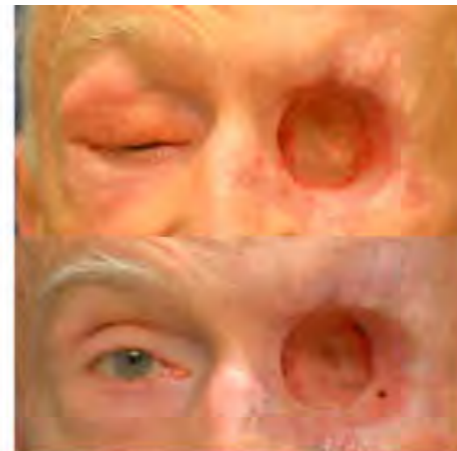
**Figure 2**



**Figure 3**



**Figure 4**



**Figure 4.** Top: Right upper and lower lid induration with superotemporal fullness corresponding to a superotemporal orbital mass. Bottom: POM 5 s/p incisional biopsy with significant regression of right upper and lower lid induration and orbital mass.

**References:**

1. Shields JA, Shields CL, Epstein JA, et al. Primary epithelial malignancies of the lacrimal gland: the 2003 Ramon L. Font lecture. *Ophthal Plast Reconstr Surg* 2004;20:10 -21.
2. Kubota T, Moritani S, Ichihara S. Clinicopathologic and immunohistochemical features of primary ductal adenocarcinoma of lacrimal gland: five new cases and review of literature. *Graefes Arch Clin Exp Ophthalmol*. 2013 Aug;251(8):2071-6.
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7:24 - 7:28 am

## Non-Traumatic Cerebrospinal Fluid Blepharocoele: A Unique Report of Waxing and Waning Eyelid Edema

Daniel Rubinstein<sup>1</sup>, Leon Rafailov<sup>1</sup>, Paul Langer<sup>1</sup>, James Liu<sup>2</sup>, Roger Turbin<sup>1</sup>

<sup>1</sup>Ophthalmology, Rutgers New Jersey Medical School, Newark, New Jersey, United States of America, <sup>2</sup>Neurological Surgery, Rutgers New Jersey Medical School, Newark, New Jersey, United States of America

**Introduction:** The term blepharocoele has been used to describe a direct communication between the subarachnoid space and the eyelid, leading to accumulation of CSF in eyelid tissues<sup>1</sup>, and is nearly always associated with trauma or previous skull base surgery. This report documents another spontaneous occurrence and adds a second case to a previous singularly described entity.

**Methods:** Retrospective descriptive case report.

**Results:** A 61-year old male developed an acute exacerbation superimposed on a 3-month relapsing and remitting course of painless right upper eyelid edema simulating blepharochalasis. He provided photographic documentation of waxing and waning course, sometimes preventing him from opening his eyelids (Figure 1). His condition was neither responsive to multiple courses of antibiotics and corticosteroids, nor a trial of a compression dressing. The edema improved with manual digital compression of the eyelid tissues, and the patient noted a sound of "rushing fluid" when he performed this maneuver. He denied previous trauma or surgery. Examination was significant for severe right upper and lower eyelid edema without tenderness, erythema, or proptosis. The remainder of the slit lamp and fundoscopic exams were normal. Laboratory testing failed to support an infectious, inflammatory, or endocrine, or neoplastic etiology. MRI demonstrated a large enhancing fluid collection in the right upper eyelid on T1 sequences (Figure 2A) which demonstrated signal suppression on FLAIR imaging (Figure 2B). Surgical biopsy of eyelid, temporalis and lacrimal gland were unremarkable. Intraoperatively, weeping clear fluid without a defined fluid pocket could be expressed from tissue planes. The fluid tested positively for Beta-2 transferrin, a highly specific marker for CSF. Careful inspection of prior CT imaging identified an unreported defect in the frontal bone of the lateral right orbital roof (Figure 3A coronal cut, and 3B axial cut). A supraorbital craniotomy identified a lateral frontal bone defect (demonstrated by surgical probe, Figure 4A), and an overlying dural defect was repaired using collagen matrix and HA cement (Figure 4B). The patient's symptoms subsequently resolved.

**Conclusions:** Blepharocoele has been reported in the setting of head trauma and craniofacial surgery. We add to a limited literature on the spontaneous development of this entity, which includes another single additional case report<sup>2</sup>. In both cases, a causative bony defect was identified in the orbital roof. Repair resolved the eyelid edema. Consideration of the entity was based on assessment of Beta-2 transferrin and critical review of previous neuroimaging. Although rare, orbital surgeons should be aware of the possibility of this condition in the absence of trauma or surgery.

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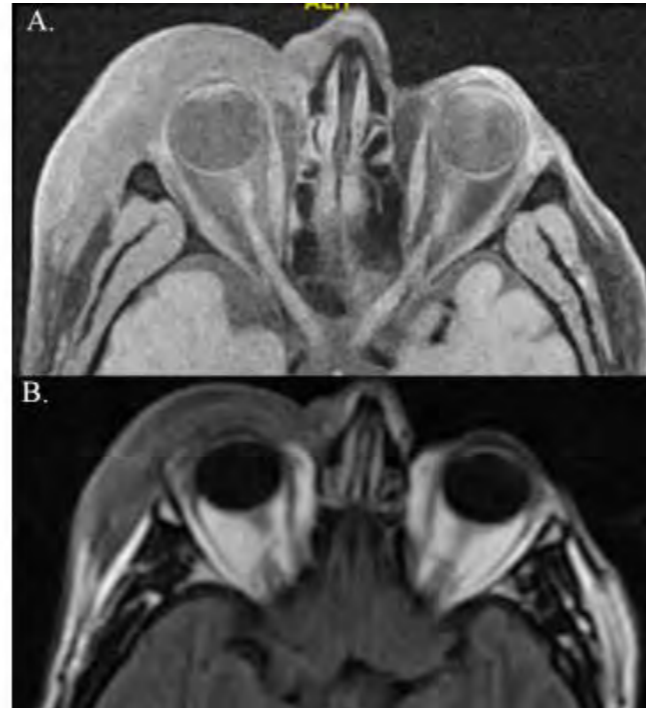


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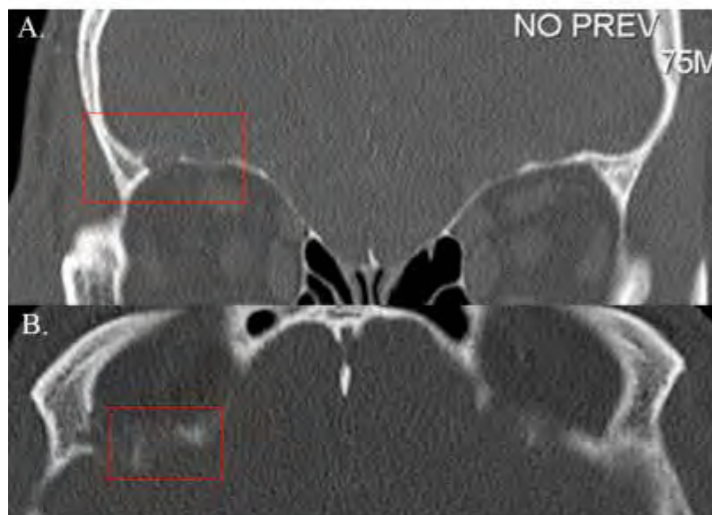
**Figure 1**



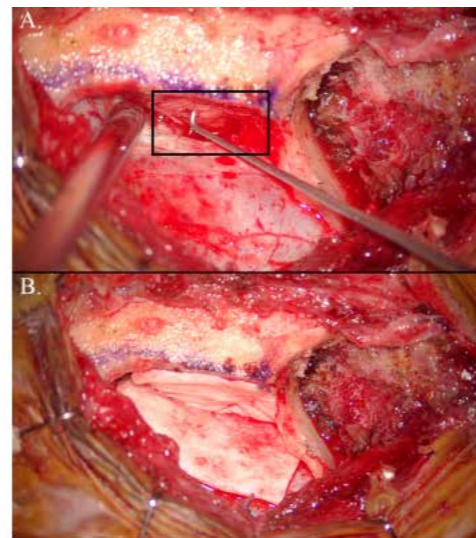
**Figure 2**



**Figure 3**



**Figure 4**



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7:28 - 7:32 am

## Potent Periorbital Fractionated CO<sub>2</sub> Laser Resurfacing: Settings and Safety

Alison Huggins<sup>1</sup>, Marie Somogyi<sup>1</sup>, Jacqueline Smart<sup>2</sup>, Tanuj Nakra<sup>1</sup>

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**Introduction:** Fractionated laser resurfacing is an important component of facial and periocular rejuvenation.<sup>1-3</sup> Despite widespread use, there is a broad range in current literature of fractionated CO<sub>2</sub> laser (Encore Ultrapulse Lumenis Inc., Santa Clara, CA) settings for the treatment of periorbital skin resurfacing. Some have argued that the addition of laser resurfacing to lower blepharoplasty may incur a theoretical risk of cicatricial changes leading to lower eyelid retraction, and increase the risk for infection.<sup>4</sup> Herein, we present our fractionated CO<sub>2</sub> laser periorbital resurfacing settings, and review its safety as an adjunct to lower eyelid blepharoplasty.

**Methods:** We performed a retrospective review over the past five years of all patients who underwent bilateral lower eyelid blepharoplasty with Total FX™ periorbital (upper and lower eyelid) laser resurfacing (Encore Ultrapulse Lumenis Inc.). All surgeries were performed by a single surgeon (TN). Patients who had preoperative cicatricial changes or a follow-up period of less than one month were excluded from this review.

**Results:** This review yielded 62 patients with an average follow up of 14 months (1-33). Fifty-four patients met the study inclusion criteria. Eight patients were excluded, 6 due to inadequate follow-up and 2 due to preoperative cicatricial changes. Mean Deep FX™ laser settings were: energy 19.3mJ (10-30), power 295Hz (200-500), and density 5.6% (5-15) with a double pulse. Mean Active FX™ settings were: energy 117mJ (70-200), power 206Hz (100-300), and density 39% (20-90). Fourteen (14/54, 25.9%) patients experienced initial post-operative complications or dissatisfaction with their surgery, 8 of these patients had complaints seemingly unrelated to their laser treatment including persistent lower eyelid fullness (2/54, 3.7%), residual lower eyelid laxity (2/54, 3.7%), dry eye (1/54, 1.9%), and persistent festoons (3/54, 5.6%). Six patients experienced iatrogenic consequences of their laser therapy including post-inflammatory hyperpigmentation, or PIH (3/54, 5.6%), refractory superficial excoriations (1/54, 1.9%), refractory hyperemia (1/54, 1.9%), and lower eyelid retraction (1/54, 1.9%). The single case of post-operative retraction required subsequent lower eyelid recession. The patient's final healing was satisfactory both functionally and cosmetically. The PIH, refractory excoriations, and hyperemia were managed conservatively with resolution pending at last follow-up. Four of the patients that experienced complications previously had lower eyelid blepharoplasty and/or underwent transcutaneous resection of skin at the time of surgery. None of the patients developed post-operative infection. All patients were pleased with their final postoperative outcome, (Figure 1).

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**Conclusions:** Robust laser settings can be safely employed for periorbital skin rejuvenation at the time of lower blepharoplasty. Concurrent transcutaneous skin removal should be conservative and pursued carefully when performed in conjunction with periorbital laser. We found our laser settings to be more aggressive than previously published settings<sup>1,3</sup> while still maintaining an acceptable safety profile. Overall patient satisfaction was high.

**Figure 1**



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7:32 - 7:36 am

## Lower Blepharoplasty with and without Fat Repositioning

Sathyadeepak Ramesh<sup>1,2</sup>, Robert Goldberg<sup>2</sup>, Allan Wulc<sup>1</sup>, Alan Brackup<sup>1</sup>

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**Introduction:** Lower blepharoplasty is one of the most commonly performed aesthetic surgeries in the world. Numerous approaches have been described, including various combinations of fat removal, transposition<sup>1,2</sup>, skin removal, and facial ligamentous release with elevation<sup>2-4</sup>. However, there have been no studies directly comparing outcomes between transconjunctival lower blepharoplasty with and without fat repositioning over the anterior maxilla<sup>5</sup>. We hypothesize that while both approaches can result in elegant and aesthetically pleasing outcomes, apparent lower lid length and the lid-cheek junction are higher after blepharoplasty without fat repositioning, while the nasojugal fold is more effaced after fat repositioning<sup>6,7</sup>.

**Methods:** In this retrospective review, 60 patients (120 eyelids) underwent lower eyelid blepharoplasty from 2015 - 2018 via a transconjunctival approach. Lower blepharoplasty fat was either excised (A.B.B.) or fashioned into pedicles with repositioning into a preperiosteal plane (R.A.G.) (Figure 1). Full face photos were taken preoperatively and at the final postoperative visit (minimum 3 months after surgery) and analyzed with ImageJ software by the authors. MRD2, lower lid length (distance from the lower eyelid margin to the first convexity), and nasojugal groove position (distance from the lower eyelid margin to the junction between eyelid and cheek skin) were measured, and the depth of the nasojugal fold was graded from 1-4. Statistical analysis was performed with correction for multiple corrections.

**Results:** Mean follow-up was 8 months. All patients were observed to have aesthetic improvement in the lower eyelid and cheek by the examining surgeon. There were no complications. After lower blepharoplasty with fat excision or transposition, mean MRD2 was not significantly increased after surgery or between groups. Mean lower lid length was decreased after surgery in both groups (-5.13mm with fat excision,  $p < 0.05$ , and -1.8mm with fat transposition,  $p < 0.05$ ). However, the lower eyelid length was significantly shorter with fat excision as compared to fat transposition (-5.5mm,  $p < 0.05$ ). The position of the nasojugal fold was higher after surgery in both groups (-6.6mm with fat excision,  $p < 0.05$ , and -3.6mm with fat transposition,  $p < 0.05$ ); therefore, the nasojugal fold elevated more after fat excision as compared to fat transposition (-1.9mm,  $p < 0.05$ ). Median nasojugal fold depth was effaced after surgery in both groups (-1 with fat excision,  $p < 0.05$ , -2 with fat transposition,  $p < 0.05$ ), with more effacement observed after fat transposition than after fat excision.

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**Conclusions:** Transconjunctival lower blepharoplasty with fat excision results in a shorter lower eyelid length with a higher lid-cheek junction. Blepharoplasty with fat repositioning results in a contoured lower eyelid as it transitions into the nasojugal groove. Fat repositioning significantly effaces the nasojugal groove compared to fat excision. While it is important to give consideration to the tear trough in aesthetic lower eyelid surgery, extensive maneuvers may not always be necessary to attain satisfying aesthetic results<sup>8</sup>. The surgical approach should be tailored to the patient's specific desires and expectations.

**Figure 1**



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7:38 - 7:42 am

## Dimensions and Morphologic Variability of the Retro-Orbicularis Oculi and Frontalis Muscle Fat Pad

Salam Bachour<sup>1</sup>, Alexander Blandford<sup>2</sup>, Rachel Chen<sup>2</sup>, Lucy Xu<sup>2</sup>, Catherine Hwang<sup>2</sup>, Julian Perry<sup>2</sup>

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**Introduction:** Our understanding of the retro-orbicularis oculi fat (ROOF) has changed little since May et al's description. Subsequent studies evaluating the different fat compartments of the forehead have called for additional investigation of previously unidentified deep fat localized between the ROOF and the middle frontal septum. This study aims to better understand the complete dimensions of the ROOF and to determine its relationship to other fat compartments of the forehead. We hypothesize that this previously unidentified deep fat is an extension of the traditionally defined ROOF.

**Methods:** A sub-muscular dissection (Figure 1) on the entire forehead of 7 fresh cadavers (4 female; average age 68) was performed. A ruler was placed at the facial midline and images of the dissection plane were taken at 90 and 45 degrees (Figure 2). Images were analyzed for height, horizontal length, the distance to midline from the point of maximal height, and area for each hemiface of both the traditionally defined ROOF, as well as ROOF+unidentified fat. A two-tailed T-test was conducted across all measurements between traditionally defined ROOF and the extended fat plane. Additionally, a wilcoxon non-parametric signed rank test was performed to determine equivalent fat distribution of the extended fat plane over each cadaver's respective eye.

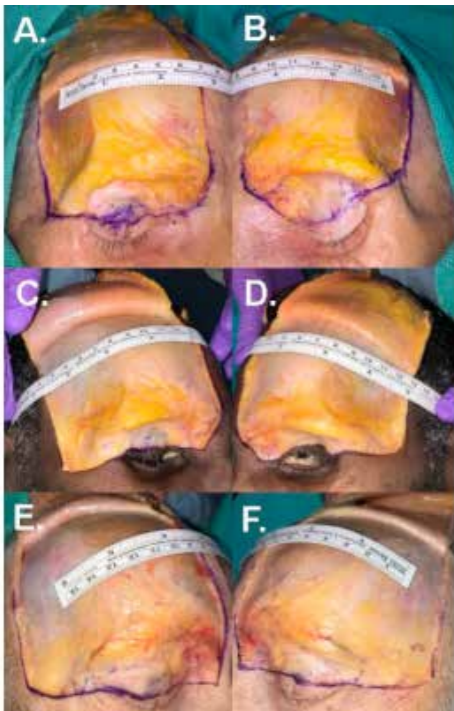
**Results:** Upon dissection, we consistently observed an extension of deep fat originating from the traditionally defined ROOF and extending laterally and superiorly, but distinctly separated via septae from the previously described deep central and lateral fat compartments, as well as the deep temporal fat compartment. The color, composition, and distribution of this contiguous deep fat did not differ phenotypically from the traditional ROOF. The extended deep fat plane had an average vertical height of  $3.089 \pm 0.6832$  cm, average distance to midline from point of maximal height of  $3.566 \pm 0.529$  cm, an average horizontal length of  $5.368 \pm 0.821$  cm, and an average area of  $13.401 \pm 2.694$  cm<sup>2</sup>. The extended deep fat demonstrated a statistically significant increase in maximal height ( $p=3.05 \times 10^{-8}$ ), horizontal length ( $p=1.05 \times 10^{-7}$ ), and total area ( $p=5.69 \times 10^{-10}$ ). A wilcoxon non-parametric signed rank test was non-significant ( $\alpha=.01$ ) across all measurements, demonstrating that the extended fat plane was normally distributed across cadavers.

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**Conclusions:** In this study, sub-muscular dissections across 14 hemifaces consistently displayed a contiguous layer of deep fat originating from the traditionally defined ROOF and extending superiorly and laterally. This is the first study to clearly demonstrate a contiguous SMAS layer of fat extending under both the orbicularis oculi and frontalis muscles. This extended, uninterrupted deep fat did not differ phenotypically from the traditionally defined ROOF leading us to believe that this previously unidentified layer of deep fat is not its own compartment, but rather an extension of the ROOF. We propose that this plane of fat should more appropriately be described as the retro-orbicularis oculi and frontalis fat (ROOFF).

**Figure 1**



**Figure 2**



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7:42 - 7:46 am

## A Consecutive Five-Year Retrospective Review of Ablative Carbon Dioxide Laser Resurfacing of the Lower Eyelids: Patient Satisfaction and Management of Post-Operative Complications

Jane S. Kim<sup>1</sup>, Varsha Manjunath<sup>1</sup>, Roshni Ranjit-Reeves<sup>1</sup>, Julie A. Woodward<sup>1,2</sup>

<sup>1</sup>Department of Ophthalmology, Duke University, Durham, North Carolina, United States of America, <sup>2</sup>Department of Dermatology, Duke University, Durham, North Carolina, United States of America

**Introduction:** Ablative carbon dioxide (CO<sub>2</sub>) laser resurfacing of the lower eyelids dramatically improves the excessive skin laxity and orbital fat prolapse seen in the aging face and has thereby become a mainstay in periocular rejuvenation. Although there are a few pilot studies examining the aesthetic outcomes and patient satisfaction following bilateral lower lid ablative CO<sub>2</sub> laser resurfacing, none have objectively reported their long-term experience with this treatment modality. This study examines the cosmetic outcomes, patient satisfaction scores, rates of post-operative complications, and the management of these complications for a single experienced oculoplastic surgeon over several consecutive years.

**Methods:** A retrospective review yielded over 200 patients who underwent bilateral lower lid ablative fractionated CO<sub>2</sub> laser resurfacing by a single experienced oculoplastic surgeon from January 2013 to January 2018. Patient satisfaction, aesthetic outcomes, and post-operative complications (e.g., hypo- or hyperpigmentation, entropion, ectropion, and infection) were evaluated.

**Results:** Patient satisfaction following ablative fractionated CO<sub>2</sub> laser resurfacing of the lower eyelids was overwhelmingly high, which corresponded with objective measurements of improvement in the appearance of the lower eyelids and periocular skin. The vast majority of cases were performed simultaneously with transconjunctival bilateral lower lid blepharoplasty. The rates of hypo- or hyperpigmentation, entropion, ectropion, and infection were exceedingly low. Proper and timely management of these complications yielded improved outcomes.

**Conclusions:** Ablative CO<sub>2</sub> laser resurfacing of the lower eyelids can be a useful tool in the armamentarium of the experienced oculoplastic surgeon, with excellent aesthetic outcomes, high patient satisfaction rates, and low complication rates. Appropriate and timely management of complications can lead to successful cosmetic outcomes.

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**Figure 1**



**References:**

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8:03 – 8:50 am

Moderators: Christopher B. Chambers, MD and Andrea L. Kossler, MD

8:03 – 8:09 am

## Increasing Utilization of Internal Blepharoptosis Repair and Endoscopic Dacryocystorhinostomy over External Approach Among Medicare Patients from 2000-2015

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**Introduction:** Recent surveys have indicated that ASOPRS members who completed fellowship more recently offer more endoscopic dacryocystorhinostomy surgeries and are more likely to perform an internal approach over an external one for ptosis repair compared to older surgeons.<sup>1,2</sup> We sought to evaluate whether these survey trends bear out in practice by evaluating trends in the prevalence of these approaches using Medicare claims data.

**Methods:** The 2000-2015 Medicare Physician and Other Supplier Public Use File, which contains Current Procedure Terminology claims for all Medicare Fee-for-Service beneficiaries, were used to assess annual trends in procedure volume for frontalis, external and internal approach ptosis repair and endoscopic and external approaches of dacryocystorhinostomy. The ratios of external to internal approach of blepharoptosis repair and of external to endoscopic approach for dacryocystorhinostomy were calculated annually from 2000 to 2015. Linear regression was used to assess the trends in these ratios and the volume of each approach performed, with year as the dependent variable, each individual approach as an independent variable, and year and total number of Medicare Fee-for-Service enrollees as covariates.

**Results:** Over the 16-year study period, frontalis approach usage did not change significantly. There was a large increase in usage of both the external and internal approach to ptosis repair, reflecting increased procedure volume overall. External approach ptosis repair volumes increased from 33785 to 57571 from 2000 to 2015, and internal approach volumes increased from 4877 to 12171 over the same period. The ratio of external to internal approach usage dropped from 6.9 at the study outset to 4.7 at the end of the study ( $P < 0.0001$ ). The rate of decrease in the ratio of external approach to internal approach following the 2009 blepharoplasty-blepharoptosis repair bundling changes (0.233 per year from 2009-2015) were similar to the rate of decrease that began prior to bundling (0.200 per year from an equivalent time frame of 2003-2009). Similarly, the volumes of both endoscopic and external dacryocystorhinostomies increased as well over the study period. From 2000 to 2015, endoscopic

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dacryocystorhinostomy volume increased from 745 to 1630 ( $P < 0.0001$ ), and external approach volumes from 6298 to 6712 ( $P = 0.02$ ). The ratio of external to endoscopic procedures dropped by more than half, from 8.5 to 4.1 over this period.

**Conclusions:** Surgical preferences have evolved, with recent years bearing increasing utilization of the internal approach for blepharoptosis repair and the endoscopic approach for dacryocystorhinostomy. The traditional external approach for both procedures still remains more common than the alternative internal and endoscopic approaches for blepharoptosis repair and dacryocystorhinostomy, respectively. Though some have suggested that bundling of blepharoplasty and blepharoptosis repair may have influenced the increased usage of the internal approach,<sup>3,4</sup> our data suggested otherwise as this increasing trend preceded the 2009 bundling changes and remained stable afterwards. ASOPRS survey data are consistent with Medicare claims data that surgical preferences have evolved for ptosis repair and dacryocystorhinostomy.

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8:09 - 8:15 am

## The Role of Ocular Dominance in Frontalis Muscle Contraction

Robert Beaulieu<sup>1,2</sup>, Kaden Andre<sup>1</sup>, Ronald Mancini<sup>1</sup>

<sup>1</sup>University of Texas Southwestern Medical Center, Dallas, Texas, United States of America, <sup>2</sup>Consultants in Ophthalmic and Facial Plastic Surgery, Detroit, Michigan, United States of America

**Introduction:** Compensatory brow elevation in patients with ptosis has been thought to be a visually-driven mechanism in which frontalis contraction aides in lid elevation to improve a visual deficit. Patients with asymmetric brow elevation or paradoxical frontalis drive complicate the understanding of compensatory drive and it could be hypothesized that ocular dominance may lead to a stronger drive to preserve the ipsilateral visual field (Figure 1). Post-operative brow position in patients with compensatory frontalis contraction undergoing ptosis repair can be difficult to predict. No factors have been identified to help estimate the movement of the brow after surgery and it could be theorized that ocular dominance may contribute to brow position. Recent studies suggest a proprioceptive or sensory pathway for frontalis contraction via mechanoreceptors in Müller's muscle via a trigemino-facial reflex in response to stretching of the upper lid.<sup>1</sup> This study investigates the role of ocular dominance in frontalis muscle contraction in the setting of external eyelid weight placement as a proxy for ptosis.

**Methods:** Healthy volunteers without underlying eyelid pathology were subjected to two study phases to investigate eyebrow position. Baseline brow position was compared to the brow position following the placement of an external eyelid weight as a proxy for involutional ptosis on the ipsilateral side of the (1) dominant eye and (2) non-dominant eye (Figure 2). Brow measurements were taken at three standardized locations and brow position ratios were determined for each study phase. Statistical analysis was performed on brow position amongst the three study phases (baseline and external eyelid weight placement on the dominant and non-dominant eyelid).

**Results:** Measurements were taken from 23 participants (14 females, 9 males). Placement of the external eyelid weight lead to a statistically significant increase in brow position from baseline in both the dominant and non-dominant eye ( $p < 0.001$ ), with 10% and 8% elevation, respectively. There was no statistical difference in the elevation of the brow in the dominant compared to the non-dominant eye.

**Conclusions:** This is the first study to investigate the relationship between brow position and ocular dominance by manipulating sensory inputs via an external weight as a proxy for eyelid ptosis in healthy subjects. These findings show that weight placement on the dominant eyelid does not lead to an increased ipsilateral brow height compared to the non-dominant eyelid. This suggests that ocular dominance does not play a role in involuntary brow elevation in the setting of eyelid ptosis and helps to support the proprioceptive theory of frontalis muscle contraction.

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**Figure 1**

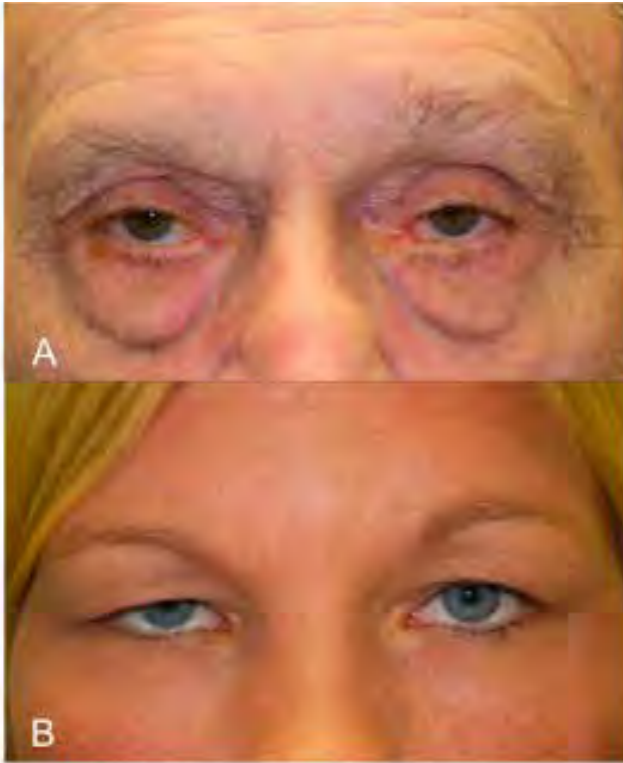


Figure 1. Asymmetric frontalis muscle contraction in bilateral ptosis (A) and paradoxical frontalis muscle contraction of the non-ptotic side and lack of contraction on the ptotic side (B).

**Figure 2**



Figure 2. Baseline (A), dominant eyelid weight placement with ipsilateral frontalis muscle contraction (B), and non-dominant eyelid weight placement with ipsilateral frontalis muscle contraction (C).

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8:15 - 8:21 am

## Blink Dynamics by High Speed Photography: Small Incision Levator Advancement Versus Müller's Muscle Conjunctival Resection

Andrew Ting, Paul Riske, Ezekiel Weis, Elysa McClintic, R. Patrick Yeatts  
*Raleigh Ophthalmology, Raleigh, North Carolina, United States of America*

**Introduction:** Voluntary (VB) and spontaneous blinks (SB) have previously been investigated using various methods and most recently with high speed photography. Previous studies have also investigated the trajectory of eyelid movement, demonstrating a horizontal component and possibly elliptical movement. The purpose of this study is to use high speed photography to investigate blink trajectory and blink dynamics in surgical ptosis repair.

**Methods:** Prospective experimental study of aponeurotic eyelid ptosis. Patients were recruited consecutively from two separate practices with all Müller's muscle conjunctival resection (MMCR) performed by one surgeon (PSR) and all small incision external levator advancement performed by another surgeon (AYT). High speed photography with Edgertronic SC1 Camera (Sanstreak Corp, USA), 1024 x 720 resolution at 700 frames per second, was used to capture VB and SB, pre- and post-operatively. Image analysis of eyelid trajectory and blink dynamics was performed by pixel tracking using Dartfish™ software. Blink trajectory was categorized as linear or curvilinear movement and whether an elliptical motion was seen, defined as greater than 1 mm between the descending and ascending trajectory of eyelid movement. VB and SB were separated into four separate phases for analysis: closing, closed, early opening and late opening phases. Blink speed, total, horizontal and vertical eyelid displacement was recorded. Statistical analysis was performed by univariate regression analysis.

**Results:** Final analysis was composed of 20 normal patients and 20 patient with ptosis, 10 underwent MMCR and 10 underwent small incision levator advancement. Patients in the normal eyelid group were younger than patients in the ptosis group ( $54.4 \pm 9.9$  vs  $69.1 \pm 8.4$  years old;  $p < 0.001$ ). Eyelid trajectory was not uniform and VB were more curvilinear (85% in normal and 70% in ptosis;  $p = 0.264$ ) while SB were more linear (75% in normal and 90% in ptosis;  $p = 0.226$ ). In patients with ptosis there was a significantly decreased odds of having an elliptical trajectory in VB ( $p = 0.001$ ) and SB ( $p = 0.040$ ) (Figure 1).

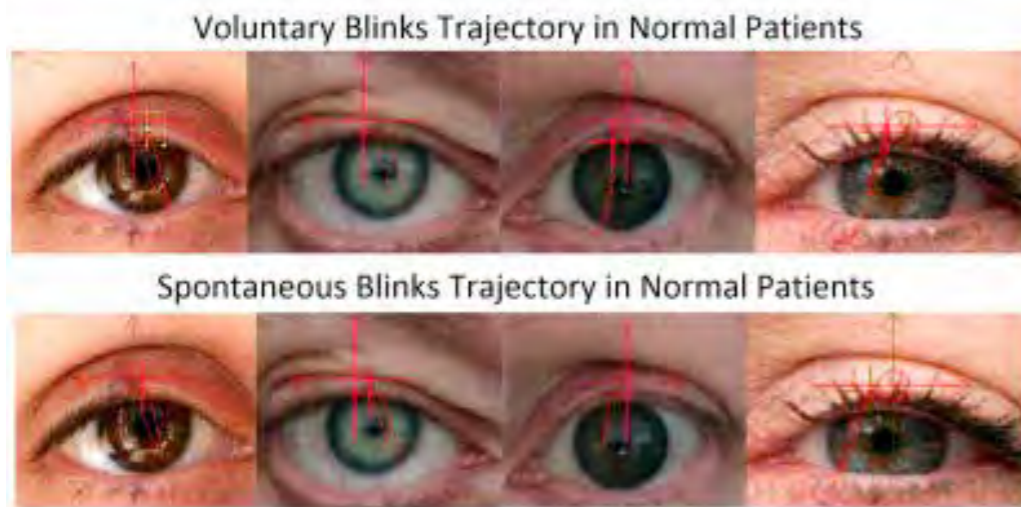
In VB, patients with ptosis had decreased total ( $9.6 \pm 1.5$  mm;  $p = 0.001$ ), vertical ( $8.8 \pm 1.5$  mm;  $p = 0.001$ ) and horizontal ( $4.3 \pm 1.2$  mm;  $p = 0.249$ ) movement and all significantly improved post-levator advancement ( $p = 0.001$ ,  $p < 0.001$  and  $p = 0.032$ , respectively). Average closing speed was also decreased in patients with ptosis ( $79 \pm 17$  mm/s;  $p = 0.002$ ) and significantly improved post-MMCR ( $p = 0.044$ ) and levator advancement ( $p = 0.053$ ). Peak opening ( $95 \pm 24$  mm/s;  $p = 0.002$ ) and average opening speed ( $49 \pm 9$  mm/s;  $p = 0.021$ ) was also decreased in patients with ptosis and significantly improved post-levator advancement only ( $p = 0.007$  and  $p = 0.006$ , respectively).

(continued)

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**Conclusions:** A variety of different eyelid trajectories were observed with more horizontal movement than previously reported. Significantly decreased odds of an elliptical trajectory was seen in patients with ptosis. Eyelid movements were decreased in patients with ptosis but only significantly improved post-levator advancement in VB. Average closing speed was improved with ptosis repair likely due to the greater distance the eyelid could travel unimpeded. Peak and average opening speed significantly improved only post-levator advancement due to the skeletal nature of the levator palpebrae superior muscle.

**Figure 1**



**Figure 2**

Demographics and Blink Analysis	Normal	Pre-op Ptosis	Normal vs Ptosis P-value	Post-op MMCK	MMCK Pre vs Post-op P-value	Post-op Levator Advancement	Levator Pre vs Post-op P-value
Mean ± Standard Deviation [Range]							
<b>Demographics</b>							
Number of Subjects	20	20		20		20	
Age in years	54.4±9.9 (31.0-80.0)	69.3±8.4	P=0.001	70.2±10.0 (51.0-80.0)		68.0±6.7 (57.0-80.0)	
Gender (Female : Male)	70% : 30%	60% : 40%	P=0.350	60% : 40%		60% : 40%	
Palpebral Fissure (mm)	9.4±1.1 (6.5-11.2)	7.1±1.1 (4.6-9.6)	P<0.001	9.7±0.8 (7.0-9.7)	P=0.012	9.4 ± 1.0 (5.6-11.9)	P=0.001
Margin to Reflex Distance (mm)	3.6±0.5 (3.0-4.6)	1.1±0.8 (0.0-2.6)	P<0.001	2.7±0.8 (1.4-4.0)	P=0.002	3.6 ± 0.7 (2.5-4.7)	P=0.001
Levator Function (mm)	15.3±0.9 (14.0-17.0)	14.6±1.9 (10.0-18.0)	P=0.117	14.1±1.3 (13.0-17.0)	P=0.358	14.5±1.5 (12.0-17.0)	P=1.000
<b>Voluntary Blinks</b>							
Total Movement (mm)	11.4±1.8 (8.5-16.1)	9.6±1.5 (6.7-12.1)	P=0.001	10.7±1.7 (8.1-14.0)	P=0.332	11.9±1.5 (9.5-13.7)	P=0.001
Horizontal Component (mm)	4.8±1.4 (2.8-7.7)	4.3±1.2 (2.4-7.0)	P=0.249	4.8±1.4 (2.7-6.7)	P=0.964	5.0±0.9 (3.9-7.0)	P=0.032
Vertical Component (mm)	10.6±1.6 (7.9-15.1)	8.8±1.5 (5.8-11.3)	P=0.001	9.9±1.8 (7.7-13.8)	P=0.270	11.2±1.8 (8.5-12.8)	P=0.001
Peak Closing Speed (mm/s)	275±80 (180-440)	241±64 (111-364)	P=0.162	290±71 (122-381)	P=0.348	271±70 (169-379)	P=0.274
Average Closing Speed (mm/s)	99±22 (54-139)	79±17 (47-111)	P<0.002	90±19 (57-121)	P=0.044	91±19 (60-119)	P=0.053
Peak Opening Speed (mm/s)	115±34 (73-196)	95±24 (57-140)	P=0.002	112±18 (90-138)	P=0.510	115±26 (83-160)	P=0.007
Average Opening Speed (mm/s)	59±16 (30-92)	49±9 (33-64)	P=0.021	57±8 (42-69)	P=0.279	60±11 (46-76)	P=0.006
Closing Phase (ms)	109±15 (91-147)	113±17 (83-169)	P=0.818	105±20 (79-137)	P=0.250	117±23 (77-154)	P=0.339
Closed Phase (ms)	149±147 (11-556)	197±225 (7-877)	P=0.414	181±154 (31-449)	P=0.372	239±154 (30-491)	P=0.092
Early Opening Phase (ms)	171±32 (125-231)	172±35 (113-231)	P=0.905	158±33 (105-217)	P=0.774	168±24 (137-211)	P=0.395
Late Opening Phase (ms)	89±22 (42-140)	106±48 (37-224)	P=0.198	111±64 (57-241)	P=0.447	117±49 (29-191)	P=0.859
Total Time (ms)	528±170 (308-1054)	587±200 (380-1196)	P=0.250	556±140 (418-850)	P=0.299	642±177 (422-920)	P=0.158
<b>Spontaneous Blinks</b>							
Total Movement (mm)	8.6±2.0 (5.7-13.7)	6.4±1.9 (2.2-9.9)	P=0.001	6.9±1.8 (5.0-10.1)	P=0.874	7.2±1.0 (2.26-11.0)	P=0.205
Horizontal Component (mm)	3.1±1.1 (1.3-5.7)	2.4±1.0 (0.6-4.8)	P=0.032	2.5±0.9 (1.2-4.2)	P=0.727	2.3±1.3 (0.4-4.2)	P=0.681
Vertical Component (mm)	8.4±1.9 (5.7-13.5)	6.3±1.8 (2.2-8.8)	P=0.001	6.7±1.8 (4.7-10.0)	P=0.757	7.1±2.0 (2.5-11.0)	P=0.148
Peak Closing Speed (mm/s)	239±90 (50-500)	176±59 (82-267)	P=0.013	189±72 (109-298)	P=0.979	238±113 (91-395)	P=0.213
Average Closing Speed (mm/s)	105±30 (29-161)	79±23 (38-115)	P=0.001	84±30 (49-131)	P=0.835	86±37 (38-137)	P=0.072
Peak Opening Speed (mm/s)	108±27 (61-151)	70±20 (29-102)	P=0.001	89±33 (51-135)	P=0.782	84±32 (52-140)	P=0.582
Average Opening Speed (mm/s)	56±15 (30-80)	43±10 (16-58)	P=0.003	47±13 (34-72)	P=0.668	48±17 (34-72)	P=0.346
Closing Phase (ms)	83±27 (54-179)	86±20 (50-121)	P=0.659	84±14 (61-109)	P=0.515	81±15 (57-111)	P=0.865
Closed Phase (ms)	111±2 (4-52)	116 (3-24)	P=0.906	1015 (4-20)	P=0.853	1117 (3-21)	P=0.892
Early Opening Phase (ms)	134±34 (71-206)	124±27 (59-161)	P=0.277	115±19 (96-157)	P=0.185	118±24 (86-156)	P=0.972
Late Opening Phase (ms)	113±81 (44-314)	114±35 (57-173)	P=0.943	130±53 (7-172)	P=0.543	106±28 (83-159)	P=1.000
Total Time (ms)	342±109 (194-552)	336±49 (251-430)	P=0.813	333±47 (212-381)	P=0.185	319±37 (250-376)	P=0.897

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8:21 - 8:27 am

## Challenging the Current Treatment of Residual Postoperative Ptosis: Safety and Efficacy of Repeat Müller's Muscle-Conjunctival Resection

Bryce Radmall<sup>1</sup>, Oluwatobi Idowu<sup>2</sup>, M. Reza Vagefi<sup>2</sup>, Keith Carter<sup>1</sup>, Erin Shriver<sup>1</sup>

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**Introduction:** Traditionally, residual ptosis after ptosis repair by internal approach with Mueller's muscle conjunctival resection (MMCR) has been treated with levator advancement or modified Fasanella-Servat. To date, there are no reports in the literature describing the efficacy of repeat MMCR for residual eyelid ptosis. The aim of the study is to determine if repeat MMCR is a viable approach in the treatment of recurrent eyelid ptosis in patients responsive to phenylephrine testing prior to the revision.

**Methods:** IRB approval was obtained and patients with duplicate ipsilateral CPT codes for ptosis repair were identified. A retrospective chart review of patients who underwent repeat MMCR from 1997 -2018 was then performed. External photos were obtained pre-operatively, post-operatively, and at last follow up after the repeat MMCR. Computer imaging software (NIH Image J) was used to perform digital image analysis to evaluate the margin to reflex distance (iMRD1 and iMRD2), brow position (iBP) and tarsal platform show (iTPS) in pre and postoperative photos. In the event that postoperative photos were not available or of unacceptable quality, the measurements as documented in the chart were used. The primary outcome measure assessed was the objective change in eyelid height following repeat ptosis repair, calculated by the change in iMRD1. The change in iTPS served as a secondary outcome measure. The change in iMRD2 and brow position served to validate the pre and postoperative photos used for analysis.

**Results:** Eleven patients with a mean age of 46.5 (range 7-88) years underwent a total of 12 repeat MMCRs, as one patient had bilateral surgery. Digital image analysis demonstrated that the mean elevation in lid height (MRD1) after *initial* MMCR was 1.7mm (+/- 1.2mm) with a p-value of 0.00002. The average MMCR resection amount for the initial MMCR was 9.0mm (range 8-12mm). No statistically significant difference was identified when comparing the change in MRD2 (p = 0.99), brow position (p=0.19) or tarsal platform show (p=0.07) with initial MMCR. Average follow up time after initial MMCR was 3.1 months. Mean interval between procedures was 12.8 months (range 2.3-48). Mean elevation in eyelid height (MRD1) after *repeat* MMCR was shown to be 1.1mm (+/- 0.9mm) with a p-value of 0.002. No statistical difference was detected regarding a change in MRD2 (p = 0.94), brow position (p = 0.20), or tarsal platform show (p = 0.08). The average resection amount for repeat MMCR was 8.1mm (range 6-12mm). Mean follow up after repeat MMCR was 2.3 months. There were no complications of repeat MMCR including: no entropion, significant fornix foreshortening, or development of dry eye signs or symptoms.

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**Conclusions:** Repeat MMCR was shown to significantly improve recurrent ptosis after initial MMCR without significant adverse consequences. The degree of elevation with repeat MMCR was diminished when compared to that of an initial MMCR, however. These results contrast the long held notion that repeat MMCR is not an option for patients with residual ptosis after MMCR. In patients with a small amount of residual ptosis after MMCR and a good response to phenylephrine testing, a repeat MMCR may be considered. Larger studies would be beneficial in determining algorithms for resection, ideal candidates for repeat MMCR, and the overall complication rate of this procedure.

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8:27 - 8:33 am

## Conjunctival Changes following Müller's Muscle Conjunctival Resection

Robert Beaulieu<sup>1,2</sup>, Sagar Patel<sup>1</sup>, Bret Evers<sup>3</sup>, R. Nick Hogan<sup>1,3</sup>, Ronald Mancini<sup>1</sup>

<sup>1</sup>Ophthalmology, University of Texas Southwestern Medical Center, Dallas, Texas, United States of America <sup>2</sup>Consultants in Ophthalmic and Facial Plastic Surgery, Detroit, Michigan, United States of America, <sup>3</sup>Pathology, University of Texas Southwestern Medical Center, Dallas, Texas, United States of America

**Introduction:** Müller's muscle conjunctival resection (MMCR) is a common procedure for ptosis correction. It offers a reliable technique to provide predictable results with excellent preservation of eyelid contour. However, there is a subset of patients with dry eye, glaucoma, or other ocular conditions in which there is a concern of post-operative conjunctival health. Tear production, dry eye symptomatology, and impression cytology following MMCR have been assessed and a technique to preserve the conjunctiva in MMCR has been developed.<sup>1-3</sup> However, no histologic examination of the conjunctiva pre and post-MMCR has been performed. The purpose of this study was to examine conjunctival properties such as scarring and goblet cell population following MMCR.

**Methods:** Conjunctival samples sent for histologic evaluation at the time of surgery from two patient populations were identified in a retrospective manner. To evaluate conjunctival changes following MMCR, samples from individuals who had previously undergone an initial MMCR and required a repeat MMCR surgery in the same eyelid were examined. The control samples were conjunctiva from patients who underwent an initial MMCR surgery. Conjunctival samples underwent hematoxylin and eosin (H&E), Periodic Acid-Schiff (PAS), and Masson trichrome staining to accentuate goblet cells and collagenous fibrous tissue. Samples were examined by an ocular pathologist.

**Results:** Three samples were identified in each of the (1) post-MMCR group and the (2) control group. Goblet cell populations in the post-MMCR group showed a relative loss compared to controls in the histologic sections analyzed. There was also a significant volume of collagenous fibrous tissue in the post-MMCR group (Figure 1 & 2). Samples from both groups showed some low level of sub-epithelial scarring and inflammation.

**Conclusions:** This is the first study to describe conjunctival changes in patients who underwent MMCR compared to a control population through histologic evaluation. One individual included in the study had previously undergone a unilateral MMCR, and then later underwent bilateral MMCR. This offered the unique opportunity to compare the conjunctival changes which had taken place in the same patient, as she served as her own control. This study shows that there is a relative loss of goblet cell population and increased collagenous scarring in the conjunctiva overlying the area of surgery following MMCR compared to non-operated tissue. Prior studies show that MMCR does not exacerbate dry eye symptoms, suggesting that there may be patients with enough reserve in the preserved accessory lacrimal glands and goblet cell populations within the unadulterated conjunctiva. However, the notable scarring and conjunctival changes that occur in the areas overlying the resected tissue could be (continued)

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problematic in patients with significant dry eye or patients with glaucoma, who may ultimately need a filtering or shunting procedure. We are unsure how to explain the low levels of inflammation and sub-epithelial scarring in both groups. Limitations of this study include sampling bias as the entire area of conjunctival resection was not evaluated. Additionally, many samples had multiple regions of epithelial loss, likely due to manipulation during surgery and sample processing, which could confound overall goblet cell and inflammatory cell populations.

**Figure 1**

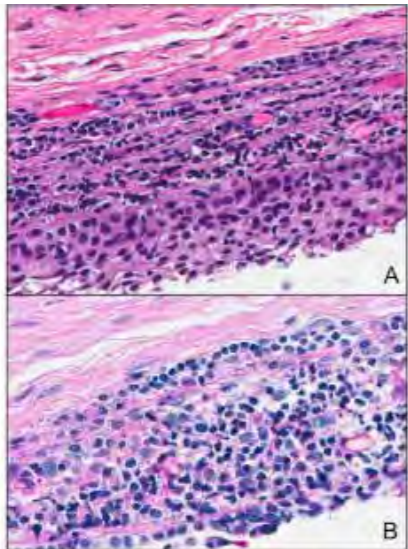


Figure 1. Post-MMCR samples showing a relative lack of goblet cells and increased collagenous fibrous tissue on H&E (A) and PAS (B) stains.

**Figure 2**

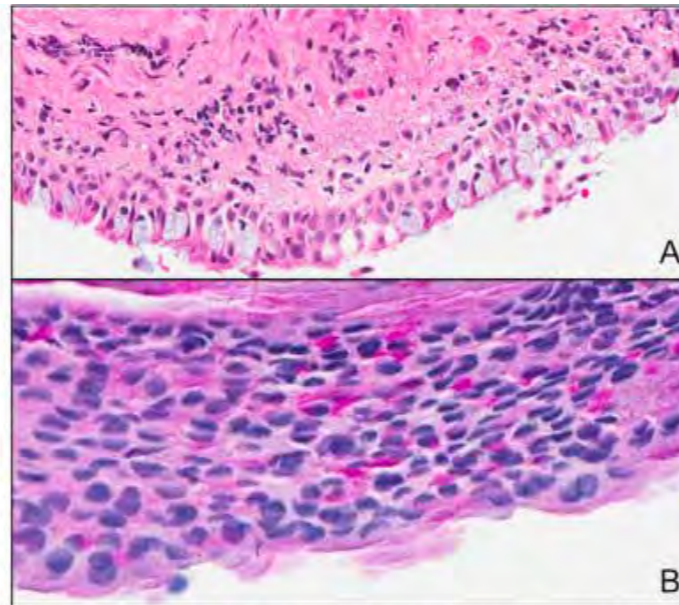


Figure 2. Control samples showing numerous goblet cells on H&E (A) and PAS (B) stains.

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8:33 - 8:39 am

## New Evidence of Müller's Muscle as a Sensory Proprioceptive Organ

Daphna Prat<sup>1</sup>, Amir Dori<sup>2</sup>, Nir Gomel<sup>1</sup>, Ofira Zloto<sup>1</sup>, Guy Ben Simon<sup>1</sup>

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**Introduction:** Upper eyelid retraction was believed to be maintained solely by voluntary contraction of the levator palpebrae superioris (LPS) and frontalis muscles, together with involuntary contraction of the sympathetically innervated Müller's muscle (MM). However, several studies have suggested that the LPS also undergoes involuntary contractions, and that a visual stimulus may not be the only trigger for retractor muscles contractions<sup>1,2</sup>. Recent studies hypothesized that the MM contains proprioceptive neuronal structures, which elicit involuntary LPS muscle contraction by the mesencephalic trigeminal nucleus via a continuous stretch reflex. However these studies did not distinguish between true sensory proprioceptive axons to large myelinated motor axons<sup>3,4</sup>. Our aim was to identify proprioceptive structures in MM by means of histological examinations, immunohistochemical staining and fluorescein microscopy.

**Methods:** Ten fresh MM specimens from patients undergoing posterior approach ptosis surgery were evaluated. Cryo-embedded sections were processed and stained to identify axons, myelinating Schwann cells and non-myelinating Schwann cells. Axons were identified by immunostaining with anti-peripherin antibodies, myelin with anti-myelin protein zero. Non-myelinating Schwann cells were stained with neural cell adhesion molecule (NCAM) antibodies. Light and fluorescein microscopy were used to analyze the samples. Hematoxylin & eosin (H&E) staining was used to identify muscle fibers. Sural nerve was used as positive control.

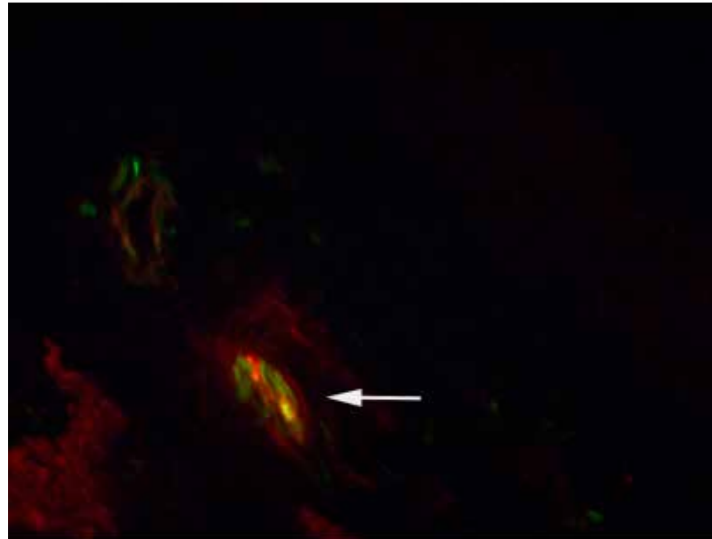
**Results:** Thin and thick myelinated axons were stained in each MM, these were attributed to sensory (sharp pain) and sensory proprioceptive fibers respectively (Figure 1). Small axons embedded in these specimen double-stained for both neurofilament and NCAM were determined to be sensory-pain fibers. Müller muscle fibers (H&E) were noted in all specimen prior to immune-staining (Figure 2). Anti-peripherin axonal staining denoted horizontal alignment of most fibers (Figure 3).

**Conclusions:** Our findings may be the first evidence-based proof of a proprioceptive mechanism in the eyelid. This can explain why eyelid spatial position and not visual deprivation alone stimulates retractors activation, and sheds new light on our understating of this complex mechanism.

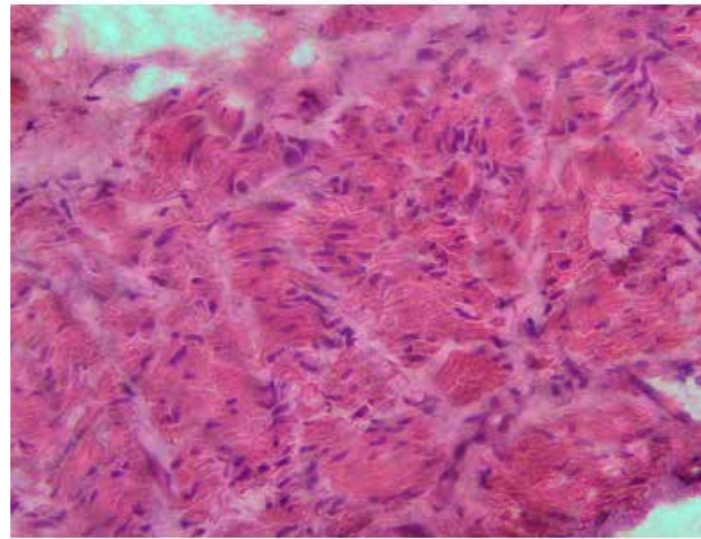
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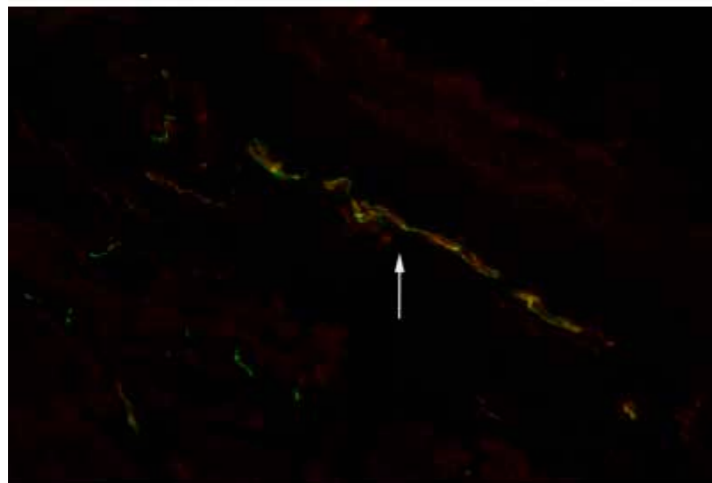
**Figure 1**



**Figure 2**



**Figure 3**



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**Featured Speaker: Babak Azizzadeh, MD, FACS**

8:55 - 9:20 am

**Modified Selective Neurectomy for the Management of Post-Facial Paralysis Synkinesis**

Most facial nerve disorders initially present with flaccid and complete paralysis. Depending on the etiology, the majority of patients experience partial or complete recovery. Any form of facial nerve repair (neurorrhaphy, cable nerve grafting), incomplete nerve injury (Bell's palsy, Ramsay Hunt Syndrome, acoustic neuroma, temporal bone fracture), or cranial nerve substitution technique (hypoglossal or masseteric to facial nerve transfer) can lead to synkinesis. Simultaneous triggering of the orbicularis oris, platysma, depressor anguli oris (DAO) and buccinator muscles resist appropriate activation of key smile muscles such as zygomatic major/minor (ZM), levator labii/anguli muscles (LM) and depressor labii inferioris (DLI) leading to an inferior and lateral vector of pull on the oral commissure as well as decreased upper and lower teeth show. The ideal facial reanimation technique should improve spontaneous smile mechanism, symmetry of upper and lower dental show and oral competency. Historically, facial nerve experts have had diverse management protocols for patients with post-facial paralysis with synkinesis (PFPS). The current treatment options include observation, physiotherapy, onabotulinum toxin A as well as procedures such as free functional muscle transfer and temporalis myoplasty in order to increase superior excursion forces on the oral commissure. Since patients with synkinesis have innervated facial musculature, the treatment philosophy should be different than those who have long-term flaccid paralysis without any functioning muscles. Treatments that can reduce but not completely eliminate the activity of DAO, platysma, orbicularis oris and buccinator while preserving smile elevators and DLI should enhance the smile mechanism and dental show. Powering or augmenting the elevators which is the basis of almost all facial reanimation procedures may not be necessary. This presentation describes the speaker's current reanimation technique for patients with PFPS referred to "modified selective neurectomy."

9:30 - 10 am

Moderators: Mark Alford, MD and Pari N. Shams, MD

9:30 - 9:37 am

## Orbit-Sparing Treatment with Surgical Debridement in Invasive Rhino-Orbital Mucormycosis

Arthika Chandramohan, Katie Topping, Benjamin Erickson

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**Introduction:** Orbit-involving mucormycosis is a devastating infection for which the standard of care often involves lid sparing exenteration (Arndt, Hargrove). To date, soft tissue microdebridement has been described only as an adjunct to exenteration in order to achieve better clearance of apical tissue (Freitag). We present three cases with orbital involvement wherein the microdebrider was used to selectively debride clinically involved tissues based on frozen section guidance following enucleation, permitting preservation of vascularized anterior tissues with the potential for ocular prosthesis placement.

**Methods:** Case series of three consecutive patients, all of whom were found to have orbital extension of biopsy confirmed mucormycosis from the adjacent sinuses. Each was treated with endoscopic sinus surgery, enucleation, selective microdebridement of orbital tissue based on frozen section guidance, and placement of a Jackson Pratt drain for 5-7 days of orbital irrigation with nonliposomal amphotericin B following surgery.

**Results:** All three patients presented with unilateral eye swelling, motility disturbance, and degree of vision loss and underlying immunocompromise (diabetes mellitus in two, and myelodysplastic syndrome in the third). Radiographic evaluation demonstrated unilateral orbital apex involvement without progression to the cavernous sinus. Following endoscopic sinus surgery, a standard enucleation was performed based on preoperative examination and intraoperative findings of diffuse orbital and/or retinal ischemia. Margin control assisted microdebridement of clinically involved orbital tissues was then performed (Figure 1). In all cases the conjunctiva, eyelids, and uninvolved orbital tissue were spared and remained well perfused. Serial MRI imaging showed no evidence of residual orbital disease or cavernous sinus progression while receiving systemic and local antifungal therapy. The patient with MDS developed intracranial extension via the ethmoid sinuses and cribriform plate and expired from his disease. The remaining two patients recovered with well vascularized tissues and the ability to wear a standard ocular prosthesis. They have been offered secondary orbital implant placement to further improve appearance and function.

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**Conclusions:** The decision whether or not to exenterate in advanced cases of mucor continues to be a difficult one. The functional and cosmetic differences between lid sparing exenteration and enucleation with aggressive debridement are vast. We present a case series combining enucleation, frozen section microdebridement and local irrigation with amphotericin B with successful prevention of cavernous sinus spread and retention of tissues to permit standard ocular prosthesis placement.

**Figure 1**



Figure 1. Use of microdebrider in orbit for use in margin control of debridement.

**Figure 2**

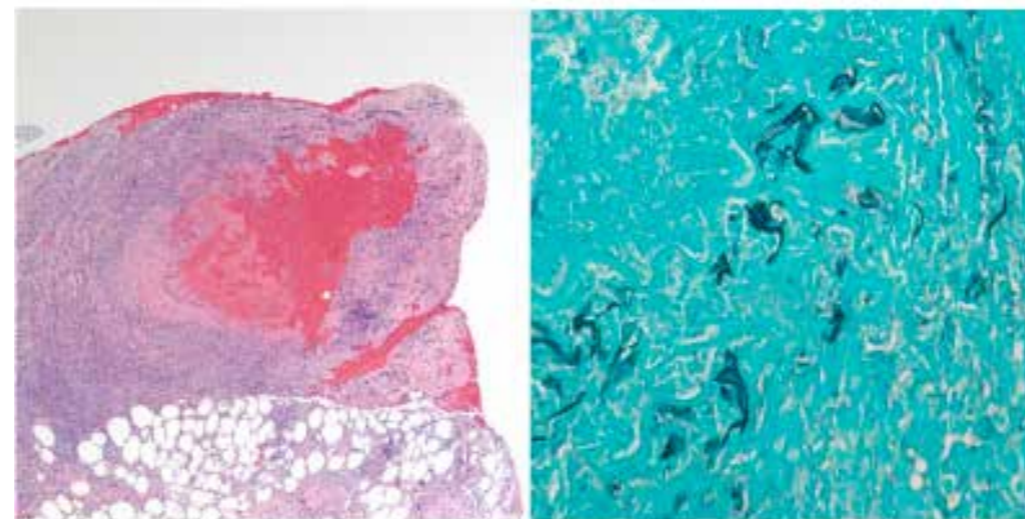


Figure 2. Low power H&E and high power view of GMS stain showing showing angioinvasive fungal hyphae with fibrin within the vessel lumen of patient with MDS

**References:**

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9:37 - 9:44 am

### Patients', Globe, and Vision Survivals in Rhino-Orbito-Cerebral Mucormycosis

Mohsen Kashkouli, Parya Abdolalizadeh, Mitra Oghazian, Yasaman Hadi, Nasser Karimi, Mahya Ghazizadeh  
*Eye Research Center, Rassoul Akram Hospital, Iran University of Medical Sciences, Tehran, Iran*

**Introduction:** To report the frequency and factors affecting patients', globe, and vision survivals in rhino-orbito-cerebral mucormycosis (ROCM) as well as comparing the characteristics of diabetic versus non-diabetic ROCM.

**Methods:** In a retrospective case series, 63 patients (79 eyes) with biopsy proven ROCM were included (2008-2016). Systemic and ophthalmic manifestations, imaging, management, and final results were recorded. Globe survival was defined as no exenteration and vision survival as final visual acuity of light perception and more.

**Results:** Mean age was 55.56 (SD:12.92) years old with no gender preference. Diabetes was the most common underlying disease (68.3%). Patients' survival was observed in 57.1%. Presence of frozen eye (OR=4.62), nasal mucosal involvement (OR=7.32), and shorter duration of anti-fungal therapy (OR= 1.03) were significantly associated with increased mortality rate. Exenteration did not significantly change the mortality rate in total and diabetics. Globe survival was detected in 43%. Higher white-blood-cell was associated with higher risk of exenteration (P=0.02). Vision survival was observed in 25.3% in whom older age had significantly better vision survival. Ketoacidosis was observed in 46.5% of diabetic patients. Significantly higher number of females and lymphocyte count were observed in diabetic ROCM.

**Conclusions:** Patients', globe, and vision survivals were 57%, 43% and 25%. Exenteration did not affect the patients' survival in total nor in diabetics. While frozen eye, nasal mucosal involvement, and shorter duration of treatment were significantly associated with a higher mortality, higher WBC count significantly increased the risk of exenteration.

9:44 - 9:51 am

## Retrobulbar Injection of Amphotericin B for Acute Invasive Fungal Rhino-Orbital Sinusitis

Davin C. Ashraf<sup>1</sup>, Oluwatobi O. Idowu<sup>1</sup>, Thomas S. Copperman<sup>1</sup>, Kristin E. Hirabayashi<sup>1</sup>, Evan Kalin-Hajdu<sup>2</sup>, M. Reza Vagefi<sup>1</sup>, Robert C. Kersten<sup>1</sup>  
<sup>1</sup>Department of Ophthalmology, University of California, San Francisco, California, United States of America, <sup>2</sup>Department of Ophthalmology, University of Montreal, Quebec, Canada

**Introduction:** Acute Invasive Fungal Rhino-Orbital Sinusitis (AIFROS) is a significant cause of mortality and morbidity in immunocompromised patients. Adjunctive retrobulbar injection of amphotericin B is a globe-sparing, minimally invasive therapeutic option for AIFROS. This study reviews treatment outcomes at a single institution.

**Methods:** In this retrospective case series, review of the electronic medical record identified patients with AIFROS disease managed by the Department of Ophthalmology at a tertiary institution over a 10-year period. Beginning in 2015, retrobulbar amphotericin B (1ml of 3.5mg/ml) was used for all cases except two that had only mild orbital disease. Prior to 2015, retrobulbar amphotericin was administered only to two eyes while awaiting surgery (sinus surgery and exenteration). Medical records, radiographic imaging, operative reports, and tissue cultures were analyzed. Statistical analysis consisted of logistic regression, the t-test, and the Chi-squared test.

**Results:** Thirty eyes among 27 patients were identified, composed of 19 eyes not treated with retrobulbar amphotericin (NRA) and 11 eyes treated with retrobulbar amphotericin (RA). Median follow-up time was 49.5 weeks (range 0.14-156). Patients in the RA group were younger, less often had diabetes as a cause of immunosuppression, and less often had a negative fungal culture (Table 1). All patients were treated with systemic antifungals, attempted reversal of immunosuppression, and debridement during endoscopic sinus surgery. In addition, eyes in the RA group received a median of 2 (range 1-6) retrobulbar injections of amphotericin B. Whereas acuity and motility were not significantly different at presentation, the RA group had better mean visual acuity and worse motility at final exam (Table 2). More patients in the NRA group underwent exenteration, but the difference was not significant. Mortality was significantly higher in the NRA group. After controlling for presenting acuity, motility, underlying diagnosis, and age, the odds of death or exenteration for the NRA group were 42.1 times higher [95% CI 2.2-789.3; p=0.01]. One retrobulbar injection was complicated by orbital compartment syndrome requiring canthotomy and cantholysis.

**Conclusions:** Adjunctive retrobulbar amphotericin B may offer less need for exenteration, better visual outcomes, and improved mortality over standard care. This study is limited by its retrospective nature and non-randomized groups. Advancements in standard care may have played a role in the superior outcomes of the more recently treated RA group. Nevertheless, adjunctive retrobulbar amphotericin B should be considered in the management of AIFROS.

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**Table 1**

Table 1. Patient Characteristics

	No Retrobulbar Amphotericin B (NRA)	Retrobulbar Amphotericin B (RA)	p-value
Age (years)	53.6 ± 19.3	43.6 ± 18.6	0.20
<b>Underlying diagnosis</b>			
Diabetes	63%	36%	0.16
Leukemia	21%	27%	0.71
Organ transplant	5%	18%	0.26
HIV	6%	9%	0.76
Other	6%	9%	0.76
<b>Fungal Culture</b>			
Zygomycota	32%	45%	0.48
Ascomycota	37%	55%	0.35
No growth	32%	0%	0.04

**Table 2**

Table 2. Vision, Motility, and Outcome Data

	No Retrobulbar Amphotericin B (NRA)	Retrobulbar Amphotericin B (RA)	p-value
<b>Visual Acuity (logMAR)</b>			
Presenting: Mean (SD)	0.69 (0.78)	0.37 (0.57)	0.44
Presenting: No Light Perception	42%	45%	0.88
Final: Mean (SD)	1.29 (0.89)	0.25 (0.21)	0.04
Final: Improved or Stable	40%	80%	0.22
<b>Ocular Motility (0 to -4)</b>			
Presenting: Mean (SD)	-1.99 (1.88)	-2.53 (1.83)	0.47
Presenting: Frozen globe	26%	45%	0.29
Final: Mean (SD)	-0.22 (0.41)	-1.72 (1.80)	0.04
Final: Improved or Stable	100%	100%	1.00
<b>Exenteration</b>	32%	9%	0.16
<b>Death</b>	35%	0%	0.04

**References:**

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10:30 am – 12 pm

Moderators: Jennifer A. Sivak-Callcott, MD and Michael Kazim, MD

10:30 – 10:36 am

## Predictive Factors of Pre-Operative Diplopia Resolution Following Orbital Decompression for Thyroid Related Orbitopathy (TRO)

Lilangi Ediriwickrema<sup>1</sup>, Archana Nair<sup>2</sup>, Andrew Harrison<sup>3</sup>, Krista Stewart<sup>3</sup>, Michael Yen<sup>4</sup>, Michael Kazim<sup>5</sup>, Kyle Godfrey<sup>6</sup>, Peter Dolman<sup>7</sup>, Rohan Verma<sup>8</sup>, James Garrity<sup>9</sup>, Lawrence Eckel<sup>9</sup>, Mark Lucarelli<sup>10</sup>, Bobby Korn<sup>8,11</sup>, Don Kikkawa<sup>8,11</sup>, Clara Men<sup>12</sup>

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**Introduction:** Patients with thyroid related orbitopathy can present with a diverse spectrum of clinical findings including eyelid retraction, proptosis, restrictive strabismus, congestion, and vision loss. It is estimated approximately 26% of patients will present with pre-operative diplopia prior to orbital decompression; 28.1% of these patients experienced resolution of their symptoms, whereas 65.6% remained stable and 6.3% worsened.<sup>1</sup> The objective of the study is to determine whether certain patient demographics, clinical exam findings, or radiographic parameters may risk stratify the likelihood of experiencing improvement in clinically significant diplopia following orbital decompression surgery for TRO.

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**Methods:** An academic multi-center retrospective chart review of patients who underwent orbital decompression for TRO. Patient demographics (i.e. age, gender, smoking history), type of orbital decompression (i.e. lateral wall decompression vs. medial wall decompression, endoscopic procedure, fat decompression, or strut preservation), use of peribulbar and/or systemic steroids, and clinical activity score (CAS) were reviewed. Postoperative diplopia was determined at a minimum of three months postoperatively and prior to any further orbital surgeries. Preoperative imaging measurements (i.e. surface area ratios of fat to muscle, fat to orbit, and muscle to orbit of both globes at approximately 1.5 cm anterior to the superior orbital fissure on coronal neuroimaging) were calculated using imaging software (Fig 1). Statistical analysis was performed using Stata (StataCorp, TX) to determine if an individual or multiple variables could risk stratify the likelihood of diplopia resolution following TRO orbital decompression surgery.

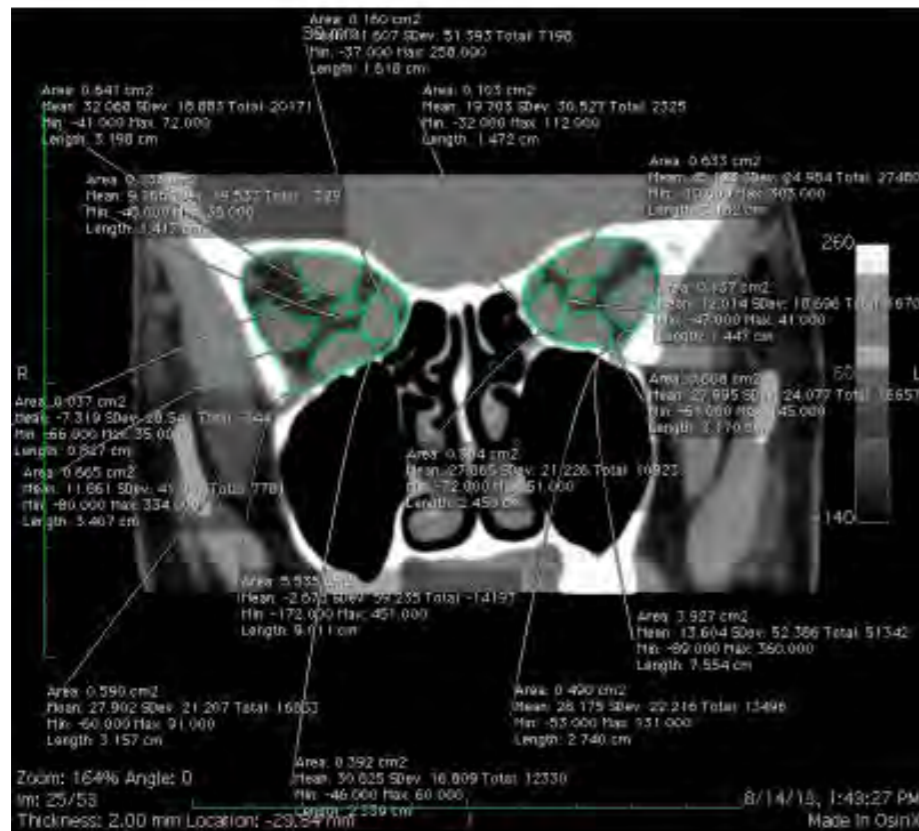
**Results:** A total of 22 patients were identified with clinically significant diplopia prior to orbital decompression. Two patients had postoperative resolution of diplopia at three months whereas 20 patients had persistent diplopia. Average postoperative follow-up was 34 (range 3-151) months. The mean ratio of the cross-sectional muscle area of the lateral rectus to overall orbital area was 15.35% and 7.45% for the resolution and persistence of diplopia, respectively, and was statistically significant ( $p = .041$ ) (Table 1).

**Conclusions:** Resolution of preexisting diplopia following decompression is unpredictable. This study suggests that larger preoperative cross-sectional lateral rectus muscle to orbit ratios is a predictive factor for resolution of preoperative diplopia. We hypothesize that a larger lateral rectus might be able to counteract the medial rectus restriction that occurs from medial wall decompression. Further studies with a larger sample size is required to generate a highly powered prediction, multivariate linear regression, analysis, and further stratify other risk factors.

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**Figure 1** Imaging software contouring of coronal neuroimaging of a patient with preoperative diplopia that resolved following TRO decompression.



**Figure 2** T-tests of muscle measurements

Muscle/Fat to orbit ratio	Mean no post-op diplopia (%); n=2	Mean post-op diplopia (%); n=9	p-value
Left Inferior rectus	9.91	10.06	0.4898
Left Medial rectus	7.55	7.01	0.4546
Left Superior rectus	21.17	10.89	0.0636
Left Lateral rectus	15.35	7.45	0.0415
Right Inferior rectus	14.34	9.24	0.173
Right Medial rectus	8.62	7.54	0.4511
Right Superior rectus	11.28	8.37	0.2374
Right Lateral rectus	16.91	9.06	0.0726
Fat to orbit right	38.1	38.22	0.5026
Fat to orbit left	38.01	37.57	0.4901

**References:**

1. Mainville NP, Jordan DR. Effect of orbital decompression on diplopia in thyroid-related orbitopathy. *Ophthal Plastic Reconstr Surg.* 2014 Mar-Apr;30(2):137-40.
2. Ediriwickrema LS, Korn BS, Kikkawa, DO. Orbital Decompression for Thyroid-Related Orbitopathy during the Quiescent Phase. *Ophthal Plastic Reconstr Surg.* 2018 May 2. [Epub ahead of print].
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10:36 - 10:42 am

## Surgical Outcome and Complication Rate for Patients That Underwent Adjustable Muscle Surgery (AMS) for Thyroid Related Strabismus (TRS)

Matthew Zhang<sup>1,2</sup>, Nina Boal<sup>3</sup>, Jacqueline Carrasco<sup>1</sup>, Michael Rabinowitz<sup>1</sup>, Robert Penne<sup>1</sup>, Mary Stefanyszyn<sup>1</sup>

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**Introduction:** Strabismus surgery in thyroid eye disease (TED) is unpredictable and has high risk of over correction and undercorrection. In thyroid patients who have been decompressed the success in correcting the diplopia depends on releasing scar tissue and when freed doing the muscle surgery. Our study reports the postop outcomes of TED patients who underwent release of scar tissue and adjustable muscle surgery by oculoplastic surgeons.

**Methods:** We retrospectively reviewed the records of patients seen for TED strabismus surgery by Drs. Stefanyszyn, Rabinowitz, Penne, and Carrasco from 1/2012 through 12/2017. Inclusion criteria were Patients >21 years of age with diagnosis of TED that had decompressive surgery followed by muscle surgery. Adjustable muscle surgery was performed using a 5-0 polyglactin 910 on S-14 needle. Muscle adjustment was done in the office following recovery from anesthesia. Surgical success was defined as within 10PD of orthophoria on primary gaze at distance.

**Results:** 61 patients were included in the study. Mean age was 64.8 years and 78% were female. All patients had diplopia preoperatively. The mean horizontal deviation was 25PD, and mean vertical deviation was 26PD. Overall, 87% patients achieved within 10 PD of orthophoria and 84% were free of diplopia postop. Percentage of AMS achieving within 10PD of orthophoria were 87% for one horizontal muscle, 95% for one vertical muscle, and 78% for more than one muscle. The percentage of patients without diplopia post operatively was 63% for one horizontal muscle, 95% for one vertical muscle, and 78.5% for more than one muscle. There was a 0% muscle slip rate. In TED patients that had orbital radiotherapy, diplopia were easier to fix because of non-progression with 90% patients being free of diplopia post operatively versus 79% in patients without radiotherapy (P=0.08). Chi squared test was utilized.

**Conclusions:** Adjustable muscle surgery is effective in treating diplopia in patients with Graves' disease. Our surgical success rate is comparable to strabismus surgeons. Patients who have had decompressive or lid surgery need a release of the scar tissue combined with muscle surgery better performed by the oculoplastic surgeon. TED patients who had orbital radiation are more likely to have easier correction of their diplopia because of lack of progression.

10:42 - 10:48 am

## Risk-Stratifying the Development of Postoperative Diplopia following Orbital Decompression for Thyroid Related Orbitopathy (TRO)

Archana Nair<sup>1,2</sup>, Lilangi Ediriwickrema<sup>1</sup>, Andrew Harrison<sup>3</sup>, Krista Stewart<sup>3</sup>, Michael Yen<sup>4</sup>, Michael Kazim<sup>5</sup>, Kyle Godfrey<sup>6</sup>, Peter Dolman<sup>7</sup>, Rohan Verma<sup>1</sup>, James Garrity<sup>8</sup>, Laurence Eckel<sup>9</sup>, Mark Lucarelli<sup>10</sup>, Allison Chen<sup>1</sup>, Bobby Korn<sup>1,11</sup>, Don Kikkawa<sup>11,12</sup>

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**Introduction:** Development of postoperative diplopia is a recognized side-effect of orbital decompression. Studies estimate new onset diplopia ranges from 10-60% of patients<sup>1</sup>. More accurate information would help guide preoperative patient counseling. This study aims to evaluate risk stratification for postoperative diplopia based on patient demographics, clinical exam, and radiographic parameters before and after orbital decompression for thyroid related orbitopathy (TRO).

**Methods:** An academic multi-center retrospective chart review of patients who underwent orbital decompression for TRO was conducted. Patient demographics including age, gender, smoking history, type of orbital decompression (i.e. lateral wall vs. medial wall, endoscopic, fat decompression, or strut preservation), use of peribulbar and/or systemic steroids, and clinical activity score (CAS) were reviewed. Postoperative diplopia was determined at a minimum of three months postoperatively and prior to any further surgeries. Cross-sectional area ratios of each extraocular muscle to orbit and total fat to orbit were calculated at approximately 1.5 cm anterior to the superior orbital fissure on coronal neuroimaging. All measurements were done using imaging software (Figure 1). Statistical analysis was performed using Stata (StataCorp, TX).

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**Results:** A total of thirty patients without preoperative diplopia were identified. At three months postoperatively, eighteen patients had no diplopia whereas twelve patients developed diplopia. Average postoperative follow up was 32 (range 3-160) months. Enlargement by cross-sectional area of each of the eight rectus muscles to the overall orbital area is independently correlated with the development of diplopia. Statistically significant differences were noted for the left inferior rectus muscle (5.96% vs. 9.58%,  $p=0.023$ ), right inferior rectus (6.53% vs. 10.62%,  $p=0.007$ ), left medial rectus (5.07% vs. 8.67%,  $p=.017$ ), right medial rectus (5.36% vs. 7.85%,  $p=0.024$  vs. 10.62%,  $p = .007$ ), left superior rectus (6.83% vs. 11.39%,  $p=0.027$ ), right superior rectus (7.04% vs. 12.98%,  $p = .005$ ), left lateral rectus (6.36% vs. 9.63%,  $p=0.027$ ), right lateral rectus (6.1% vs. 11.08,  $p = .002$ ), and left fat to orbit ratio (37.55% vs. 55.28%,  $p=0.031$ ) for the control and postoperative diplopia groups, respectively.

**Conclusions:** To the authors knowledge, this is the first study to identify risk factors for development of diplopia following orbital decompression using preoperative radiographic imaging. This study demonstrates that preoperative cross-sectional muscle to orbit ratios are predictive factors for postoperative diplopia. Further data analysis will be needed to make further generalizations. We aim to further stratify risk factors and develop a risk calculator using multivariate analysis.

**Figure 1**

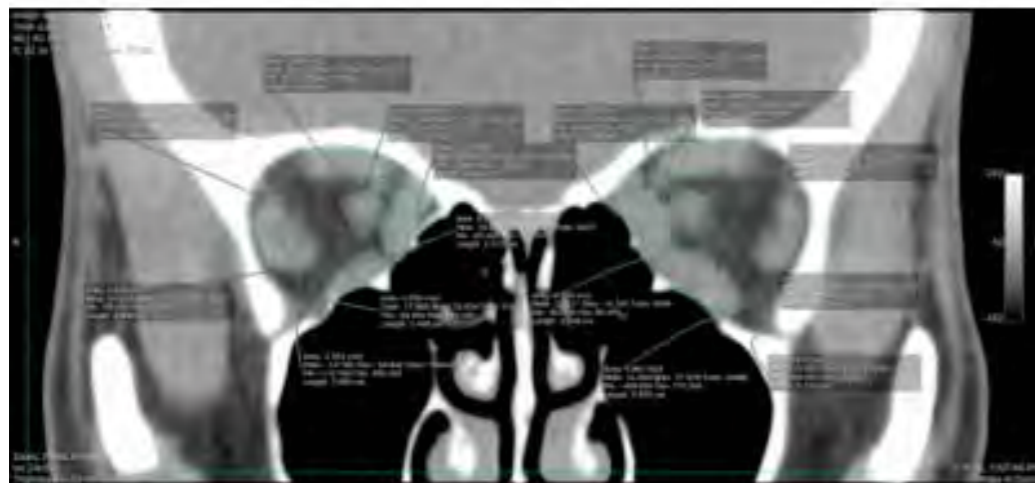


Figure 1: Contouring of coronal neuroimaging on Osirix

**Figure 2**

Figure 2: T-test calculations of muscle to orbit ratio

Muscle/Fat to orbit ratio	Mean no post-op diplopia (%) : n=18	Mean post-op diplopia (%) : n=12	p-value
Left Inferior rectus	5.96	9.58	0.023
Left Medial rectus	5.07	8.67	0.017
Left Superior rectus	6.83	11.39	0.027
Left Lateral rectus	6.36	9.63	0.027
Right Inferior rectus	6.53	10.62	0.007
Right Medial rectus	5.36	7.85	0.024
Right Superior rectus	7.04	12.98	0.005
Right Lateral rectus	6.1	11.08	0.002
Fat to orbit right	39.12	51.31	0.091
Fat to orbit left	37.55	55.28	0.031

**References:**

1. Ediriwickrema LS et al. Orbital Decompression for Thyroid-Related Orbitopathy During the Quiescent Phase. Ophthalmic Plast Reconstr Surg 2018.
2. Forbes G et al. Ophthalmopathy of Graves' disease: computerized volume measurements of the orbital fat and muscle. AJNR Am J Neuroradiol. 1986 Jul-Aug;7(4):651-
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10:48 - 10:54 am

## Simultaneous Aesthetic Eyelid Surgery and Orbital Decompression for Rehabilitation of Thyroid Eye Disease

Francesco Pietro Bernardini<sup>1</sup>, Martin Hector Devoto<sup>2</sup>

<sup>1</sup>*Oculoplastica Bernardini, Genova, Italy*, <sup>2</sup>*Consultores Oftalmologicos, Buenos Aires, Argentina*

**Introduction:** Aesthetic rehabilitation of thyroid orbitopathy includes orbital decompression, correction of eyelid retraction, and aesthetic blepharoplasty, performed traditionally in separate stages. To report the results of orbital decompression surgery associated with aesthetic eyelid surgery in one stage for aesthetic rehabilitation of patients affected by thyroid eye disease.

**Methods:** Retrospective, multicentric study including 40 consecutive patients, who underwent orbital decompression surgery associated with aesthetic eyelid surgery in two centers: Genova (group 1) + Buenos Aires (group 2).

**Results:** Mean patient age in the study group was 41.2, 85% of the patients were female, and minimum follow-up time was 12 months, with average follow up of 27 months. All patients underwent orbital decompression; at the same time, 26 patients (65%) underwent bilateral upper blepharoplasty and 32 patients (80%) underwent transconjunctival lower blepharoplasty. Associated upper eyelid procedures included 23 patients (58%) undergoing upper eyelid retraction repair, 9 patients (23%) undergoing associated inferior retractor recession, and 12 patients (30%) closed transcanthal lateral canthopexy. Seven patients (17%) needed strabismus surgery for the treatment of new-onset diplopia and none required further revision eyelid surgery.

**Conclusions:** Shorr and Seiff suggested 4 stages of surgical rehabilitation: (1) orbital decompression; (2) eye muscle surgery; (3) correction of eyelid retraction; and (4) removal of excess fat and skin. This is the first study to suggest single-stage aesthetic rehabilitation consisting of combined orbital decompression and aesthetic eyelid surgery. This approach has high patient satisfaction and significant reduction in direct and indirect healthcare costs.

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**Figure 1**



**Figure 2**



**Figure 3**



**Figure 4**



**Figure 5**



**References:**

1. Francesco P. Bernardini, MD; Brent Skippen, MD, FRANZCO; Alessandra Zambelli, MD; Benjamin Riesco, MD; and Martin H. Devoto, MD. Simultaneous Aesthetic Eyelid Surgery and Orbital Decompression for Rehabilitation of Thyroid Eye Disease: The One-Stage Approach. *Aesthetic Surgery Journal* 2018, 1-10.

10:54 - 11 am

## Simultaneous Orbital Decompression Surgery, Eyelid Surgery and Strabismus Surgery in Moderate to Severe Thyroid-Associated Orbitopathy

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**Introduction:** A four-stage operation is considered the most effective treatment in the management of stable thyroid-associated orbitopathy (TAO). In this study it was evaluated the efficacy and safety of orbital decompression surgery combined with strabismus and/or eyelid surgery for moderate to severe TAO as a one-step procedure.

**Methods:** Case series: Analysis of the clinical charts of 19 consecutive patients with inactive TAO treated surgically from January 2013 to July 2017 with customized endoscopic orbital decompression of the medial wall, external decompression of the lateral wall and simultaneously performed correction of eyelid retraction and/or strabismus surgery. The patients had a minimum preoperative period of 6 months of stable range of ocular motility and eyelid position. Preoperative and postoperative examinations included visual acuity, margin reflex distance, Hertel exophthalmometry, ocular motility, visual fields and CT scan.

**Results:** Twenty-nine decompressions were performed on 19 subjects (11 females, 8 males; mean age,  $40.6 \pm 14.6$  years). Ocular motility restriction was corrected through recession of the extraocular muscles in 9 cases, no worsening of diplopia was noted and binocular single vision field increased in all patients. Eyelid retraction correction surgery was simultaneously performed in the same surgical session in 10 of 19 cases, and strabismus and eyelid retraction surgery were performed together with decompression surgery in 7 cases. Two subsequent surgical steps were necessary in 4 patients to achieve a satisfactory cosmetic result. At last follow up, mean reduction in proptosis across all patients was 4.1 mm (range, 3-9 mm). Margin reflex distance decreased from a preoperative average of  $4.1 \pm 0.8$  to  $3.3 \pm 0.5$  mm postoperatively.

**Conclusions:** In this series a customized orbital decompression with simultaneous strabismus surgery and/or eyelid surgery decreased proptosis, improved diplopia and eyelid position with a one-step procedure in a range comparable to that achieved through a multi-step technique.

### References:

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11 - 11:06 am

## Natural Course of Upper Eyelid Retraction in Thyroid Eye Disease

Stephanie Young<sup>1</sup>, Yoon-Duck Kim<sup>2</sup>, Dong Cheol Lee<sup>3</sup>, Kyung In Woo<sup>2</sup>

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**Introduction:** Upper eyelid retraction (UER) is commonly observed in thyroid eye disease (TED). However, the natural course of UER has not been well documented. In many old studies the natural course of TED was based on an incomplete ocular assessment, and mainly a measurement of exophthalmos. Hence the purpose of our study was to evaluate the natural course of UER in TED patients and factors affecting its course.

**Methods:** Retrospective noninterventional cohort study on patients with TED in a single tertiary institution from 2006 to 2015 with the following inclusion criteria: 1) unilateral or bilateral UER within 6 months from initial presentation, 2) no prior interventions nor surgical treatment for their UER, and 3) minimum follow-up of 2 years.

**Results:** There was a total of 61 patients included in the study. Forty-one (67.2%) patients had unilateral UER, giving a total of 81 eyes. Mean age was 42.3±15.1 years. Figure 1 shows the natural course of eyes with UER over 48 months, with mean MRD1 decreasing from 6.1mm at presentation to 4.8mm at 12 months, and 4.4mm at 24 months, and mean lagophthalmos decreasing from 1.3mm at initial presentation to 0.7mm at 12 months and 0.5mm at 24 months.

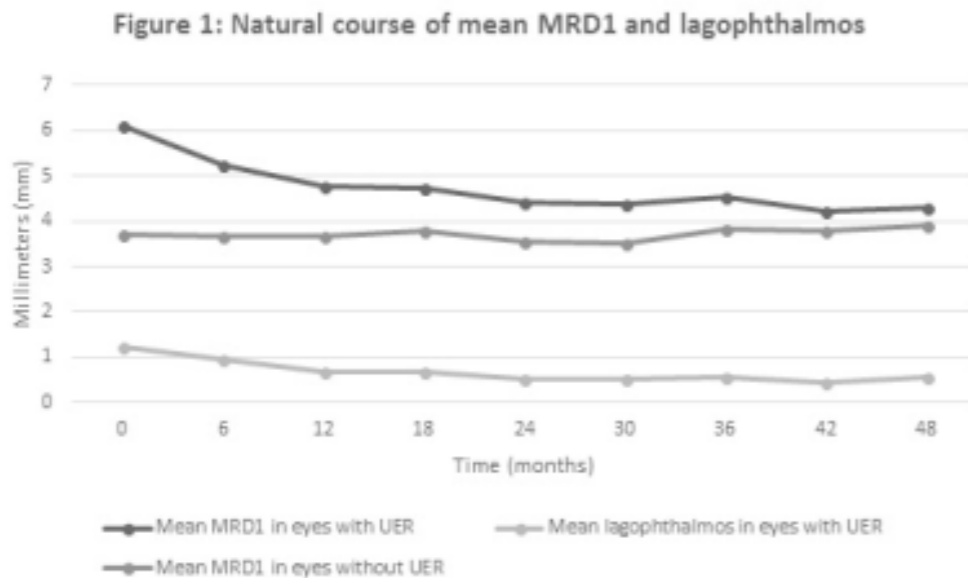
Figure 2 shows the natural course of eyes with UER (MRD1 > 5mm), borderline UER (4 < MRD1 ≤ 5mm), and normalization (MRD1 ≤ 4mm) over time. The proportion of eyes with normalization of lid height increased from 0% at presentation to 22.2% at 6 months, 37.0% at 12 months, and 49.4% at 24 months. 69.1% of eyes had at least one episode of normalization of MRD1, with mean time to normalization being 18.0±12.4 months. A negative family history of TED was significantly associated with a 6.2 times likelihood of normalization compared to a positive family history of TED (Figure 3). Factors found to be associated with a lower likelihood of normalization include male sex (odds ratio[OR] 0.3), age between 40 to 50 years old (OR 0.5), and smoking history (OR 0.8). Figure 4 shows the correlation between MRD1 and various factors, with change in exophthalmometry, CAS and TSI being significantly correlated to change in MRD1. There was no correlation between change in MRD1 and TRAb.

**Conclusions:** Our study shows that TED-related UER spontaneously improves in approximately 75% of patients by 24 months and normalizes in approximately half of patients by 24 months, with certain factors affecting this likelihood. An improved knowledge of the natural history of eyelid signs in TED, particularly that of UER, will allow more optimal management of patients with mild to severe disease.

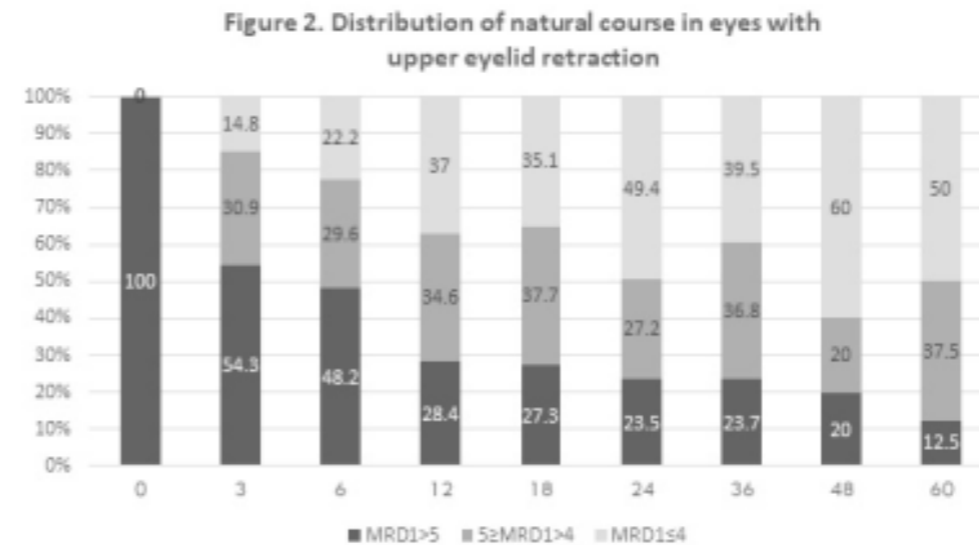
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**Figure 1**



**Figure 2**



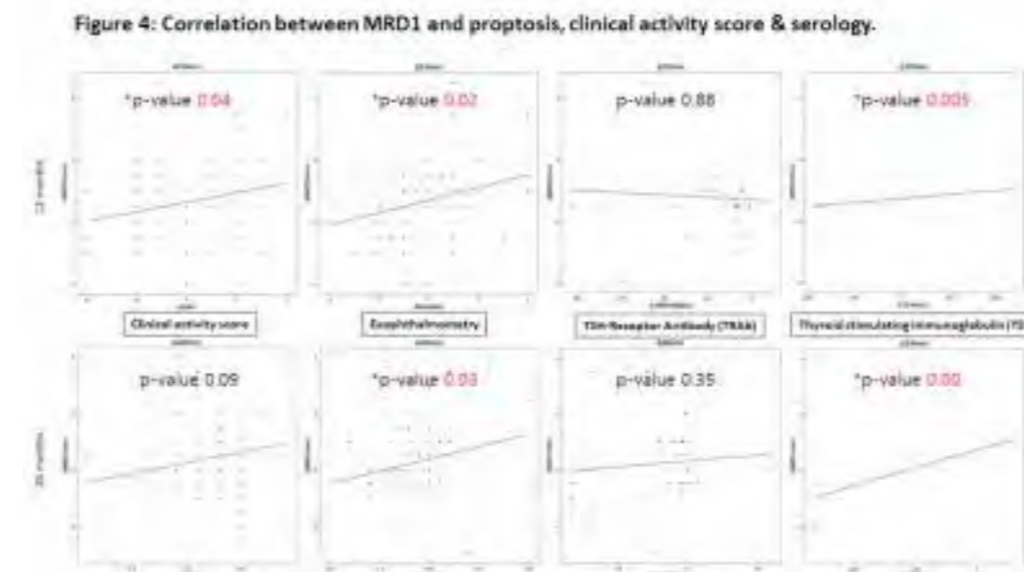
**Figure 3**

**Figure 3: Factors associated with normalization or non-normalization of UER**

Factors	P-value	Odds ratio (OR)
Gender	Female	1
	Male	0.3
Age (years)	<30	1
	30s, 40>	0.96
	40s, 50>	0.47
	50s, 60>	0.97
Smoking	No	1
	Yes	0.73
Family history of thyroid disease	Yes	1
	No	0.03*
Ocular motility disorder	No	1
	Yes	0.12
Clinical activity score (CAS)	CAS < 4	1
	CAS ≥ 4	0.62
Systemic treatment	No	1
	Yes	0.32

\*P-value significant at p<0.05 using univariable logistic regression

**Figure 4**



**References:**

1. Rundle FF, Wilson CW. Development and course of exophthalmos and ophthalmoplegia in Graves' disease with special reference to the effect of thyroidectomy. Clin Sci 1945;5:177-194.
2. Anagnostis P, Boboridis K, Adamidou F, Kita M. Natural course of mild Graves' orbitopathy: is it a chronic remitting or a transient disease? J Endocrinol Invest 2017;40:257-261.
3. Piantanida E, Tanda ML, Lai A, Sassi L, Bartalena L. Prevalence and natural history of Graves' orbitopathy in the XXI century. J Endocrinol Invest 2013;36:444-449.

11:06 - 11:13 am

## Supraorbital Neuralgia and Thyroid Eye Disease

J. Randall Patrinely, Jr, BA, James R. Patrinely, MD, FACS, Charles N.S. Soparkar, MD, PhD, FACS  
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**Purpose:** To establish a relationship between thyroid eye disease (TED) and supraorbital neuralgia (SON), and to identify a reliable approach to the diagnosis and management of SON in people with TED.

**Design:** Retrospective case series.

**Participants:** One thousand one hundred twenty-six consecutive patients with a confirmed diagnosis of TED.

**Methods:** Patients presenting to a single TED referral practice between 2010 and 2014 who were followed until December 2017 or care completion were retrospectively studied, and demographics, active and inactive phase durations, and reactivation rates were recorded. TED activity was assessed using the vision, inflammation, strabismus, and appearance modification of the clinical activity score system (CAS), and TED severity was classified using the European Group of Graves' Orbitopathy system. Clinical subtypes of peri-orbital pain were identified, and the diagnosis of SON was confirmed by resolution with a supraorbital nerve block. Responsiveness of SON to different treatment modalities was recorded.

**Main Outcome Measures:** Pain characteristics and treatment response.

**Results:** One thousand one hundred twenty-six patients with TED were included. Nine hundred thirty-five patients (83%) were deemed "active" at some time during the 7-year study period, and 1092 (97%) achieved "inactive" phase by the study conclusion. Of the 1,126 patients, 946 (84%) reported a "pressure," "aching," or "soreness" at some time behind at least one eye, whereas 91 (8%) complained of far more debilitating symptoms suggestive of SON. All 91 patients were given a supraorbital nerve block, and 100% had complete resolution of their pain within 15 minutes. Eighty-eight of the 91 patients (97%) with SON-type pain eventually underwent orbital decompression compared to 496 (48%) without SON-type pain ( $p < 0.00001$ ). Among patients with SON, 8% experienced TED reactivation compared to 2% among those who did not ( $p = 0.01$ ). Curiously, orbital decompression, neuroleptic cocktails, and supraorbital nerve blocks were each more effective in SON management than narcotics, triptans, ergots, tricyclic antidepressants, or high dose corticosteroids, and no correlation was found between CAS or TED severity and the development of SON.

**Conclusions:** SON, a debilitating condition sometimes seen with TED, appears to be associated with an increased risk for future TED reactivation, and local anesthetic administered at the supraorbital notch can be both diagnostic and therapeutic. The cause of SON in TED remains uncertain and does not appear to be solely related to the severity or duration of TED activity.

11:13 - 11:20 am

## Efficacy and Safety of Intravenous Methylprednisolone for Active Thyroid Eye Disease - An 8-Year Southeast Asian Centre Experience with Comparison of 3 Different Protocols

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**Introduction:** Pulsed intravenous methylprednisolone (IVMP) has been the first line treatment for the active inflammatory phase of thyroid eye disease (TED) globally. However, no standardized protocol is practiced worldwide with reported efficacy but potential morbidity. The aim of this study is to present our center's experience on the efficacy and safety of three different IVMP protocols used for patients with active TED at a multidisciplinary tertiary care hospital.

**Methods:** This retrospective case series of 80 patients treated over an 9-year period (2010 - 2018) compared three different protocols of IVMP infusion in active TED patients.

**Protocol 1: High dose protocol:** 1gm/day for 3 days every month for 6 months.

**Protocol 2: Modified protocol:** 1gm/day for 3 days followed by 1g/month for 5 months.

**Protocol 3: EUGOGO protocol:** 500mg weekly for 6 weeks, followed by 250mg/day weekly for 6 weeks.

Data collected: Demographics, inflammatory scores (CAS, VISA-ITEDS Inflammatory Index), autoantibodies, compliance, quiescence of disease vs persistent active disease, need for additional immunological interventions and complications.

**Results:** There were a total of 80 patients who were treated with IVMP, of which 50 patients belonged to the High dose IVMP (Protocol 1), 18 patients belonged to the Modified protocol (protocol 2) and 12 belonged to the EUGOGO protocol (protocol 3). The Clinical Activity Scores before, during and after completion of the 3 protocols, the quiescence vs. persistent activity, compliance rates and complication rates are shown in Table 1.

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Table 1. Comparison of three different protocols

	<u>PROTOCOL 1:</u> High dose protocol	<u>PROTOCOL 2:</u> Modified protocol	<u>PROTOCOL 3:</u> EUGOGO protocol	p-value
<b>No. of patients</b>	<b>50</b>	<b>18</b>	<b>12</b>	
<b><u>CAS grading</u></b>				
Pre-treatment	4.00 ± 1.2	4.67 ± 1.1	4.17 ± 1.6	0.840
Mid treatment	1.94 ± 1.2	2.61 ± 1.4	2.42 ± 0.9	0.153
Post-treatment	1.40 ± 1.5	2.11 ± 1.9	1.75 ± 1.2	<b>0.043</b>
<b><u>Activity status</u></b>				
Quiescent	29 (58%)	10 (55%)	5 (42%)	0.284
Persistent	14 (28%)	8 (45%)	6 (50%)	
<b><u>Compliance rate</u></b>				
Completed	86%	100%	92%	0.232
Drop out	7 (14%)	0	1 (8%)	
<b><u>Complication rate</u></b>				
None	32 (74%)	15 (83%)	10 (91%)	0.413
Mild	6 (14%)	3 (17%)	0	
Moderate	5 (12%)	0	1 (9%)	
Severe	0	0	0	

**Conclusions:** High dose IVMP protocol appears to be more efficacious with higher quiescence rates, good compliance rates and minimal complications as well. Persistent active TED was noted to be higher in both the Modified protocol and the EUGOGO protocols which required additional steroid-sparing immunomodulators for more patients and for a longer period. With good screening and monitoring, all three protocols reported good safety outcomes without any severe complications. In summary, until specific targeted therapies are readily available and time tested, IVMP remains a safe and effective of managing active TED, given the poor quality of life and significant morbidity of the disease.

**References:**

1. Lim NC, Sundar G, Amrith S, Lee KO. Thyroid eye disease: a Southeast Asian experience. Br J Ophthalmol. 2015 Apr;99(4):512-8. doi:10.1136/bjophthalmol-2014-305649.
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4. Liu X, Wang S, Qin L, Qiang W, Dahal M, Fan P, Gao S, Shi B. Short and long-term effects of high-dose intravenous methylprednisolone pulse therapy on thyroid-associated ophthalmopathy. Exp Ther Med. 2016 Aug;12(2):901-908.
5. Sinha A, Bagga A. Pulse steroid therapy. Indian J Pediatr. 2008Oct;75(10):1057-66. doi: 10.1007/s12098-008-0210-7.

11:20 - 11:25 am

## Tocilizumab for Active Thyroid Eye Disease Resistant to Intravenous Steroids and Radiotherapy

Katie Topping<sup>1,2</sup>, Benjamin Erickson<sup>1</sup>, Andrea Kossler<sup>1</sup>

<sup>1</sup>Ophthalmology, Stanford University, Palo Alto, California, United States of America, <sup>2</sup>United States Navy, San Diego, California, United States of America

**Introduction:** Tocilizumab is beneficial in patients with active thyroid eye disease (TED) who are resistant to intravenous steroids and radiotherapy (RT), however there are risks to this treatment.

**Methods:** This is a case series presenting 2 patients with moderate to severe TED with incomplete response to both intravenous steroids and RT.

**Results:** The first patient is a 41 year-old male with active TED resistant to treatment with intravenous steroids and RT. His clinical activity score (CAS) remained elevated at 6/7 (Figure 1 & 2). Infusion of tocilizumab 840 mg 9 weeks following intravenous steroid therapy resulted in significant improvement, however he had elevation of his liver function tests (LFTs). Further infusions were held until cleared by hepatology. His LFTs worsened with an additional 520 mg dose (4 mg/kg) and further infusions were halted. His CAS within 1 month of his second infusion improved to 1/7. His proptosis improved by 1 mm in the right eye and 1.5 mm in the left eye. Thyroid stimulating immunoglobulin (TSI) index trended down from 6.4 before to 4.5 after tocilizumab.

The second patient is a 62 year-old male with progressively worsening TED despite intravenous steroids and RT (Figure 3 & 4). Shortly after these treatments, he required urgent orbital decompression for left compressive optic neuropathy. The intravenous steroid protocol was repeated, again with incomplete response. Tocilizumab infusions (800 mg) were then started 2.5 months after steroids. After 4 monthly infusions, his CAS improved from 5 to 2. His proptosis improved by 2 mm in the left eye. Notably, TSI index decreased from 6.1 before treatment to 1.6 less than 3 months after tocilizumab.

**Conclusions:** Interleukin 6 (IL-6) stimulates thyrotropin receptor expression on orbital fibroblasts and participates in pro-inflammatory processes integral to the pathogenesis of TED. Tocilizumab is a monoclonal antibody that acts as an IL-6 receptor antagonist (1). Previous reports have shown benefit of tocilizumab for steroid-refractory TED or treatment in those intolerant of steroids (2-4). Patients with active TED resistant to steroid treatment and radiation are potential candidates for tocilizumab as demonstrated by both patients in our series.

Tocilizumab is associated with rare but serious risks of infection, hepatotoxicity, gastrointestinal perforation, and malignancy. Although elevated LFTs are reported to occur, they are typically mild and do not require cessation in the setting of TED (3). One of our patients experienced a significant increase in LFT's after 4 mg/kg dose requiring cessation of treatment. While the safety profile is favorable, there are risks which must be weighed carefully when determining the appropriate management of these patients.

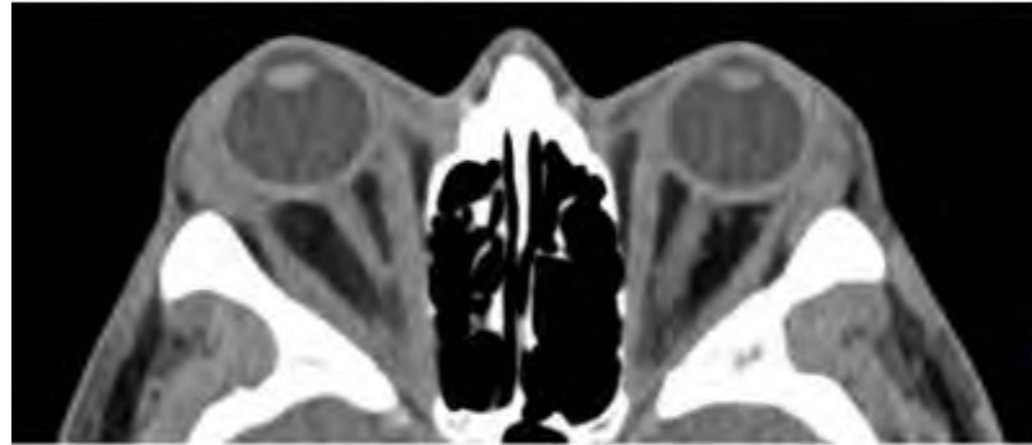
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**Figure 1**



**Figure 2**



**Figure 3**



**Figure 4**



**References:**

1. Jyonouchi SC, Valyasevi RW, Harteneck DA, et al. Interleukin-6 stimulates thyrotropin receptor expression in human orbital preadipocyte fibroblasts from patients with Graves' ophthalmopathy. *Thyroid*. 2001;11:929-34
2. Sy A, Eliasieh K, Silkiss RZ. Clinical Response to Tocilizumab in Severe thyroid eye disease. *Ophthalmic Plastic and Reconstructive Surgery*. 2017 May/Jun;33(3):e55-357.
3. Perez-Moreiras JV, Alvarez-Lopez A, Gomez EC. Treatment of active corticosteroid-resistant graves orbitopathy. *Ophthalmic Plastic and Reconstructive Surgery*. 2014 Mar-Apr;30(2):162-7.
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11:25 - 11:37 am

## Teprotumumab in TED: Diplopia Outcome Analysis

Raymond Douglas<sup>1</sup>, Megan Francis-Sedlak<sup>2</sup>, Robert Holt<sup>2</sup>

<sup>1</sup>Department of Surgery, Cedars-Sinai Medical Center, Los Angeles, California, United States of America, <sup>2</sup>Horizon Pharma, Lake Forest, Illinois, United States of America

**Purpose:** To examine the severity and long-term diplopia response from a masked, placebo controlled trial of teprotumumab in active thyroid eye disease (TED).

**Methods:** Active TED is an inflammatory autoimmune disease characterized by orbital tissue remodeling from activation of TSH and IGF-1 receptors, resulting in excess extracellular matrix and proptosis/diplopia when severe. Phase 2 Trial of an IGF-1R inhibitor teprotumumab reduced proptosis and clinical activity score in active TED (Smith et. al. 2017). 42 teprotumumab-treated patients with active TED were examined for diplopia severity compared with 45 placebo patients up to 48 weeks after trial completion. Diplopia grades were none, intermittent, inconstant, and constant. Constant diplopia, a major quality of life issue for patients with active TED, was examined in this teprotumumab study to see if severe patients would benefit.

**Results:** At the end of the controlled trial (Week 24) there were significantly more teprotumumab patients who had improved by  $\geq 1$  grade than placebo (62% v 22%,  $P < 0.001$ ), improvement in Graves' Ophthalmopathy Quality of Life (GO-QOL) Visual Function Score for those with constant diplopia at baseline versus placebo ( $P = 0.03$ ), reduction in constant diplopia (36% to 9.5%) and increase in those with no diplopia (9.5% to 50%). Grade improvement remained significant out to Week 72 (48 weeks off drug) of follow-up (50% v 24%,  $P = 0.01$ ).

**Conclusion:** Teprotumumab treatment improved diplopia during treatment phase and maintained significance after drug discontinuation in active TED patients.

### References:

1. Smith TJ, Kahaly GJ, Ezra DG, Fleming JC, Dailey RA, Tang RA, Harris GJ, Antonelli A, Salvi M, Goldberg RA, Gigantelli JW, Couch SM, Shriver EM, Hayek BR, Hink EM, Woodward RM, Gabriel K, Magni G, Douglas RS. Teprotumumab for Thyroid-Associated Ophthalmopathy. *N Engl J Med* 2017; 376: 1748-1761.

11:37 - 11:50 am

## What Is the Evidence for Medical Treatment of Thyroid Eye Disease?

Diego Strianese, MD

*King Khaled Eye Specialist Hospital, Riyadh, Kingdom of Saudi Arabia*

**Purpose:** To present an update on the efficacy and safety of immunosuppressive therapy for thyroid eye disease (TED) and to offer a general recommendation for management of TED.

**Methods:** Data were retrieved from a literature search on PubMed, using the following words: thyroid eye disease, immunosuppressant, corticosteroid, methotrexate, azathioprine, cyclosporine, cyclophosphamide, rituximab, etanercept, adalimumab, tocilizumab, teprotumumab, adverse effects, side effects, and complications.

**Results:** Corticosteroids remains the mainstay of TED therapy. Recent research has shown that intravenous corticosteroid treatment regimens is more suitable than oral corticosteroid in terms of efficacy and side-effect profiles. The use of some traditional immunosuppressive agents, such as methotrexate and mycophenolate, seems suitable as steroid- sparing medications. In recent years, many scientific reports have reported the effectiveness of biologic immunosuppressive agents in the management of TED. Etanercept, adalimumab, and tocilizumab have been shown to be effective in reduction of the inflammatory signs with the possible added advantage of preventing relapse of the disease. Teprotumumab may control the disease activity, and it seems to be very effective in preventing disease progression. Infliximab might be useful in severe TED resistant to steroids and orbital decompression.

**Conclusions:** Steroid therapy remains the first-line therapy for moderate/severe and severe vision-threatening TED. The biological agents potentially may provide a deep and long-standing block of inflammatory activity in TED, with the hope to lower the risk of recurrences and to reduce the need of surgical intervention in moderate-to-severe disease. Indeed, the actual incidence of adverse effects is not yet well assessed. Therefore, their use should be limited to those cases that really need an alternative therapy to steroids, handled by expert physician in this field.

# YASOPRS LUNCH SESSION: HOW TO WRITE A JOURNAL ARTICLE: INSIGHTS FROM JOURNAL EDITORS (NON-CME)

Thursday, October 25

12 – 1 pm

Moderators: David B. Samimi, MD and Andrea L. Kossler, MD

12 – 1 pm

## Ethical Considerations

Jonathan J. Dutton, MD, PhD, Editor in Chief, *OPRS*

### EFFECTIVE MEDICAL WRITING

Michelle Biros, MS, MD  
Editor-in-Chief  
*Academic Emergency Medicine*

#### Why We Write

- To disseminate information
- To share ideas, discoveries, and perspectives to a broader audience
- Job security, requirements
- Personal satisfaction, prestige
- Research completion
- To develop a fundable track record

#### How to begin

- Do compulsive pre-study preparation
- Critically read successful papers on the same topic
- Develop the study question and hypothesis concisely
- Write your results first; these are the heart of your message and drive everything else
  - Introduction* must include the study question your results have answered
  - Methods* must indicate how you derived your results
  - Discussion* must argue the reasonable-ness of your results
  - Conclusions* must answer the study question in light of the results obtained

#### General tips

- Adhere to scientific and writing ethics
  - Indicate that the study had proper approvals
  - Be a responsible coauthor
  - Let the editor know about other similar submissions
- Follow the instructions for authors
- Apply research analytical principles to writing; if-then
  - The Abstract may be all that the reader looks at; make sure it is correct
  - The Introduction should justify why you did the study; make it intriguing
- Be patient - centered and not numbers centered
  - Avoid emphasis of statistical significance at the expense of clinical significance
- Write with vigor
  - Consider the active voice and be brief but complete
- Write vividly
  - Describe exactly what you mean in specific and concise terms
- Write for readers and not to please peer reviewers
  - Write as if you are talking to an informed colleague
  - Write as if you are explaining a new technique to an experienced research technician
- Avoid self plagiarism
  - Avoid writing templates from paper to paper
- Update the literature review before you submit the manuscript
  - Be comprehensive in your evaluation of the literature to date
  - Quote primary resources ( not text books)
  - Be compulsive about and cite the literature of emergency medicine
- Don't provoke the reviewers with misspelling, incorrect formatting ,typos
  - Proof read the final version for logic ,accuracy, flow, syntax, spelling etc.
- Don't ignore requests
  - Comply or justify why not

#### Why Manuscripts Fail

1. Technical reasons
  - The focus of the article is not within the scope of the journal
  - The authors did not follow the instructions for authors
  - Unclear purpose, poor syntax, extremely verbose, flight of ideas
  - Ethical concerns about the study or even the study question
  - Lowest denominator paper, with a backlog of higher priority works
  - Author unwilling to revise the manuscript to address reviewer's concerns
2. Cognitive reasons
  - The concept is not unique
  - The question is trivial
  - There are obvious serious uncorrectable scientific flaws in the study itself
  - Selection bias is detected; the study is underpowered
  - The wrong groups are studied
  - The methods are inadequate to answer the study question
  - The results are statistically significant but not clinically significant
  - The conclusions are overstated or cannot be supported
  - The conclusions simply restate the results and do not answer the study question
3. "Degrees" of Manuscript Failures
  - "Fatal Flaws"
    - Serious errors that cannot be corrected with the data at hand or given the limitations of the methods: the question, methods and data collection were wrong from the start.
  - "Rejection threshold"
    - The cumulative weight of many smaller flaws tips the reviewers towards rejection.
  - Rejection = not seriously considered
    - The submitted manuscript is not in the scope of the journal
    - The submission is deemed unethical
    - The science is fatally flawed
  - Not accepted= considered, but
    - Peer review raises seemingly insurmountable concerns
    - There is a backlog of similar manuscripts
    - The submission will not enhance the literature
    - The relevance is unclear

#### Common errors in manuscripts

1. In the Title
  - The title is misleading
  - The title does not set limits
2. In the Abstract
  - The abstract results are not the same as the reported results
  - The abstract reports different measures than the study itself
  - The conclusions of the manuscript are not the same as the conclusions of the paper
3. In the Introduction
  - The study question, hypothesis, study objectives are not specified

The study question, study purpose, objectives, hypothesis and goals are confused  
The importance, novelty, originality of the study is not shown  
The presentation is not intriguing ( ie, the introduction is boring)

#### 4. In the Methods

Methods are reported that were not used ( ie template methods from other papers)  
Details of the methods are missing  
Methods are omitted ( ie some results do not relate to the described methods)

#### 5. In the Discussion

The logic is loose – a flight of ideas  
The content is too expansive and wanders from the results  
The presentation is biased, and omits key findings from other investigators  
Key results are not eluded to or are poorly explained  
The references are outdated or misrepresented  
Speculation is not identified as such  
Possible implications/ the study's importance are overstated  
The study's limitations are not described

#### 6. In the Conclusions

The conclusions simply restate the results  
The conclusions do not answer the study question  
The conclusions do not set limits for application  
The conclusions call for more study

#### Common errors when reporting RESULTS

1. Errors of Omission: Something is left out, either intentionally without justification, or unintentionally

##### A) Not accounting for all study subjects

The table Ns don't add up  
Numbers in the paper are not consistent  
Categories equal more than 100 %

*Suggestion*: Include a schematic summary of the study population. This will account for all patients at each stage of the study, efficiently summarize the study design, and indicate the probable denominators for proportions, percentages, and rates. Double check all tables, the text and the abstract for consistency.

##### B) Not naming which statistical tests were used for specific analyses

Multiple tests are described in the methods : which is used where is not identified

*Suggestion*: Indicate the test used after each type of result. If the editor thinks this is redundant, it will be removed in the final edit.

##### C) Not presenting the results in a clinically relevant units

Try to answer " How will medicine be different as a result of this research?"

##### Suggestions:

- 1) When applicable, make the patient the unit of reporting.  
Report the group response, but if appropriate, provide the number of patients who got better or worse after the interventions.
- 2) When applicable, include " efforts to yield" measures  
This allows treatments to be compared in similar terms by determining how many units of a resource are needed to produce one unit of an outcome.

(continued)

(continued)

3) When applicable, describe the quality of life after treatment

This acknowledges that patients have a say in what types of treatment they desire, and is therefore important in decision analysis or the development of clinical guidelines. It also may make a statistically nonsignificant finding clinically significant.

4) When possible, use a positive frame of reference.

Report a success rate instead of the failure rate: survival instead of mortality.

5) Report confidence intervals (CI) for primary outcomes

Confidence intervals report the precision of the estimates of the responses of the entire population, and indicates the size of the treatment effect and therefore if it clinically important.

2. Errors in the Analysis

A) Lack of power

Statistical power indicates the ability of a test to detect a difference if one truly exists. If no difference is found between two groups, it can mean that there is no difference, or there is not enough data to determine if there is a difference (the sample size is too small)

*Suggestions:* Early statistical consultation with power calculations before the study to determine how many subjects are needed; report power calculations in the methods section of the paper.

B) Failure to adjust for multiple comparisons

The more tests done, the greater the chances of false positives; the likelihood of false positives increases each time comparisons are made.

*Suggestions:* Early statistical consultation to apply a corrective measure (ie Bonferroni's correction) or readjusting the p to accommodate for multiple tests in the same data set. Report your attention to this in the methods.

C) Analysis by treatment received and not by intention to treat

The success of an intervention is related to the efficacy of the therapy and the ability to deliver it within the designated clinical setting. Therefore, to accurately estimate its effectiveness, you must account for those patients for whom the treatment is initiated but cannot be completed.

*Suggestions:* Early statistical consultation. Indicate that the analysis used intention to treat; if data is reported otherwise, this must be explained and justified.

D) Providing no assurance that the data conform to the assumptions of the analysis

Parametric tests (t-test, ANOVA) assume normally distributed data but most biological data are not normally distributed

*Suggestions:* Early statistical consultation. The assumptions of the data must be declared or easily implied. For biological data, reporting the median and range (or intraquadrile range) is usually better than the mean and the standard deviation.

E) Mixing up incidence vs prevalence

Prevalence = the proportion of the population that has a disease at a particular time  
Incidence = the rate at which new disease occurs in a population

*Suggestion:* Re-visit your study question to be sure you are reporting what you intended.

3) Errors in Interpretation

A) Not recognizing the limits/meaning of p

If  $p < .05$ , the difference between two groups is statistically different from zero. This does not indicate the size of the difference or how precisely the trial was able to estimate a true treatment difference.

*Suggestion:* Consider reporting confidence intervals as well as p values.

B) Pragmatic vs explanatory studies

Explanatory studies attempt to understand a disease or therapeutic process and are conducted under tightly controlled conditions.

Pragmatic studies or effectiveness studies are designed to make clinical decisions, and are conducted under clinical conditions; these may be confounded by uncontrollable factors.

*Suggestion:* Do not imply that the results of a pragmatic study suggests a disease or therapeutic mechanism.

**Guidelines for Writing Results- The Study as it was Conducted (Adapted from Lang and Seric)**

- Specify the dates of the data collection period, and state why these dates were picked.
  - Places the study in time
  - Allows for the consideration of technologic advances in care or differences between what is reported then and what is standard now
- Provide a schematic summary of the study, showing the number and disposition of participants at each stage.
  - Accounts for all patients at each stage of the study
  - Efficiently summarizes the study design
  - Indicates the probable denominators for proportions, percentages, and rates
- Describe the characteristics of each group to ensure that no one subcategory includes atypical subjects.
  - Eligible but not approached for participation
  - Evaluated for participation but did not meet the study inclusion criteria
  - Evaluated and met criteria but declined participation
  - Did not complete treatment
  - Completed treatment but were lost to follow up
  - Completed entire protocol
- Indicate how the sample group represents the population as a whole and similarities or differences between the control groups and experimental groups at baseline.
- Indicate if allocation (randomization) of patients or masking was successful.
- Describe duration and nature of the follow up.
- For observations based on judgment, provide an assessment of consistency of agreement between observers.

**Guidelines for Writing Results: The Study Outcomes**

- Present the results and absolute changes or differences for all primary endpoints.

- Report 95% CI for changes or differences in endpoints.
- Report actual p values for all primary analyses.
- Whenever possible, report the main findings of the study in figures or tables.
- When possible, report statistical findings in enough detail to allow reanalysis or metaanalysis.
- Report any potential confounding or interactive effects.
- Indicate the degree to which the participants adhered to the study protocol and explain any exceptions or deviations from the protocol.
- Report all potential treatment related side effects and adverse events.
- Describe the treatment of outlying values.
- Account for all observations and explain any missing data.
- Report any anecdotal evidence or observations that might contribute to a more accurate or complete understanding of the study or its results.

**Suggested readings**

- Hall GM. *How to write a paper.* BMJ Publishing Group, London 1994.  
*Very basic guide to pulling together ideas, results and analysis of research. Defines what should be in each paper subsection.*
- Hulley SB, Cummings SR. *Designing clinical research.* Williams and Wilkins, Baltimore, 1988.  
*A research classic, this is an excellent, easy read, which discusses the research process from developing the question to publishing the data.*
- Lang TA, Secic M. *How to report statistics in medicine.* BMJ Publishing Group, ACP, Philadelphia, 1997.  
*The title is misleading- this excellent book describes not only the meaning of statistical tests but also how to write research, how to interpret it, and how to clinically apply it.*

## Writing the Manuscript

Julian D. Perry, MD, Executive Editor, *AJO*

## What Happens after Submission?

Suzanne K. Freitag, MD, Editor in Chief, *Orbit*

## Supplemental Reading:

*Ophthalmic Plastic and Reconstructive Surgery*  
Vol. 15, No. 1, pp 2-3  
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### Editorial

#### Getting Into Print: Ten Suggestions for Success in Publishing

I am grateful to the Executive Committee of the American Society of Ophthalmic Plastic and Reconstructive Surgery for the opportunity to serve as Editor of *Ophthalmic Plastic and Reconstructive Surgery*. In concert with thoughtful authors, a hard-working Editorial Board, and a dedicated publisher, I hope that this journal will help "to heal the sick and to advance the science" (1). Since I assumed the responsibilities of Editor last July, I have been delighted by the diligence with which the Editorial Board and our ad hoc reviewers have approached their work. In this editorial, I'd like to offer a few suggestions to potential authors who have great ideas and who aspire to see them in print.

1. Clearly state the purpose of your project in the introduction to the paper. What specific questions did you set out to answer? Is the subject truly worth writing about? Why should the reader take the time to read your work? "If you don't strike oil quickly, stop boring" (2).
2. Be assiduous in reviewing and citing pertinent published work. Remember, however, that references have been likened to insulin: both are essential, but in excess they induce coma. Additionally, impurities are disastrous (2).
3. Be honest. Everyone has seen preoperative and postoperative photographs with the head tilted just so to camouflage an imperfect result, and no one is fooled. Even worse, avoid unauthorized duplicate publication of entire articles or parts of manuscripts.
4. In a similar vein, be mindful of potential legal issues. Make sure that a patient whose identity can be determined gives permission for his or her photograph to be published. It's prudent, too, to be aware of copyright laws—it is surprising to learn sometimes who actually "owns" our ideas and work.
5. Write clearly and concisely (3). Avoid "carcinomenclature" (4) and needless words (5). In medical writing, "brevity is the kiss of life" (2). Additionally, we should heed the advice

we received in childhood to make sure that we understand the meaning of the words we use. For example, although sports television brings pleasure to millions (including me), the medium can be a hazardous environment for the mother tongue. I was amazed one evening to hear a panel of sportswriters declare Steve Carlton "the penultimate left-hander." On another show, an interview with a highly paid running back disclosed that he had no problem carrying the football with either hand because he is "amphibious," and that learning his team's extensive playbook was easy because he has a "photogenic memory." And it may surprise some on network television to learn that "histrionics" is not the study of history and that "renumeration" is not a synonym for financial compensation. While we're saving the English language, let's abandon "irregardless," a distasteful hybrid of irrespective and regardless. Although the term has elbowed its way into the dictionary because of persistent incorrect use, "its reputation has not risen over the years, and it is still a long way from general acceptance" (6).

6. Read your paper aloud to help identify strange wording. My favorite example: "If the baby fed on milk fails to thrive, boil it" (2). It was interesting, as well, to read in a prominent East Coast newspaper that an athlete's hard work allowed him to "reap what he had sewn."
7. Make sure the number and order of authors is appropriate (7-9). One should share credit but not be profligate. Neither the ward clerk nor the department chair need to be listed as an author unless substantial intellectual contributions (such as project design, data acquisition or analysis, critical suggestions, or writing) were provided. I recently read a case report that was "authored" by nine persons. Perhaps a good rule of thumb is that there should not be more than two authors for each patient being reported. Even something as unusual as the description of a human baby with a tail-like appendage was a single-authored paper (10).

Supported in part by an unrestricted grant from Research to Prevent Blindness, New York, New York, U.S.A.

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### EDITORIAL

3

8. Don't neglect the physical presentation of the manuscript. Although style never should supersede substance, fine wine should not be served in a paper cup. An untidy manuscript, unfortunately, may suggest sloppy research.
9. Include a cover letter to the Editor when your manuscript is submitted. No one is the world's authority on every facet of a specialty or subspecialty, so it may be helpful to explain the importance and relevance of the investigation. Similarly, if you believe that the peer-review process has not given your paper its proper due, explain why to the Editor and request an additional review.

10. Finally, enjoy the process! Writing, even scientific writing, can be fun and fulfilling. Although I'm certain I'll never experience writing as described by the Nobel Laureate Gabriel García Márquez—"the human condition that most resembles levitation"—occasionally we may be fortunate enough to appreciate it as "the most intimate, solitary pleasure one can imagine" (11).

I'm constantly impressed with the creativity and energy of our colleagues in the oculoplastic surgery community. Because we are obliged as physicians to share our ideas and innovations with others, and because our writings will outlive us, it's worthwhile to do the task well. The responsibility of ed-

itors and reviewers is to determine what is most meritorious for publication and to assist authors in producing the best work possible. If we all do our jobs well, our patients will be the greatest beneficiaries.

George B. Bartley, M.D.  
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*Ophthalmic Plast Reconstr Surg*, Vol. 15, No. 1, 1999



1 – 1:40 pm

Moderators: Martin H. Devoto, MD and Jill A. Foster, MD, FACS

1 – 1:06 pm

## **Biplanar Hyaluronic Acid Filler Injections to the Temple and Lateral Brow Continuum**

John Fezza

*Center for Sight, Sarasota, Florida, United States of America*

**Purpose:** Filling the Temples and Brows with hyaluronic acid (HA) has grown in popularity as a nonsurgical method to restore youthfulness to the upper face. The purpose of this presentation is to describe an anatomically based approach to achieve safe and reproducible results to counteract temple deflation.

**Methods:** Over 30 patients were assessed and treated for temple hollowing and associated lateral brow ptosis. The HA filler was placed superficially beneath the skin and above the superficial temple fascia for maximal lift. The lateral brow was inflated with deep injections into the retro-orbicularis fat pad (ROOF). A video detailing the injection technique incorporated. The use of cannula vs. needle is addressed as well as the rationale for placement of HA filler in a biplanar fashion.

**Results:** Most patients experienced a lateral brow-temple lift and were happy with the results. One patient required reversal of filler for bumps. No cases of infection, necrosis or vision changes were noted.

**Conclusion:** HA filler can be placed into the lateral brow and temple for a more youthful appearance in those patients with hollow temples and lateral brow ptosis. The temples and lateral brow should be treated as a continuum to achieve maximum results.

1:06 - 1:12 pm

## Does One Really Need to Aspirate when Doing Filler?

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<sup>1</sup>Ophthalmology Div Oculofacial Plastic Surgery, Mount Sinai Hospital ICAHN School of Medicine, New York, New York, United States of America,

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**Introduction:** Hyaluronic acid (HA) fillers have increased in popularity, especially for scar correction, rhytid augmentation, and volume rejuvenation. While complications are rare, knowledge regarding their prevention and management are crucial. Intra-arterial injection can cause visual impairment and local skin damage, including necrosis. The utility of pre-injection aspiration as a safety checkpoint to prevent intravascular injection has become controversial. Shedding light on this technique can help practitioners increase patient safety. There are a plethora of new hyaluronic acid fillers on the market that come equipped with a variety of needles. The different fillers have varying amounts of viscosity and thus differences in negative pressures are created with aspiration. It is important to know if these differences vary the effectiveness of aspiration prior to injection to assess intravascular dangers. This study evaluates the differences that could be necessary in pre injection aspiration.

**Methods:** Syringes of ten commonly used HA fillers were evaluated: Allergan (Pringy, France) Juvéderm Ultra Plus XC, Juvéderm Ultra XC, Juvéderm Volbella, Juvéderm Vollure, and Juvéderm Voluma; Galderma (Uppsala, Sweden) Restylane Defyne, Restylane Lyft, Restylane Refyne, and Restylane Silk; and Merz (Raleigh, N.C.) Belotero Balance. Factory provided needles were utilized. Values for physiochemical and rheological properties at 0.1 Hz were gathered.<sup>11</sup>

Whole blood was drawn from a willing author and collected in EDTA-coated vacutainers that were pressure stabilized. Various syringes containing HA filler were each inserted, and the plunger was pulled back at a volume of either 0.2cc or 0.5cc to mimic pre-injection aspiration. For each type of filler, there was a separate syringe for each pullback volume. The plunger was held at this distance until flashback was visualized or until 30 seconds had passed. Each aspiration attempt was filmed to monitor the presence or absence of a flash upon aspiration. The syringe was then withdrawn from the container and evaluated for the presence of blood.

For samples with a negative flash in 30 seconds, a value of 30 seconds was used for purposes of statistical analyses. A multivariable regression model was utilized to evaluate factors influencing time to flash. Paired t-test was used to compare pullback volumes of each HA filler in order to control for outside variables. Two-sample t-test was used to compare changes in time to flash with varying HA concentration,  $G'$ ,  $G''$ , and  $G^*$ .

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**Results:** For the ten HA fillers, the time to flash varied (Table 1). Using a multivariable regression model ( $R^2=.8324$ ;  $p<.0001$ ),  $Y=-76.01-6.67A+1.46B+2.13C-10.27D-1.79E+10.41F$ , where  $Y$ =time to flash (s),  $A$ =pullback volume (cc),  $B$ =needle gauge (G),  $C$ =HA concentration (mg/ml),  $D$ = $G'$  (Pa),  $E$ = $G''$  (Pa), and  $F$ = $G^*$  (Pa). HA concentration ( $p=.0016$ ),  $G'$  ( $p=.0017$ ),  $G''$  ( $p=.0029$ ), and  $G^*$  ( $p=.0017$ ) were shown to have significant relationships with time to flash, whereas needle gauge ( $p=.1641$ ) and pullback volume ( $p=.3263$ ) did not.

However, when comparing pullback volume using an appropriate paired analysis for each HA filler, 0.5cc pullback volume had a significantly decreased mean time to flash than 0.2cc pullback volume (8.86 vs 10.86;  $p=.0389$ ). All HA fillers, except for Restylane Defyne, showed a decreased time to flash with 0.5cc vs 0.2cc pullback volume (Figure 1). A significantly greater decrease in time to flash between 0.5cc vs 0.2cc pullback volume was associated with HA concentration  $>21$ mg/ml ( $p=.0166$ ),  $G' <153$ Pa ( $p=.0024$ ), and  $G^* <155$ Pa ( $p=.0024$ ), while  $G''$  showed no significant differences.

**Conclusions:** Pre-injection aspiration may have utility as a safety checkpoint for HA fillers. Practitioners may have to adjust pullback volume of the plunger and waiting time to visualize the flash based on physiochemical and rheological properties of the filler.

The use of pre-injection aspiration as a safety checkpoint has been utilized for many years in soft-tissue augmentation. However, controversy exists on whether it has any utility, especially since there is no standardized technique. Although limited, our study suggests that practitioners may have to adjust pullback volume of the plunger and waiting time to visualize the flash based on physiochemical and rheological properties of the filler. However, more robust clinical studies are needed to appropriately evaluate the role of pre-injection aspiration as a safety checkpoint for soft-tissue augmentation.

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Figure 1

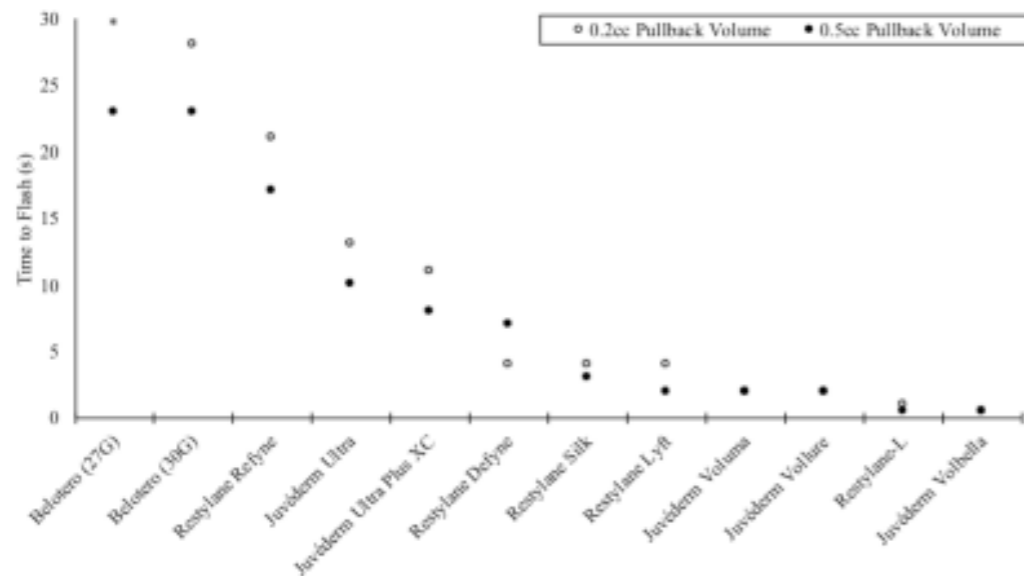


Figure 2

TABLES

HA Filler	Needle Gauge (G)	Pullback Volume (cc)	Time to Flash (s)
Belotero Balance	27	0.2	30*
		0.5	23
		0.2	28
Juvéderm Ultra Plus XC	27	0.5	23
		0.2	11
Juvéderm Ultra XC	30	0.2	13
		0.5	10
Juvéderm Volbella	30	0.2	0.5
		0.5	0.5
Juvéderm Vollure	30	0.2	2
		0.5	2
Juvéderm Voluma	27	0.2	2
		0.5	2
Restylane Defyne	27	0.2	4
		0.5	7
Restylane Lyft	29	0.2	4
		0.5	2
Restylane Refyne	30	0.2	21
		0.5	17
Restylane Silk	30	0.2	4
		0.5	3

Table 1. Time to flash for various HA fillers. \*Time to flash was negative at 30s.

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1:12 - 1:18 pm

## Refining Facelift Results: A Modified Approach to Improving Jowls

Bhupendra C. K. Patel

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**Introduction:** It is now well accepted that for decent, long-lasting facelift results, there should be proper repositioning and tightening of not only skin but also the SMAS. Many different approaches are used to manipulate the SMAS: SMASectomy, imbrication, high-incision lift, and deep-plane lift. Although all these techniques give gratifying results, the area that shows the earliest reversal of changes is the jowl area. This has continued to be a challenge for aesthetic surgeons.

**Methods:** There have been conflicting findings in anatomical studies of the jowl area. Mendelson suggests that there is weakening of masseteric ligaments, with resultant loosening of the platysma, resulting in a jowl (Fig 1). Pessa's group suggests that there is a mandibular septum that separates jowl fat from the neck fat and that there are two separate jowl fat pads (Fig 2). Although surgically most surgeons attempt to mobilize the SMAS adequately to improve the jowl there is disagreement as to how to get the best surgical results with regards the jowls and the pre-jowl sulcus.

Based upon cadaveric studies, we found that there is a subcutaneous layer of fat which is very adherent to the skin which forms the jowl, in addition to the jowl fat that we see as a single fatty collection above and lateral to the mandibular ligament as has been shown recently (Schenck et al) (Fig 3).

Our surgical technique, which we will demonstrate with the help of videos, consists of three steps to give a substantial improvement to this region:

1. Release of the mandibular ligament.
2. Removal and repositioning of the jowl fat pad.
3. Direct vision "nibble-and-remove" technique of fat removal from the subcutaneous fat deposit found under the jowl skin.

**Results:** Using these techniques, we have improved our facelift results with well-defined jawlines and persistence of the results for up to four years to date. (Figs 4, 5). We will discuss the nuances to allow the audience to understand how to best get an improvement in this difficult area.

**Conclusions:** Addressing the subcutaneous fibrous fatty layer together with manipulation of the jowl fat and mandibular ligament gives excellent, reliable and lasting results with facelifts as we will illustrate with videos and surgical results.

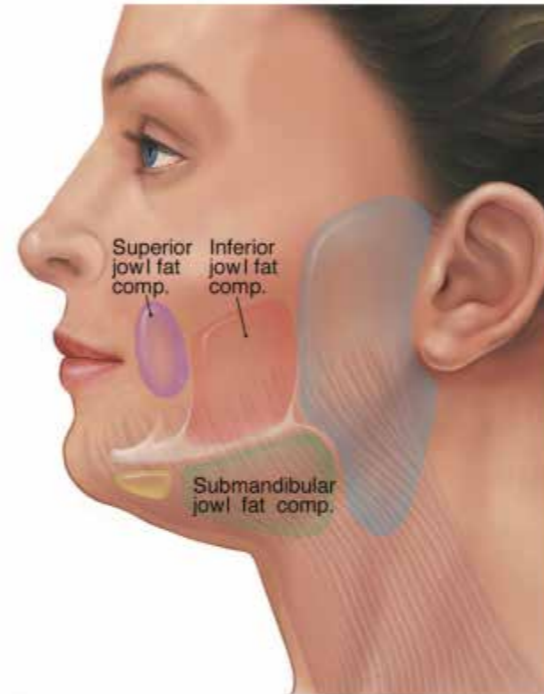
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**Figure 1**



**Figure 2**



**Figure 3**



**Figure 4**



**Figure 5**



**References:**

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1:18 - 1:24 pm

## Transconjunctival Blepharoplasty with Adjunctive Canthal Suspension: An Analysis of Outcomes

Amy Patel<sup>1</sup>, Raymond Douglas<sup>2</sup>, Guy Massry<sup>3</sup>

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**Introduction:** To Analyze Various Forms of Canthal Suspension Used as Adjuncts to Aesthetic Lower Blepharoplasty (ALB)

**Methods:** A 3-year retrospective review of charts of patients undergoing canthal suspension as an adjunct to ALB was performed. In all cases when fat was addressed, only the transconjunctival approach was used. Patients were subdivided into 3 types of canthal suspension: 1. Closed (CCS), 2. Open commissure sparing (OCSCS), and 3. Open (OCS). An analysis of each suspension technique was correlated to breadth of blepharoplasty surgery (skin excision only, fat reduction or fat transposition plus minus skin excision). Complications and patient satisfaction were assessed.

**Results:** From Sept 2014-Spet 2017, 205 patients (149 women and 49 men) underwent ALB. The average patient age was 49 years (range 29-82 years) and the average follow-up was 13 months (range 3-28 months). Adjunctive canthal suspension was performed on 122/205 patients (60%). Of this group 70 patient (57%) had a CCS, 21 patients (17%) had an OCSCS, and 31 patients (25%) had an OCS. Thirteen of 205 patients (6%) had skin excision blepharoplasty only, and all (100%) had canthal suspension (8 patients (62%) had CCS, and 5 patients (38%) had OCS). Sixteen patients (8%) patients had fat reduction ALB. Three of these patients (19%) had added skin excision with CCS, 4 patients (25%) has skin excision without canthal suspension, and 9 patients (56%) had only TCB (no canthal suspension). One hundred and seventy-six patients (86%) had TCB with FR. Sixty-one of these patients (35%) had isolated FR (no canthal suspension). 9 patients (5%) had skin excision without canthal suspension, fifty-nine patients (34%) had skin excision with CCP, 26 patients (15%) had skin excision with OCS, and, 21 patients (12%) had skin excision with OCSCS. Canthal pain/tenderness (> 1 month) was notes in 12 patients (10%). Seven of these (58%) were in the OCS group. In 2 patients (1.6% - both OCS) pain persisted > 6 months. Canthal asymmetry was noted by 10 patients (8%), 4 of which (50%) were in the OCS group. Two patients (1.6% - both OCS) noted asymmetry beyond 6 months. Finally, a palpable nodule was noted in 13 patients (11%) more commonly in the CCS group (6 patients). All but 1 nodule resolved after 6 months. There was 1 case of canthal dehiscence (OCS <1%). Canthal webs were noted in 3 patients (2% -all OCS group). Only 1 was clinically obvious. Patient satisfaction was high with most complaints in the OCS group.

**Conclusions:** All types of canthal suspension evaluated are effective and lead to excellent results. In this series the CCS and OCSCS led to fewer complications and patent complaints.

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1:24 - 1:30 pm

## Superior Sulcus Rejuvenation in the Asian Eyelid - The "Bottoms-Up" Technique

Sathyadeepak Ramesh<sup>1,2</sup>, Robert Goldberg<sup>2</sup>

<sup>1</sup>Eye and Facial Plastic Consultants, LLC, Langhorne, Pennsylvania, United States of America, <sup>2</sup>Division of Orbital and Ophthalmic Plastic Surgery, University of California, Los Angeles, Los Angeles, California, United States of America

**Introduction:** Superior sulcus hollowing is a hallmark of the aging face, and numerous approaches have been considered, including fat grafting<sup>1</sup>, fat repositioning within the eyelid<sup>1,2</sup>, acellular dermal matrix placement<sup>3</sup>, or hyaluronic acid gel injection<sup>4</sup>. The Asian eyelid in particular has a smooth convexity from the brow to the crease due to diffuse aponeurotic attachments allowing inferiorization of fat, as well as the presence of subcutaneous and suborbicularis fat layers. Fat atrophy with aging does not occur uniformly, with volume loss most pronounced in the superior orbital rim hollow<sup>5</sup> (Figure 1). However, thin eyelid skin overlying bone presents a difficult challenge for volumization, as the aforementioned methods are prone to contour irregularities. We have developed a novel method of superior sulcus volumization to address the superior orbital rim hollow in the Asian eyelid, and present our experience herein.

**Methods:** In this cohort study, five patients (10 eyelids) underwent upper eyelid blepharoplasty from January - June 2018 with a novel superior sulcus volumization technique. After removal of an ellipse of skin, the preaponeurotic and nasal fat pads of the upper eyelid were dissected and formed into pedicles, with care to ensure no residual attachments to the levator aponeurosis or orbital septum. The superior orbital rim was then bluntly dissected in the area of hollowness in the preperiosteal plane, and the brow fat pad exposed. The pedicles were then sutured into this pocket to the undersurface of the brow fat pad with fast gut suture, and the incision was closed in standard fashion (Figure 2). Full face photographs were taken preoperatively and at postoperative month 3, and patient satisfaction assessed qualitatively.

**Results:** Five patients (10 eyelids) were included in this study. Mean follow-up was 2.8 months. All patients were observed to have significant improvement in the superior sulcus region, with excellent patient satisfaction. There were no contour irregularities. No patients requested further treatment for the superior sulcus. There were no complications including infection, ptosis, retraction, or forehead anesthesia noted in the postoperative period.

**Conclusions:** Superior transposition of the preaponeurotic and nasal fat pads into the preperiosteal superior orbital rim pocket provides excellent rejuvenation of the superior orbital rim hollow in Asian patients.

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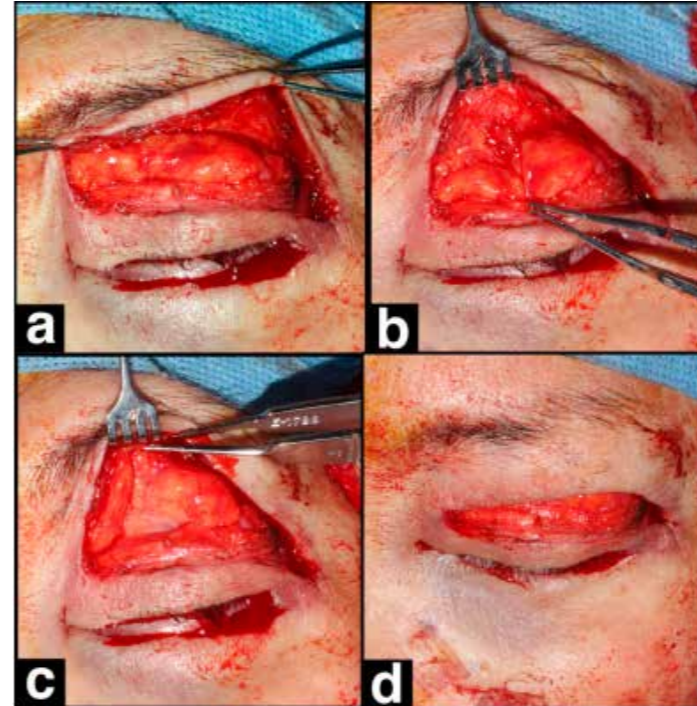


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**Figure 1**



**Figure 2**



**References:**

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**Featured Speaker: Babak Azizzadeh, MD, FACS**

1:40 - 2:10 pm

**Reshaping Rhytidectomy**

The history of facial rejuvenation has mainly focused on addressing cervicofacial laxity. It was not until the latter half of the 20<sup>th</sup> century when surgeons started considering that facial rejuvenation requires three-dimensional considerations. The ultimate goal of facial rejuvenation is to improve the appearance of patients in a natural, youthful, attractive and appropriate manner. Over the past decade, the speaker's view relating to rhytidectomy as the cornerstone of facial rejuvenation has significantly changed due to a much better understanding of the anatomic changes that occur in the aging process. The principles of "facial anatomic subunits" that have long been the guiding principles in facial and nasal reconstruction but rarely considered in aesthetic procedures are now utilized by the speaker to improve patient's facial shape and surface topography as well as create smooth transitions between the temple, zygomatic arch, lateral cheeks, lower eyelids, anterior midface, buccal space, mandibular jaw line and neck to obtain ideal results. Henceforth, the rhytidectomy technique and complementary procedures should be modified to address a more holistic approach to facial rejuvenation. Whereas in the past, rhytidectomy was a standardized procedure performed in a cookie-cutter fashion for all aging face patients, it is now a customized procedure and just one of many tools in our armamentarium for comprehensive facial rejuvenation. Procedures such as autologous fat grafting, chin augmentation, conservative periorbital rejuvenation and buccal space modification are often utilized in conjunction with rhytidectomy to create facial harmony and enhance youthful contours and shape.

2:20 - 2:45 pm

Moderators: Gary J. Lelli, MD and Steven M. Couch, MD

2:20 - 2:26 pm

## Opioid Use after Oculofacial Plastic Surgery

Priscilla Vu<sup>1</sup>, Jeffrey Yu<sup>1</sup>, Emily Charlson<sup>1</sup>, Seanna Grob<sup>2</sup>, Jeremiah Tao<sup>2</sup>

<sup>1</sup>University of California, Irvine, Irvine, California, United States of America, <sup>2</sup>Oculoplastic and Reconstructive Surgery, University of California, Irvine, Irvine, California, United States of America

**Introduction:** Opioid abuse was declared a public health emergency in the United States in 2017 and prescription opioids may be at the core of the problem<sup>1,2</sup>. In particular, opioids prescribed for post-operative pain may be the introduction of these medications that are later overused or abused<sup>3</sup>. There is minimal data describing opioid needs after oculofacial plastic surgery. This pilot study aims to characterize typical opioid needs for post-operative pain after oculofacial surgery.

**Methods:** 69 consecutive patients who underwent oculofacial plastic surgery and were given an analgesic prescription analgesics containing opioids (hydrocodone/acetaminophen 5mg/325mg every 6 hours as needed for pain, 10 tablets) were surveyed about their post-operative opioid use. The type of surgery and relevant patient history was recorded.

**Results:** 27.5% of patients underwent orbital surgery, 17.4% of patients underwent lacrimal, and 55.1% of patients underwent eyelid and brow surgery (include aesthetic surgery). 43 patients (62.3%) filled their opioid prescriptions for postoperative pain. After all oculofacial plastic surgeries, patients needed on average 3.5 tabs (standard error: 0.58) and only consumed 32.3% (standard error: 5.2%) of prescribed tabs. 34 patients took no opioids (49.3%), 13 patients finished the whole prescription (18%), and 4 patients required an additional prescription of the same (5.8%). Those undergoing orbital surgery consumed a greater number of opioid tablets on average (mean: 6.90 tabs, standard error: 1.29) than those undergoing eyelid (mean: 1.89 tabs, standard error: 0.52) and lacrimal surgery (mean: 3.08 tabs, standard error: 1.38) ( $P < 0.05$ ). There was no significant difference between the mean tabs consumed for eyelid and lacrimal surgery. 27 patients (39.1%) had leftover opioid tabs and 59.3% of those patients stored them in their bedroom or bathroom cabinet instead of disposing.

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**Conclusions:** Opioids needs were much less than what was prescribed for this series of oculofacial plastic surgery patients. Orbital surgery was associated with greater opioid needs than eyelid or lacrimal surgery. Further research is warranted to evaluate opioid indications and dosing after oculofacial plastic surgery. Single institution data is limited in power, however may be important to account for population and culture variables in guiding local initiatives to help stem the opioid epidemic.

**References:**

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2:26 - 2:32 pm

## Intravenous Ketorolac in Ptosis Repair

Edward Wladis<sup>1,2</sup>, Arup De<sup>3</sup>, Valerie Chen<sup>1</sup>, Kate Dennett<sup>4</sup>

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<sup>2</sup>Albany Medical College, Division of Otolaryngology, Department of Surgery, Albany, New York, United States of America, <sup>3</sup>Anesthesiology, Albany Medical College, Albany, New York, United States of America, <sup>4</sup>Ophthalmology, Albany Medical College, Albany, New York, United States of America

**Introduction:** Historically, intravenous ketorolac (IVK) has been contraindicated in oculoplastic surgery, in light of concerns about hemorrhagic complications. However, this agent has been widely employed in other fields of surgery, and offers analgesia without the risks of narcotic medications. Furthermore, IVK does not alter consciousness, and thus may be well-suited for levator advancement surgery (LAS). We sought to determine the effect of IVK on postoperative pain, nausea, and hemorrhage in LAS.

**Methods:** In a randomized trial, 50 patients underwent LAS without IVK ("controls"). 50 patients received IVK prior to LAS. The surgeon was unaware of whether or not patients received IVK. Pain scores, the requirements for narcotic analgesics and anti-emetic agents, and the presence of bleeding complications were assessed immediately postoperatively, prior to discharge, and on post-operative day (POD) 1.

**Results:** Mean post-operative pain scores were statistically significantly lower among patients that received IVK than controls immediately after surgery (1.4 vs 4.6, respectively,  $p < 0.05$ ) and on POD 1 (1.2 vs. 3.2, respectively,  $p < 0.05$ ). 8% of patients that received IVK required narcotic analgesics, as compared to 28% of control patients ( $p < 0.05$ ), and 2% of patients that received IVK required anti-emetics, as compared to 14% of control patients ( $p < 0.05$ ). No patient developed a bleeding complication.

**Conclusions:** In ptosis repair, IVK reduces post-operative pain and the requirement for narcotic analgesics and anti-emetic medications without increased risks of bleeding. This medication may be safely employed to address these issues without the concerns surrounding the use of narcotic analgesics.

2:32 - 2:38 pm

## A Systematic Review of Methods for Reducing Local Anesthetic Injection Pain among Patients Undergoing Periocular Surgery

Mišo Gostimir<sup>1</sup>, Ahsen Hussain<sup>2</sup>

<sup>1</sup>Ivey Eye Institute, Western University, London, Ontario, Canada, <sup>2</sup>Department of Ophthalmology and Visual Sciences, Dalhousie University, Halifax, Nova Scotia, Canada

**Introduction:** Various approaches can be used to help minimize pain during the injection of local anesthetic. The majority of current evidence involves non-specific injection sites. The purpose of this review was to provide a comprehensive summary of all existing evidence for methods used to reduce injection pain specifically in the context of periocular procedures.

**Methods:** A literature search of the MEDLINE, EMBASE, and Scopus databases was conducted to identify all relevant experimental and observational studies from 1946 to 2018. Studies were included of patients undergoing periocular surgery under subcutaneous local anesthesia whereby outcomes were reported following a specific intervention intended to help reduce pain. Risk of bias was assessed using recognized tools.

**Results:** Following the review of 2089 search results, 26 articles representing 1662 patients were included. The methods assessed in the studies included choice of anesthetic agent, buffering, warming, dilution, needle type, administration of an inhalational anesthetic, conscious sedation, application of topical anesthetics, iontophoresis, skin cooling with ice, tactile distraction with vibration, and decreasing the rate of injection. Methods demonstrating best efficacy included solution modification (buffering, dilution, warming), skin cooling with ice, vibration, and decreased rate of injection. Methods with less empirical support included the administration of inhalational anesthetics and the application of lidocaine/prilocaine mixture cream to the injection site. Aspects of the injection process that warrant additional study include modification of equipment factors, patient preparation, and strategies to reduce pain due to anesthetic infiltration.

**Conclusions:** Several methods of reducing injection pain in periocular procedures have been studied and this growing body of literature is of considerable value in oculoplastic surgery. We have summarized these studies and presented them in a logical format for application to practice. Further study may be inspired from methods shown to be effective in non-periocular regions, with consideration for the nuances of periocular tissue and the context of facial procedures.

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**Figure 1**

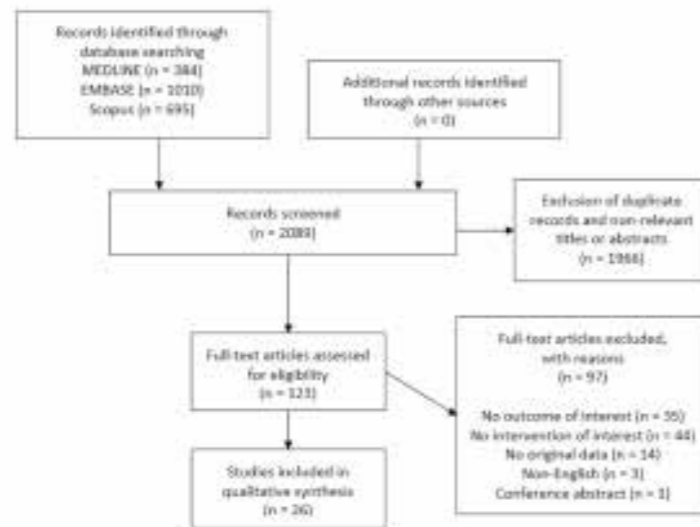


FIG. 1. Flow diagram demonstrating the study selection process according to Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines.

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# BREAKOUT #1: PRACTICE MANAGEMENT

Thursday, October 25

3:15 – 5:15 pm

Chair: Catherine J. Hwang, MD

Faculty: Brett S. Kotlus, MD; Tanuj Nakra, MD; Jeffrey A. Nerad, MD, FACS; John B. Holds, MD; and Michael Kazim, MD

3:15 – 3:20 pm – Introduction Panel

## **Starting a Solo Cosmetic Private Practice: Things I Wish I Knew**

3:20 – 3:30 pm – Brett S. Kotlus, MD

3:30 – 3:40 pm – Questions from Audience

## **Mid-Career Transitions: How I Changed my Practice**

3:40 – 3:50 pm – John B. Holds, MD (University → Solo Private Practice)

3:50 – 4 pm – Jeffrey A. Nerad, MD, FACS (University → Group Multispecialty Private Practice)

4 – 4:10 pm – Questions from Audience

## **How to Break the Shackles of Managed Care**

4:10 – 4:20 pm – Michael Kazim, MD

4:20 – 4:30 pm – Questions from Audience

## **Going Green: Tips on How to Increase Cash Business**

4:30 – 4:40 pm – Tanuj Nakra, MD

4:40 – 4:50 pm – Questions from Audience

## **Final Remarks**

4:50 pm – 5 Pearls for Maximizing your Practice from all Panelists

5:15 pm – Adjourn

3:15 – 5:15 pm

Chair: Aaron Fay, MD

Faculty: Babak Azzizadeh, MD; Jacqueline Diels, OT; Raymond S. Douglas, MD, PhD; Mark J. Lucarelli, MD, FACS; Guy G. Massry, MD; and Michael T. Yen, MD

3:15 – 3:30 pm

### Physical Therapy for Facial Nerve Palsy/synkinesis

Jacqueline Diels, OT

Facial neuromuscular retraining (NMR) is a specific subset of occupational and physical therapy created for improving functional outcomes in patients with facial paralysis, paresis and/or synkinesis after facial nerve injury. It is unfamiliar to many physicians encountering patients with facial paralysis and its sequelae. However, it may represent an opportunity for improved function and recovery from facial paralysis and synkinesis. Facial NMR is distinguished from non-specific therapies in that it does not use gross motor, maximum effort exercises or electrical stimulation, which can reinforce abnormal movement patterns. In contrast, facial NMR identifies neuromuscular firing and sequencing abnormalities in the facial musculature and treats them by focusing on improving coordination between muscles as opposed to simply increasing their strength.

Facial paralysis can result in significant functional and psychological consequences, substantially decreasing quality of life. Functional deficits can include impaired eye closure and lacrimation, difficulty with oromotor functions of speech and mastication, hypotonus resulting in flaccidity, hyper tonus resulting in synkinesis, mass action, contracture, and disfigurement with decreased emotional expression. Acutely, injury to the facial nerve causes a readily recognizable flaccid paralysis. In delayed recovery, this may be followed by aberrant neural re-innervation causing inappropriate movement (synkinesis). Many acute flaccid facial paralysis patients seen by ophthalmologists will go on to develop synkinesis. Deceptively, what appears to be weakness in the synkinetic face may in fact be abnormal co-contraction of opposing musculature decreasing range of motion and normal movement patterns. It can go unrecognized by patients and medical professionals alike. This sequela is best evaluated by a multidisciplinary team to provide an optimal management strategy. A combination of NMR and adjunctive botulinum toxin is suggested as the best currently-available treatment for patients with this challenging problem. When used in conjunction with NMR, selective temporary muscle denervation provides a window of opportunity during which the patient can practice coordinated movement patterns without the co-contraction and restriction caused by synkinesis. This new motor learning develops more appropriate movement patterns that, in some patients, appear to persist well beyond the botulinum toxin effect.

This presentation will: 1) provide an overview of facial NMR, highlighting its importance in the multidisciplinary treatment of facial paralysis, 2) outline treatment methods and referral timelines for treating flaccidity, paresis and synkinesis; 3) discuss the therapists role in determining optimal botulinum toxin placement to enhance comfort, symmetry and motor learning of the patient.

3:30 - 3:40 pm


## Treatment of Synkinesis

Mark J. Lucarelli, MD, FACS

### Botulinum Toxin for Facial Synkinesis

ASOPRS Fall Scientific Symposium 2018  
Breakout Session

Mark J. Lucarelli, M.D., FACS  
Dortzbach Professor  
Director, Oculoplastic, Orbital & Facial Cosmetic Surgery



### Financial Disclosures

- I have no financial disclosures

### Overview

- Synkinesis basics
- Case examples
- Treatment strategies with botulinum toxin

### Synkinesis

Involuntary movement of one mimetic muscle group occurring during the attempted movement of a second muscle group

### Synkinesis

Common Facial Findings

- Dynamic facial asymmetry
  - Eyelid aperture narrowing
  - Limited oral commissure excursion
  - Smile dysfunction
  - Platysma activation
- Increased resting tone of involved muscles
- Deepening of nasolabial fold




Photo and video credits:  
Jackie Diels, OT

### Synkinesis

- Proposed Mechanisms
  - Aberrant regeneration of facial nerve axons
  - Peripheral ephaptic (adjacent, non synaptic) transmission between axons (ineffective myelination)
  - Synaptic reorganization and hypersensitivity within the facial nerve nucleus
- Baker RS, et al. Neurology 1994

### Synkinesis

Common Patterns


Oro → Ocular  
"Pseudoptosis"  
Marin-Amat variant (eye closure when opening jaw)

Oro → Platysmal  
Oculo → Platysmal  
Oculo → Oral

### Physiotherapy for Synkinesis

Pioneering work

- Balliet R, Shinn JB, Bach-y-Rita P. Facial Paralysis Rehab: Retraining Selective Muscle Control. Int Rehabil Med. 1982.
- Neuroplasticity



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## Physiotherapy for Synkinesis



Diels HJ, Beurskens C. Neuromuscular Retraining: Non-surgical Therapy for Facial Palsy. In: Slattery & Azzizadeh, editors. The Facial Nerve. 2014

## Botulinum for Synkinesis

- Botulinum first reported for synkinesis in 1991
  - Roggenkamper P. et al.
- Duration of improvement: 3-6 mo
  - Mean duration: 4 mo
    - Toffola, et al Disability and Rehab, 2010
- Several studies demonstrate **synergistic effect of botulinum in combination with rehab / neuromuscular retraining**

## Synkinesis

- Placebo-controlled RCT supporting Botulinum
  - OnabotulinumtoxinA vs saline injections
    - 0 – 6 scale by expert (0= no synkinesis; 6 = very severe)
    - **Post injection: 0.5 +/- 1.1 vs 4.4 +/- 1.4 (p < 0.001)**
  - **Patient-reported QoL, social functioning, and synkinesis** all improved in OnabotulinumtoxinA group (p < 0.5)
    - Borodic G. et al. Plast Reconstr Surg 2005

## Synkinesis and Botulinum

### UW-Madison Treatment Strategies

- In conjunction with Neuromuscular Retraining
  - Toxin usually after 6 mo NMR
- Timing and pattern of injections based on highly-detailed evaluation by Therapist (JD); SAQ, Sunnybrook FGS scores
- Goals – personalized and specific
  - In general--
    - **Diminish synkinesis**
    - **Improve normal movement** by relaxing counterproductive co-contraction
    - **Improve patient comfort** by reducing muscle contraction
    - **Assist motor control / learning**
      - Toxin – adjunct for “simplifying” the synkinetic problem

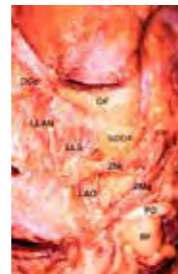
## Synkinesis and Botulinum

### UW-Madison Treatment Strategies

- Small doses (< 1 unit to 2.5 units) onabotulinum toxin at key sites
  - **Almost always:** platysma, orbic oculi, mentalis, corrugator,
  - **Usually / Often:** frontalis, **buccinator**, depr anguli oris, I.I. alaeque nasi
  - **Sometimes:** depressor labii inferioris, orbic oris
  - **Avoid:** zygomatic maj, zyg min, lev ang oris, lev labii superioris
    - even when significant synkinesis / hypertonicity



## Commonly treated facial muscles



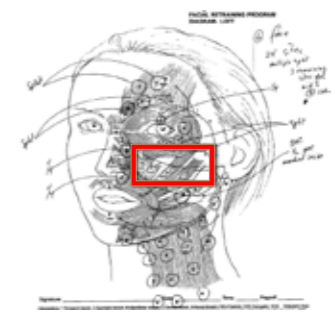
- Orbicularis oculi
- Corrugator supercilii
- Mentalis
- Platysma
- Depressor anguli oris
- Frontalis
- Depressor labii inferioris

## Typical treatment plan



Full dose sites = 2.5 units onabotulinum toxin (BTX-A)

## Typical treatment plan



Low doses; many sites– often > 30 sites

## Synkinesis and Botulinum

### UW Treatment Strategies

- Generally **avoid decreasing normal function** on the unaffected side to “even things out”
  - Patient needs the **unaffected side as a model** for learning
  - Poor motion of synkinetic side NOT from flaccid paralysis
  - Most commonly treated muscles on normal side: **corrugator, frontalis, mentalis**



- 37 yo, Bell's palsy 3.5 yrs prior
- Symptoms:
  - Right eye closes when smiling, speaking or drinking from a glass
  - Right face and neck tight and uncomfortable
  - Cheek “pulls into teeth when smiling”



- 50 yo, Bell's palsy 22 mo prior
- Goals
  - Improve smile
  - Reduce undesired eye closure
  - Decrease tightness of Left face

## Treating buccinator with botulinum toxin in patients with facial synkinesis - a previously overlooked target

Leslie A. Wei, MD, H. Jacqueline Diels, OT, Mark J. Lucarelli, MD

Ophthalmic Plast Reconstr Surg 2016

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## Buccinator muscle

- Buccinator was not a routinely evaluated or treated muscle in synkinesis patients, despite the prevalence of symptoms such as cheek biting, difficulty eating, and speech difficulties.



## Buccinator functions

- Chewing
- Whistling
- Sucking
- Speech (fricative, plosive)
- Flattening the cheek



## Technique

- Sterilely reconstituted onabotulinumtoxin A (concentration 2.5 U per 0.1 mL) was given trans-orally to the buccinator muscle
- Other synkinetic facial muscles treated as well



## Sunnybrook FGS (objective)

Resting Symmetry	Symmetry of Voluntary Movement	Synkinesis
<p>Compared to normal side</p> <p>Forehead (forehead wrinkles)</p> <p>Eye (eye closure)</p> <p>Upper lip (lip elevation)</p> <p>Lower lip (lip depression)</p> <p>Smile (smile)</p> <p>Blow (blow)</p> <p>Whistle (whistle)</p> <p>Other (other)</p>	<p>Degree of asymmetry (0-100%)</p> <p>Forehead (forehead wrinkles)</p> <p>Eye (eye closure)</p> <p>Upper lip (lip elevation)</p> <p>Lower lip (lip depression)</p> <p>Smile (smile)</p> <p>Blow (blow)</p> <p>Whistle (whistle)</p> <p>Other (other)</p>	<p>Note: The Degree of Synkinesis (0-100%)</p> <p>Forehead (forehead wrinkles)</p> <p>Eye (eye closure)</p> <p>Upper lip (lip elevation)</p> <p>Lower lip (lip depression)</p> <p>Smile (smile)</p> <p>Blow (blow)</p> <p>Whistle (whistle)</p> <p>Other (other)</p>

Score of 100 = normal function; score of 0 = complete facial paralysis  
Severe synkinesis can decrease score by 15 points

## SAQ (subjective)

according to the following scale:

- 1 = seldom or not at all
- 2 = occasionally, or very mildly
- 3 = sometimes, or mildly
- 4 = most of the time, or moderately
- 5 = all the time, or severely

Question	Score (1-5)
I When I smile, my eyes close	
II When I speak, my eye closes	
III When I whistle or suck my lips, my eye closes	
IV When I smile, my neck tightens	
V When I close my eyes, my face gets tight	*
VI When I close my eyes, the corner of my mouth moves	*
VII When I close my eyes, my neck tightens	
VIII When I eat, my eye waters	
IX When I move my face, my chin develops a dimpled area	

Sum/45 x 100 = SAQ score.

Score of 100 = severe synkinesis; Score of 20 = Minimal synkinesis

Limited utility in specifically assessing buccinator synkinesis

## Results

- 42 patients
- 9:1 F:M ratio
- Mean follow up 5.5 years
- Mean dose of botulinum toxin to the buccinator per session was 2.0 units
- Mean total dose of botulinum toxin to all facial muscles administered per session was 54 units (range 31 - 108 units)

## Results

- FGS scores showed a statistically significant improvement from a mean of 52 pre-injection to 66 (range 40 - 88) post injection ( $p < 0.0001$ )
- SAQ scores showed a statistically significant improvement from a mean of 66.6 pre-injection to 45.0 post injection ( $p < 0.0001$ )

## Complications

- 3/42 (7%) bothered by temporary decreased tone/increased flaccidity of the cheek

## Limitations

- Retrospective
- Relative value of NMR vs toxin unknown
- SAQ scores obtained from only 2/3 of the cohort

- The combination of botulinum toxin administration (including buccinator) and neuromuscular retraining is effective in the treatment of facial synkinesis both objectively (FGS) and subjectively (SAQ)

- Buccinator injections well tolerated

- improve:

- ease of facial expression
- cheek biting
- speech

- LOW DOSES of TOXIN KEY (0.5-1 unit total to start)

## Botulinum for Synkinesis

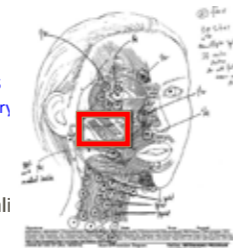
### Getting Started...

- A physiotherapist familiar with facial synkinesis is most helpful
- Low doses are key
  - Usually 1.25 units or 2.5 units / site
  - 1.25 units x 1-2 sites for buccinator
- Consider lagophthalmos and dry eye for periocular sites

## Botulinum for Synkinesis

### Getting Started...

- AVOID midfacial paralysis
  - Improving SMILE is a primary motivator
- Caution with treating contralateral side
- Lateral orbic oculi, mentalis, platysma easiest starting targets



## Botulinum for Synkinesis

### Getting Started...

- AVOID midfacial paralysis
  - Improving SMILE is a primary motivator
- Caution with treating contralateral side
- Lateral orbic oculi, mentalis, platysma easiest starting targets



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## Botulinum for Synkinesis

### Getting Started...

- AVOID midfacial paralysis
  - Improving SMILE is a primary motivator
- Caution with treating contralateral side
- Lateral orbic oculi, corrugator, mentalis, platysma easiest and safest starting targets



## Summary

- Botulinum toxin potent modality in Rx of facial synkinesis
- hypertonicity
- spasms
- social interaction and self-confidence
- overall patient quality of life



Mbango Sickness Mask  
Pende, Congo  
mid-20<sup>th</sup> century

Thank You!



3:40 - 3:45 pm

## The Impact of Neuromuscular Retraining Therapy with and without Botulinum Toxin Injections on Patients with Facial Synkinesis

Suzanne van Landingham<sup>1</sup>, Scott Chaiet<sup>2</sup>, Jacqueline Diels<sup>3,2</sup>, Xing Wang<sup>4</sup>, James Xu<sup>5</sup>, Mark Lucarelli<sup>1</sup>

<sup>1</sup>Department of Ophthalmology and Visual Sciences, University of Wisconsin-Madison, Madison, Wisconsin, United States of America, <sup>2</sup>Division of Otolaryngology-Head & Neck Surgery, Department of Surgery, University of Wisconsin-Madison, Madison, Wisconsin, United States of America, <sup>3</sup>Facial Retraining LLC, McFarland, Wisconsin, United States of America, <sup>4</sup>Department of Surgery, University of Wisconsin-Madison, Madison, Wisconsin, United States of America, <sup>5</sup>School of Medicine, University of Wisconsin-Madison, Madison, Wisconsin, United States of America

**Introduction:** This study evaluates the impact of neuromuscular retraining therapy (NMR) with and without subsequent botulinum toxin injection on patients with facial synkinesis.<sup>1</sup>

**Methods:** This is a retrospective cohort study of consecutive facial synkinesis patients seen at the University of Wisconsin Facial Nerve Clinic from 2012-2016. Inclusion criteria required at least 4 months from onset of paralysis to the first therapeutic encounter and at least 3 months of NMR treatment alone before botulinum toxin therapy (if applicable). The patient-reported Synkinesis Assessment Questionnaire (SAQ)<sup>2</sup> (**Figure 1**) and clinician-reported Sunnybrook Facial Grading System (FGS)<sup>3</sup> (**Figure 2**) were administered before and after at least 3 months of treatment, and 2-6 weeks after botulinum toxin injection for some patients who received botulinum toxin treatment. Improvement is indicated by a decrease in SAQ score, an increase in the composite FGS, or decrease in the synkinesis section of the FGS. Scores from before and after NMR and, when applicable, botulinum toxin injections were compared using Wilcoxon Signed-Rank testing. Additionally, the correlation of SAQ and FGS score changes was calculated using Spearman correlation coefficients.

**Results:** 53 patients were eligible for this study. Patients received NMR for a median of 185 days (interquartile range [IQR] 154-287) prior to receiving botulinum toxin (if applicable). Median baseline SAQ score was 64.4 (IQR 46.7-80.0) with mean change following fNMR therapy -3.9 (SD 24.0, p=0.25). Median baseline composite FGS score was 53.0 (IQR=47.0-67.0) with mean change following NMR therapy 9.4 (SD=7.1, p <0.001). The median baseline FGS synkinesis sub-score was 7.0 (IQR 6.0, 8.0), with median improvement of 1.0 (IQR 0.0-2.0, p<0.001). Additionally, the correlation between SAQ and FGS composite score changes was calculated and found to correlate poorly ( $r=-0.16$ ) (**Figure 3**). The correlation remained weak when comparing the SAQ to the FGS synkinesis sub-score ( $r=-0.24$ ). 35 patients went on to have botulinum toxin injections, of whom 9 patients had post-injections scores available. They had significant changes in SAQ (median 75.6, IQR 57.8-84.4, p=0.004) and FGS synkinesis sub-score (median 1.0, IQR 1.0-1.0, p=0.008), but not in composite FGS (median 4.0, IQR 2.0-10.0, p=0.26).

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**Conclusions:** NMR is an effective treatment for synkinesis and improves clinician-reported outcomes (FGS composite and synkinesis sub-scores) in a significant and clinically meaningful manner. Addition of botulinum toxin resulted in a statistically significant improvement in the patient-reported SAQ instrument not seen in patients undergoing NMR alone, and also improvement in the FGS synkinesis subscore. Unexpectedly, the SAQ and FGS correlated poorly in our sample. These instruments have not been directly compared in the literature. The poor correlation of instruments may suggest discrepancies between the patient's interpretation of the disease and the clinician's, or flaws of the instruments themselves. The authors plan to explore these questions further prospectively.

**Figure 1**

Please answer the following questions regarding facial function, on a scale from 1-5, according to the following scale:

- 1 = seldom or not at all
- 2 = occasionally, or very mildly
- 3 = sometimes, or mildly
- 4 = most of the time, or moderately
- 5 = all the time, or severely

	Question	Score (1-5)
I	When I smile, my eye closes	
II	When I speak, my eye closes	
III	When I whistle or pucker my lips, my eye closes	
IV	When I smile, my neck tightens	
V	When I close my eyes, my face gets tight	
VI	When I close my eyes, the corner of my mouth moves	
VII	When I close my eyes, my neck tightens	
VIII	When I eat, my eye waters	
IX	When I move my face, my chin develops a dimpled area	
<i>Office use only</i> Sum of Scores I-IX		
<i>Office use only</i> SAQ Total Score		

Summate scores for questions 1-9 /45 x 100 = SAQ Total Score

**Figure 2**

**Sunnybrook Facial Grading System**

**Resting Symmetry**  
Compared to normal side

Eye (choose one only)  
normal 0  
asymmetric 1  
asymmetric 2  
asymmetric 3  
asymmetric 4  
asymmetric 5

Cheek (nose-lipal fold)  
normal 0  
abnormal 1  
less pronounced 2  
more pronounced 3

Mouth  
normal 0  
corner dropped 1  
corner pulled up 2

Total:

**Symmetry of Voluntary Movement**  
Degree of muscle EXCURSION compared to normal side

Standard Expressions:  
Forehead (FROW)  
Gentle eye closure (SCL)  
Open mouth smile (ZYGUSM)  
Sneer (LALALL)  
Lip Pucker (DGGDDG)

Voluntary movement score: Total:

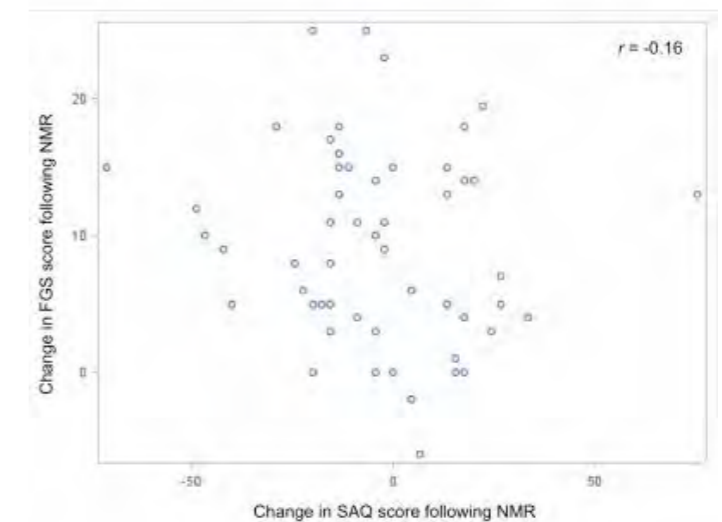
**Synkinesis**  
Rate the degree of INVOLUNTARY MUSCLE CONTRACTION associated with each expression

None 0  
Mild 1  
Moderate 2  
Severe 3

Synkinesis score: Total:

Voluntary movement score:  + Resting symmetry score:  = Synk score:  = Composite score:

**Figure 3**



**References:**

- Diels HJ, Beurskens C. Neuromuscular retraining: non-surgical therapy for facial nerve palsy. In: *The Facial Nerve*. New York, NY: Thieme; 2014:205-212.
- Mehta RP et al. Validation of the Synkinesis Assessment Questionnaire. *The Laryngoscope* 2007;117:923-926.
- Ross BG et al. Development of a sensitive clinical facial grading system. *J Am Acad Otolaryngol-Head Neck Surg* 1996;114:380-386.



3:45 - 3:50 pm

## The Epidemiology and Surgical Outcomes of Facial Nerve Palsy in a Population-Based Cohort

Sarah Alshami<sup>1,2</sup>, David Hodge<sup>3</sup>, Elizabeth Bradley<sup>4</sup>

<sup>1</sup>Mayo Clinic Department of Ophthalmology, Kansas City, Missouri, United States of America, <sup>2</sup>University of Missouri-Kansas City School of Medicine, Kansas City, Missouri, United States of America, <sup>3</sup>Mayo Clinic Department of Health Sciences Research, Jacksonville, Florida, United States of America, <sup>4</sup>Mayo Clinic Department of Ophthalmology, Rochester, Minnesota, United States of America

**Introduction:** Herpes zoster likely plays a causal role in many cases of Bell's palsy. The incidence of herpes zoster has increased substantially over the last 4 decades. We sought to evaluate whether the incidence of facial nerve palsy is also changing over time. We also describe the surgical management and outcomes of facial nerve palsy rehabilitation surgery in an incidence cohort.

**Methods:** We used the Rochester Epidemiology Project (REP) database to search cases of facial nerve palsy in Olmsted County from 2000 through 2010. Of the 1,316 patients identified, 619 patients met our inclusion criteria. Data were gathered regarding age, gender, cause of facial nerve palsy, laterality and degree of paralysis, and medical and surgical treatment outcomes. The overall incidence of facial nerve palsy in Bell's palsy patients and stroke patients was estimated using the age- and sex-specific population figures. Yearly incidence rates for age and sex groups were determined by dividing the number of cases within that group by the estimated total Olmsted County resident population of the group for that given year. The 95% confidence intervals (CIs) for the rates were calculated assuming Poisson error distribution.

**Results:** Bell's palsy and stroke were the two most common causes of facial nerve palsy. The annual incidence of Bell's palsy in Olmsted County per 100,000 population was 39.9 (95% CI 36.1-43.7) for the total population. The annual incidence per 100,000 for stroke resulting in facial nerve palsy was 17.4 (95% CI 14.1-20.6). The incidence of facial nerve palsy due to Bell's palsy and stroke did not differ between males and females. Compared to an earlier study performed at our institution from 1968 to 1982, the incidence of Bell's palsy increased from 25.0 per 100,000 (95% CI 21.7-28.7), a 14.9 per 100,000 absolute increase and a 60% relative increase in the incidence of Bell's palsy. 11 of 619 patients (1.7%) required surgical intervention for facial nerve palsy. The most common procedures were gold weight placement, performed in 3 patients, and tarsorrhaphy, performed in 5 of 11 patients.

**Conclusions:** The incidence of Bell's Palsy has increased significantly over 35 years. This increase has occurred in the context of increasing rates of herpes zoster infection. Only a minority of patients underwent surgical management for facial nerve palsy.

### References:

1. Katusic SK, Beard CM, Wiederholt WC, Bergstralh EJ, Kurland LT: Incidence, clinical features, and prognosis in Bell's palsy, Rochester, Minnesota, 1968-1982. *Annals of Neurology* 1986; 20:622-27.
2. Kawai K, Yawn, BP, Wollan P, Harpaz R: Increasing incidence of herpes zoster over a 60-year period from a population-based study. *Clinical Infectious Diseases* 2016; 63(2):221-26.

3:50 - 3:55 pm

**Ocular and Periocular Manifestations of Facial Nerve Palsy in Pediatric Age Group**

Adel Alsuhaibani, Abdulrahman AlZaid

*Ophthalmology, King Saud University, Riyadh, Saudi Arabia***Introduction:** To assess the ocular and periocular manifestations of facial nerve palsy (FNP) in pediatric age group.**Methods:** Retrospective chart review for all pediatric patients presented with FNP for the last 34 years in two tertiary eye hospitals, Riyadh.**Results:** Among the 90 recruited subjects, the mean duration between onset and presentation was 185 weeks. Male to female ratio was 1.3:1. Traumatic and congenital were the most common causes representing over 80% of cases. 71 patients developed lagophthalmos, 26 of them had severe exposure that ended up with scarring. Lower lid retraction was the most common eyelid abnormality noticed in 23 cases followed by Entropion in 16 and Ectropion in 6.**Conclusions:** Lagophthalmos is a common finding in pediatric FNP that needs to be early managed to prevent permanent visual loss. Compared to adults, children with FNP present with a different spectrum of eyelid abnormality, with lower lid retraction and entropion being the most common findings.

3:55 - 4 pm

## Measurement of the Strength of the Orbicularis Oculi Muscle

Daniel Rootman, Shoaib Ugradar, Robert Goldberg  
*Oculoplastics, UCLA, Los Angeles, California, United States of America*

**Introduction:** There are a range of physiologic conditions in which orbicularis strength is weakened. In terms of assessment, management and following progress, an accurate and reproducible measure of orbicularis strength would be of value to oculofacial plastic surgeons. The purpose of this investigation is to describe the development and testing of a digital orbiculometer for this purpose.

**Methods:** The device (Orbiculometer) was constructed by attaching paired specula (Cook's) to two aluminum cylinders at right angles. An electronic force sensor was mounted at the base of the independently adjustable cylinders (figure 1). The force sensor was attached to a microprocessor using a non-inverting amplifier.

The first stage of reliability assessment involved testing force generated by known weights corresponding to 1/3, 2/3 and the maximum capacity of the sensor. The second stage involved testing normal orbicularis strength in males and females. Subjects with no known orbital or eyelid pathology were recruited. The device was introduced into the palpebral aperture of participants and was set to maintain an intrapalpebral distance of 5 mm. Participants were then asked to close their eyes so that the eyelids would engage the specula. At this point, the force sensor was set to 0. Participants were then asked to squeeze their eyes with full force for a period of 3 seconds. This was repeated 5 times for each participant. A T test was used to compare the results from males and females.

**Results:** In the first stage, the force sensor was found to have an accuracy of 99.1% in the measurement of known weights.

The strength of the left orbicularis oculi was tested in 20 participants. The study included 8 males and 12 females. The mean (SD) force generated by males was 2.52 N (0.09), while that for females was 2.41 N (0.18). The range across all participants was 0.6 N (highest 2.77 N, lowest 2.17 N). Within participants, the SD for 5 measurements was 0.3 N. The difference between males and females was significant ( $p < 0.001$ ).

**Conclusions:** The mechanical device described in this study provides a reliable and accurate means for testing the strength of the orbicularis oculi muscle. We noted a significant difference between the muscle strength of male and female participants.

**Figure 1**

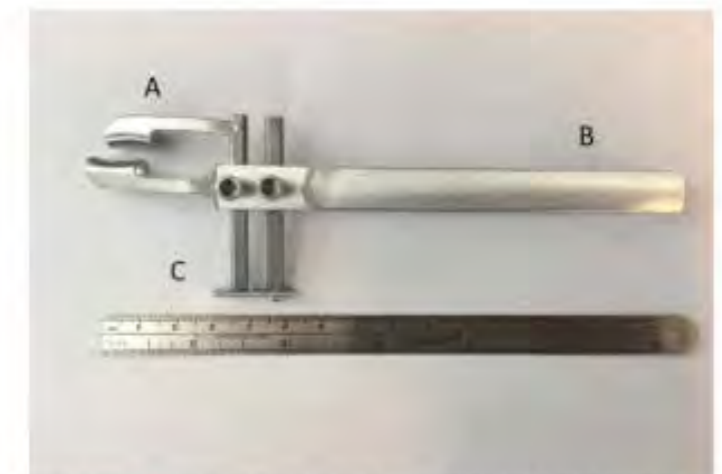


Figure 1: The Orbiculometer. A: Cook's Specula, B: handle and C: adjustable cylindrical columns with footplates for the force sensor.

4:10 - 4:25 pm

### **Periocular Surgery for Facial Nerve Palsy**

Guy G. Massry, MD

The talk will review the speaker's experience with procedures which optimize surgical outcomes and patient satisfaction in eyelid paralysis surgery. An emphasis will be placed on procedures founded on orbicularis preservation and maintenance of aesthetic appearance. Topics to be discussed include camouflaging eyelid weight implants, less invasive canthal suspension, true eyelid retractor recession, brow lifting and improving the biomechanics of eyelid function.

4:25 - 4:35 pm

### **Palpebral Springs**

Aaron Fay, MD

4:35 - 4:40 pm

## Initial Tolerability Testing of the “Blink Assistant”: A Novel Device for Lagophthalmos due to Facial Nerve Palsy

Michael Sun, Charles Yu, Mark Rosenblatt, Vinay Aakalu

*Ophthalmology and Visual Sciences, University of Illinois at Chicago, Chicago, Illinois, United States of America*

**Introduction:** Bell’s palsy is a common, usually acquired facial nerve weakness that affects around 11-40 persons per 100,000 annually with more than 60,000 cases a year in the U.S. alone<sup>1</sup>. Recovery rates are high and depend on etiology and severity of paralysis at disease onset and can range from 70% to 94%<sup>2,3</sup>. During recovery and while palsied, patients can suffer from ocular desiccation, pain and can develop vision loss and ocular infections. This is due to an inability to completely close the eyes (lagophthalmos) and an incomplete blink which both disturb ocular homeostasis and cause excessive dryness<sup>4</sup>.

Most current interventions are intended to treat patients with long-term complications from residual facial paralysis, while few options are available to address the majority of patients who have temporary facial palsy. The interventions available for these patients primarily focus on maintaining ocular lubrication which requires frequent eye drop administration. Ointments, taping of the eyelids closed or a weighted applique for the eyelid are also used to assist in recovery<sup>5</sup>. These interventions help with the lagophthalmos but can limit vision and do not address the incomplete blink. Lagophthalmos causes desiccation during the interblink period, when an individual is not actively blinking. This is what is addressed by the current weighting devices and surgical techniques. Desiccation of the ocular surface also occurs significantly in the “intra-blink” period when patients are actively blinking. This “intrablink” period is critical and is characterized by an incomplete blink in patients with Bell’s palsy.

In order to address the limitations of current therapies, we designed a new device that treats both lagophthalmos and improves blink for patients with temporary facial palsy. The device consists of a modified eyeglass frame, an eyelid coupling arm that adheres to the eyelid with tape, and an elastic band. The mechanism of this device attempts to recapitulate normal blink physiology. As the upper eyelid is opened, the elastic band stretches and generates a downward force that promotes rapid closure of the eyelid, improves the eyelid position during primary gaze, and improves lagophthalmos. We sought to test the hypothesis that the Blink Assistant is a tolerable and safe device for testing in normal patients, prior to proceeding further with development.

**Methods:** In a University of Illinois at Chicago IRB approved protocol, five normal human subjects (four male and one female) without a history of facial nerve palsy, eyelid surgery or disorder participated in a screening comfort and safety test of the Blink Assistant. A custom designed tolerability score was used to determine the level of tolerability of the device and any adverse events were recorded. We utilized a 3D printer with design software for creating the device. The device was printed using biocompatible MED610 material.

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**Results:** There were no adverse events, including no significant eye trauma, eyelid trauma, skin sensitivity and the mean tolerability score was 25.6 (scale 3-30).

**Conclusions:** Thus, the Blink Assistant is a promising non-surgical device for facial nerve palsy related incomplete blink. Further studies to determine efficacy and refinement of the device are ongoing.

**Figure 1**

### Blink Assistant Device



Device diagram depicts the main components of the Blink Assistant. (A) Eyelid coupling arm passes through frame and affixes to the pretarsal skin with double sided tape. (B) Anchor for elastic band to generate dynamic tension and force to assist in blinking. (C) Eyeglass frame modified to allow for anchoring of elastic band and passage of eyelid coupling arm.

**Figure 2**

### Mechanism of the Blink Assistant



Schematic of vector forces during the blinking process in a patient with facial nerve palsy and wearing the Blink Assistant. In the open position (A), the Blink Assistant (device on eyelid with downward arrow) provides the most assistance for closing (replicating some of the vector forces from the pulsed orbicularis oculi) and the levator (upward going arrow on sagittal section) provides little resistance. Progressing from B, C, D, the Blink Assistant provides decreasing assistance for closure and the levator is able to easily open the eyelid as the proportional forces dynamically change. This dynamic vector force change through the blink cycle could help with incomplete blinking seen in facial nerve palsy.

**Figure 3**

## Tolerability and Adverse Event Testing of the "Blink Assistant"

### DEMOGRAPHICS

n=5	Sex	Age
M	4	Range 28-55
F	1	Mean 39.6

Tolerability Score
Ease of application (1-10)
Aesthetics (1-10)
Comfort (1-10)

### PRELIMINARY TESTING IN CONTROL SUBJECTS (n=not-blem)

n=5	Tolerability Score (3-30)	Adverse Events
Mean	25.6	Eye trauma 0/5
Range	19-30	Skin sensitivity 0/5

4:40 - 4:50 pm

**Rescuing the Ocular Surface Ecosystem with Scleral Lenses in Facial Palsy**

Michael T. Yen, MD

The most common cause of visual compromise after facial nerve palsy is corneal epithelial irregularity resulting from exposure keratopathy. The severity of visual compromise can range from mild dryness of the eye to frank corneal ulceration with perforation. Most patients with facial palsy will require aggressive lubrication with supplemental eye drops or ophthalmic ointment. Surgical eyelid repositioning and reanimation can minimize the amount of corneal exposure, but many patients continue to have visual compromise. Scleral contact lenses or other prosthetic devices to reconstruct the ocular surface ecosystem allow for a fluid reservoir to constantly bath the ocular surface and maintain corneal integrity. These devices not only preserve visual function by preventing ocular surface exposure and breakdown, but also achieve this without the use of thick lubricating gels or ointments that can cause significant blurring of vision. In patients with anticipated long-term sequelae of facial palsy, these devices should be considered to allow for maximal visual function.

4:50 - 5:05 pm

**Orbital Surgery to Improve Function in Facial Nerve Paralysis**

Raymond S. Douglas, MD, PhD

3:15 – 5:15 pm

Chair: William R. Katowitz, MD

Faculty: Francesco Pietro Bernardini, MD; Kenneth V. Cahill, MD; Christopher B. Chambers, MD; Angela M. Dolmetsch, MD; James A. Katowitz, MD; Douglas P. Marx, MD; John D. Ng MD, MS, FACS; and Erin M. Shriver, MD

## Congenital Ptosis Session

3:15 – 3:22 pm

### Timing of Congenital Ptosis Surgery

Erin M. Shriver, MD

3:22 – 3:30 pm

### Treatment of Unilateral Congenital Ptosis

Francesco Pietro Bernardini, MD

#### Section V: Congenital Ptosis

Chapter 17

Anterior Approach to Correction of Levator Maldevelopment Ptosis with a New Emphasis on Supra-Maximal Levator Resection for Poor Function Ptosis

#### ABSTRACT

Managing congenital ptosis usually employs either a frontalis sling or levator resection. Each surgery has its advantages and disadvantages. Unilateral, poor levator function congenital ptosis is particularly difficult to manage. Successful surgery has been described with both a unilateral and bilateral frontalis sling in these cases. The purpose of this chapter is to describe the management of unilateral congenital ptosis with a new emphasis on supra-maximal levator resection.

#### KEY WORDS

Congenital ptosis, Levator resection, Frontalis sling, Supra-maximal levator resection  
(continued)



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When evaluating blepharoptosis, it is best to use a system of classification based on the anatomic defect that caused the ptosis. Treatment can then be directed at the specific anatomic defect. The classifications of Frueh and Beard have been combined here as shown in **Table 17.1**.

Levator maldevelopment ptosis is the most common type of ptosis seen in children and is caused by a dystrophy of the levator muscle, thought to be secondary to dysinnervation of the muscle during development. It may be unilateral or bilateral. It may be mild, giving a slight cosmetic defect; or it may be severe, leading to visual occlusion and amblyopia.

### PREOPERATIVE EVALUATION

The amount of ptosis is measured as the distance between the upper and lower eyelid margins with the brow held in a relaxed position. If the lower eyelid margin is out of normal position just covering the inferior limbus, the measurement can be made from the lower limbus. An alternative method is to measure the distance of the upper eyelid margin from the midpupil light reflex. This requires the patient to look at a light, which may provoke squinting, which may distort the measurement (**Table 17.2**).

Levator muscle function is the measurement of the upper eyelid excursion from far downgaze to far upgaze with the eyebrow held in a fixed position to eliminate frontalis muscle action (**Table 17.3**).

The height and contour of the upper eyelid creases are observed to determine the point of action and thus the point of insertion of the levator aponeurosis. The relative positions of the eyelids in downgaze are important because the fibrotic levator muscle in levator maldevelopment ptosis prevents full movement of the upper eyelid in down gaze. Bell's phenomenon, lacrimal secretory function, the presence of synkinetic jaw-winking, strabismus, visual acuity, and the general status of the patient need to be evaluated in the work-up of the ptosis patient.

### CHOICE OF SURGICAL PROCEDURE

Frontalis suspension is considered the procedure of choice to treat congenital, poor function (less than 4 mm) ptosis in bilateral cases as children spontaneously raise the forehead, lifting both eyebrows symmetrically. The frontalis suspension (autologous fascia is the authors' personal preference) is a very effective and reliable technique that delivers symmetrical results consistently and therefore is in our opinion still the best technique to treat bilateral congenital, poor function ptosis.

In cases of levator function  $> 12$  mm, a posterior approach is a very good option that delivers excellent results with minimal risks and complications, provided that the phenylephrine test is positive.

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When the levator function is intermediate (5 to 12 mm) maximal levator resection (ie, muscle resection less than 2 cm, before the Whitnall's ligament with the levator horns left undisturbed) is considered the most appropriate technique of correction. The amount of levator aponeurosis and levator muscle resection is determined preoperatively according to **Table 17.4** and **Table 17.5**.

The problems arise in cases of unilateral, poor function (< 4 mm) ptosis, which unfortunately represents 70-80% of cases according to the different series reported. In this setting, variable surgical approaches are proposed by the various surgeons. Many authors still prefer to extirpate the good levator muscle of the non-affected side in order to cause a symmetric, bilateral ptosis and subsequently perform a bilateral frontal suspension.[1] With this approach, the risks of lagophthalmos and corneal exposure are extended also to the healthy, non-ptotic eye, while the forces that drive frontalis elevation are not so certainly extended to both sides symmetrically, as it depends on eye dominance and other unpredictable variables. In past publications we have shown that unilateral suspension on the affected side only offers very good results provided that a spontaneous frontalis over action is present preoperatively in the affected side.[2-4]

Even though the postoperative changes in primary position are aesthetically pleasing after frontal suspension in most cases, variable degrees of asymmetry between the operated and the healthy eyelid remain, especially in dynamic conditions. The "ideal" postoperative result relies not only on the symmetrical height position in primary gaze, but also on the rapid and spontaneous symmetry of the natural eyelid movements at every moment of eyelid opening, which is achievable only with levator muscle surgery and not with frontalis suspension.

Maximal levator resection traditionally is not indicated when levator function is below 4 mm, which unfortunately represents a very common condition in congenital ptosis. In a recent publication, we have shown favorable results with supra-maximal levator excision also in this setting. [5] Proper indications were limited to cases of unilateral poor function (less than 4 mm) ptosis complicated by amblyopia or where there was no evidence of compensatory unilateral brow elevation preoperatively as all other cases were treated with frontalis suspension.

Supra-maximal levator resection—ie, levator muscle resected above the Whitnall ligament—was reported originally by Berke in 1959,[6] and subsequently proposed also by Epstein and Putterman in 1984.[7] Since then, supra-maximal levator resection for the treatment of poor function congenital ptosis was abandoned by many for fear of excessive postoperative lagophthalmos, corneal exposure, and conjunctival prolapse.

Because of the good results achieved with this approach over the years, the evident advantages of levator surgery relative to frontalis suspension, and the acceptable risk of complications, which are similar to those of frontalis suspension, supra-maximal levator resection has become our procedure of choice to correct poor function unilateral ptosis even in cases where spontaneous frontalis over-action is present.

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## **ANESTHESIA**

Most cases of ptosis correction in children require the use of general anesthesia, although some older children may be able to undergo surgery with a combination of local anesthesia and intravenous sedation. The latter method allows evaluation of eyelid contour, height, and lash position intraoperatively. Even if general anesthesia is required, local anesthetic consisting of equal parts of 0.75% bupivacaine and 2% lidocaine with 1:100,000 epinephrine is injected for operative hemostasis and postoperative pain control.

## **SURGICAL PROCEDURE**

### **Anterior Approach to Correction of Moderate Levator Maldevelopment Ptosis**

#### **Step 1**

After sterile skin preparation and sterile draping, the upper eyelid crease is marked at the desired height so as to be symmetrical with the opposite upper eyelid crease. A predetermined amount of skin may be marked out now or removed at the end of the procedure.

#### **Step 2**

Local anesthesia is injected subcutaneously along the eyelid crease and subconjunctivally along the superior border of the tarsus.

#### **Step 3**

The skin is incised along the marked eyelid crease with a 15 blade. The incision is made deeper through the orbicularis muscle to expose the superior border of the tarsus from medial to lateral with scissors (**Figure 17.1, Video 17.1**).

#### **Step 4**

A 4-0 silk traction suture is placed centrally in the upper lid just above the lash line, and the lid is placed on traction. This is done after the eyelid incision is carried to the tarsus so as to not distort the various layers of the anterior lamella.

#### **Step 5**

The orbicularis muscle is dissected inferiorly 3 mm to 4 mm to expose the superior tarsal border, and approximately 10 mm superiorly to expose the levator aponeurosis and orbital septum.

#### **Step 6**

The orbital septum in children is very thick. Gentle pressure on the globe will prolapse the preaponeurotic fat.

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### **Step 7**

The orbital septum is open, completely identifying the prolapse preaponeurotic fat. Depending on the amount of levator resection, some preaponeurotic fat may need to be removed, otherwise a blunt, cotton-tipped applicator stick may be used to push the fat off the levator muscle and aponeurosis (**Figure 17.2**).

### **Step 8**

With inferior traction on the pretarsal skin muscle flap, a handheld cautery is then used to dissect the levator aponeurosis off the tarsal plate. The dissection continues superiorly off Müller's muscle and conjunctiva to the desired predetermined level. The superior transverse ligament of Whitnall is not cut. The levator is dissected from Whitnall's, however. In moderate congenital ptosis surgery, the lateral medial horns are not cut (**Figure 17.3**).

### **Step 9**

The amount of levator resection is measured from the inferior edge of the cut aponeurosis without tension (**Figure 17.4**).

### **Step 10**

A double arm, 6-0 silk is placed partial thickness through the middle tarsus slightly medial to the center of the tarsal plate, back to the levator at the desired predetermined level and tied over a 4-0 silk suture. The contour and height is then determined and readily adjustable if necessary by pulling on both ends of the 4-0 silk suture. Two additional 6-0 silk sutures are placed nasally and temporally for reinforcement and contour adjustment. The 4-0 silk sutures are removed and sutures tied down permanently (**Figure 17.5**).

### **Step 11**

The excess levator is excised with a handheld cautery (**Figure 17.6**).

### **Step 12**

Skin may be excised superior to the incision before closure if it was not done in Step 1. Usually 2 mm to 3 mm of skin is excised in levator maldevelopment ptosis in children, and more in older individuals. Lid crease sutures of 6-0 plane, usually 3 or 4, are placed through the skin orbicularis muscle inferiorly, then through the edge of the levator and out through the orbicularis muscle and skin superiorly. The remainder of the skin incision is closed with a 6-0 fast absorbing suture (**Figure 17.7**).

### **Step 13**

A 4-0 silk traction suture is placed in the lower eyelid margin and taped to the forehead for ocular protection. The eye is then doubly patched.

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**Step 14**

The next morning the patch and suture are removed, the lid position checked, and the cornea lubricated with artificial tears and lubricating ointment during the day and at bedtime. Evening protection may be augmented with a plastic bubble or plastic wrap if exposure is a problem.

**Supra-Maximal Levator Resection**

The surgical indications for supra-maximal levator resection are extended to all cases of unilateral, poor function congenital ptosis independent of the degree of ptosis. Intraoperatively, the amount of muscle excision is tailored to compensate the 2 main variables: the amount of ptosis and the amount of levator function. The algorithm that we adopt is simple and consists of a progressive increase in levator excision, proportional to the amount of reduced levator function. For example, for muscle function nil to minimal (between 0 mm and 2 mm) the amount of levator excised will be in the range of 3 cm to 2.5 cm respectively, while it will be in the 2 cm range for levator function between 2 mm and 4 mm.

Similarly, intraoperatively the eyelid height will be set at the upper limbus or 1 mm below it for the nil/minimal levator function group (0-2 mm) and only a slight overcorrection (1 mm above the contralateral eyelid position) for the better function group (2-4 mm). Naturally, most of the surgeries will take place with the child under general anesthesia, therefore these operative end-points should be predetermined, similarly to what occurs for frontalis suspension.

**Step 1**

After marking the eyelid skin in the upper lid crease and routine sterile prepping, 2-3 cc of local anesthesia with epinephrine 1:100,000 are injected subcutaneously along the entire eyelid length.

**Step 2**

The skin is incised in the marked crease and usually 2-3 mm of upper eyelid skin is excised along with the orbicularis muscle to expose the orbital septum.

**Step 3**

The orbital septum is opened along the entire horizontal length of the upper eyelid and some of the pre-aponeurotic fat prolapsed is excised or coagulated with bipolar diathermy.

**Step 4**

The underlying levator muscle is exposed, from the aponeurosis to the Whitnall ligament. At this point the orbicularis and the aponeurosis are dissected off the tarsal plate.

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**Step 5**

The levator aponeurosis/muscle are separated en-bloc with the underlying Müller's muscle off the palpebral conjunctiva; this dissection is normally performed with a sharp, tungsten needle tip and it is sharp at the beginning just above the tarsal plate where the Müller's and conjunctiva are fused together, while they can be peeled off bluntly while proceeding upwardly toward the Whitnall's ligament. Occasionally, button holes of the conjunctiva can occur during this dissection, and are left un-sutured.

**Step 6**

The medial and lateral horns of the levator muscle are incised up above the Whitnall's ligament allowing the creation of a flap formed by levator and Müller's muscles. Once the Whitnall's ligament is released, the muscle flap is freely movable. If further dissection is necessary, blunt dissection is performed with a cotton tipped applicator on the anterior surface between the orbital fat and the levator muscle and posteriorly between the Müller's and the conjunctiva (**Figure 17.8**).

**Step 7**

A 6-0 nylon suture is placed between the anterior surface of the tarsal plate and the levator/Müller complex centrally with a temporary knot and the eyelid height is then checked. If the central height corresponds to the desired operative end-point, the knot is permanently tied and 2 further sutures are placed laterally and medially for contour adjustments. The excess muscle flap is excised, and a small strip of pre-tarsal orbicularis muscle is also excised to avoid visible postoperative increased thickness at the pre-tarsal level.

**Step 8**

The eyelid crease is reformed by tying multiple interrupted 7-0 polyglactin 910 sutures between the eyelid margins and the edge of the levator muscle. No Frost sutures are placed.

**POSTOPERATIVE MANAGEMENT**

Antibiotic-steroid ophthalmic ointment is applied to the suture line. A full or partial eye pad may be applied. The patient is instructed to keep the head elevated and to apply an ice pack for at least 15 minutes every 2 hours. Aspirin or other anti-coagulant medications are to be avoided. Nonabsorbable skin sutures are removed in 6-7 days. Frequent corneal lubrication with artificial tears and lubricating ointment is very important and may be augmented with plastic wrap during the day or evening if exposure is a problem.

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### **COMPLICATIONS**

Complications are similar to those of frontalis suspension and include mild contour abnormalities (29%), lash ptosis (31.4%). Under-correction can occur in 8% of the patients; less frequently over-correction. Superficial punctate keratopathy is a common finding, and intense lubrication therapy is to be prescribed to all patients for 1 week and tapered gradually over 1 month. Conjunctival prolapse is not uncommon in the early postoperative period and usually resolves spontaneously. If it does not resolve, full-thickness sutures to fixate the conjunctiva in the upper fornix may be used. Downward saccadic movements are restricted, which provokes eyelid lag and lagophthalmos. The spontaneous blinking amplitude is also diminished. These effects are prominent in the early postoperative period and the ocular surface over time adapts to the new eyelid kinetics, and superficial keratopathy resolves.

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**TABLES**

**Table 17.1** - Classification of ptosis. Adapted from Rathbun JE. Eyelid Surgery. Boston, MA: Little, Brown. 1990;203.

<b>Levator maldevelopment (dysmyogenic) ptosis</b>	<b>Aponeurotic ptosis (dehisced or disinserted aponeurosis secondary to the following)</b>
<ul style="list-style-type: none"> <li>• Simple (defect isolated to levator muscle)</li> <li>• With superior rectus muscle weakness</li> <li>• Blepharophimosis syndrome</li> <li>• Congenital fibrosis of the extraocular muscles</li> </ul>	<ul style="list-style-type: none"> <li>• Age</li> <li>• Cataract or other ocular surgery</li> <li>• Local blunt trauma</li> <li>• Blepharochalasis</li> <li>• Chronic edema (Graves' disease, allergy, etc.)</li> </ul>
<b>Myogenic (myopathic) ptosis</b>	<b>Mechanical ptosis</b>
<ul style="list-style-type: none"> <li>• Oculopharyngeal dystrophy</li> <li>• Chronic progressive external ophthalmoplegia</li> <li>• Muscular dystrophy</li> <li>• Myasthenia gravis</li> <li>• Trauma to the muscular levator</li> </ul>	<ul style="list-style-type: none"> <li>• Excess lid weight (lid or orbital mass)</li> <li>• Scarring</li> </ul>
<b>Neurogenic ptosis</b>	<b>Pseudoptosis</b>
<ul style="list-style-type: none"> <li>• Oculomotor nerve palsy (third nerve)</li> <li>• Misdirected oculomotor nerve regeneration</li> <li>• Marcus-Gunn jaw-winking ptosis</li> <li>• Horner's syndrome</li> <li>• Ophthalmoplegic migraine</li> </ul>	<ul style="list-style-type: none"> <li>• Due to lack of posterior eyelid support</li> <li>• Due to hypotropia</li> <li>• Due to dermatochalasis</li> <li>• Due to globe malposition</li> </ul>

**Table 17.2** - Amount of ptosis.

Amount of Ptosis (mm)	Classification
≤ 2	Mild
3	Moderate
≥ 4	Severe

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**Table 17.3** - Levator muscle function.

Levator muscle function (mm)	Classification
15	Normal
≥ 8	Good
5 to 7	Fair
≤ 4	Poor

**Table 17.4** - Quantitative approach to congenital ptosis. Adapted from Beard C. The surgical treatment of blepharoptosis: the quantitative approach. Trans Am Ophthalmol Soc. 1966;64:401 and from Rathbun JE. Eyelid Surgery. Boston, MA: Little, Brown. 1990;222.

Description	Procedure
Moderate ptosis (3 mm) with good levator muscle function (≥ 8 mm)	Moderate muscle resection (14 to 17 mm)
Moderate ptosis (3 mm) with fair levator muscle function (5 to 7 mm)	Large levator resection (18 to 22 mm)
Moderate ptosis (3 mm) with poor levator muscle function (≤ 4 mm)	Maximum levator muscle resection (≥ 23 mm)
Severe ptosis (>4 mm) with fair levator muscle function (5 to 7 mm)	Maximum levator muscle resection (≥ 23 mm)

**Table 17.5** - Levator resection. Adapted from data courtesy of Mark R. Levine, MD.

Levator Function 12 to 15 mm	
Levator ptosis (mm)	Resection (mm)
2	10
3	12
4	14
Levator Function 9 to 11 mm	
Levator ptosis (mm)	Resection (mm)
2	12
3	14
4	16
Levator Function 5 to 8 mm	
Levator ptosis (mm)	Resection (mm)
2	14
3	16
4	18

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**FIGURE LEGENDS**

**Figure 17.1** - Anterior approach to correction of moderate levator maldevelopment ptosis (Step 3). Cleveland Clinic Center for Medical Art & Photography ©2017. All Rights Reserved.

**Figure 17.2** - Anterior approach to correction of moderate levator maldevelopment ptosis (Step 7). Cleveland Clinic Center for Medical Art & Photography ©2017. All Rights Reserved.

**Figure 17.3** - Anterior approach to correction of moderate levator maldevelopment ptosis (Step 8). Cleveland Clinic Center for Medical Art & Photography ©2017. All Rights Reserved.

**Figure 17.4** - Anterior approach to correction of moderate levator maldevelopment ptosis (Step 9). Cleveland Clinic Center for Medical Art & Photography ©2017. All Rights Reserved.

**Figure 17.5** - Anterior approach to correction of moderate levator maldevelopment ptosis (Step 10). Cleveland Clinic Center for Medical Art & Photography ©2017. All Rights Reserved.

**Figure 17.6** - Anterior approach to correction of moderate levator maldevelopment ptosis (Step 11). Cleveland Clinic Center for Medical Art & Photography ©2017. All Rights Reserved.

**Figure 17.7** - Anterior approach to correction of moderate levator maldevelopment ptosis (Step 12). Cleveland Clinic Center for Medical Art & Photography ©2017. All Rights Reserved.

**Figure 17.8** - Supra-maximal levator resection (Step 6). Cleveland Clinic Center for Medical Art & Photography ©2017. All Rights Reserved.

**VIDEO LEGEND**

**Video 17.1** - Pediatric levator advancement. <http://webeye.ophth.uiowa.edu/eyeforum/video/plastics/1/Pediatric-levator-advancement.htm>

3:30 - 3:35 pm

**Müller's Muscle-Conjunctival Resection Combined with Tarsotomy in the Treatment of Congenital Ptosis**Inbal Gazit<sup>1</sup>, Lior Or<sup>1</sup>, Cat N. Burkat<sup>2</sup>, Morris E. Hartstein<sup>1</sup>

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**Introduction:** The purpose of this study is to present our experience with Müller's muscle conjunctival resection combined with tarsotomy in the treatment of congenital ptosis.

**Methods:** A retrospective case analysis was performed on 38 eyes of 36 patients who underwent Müller's muscle-conjunctival resection with tarsotomy for the treatment of congenital ptosis.

Follow-up measurements taken up to 4 years after procedure were compared with baseline values.

**Results:** Thirty six patients presenting with congenital ptosis underwent Müller's muscle-conjunctival resection combined with tarsotomy. All patients had fair to moderate levator function of 5-10 mm. A mean improvement in the margin reflex distance of 2.79 mm was noted. All except one case achieved a good postoperative and symmetrical result.

**Conclusions:** Müller's muscle-conjunctival resection combined with tarsotomy is a useful option for the treatment of congenital ptosis in patients with fair to good levator function.

No complications were noted in any of our patients. Our experience suggests that this is a safe and reliable procedure with excellent outcomes in selected patients.

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3:35 - 3:40 pm

## Histological Findings of Levator Muscle in Unilateral Congenital Ptosis

Francesco Quaranta-Leoni<sup>1,2</sup>, Stefano Nardoni<sup>3</sup>, Sara Verrilli<sup>1</sup>, Antonella Leonardi<sup>2</sup>

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**Introduction:** A previous study demonstrated that surgical correction of unilateral congenital ptosis might be influenced by the age of the operation, as cosmetic and functional results appear to be better and the rate of ptosis recurrence appears lower if levator resection is performed in the range of 2 to 4 years. In this study it was evaluated the different degree of muscle atrophy in specimens of levator muscle of patients operated on for unilateral congenital ptosis, as related to the age of the patient.

**Methods:** Histological analysis of the specimen of the levator muscle of 17 patients who underwent a unilateral levator muscle resection under the care of one surgeon from February 2014 to April 2018 was performed. The study population was divided into two different groups according to the age of surgery: group 1 included 10 children from 2 to 4 years; group 2 included 7 children from 4.1 to 11 years.

**Results:** Levator muscle of most patients of group 1 showed mild to moderate degree of muscle atrophy, with striated muscle fibers separated by thin fibrous septa incorporating groups of cells with peripheral nuclei and non-hyalinized cytoplasm (Masson's trichrome stain). Levator muscle showed in most cases of group 2 severe atrophy, with discontinuous striated muscle fibers separated by thick fibrous septa including cells with centralization of nuclei, hyalinization of cytoplasm (Masson's trichrome stain) and fatty infiltration.

**Conclusions:** Myofibers found in specimens of levator muscle obtained following levator resection for congenital ptosis show characteristics of a degenerative process. A previous study showed that fat amount or atrophy in the levator muscle from congenital ptosis appeared not to be related to age, sex, or levator muscle function. This study seems instead to demonstrate that atrophy of the muscle tends to be more evident in older children with congenital ptosis, as in these cases histology shows signs of more severe atrophy of levator muscle.

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3:40 - 3:45 pm

## Orbital Septum Fibrosis in Congenital Ptosis Correlates with Eyelid Function: A Clinico-Pathologic Study

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**Introduction:** Congenital ptosis is a common condition affecting the levator muscle that can threaten visual function and is usually treated with surgical correction (1). We have noted that many patients with severe congenital ptosis may have a grossly thickened septum. This study tests the hypothesis that congenital ptosis involves not only the levator muscle but also the septum, and that congenital septal fibrosis may tether the lid in the primary position and impact the outcome of attempted surgical repair.

**Methods:** The study was approved by the University of Michigan IRB (HUM00040783), and is in compliance with the Declaration of Helsinki. A retrospective chart review was performed on twenty-nine patients with congenital ptosis who underwent surgical correction that included partial septum excision. Histologic analysis was performed by a masked pediatric pathologist, with grading of septal tissue disorganization and fibrosis based on standard histologic criteria. Disorganization was scored as not-present, or present. Fibrosis was scored as not-present, mild, or significant. An independent comparison of histologic grading with clinical ptosis measures was then performed.

**Results:** A pattern of septal thickening, fibrosis and disorganization was consistently noted on histopathological examination. Ten of twenty-nine samples showed significant septal fibrosis, fourteen showed mild fibrosis, and five showed no significant fibrosis. Twenty-five samples demonstrated disorganization of collagen fibers. Three patients had no fibrosis or disorganization. Samples that showed any fibrosis had a significantly lower levator function when compared to samples without fibrosis ( $3.81 \text{ mm} \pm 0.44$  vs.  $9.00 \text{ mm} \pm 2.17$ ,  $p=0.0006$ ). Samples that demonstrated disorganization also showed a significantly lower levator function when compared to samples without disorganization ( $4.16 \text{ mm} \pm 0.50$  vs.  $8.13 \text{ mm} \pm 2.98$ ,  $p=0.02$ ). There was no significant difference in levator function between samples with mild and significant fibrosis ( $3.39 \text{ mm} \pm 0.50$  vs.  $4.40 \pm 0.78$ ,  $p=0.27$ ).

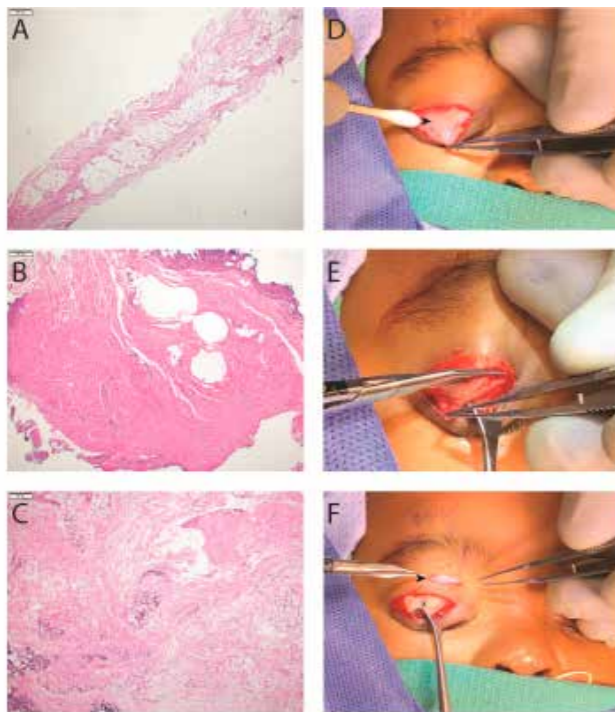
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**Conclusions:** The potential role of the orbital septum in eyelid disease is under-studied. We report that the orbital septa in patients with congenital ptosis demonstrate increased histological disorganization and fibrosis. It appears that when decreased levator function is observed clinically, there is a significant likelihood that septal fibrosis and/or disorganization is present. These observed histological abnormalities suggest that resecting fibrotic septum during congenital ptosis correction surgery may improve outcomes for both lid opening and closing by releasing the lid from its congenitally tethered position and improving eyelid elasticity. A limitation of the study is its relatively small size, but given the statistical significance of the results, additional studies are warranted.

**Figure Legend:** Histological and procedural images of orbital septum excision. A. Normal orbital septum. B. Orbital septum demonstrating marked fibrosis. C. Orbital septum demonstrating histological disorganization. D, E, F. Orbital septum excision during congenital ptosis repair. Arrow: orbital septum overlying preaponeurotic fat pad. Asterisk: preaponeurotic fat pad.

**Figure 1**



**References:**

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## Sling Materials

3:55 - 4:05 pm

### **Craniofacial Collaboration - What Do We Need to Know in These Cases?**

James A. Katowitz, MD

### **Craniofacial Malformations: Collaboration in Management**

#### **Craniofacial Malformations: Multisystem Disorders**

- Multi-Disciplinary Team Approach
- Multi-Specialty Grand Rounds
- Critical feature of team efforts:
  - To facilitate evaluation and management
  - To provide broader perspectives
  - To coordinate joint team surgery and followup

### **Classification: Craniofacial Malformations**

#### **Craniosynostosis:**

- Brain is the engine that drives growth of the skull
- Doubles in weight by 6 months; Triples in weight by one year
  - Sutures are passive partner

#### **Craniosynostoses**

- Premature closure of sutures and fontanelles will produce deformities in the shape of the skull

#### **Craniofacial Clefts**

- Exhibit surface defects in both soft tissue and underlying facial skeleton

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**Tessier Classification System**

- An Architectural System: Descriptive of topography rather than pathogenesis
  - Katowitz JA and Katowitz WR (eds) Pediatric Oculoplastic Surgery, Springer, NY, 2018

**Craniofacial Clefts: Etiology**

- Resemble specific stages in embryonic development
- Appears as if growth and development stopped at certain point
- Neural Crest Tissue: Forms 5 embryonic facial prominences:
  - Frontonasal
  - Maxillary (2)
  - Mandibular (2)

**Embryogenic Cleft Etiologies**

- Except for Treacher-Collin Syndrome- Heredity plays a minor role in most rare craniofacial clefts
- Other possible causes:
  - Radiation
  - Infection
  - Maternal metabolic imbalances
  - Drugs and chemicals
  - Trauma (amniocentesis and amniotic bands)

**Amniotic Bands**

- Can be swallowed creating an oro-facial cleft
- Can also cause constriction of limbs and fingers causing amputations and constrict the cranium causing death of the fetus

**Craniofacial Malformations:**

- Many Varieties of Craniosynostosis
  - Cohen MM Jr; An etiologic and nosologic overview of craniosynostosis syndromes. Birth Defects 11:137, 1975

**Syndromic Craniosynostoses:**

- Refers to the association of craniosynostosis with other dysmorphic features
- Most common entities: Crouzon Syndrome and Apert Syndrome
- Most severe: Clover Leaf Skull

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**Crouzon Syndrome**

- Autosomal dominant
- Incidence: 1 in 60,000 births
- Exorbitism
- Normal intelligence
- Normal hands and feet

**Apert Syndrome**

- Autosomal dominant trait – but mostly sporadic
- Incidence: 1 in 100,000 live births
- Distinguishing feature from Crouzon is bone and cutaneous syndactyly, symmetric, usually in 2nd, 3rd and 4th digit of hands and/or feet

**Clover-leaf Skull**

- Stenosis of all cranial sutures
- Hydrocephalus often present
- Severe corneal exposure issues

**Functional Issues in Craniosynostoses**

- Blindness: optic nerve disorders; corneal exposure; Abnormalities of motility and ocular adnexa
- Neuropsychiatric disorders from increased ICP

**Surgical Repair for Craniosynostosis**

- Primarily done early to prevent restriction of normal brain growth from increased ICP

**Timing of Surgery for Syndromic Craniosynostosis**

- Age range 2 weeks - 4 months
- Primarily done to protect normal brain development from increased ICP

**Cranial Decompression for Syndromic Craniosynostosis**

- Strip craniectomy at 2-4 months to control intracranial pressure

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**Mid Face Retrusion**

- Le Fort III Midface Advancement deferred if at all possible until puberty
- Outcomes less predictable when done early
- May need several repeat procedures

**Craniofacial Clefts: Tessier Classification**

- Topographical not pathognomonic; useful for clefting syndrome classification

**Ophthalmologic Considerations in the Management of Craniofacial Malformations**

- Ophthalmologic Issues
- Acute: corneal exposure, glaucoma, papilledema
- Long-term: ocular and adnexal concerns - strabismus, tearing lid abnormalities, amblyopia
- Team Approach to Repair of Craniofacial Malformations
- Joint surgical efforts for some cases
- Majority of oculoplastic procedures done independently

**Team Approach to Repair of Craniofacial Malformations**

- **Craniosynostosis repairs** usually do not require joint oculoplastic participation
- **Clefting Syndrome adnexal repairs** most commonly done independently by Oculoplastics
- Tessier 6, 7, 8 Clefts more common problem for Oculoplastics
- Mandibulofacial dysostosis (Treacher-Collin)
- Oculoauriculo-vertebral dysplasia (Goldenhar)
- Facial microsomias

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## Timing of Ocular and Adnexal Repair

- During CF Procedure:
  - Lid contour deformities
  - Telecanthus
  - Canthal dystopias
- Independent of CF Procedure:
  - Ptosis
  - Strabismus
  - Nasolacrimal:
    - Early - probing and irrigation  
- silastic intubation
    - Delayed - DCR  
- CJ-DCR

## Craniofacial Series (1979 - 1990)

- 322 patients had detailed ophthalmic evaluations
- With severe deformities would expect major problems ophthalmologic problems
- **What Actually Happened?**
- **Visual impairment occurred in only 20% of patients**
- Due to subtle problems much more commonly than from structural abnormalities
- **Visual Impairment was 90% due to amblyopia and only 10% due to structural abnormalities**

## Amblyopia: Etiology Multifactorial

- Significant refractive error 73%
- Strabismus 50%
- Ptosis 26%
- Anisometropia 15%

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**Significance for Management**

- Even in severe Craniofacial Malformations, amblyopia is preventable form of vision impairment

**Amblyopia Therapy**

- Correct refractive error
- Patch normal eye
- Perseverance

**Take Home Point: Critical Role of the Community Ophthalmologist**

- CF Team essential but children born with severe malformations also need local care
  - acute systemic issues
  - acute ophthalmologic issues
  - long-term followup

**A Final Recommendation**

- Appearance very important to child and family
- Critical factor for happiness and future productivity
- While surgical correction of ocular and adnexal abnormalities is a primary concern:
  - surgeons have an additional responsibility to be an advocate for psychological counseling and social services for both the child and family

## Lacrimal Session

4:05 - 4:10 pm

### **Treatment of Dacryocystocele**

Douglas P. Marx, MD

4:10 - 4:17 pm

### **Pediatric Endo-DCR and Endoscopic Probing and Intubation**

Angela M. Dolmetsch, MD

Congenital nasolacrimal duct obstruction (CNLDO) is reported to occur in 5-20% of newborn infants. It is characterized by tearing and mucopurulent discharge and can be unilateral or bilateral. Although spontaneous resolution occurs in 85-95% of patients, intervention is required for persistent symptoms. Traditionally it has been managed with a stepwise approach beginning with massage for the first 6 months to a year of age, subsequently one or two blind probings and/or balloon dacryocystoplasty are performed, intubation is the next step and finally dacryocystorhinostomy (DCR) is performed at approximately 5 years of age. Recently, several studies have demonstrated that intervention under endoscopic visualization can dramatically improve success rates of probing and intubation and can also aid in the diagnosis and treatment of concomitant intranasal anomalies. Furthermore, with direct endoscopic visualization, probing, which was thought to be of very poor prognosis in older children (> than 5 y) can be successful. If, however, the patient continues with epiphora and/or discharge, despite endoscopically assisted probing or if a bony obstruction is encountered during the procedure, an endoscopic DCR (EnDCR) can be performed. Several studies have confirmed that EnDCR can be done in children safely and successfully. Surgical techniques for endoscopic probing and EnDCR will be described as well as the potential advantages of the endoscopic route vs the external or cutaneous DCR.

4:17 - 4:25 pm

### **Timing of Jones Tube and DCR**

Christopher B. Chambers, MD

4:25 - 4:30 pm

## A Pre-Loaded Device for the Insertion of Monocanalicular Stents in the Management of Congenital Nasolacrimal Obstruction

William Katowitz<sup>1,2</sup>, Bruno Fayet<sup>3</sup>, Jean-Marc Ruban<sup>4</sup>, Emmanuel Racy<sup>5</sup>, Dominique Bremond-Gignac<sup>6</sup>, James Katowitz<sup>1,2</sup>

<sup>1</sup>Ophthalmology, The University of Pennsylvania, Philadelphia, Pennsylvania, United States of America, <sup>2</sup>The Children's Hospital of Philadelphia, Philadelphia, Pennsylvania, United States of America, <sup>3</sup>Ophthalmology, Hospital Cochin, University of Paris, Paris, France, <sup>4</sup>Ophthalmology, Hospital Edouard Herriot, Lyon, France, <sup>5</sup>ENT, Clinique Saint-Jean-de-Dieu, Paris, France, <sup>6</sup>Ophthalmology, Hôpital Necker-Enfants malades, Paris, France

**Introduction:** Objective: To study the intraoperative deployment of a preloaded instrument for insertion of a "pushed" monocanalicular nasolacrimal stent.

**Methods:** This is a non-randomized study of consecutive cases from October 2016 to April 2018 at 2 institutions using a preloaded instrument for a "pushed" monocanalicular nasolacrimal intubation. Only patients with epiphora from congenital nasolacrimal duct stenosis were included. Intraoperative findings and surgical outcomes were recorded.

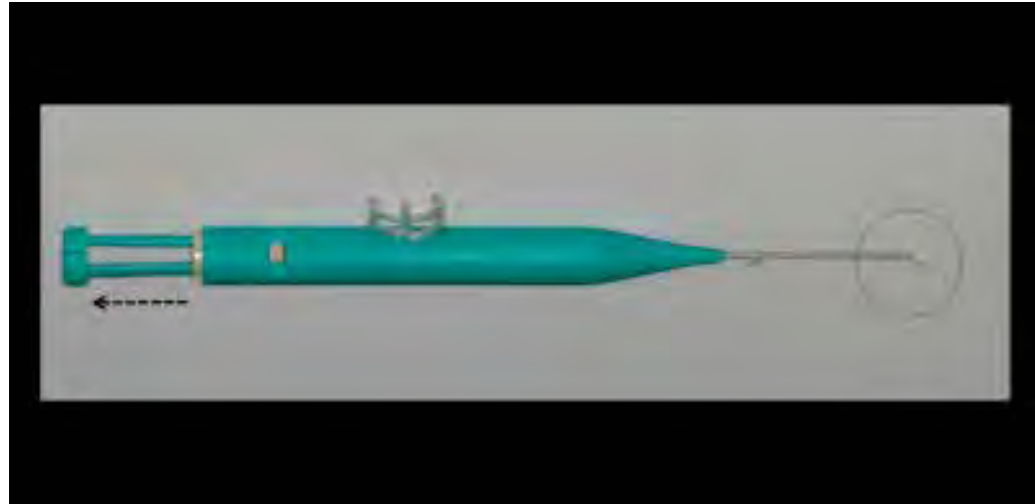
**Results:** Thirty-seven preloaded monocanalicular stents were placed consecutively in 25 pediatric patients. The mean age at surgery was 2.8 years (range 1.2-3.3) with a mean follow-up of 17 weeks (range 8-53). Intraoperative difficulties encountered with the inserter device included a premature insertion of the stent from the insertion piston in 13.5% (5/37) cases and a retention of the stent on the piston in 5.4% (2/37) cases. 30 cases (in 24 patients) were included with a minimum follow up of 2 months. Surgical success was the resolution of tearing symptoms. The overall success of these cases was 90% (27/30). On follow up, early loss of the stent occurred in 20% (6/30), punctal unseating (loose stent) in 16.6% (5/30) and intracanalicular migration in 3.3% (1/30) cases.

**Conclusions:** The device for pushed monocanalicular stent insertion appears to be a safe and effective method for both stent intubation and resolution of congenital nasolacrimal obstruction symptoms in this small series.

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**Figure 1**



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## Stent Preferences

4:35 - 4:45 pm

### **Microphthalmos: Preferences in Treatment**

John D. Ng, MD, MS, FACS

Microphthalmia is present when an individual is born with a small, anatomically and functionally abnormal eye. It may be a unilateral or bilateral condition and may be very asymmetric in the latter instances. The incidence is approximately 30/100,000 and is present in about 11% of individuals born with blindness. Potential causes are varied and include genetic and environmental etiologies. There is a broad range of severity of underdevelopment in terms of the eye's visual potential, size and ocular surface sensitivity. These variables are important to consider in developing the goals of treatment for each patient.

The major goals of management include: maintaining useful vision if possible, stimulating symmetrical facial, orbital and eyelid development and creating an optimal socket anatomy for prosthesis fitting when needed.

There are numerous challenges in managing patients with microphthalmia, especially in patients with more severe presentation of the condition. Management requires intense, life-long partnership and commitment between the patient and family, the ophthalmologist and the surgeon. This is especially true from birth to early childhood where the greatest potential growth stimulation can be achieved and when very frequent follow up and patient/parental compliance is needed. It is especially challenging when patients present later in age and the degree of asymmetry in orbital, eyelid and facial growth is great. There is also variable tissue response to surgical and non-surgical interventions from individual to individual.

Management can be roughly divided into early, mid and late phases. Early intervention is mainly with lid and anterior orbital growth stimulation with placement of incrementally larger conformers with very frequent adjustments. In patients where there is less compliance, self-expanding socket conformers is a good alternative. Mid phase management includes continual conformer/prosthesis adjustments. If growth begins to lag behind the normal side, deeper socket expansion will be required. Options include enucleation and implant placement, self-expanding orbital implants, tissue expanders, solid sphere implant placement and dermis fat grafting. A good general principle is to avoid disturbing the lid anatomy and canthal angles if at all possible. Excessive surgical manipulation in a patient that will need procedures in the future can result in significant scar tissue, decreased vascularization and decreased tissue compliance, which make surgical outcomes much less predictable. Late phase management is aimed at maintaining optimal prosthetic fit and creating as much symmetry in eyelid position and contour as possible. It is common for eyelids of severely microphthalmic eyes to have under developed lid retractors, lid creases and lash quantity and position.

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Complicating factors are not uncommon in managing these patients. The more frequent challenges include tissue contraction (socket and lids), dense scarring and dry socket if the conjunctiva has not developed well.

In summary, there is a broad range of presentations in patients with microphthalmic sockets. Early intervention, close and frequent follow up, and minimizing the amount of surgical manipulation of the eyelid tissues are solid general principles to follow. Given the variety of presentations and patient tissue responses, having a broad palette of treatment techniques and tailoring intervention to the specific patient's circumstances will maximize overall success in managing these life long patients we encounter.

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4:45 - 4:55 pm

## Lymphatic Malformations: Update

Kenneth V. Cahill, MD

8/30/2018

8/30/2018

8/30/2018

**Lymphangioma/Venolymphatic Malformation Update**

Kenneth V. Cahill, M.D., F.A.C.S.  
Chief, Pediatrics  
The Ohio State University

**Correct Diagnosis**

- History
  - usually unilateral change over time
- Imaging
  - MRI
  - intraoperative
- Findings during treatment

**Usually More Than 1 Treatment**

- Don't go into a cyst to treat a deeper cyst
- Typically 2 treatments are used
- Typically 3 months between treatments

**"Re-bleeds"**

- Uncommon after treatment
- Tractation better with sclerosant than surgery

**Surgery**

- Occasionally includes fibrous component

Lymphangiomas are characterized by

- discrete venous outflow
- single or multiple cysts
- pulsations synchronous with the heart beat
- communication with CSI

**Venix, Dermoid, AVM, Cavernous hemangioma, meningioma**

→ include different treatment

**Sclerosant: Bleomycin**

- Etanol
  - greater inflammation
  - post-treatment collapse
- Doxorubicin
  - greater inflammation

**Endpoint**

- Treat all treatable cysts
- Best cysts sufficient improvement
  - less expansion
  - less time and bleed
- best (all with bleed, difficult to assess bleed)
  - as far as program's endpoint bleed

**Non-Cystic Components**

- "Spongy" component
  - sometimes invades to sclerosant
- Fibrous component
  - depth of cyst with fibrosis

**a) Sclerosing agents for Lymphangiomas**

- are too toxic to use in the eye
- decrease the viscosity of fibrosis
- could be administered with fluoroscopy
- are not a first-line treatment for lymphangiomas

**Bleomycin Foam**

- Monitor infusion with ultrasound
- Less leakage
- Lower dose

**Minimize Fluoroscopy**

Helpful for assessing:

- Absence of leakage
- Absence of vascular connection
- Connectivity of cysts

**Surgery**

- Aspirate cysts if acute vision threat
- Excise fibrous form

**Surgery**

- Prophyl

4:55 - 5:05 pm

## Approach to Plexiform Neurofibromas - Timing, Debulking, Ptosis Repair

William R. Katowitz, MD

7 - 8 am

Moderators: Anne Barmettler, MD and James Chelnis, MD

7 - 7:04 am

## Concurrent Injuries in Pediatric Orbital Fractures

Adam Weber, Gina Mahatma, Michael Yen

*Baylor College of Medicine, Houston, Texas, United States of America*

**Introduction:** Pediatric orbital fractures are a common injury encountered by oculoplastic surgeons, and often are accompanied by other ocular and craniofacial injury.

**Methods:** This study was a retrospective chart review of all patients presenting to the Texas Children's Hospital for craniofacial fracture from 8/2011 to 1/2014. Demographic information, injury mechanism and ophthalmological exam findings from the initial encounter were recorded. Imaging reports were reviewed for characterization and extent of the fractures and intracranial injury. Statistics were performed with chi-squared test and t-test.

**Results:** 300 patients were included in the study group, with 171 sustaining an orbital fracture. 66 percent of patients sustaining an orbital fracture were male, and the average time from injury to presentation was five days. 120 patients with an orbital fracture received an ophthalmological examination on presentation. Average logMAR visual acuity was 0.11, and 20% were noted to have a motility deficit. Commotio retinae was noted in 6.4%, hyphema in 4.5%, corneal injury in 3.6%, and pupil irregularity in 2.7%. 43.8 percent of patients with orbital fracture also had another craniofacial fracture. Patients with concurrent non-orbital fractures were older than patient with isolated orbital fractures (10.2 v 8.5 years,  $p=0.028$ ). The most common non-orbital fractures were to the maxilla (61%), nasal(31%) and zygomatic (28%) bones. Subdural and subarachnoid hemorrhages were noted in 2.9% of patients with an orbital fracture, and 2.3% had an epidural hemorrhage.

**Conclusions:** Orbital fractures are commonly encountered by oculoplastic surgeons caring for the pediatric population. The treating physician should be aware of the risk for ocular injury concurrent with orbital fractures. Patients need to have the proper examination to diagnose these conditions, and adequate treatment and follow-up is crucial. As well, orbital fracture also occur in the setting of other craniofacial injuries, some of which may be serious and require urgent management.

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7:04 - 7:08 am

## Characterization of Periocular Dog Bites over 10 Years at an Adult and Pediatric Level-1 Trauma Center

Nina Farivari<sup>1</sup>, H. Russell Day<sup>2</sup>, Heather Tamez<sup>1</sup>, Behin Barahimi, Louise Mawn, Eric Brown, Rachel Sobel

<sup>1</sup>Ophthalmology, Vanderbilt University Medical Center, Nashville, Tennessee, United States of America, <sup>2</sup>Vanderbilt University School of Medicine, Nashville, Tennessee, United States of America

**Introduction:** Patients who suffer periocular dog bite injuries frequently present for care to oculoplastic surgeons. The purpose of this study is to characterize the types of ocular and periocular injuries from dog bites as well as to investigate the relationship between dog bite injuries and socioeconomic status.

**Methods:** A retrospective chart review was performed on all dog bite injuries seen by the ophthalmology consult service at a single regional level-1 trauma center from 7/1/2006 to 4/1/2016. United States Census and Center for Disease Control data including poverty rate, education levels, and urban-rural classification was obtained for the zip codes of included patients. This information was compared to the data for all zip codes within the hospital referral region (HRR) for this trauma center to evaluate for a significant relationship between dog bite injuries and patient socioeconomic status.

**Results:** A total of 150 periocular dog bite victims were identified, including 130 (87%) children and 20 (13%) adults. 62% of patients were male (n=93). Mean age was 9.9 years. Eighty-one percent of patients were white (n=122) and 11% were black (n=17). Fifty-three percent of patients were Medicaid recipients (n=80) and 5% were uninsured (n=8).

Patient injuries are summarized in Figure 1. Notably, the most common periocular injury was eyelid laceration (n=133), with almost half involving the canaliculus (n=65). Five percent sustained orbital fractures (n=7). No patients suffered an open globe injury. One patient suffered hemorrhagic shock leading to death.

Dog characteristics are summarized in Figure 2. Ninety-five percent of dogs were familiar to the victim at the time of attack (n=144). The most commonly documented offender was a pit bull (n=37, 35%). Thirty-nine percent of bites occurred during friendly or unprovoked encounters including playing and petting. The vaccination status of the dog was unknown or inadequate in 38% of cases, however only 2% of patients received rabies prophylaxis.

Two-thirds of dog bite victims live in zip codes with poverty rates greater than the national poverty rate. Furthermore, when compared to the overall population that is served by this institution, the dog bite victims were more likely to have come from impoverished areas (p < 0.001, Fig. 3).

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Patients with dog bite injuries came from disproportionately urban areas compared to suburban and rural regions ( $p < 0.001$ , Fig. 4). There was no difference between the dog bite population and the overall patient catchment area when comparing education level and unemployment rates.

**Conclusions:** This study explores the relationship between socioeconomic status and incidence of dog bites. These findings suggest that patients living in urban regions and impoverished areas are more likely to suffer periocular dog bite injuries. Furthermore, the results of this study confirm previous reports of increased incidence of periocular dog bites in children compared to adults. The data also demonstrate the increased likelihood of canalicular injuries and the rarity of severe ocular injury.

**Figure 1**

Table 1. Injuries from periocular dog bites.

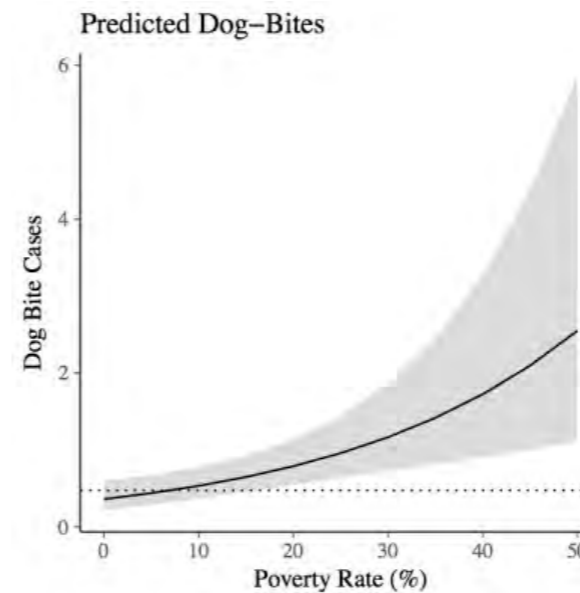
	n (% of all patients)
<b>Ocular and orbital injuries</b>	
Subconjunctival hemorrhage	25 (17)
Orbital fracture	7 (5)
Conjunctival laceration	5 (3)
Hemorrhagic chemosis	5 (3)
Preseptal cellulitis	5 (3)
Conjunctival laceration	5 (3)
Corneal abrasion	3 (2)
Corneal exposure	3 (2)
<b>Lid and lacrimal injuries</b>	
Eyelid laceration	133 (89)
Canalicular	65 (49)
Non-marginal	60 (40)
Marginal	41 (27)
Lid avulsion	7 (5)
Periorbital ecchymosis	7 (5)
<b>Non-ocular injuries</b>	
Other facial laceration	35 (50)
Extremity laceration	10 (7)
Facial dogloving	3 (2)
Non-orbital facial fracture	3 (2)
Death	1 (0.7)

**Figure 2**

Table 2. Dog characteristics.

	N (% of those documented)
<b>Canine species</b>	
Pit bull	37 (35)
Labrador retriever	8 (8)
German shepherd	6 (6)
Australian shepherd	4 (4)
Great Dane	3 (3)
<b>Relationship of dog to patient</b>	
Household's	78 (52)
Family member's	26 (19)
Neighbor's	19 (13)
Friend's	17 (11)
Stranger's	2 (3)
<b>Activity at time of bite</b>	
Playing	30 (20)
Unprovoked	24 (16)
Child aggression	25 (17)
Feeding	10 (7)
Petting	5 (3)
Multiple dogs fighting	2 (1)
<b>Canine vaccination status</b>	
Vaccinated	93 (62)
Unvaccinated or not up-to-date	34 (29)
Unknown	43 (29)

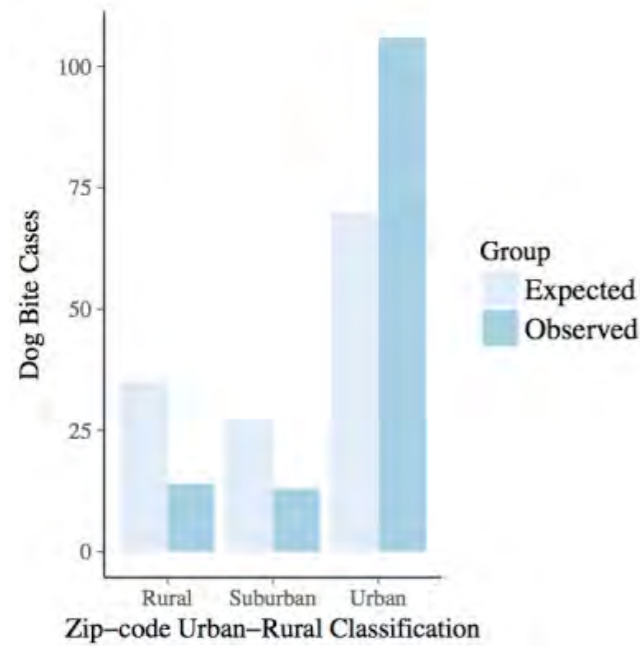
**Figure 3**



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**Figure 4**



**Figure 5**



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7:08 - 7:12 am

## Ophthalmic Changes in Patients with Hemifacial Atrophy (Parry-Romberg Syndrome)

Adam Sweeney, Christopher Chambers, Shu-Hong Chang

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**Introduction:** Parry-Romberg syndrome, or progressive hemifacial atrophy, is a very rare condition characterized by progressive atrophy of one side of the face. The etiology of this disease is unknown and the associated ophthalmic findings in this condition are poorly understood. We hypothesize that patients with this condition may have progressive involvement of the eye and/or orbital structures. The goal of this research is to determine the anatomic measurements of the globe and orbital structures in patients with Parry-Romberg syndrome.

**Methods:** In this prospective case series, patients diagnosed with Parry-Romberg syndrome were invited to participate in a research-oriented ophthalmology clinic visit. Visits included measurement of best corrected vision, refractive error, intraocular pressure, Ishihara plates, Hertel and eyelid position measurements, a complete slit lamp examination with dilated fundus exam, and IOL master calculations including axial length, corneal diameter, anterior chamber depth, and keratometry.

**Results:** Six patients underwent complete eye exams. The atrophic hemiface averaged 2.8 mm of enophthalmos on Hertel exophthalmometry and 0.91 mm shorter globe axial length. Mean visual acuity in the affected eye was 20/30 (range 20/20 to 20/600) compared to 20/20 in the unaffected eye. Two patients had history of severe unilateral ophthalmic disease on the side of the hemifacial atrophy, including high hyperopia, hypotony maculopathy and severe enophthalmos. Both of these patients had abnormalities on gonioscopy. One patient was found to have new onset uveitis at time of the study exam.

**Conclusions:** Parry-Romberg syndrome is a disease with variable degrees of ocular involvement. We report patients with and without ophthalmic findings associated with longstanding facial atrophy. Our results suggest the globe and orbit may demonstrate similar atrophic changes to other soft tissues in the face known to be affected by this condition. This is the first prospective exploratory ophthalmic study on the ophthalmic changes in patient with Parry-Romberg syndrome.

7:12 - 7:16 am

## Characterization of Pediatric Optic Nerve Glioma with Next Generation Sequencing Analysis and Multiplex Immunofluorescence

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**Introduction:** Optic nerve glioma (ONG) in childhood is a rare and potentially sight-threatening tumor. ONG remains a management challenge given its unpredictable clinical behavior<sup>1,2</sup>. Some evidence suggests that pediatric ONG's have alterations in the mitogen-activated protein kinase pathway, with microglia playing a role in the pathogenesis<sup>3</sup>. The goal of this study was to describe the molecular landscape and tumor immune microenvironment in ONG by applying Next Generation Sequencing (NGS) and quantitative multiplex immunofluorescence (qmIF) technology.

**Methods:** In an IRB-approved and HIPAA-compliant retrospective study, clinical data of six patients with pediatric ONG biopsied or resected between 2000 and 2017 was collected including gender, age at diagnosis, age of presentation to office, presenting visual acuity, NF1 status, and preoperative treatments. Five of these patients had previously been analyzed via FISH evaluation for BRAF tandem duplication and immunostaining for p53, IDH1, and MIB-1<sup>4</sup>. The tumor DNA was sequenced using the Columbia Combined Cancer Panel (CCCP) assay, consisting of 467-genes associated with solid tumors. Samples were stained using qmIF for CD3, CD8, CD68, CD163, HLA-DR, and Olig2. Multispectral images were acquired using multispectral imaging and analyzed using software and statistical software to evaluate density of immune phenotypes within the tumor microenvironment (Figure 1).

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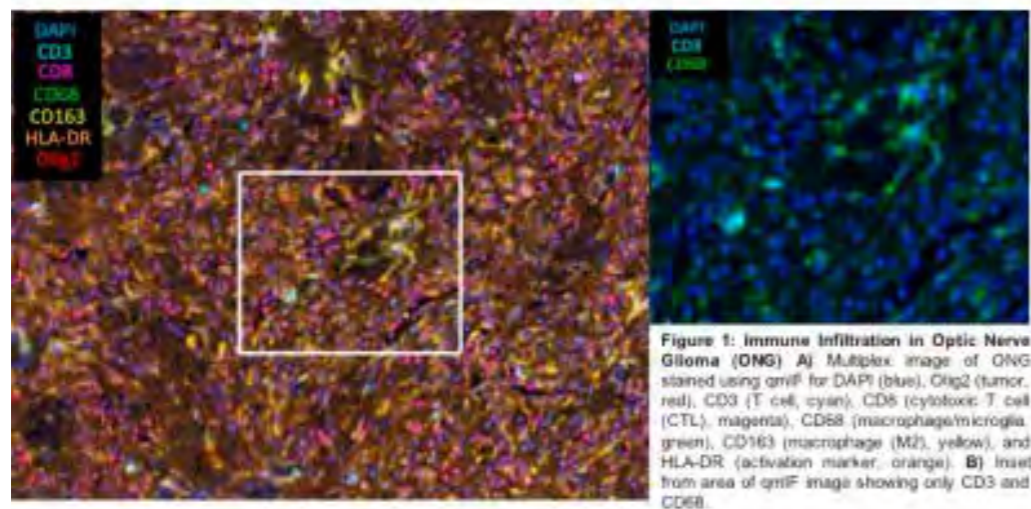


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**Results:** Six patients were studied. NGS analysis of 5 evaluable cases identified the NF1 mutation in two specimens, the KIAA1549:BRAF fusion mutation in two specimens, and a novel truncating mutation in histone methyltransferase, SETD2, in one specimen (with accompanying KIAA1549:BRAF fusion and clinically aggressive behavior). QmIF identifies variable amounts of immune cell density in six cases of ONG, specifically evaluating for T-cells (CD3), cytotoxic T-cells (CD3+CD8+), macrophages/microglia (CD68), and antigen-presenting cells (APCs, HLA-DR+) (Figure 2). There are few CD3+ (0.4% - 1.5%) and very few CD3+CD8+ (0 - 0.3%). There are many HLA-DR+ cells, however only a few are CD68+HLA-DR+.

**Conclusions:** NGS technology showed mutually exclusive recurrent KIAA1549:BRAF fusions and NF1 mutations in ONG and 1 novel mutation, SETD2 in an aggressive ONG. QmIF analysis shows immune cell infiltration of T cells, macrophages, and APCs. Further analysis is warranted to analyze sub-typing of APCs. The use of qmIF and NGS technology represents a novel way of analyzing the tumor microenvironment in an attempt to understand the variable clinical behavior of sporadic and NF-1 associated ONG.

**Figure 1**



**Figure 1: Immune Infiltration in Optic Nerve Glioma (ONG)** A) Multiplex image of ONG stained using qmIF for DAPI (blue), Olig2 (tumor, red), CD3 (T cell, cyan), CD8 (cytotoxic T cell (CTL), magenta), CD68 (macrophage/microglia, green), CD163 (macrophage (M2), yellow), and HLA-DR (activation marker, orange). B) Inset from area of qmIF image showing only CD3 and CD68.

**Figure 2**

	ONG1	ONG2	ONG3	ONG4	ONG5	ONG6
Age at presentation (diagnosis)	2	7 (6.5)	8 (6)	3 (3)	23 (16)	7 (6)
Gender	M	M	MA	F	F	M
NF1 status	(-)	(-) but (+) for in toxin	(-)	(-)	(-)	Refused testing
Site	Chiasm	Intracanalicular	Prechiasm, >5mm from chiasm	Bilateral nerves, chiasm, bilateral internal capsules, likely optic tracts and radiations	Prechiasm, <5mm from chiasm	Intracanalicular
Preoperative treatment	IV steroids, oral steroids	None	None	Radiation, IV steroids	Radiation	None
Next Generation Sequencing	KIAA1549:BRAF fusion + SETD2 mutation	KIAA1549:BRAF fusion	KIAA1549:BRAF fusion	Unknown	NF1 mutation	NF1 mutation
*CD3+	0.4%	0.8%	0.8%	1.4%	1.5%	0.4%
*CD3+CD8+	0.02%	0.1%	0.3%	0	0.2%	0.2%
*CD68	6.5%	5.3%	1.6%	3.1%	1.9%	4.9%
*CD68+HLA-DR+	5.0%	5.0%	1.6%	2.5%	1.8%	2.4%
*Total HLA-DR+	28.7%	26.2%	49.2%	6.6%	76.2%	25.5%

\* Reported as % per total cells

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7:16 - 7:20 am

## **Orbital Hemorrhagic Necrosis, Globe Rupture, and Death from Intraorbital Injection of 1% Sodium Deoxycholate in a Murine Model**

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**Introduction:** 1% sodium deoxycholate is an injectable detergent indicated for submental fat reduction. Clinically, it is being injected off-label for fat reduction in other parts of the body such as the periorbital region. In the submental region, it is known to cause severe inflammation and tissue edema, and can also cause temporary impairment of sensory and motor nerves. These types of reactions could be catastrophic in a confined space such as the orbit, which contains structures of the visual pathway, delicate sensory and motor nerves, and orbital fat. We studied the effects of intraorbital 1% sodium deoxycholate injection in a murine model.

**Methods:** 11 mice underwent split-face intraorbital injections with 100 ul saline injected into one orbit and 100 ul of 1% sodium deoxycholate injected into the other. 3 control mice underwent bilateral 100 ul saline injections. Daily clinical photos were taken, and animals were sacrificed after 5-7 days. Whole heads were fixed, decalcified, and sectioned for orbital histology.

**Results:** 6/11 mice injected with 100 ul of 1% sodium deoxycholate died during the procedure and never awoke from anesthesia, whereas all 3/3 mice injected with 100 ul of saline survived. All orbits injected with saline were clinically and histologically normal, whereas all orbits injected with 1% sodium deoxycholate developed globe rupture or complete globe necrosis, in addition to complications such as retrobulbar hemorrhage, suprachoroidal hemorrhage, hyphema, and Harderian glandular inflammatory necrosis.

**Conclusions:** Intraorbital 1% sodium deoxycholate injection can cause devastating ocular and orbital complications and even death in a murine model. Given its known ability to dissolve fat, cause extensive tissue edema, and demyelinate sensory and motor nerves, 1% sodium deoxycholate should be used with extreme caution around the periorbital region.

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**Figure 1**

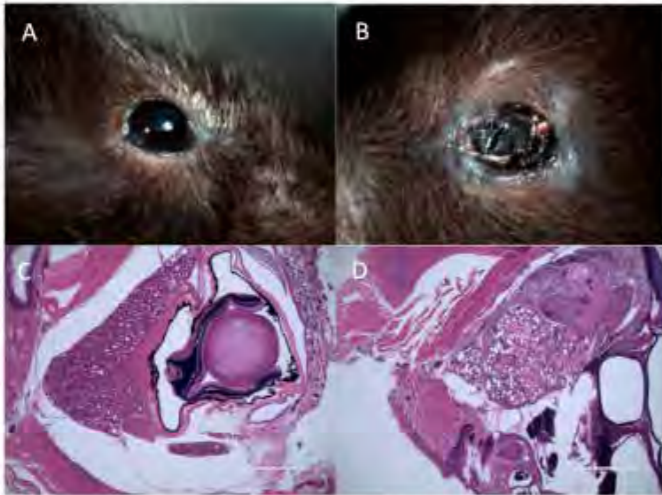


Figure 1. Clinical photos one week following 100 ul of PBS injected to right orbit and 100 ul of Kybella injected to left orbit, with a normal appearing right eye (A) and a collapsed globe with inflammatory hemorrhagic necrosis (B). Histopathological analysis showed a normal mouse orbit (C) and an orbital apical hematoma, Harderian glandular inflammatory necrosis, and globe necrosis (D).

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7:20 - 7:24 am

## Optic Nerve Sheath Fenestration for Treatment of Retrolaminar Silicone Oil Migration

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**Introduction:** We present a rare complication of pars plana vitrectomy (PPV), in which silicone oil migrated to the optic chiasm and was managed successfully with optic nerve sheath fenestration.

**Methods:** Case Report

**Results:** Silicone oil (SO) endotamponade is typically reserved for complex retinal detachments.<sup>1</sup> There have been reported cases of retrograde migration of SO into the ventricular system.<sup>2-5</sup> We report a case of a 75-year-old Caucasian male with pre-existing glaucoma who underwent his first PPV for epiretinal membrane peel and air-fluid exchange for the right eye. Unfortunately, he underwent two more PPVs due to new retinal detachments, with eventual placement of a scleral buckle (SB) and SO. Post-operatively, his intraocular pressures were consistently elevated to the 40s-50s, despite maximal topical and oral antihypertensives along with frequent anterior chamber (AC) taps.

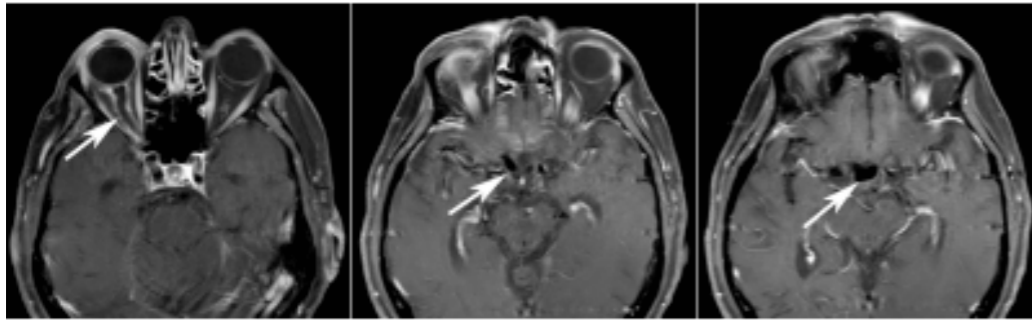
Four days after SB and SO placement, he was found to have no light perception (NLP) vision in the right eye. He urgently underwent SB explantation and SO removal. The following day, he reported loss of central and temporal vision of his previously normal left eye. Visual field confirmed a new temporal defect. Magnetic resonance imaging (MRI) demonstrated SO tracking from the right globe to the optic chiasm and into the bifrontal horns of the lateral ventricles (Figures 1&2). He was placed urgently on high dose oral corticosteroids and underwent a successful right optic nerve sheath fenestration one week later (Figure 3), with video revealing a significant amount of recovered silicone oil. Two weeks following his fenestration, his vision in the left eye improved to 20/20 and his visual field improved. Repeat imaging showed reduction of chiasmal SO (Figure 4). The right eye remained NLP.

**Conclusions:** Silicone oil endotamponade infrequently demonstrates retrolaminar migration resulting in optic neuropathy and chiasmopathy. Multiple mechanisms have been postulated, including direct passage of SO through the periphery of the lamina cribrosa into the subarachnoid space in patients with significant glaucomatous cupping.<sup>6</sup> It is important for clinicians to be cognizant of this rare complication and of the radiographic appearance of silicone oil in order to facilitate early intervention. Our case adds to the previous reports of intracranial silicone oil migration and constitutes the second case successfully employing optic nerve sheath fenestration to drain silicone oil, and the first from an orbital approach, from the anterior visual pathways in order to restore vision.

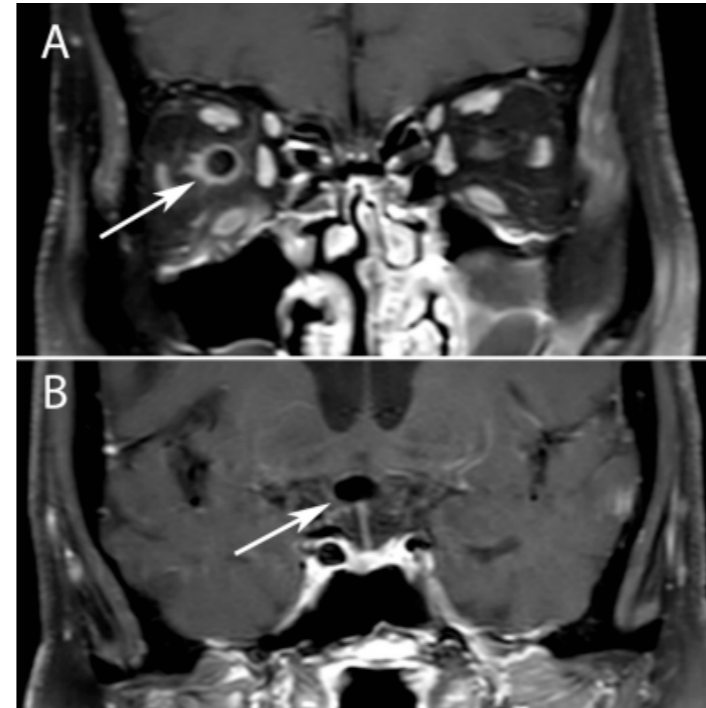
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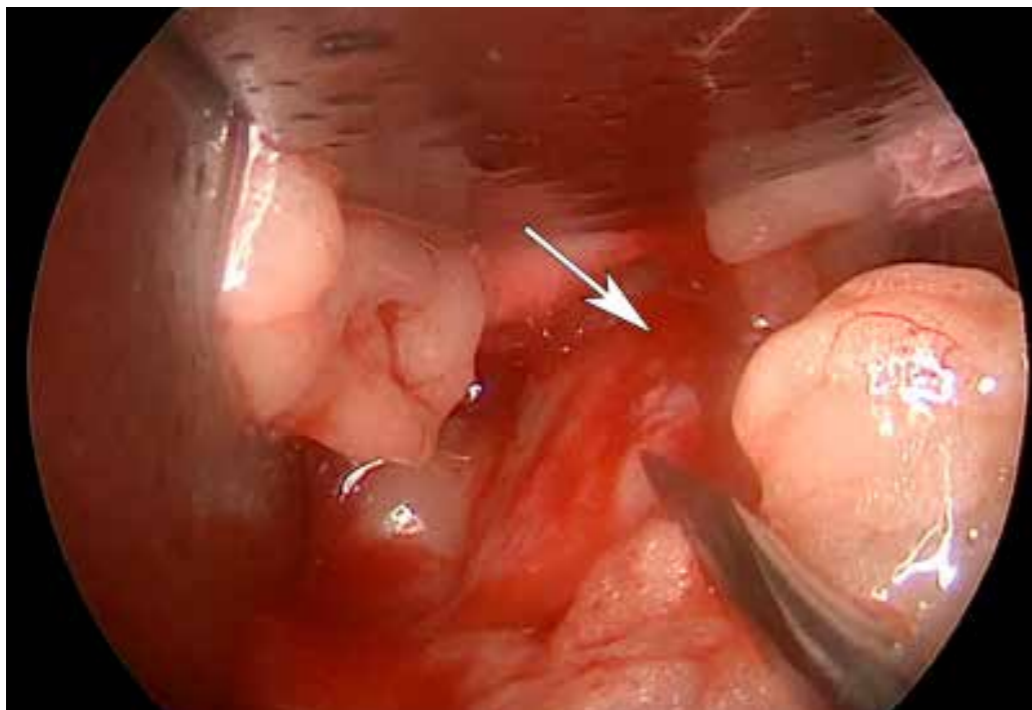
**Figure 1**



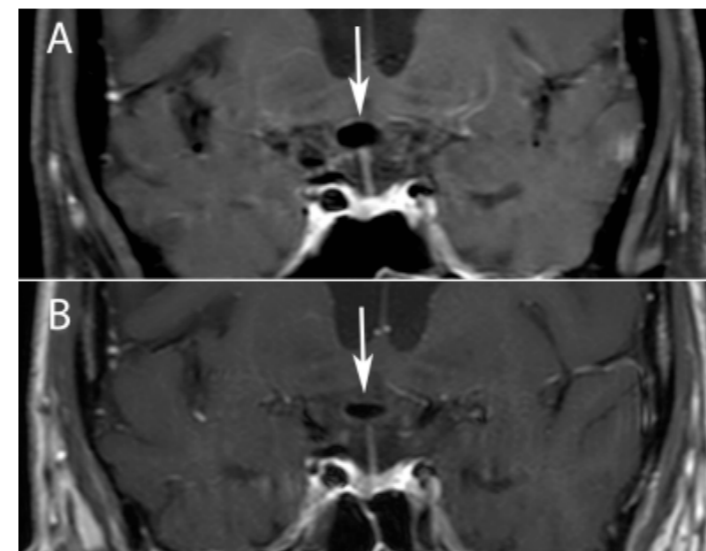
**Figure 2**



**Figure 3**



**Figure 4**



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**References:**

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7:24 - 7:28 am

## The Cocaine Orbitopathy Triad

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**Introduction:** Cocaine abuse causes a number of nasal and sinus complications, and rarely osteolytic orbital defects, leading to localized orbital ischemia, inflammation, and necrosis.<sup>1</sup> We describe three patients who each displayed the clinical triad of restrictive exotropia, sclerosing medial orbital inflammation, and orbital bony destruction from chronic intranasal cocaine abuse.

**Methods:** Retrospective case series from the practice of two surgeons (PDL and RET).

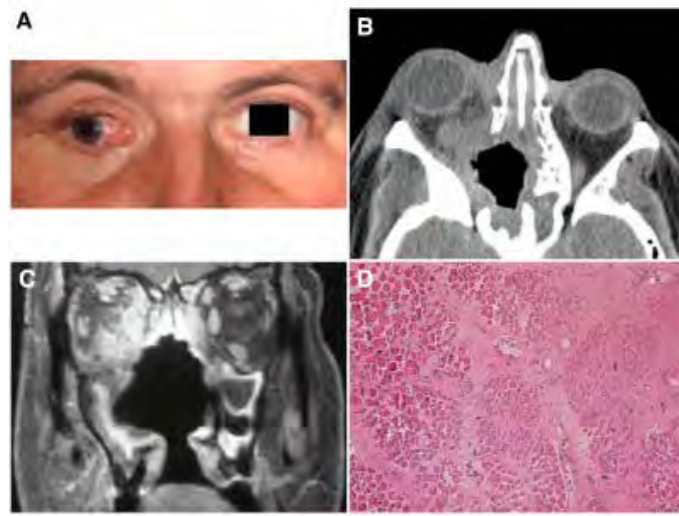
**Results: Case 1:** A 46-year-old man with a several-year history of intranasal cocaine use and recurrent rhinotillexomania developed saddle nose deformity, nonhealing ulceration of both nostrils, right proptosis, restrictive exotropia, and hypertropia. CT scans revealed opacification of the right paranasal sinuses, destruction of the right orbital floor and medial wall, and a dense medial orbital infiltrate. (Figure 1). Within a year, he developed a frozen exotropic globe, and NLP vision. Orbitotomy revealed avascular, firm, fibrotic material adherent to and restricting the globe with a significantly atrophic medial rectus muscle. **Case 2:** A 37-year-old woman with a several year habit of intranasal cocaine use presented with a 50-diopter exotropia and fistula of the hard palate. A maxillofacial CT scan revealed a left medial orbital infiltrate and a left-sided osteolytic process with significant loss of the medial orbital wall, the medial wall of the maxillary sinus, the nasal bone, turbinates, and hard palate. (Figure 2) She underwent orbital reconstruction with debulking of dense fibrotic tissue and placement of inferior and medial wall implants. A dense, restrictive sclerotic infiltrate adherent to the globe lead to failure to correct her exotropia with subsequent attempted extraocular muscle recession and resection. **Case 3:** A 42-year-old woman presented with periorbital, nasal, and sinus inflammation, restrictive exotropia, a nasocutaneous fistula, and NLP vision following 10 years of chronic intranasal cocaine use. CT scan revealed osteolytic defects of the inferomedial orbit and left midface, and a left medial orbital infiltrate. (Figure 3). A forced duction test revealed marked restriction of adduction of the left eye. She underwent a cheek advancement flap to cover the facial defect, and an orbitotomy and attempted debulking of the orbital infiltrate. Histopathology of orbital tissue in all three patients reveals dense fibrotic tissue with an inflammatory infiltrate.

**Conclusions:** Cocaine orbitopathy likely results from chronic ischemia leading to an osteolytic process involving the inferomedial orbit, recurrent inflammation, and ultimately, the development of a dense fibrotic medial orbital infiltrate causing a frozen exotropic globe. The ischemic process may affect the eye, the optic nerve or the retina leading to profound loss of vision: two of our patients became NLP in the affected eye. The triad of a restrictive exotropia with ipsilateral inferomedial orbital osteolytic defects and a medial orbital fibrotic infiltrate – an association not formally (continued)

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described – appears to be virtually pathognomonic of chronic intranasal cocaine use. Ophthalmic plastic surgeons should be aware of the insidious pattern of these findings characteristic of this enigmatic orbital process.

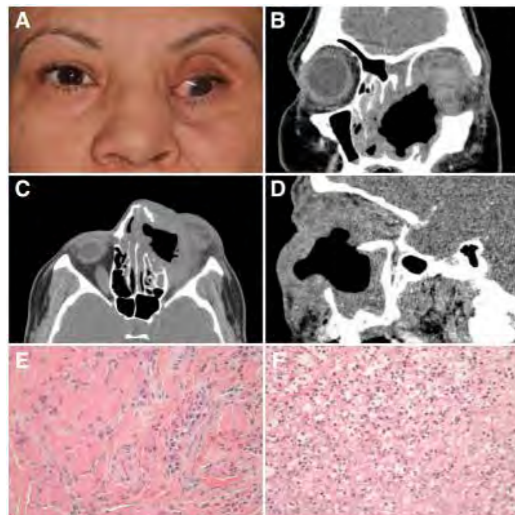
**Figure 1**



**Figure 2**



**Figure 3**



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7:28 - 7:32 am

## Lacrimal Gland Botulinum Toxin Injection for Tearing of Various Etiologies: Experience in 60 Patients

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**Introduction:** Tearing is a common ophthalmic complaint that can cause irritation, decreased vision and unpleasant social interactions. Various etiologies can lead to bothersome tearing including hypersecretion or maladies with the tear drainage pathway. The treatment of these entities often requires surgical intervention, or in the case of gustatory lacrimation lacks satisfactory treatment options. Lacrimal gland (LG) botulinum toxin (BT) injection has previously been described in the treatment of ephiphora from gustatory tearing and lacrimal obstruction. Here we report our experience using LG BT in treating tearing from several etiologies, including some not reported to date including diseases of the puncta, lacrimal sacrifice from cancer excision and a faulty lacrimal pump. We also attempt to assess the pain of injection in a quantitative manner.

**Methods:** Retrospective non-comparative interventional series of 60 consecutive patients with subjective tearing treated with LG BT. Patients were offered more traditional treatments when appropriate based on etiology and surgical risk and either failed or deferred. Tearing severity and frequency were recorded in a semi-quantified manner from 0 to 4 based on grading previously described by Keegan at each visit.<sup>2</sup> Etiology of tearing was confirmed through complete ophthalmic exam. Schirmer test was conducted before treatment and at each subsequent visit. In gustatory lacrimation patients, Schirmer test was measured at rest and while stimulated with the patient sucking a mint candy. A transconjunctival 2.5u BT injection was performed into the LG after topical anesthetic. Patients graded injection pain using a Likert-type Wong Baker FACES Pain analog scale. Follow-up visits occurred at 1, 4, and 12 weeks. Patients who did not improve satisfactorily after 1 week were re-injected with 2.5u and a new follow-up regimen began with repeat injections dosed at 5u. If benefit persisted at 12 weeks, patients were called monthly until tearing returned and re-injection offered. Exclusion criteria included significant dry eye including Schirmer's test.

**Results:** Table 1 summarizes the pertinent mean cohort data. Thirty-nine females and 21 males had a mean age of 57.4 years (range 19-93). The most common tearing etiologies were gustatory lacrimation (20 patients, 33.3%) and functional tearing (13, 21.7%). Reported injection pain was low at a mean of 0.2 (range 0-2), with 47 patients (78.3%) reporting no pain. Fifty-six patients (93.3%) improved within 1 week, and 58 (96.7%) improved within 4 weeks. The mean tearing severity and frequency declined sharply by week 1 (3.0 to 1.1,  $p < 0.05$ ; 3.4 to 1.3,  $p < 0.05$ ), and more gradually by week 4 (1.1 to 0.8,  $p < 0.05$ ; 1.3 to 0.9,  $p < 0.05$ ). The least amount of residual tearing was noted in patients with punctal stenosis, gustatory lacrimation and functional tearing. Four patients required additional 2.5u (5u total) injections, with 2 noting improvement and 2 having stable persistent tearing. Seven patients (11.7%) improved subjectively without matching improvement in Schirmer testing. Fifty-six patients (93.3%) elected for repeat injections after a favorable clinical response. The mean frequency of re-injection was 3.8 months, with the longest duration of action seen

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in gustatory lacrimation patients at 6.3 months. Side effects noted with 2.5u dosing included 3 patients with dry eyes that resolved with lubricating drops, and 2 patients with mild ptosis that resolved within 2 weeks. Mean follow-up was 26.2 months (range 6-63).

**Conclusions:** This may represent the largest series describing LG BT to date, and the first describing treatment for etiologies including lacrimal sacrifice during cancer excision, a faulty lacrimal pump, among others. Tearing severity and frequency improved in the great majority of patients, with the most drastic improvements noted for punctal stenosis, gustatory lacrimation and functional tearing. Injections were well tolerated with low perceived injection pain scores, and few mild reversible side effects that resolved within weeks. A re-injection rate of 93.3% reflects the high patient satisfaction rate. The mean duration of action of LG BT seen in the treatment of hyperlacrimation patients was 6.3 months. This is longer than typically seen for orbicularis oculi injections, possibly due to anatomic differences in axonal nerve sprouting following injections in different locations. Although there is a theoretic risk of damage to the lacrimal secretory apparatus and dry eye with repeated trauma to the LG, we did not notice this in our cohort who received a mean of 6.7 injections. Clinicians may wish to consider LG BT in all gustatory lacrimation patients and other tearing patients who have failed, defer, or are suboptimal candidates for conventional treatment.

**Table 1**

**References:**

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7:32 - 7:38 am

## Prevalence and Clinical Features of Orbital Vascular Anomalies in Children

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**Introduction:** While vascular anomalies have been reported systemically in up to 1% of children, there are, to our knowledge, no population-based studies describing the prevalence of orbital vascular anomalies. Broadly divided into vascular tumors and vascular malformations, orbital vascular anomalies are a heterogeneous group of potentially vision threatening lesions. Herein, we present the birth prevalence, demographics, types, and ocular sequelae of orbital vascular anomalies in a pediatric patient population over 50 years.

**Methods:** Medical records of all children

**Results:** A total of 109 children were diagnosed with an orbital vascular anomaly, including 25 from Olmsted County, yielding a birth prevalence of 1 in 4305 births. The median age at diagnosis was 1.2 (0 to 17.9) years, and 67 (61.5%) were female. There were 55 (50.5%) cases of vascular malformations [50 (91%) low-flow lymphatic malformations, 3 (5.5%) high-flow arteriovenous malformations, and 2 (3.5%) low flow venous malformations] and 54 (49.5%) cases of vascular tumors [53 (98%) orbital hemangiomas and 1 (2%) case of kaposiform hemangioendothelioma]. During a mean follow-up of 5.95 years (range 0 to 27.7) years, amblyopia was diagnosed in 46 (43.4%) patients and strabismus in 44 (42.3%) patients. Sixty-four (59%) patients received treatment, the most common being surgical excision (n=45, 41%).

**Conclusions:** Within this largest series to date, we present the previously unknown birth prevalence of pediatric orbital vascular anomalies as approximately 1 in 4300 births. Hemangiomas and low-flow lymphatic malformations comprised more than 90% of the orbital vascular anomalies and significant ocular sequelae, including amblyopia and strabismus, were prominent.

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7:38 - 7:42 am

## Quantified Orbital Fat Atrophy in Late Post-Traumatic Enophthalmos: Volumetric Analysis of Unoperated Orbital Fractures

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**Introduction:** Development of late enophthalmos occasionally occurs following orbital fracture, particularly if initial surgical repair is not performed. Correction of this form of enophthalmos is more challenging than other entities, such as the silent sinus syndrome, possibly because the mechanisms of traumatic enophthalmos are incompletely understood. We hypothesized that orbital fat atrophy occurs in patients with late post-traumatic enophthalmos and measured the volume of orbital fat in these patients.

**Methods:** An Institutional Review Board approved retrospective review of medical records from a single institution from January 2003 to May 2018 identified patients with diagnoses of both orbital fracture and enophthalmos. Patients with a CT scan of the orbits at least 3 months after injury (to allow resolution of edema and hemorrhage) who did not undergo surgical repair, had no other orbital disease or surgery, and had a normal contralateral orbit were included. Scans were exported in DICOM format and analyzed using imaging software. Total orbital volume and orbital fat volume for the fractured and normal contralateral orbits were measured via 3D volume rendering assisted region-of-interest computation in the axial plane (Figure 1). Enophthalmos was measured radiographically in relation to the lateral orbital rim and orbital apex. Paired samples *t*-tests were used to compare orbital fat and total orbital volumes between the fractured and normal contralateral orbits to determine late post-traumatic changes.

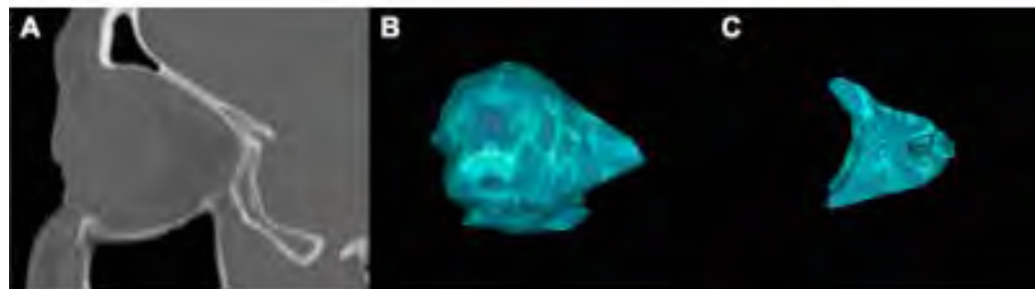
**Results:** Thirteen patients (6 women, 7 men) with mean age 39.5 years (SD 14.6, range 23-63) met inclusion criteria. The numbers of patients with each fracture pattern were floor (4), medial wall (4), floor/medial wall (3), floor/lateral wall (1), and floor/medial/lateral walls (1). Average time from injury to CT scan was 21.8 months (SD 16.3, range 3-57). Comparing the fractured and normal contralateral orbits, there was a statistically significant decrease in orbital fat volume (mean difference 0.9 ml (14.2%),  $p=0.00018$ ) and increase in total orbital volume (mean difference 2.1 ml (7.0%),  $p=0.000096$ ) (Figure 2). Mean enophthalmos measurements in relation to the lateral orbital rim and orbital apex were 2.5 mm and 2.4 mm, respectively.

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**Conclusions:** In addition to an increase in total orbital volume, there was a decrease in orbital fat volume in fractured orbits, demonstrating an additive effect. This is the first study to objectively demonstrate orbital fat loss via volumetric analysis in patients with late post-traumatic enophthalmos. This has important implications in the treatment of orbital fractures and may support early repair as well as designing implants that compensate for fat atrophy. Going forward, use of advanced 3D imaging techniques and custom orbital implants may aid in surgical correction of late post-traumatic enophthalmos.

**Figure 1**



**Figure 2**

Statistical Data	Total volume			Fat volume			Enophthalmos	
	Fractured side (ml)	Normal side (ml)	Difference (ml) (%)	Fractured side (ml)	Normal side (ml)	Difference (ml) (%)	Lateral orbital rim (mm)	Orbital apex (mm)
Mean	31.3	29.3	2.1 (7.0)	5.8	6.7	0.9 (14.2)	2.5	2.4
SD	4.8	4.3	1.3 (4.2)	1.8	2.0	0.6 (9.0)	0.7	0.8
Range	23.5-40.4	22.6-36.5	0.7-4.7 (2.4-16.3)	2.7-9.2	3.5-11.3	0.1-2.1 (0.2-30.5)	0.9-3.4	1.0-3.4
P-value			0.00095			0.00018		

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7:42 - 7:46 am

## **Bicanalicular Silicone Intubation for the Management of Punctal Stenosis and Obstruction in Patients with Allergic Conjunctivitis**

Adel Alsuhaibani, Naif Al-Sulaiman

*Ophthalmology, King Saud University, Riyadh, Saudi Arabia*

**Introduction:** To present the effect of bicanalicular silicone intubation for the management of punctal stenosis and obstruction in patients with allergic conjunctivitis.

**Methods:** The retrospective interventional case series included 97 eyes of 51 patients with acquired epiphora with bilateral visible stenotic or obstructed puncti. Under sedation, punctal dilation and bicanalicular silicone intubation were performed bilaterally in all patients. Munk Scale for grading of epiphora was used to assess the improvement along with grading of fluorescein dye disappearance test and grading of punctal stenosis. Patients with punctal stenosis and obstruction due to other causes were excluded along with patients having canalicular or nasolacrimal duct obstruction

**Results:** 51 patients out of 60 were included (met the inclusion criteria) with male female ratio of 1:1.5 and average age of 46 year old. Epiphora, tear meniscus, and punctal size all were improved based on Munk scale and the grading of the fluorescein dye disappearance test and the punctal stenosis ( $P < 0.05$ ). No difference was found following tube removal. High patient satisfaction and tolerance were reported while tubes were in place in both groups, with no complications. Two patients had recurrence of the punctal stenosis several months following stent removal due to exacerbation of the allergic conjunctivitis.

**Conclusions:** Bicanalicular silicone intubation seems to be well tolerated and effective in the management of acquired punctal stenosis or obstruction secondary to allergic conjunctivitis which typically present with bilateral involvement of both puncti.

8:20 - 8:40 am

**Novel Imaging Techniques in Oculoplastic Surgery**

Malin Malmsjö, MD, PhD

8:45 - 9:25 am

Moderators: Sara Tullis Wester, MD and Dan Georgescu, MD, PhD

8:45 - 8:51 am

## Clinical Outcomes of Minimally Invasive Corneal Neurotization

Ilya Leyngold<sup>1</sup>, Michael Yen<sup>2</sup>, Gargi Vora<sup>1</sup>, James Tian<sup>3</sup>, Mark Leyngold<sup>4</sup>, Christopher Weller<sup>5</sup>

*<sup>1</sup>Ophthalmology, Duke University School of Medicine, Durham, North Carolina, United States of America, <sup>2</sup>Cullen Eye Institute, Baylor College of Medicine, Houston, Texas, United States of America, <sup>3</sup>Duke University School of Medicine, Durham, North Carolina, United States of America, <sup>4</sup>Surgery, University of Florida College of Medicine, Gainesville, Florida, United States of America, <sup>5</sup>Ophthalmology, Penn State Health Milton S. Hershey Medical Center, Hershey, Pennsylvania, United States of America*

**Introduction:** Neurotization is the process of transferring a healthy donor nerve segment to denervated tissue thereby re-establishing either motor or sensory innervation. Prior descriptions of corneal neurotization for neurotrophic keratopathy are limited by the amount of patients studied and potential morbidity of the surgical techniques.

In this retrospective study we describe clinical and morphologic outcomes of corneal neurotization using minimally invasive techniques which avoid the morbidity of the previously described methods. We also describe the largest case series of corneal neurotization to date.

**Methods:** Acellular nerve allograft coapted to a sensory donor nerve (Fig.1) or direct endoscopic transfer of a donor nerve (Fig.2) was used to neurotize the cornea. Retrospective evaluation of post-operative corneal sensibility, ocular surface, visual acuity, and corneal nerves was performed.

**Results:** Corneal neurotization was successfully performed in 10 patients (Fig. 3). Average follow up was 6 months with average improvement in corneal sensibility of 3 cm. All patients demonstrated complete healing of persistent epithelial defects and improvement in ocular surface health. In vivo confocal microscopy demonstrated increased nerve density in corneal stroma as early as 4 months after surgery (Figs. 4,5).

**Conclusions:** The use of acellular nerve allograft or endoscopic donor nerve transfer allows for a minimally invasive approach to successful corneal neurotization.

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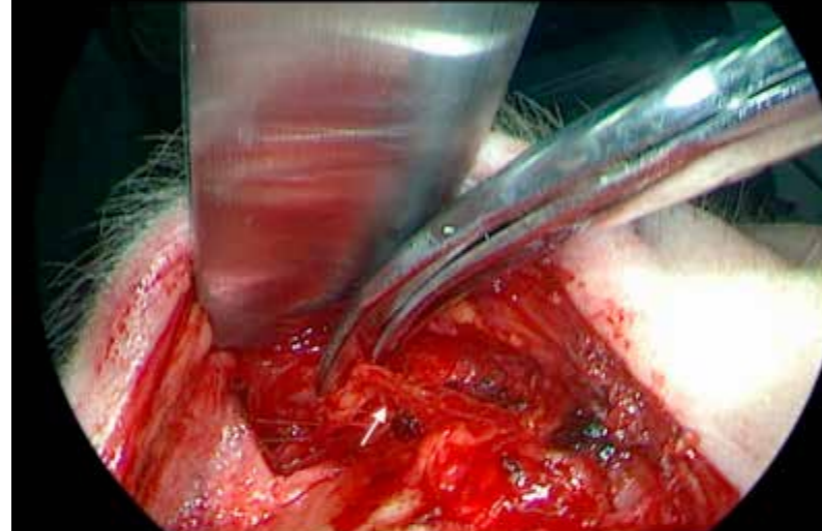


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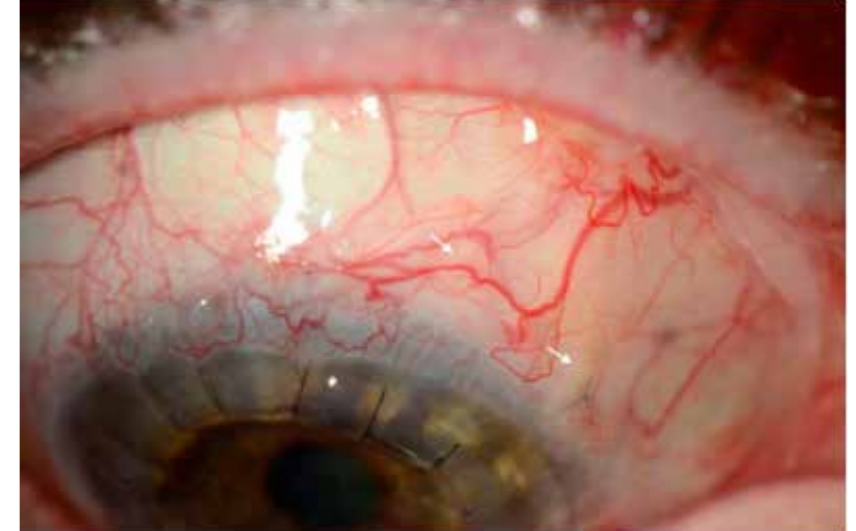
**Figure 1**



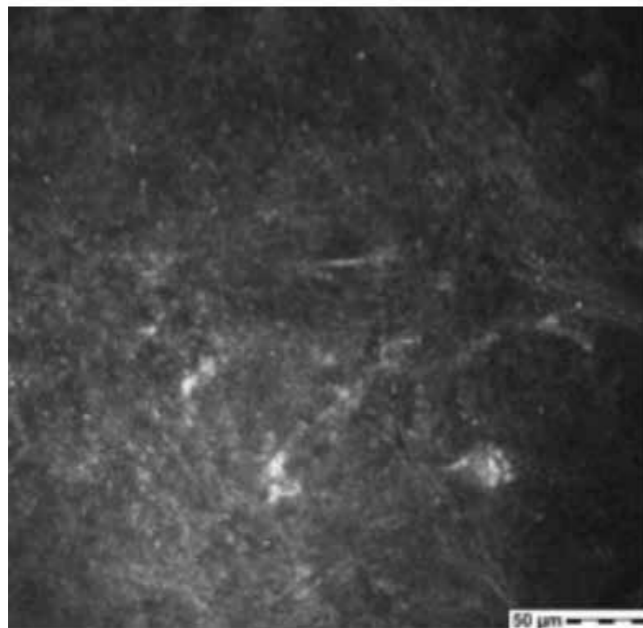
**Figure 2**



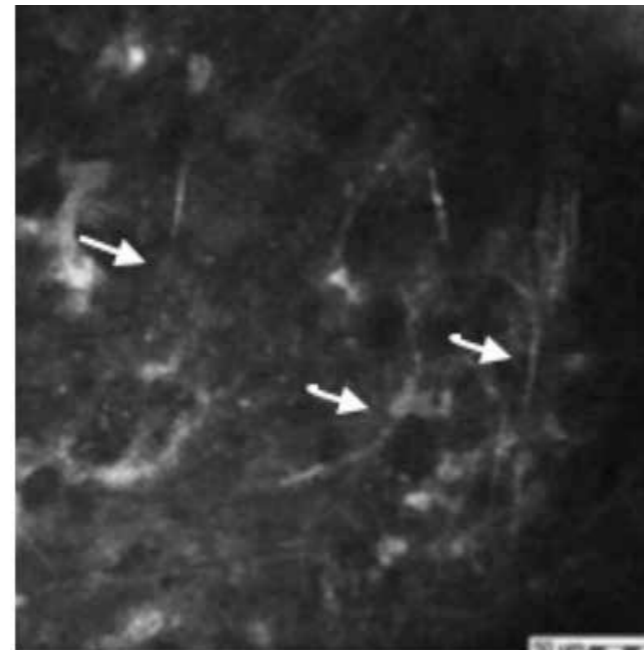
**Figure 3**



**Figure 4**



**Figure 5**



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8:51 - 8:57 am

## Effects of Collagen Crosslinking on Porcine and Human Tarsal Plate

Sarah W. DeParis<sup>1</sup>, Angela Zhu<sup>1</sup>, Shoumyo Majumdar<sup>2</sup>, Jennifer Elisseff<sup>2</sup>, Albert S. Jun<sup>1</sup>, Nicholas R. Mahoney<sup>1</sup>

<sup>1</sup>Department of Ophthalmology, Wilmer Eye Institute/Johns Hopkins Hospital, Baltimore, Maryland, United States of America, <sup>2</sup>Department of Ophthalmology and Department of Biomedical Engineering, Wilmer Eye Institute/Johns Hopkins Hospital, Baltimore, Maryland, United States of America

**Introduction:** As human tarsal plate contains type I collagen,<sup>1,2</sup> which is crosslinked in corneal tissue as a treatment for keratoconus,<sup>3</sup> we hypothesized that collagen crosslinking would similarly stiffen porcine and human tarsal plate tissue in a preliminary investigation of a potential treatment for floppy eyelid syndrome.

**Methods:** Porcine crosslinking experiments were analyzed with gross photographs, anterior segment optical computed tomography (AS-OCT) imaging, and tensile strength testing. A prospective study of human specimens was performed on tarsal plate tissue obtained from patients undergoing wedge excision for floppy eyelid syndrome and was analyzed with AS-OCT and tensile strength testing.

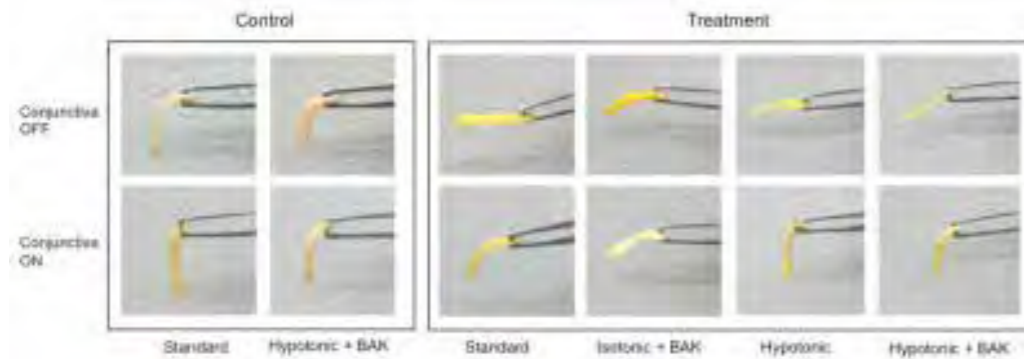
**Results:** Grossly, greater stiffness was observed in crosslinked porcine tissue. AS-OCT imaging in porcine tissue showed a hyperreflective band in crosslinked specimens that was significantly wider after 60 minute treatment compared to 30 minute treatment. This band was also visible in human specimens. Tensile strength testing was performed for both porcine and human specimens, but results did not reach significance.

**Conclusions:** Current treatments for FES are limited to supportive therapy with artificial tears or eye shields applied at night, or surgical treatment. An effective, minimally invasive method of increasing tarsal plate stiffness could prove useful either alone or in combination with current treatment methods. Given the presence of type I collagen in both human cornea and tarsal plate, we hypothesized that collagen crosslinking could be utilized to increase the stiffness of tarsal plate tissue. Initial porcine studies demonstrated a gross difference between treatment and control specimens with treatment specimens having greater stiffness (Figure 1). AS-OCT imaging, which has not been previously described for tarsal plate, showed a structural change in crosslinked tissue in both porcine (Figure 2) and human specimens (Figure 3). Tensile strength testing showed a trend toward increased stiffness (higher Young's modulus) after crosslinking in both porcine and human tarsus, but results were not statistically significant (Figure 4). Further study is warranted to determine relevance as a potential treatment for floppy eyelid syndrome.

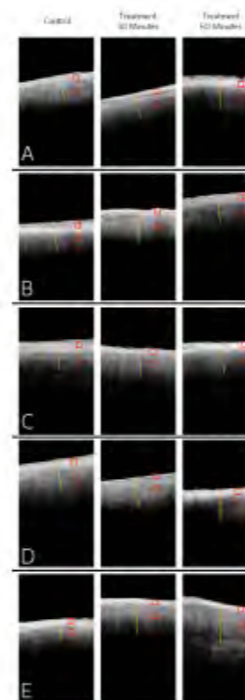
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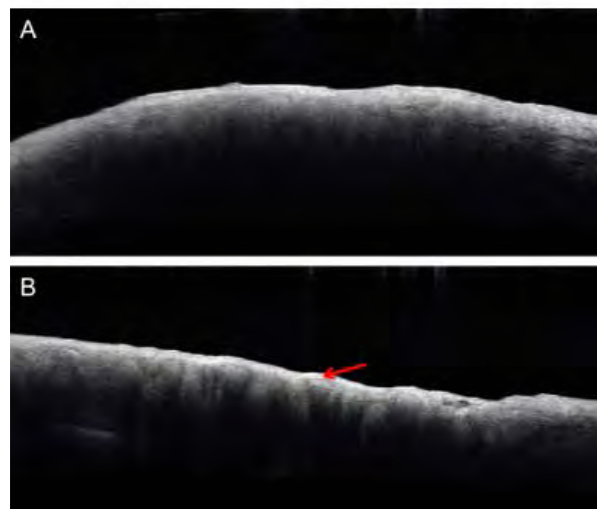
**Figure 1**



**Figure 2**



**Figure 3**



**Figure 4**

	Stress-strain Measures	Control samples	Treatment samples	Two-tailed P-value
Porcine tarsal experiments	Peak Load (N)	28.53	32.75	0.42
	Peak Strain (MPa)	4.19	5.31	0.28
	Strain at break point (in/in)	1.70	3.02	0.16
	Young's modulus (MPa)	8.60	8.99	0.80
Human tarsal experiments	Peak Load (N)	10.43	11.13	0.54
	Peak Strain (MPa)	2.16	2.82	0.28
	Strain at break point (in/in)	0.48	0.49	0.82
	Young's modulus (MPa)	6.32	7.82	0.38

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8:57 - 9:03 am

## Biomechanical and Morphologic Assessment after Collagen Cross Linking of Human Tarsus

Shoaib Ugradar<sup>1</sup>, Umar Rehman<sup>1</sup>, Joseph Park<sup>2</sup>, Alan Le<sup>2</sup>, Robert Goldberg<sup>1</sup>, Daniel Rootman<sup>1</sup>

<sup>1</sup>Oculoplastics, UCLA, Los Angeles, California, United States of America, <sup>2</sup>Biomedical Science, UCLA, Los Angeles, California, United States of America

**Introduction:** The purpose of this study is to investigate the feasibility of increasing the rigidity of human tarsal tissue following treatment with Riboflavin and ultraviolet A (UVA) light to induce cross linking of collagen fibers.

**Methods:** In this prospective ex vivo study, the upper eyelid was excised *en bloc* from human cadavers with the conjunctiva and skin intact. The samples were divided vertically into four sections (2 controls and 2 experimental samples). The amount of UVA penetrating the tissue at different intensity settings (3 mW/cm<sup>2</sup>, 9 mW/cm<sup>2</sup>, 18 mW/cm<sup>2</sup>, 30 mW/cm<sup>2</sup> and 45 mW/cm<sup>2</sup>) was calculated using a UV light meter. The posterior surface of the 2 experimental samples for each specimen were then exposed to UVA (365 nm) delivered from a cross linking machine at 18 mW/cm<sup>2</sup> in the presence of riboflavin as a photosensitizing agent. Control samples were kept in a moisture chamber during this period. Following the cross linking procedure, the anterior lamella and conjunctival tissue were dissected off the tarsus on all samples to allow further testing.

The control and experimental samples were split and assessed for biomechanical and histological properties respectively. In the biomechanical assessment, stiffness (Young's modulus) was calculated for 1 control and 1 experimental sample from each specimen using a horizontally mounted microtensile load cell including a linear motor capable of high speeds (100 mm/s) and 20 nm resolution, with a strain gauge having 5 mN force resolution. Testing was performed in a physiological environment. The difference in stiffness between experimental cross linked samples and controls was calculated. Histologic examination of the second set of experimental and control samples was carried out to evaluate the effect of UVA on the meibomian glands and collagen fibers (H&E and Masson Trichrome stains).

**Results:** Fifteen eyelids from 15 cadavers were used in this study. A UVA intensity of 3 mW/cm<sup>2</sup> was found to be sufficient to pass full thickness through the eyelid (figure 1), and was used for the rest of the experiments. The mean (SD) Young's modulus for controls was 51.97 (12.3) and 105.61 (22.96) for experimental samples. The difference in stiffness of treated and untreated tarsus was significant ( $p = 0.02$ ). All cross linked samples had an increase in stiffness compared to controls, ranging from a 17% to a 282%. Typical stress-strain plots are included (figure 2). There were no signs of UVA induced damage to the Meibomian glands on histological analysis of any specimen.

**Conclusions:** The findings of this study suggest that collagen cross linking is a viable and effective modality for increasing the stiffness of tarsus. Further studies may be required to establish this method for the management of floppy eyelid and other tarsal laxity syndromes.

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**Figure 1**

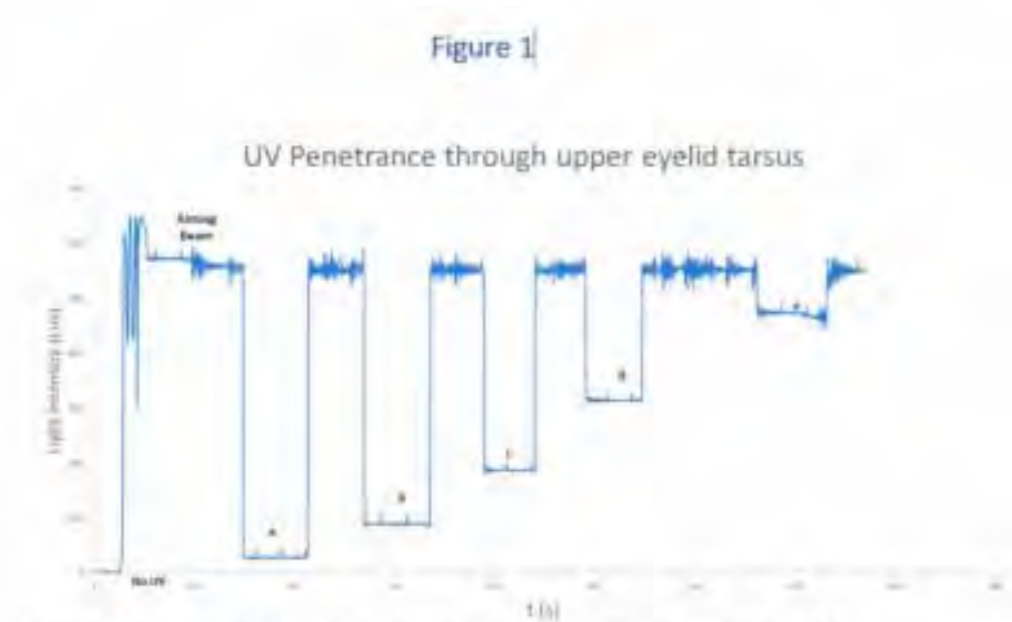


Figure 1: Penetrance of UV Light through upper lid tarsus at the following intensities: a) 3 mW/cm<sup>2</sup>, b) 9 mW/cm<sup>2</sup>, c) 18 mW/cm<sup>2</sup>, d) 30 mW/cm<sup>2</sup> and e) 45 mW/cm<sup>2</sup>

**Figure 2**

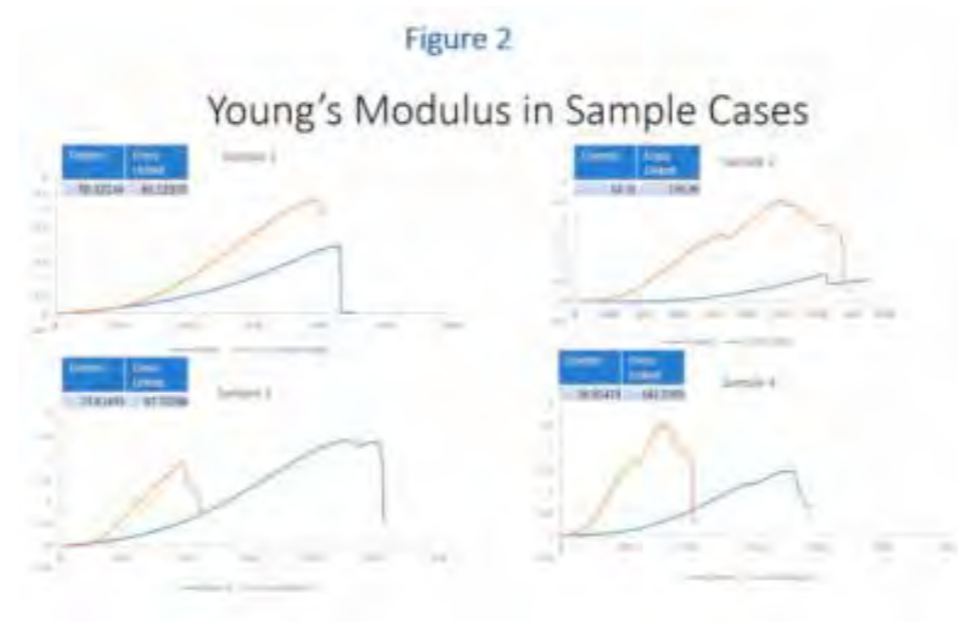


Figure 2: The Young's modulus in sample cases, demonstrating the difference in Young's modulus (gradient of the graph) between cross linked and control cases

9:03 - 9:09 am

## The Hatchet Flap: Where Have You Been All My Career?

Philip Custer, Robi Maamari

*Department of Ophthalmology and Visual Sciences, Washington University in St. Louis, St. Louis, Missouri, United States of America*

**Introduction:** The hatchet flap was first described by Emmett in 1977. While there are several reports of its use in facial reconstruction, the technique has received little attention in the ophthalmic or oculoplastic literature. This flap incorporates features of both advancement and rotational flaps. Combining a transposition flap at the tail of the hatchet flap increases the amount of tissue that can be mobilized into a defect and facilitates closure of the flap donor site.

**Methods:** This IRB approved case series includes patients undergoing reconstruction using a hatchet flap. Patient characteristics, defect size and location, simultaneous procedures, complications, and post-operative care were reviewed.

**Surgical Technique:** Theory, design, and limitations of the flap in different anatomic locations will be discussed. The flap is developed in an area of tissue laxity adjacent to the defect. A curvilinear incision extends from the edge of the defect, creating a rotational flap. At the end of this incision, a cut-back is created. This cut-back is closed in a V-Y fashion mobilizing tissue toward the defect. The tip of the flap created by the cut back can either be partially excised or used to create a small transposition flap, facilitating closure of the flap donor site.

**Results:** Between 2016 and 2018 a hatchet flap was used to repair Mohs surgery defects of the upper eyelid, lower eyelid, lateral canthus, medial canthus, cheek, and nose in 16 separate procedures. Estimated surface area of the defects repaired ranged from 0.9-23.6 cm<sup>2</sup>, with 44% (7/16) defects being greater than 4 cm<sup>2</sup> in size. The flap tail was transposed in 78% (14/18) cases. Wound closure was aided by a small transposition flap developed from redundant tissue near the advanced base of the hatchet flap in 6 cases and a small skin graft was used in 6 procedures. Minor complications included transient localized flap ischemia (n=2), suture granuloma (n=1), and hypertrophic scar responding to steroid injection (n=2). There were no permanent or severe complications. All patients achieved an excellent result.

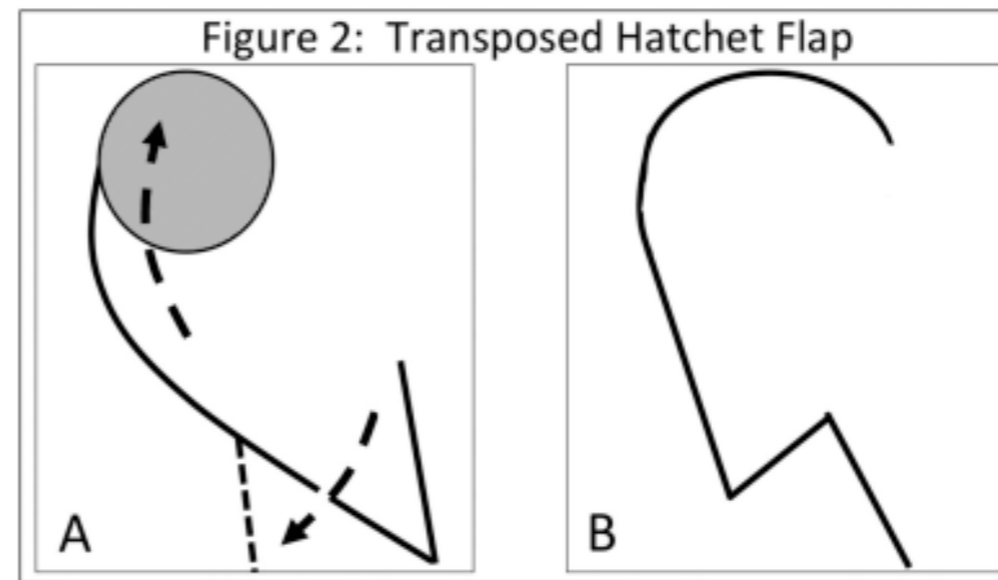
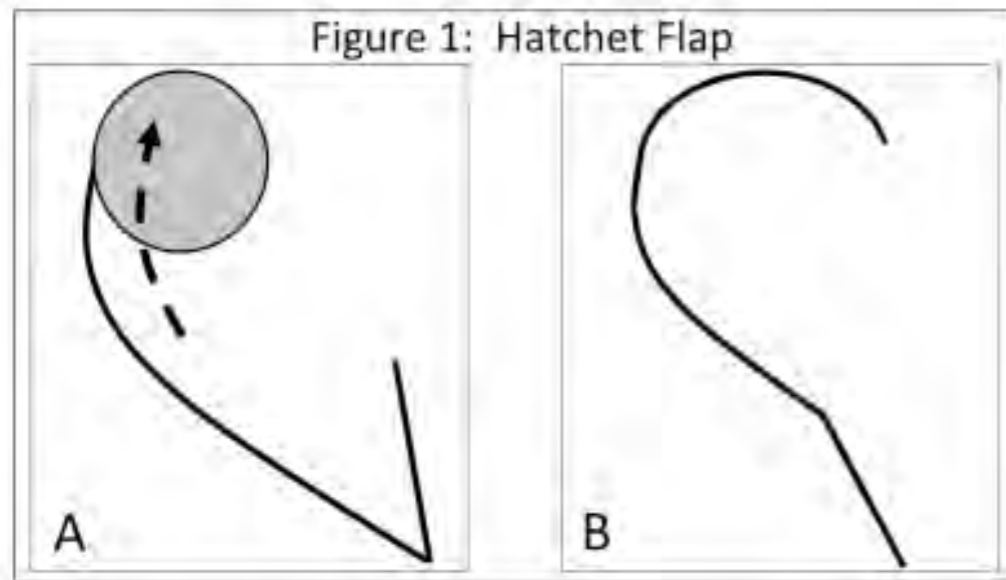
**Conclusions:** Since learning of the hatchet flap, we are using this technique with increasing frequency to repair periocular and mid-facial defects. Transposing the tail of the flap increases the amount of tissue that can be mobilized. The hatchet flap is particularly suited to repair defects where there has been combined loss of skin, subcutaneous tissue, and muscle. In selected patients it provides a result superior to that which likely could be achieved with other techniques, such as forehead or Mustarde flaps.

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**Figure 1**

**Figure 2**



**References:**

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9:09 - 9:15 am

## Utility of Non-Contact Infrared Meibography in the Diagnosis of Eyelid Margin Lesions

Ricardo Couso, Michael J. Schatz, César A. Briceño

*Ophthalmology, Scheie Eye Institute, University of Pennsylvania, Philadelphia, Pennsylvania, United States of America*

**Introduction:** Meibography has made it possible to more precisely and objectively describe meibomian glands and correlate findings with other ocular pathologies such as dry eye. However, there is little research examining meibography as it relates to specific eyelid margin lesions. The purpose of this prospective study is to determine the clinical significance and utility of meibography in diagnosing eyelid margin lesions.

**Methods:** Routine slit-lamp eye examination was performed to confirm the presence of a mass lesion within or abutting the margin. Exclusion criteria include age < 18, history of prior lid surgery, and other ocular diseases leading to significant MGD. Meibography was obtained using an Oculus Keratograph 5M. Each affected lid and contralateral lid were imaged. Images were evaluated for gland dropout and compared to the corresponding contralateral lid. Results were grouped by diagnosis, and further by lesion type (inflammatory or neoplastic). Chi-squared analysis was used to determine if there were differences in dropout between the inflammatory and neoplastic groups, and differences in dropout between affected and unaffected lids within each group.

**Results:** Six patients with chalazion were imaged. The patients' age ranged from 30-80 years (mean age = 53.7 years). All six patients had unilateral disease. Five of the six patients (83%) had local dropout in the area of the chalazion, and one of the six patients (17%) had local dropout in the same area of the contralateral lid. In a patient with basal cell carcinoma, meibography showed normal glands. One patient with a right lower eyelid seborrheic keratosis at the lash line was imaged and also had normal meibography. A patient with a chronic inflammatory lesion of the eyelid suspicious for sarcoidosis was imaged. There was complete dropout with a normal contralateral lid. Six of the seven patients with inflammatory lesions showed local gland dropout, while neither of the two patients with neoplastic lesions showed local dropout (Chi-square= 5.14,  $p= 0.0233$ ). Patients with inflammatory lesions were significantly more likely to exhibit gland dropout in the affected lid versus the unaffected lid (Chi-square= 7.14,  $p= 0.0075$ ). There was no difference in gland dropout between the affected and unaffected lids of the two patients with neoplastic lesions (Table 1).

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		Gland Dropout (% Total)	No Gland Dropout (% Total)
Inflammatory*	Affected Lid**	6 (85.71%)	1 (14.29%)
	Unaffected Lid	1 (14.29%)	6 (89.71%)
Neoplastic	Affected Lid	0 (0%)	2 (50%)
	Unaffected Lid	0 (0%)	2 (50%)

**Table 1. Comparison of gland dropout by subgroup**

\*Dropout more likely in inflammatory lesions (p= 0.0233).

\*\*Dropout more likely in the affected lid versus the unaffected lid (p= 0.0075)

**Conclusions:** Examining dropout associated with eyelid margin lesion may help providers decide between biopsy and watchful waiting. Our findings suggest that inflammatory margin lesions, generally considered benign, are more likely to be associated with meibomian gland dropout in the area of the lesion, while neoplastic lesions do not show a similar association with gland dropout.

**References:**

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9:25 - 10 am

Moderators: Paul D. Langer, MD, FACS; Raymond I. Cho, MD, FACS; and Michael P. Grant, MD, PhD

9:25 - 9:31 am

## Computer-Assisted 3-Dimensional Reconstruction of the Orbit: A Current Perspective

Christopher Lo<sup>1</sup>, Ebby Elahi<sup>2</sup>

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**Introduction:** The technological advent of computer-assisted pre-operative planning and manufactured patient-specific implants has greatly expanded our surgical armamentarium for complex orbital and periorbital defects. Customizable materials, including titanium, silicone, porous polyethylene, and polyetheretherketone (PEEK) are available, however there are currently no accepted norms or design algorithms to guide the choice of material.

**Methods:** A retrospective review of a surgeon's experience with different patient-specific implant materials was performed. The surgical indications were evaluated. Pre-operative planning, intraoperative ease of use, aesthetic outcomes and considerations, and complications were compared.

**Results:** Nine consecutive patients with 3-D reconstructed patient-specific implants were included. Mean age was 43.4 years (range 13-75 years). Of this group, 66.7% of the patients were female. Indications for surgery included postsurgical and senescent enophthalmos (44.4%), trauma (11.1%), and repair of defect status post excision of rhabdomyosarcoma (22.2%), sphenoid wing meningioma (11.1%), and fibrous dysplasia (11.1%). Five patients were fit with silicone implants, 3 received PEEK, and 1 patient had a porous polyethylene implant. The silicone implants had excellent intraoperative sculpting and manipulability compared to the other implants. PEEK, porous polyethylene, and silicone all had superior tactile and aesthetic outcomes (Table 1). There were no surgical complications.

**Conclusions:** Current patient-specific implants allow for a precise lock and key fit for complex defects, which increases surface contact and implant stability while protecting neurovascular structures and decreasing dead space. While each material may have a place, knowledge of the physical properties of each material is important prior to deciding which offers the best reconstructive option.

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**Table 1**

TABLE 1

	Pros	Cons
<b>Titanium</b>	-Lightweight with malleable surface -Easy placement	-Temperature conduction and weight dissimilar to bone -Implant creates significant noise on CT
<b>Silicone</b>	-Malleable, pliable -Easy intraoperative shaping with scalpel -Good for anterior facial skeleton use due to easy removal.	-Can form biofilm
<b>Porous Polyethylene</b>	-Some intraoperative shaping possible -Temperature conduction, hardness, and weight similar to bone -Integrative and allows for stability with vascular ingrowth	-Difficult to remove due to <u>biointegrative</u> properties -Less easy to sculpt than silicone.
<b>Polyetheretherketone (PEEK)</b>	-Temperature conduction, hardness, and weight similar to bone -Can be removed.	-Difficult to sculpt <u>intraop</u> -Requires drilling and edges require refinement - <u>Nonbendable</u> -Nonintegrative

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9:31 - 9:37 am

## Custom Made Implants for Orbital Blowout Fracture Repair

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**Introduction:** Customized implants is yet to be commonly practiced in orbital fracture repair, despite their increasing use in craniofacial reconstruction<sup>1 2 3</sup>. We describe our experience with a novel custom made orbital implant for large orbital blow out fractures. Our purpose was to inspect possible advantages of custom made implants over regular implants, including: shorter total surgical time due to decreased need for intraoperative implant adjustment, and improved overall clinical outcome and patient satisfaction due to better suitability of the implant to the patient's orbital structure<sup>4,5</sup>.

**Methods:** Data of patients who underwent orbital fractures reconstruction using regular implants or custom made implants were collected and analyzed. Main outcome measures were degree of enophthalmos, deep superior sulcus (DSS), ocular motility, patients' satisfaction and intra / post-operative complications.

**Results:** Three patients with large orbital blowout fracture were operated using custom made orbital implants. Two underwent previous orbital reconstruction with integrated porous polyethylene / titanium implants but had persistent enophthalmos with DSS and ocular motility limitations. One patient sustained a large medial and orbital floor fracture with bone displacement. Post-operatively, all three patients showed marked improvement in enophthalmos DSS and ocular motility. One enophthalmic patient sustained intra-operative soft tissue laceration that was not implant related. Figure 1 to 5 represent: implant design, manufactured implant, clinical and imaging studies pre- and post-operatively.

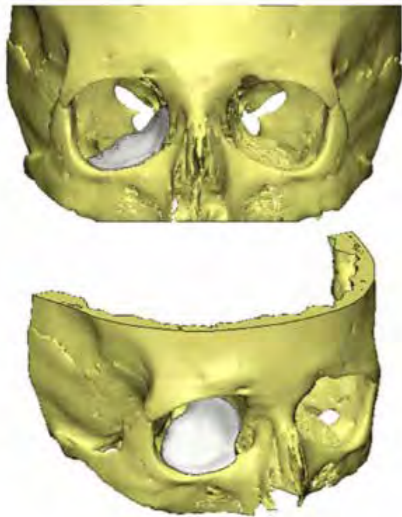
When comparing these patients to a recent cohort of 20 patients operated using regular implants (integrated porous polyethylene / titanium), post-operative enophthalmos, ocular symmetry and patients' satisfaction was greater in the custom made implant group.

**Conclusions:** Custom made orbital implants are an interesting alternative to regular integrated implants. We believe that these implants should be the 1<sup>st</sup> choice for reconstructive surgery, since volume / bony deficit is calculated and designed according to the normal uninjured orbit. This also enables the surgeon a safer intra-operative judgment of implant placement in comparison to regular implant. Additional studies with larger group of patients are required to evaluate the exact benefit of these implants.

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**Figure 1**



**Figure 2**



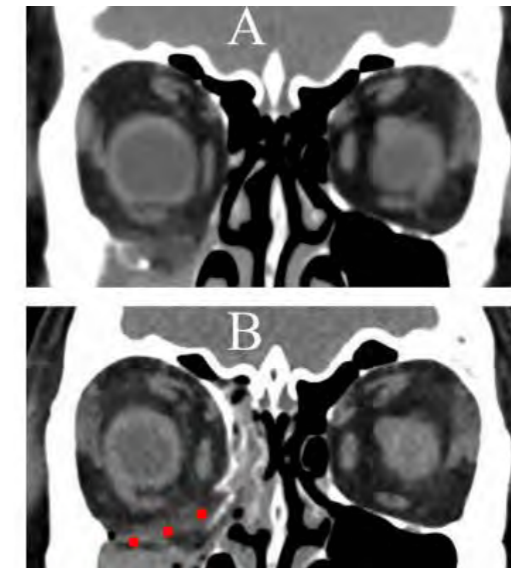
**Figure 3**



**Figure 4**



**Figure 5**



**References:**

1. Callahan AB, Campbell AA, Petris C, Kazim M. Low-Cost 3D Printing Orbital Implant Templates in Secondary Orbital Reconstructions. *Ophthal Plast Reconstr Surg* 2017;33:376-380.
2. Mahoney NR, Peng MY, Merbs SL, Grant MP. Virtual Fitting, Selection, and Cutting of Preformed Anatomic Orbital Implants. *Ophthal Plast Reconstr Surg* 2017;33:196-201.
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4. Fan X, Li J, Zhu J, et al. Computer-assisted orbital volume measurement in the surgical correction of late enophthalmos caused by blowout fractures. *Ophthal Plast Reconstr Surg* 2003;19:207-211.
5. Kim JS, Lee BW, Scawn RL, et al. Secondary Orbital Reconstruction in Patients with Prior Orbital Fracture Repair. *Ophthal Plast Reconstr Surg* 2016;32:447-451.

9:37 - 9:43 am

## Patient Specific Implants for Orbital Reconstruction

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**Introduction:** Although repair of routine orbital skeleton injuries, such as floor fracture, can be accomplished with standard implants, complex reconstruction may require specialized materials. Restoration of normal function and cosmesis requires normalization of globe position, motility of the extraocular muscles, and restoration of the orbital skeleton. The expanding use of patient specific implants (PSI) presents a personalized approach to these challenging cases for the orbital surgeon.<sup>1,2,3</sup> Herein, we report our experience using patient specific implants for orbital reconstruction.

**Methods:** An IRB-approved review of medical records was conducted of patients who received PSI. Clinical examination, including facial and orbit symmetry as well as globe position, were reviewed. CT imaging with fine cuts were performed, and a PSI was designed using high-density porous polyethylene (Poriferious Newnan, GA, USA) or polyetheretherketone (PEEK). The postoperative course was reviewed for surgical outcomes and complications.

**Results:** Five patients were included. Two of these patients had silent sinus syndrome, one had excision of a juvenile nasopharyngeal angiofibroma resulting in lower eyelid retraction, and one patient had maxillectomy without an orbital floor or inferior orbital rim, all had porous polyethylene implants. The fifth had a recurrent meningioma causing hyperostosis of the lateral wall of the orbit and received a PSI made of PEEK. Average follow up time was 8.2 months (4 - 21 months). All five patients had an acceptable functional and aesthetic result at last follow up as compared to the preoperative measurements and the contralateral side. In the patients with silent sinus syndrome, enophthalmos was resolved with complete resolution of diplopia in one patient and near complete resolution (present only in extreme upgaze) in the other. Lower eyelid retraction was stable after inferior rim implant. There were no implant-related complications.

**Conclusions:** Implants designed specifically for patients with complex anatomy have promise as safe and effective considered when approaching certain complicated surgical reconstructions.

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2. Pedemonte C, Sáez F, Vargas I, González LE, Canales M, Salazar K. Can customized implants correct enophthalmos and delayed diplopia in post-traumatic orbital deformities? A volumetric analysis. *Int J Oral Maxillofac Surg.* 2016;45(9):1086-94.
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9:43 - 9:49 am

## 3D-Printing for Surgical Instrument and Orbital Moulds (3SIOM) for Orbital Fracture Repair

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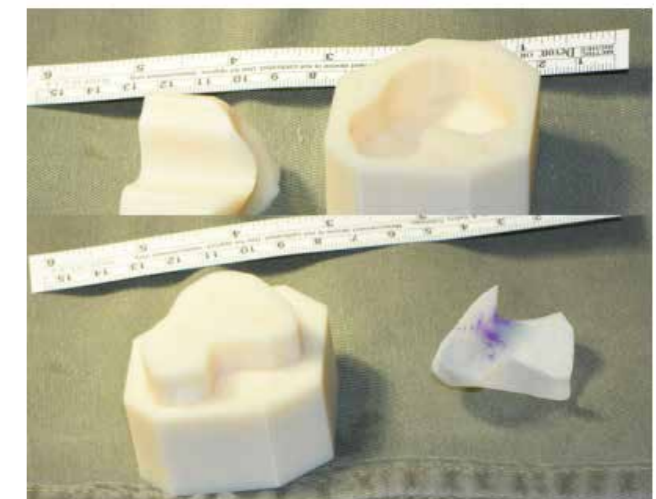
**Introduction:** Orbits are amongst the thinnest bones in human and orbital reconstruction demands specific strategies to cater for its delicacy and intricacy. This study aims to explore the application of additive manufacturing, also known as three-dimensional printing (3DP) technology in assisting unilateral orbital reconstruction and software automation in assisting computerized tomography (CT) image segmentation.

**Methods:** We adopted 3DP to manufacture tailor-mades surgical instruments and orbital moulds. These 3D-printed (3Dp) moulds were used to shape commercially available sheet products (porous polyethylene or absorbable materials e.g. 85:15 poly(L-lactide-co-glycolide) for implantation and 3Dp patient-specific instruments were used to retract prolapsed orbital tissues during repair. Computer vision and image processing techniques were combined to automatically identify and segment the extent of the orbital bony defects. Corresponding segments over the contralateral, uninjured orbit were then segmented and transformed into a 3D model. Using mirror image overlaying technique, this model was then flipped to simulate the pre-injured shaped of the fractured orbit and was converted as a standard stereolithography file. The 3D file was reviewed by treating oculoplastic surgeons with the software engineers. A professional grade 3D printer was used to fabricate a pair of negative moulds as well as a patient-specific tissue retractor. Intraoperatively, surgeons used the 3DP-mould to shape the implant material of choice, which were inserted to span the orbital defect with the help of the 3D-printed retractor.

**Results:** Significant reduction in preoperative chair-time on image segmentation by software engineer, intraoperative time, effort and tissue trauma by surgeons for implant shaping and fitting were evident in ten patients who underwent 3DP-assisted orbital fracture repair (n=7), 3DP-assisted orbital reconstruction (post-ablative n=2 and post-decompression n=1). Improvement in enophthalmos, extraocular motility were expected from standard orbital reconstruction.

**Conclusions:** Our pilot study suggested feasibility and safety of 3DP patient-specific surgical instruments and implant moulds for orbital reconstruction. Software automation and 3DP shortened engineer's and surgeon's time pre and intraoperatively. Further studies are required to evaluate any potential benefit on clinical outcome.

**Figure 1**





9:49 - 9:55 am

## Customized Orbital Wall Reconstruction using 3-Dimensional Printing in Patients with Blowout Orbital Fracture

Ho-Seok Sa<sup>1,2</sup>, Sunah Kang<sup>1</sup>, Chan Joo Ahn<sup>1</sup>, Namkug Kim<sup>3</sup>, Bitá Esmaeli<sup>2</sup>

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**Introduction:** To describe a novel surgical approach to orbital wall reconstruction that uses three dimensionally (3D) printed customized orbital implant templates and to report the surgical outcome.

**Methods:** A review was conducted of 18 patients who underwent orbital wall reconstruction using 3D printed customized orbital implant templates. In these procedures, the orbital implant was 3-dimensionally designed during surgery and inserted into the fracture site. The outcomes of this approach were analyzed quantitatively by measuring the orbital tissue volumes using computed tomography.

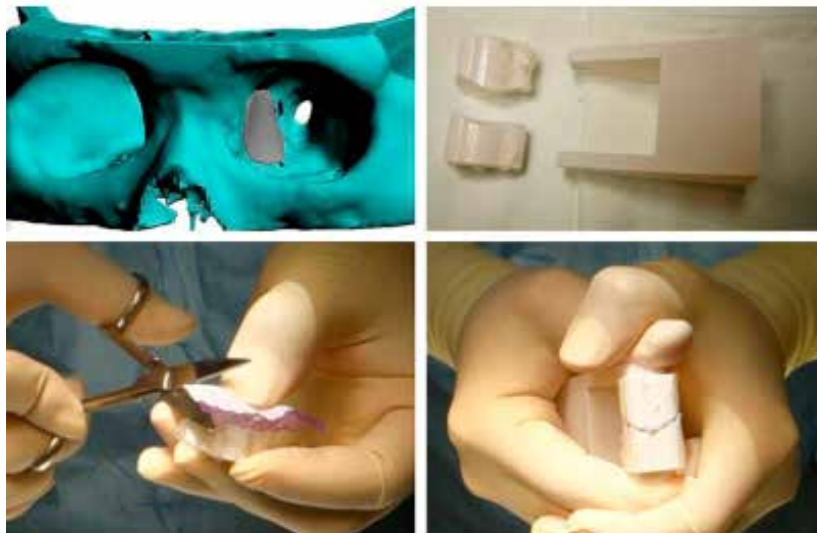
**Results:** All 18 orbital wall reconstructions (9 orbital floor and 9 medial wall fractures) were successfully performed without any postoperative ophthalmic complications. Statistically significant differences were found between the pre- and post-operative orbital tissue volumes for the affected orbit ( $24.28 \pm 2.12 \text{ cm}^3$  vs  $22.47 \pm 1.91 \text{ cm}^3$ ;  $P = 0.001$ ). There was no statistically significant difference found between the tissue volume of the contralateral unaffected orbit and the affected orbit after reconstruction ( $22.35 \pm 1.73 \text{ cm}^3$  vs  $22.47 \pm 1.91 \text{ cm}^3$ ;  $P = 0.420$ ).

**Conclusions:** 3D printed customized orbital implant templates can be used to design conventional implantable materials with patient-specific contours and sizes for optimal orbital wall reconstruction.

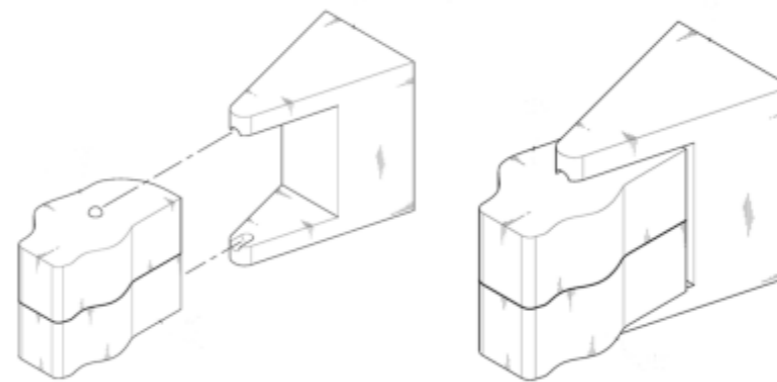
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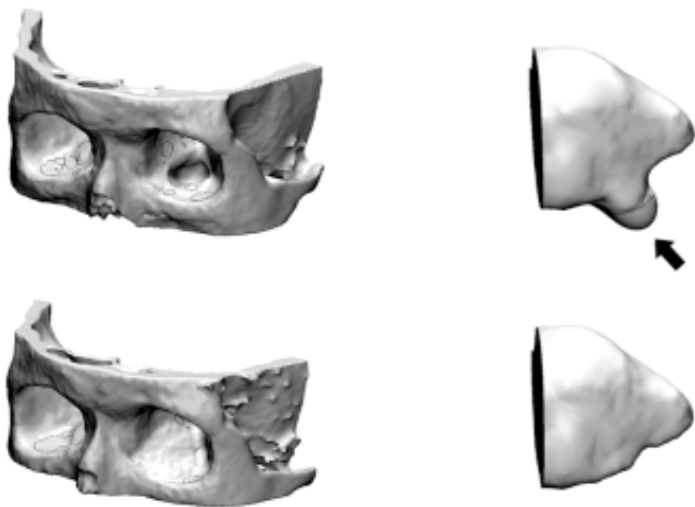
**Figure 1**



**Figure 2**



**Figure 3**



**Figure 4**



**References:**

1. Vehmeijer M, van Eijnatten M, Liberton N, Wolff J. A novel method of orbital floor reconstruction using virtual planning, 3-dimensional printing, and autologous bone. *J Oral Maxillofac Surg* 2016; **74**: 1608-1612.
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4. Lee KM, Park JU, Kwon ST, Kim SW, Jeong EC. Three-dimensional pre-bent titanium implant for concomitant orbital floor and medial wall fractures in an East asian population. *Arch Plast Surg* 2014; **41**: 480-485.

10:30 – 11:05 am

Moderators: David R. Jordan, MD and Erin M. Shriver, MD

10:30 – 10:36 am

## Experimental Research on Blast-Induced Ocular Trauma: Methodologies are too Heterogeneous

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**Introduction:** Fundamental understanding of the mechanisms and functionally significant effects of blast injury on the eye and/or retro-ocular visual system can only be accomplished at the basic science level in experimental mammals or in advanced computational simulation. However, methodological approaches vary substantially. Study design consistency and common reporting methods should be sought so eye care professionals can draw applicable information to integrate into their knowledge base.

**Methods:** A PubMed database query in April 2018 gathered all experimental blast literature that addressed damage to the eye or retro-ocular visual system in laboratory mammals or computational simulation. Upon review, 40 relevant publications warranted inclusion; which was further divided into individual blast “experiments” (porcine eye ( $N = 6$ ), rat ( $N = 11$ ), mouse ( $N = 26$ ), rabbit ( $N = 3$ ), and simulation ( $N = 10$ )). Quantitative specifications (e.g., peak overpressure, sample size) and experimental design variables (e.g., blast induction system, location of specimen) were noted.

**Results:** In animal studies, the average peak pressures,  $\pm$  standard deviation, used across experiments were  $128.22 \pm 55.85$  kPa ( $18.60 \pm 8.10$  PSI) in porcine eyes,  $154.47 \pm 113.64$  kPa ( $22.4 \pm 16.48$  PSI) in the rat,  $226.72 \pm 89.60$  kPa ( $32.89 \pm 13.01$  PSI) in the mouse, and  $85.9 \pm 29.11$  kPa ( $12.47 \pm 4.25$  PSI) in the rabbit; blast parameters in simulation studies often varied in ways not directly comparable to one another, or to animal studies. Measures of peak pressure variance and/or sample size was not reported in nearly half of experiments. A “shock tube” (i.e., a long, enclosed cylindrical “cannon”) was used as the method of blast induction in 20 (43.4%) experiments, a modified paintball gun was used to provide a near-direct air-blast in 20 (43.4%) experiments, a blast chamber (i.e., an enclosed barrel-like chamber with a wide radius) was used in 3 (6.5%) experiments, trinitrotoluene (TNT) detonation proximal to encaged rats was used in 2 (4.3%) experiments, and an open field was used in 1 (2.1%) experiment.

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**Conclusions:** Methodological approaches in the literature varied substantially; variance in peak pressures was very high and the methods of blast induction and animal orientation were diverse. The current state of the literature makes it difficult for eye care professionals seeking applicable insight from animal models of ocular blast to extrapolate from the data. Recommendations for future research include providing real-world comparisons for the types of explosives used, reporting pressure values in both pascal and pounds per square inch, and novel approaches should be reconciled with previously established methodologies. In addition, simulation studies should validate that their models of the head, orbit, and globe adequately estimate human tissue, and predictions of ocular damage should be tested in animal blast exposure where necessary.

10:36 - 10:42 am

## Quality of Life Comparison of Exenterated Versus Non-Exenterated Patients with Sinonasal and Craniofacial Malignancies

Michele Markovitz<sup>1</sup>, Chandala Chitguppi<sup>2</sup>, Alexander Graf<sup>3</sup>, Michael Topf<sup>2</sup>, Megan Falls<sup>3</sup>, Marc Rosen<sup>2</sup>, Joseph Curry<sup>4</sup>, Mindy Rabinowitz<sup>2</sup>, Michael Rabinowitz<sup>5</sup>

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**Introduction:** Our study serves to create and validate a vision-related quality of life questionnaire concerning orbital exenteration. We compare quality of life outcomes in exenterated vs. non-exenterated patients with orbit-involving sinonasal and craniofacial malignancies.

**Methods:** This is a prospective case control study. A questionnaire targeting vision-related outcomes in exenterated versus non-exenterated patients was created using a nine-category survey to quantitatively and qualitatively assess quality of life following cancer treatment. 192 patients treated at a tertiary institution between May 2007 and March 2017 with sinonasal malignancies grossly involving the orbit or in close proximity to the orbit were identified. The questionnaire was administered at follow up visits or via telephone. Subjects were questioned on eight quality of life measures, which included: Pain, Appearance, Activity, Recreation, Driving, Mood, Anxiety and Vision. Further assessment of vision was made by addressing perceived visual limitation completing 14 common activities of daily living. Fisher's exact tests were performed for categorical variables and Student's t-tests were run for Likert scale data.

**Results:** 18 exenterated and 16 non-exenterated patients were surveyed. Both groups were found to be equivalent in terms of demographics, stage and site of tumor, and rate of recurrence. Survey results revealed a statistically significant difference in only two quality of life parameters: Appearance and Driving. Exenterated patients reported greater difficulty with driving ( $p=0.009$ ) and worse perception of their appearance ( $p=0.005$ ) compared to non-exenterated patients. There was no statistically significant difference among all other data points, including perceived visual limitation performing the 14 common activities of daily living.

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**Conclusions:** Orbital exenteration has long been considered the gold standard in treating orbit-invading sinonasal and craniofacial malignancies, despite the rising popularity of orbit-sparing surgeries in certain circumstances. Typically, the concern for both the surgeon and patient is the potential disfigurement and altered lifestyle with decreased quality of life that may follow exenteration. Our study shows no statistically significant difference in any quality-of-life endpoint between exenterated and non-exenterated groups, including vision-related complaints, with the exception of ease of driving and appearance. Despite these two statistically significant differences, their impact remains unclear. The ease of driving difference seen in part I of the survey does not appear to be vision-related, as there was no difference in both groups' assessment of visual limitation with daytime or nighttime driving in part II. While the difference in perceived appearance is significant, patients report no social impact as a result. Our study concludes that exenterated and non-exenterated patients fare similarly in terms of post-treatment quality of life. We encourage providers to discuss these results with patients preoperatively and to choose the best medical and surgical treatment, placing decreased emphasis on pre-operative social perceptions.

**Figure 1**

Figure 1: Orbital Exenteration Questionnaire

This questionnaire asks about your current health and quality of life as compared to before your cancer diagnosis and treatment.

- Part I:**  
For each of the following, please select one answer:
- Pain**
    - A) I have no pain
    - B) I have mild pain not requiring any medication
    - C) I have moderate pain requiring regular medication (nonsteroidal or codeine)
    - D) I have severe pain controlled only with narcotics
    - E) I have severe pain not controlled by any medication
  - Appearance**
    - A) There is no change in my appearance
    - B) The change in my appearance is minor
    - C) My appearance bothers me but I remain active
    - D) I feel significantly disfigured and limit my activity due to my appearance
    - E) I cannot be with people due to my appearance
  - Activity**
    - A) I am as active as I have ever been
    - B) There are times I cannot keep up my old pace, but not often
    - C) I am often tired and have slowed my activities but I still get out
    - D) I don't go out because I don't have the strength
    - E) I don't go out because of changes to my vision
    - F) I am usually in bed or in a chair and I do not leave my home
  - Recreation**
    - A) There are no limitations to recreation at home or away from home
    - B) There are a few things I can't do but I still get out and enjoy life
    - C) There are many times when I wish I could get out more, but I'm not up for it
    - D) There are severe limitations to what I can do, mostly I stay at home and watch TV
    - E) I can't do anything enjoyable
  - Driving**
    - A) There is no change in my ability to drive
    - B) I can still drive, but do so more cautiously
    - C) I don't feel comfortable driving, though I still do
    - D) I no longer drive
    - E) N/A - I did not drive before my cancer and its treatment
  - Mood**
    - A) My mood is excellent and unaffected by my cancer and its treatment
    - B) My mood is generally good and only occasionally affected by my cancer and its treatment
    - C) I am neither in a good mood nor depressed about my cancer and its treatment
    - D) I am somewhat depressed about my cancer and its treatment
    - E) I am extremely depressed about my cancer and its treatment
  - Mood prior to diagnosis**
    - A) My mood 5 years prior to diagnosis was excellent
    - B) My mood 5 years prior to diagnosis was generally good
    - C) 5 years prior to my diagnosis I was neither in a good mood nor depressed
    - D) 5 years prior to my diagnosis I was somewhat depressed
    - E) 5 years prior to my diagnosis I was extremely depressed
  - Anxiety**
    - A) I am not anxious about my cancer and its treatment
    - B) I am a little anxious about my cancer and its treatment
    - C) I am anxious about my cancer and its treatment
    - D) I am very anxious about my cancer and its treatment

**Figure 2**

Table 1: Survey Part I Results

Survey Item	N	P value	Reference
<b>Pain</b>			
A	10	0.2	Groups comparable
B	5	0.4	
C	3	1	
D	0	1	
E	1	1	
<b>Appearance</b>			
A	0	1	Groups differ
B	5	2	
C	13	7	
D	2	0.5	
E	0	0	
<b>Activity</b>			
A	5	4	Groups comparable
B	7	0	
C	5	8	
D	2	0.5	
E	0	0	
<b>Recreation</b>			
A	3	5	Groups comparable
B	11	8	
C	7	1	
D	0	2	
E	0	0	
<b>Driving</b>			
A	5	0	Groups differ
B	4	2	
C	3	1	
D	2	1	
E	4	0	
<b>Mood After Treatment</b>			
A	3	1	Groups comparable
B	10	8	
C	7	5	
D	4	1	
E	0	0	
<b>Mood Before Treatment</b>			
A	1	1	Groups comparable
B	4	0	
C	7	2	
D	1	1	
E	0	0	
<b>Anxiety</b>			
A	5	4	Groups comparable
B	3	8	
C	3	1	
D	2	1	
E	0	0	

1 = excellent, 5 = worst possible

**Figure 3**

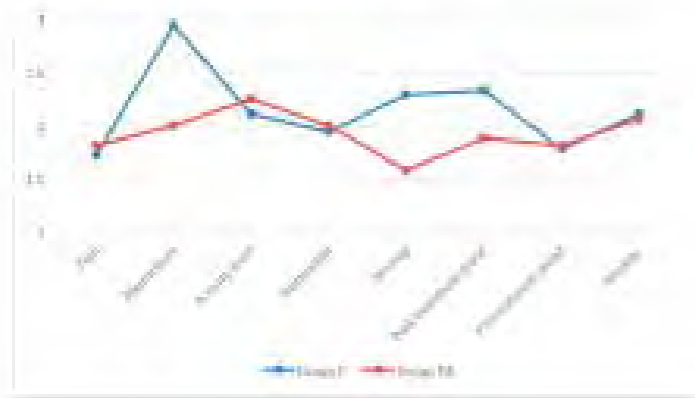
Survey Item	N	P value	Reference
<b>Visual limitation with daytime driving</b>			
A	10	0.2	Groups comparable
B	5	0.4	
C	3	1	
D	0	1	
<b>Visual limitation with nighttime driving</b>			
A	10	0.2	Groups comparable
B	5	0.4	
C	3	1	
D	0	1	
<b>Visual limitation with driving in low light</b>			
A	10	0.2	Groups comparable
B	5	0.4	
C	3	1	
D	0	1	
<b>Visual limitation with driving in bright light</b>			
A	10	0.2	Groups comparable
B	5	0.4	
C	3	1	
D	0	1	
<b>Visual limitation with driving in fog</b>			
A	10	0.2	Groups comparable
B	5	0.4	
C	3	1	
D	0	1	
<b>Visual limitation with driving in rain</b>			
A	10	0.2	Groups comparable
B	5	0.4	
C	3	1	
D	0	1	
<b>Visual limitation with driving in snow</b>			
A	10	0.2	Groups comparable
B	5	0.4	
C	3	1	
D	0	1	
<b>Visual limitation with driving in ice</b>			
A	10	0.2	Groups comparable
B	5	0.4	
C	3	1	
D	0	1	
<b>Visual limitation with driving in hail</b>			
A	10	0.2	Groups comparable
B	5	0.4	
C	3	1	
D	0	1	
<b>Visual limitation with driving in sleet</b>			
A	10	0.2	Groups comparable
B	5	0.4	
C	3	1	
D	0	1	
<b>Visual limitation with driving in dust</b>			
A	10	0.2	Groups comparable
B	5	0.4	
C	3	1	
D	0	1	
<b>Visual limitation with driving in sand</b>			
A	10	0.2	Groups comparable
B	5	0.4	
C	3	1	
D	0	1	
<b>Visual limitation with driving in smoke</b>			
A	10	0.2	Groups comparable
B	5	0.4	
C	3	1	
D	0	1	
<b>Visual limitation with driving in steam</b>			
A	10	0.2	Groups comparable
B	5	0.4	
C	3	1	
D	0	1	
<b>Visual limitation with driving in mist</b>			
A	10	0.2	Groups comparable
B	5	0.4	
C	3	1	
D	0	1	
<b>Visual limitation with driving in fog</b>			
A	10	0.2	Groups comparable
B	5	0.4	
C	3	1	
D	0	1	
<b>Visual limitation with driving in rain</b>			
A	10	0.2	Groups comparable
B	5	0.4	
C	3	1	
D	0	1	
<b>Visual limitation with driving in snow</b>			
A	10	0.2	Groups comparable
B	5	0.4	
C	3	1	
D	0	1	
<b>Visual limitation with driving in ice</b>			
A	10	0.2	Groups comparable
B	5	0.4	
C	3	1	
D	0	1	
<b>Visual limitation with driving in hail</b>			
A	10	0.2	Groups comparable
B	5	0.4	
C	3	1	
D	0	1	
<b>Visual limitation with driving in sleet</b>			
A	10	0.2	Groups comparable
B	5	0.4	
C	3	1	
D	0	1	
<b>Visual limitation with driving in sand</b>			
A	10	0.2	Groups comparable
B	5	0.4	
C	3	1	
D	0	1	
<b>Visual limitation with driving in smoke</b>			
A	10	0.2	Groups comparable
B	5	0.4	
C	3	1	
D	0	1	
<b>Visual limitation with driving in steam</b>			
A	10	0.2	Groups comparable
B	5	0.4	
C	3	1	
D	0	1	
<b>Visual limitation with driving in mist</b>			
A	10	0.2	Groups comparable
B	5	0.4	
C	3	1	
D	0	1	

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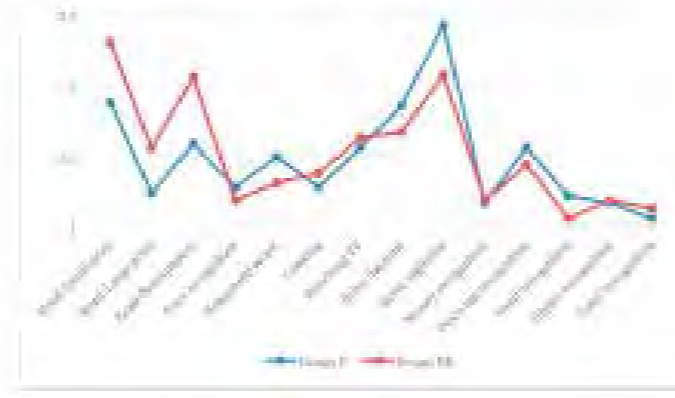
**Figure 4**

Figure 2: Comparison of Mean Score for Survey Part I



**Figure 5**

Figure 2: Comparison of Mean Score for Survey Part II



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10:42 - 10:46 am

## Smoking an Independent Risk Factor for Implant Exposure Following Enucleation

Austin Gerber<sup>1,2</sup>, Madison Duff<sup>3</sup>, Christopher Compton<sup>1</sup>, William Nunery<sup>1,2</sup>, H.B. Harold Lee<sup>2</sup>, Jeremy Clark<sup>1</sup>

<sup>1</sup>Ophthalmology, University of Louisville, Louisville, Kentucky, United States of America, <sup>2</sup>Oculofacial Plastic and Orbital Surgery, Indianapolis, Indiana, United States of America, <sup>3</sup>University of Louisville, Louisville, Kentucky, United States of America

**Introduction:** To determine the risk factors for postoperative implant exposure in adults following enucleation.

**Methods:** All patients 18 years of age and older who underwent enucleation and primary placement of a wrapped, nonporous orbital implant with attachment of rectus muscles at a single institution between 5/1/2011 and 4/30/2017 were retrospectively reviewed. 132 eyes from 132 consecutive adult patients were evaluated. Data obtained included patient demographics, surgical indication, comorbid medical conditions, smoking status, implant size, type of implant wrap used, and any reported complications. The primary outcome measure was presence or absence of implant exposure at any point in the postoperative period.

**Results:** Mean follow up time was 12.14 months. Seven of 132 patients (5.3%) developed implant exposure in the postoperative period. Five of these seven patients (71%) were self-described as current, everyday smokers at the time of surgery, compared to only 30 of 125 patients (24%) who had an uncomplicated postoperative course ( $p < 0.01$ ). Both of the non-smoking patients who developed implant exposure were diagnosed with acute endophthalmitis at the time of surgery, a suspected risk factor for implant extrusion in the literature that did not reach statistical significance in this cohort. The five smokers who developed implant exposure all did so within four weeks of surgery. There was no statistically significant correlation in complication rate based on gender, concurrent immunosuppression or diabetes, ocular or orbital trauma at time of initial presentation, infection at time of surgery, size of orbital implant, or type of wrapping material used.

**Conclusions:** To our knowledge, this is the first study to implicate smoking status as an independent risk factor for postoperative implant exposure following enucleation. The rapid onset of implant exposure in these patients points toward a failure to primarily heal, rather than secondary migration of the implant or another late sequelae of the technique used for socket reconstruction. As it is a modifiable risk factor, we contend that all patients undergoing enucleation should be counseled regarding smoking cessation in the peri-operative period as an attempt to minimize the risk for postoperative complications.

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10:46 - 10:50 am

## Medical Comorbidities and Orbital Implant Extrusion

Larissa Habib, Suzanne Freitag, Michael Yoon, Daniel Lefebvre, Nahyoung Grace Lee  
*Massachusetts Eye and Ear Infirmary, Boston, Massachusetts, United States of America*

**Introduction:** Enucleation is performed for a variety of reasons including ruptured globe, malignancy, infection and for pain in a blind eye. Following enucleation or evisceration, the anophthalmic socket must be optimized such that the patient is able to wear a prosthesis. Placement of an implant at the time of surgery replaces volume in the orbit allowing for a smaller prosthesis to be made.<sup>1</sup> Successful wound healing in the postoperative period can be complicated by a patient's medical comorbidities ranging from cardiovascular insufficiency and diabetes to autoimmune conditions and malignancy. Extrusion of the implant, albeit rare, may warrant additional surgery and can affect the ability to wear a prosthesis. A complete understanding of factors that influence the likelihood of extrusion is important for follow up care and surgical planning.<sup>2</sup> Herein we review the extrusions from four oculoplastic surgeons at a single institution and the associated medical comorbidities at the time of extrusion.

**Methods:** Retrospective review of all orbital implant extrusions at a single center from January 1, 2008 to March 1, 2018. The surgical method and reason for removal of the eye were reviewed. The medical comorbidities, specifically cardiovascular risk factors, malignancy and autoimmune conditions were recorded as well as medications taken at the time of extrusion were reviewed.

**Results:** Twenty-five implants extruded during this time period. Of these, 22 were enucleations and 3 were eviscerations. Eyes were removed for pain (28%), trauma (40%), endophthalmitis (12%) and malignancy (16%). All surgeons closed Tenon's capsule and conjunctiva in two separate layers and a synthetic implant was placed primarily. Cardiovascular risk factors, including diabetes, hypertension, atrial fibrillation were present in 92%. Autoimmune conditions were present in 8% of the cohort. Twenty-four percent of the patients had a malignancy. The average time to extrusion was 8yrs with a range from 2 weeks - 44 years. Two patients were irradiated for intraocular tumors. Most of the patients underwent dermis fat graft placement to manage the exposed or extruded implant.

**Conclusions:** This is the first report examining comorbidities in a population of patient with orbital implant extrusion. The overall health of the patient must be considered when deciding between using an implant and a primary autogenous dermis fat graft.

### References:

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2. [Christmas NJ](#)<sup>1</sup>, [Gordon CD](#), [Murray TG](#), [Tse D](#), [Johnson T](#), [Garonzik S](#), [O'Brien JM](#). Intraorbital implants after enucleation and their complications: a 10- year review. *Arch Ophthalmol.* 1998 Sep;116(9):1199-203.

10:50 - 10:55 am

## Early Quality-of-Life Benefit and Pain Reduction in Patients Undergoing Eye Removal: A Patient Survey

Elizabeth Chiang<sup>1</sup>, Courtney Kauh<sup>2</sup>, Jasmina Bajric<sup>1</sup>, Mark J. Lucarelli<sup>2</sup>, Cat Burkat<sup>2</sup>, Gregory J. Griepentrog<sup>1</sup>

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**Introduction:** Long-term follow-up studies of patients who have undergone eye removal reveal residual visual deficits combined with overall good physical and mental quality-of-life (QOL) scores. However, there has been little research directed at early outcomes, including pain relief. Herein, we present early quality outcomes in a cohort of patients undergoing eye removal with either enucleation or evisceration.

**Methods:** In this non-randomized, two institution, questionnaire-based study, patients with light perception or worse vision for greater than one month, undergoing either enucleation or evisceration, were provided a pre- and post-operative Brief Pain Inventory Short Form questionnaire along with the Glasgow Benefit Inventory (GBI); a validated and widely-used patient-recorded outcome measure to evaluate change in quality of life post-intervention. Patients under the age of 18 years, undergoing urgent enucleation or evisceration, and those with intraocular malignancy, were excluded. The final questionnaires were answered 2 to 6 months following surgery. Statistical analysis was performed with the non-parametric Wilcoxon signed rank and Mann-Whitney tests, as appropriate. Nonparametric tests were used to account for the discrete nature of the data.

**Results:** A total of forty patients, 21 (53%) who underwent enucleation and 19 (47%) who underwent evisceration, completed the study. The median age was 56 (range 21-96) years and 24 (60%) patients were male. The leading indications for eye removal were a history of remote trauma (n=14, 35%), end-stage glaucoma (n=8, 20%) and diabetic retinopathy (n=7, 18%). Twelve (30%) patients had vision worse than 20/40 in the fellow eye, of which, 6 (15%) had vision worse than 20/200. Thirty-six (90%) patients complained of eye/facial pain with a pre-surgical median pain score of 5.6 (range 1-10) that reduced to 0.9 (range 0-7) following surgery (p<0.01). Thirty-one (77.5%) patients were using pre-operative oral pain medications, including 17 (42.5%) on opioids. Following surgery, 9 (22.5%, p<0.01) patients were using oral medications, of which, 3 (7.5%, p<0.01) continued opioid use. The total GBI score for patients undergoing eye removal was +9.79 (95% CI 0.90-18.69 p<0.05) demonstrating a statistically significant benefit in quality of life from eye removal.

**Conclusions:** This outcomes study using validated instruments demonstrates significant early quality-of-life benefit to enucleation and evisceration along with a dramatic 5-fold reduction in oral opioid use. There were no significant differences between enucleation and evisceration.

### References:

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10:55 - 11 am

## A Digital Ocular Prosthesis with Wireless Transmission of Real-Time Pupil Tracking

Emily Sarah Charlson<sup>1</sup>, Zonglin Guo<sup>2</sup>, Ian Harris<sup>2</sup>, Jeremiah Tao<sup>1</sup>

<sup>1</sup>University of California, Irvine, Gavin Herbert Eye Institute, Irvine, California, United States of America, <sup>2</sup>University of California Irvine, Donald Bren School of Information and Computer Sciences, Irvine, California, United States of America

**Introduction:** Loss of an eye can cause anxiety and a sense of disfigurement. Current ocular prosthetics restore a natural appearance well when both eyes face forward, however, lack of full motility creates a look of strabismus ("lazy eye") on extreme side gaze. Prior work has demonstrated the feasibility of applying microscreen technology to create a next generation digital prosthetic eye. Here we develop a novel pupil tracking algorithm and incorporate wireless transmission of eye location to a miniature digital screen encased within a custom-designed prosthetic shell.

**Methods:** A microcamera embedded within 3D printed glasses records the healthy eye. A pupil-tracking algorithm based on the location of the dark pupil and light reflex was written in Python to operate on a Raspberry Pi 3 B+. A database of pupil images, including difficult images such as bad pupil illumination or eyelid/lashes covering the pupil image, were used to challenge and then refine the algorithm. A custom manufactured miniature Bluetooth receiver was developed and fixated to a mini Organic Light Emitting Diode screen. A prosthetic shell was designed to encase and protect the ocular prosthetic.

**Results:** Iris size and movement speed were empirically identified as reliable markers for pupil location. Distortion of iris shape best indicated eyelid/lash blockage. Both features were incorporated into our algorithm to improve pupil tracking in changing environments and implemented alongside OpenCV functions. A custom designed microprocessor featuring a Bluetooth receiver allowed for display of pupil movement on a microscreen at 32 frames per second without undue battery power costs. Acrylic and silicone components both cushioned and protected the prosthetic while maintaining a water-tight seal.

**Conclusions:** Iris location, speed and shape were identified as important markers of eye location when pupil tracking from a spectacle mounted camera. Incorporation of Bluetooth on a specially manufactured miniature circuit board permitted the real-time transmission of pupil location needed for a wearable device. A custom prosthetic casing fabricated from silicone and acrylic allowed for a protective prosthetic shell feasible for implantation into a human anophthalmic orbit.

Featured Speaker: Andrew G. Lee, MD

11:10 - 11:30 am

Five Neuro-Ophthalmic Diagnoses the Oculoplastic Surgeon cannot Afford to Miss

8/14/2018

8/14/2018

**Five diagnoses the oculoplastic surgeon cannot afford to miss**

- Andrew G. Lee, MD
- Chair Ophthalmology, Houston Methodist Hospital, Professor of Ophthalmology, Neurology, & Neurosurgery, Weill Cornell Medical College, Adjunct Professor: Baylor College of Medicine, U. Iowa & Clinical Professor, UTMB Galveston, UT MD Anderson Cancer Center, U. Buffalo, SUNY

I have no financial interest in the contents of this talk

Yes, temple, but also neck, ear, jaw, occipital, scalp pain

Initial symptoms in GCA (n = 100)

Symptom	Number	Percentage
Headache	95	95%
Jaw claudication	85	85%
Temporal artery tenderness	80	80%
Scalp tenderness	75	75%
Neck pain	70	70%
Ear pain	65	65%
Occipital pain	60	60%
Scalp pain	55	55%
Other	50	50%

**Overview**

- List five potentially life threatening diagnosis in neuro-op that can present to the oculoplastic surgeon
- Define "rule of the pupil"
- Define best imaging study for the 5 dx
- Show key clinical or radiographic features for the above 5 dx

Overview: Lee's "A"s: The five chances to save the life of your next neuro-ophthalmology patient

- Arteritis (Giant cell)
- Apoplexy (Pituitary)
- Abscess (Mucor)
- Aneurysm (pupil involved third nerve palsy)
- Arterial (carotid or vertebral) dissection

And the MRI of head was normal.....

**WHY?**

How it comes to oculoplastic surgeon

- Sent by optometry for decreased peripheral vision
- Found to have levator dehiscence OU
- Imp: "Is visual field loss from ptosis?"

**Giant cell arteritis: What everyone knows....**

- Elderly patient (often female)
- Acute onset headache, jaw claudication, temporal artery pain, neck or ear pain
- Loss of vision (typically due to ischemic optic neuropathy)
- Elevated erythrocyte sedimentation rate (ESR) & C-reactive protein

How it comes to oculoplastic surgeon

- Headache or eye pain
- Normal exam otherwise
- IMP: "not oculoplastics"
- Plan: "Refer"

Beware acute levator dehiscence

Orthopedic surgery bitemporal hemianopsia

(continued)

8/14/2018

8/14/2018

### How about this one?

### Pituitary tumors common

- Incidence of pituitary tumors = 7 per 100K population per year
- As high as 1 in 500 > 65 years
- "The average ophthalmologist should see about one pituitary tumor per year....are you missing your quota?" ----B. Katz MD

[www.ahajournals.org/doi/10.1161/01.STR.0000111111.53333.9f](http://www.ahajournals.org/doi/10.1161/01.STR.0000111111.53333.9f)  
[www.clinical-neurology.com](http://www.clinical-neurology.com)

### Case from Iowa

- 76-year-old woman with acute myelogenous leukemia (AML)
- Induction chemotherapy (day 13)
- Two day history of worsening right-sided periorbital swelling & erythema

<http://webeye.ophth.uiowa.edu/eyeforum/cases/108-Orbitointraorbital-Mucormycosis.htm>

<http://webeye.ophth.uiowa.edu/eyeforum/cases/108-Orbitointraorbital-Mucormycosis.htm>

### Pituitary apoplexy

- Acute onset
- Usually severe headache
- Bitemporal hemianopsia
- Apoplexy can kill (8%)
- Hypopituitarism (cortisol)
- Emergent scan

[radiology.ucsf.edu](http://radiology.ucsf.edu)

### How it comes to oculoplastic surgeon

- Diabetic third nerve palsy
- ? ischemic

### How it comes to oculoplastic surgeon

- Orbital pseudotumor or orbital cellulitis in immunosuppressed patient

### Is this orbital inflammatory pseudotumor? Tolosa Hunt?

- Wicked good pearl: Don't give patients who are immunosuppressed the diagnosis of autoimmune disease!

### Most important question on exam?

### Right third nerve palsy looking down. Who has the cavernous sinus lesion?

### Intraoperative endoscopic photos showing pale, necrotic tissue

<http://webeye.ophth.uiowa.edu/eyeforum/cases/108-Orbitointraorbital-Mucormycosis.htm>

<http://webeye.ophth.uiowa.edu/eyeforum/cases/108-Orbitointraorbital-Mucormycosis.htm>

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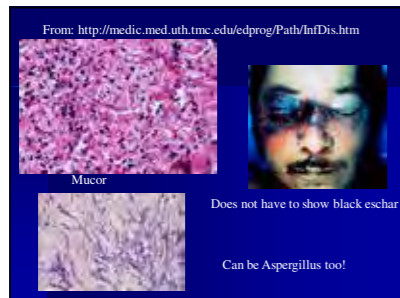
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8/14/2018

8/14/2018



### How could a fungal orbital apex lesion be missed on MRI?

- Need contrast to see enhancement
- Fungi are dark on MRI
- No fat suppression can miss lesion
- Super-dangerous because tempting to give steroids to...
  - Presumed retrobulbar optic neuritis
  - Presumed Tolosa Hunt syndrome

### Horner syndrome

- Wicked good pearl: In acute setting just image sympathetic axis for Horner syndrome

### Life threatening diagnosis?

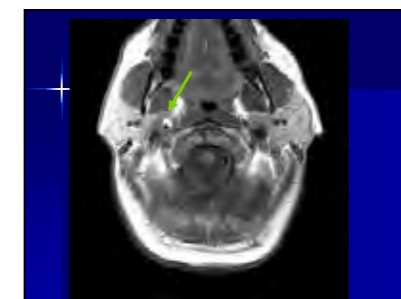
### How it comes to oculoplastics

- Ptosis evaluation OD

### Acute pupil involved third n. palsy

Life threatening diagnosis?

### As if death weren't enough....



### CTA: R posterior communicating a. aneurysm

<http://www.cedars-sinai.edu>

### Acute painful anisocoria after car accident

### Summary

- List five potentially life threatening diagnosis in neuro-op
- Define "rule of the pupil"
- Define best imaging study for the 5 dx
- Show key clinical or radiographic features for the above 5 dx

### Bottom line: Its your job

5

6

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8/14/2018

8/14/2018

On July 20, 1969, I was 5 years old, the moon landing was on tv...



"Houston" was the first word spoken from the moon



Most of the computing power was human brains at NASA



It was human brain power that brought Apollo 13 home....





April 1970: "Houston, we've had a problem"—Jim Lovell



Jim Lovell



Today I get to fulfill my childhood dreams & work with real rocket scientists at NASA JSC Houston



Half spacecraft panel lost



Apollo fuel cell



Thanks for your time & attention

■ Andrew G. Lee, MD  
■ Chair Ophthalmology, Houston Methodist Hospital, Professor of Ophthalmology, Neurology, & Neurosurgery, Weill Cornell Medical College; Adjunct Professor: Baylor College of Medicine, U. Iowa & Clinical Professor, UTMB Galveston, UT MD Anderson Cancer Center, U. Buffalo, SUNY



7

8

11:30 am - 12 pm

Moderators: Holly Chang, MD, FACS and Rao Chundury, MD, MBA

11:30 - 11:36 am

## Doxycycline Injection for Sclerotherapy of Malar Edema and Lower Eyelid Festoons, Preliminary Results

Kyle Godfrey<sup>1,2,3</sup>, Peter Kally<sup>1</sup>, Kristen Dunbar<sup>1,2,3</sup>, Ashley Campbell<sup>4,1,2</sup>, Alison Callahan<sup>5,1,2</sup>, Christopher Lo<sup>6,1</sup>, Robert Freund<sup>7</sup>, Richard Lisman<sup>1,2</sup>

<sup>1</sup>Department of Ophthalmology, New York University Langone Medical Center, New York, New York, United States of America, <sup>2</sup>Department of Ophthalmology, Manhattan Eye, Ear, and Throat Hospital, New York, New York, United States of America, <sup>3</sup>Department of Ophthalmology, Columbia University Harkness Eye Institute, New York, New York, United States of America, <sup>4</sup>Department of Ophthalmology, The Wilmer Eye Institute, Johns Hopkins University School of Medicine, Baltimore, Maryland, United States of America, <sup>5</sup>Department of Ophthalmology, Tufts Medical Center, Boston, Massachusetts, United States of America, <sup>6</sup>Department of Ophthalmology, UCLA Doheny and Stein Eye Institute, Los Angeles, California, United States of America, <sup>7</sup>Lenox Hill Hospital, Department of Surgery, Division of Plastic Surgery, New York, New York, United States of America

**Introduction:** Aesthetically undesirable malar edema and lower eyelid festoons present a clinical challenge due to their varied components of edema, lymphatic stasis, and anatomical laxity of dermal attachments.<sup>1</sup> Current treatment options demonstrate either limited efficacy, undesirable side effects, or are technically challenging to prepare and administer. These include direct surgical excision, blepharoplasty, midface lifts, oral diuretics, chemical peels, and intralesional tetracycline. A previous study by Perry et al. reported improvement of festoons following 2% tetracycline injections as an intralesional sclerosing agent. However, preparing tetracycline for injection is a multistep process, requiring reconstitution and filtration, which may be difficult in the clinical setting.<sup>2</sup> Doxycycline is another antibiotic in the tetracycline class that is also an effective sclerosing agent.<sup>3,4</sup> Furthermore, doxycycline does not require filtration, making it a potential treatment option that is logistically simpler to prepare at the point of care. To the authors' knowledge, the use of doxycycline injections is previously unreported in the treatment of malar edema and lower eyelid festoons.

**Methods:** After IRB approval was obtained, a single institution retrospective review evaluated 15 consecutive patients previously injected with doxycycline hyclate at a concentration of 10 mg/mL into their malar edema and festoons. Pre- and post-injection photographs were reviewed and graded on a scale of 0 to 3 (0 no festoon, 1 small festoon, 2 medium festoon, 3 large festoon) by 3 independent physician observers. Subjective pain, volume of injection, location of injection, number of injections, complications, and prior unsuccessful treatment modalities were also recorded. Patients were excluded from the final analysis if they received an alternate dose concentration, had incomplete photographic records, or did not follow up. Student *t*-test was used for statistical analysis.

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**Results:** 20 consecutive festoons from 11 patients were included. Final follow up evaluation ranged from 3-104 weeks, with a median follow up of 10 weeks. The average (SD) initial festoon grade of 2.5 (0.58) decreased to 0.9 (0.82) with a p-value <0.001 (Fig. 2). The average number of injections performed per side was 1.4 (range 1-2), and the average volume of each injection was 0.72 mL (range 0.15 - 2 mL). Commonly documented subjective complaints were burning sensation, pain, bruising and transient erythema. There were no other dermatological or visual complications following treatment.

**Conclusions:** Preliminary results suggest that intralesional injection of doxycycline hyclate may be an effective treatment option for lower eyelid festoons and malar edema that is easier to prepare and use in clinical practice. These results are consistent with prior studies evaluating tetracycline injection for lower eyelid festoons. Future prospective studies with increased patient numbers, and alternate doxycycline concentrations, will be performed to confirm safety, efficacy, and determine optimal dosing concentration.

**Figure 1**



Figure 1. Festoon improvement from intralesional doxycycline injections. Patient 1 (A.) Pre-operative and (B.) 2-month post-operative follow-up presenting with moderate festoons. Patient 2 (C.) Preoperative and (D.) 1 week post-operative photograph from severe festoon.

**Figure 2**

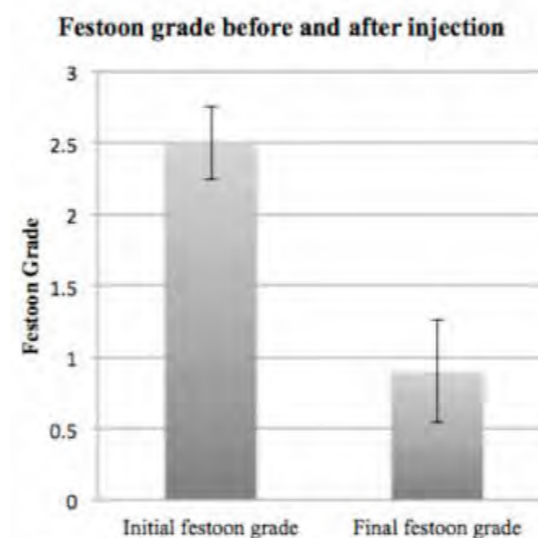


Figure 2. Improvement in malar edema festoons from pre-operative and follow-up photo grading (p <0.001).

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11:36 - 11:42 am

## Reduction in Post Operative Cicatricial and Hypertrophic Changes in Upper Eyelid Incisions with the Use of Scar Cream consisting of Highly Selective Growth Factors within a Silicone Cream Matrix

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**Introduction:** Several growth factors and high-molecular weight hyaluronic acid (HMWHA) are implicated in fetal scarless healing. SKN2017B is a proprietary topical cream consisting of synthetic recombinant growth factors and HMWHA in a silicone cream base. It has already been shown to be safe, effective, and superior in improving the appearance of scars (eyelids, face, breasts, abdominal scars) in a head to head, double-blinded, randomized, multi-center clinical trial against silicone cream. Although upper eyelid blepharoplasty incisions heal relatively well with usually no adjunct need for topical scar therapy, there are instances of cicatricial and hypertrophic changes that can occur along the upper eyelid postoperatively. These may necessitate intralesional injections of triamcinolone with or without 5-fluorouracil for wound modulation. This study compared the incidence of post upper blepharoplasty cicatricial and hypertrophic scarring in subjects that used SKN2017B beginning two weeks post procedure to those that did not receive topical scar therapy (no treatment).

**Methods:** In this retrospective, single-surgeon case series, upper blepharoplasty incisions were treated with either SKN2017B twice daily for three months versus no treatment. Patients were excluded from study if they underwent a concomitant ptosis repair, eyelid surgery that required supratarsal fixation, or prior upper eyelid surgery. Those that had combined endoscopic brow lift and/or lower eyelid blepharoplasty were included. Chart review was performed from January 2015 to December 2017. The incidence of combined intralesional injections of triamcinolone (5mg/ml) and 5-fluorouracil (25mg/ml) for cicatricial and hypertrophic areas along the upper eyelid incisions within the first three months post blepharoplasty was recorded in patients that were using SKN2017B versus no treatment. T-test was performed for statistical analysis.

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**Results:** A total of 272 eyelids (136 patients) (Average age, 52.1 +/- 12.7 years) (30 males:106 females) were identified that underwent upper eyelid blepharoplasty. All patients underwent a running wound closure with several interrupted sutures along the entire upper eyelids using 6-0 polypropylene suture. Of these, 140 eyelids (70 eyelids) (Average age, 51.7 +/- 11.5 years) (17 males: 53 females) that underwent upper eyelid blepharoplasty were treated with SKN2017B twice a day for three months beginning two weeks post procedure. The remaining 132 eyelids (66 patients) (Average age, 53.7 +/- 14.4 years) (13 males: 53 females) did not receive any postsurgical topical scar treatment. Of those that received SKN2017B post blepharoplasty, 31 eyelids (21.1%) received at least one round of combined intralesional injection of triamcinolone (5mg/ml) and 5-fluorouracil (25mg/ml) for focal cicatricial and hypertrophic areas postoperatively. Of those that received no topical scar treatment post blepharoplasty, 57 eyelids (40.9%) received at least one round of combined intralesional injections of triamcinolone (5mg/ml) and 5-fluorouracil (25mg/ml) for focal cicatricial and hypertrophic areas postoperatively. This difference between the two groups was found to be statistically significant,  $p < 0.05$ .

**Conclusions:** Topical application of SKN2017B to post upper blepharoplasty incisions can help reduce the incidence of postoperative cicatricial and hypertrophic changes. Surgeons should consider recommending a topical scar cream post surgery to help reduce the need for intralesional injections for wound modulation.

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## Melanin and Erythema Values Pre- and Post-Operatively after Bilateral Transconjunctival Lower Lid Blepharoplasty with Lower Lid Ablative CO<sub>2</sub> Laser Skin Resurfacing

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**Introduction:** The purpose of this study is to retrospectively review cutaneous melanin and erythema measurements with a reflectometer pre- and post-operatively after bilateral lower lid transconjunctival blepharoplasty with bilateral lower lid ablative CO<sub>2</sub> laser skin resurfacing. We hypothesized that melanin and erythema measurements would not increase significantly post-procedure, and would not significantly differ between laser type.

**Methods:** A retrospective review of reflectometer measurements of the medial and lateral portion of the inferior orbital rim taken pre-operatively and at regular post-operative intervals (i.e. 4-6 weeks, 2-3 months, and 4-6 months) in adult patients that underwent the aesthetic procedure at a single institution from August 2017 to January 2018.

**Results:** This study received approval from the Duke Institutional Review Board. A total of 25 (4 males, 21 female) patients were retrospectively reviewed over the five-month period. The patients were stratified by Fitzpatrick and laser type. Forty-eight percent (n=4 Fitzpatrick I-II and n= 8 Fitzpatrick III) of the patients underwent traditional laser and 52% (n=4 Fitzpatrick I-II and n= 9 Fitzpatrick III) of the patients underwent fractional laser. The melanin and erythema values were plotted graphically and analyzed at the medial and lateral inferior orbital locations (Figures 1 and 2; Tables 1 and 2). Melanin and erythema values increased at 4-6 weeks in both laser groups. However, the lateral inferior orbital rim values were statistically significant only in the fractionated group in both eyes for melanin (OD p=0.002 and OS p=0.035) and erythema (OD p=0.014 and OS p=0.053). Erythema peaked at 2-3 months in both laser groups, but did not significantly differ between laser groups (p>0.05). At 2-3 months melanin was trending down and did not significantly differ from baseline (p>0.05). No adverse events were noted and all of the patients were satisfied with their post-operative result. One patient in the fractional laser group used a tyrosinase inhibitor at post-operative month two to prevent hyperpigmentation.

**Conclusions:** This is the first study to objectively quantify cutaneous healing patterns following ablative CO<sub>2</sub> laser skin resurfacing with a portable reflectometer. Melanin and erythema measurements increased during the 4-6 week post-operative period, but only with statistical significance in the fractionated laser group at the lateral inferior orbital rim bilaterally. By 2-3 months, the melanin values were trending down and no longer differed significantly from pre-operative values. Post-inflammatory hyperpigmentation is described in the literature in approximately 5% of patients in the periorbital region.<sup>1</sup> Our data supports this finding, with 1/24 patients (4%) being placed on a tyrosinase inhibitor at post-op month two to

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help prevent inflammatory pigmentation changes. The lack of statistical difference between traditional and fractional laser therapies in these post-operative cutaneous markers is clinically relevant since both modalities are commonly used for facial rejuvenation. Both lasers in our study were safe for treatment around the inferior orbital rim in Fitzpatrick Skin Types I-III, with minimal and temporary post-laser hyperpigmentation. This objective data regarding healing time and post-surgical results following CO2 laser skin resurfacing is important to provide when counseling aesthetic patients and managing post-operative expectations.

Figure 1

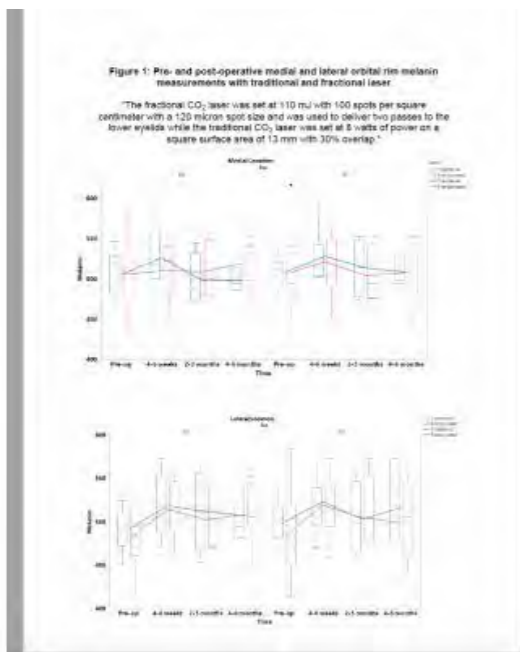


Figure 2

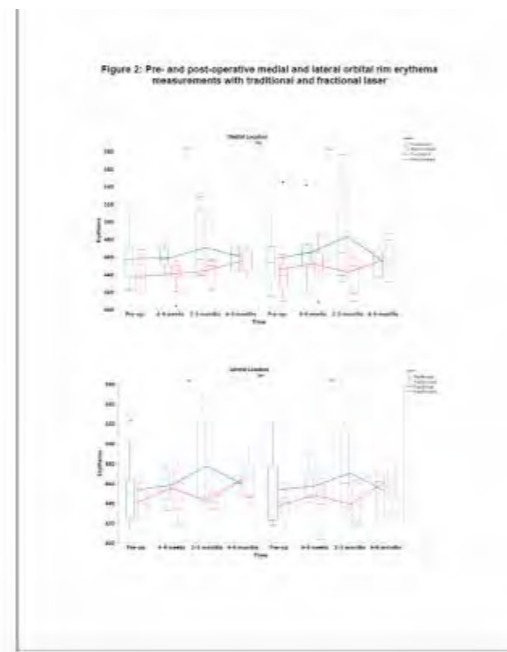


Figure 3

Table 1. Melanin Change of Post-Operative Resection

Location	Eye	Time	Modality	Traditional	Fractional	P value*
Lateral	OD	4 weeks	N	4	5	
			Mean (SD)	27.19 (24.81)	38.6 (14.07)	
		Min-Median, Max	-20.20 (2)	17.28 (3.58)	0.387	
		P-value**	0.008	0.002		
	2.3 months	N	4	4		
		Mean (SD)	16.75 (24.48)	11.1 (27.81)		
		Min-Median, Max	20.19 (27)	0.90 (24)	0.391	
		P-value**	0.503	0.180		
	4.8 months	N	2	2		
		Mean (SD)	3.2 (1.58)	32.43 (11.58)		
		Min-Median, Max	-20.19 (20)	12.57 (47)	0.262	
		P-value**	0.008	0.018		
Medial	4.8 weeks	N	8	8		
		Mean (SD)	22.99 (29.76)	36.2 (26.23)		
		Min-Median, Max	2.8 (47)	47 (47.68)	0.398	
		P-value**	0.020	0.030		
	2.3 months	N	4	4		
		Mean (SD)	7.2 (2.43)	44.5 (6.42)		
		Min-Median, Max	40.8 (58)	34.4 (54)	0.191	
		P-value**	0.020	0.020		
	4.8 months	N	2	2		
		Mean (SD)	8.4 (1.24)	22.28 (23.87)		
		Min-Median, Max	-27.0 (54)	32 (25.6)	0.146	
		P-value**	0.008	0.188		
Medial	4.8 weeks	N	8	8		
		Mean (SD)	24.41 (22.94)	11.5 (22.42)		
		Min-Median, Max	-23.20 (76)	108 (118.71)	0.024	
		P-value**	0.008	0.020		
	2.3 months	N	4	4		
		Mean (SD)	6.75 (14.4)	17.04 (24)		
		Min-Median, Max	-20.1 (26)	2 (2.5)	0.302	
		P-value**	0.008	0.020		
	4.8 months	N	2	2		
		Mean (SD)	18.13 (7.87)	26 (18.92)		
		Min-Median, Max	-47.20 (13)	0.90 (38)	0.217	
		P-value**	0.008	0.020		
Medial	4.8 weeks	N	8	8		
		Mean (SD)	22.11 (24.37)	14 (26.37)		
		Min-Median, Max	-25.15 (52)	67 (36.78)	0.302	
		P-value**	0.010	0.060		
	2.3 months	N	4	4		
		Mean (SD)	11.15 (17.38)	2.75 (8.21)		
		Min-Median, Max	-7.8 (2.25)	-10.3 (24)	0.173	
		P-value**	0.008	0.020		
	4.8 months	N	2	2		
		Mean (SD)	-13.1 (10.21)	8.81 (20.8)		
		Min-Median, Max	-26.42 (8)	20 (9.38)	0.215	
		P-value**	0.008	0.060		

Figure 4

Table 2. Erythema Change of Post-Operative Resection

Location	Eye	Time	Modality	Traditional	Fractional	P value*
Lateral	4.8 weeks	N	4	4		
		Mean (SD)	-2.84 (2.36)	16.8 (14.81)		
		Min-Median, Max	-13.2 (4)	-13.7 (4.41)	0.179	
		P-value**	0.417	0.014		
	2.3 months	N	4	4		
		Mean (SD)	28.1 (18.02)	15.1 (14.42)		
		Min-Median, Max	11.28 (41)	8.5 (5.8)	0.138	
		P-value**	0.123	0.286		
	4.8 months	N	2	2		
		Mean (SD)	15.33 (28.41)	18.29 (19.41)		
		Min-Median, Max	18.9 (42)	12.20 (28)	0.889	
		P-value**	0.208	0.016		
Lateral	4.8 weeks	N	8	8		
		Mean (SD)	-4.8 (21.28)	13.1 (14.5)		
		Min-Median, Max	-23.1 (36)	-15.1 (29)	0.507	
		P-value**	0.161	0.021		
	2.3 months	N	4	4		
		Mean (SD)	29.15 (19.76)	13.8 (27.82)		
		Min-Median, Max	2.2 (15.48)	18.6 (5.48)	0.281	
		P-value**	0.122	0.020		
	4.8 months	N	2	2		
		Mean (SD)	8.67 (27.87)	17.37 (20.82)		
		Min-Median, Max	-27.70 (47)	45.4 (43)	0.580	
		P-value**	0.008	0.016		
Medial	4.8 weeks	N	8	8		
		Mean (SD)	8.88 (20.18)	3.1 (22.78)		
		Min-Median, Max	16.0 (38)	-45.0 (27)	0.414	
		P-value**	0.113	0.002		
	2.3 months	N	4	4		
		Mean (SD)	78.1 (13.26)	19.8 (26)		
		Min-Median, Max	1.8 (37)	2.8 (3.7)	0.888	
		P-value**	0.438	0.020		
	4.8 months	N	2	2		
		Mean (SD)	11.0 (12.45)	10 (12.63)		
		Min-Median, Max	1.7 (25)	1.5 (37)	0.588	
		P-value**	0.220	0.016		
Medial	4.8 weeks	N	8	8		
		Mean (SD)	3.69 (15.71)	14.4 (14.88)		
		Min-Median, Max	10.0 (38)	-2 (2.68)	0.170	
		P-value**	0.113	0.020		
	2.3 months	N	4	4		
		Mean (SD)	27.25 (24.56)	12.75 (15.82)		
		Min-Median, Max	11.38 (35)	-1.3 (38)	0.181	
		P-value**	0.122	0.020		
	4.8 months	N	2	2		
		Mean (SD)	-15.07 (22)	2 (4 (8.52))		
		Min-Median, Max	10.0 (37)	-49 (17.5)	0.480	
		P-value**	0.220	0.020		

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11:48 - 11:54 am

## Plasma Exeresis in the Management of Various Oculoplastic Conditions

Altug Cetinkaya

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**Introduction:** Plasma Exeresis is a new technology that is extensively been adopted by non-surgeon physicians, especially for the treatment so-called 'non-surgical blepharoplasty'. Pubmed search reveals no clinical studies showing the indications or outcomes of this technique for eyelid conditions. This study aims to provide the first clinical report on the use of Plasma Exeresis method for the management of various oculoplastic conditions and report whether this technique may be a viable option in the oculoplastic practice.

**Methods:** All cases treated with Plasma Exeresis between November 2017 and May 2018 were investigated. Patient demographics, indications for treatment, outcomes, crusting and edema periods, complications and patient/physician satisfaction were analysed.

**Results:** A total of 43 patients were treated during the study period: 15 for eyelid masses/nodules (5 marginal masses, 3 multiple papilloma/nevi cases, 2 multiple syringomas, 3 xanthelasma cases, 2 sessile pigmentations), 13 for non-surgical blepharoplasties (6 bilateral upper eyelids, 6 bilateral lower eyelids, 1 upper and lower eyelids), 8 for asymmetric eyelid skin or crease adjustments or management of lower eyelid wrinkles and rhytides after previous surgeries (lower blepharoplasty in 4 cases, upper blepharoplasty in 2 cases, evisceration+prosthesis in 1 case, unilateral levator surgery in 1 case), 4 for lower eyelid skin tightening and wrinkles in combination to tear trough fillers, and 3 for skin rejuvenation during transconjunctival lower lid blepharoplasties. Except for the masses, wide field treatments resulted in an average crusting period of 7 days and edema for 3 days. Only complication was long-lasting lower lid erythema observed in 2 patients who did not use UV-blocking agents as recommended. The most satisfied group of patients were the ones with eyelid masses, and the revision cases after initial surgeries. The least satisfied group included non-surgical blepharoplasty group, almost half requiring a second session.

**Conclusions:** Plasma Exeresis treatment is an easy, fast and bloodless type of treatment which appeals to many patients for not requiring operative room setting, an incision or perioperative blood, stiches and post-surgical ecchymosis. It is an excellent treatment especially for marginal eyelid masses, crow's feet, wrinkles and for postoperative minor extra skin and eyelid crease revisions, however despite very careful patient selection, it does not seem to provide similar high satisfaction for non-surgical blepharoplasty cases in a single session. Overall, it is a valuable add-on office tool for the oculoplastic surgeon for various in-office procedures and as a practical way of skin rejuvenation during lower blepharoplasty.

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1 – 1:55 pm

Moderators: Louise A. Mawn, MD and Suzanne K. Freitag, MD

1 – 1:06 pm

## Orbital Apex Cavernous Hemangiomas with Optic Neuropathy - Treatment with Multisession Gamma Knife Radiosurgery

Stephanie Young<sup>1</sup>, Yoon-Duck Kim<sup>2</sup>, Kyung Hwan Kim<sup>3</sup>, Stephanie Lang<sup>4</sup>, Ji Woong Park<sup>5</sup>, Kyung In Woo<sup>2</sup>, Jung-Il Lee<sup>6</sup>

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**Introduction:** Orbital cavernous hemangiomas located in the orbital apex are a challenge to manage. Surgery of these tumors is challenging because of limited visualization and access. Gamma knife radiosurgery (GKRS) represents an alternative treatment for such lesions. The purpose of our study was to evaluate the efficacy and safety of multisession GKRS for orbital apex cavernous hemangiomas causing optic neuropathy.

**Methods:** Retrospective cohort study from January 2007 to December 2016 in a single tertiary institution of patients who underwent multisession GKRS for orbital apex cavernous hemangiomas causing optic neuropathy. Each patient was treated with GKRS with a total radiation dose of 20 Gy in 4 sessions (5 Gy in each session with an isodose line of 50%) delivered to the tumor margin. Main outcome measures included best corrected visual acuity (BCVA), relative afferent pupillary defect (RAPD), Humphrey visual field (HVF), proptosis, diplopia, mean tumor volume, and complications related to GKRS.

**Results:** Our study comprised of 12 patients. The mean age was  $40.2 \pm 14.5$  years. There were 8 males (66.7%). Decrease in visual acuity (83.3%) was the most common symptom at presentation. Mean clinical follow-up was 28.5 months. Ten (83.3%) of the 12 patients had improvement in BCVA. Of the 10 patients with pre-existing RAPD, 6 (60%) had complete resolution of RAPD. Of the 12 patients with visual field defect, 7 (58.3%) had complete resolution, 3 (25%) had partial improvement, while 2 (16.7%) remained unchanged due to optic atrophy from long standing compressive optic neuropathy (Figures 1-3). Nine patients (75%) had proptosis before GKRS, which reduced to 5 (41.7%) after treatment. The mean proptosis reduced from  $2.3 \pm 1.7$  mm pre-GKRS to  $0.5 \pm 1.3$  mm post-GKRS ( $p=0.005$ ). Tumor shrinkage was observed in all patients. Mean tumor volume at the time of GKRS was  $3104 \text{ mm}^3$  (range 221 –  $8500 \text{ mm}^3$ ), which reduced to  $658 \text{ mm}^3$  (range 120 –  $3350 \text{ mm}^3$ ) at last follow-up (Figure 4). None of the patients experienced GKRS related ocular morbidity during the follow-up period.

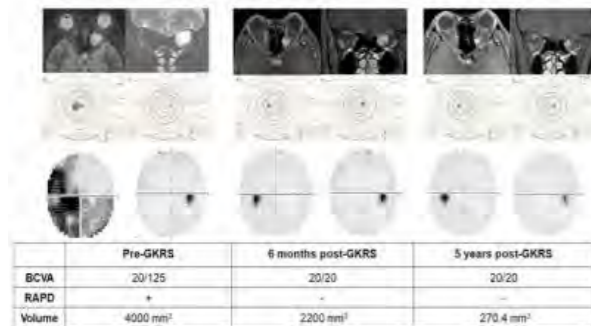
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**Conclusions:** Multisession GKRS has shown to be an effective and safe option for the treatment of orbital apex cavernous hemangiomas causing optic neuropathy, with significant improvement in ophthalmic outcomes and reduction in tumor volume.

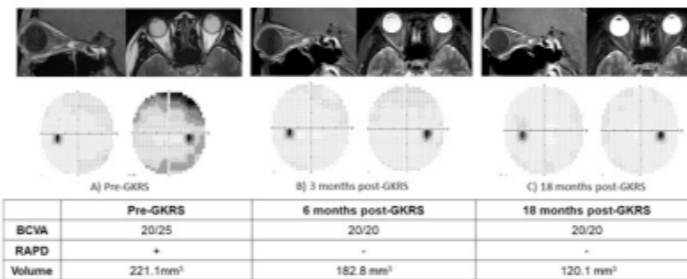
**Figure 1**

**Figure 1:** Pre- and Post-GKRS. A 44-year-old female presented with proptosis and visual field defect of the left eye. A) Pre-GKRS, T2 axial and enhanced T2 coronal magnetic resonance (MR) images shows a large cavernous hemangioma occupying the left orbital apex with typical enhancement pattern. Goldmann visual field (GVF) shows an inferior defect of the left eye, corresponding with the Humphrey visual field (HVF) which shows a visual field defect (VFD) of the temporal and inferior fields. B) The mass has reduced in size on T1-enhanced axial and coronal MRI 6 months after GKRS, with complete resolution of the VFD on GVF and HVF. C) The mass has decreased further in size at 5 years after GKRS.



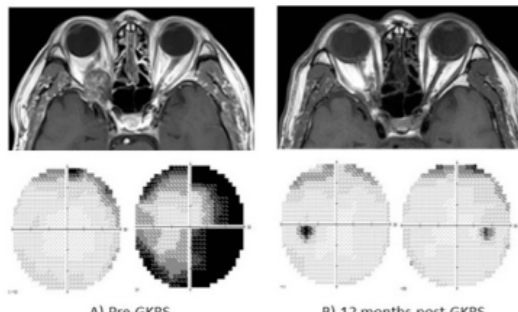
**Figure 2**

**Figure 2:** Pre- and Post-GKRS. A 32-year-old female presented with right visual blurring and visual field defect. A) Pre-GKRS, Gadolinium-enhanced T1 sagittal and axial T2 MR images showed a small cavernous hemangioma at the right orbital apex. HVF showed superior and inferior arcuate defects. B) The mass decreased in size 3 months post-GKRS, with complete resolution of the VFD. C) The mass showed further decrease in size at 18 months post-GKRS.



**Figure 3**

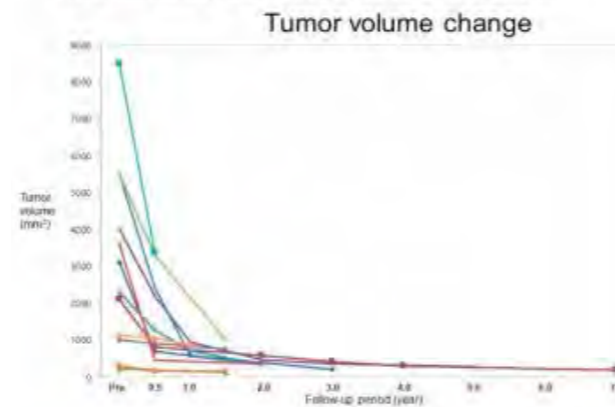
**Figure 3:** Pre- and Post-GKRS. A 62-year old male presented with right proptosis and visual blurring. A) Pre-GKRS, MRI showed a large cavernous hemangioma occupying the right orbital apex. Superotemporal and inferotemporal VFD was seen on HVF. B) 12 months post-GKRS, the mass showed significant reduction in size, and HVF showed near complete resolution of the VFD.



	Pre-GKRS	6 months post-GKRS
BCVA	20/400	20/25
RAPD	+	-
Volume	3600.0 mm <sup>3</sup>	453.8 mm <sup>3</sup>

**Figure 4**

**Figure 4:** Tumor volume change. Chart showing decreasing trend of mean tumor volume change from pre-GKRS to post-GKRS in all 12 patients.



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1:06 - 1:12 pm

## Histopathologic Observations of Eyes in Exenterated Orbits after Neoadjuvant Intra-Arterial Cytoreductive Chemotherapy for Adenoid Cystic Carcinoma of the Lacrimal Gland

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**Introduction:** To assess whether exenteration specimens obtained after neoadjuvant intra-arterial cytoreductive chemotherapy (IACC) for adenoid cystic carcinoma of the lacrimal gland (ACC) demonstrate significant ocular histopathologic alterations that might preclude future pursuit of globe sparing therapy.

**Methods:** Retrospective histopathologic analysis of globes in treated exenteration specimens.

**Results:** Eleven patients had specimens available. Ten globes revealed no abnormalities of the iris, ciliary body, lens, retinal pigment epithelium, choroid, or chorioretinal vasculature. Nine globes showed no optic nerve abnormalities. One globe from a patient who refused exenteration until after ACC recurrence demonstrated optic nerve edema with a peripapillary hemorrhage and cotton wool spot, as well as hemorrhage and necrosis within an extraocular muscle. Seven globes showed no retinal abnormalities apart from typical peripheral cystoid degeneration, while two others exhibited peripheral cobblestone degeneration. Two globes contained one to two small peripheral retinal hemorrhages. Seven demonstrated mild, chronic extraocular muscle inflammation, and three had unremarkable musculature. The single patient who received IACC via the internal carotid rather than the external carotid artery had developed ophthalmic artery occlusion with orbital apex syndrome prior to exenteration, and diffuse necrosis and hemorrhage were evident histopathologically.

**Conclusions:** Neoadjuvant IACC does not cause significant histopathologic damage to key ocular structures or compromise visual function in patients perfused via the external carotid artery. However, delivering chemotherapy through the internal carotid artery may result in visually significant thrombotic vascular events. The generally benign histopathological findings in these exenteration specimens supports the concept of IACC delivery through the external carotid system as the cornerstone of a future globe-sparing strategy for lacrimal gland ACC.

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Figure 1

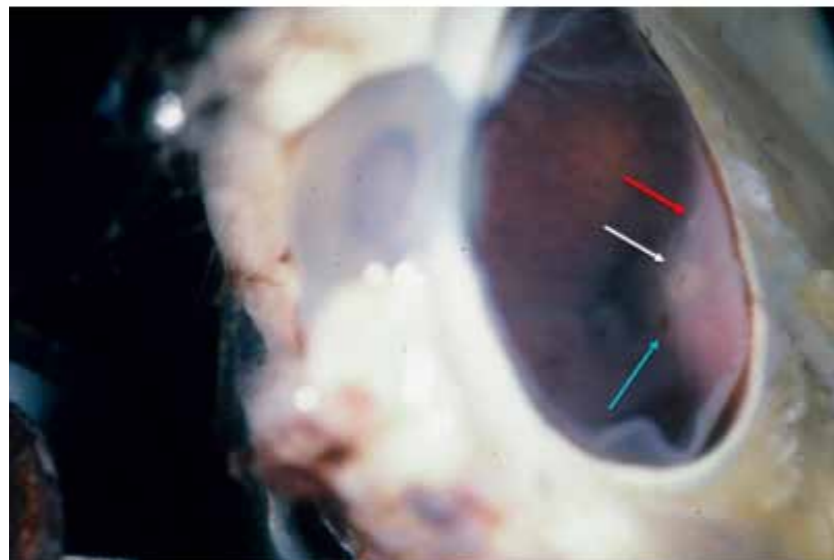


Figure 2

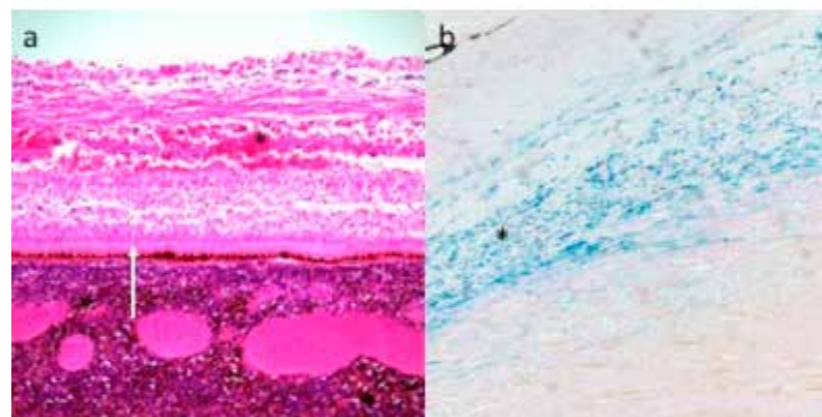


Figure 3

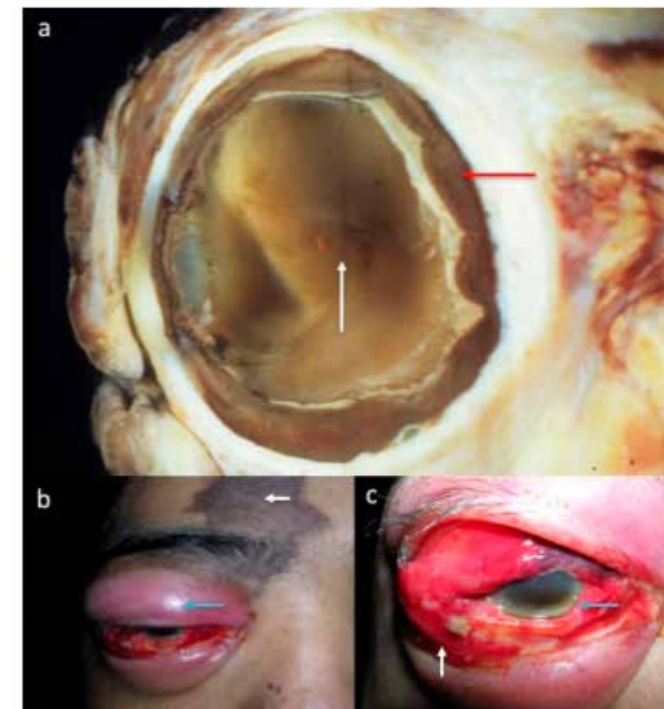


Figure 4

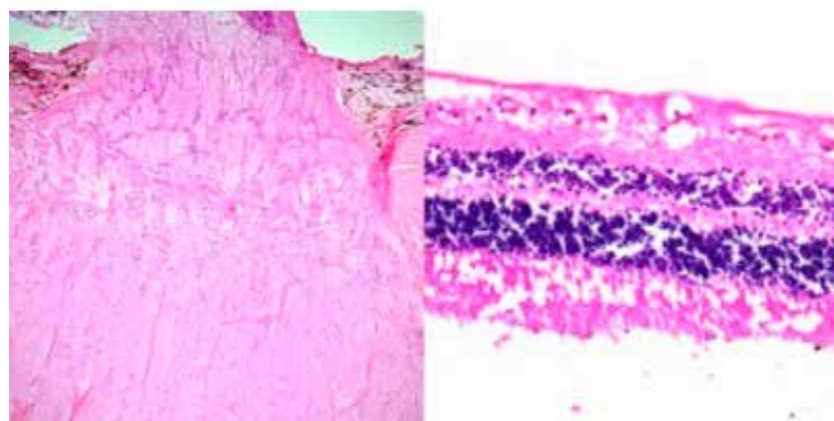


Figure 5

Feature	No./Total (%)	Range of visual acuity pre-exenteration
<b>Retina</b>		
TPCD/CD*	7/10 (70%)	20/20-20/60
Retinal heme (1-2)	2/10 (20%)	20/25-20/30
<b>Iris</b>		
Unremarkable	10/10 (100%)	20/20-20/60
<b>Ciliary Body</b>		
Unremarkable/hyalinization	10/10 (100%)	20/20-20/60
<b>Lens</b>		
Unremarkable/early cataract	9/10 (90%)	20/20-20/60
Intraocular lens	1/10 (10%)	20/30
<b>Extraocular Muscles</b>		
Heme, necrosis, mild inflammation	1/10 (10%)	20/60
Mild chronic inflammation	6/10 (60%)	20/20-20/40
Unremarkable	3/10 (30%)	20/20-20/30
<b>Retinal/Choroidal Vasculature</b>		
Unremarkable	10/10 (100%)	20/20-20/60
<b>Optic Nerve</b>		
Unremarkable	9/10 (90%)	20/20-20/40
Edema, PPH, CWS**	1/10 (10%)	20/60

\*TPCD = typical peripheral cystoid degeneration, CD = cobblestone degeneration

\*\*PPH = Peripapillary hemorrhage, CWS = cotton wool spot

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1:12 - 1:18 pm

## The Potential Use of AZD4547 Fibroblast Growth Factor Receptor-1 Inhibitor in Lacrimal Gland Adenoid Cystic Carcinoma

Ann Q. Tran, Ravi Doddapaneni, Wensi Tao, Catherine J. Choi, David Tse, Daniel Pelaez  
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**Introduction:** Signaling through the fibroblast growth factor receptor (FGFR) pathway is critical for lacrimal gland development and morphogenesis.<sup>1-6</sup> We found FGFR1 as an enriched biomarker in adenoid cystic carcinoma of the lacrimal gland (LGACC) following chemotherapeutic challenge through proteomic studies of paired patient samples. The aim of this study was to evaluate the anti-cancer activity of AZD4547 via FGFR1 inhibition in combination with cisplatin in human LGACC cell lines.

**Methods:** A total of 6 paired LGACC patient tissue samples (pre- and post-chemotherapy samples) were processed for proteomic analysis by an L-series array (Raybiotech) for 1,300 proteins. Established LGACC cell lines were used to perform drug-screening studies using cisplatin, AZD4547, and the combination treatments. MTT cell proliferation assay, scratch wound healing assay, and TUNEL assay were used to analyze the growth curve, cell migration, and apoptosis levels respectively. Targeted protein expression was detected by western blot.

**Results:** By proteomic analysis, FGFR1 expression was upregulated in post-chemotherapy samples compared to pre-chemotherapy samples. Cell viability was significantly decreased with AZD4547-cisplatin combination treatment ( $p < 0.02$ ) compared to either agent alone. However, both AZD4547 and cisplatin also exerted statistically significant effects as single agents when compared to controls. Combination treatment showed enhanced anti-metastatic potential and induction of apoptosis in the scratch and TUNEL assay than either single agent treatment alone ( $p < 0.05$ ). Furthermore, western blot analysis revealed that combination treatment upregulates the cleavage of caspase-3 and downregulates the expression of FGFR1.

**Conclusions:** Our findings demonstrate that AZD4547 potentiates the cytoreductive effects of cisplatin and suggest a potential therapeutic benefit of using AZD4547 in the adjuvant setting for the management of LGACC.

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1:18 - 1:24 pm

## Local Control Outcomes after Surgery and Frozen Section Margin Control in 99 Patients with Eyelid Sebaceous Carcinoma

Ho-Seok Sa<sup>1,2</sup>, Maria Laura Rubin<sup>3</sup>, Jing Ning<sup>3</sup>, Shiqiong Xu<sup>1</sup>, Oded Sagiv<sup>1</sup>, Sudip Thakar<sup>1</sup>, Bitá Esmaeli<sup>1</sup>

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**Introduction:** To evaluate the local control outcomes after surgery using frozen section and to identify risk factors for local recurrence in patients with eyelid sebaceous carcinoma.

**Methods:** Retrospective single-center cohort study of 99 consecutive patients with eyelid sebaceous carcinoma who underwent surgical excision with frozen section control of margins all done by the same surgeon between May 1999 and November 2017. Potential risk factors for local recurrence including T category (AJCC 8th-edition criteria) at presentation, recurrent mass at presentation, pagetoid intraepithelial neoplasia, and perineural invasion were evaluated. Distributions of time-to-local recurrence were estimated by the Kaplan-Meier method and compared by log-rank tests.

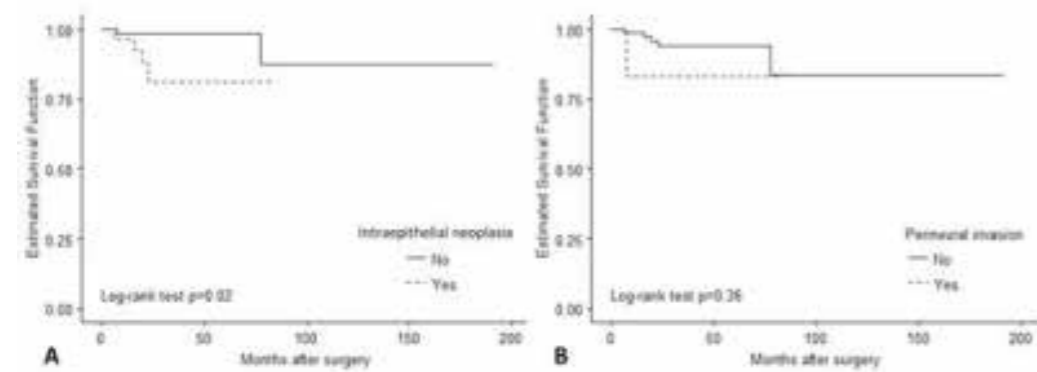
**Results:** The study included 60 women and 39 men (median age, 67 years; range, 41-94 years). All 99 patients had final margins negative for invasive carcinoma; 8 patients had a final margin positive for carcinoma in situ. Thirty-one tumors (31%) had histopathologic evidence of pagetoid intraepithelial neoplasia, that was diagnosed on the basis of pathologic review of surgical specimens in 23 tumors (74%) and on the basis of map biopsies in the other 8 tumors (26%). Six patients (6%) experienced local recurrence during follow-up. The median time to local recurrence was 17.58 months (range, 6.37-77.47). Four of the 6 patients with local recurrence had pagetoid intraepithelial neoplasia and a final margin positive for carcinoma in situ at the time of surgical excision of the tumor. Positive in-situ microscopic disease had been left behind in these 4 patients in an attempt to preserve the eye and avoid an orbital exenteration. The risk of local recurrence was significantly correlated with T3b or worse category ( $p=0.01$ ) and pagetoid intraepithelial neoplasia ( $p=0.02$ ), but it was not correlated with recurrent mass at presentation ( $p=0.91$ ) or perineural invasion ( $p=0.36$ ).

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**Conclusions:** Surgical excision with frozen section control was associated with excellent local control in patients with sebaceous carcinoma of eyelid. Size and extent of tumor, pagetoid intraepithelial neoplasia, and positive margins at the time of definitive surgery were significantly associated with local recurrence. It may be reasonable to consider adjuvant topical chemotherapy for tumors with pagetoid intraepithelial neoplasia and in patients in whom there is positive microscopic disease at the margins. A diagnosis of pagetoid intraepithelial neoplasia can be made from the surgical specimen in the majority of cases (more than 70% of cases) and random routine conjunctival map biopsies of clinically uninvolved areas have a lower yield and may not be necessary.

**Figure 1**



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1:24 - 1:30 pm

## Immunological Profile of Sebaceous Carcinoma

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**Introduction:** Sebaceous carcinoma can be highly malignant and difficult to treat. Surgical excision followed by eyelid reconstruction is the primary method of treatment.<sup>1</sup> In aggressive cases, radiation, topical chemotherapy, and systemic chemotherapy have been explored as adjuvant therapy.<sup>2,3</sup> Immunotherapy, through immune checkpoint inhibitors, has proven to have significant antitumor effect in many cancer types, including melanoma, non-small cell lung cancer, renal cell carcinoma, and very recently cutaneous squamous cell carcinoma.<sup>4,5</sup> Little is known about endogenous immune response directed against sebaceous carcinoma. In this study, we aim to characterize the expression pattern of PD-1 and its ligands PD-L1 and PD-L2 in both sebaceous carcinoma and the infiltrating immune cells to explore the potential use of checkpoint blockade as therapy.

**Methods:** We performed a retrospective chart and histology review of patients with sebaceous carcinoma between 1990-2017 at the University of Wisconsin with IRB approval. Tissue matrix assays were made from paraffin blocks. Immunohistochemistry was performed for evaluation of tumor and immune cell infiltration for expression of PD-1, PD-L1, and PD-L2. Tumor or infiltrating immune cells were considered positive if > 5% of cells had membranous (cell surface) expression of PD-1 or PD-L1. PD-L2 was considered positive with > 10% expression.<sup>6</sup>

**Results:** 28 patients met inclusion criteria. PD-L1 or PD-1 was not significantly expressed on tumor cells, however, PD-L1 and PD-1 were expressed on infiltrating immune cells in 65% and 25% of patients respectively with focal or diffuse immune infiltration. In contrast, our preliminary results show PD-L2 was expressed more often on tumor cells than infiltrating immune cells.

**Conclusions:** Sebaceous cell carcinoma currently has few effective nonsurgical treatment options. The expression of PD-L1 and PD-1 on infiltrating immune cells and PD-L2 on tumor cells restrains T-cells from full activation and proliferation, therefore limiting the anti-tumor effect of T-cells and ultimately tumor progression. Consequently, PD-1 or PD-L1 inhibitors may have a role in sebaceous carcinoma treatment. Given the prevalence of PD-L2 expression in sebaceous cell carcinoma, PD-1 blockage may provide benefit over PD-L1 inhibitors. PD-1 blockage in combination with current methods may be a viable therapeutic option for patients with sebaceous carcinoma and provides rationale for further investigation in future clinical trials.

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1:30 - 1:45 pm

## Now You See It, Now You Don't: Interim Analysis from the VISORB Clinical Trial for Periocular Basal Cell Carcinoma

Alon Kahana, MD, PhD

*Ophthalmology and Visual Sciences, Kellogg Eye Center, University of Michigan, Ann Arbor, Michigan, United States of America*

**Synopsis:** Exposure to ultraviolet light (UV) is the number one risk factor for developing skin cancer, most commonly basal cell carcinoma (BCC) [1-2]. BCC rarely metastasizes and is generally curable surgically; however, for BCCs occurring around or on the eyelid, surgical excision often results in loss of tissue that is vital for visual function. Recurrent or deeply invasive BCC can even threaten the eye itself. Up to 80% of BCCs occur on the head and neck region, with 20% of those occurring on the eyelid [3]. The large proportion of BCCs occurring around the eye presents a **critical clinical issue**, in which cancer invasion and surgical excision put vision at risk.

In 2015, based on strong preliminary data [4-9], we initiated a prospective clinical trial of vismodegib for patients with orbital and periocular BCC (VISORB, ClinicalTrials.gov Identifier: NCT02436408). The primary goal of the study is to preserve vision while treating advanced periocular BCC. To date, we have enrolled 25 patients, of which 19 have completed the study. Our interim analysis reveals that after 6 months of vismodegib treatment, average tumor size is decreased to 10.4% of baseline ( $p=0.0001$ ). All patients (19/19) were able to retain their affected eye and maintained a successful visual assessment weighted score of  $>21/50$ . In addition, of 17 patients who elected to undergo surgical excision post treatment, 12 (70.6%, 95%CI 89.7-44) showed complete or near-complete histological clearance of tumor. Our results are consistent with another study from 2017 in which 10 of 15 (67%) orbital and periocular BCC patients displayed complete response with vismodegib treatment [10]. These remarkable results highlight the possibility of using anti-hedgehog therapy as a neoadjuvant to reduce morbidity from tumor excision and reconstruction.

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Featured Speaker: Andrew G. Lee, MD

1:55 - 2:15 pm

How to Spot the Wolf in Sheep's Clothing in your Ptosis Clinic

8/14/2018

8/14/2018

**Finding the wolf in sheep's clothing in the oculoplastics clinic**

- Andrew G. Lee, MD
- Blanton Eye Institute, Houston Methodist Hospital



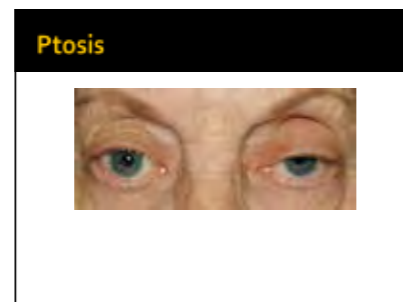
**If you don't look for the wolf you won't find the wolf.**

**Light**

Do you see the wolf now in the dark?

**Overview: Five ways to find the wolf in your oculoplastics ptosis clinic**

- Ptosis with anisocoria
- Ptosis with variability/fatigue/recurrence
- Ptosis with diplopia
- Ptosis with aberrant regeneration
- Ptosis with pain in elderly



**Lee's P's**

- Proptosis
- Pupil involvement
- Pain
- Paresthesia (V1)
- Perception loss (optic neuropathy)

**Behavior change: Don't do this...**

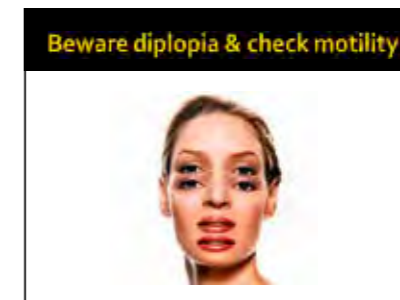
- Impression: Ptosis left
- Plan: Schedule ptosis repair next week



Check that levator function

Your job...

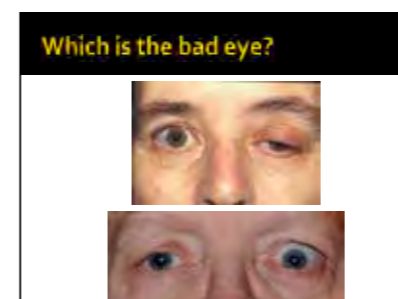
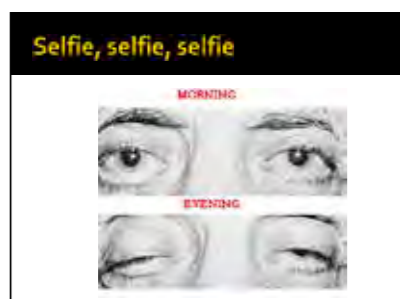
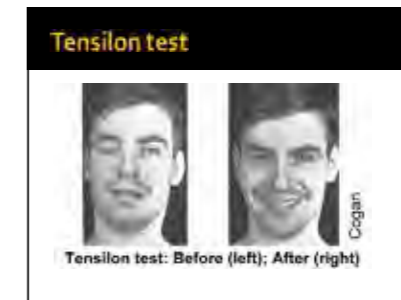
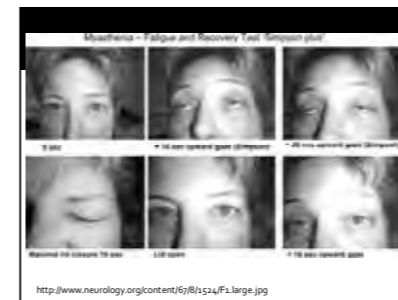
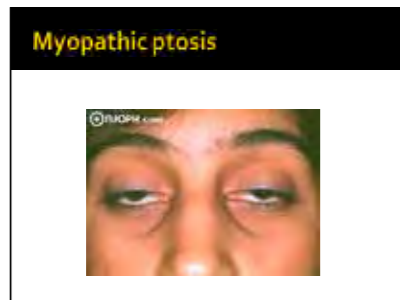
- Check pupil
- Check for fatigue/variability
- Check motility



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8/14/2018

8/14/2018



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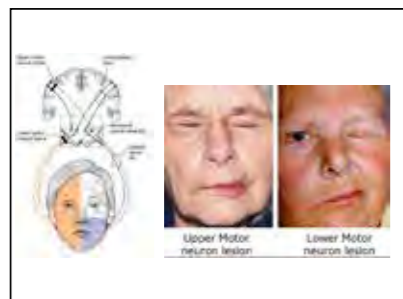
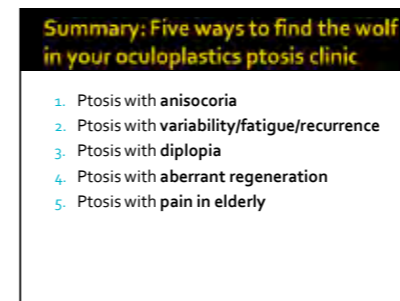
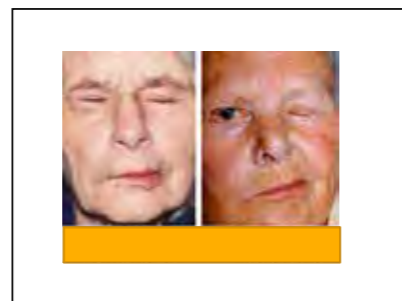
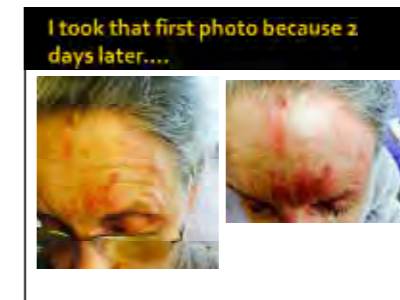
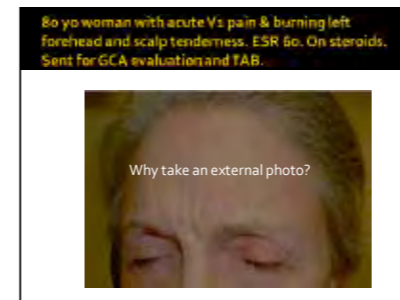
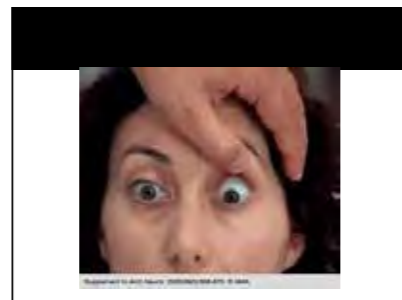
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2:25 - 3:10 pm

Moderators: Mark L. Mazow, MD and Andrew R. Harrison, MD

2:25 - 2:30 pm

## Which Healthcare Subspecialists Perform Ophthalmic and Plastic Reconstructive Surgery Procedures in the Medicare Population?

Paula Feng<sup>1</sup>, Tamara Fountain<sup>2</sup>

<sup>1</sup>Department of Ophthalmology and Visual Science, Yale School of Medicine, New Haven, Connecticut, United States of America, <sup>2</sup>Department of Ophthalmology, Rush University Medical Center, Chicago, Illinois, United States of America

**Introduction:** Surgical procedures involving the orbit, eyelids, tear duct, and periorbital facial region require an inter-disciplinary skillset, including a foundation in ophthalmology, plastic and reconstructive surgery and the medical disciplines. It is not clear how ophthalmic plastic and reconstructive surgery procedures are distributed among specialists of varying surgical and ophthalmologic subspecialties. This study sought to evaluate the distribution of providers who perform ophthalmic and plastic reconstructive procedures in a Medicare population.

**Methods:** The 2015 Medicare Provider Utilization Database was queried for commonly performed ophthalmic plastic and reconstructive surgery CPT codes to identify the proportion of procedures performed by specialty. Members of ASOPRS were identified using the ASOPRS list and matched to procedures by National Provider Identifier (NPI) number. The volume of procedures versus each provider type was compared using a Chi-square test.

**Results:** In 2015, ophthalmologists performed 97% of all blepharoplasties and ptosis repairs billed to Medicare. Members of ASOPRS and non-ASOPRS ophthalmologists split these procedures roughly equally (44% and 52% of all procedures, or 28698 and 34074 procedures each, respectively). Plastic and reconstructive surgeons performed 3% of all blepharoplasties and ptosis repairs (1914 total). Other surgical specialists, including otolaryngologists, general surgeons, and maxillofacial surgeons, performed less than 1% of all blepharoplasties and ptosis repairs combined. Ophthalmologists also performed 99% of all ectropion and entropion repairs, eyelid reconstructions, lacrimal punctum and fistula repairs, chalazia excisions, and orbitotomies. Of these, about half of all nasolacrimal duct repairs, ectropion and entropion repairs were performed by ASOPRS members and half by non-ASOPRS ophthalmologists (44% and 51%, and 56% and 43%, respectively). Members of ASOPRS performed the vast majority of eyelid reconstructions, canthus operations, and tarsorrhaphies (65%, 68%, and 63%, respectively). Non-ASOPRS ophthalmologists performed most foreign body removals from the orbit (72%), followed by ASOPRS members (16%), and optometrists (12%). Of all practitioners performing ophthalmic plastic and reconstructive procedures, 419 were ASOPRS members, 1651 non-ASOPRS ophthalmologists, (continued)

(continued)

74 non-ASOPRS plastic and reconstructive surgeons, 33 optometrists, 14 otolaryngologists, and one dermatologist, general surgeon, general practitioner and physician assistant each. All provider types differed in their share of procedures performed ( $P < 2.2e-16$ , X-squared = 7192.8,  $df=40$ )

**Conclusions:** Nationwide, ophthalmologists perform virtually all ophthalmic plastic and reconstructive surgery in the Medicare population, including blepharoplasty and ptosis repair. Members of ASOPRS perform a substantial volume of OPRS procedures, about half or more of most procedures. This is a substantial amount, especially considering the small number of ASOPRS members, who make up roughly one-fifth of all ophthalmologists performing ophthalmic plastic and reconstructive surgery procedures.

Figure 1

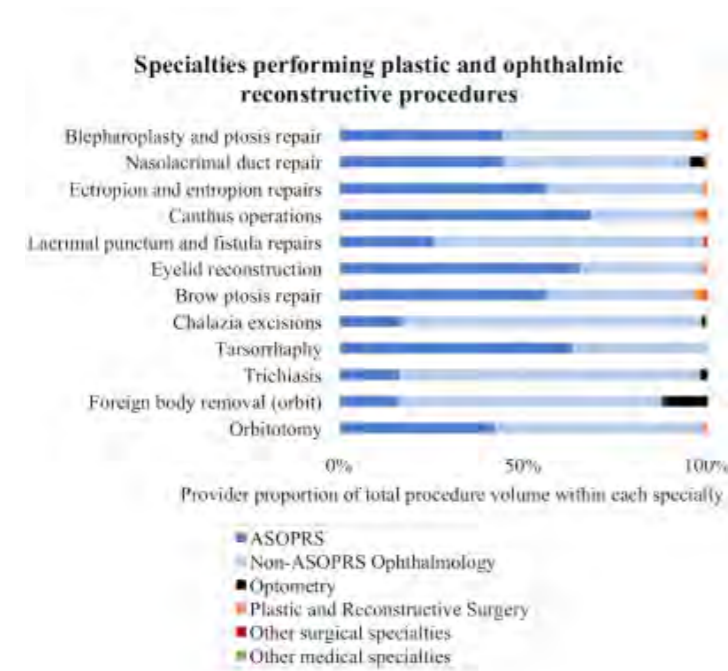


Figure 2

	ASOPRS	Non-ASOPRS Ophthalmology	All Ophthalmology	Optometry	Plastic and Recon Surgery	Other surgical specialties	Other medical specialties
Blepharoplasties and ptosis repairs	44% (28698)	52% (34074)	97% (62772)	0% (27)	3% (1914)	0% (204)	-
Nasolacrimal duct repair	44% (20520)	51% (23487)	95% (44007)	4% (1779)	1% (208)	-	0% (64)
Ectropion and entropion repairs	56% (10162)	43% (7758)	99% (17920)	-	1% (168)	-	-
Eyelid reconstruction	65% (3023)	34% (2632)	99% (7655)	-	1% (39)	0% (14)	-
Brow ptosis repair	56% (3369)	40% (2419)	96% (5788)	-	3% (190)	0% (23)	-
Canthus operations	68% (3020)	29% (1264)	97% (4284)	-	3% (128)	0% (13)	-
Lacrimal punctum and fistula repairs	26% (2092)	73% (5922)	99% (8014)	-	0% (38)	1% (55)	0% (17)
Tarsorrhaphy	63% (2089)	37% (1218)	100% (3307)	-	0% (0)	-	-
Chalazia excisions	17% (860)	82% (4138)	99% (4998)	1% (40)	0% (0)	-	1% (35)
Orbitotomy	42% (581)	57% (791)	99% (1372)	-	1% (14)	-	-
Trichiasis	16% (383)	82% (1925)	98% (2308)	2% (44)	0% (0)	-	-
Foreign body removal (orbit)	16% (256)	72% (1156)	88% (1412)	12% (194)	0% (0)	-	-



2:30 - 2:35 pm

## Digital Identities of ASOPRS Surgeons: An Analysis of Reputation Management and Content Control

Jamie Schaefer<sup>1</sup>, Tudor Crihalmeanu<sup>2</sup>, Aric Clegg<sup>1</sup>, Arpan Prabhu<sup>3</sup>, Lauren Gioia<sup>4</sup>, Aaron Fay<sup>5</sup>, Evan Madill, John Nguyen<sup>6</sup>

<sup>1</sup>West Virginia University, Morgantown, West Virginia, United States of America, <sup>2</sup>WVU Medicine, Morgantown, West Virginia, United States of America,

<sup>3</sup>University of Pittsburgh, Pittsburgh, Pennsylvania, United States of America, <sup>4</sup>Ophthalmology, West Virginia University, Morgantown, West Virginia,

United States of America, <sup>5</sup>Harvard Medical School, Boston, Massachusetts, United States of America, <sup>6</sup>Ophthalmology & Otolaryngology, West Virginia University, Morgantown, West Virginia, United States of America

**Introduction:** Physician online identity has grown more important as patients seek greater information about their physicians through popular search engines such as Google. We investigate the results a patient may encounter when searching for members of the American Society of Ophthalmic Plastic Surgery (ASOPRS) in the United States.

**Methods:** ASOPRS members were characterized by medical school education, year of graduation, city of practice, gender, and academic affiliation. Google Custom Search was utilized to automatically retrieve the top websites seen when the public queries for each ASOPRS member. The top ten websites were collected and categorized as relating to: (1) physician, hospital, or health care system; (2) third-party; (3) social media; (4) academic journal articles, (5) other; or (6) not related to the individual searched. Descriptive statistical analysis was performed

**Results:** Google searches for each of 633 ASOPRS members yielded 4,931 website links (Table 1). Third-party websites such as Healthgrades, Yelp, and Realself (30.3%; 1495) were the most commonly observed domain type (Table 2). Physician, hospital, and health-system websites (29.8%; 1469) were also common. Social media websites represented 11.2% (553) of the domains extracted, the most common being Doximity, Facebook, and LinkedIn. Peer-reviewed academic journal article results returned 6.4% websites, and 16.4% (808) pages were incorrectly associated with ASOPRS members. Higher claimed physician profiles were seen in ASOPRS members practicing in large metropolitan areas, and there were less third-party information for university employed physicians.

**Conclusions:** Search results in this study indicate that physicians are not effectively curating the information that the internet provides about them. Patients are more likely directed to independent sites that collate crowd-sourced evaluations. Large institutions also have considerable presence in web search results, but individual or small group web sites contribute little to a physician's online profile. As top search results of ASOPRS members' profile are not of physicians' own website, this creates an opportunity for oculofacial surgeons to better control their image and to improve patient provider communication by increasing their online presence.

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**Table 1**

**Table 1: Categorization of Websites and Results**

Type	Category	Example	Number of Websites	Frequency of Website Category by Percentage
1	Physician-controlled, hospital or healthcare system websites	Physician websites on provider domains, network sites of the hospital health care establishment.	1,009	<p>Frequency of Website Category by Percentage</p> <p>Domain Category</p> <ul style="list-style-type: none"> <li>35%</li> <li>25%</li> <li>15%</li> <li>10%</li> <li>15%</li> </ul>
2	Physician information and third-party websites	healthgrades.com, vitals.com, webmd.com, yelp.com	1,495	
3	Social media websites	doximity.com, linkedin.com, facebook.com, youtube.com	553	
4	Academy/journal websites	isournals.hew.com, aaojournal.org, tasciforlife.com	234	
5	Other	Blogs, legal sites, article repository.	292	
6	Not related to ADOPRS physician	Other person	808	

**Table 2**

**Table 2: Most Common Third Party Websites**

Website	#
healthgrades.com	334
health.usnews.com	282
yelp.com	132
realself.com	127
vitals.com	126
webmd.com	104

**References:**

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2:35 - 2:40 pm

## Influence of Social Media in an Oculoplastic Surgery Practice

Marie Somogyi, Alison Huggins, Emily Bratton, Sean Blaydon, Tanuj Nakra, Vikram Durairaj, John Shore  
*TOC Eye and Face, Austin, Texas, United States of America*

**Introduction:** Social media has revolutionized interpersonal communication, information gathering, and marketing. Healthcare isn't immune to technology's increasing role and influence in patients' decision making. Few studies have elucidated trends and the impact of social media<sup>1,2</sup>, and to date, none have investigated this phenomenon in oculofacial plastic surgery. We sought to examine patients' current social media practices as they relate to their healthcare, as well as the likelihood of social media engagement among various platforms through an anonymous survey.

**Methods:** All new patients who presented to a large, private oculoplastic surgery practice consecutively for two months were given an anonymous survey regarding social media preferences as part of their new patient paperwork. Exclusion criteria included existing patients, those who were under the age of 18, and failure to complete 50% or more of the questionnaire items.

**Results:** One hundred seventy-five (175) surveys were completed by new patients. Females composed 64% (112/175) of the patients. The most represented age group was 61-70 year olds (30%, 52/175); however, the mean age of respondents was in the age range of 51-60. The majority of patients (73.7%, 129/175) presented for a self-reported 'Medically Necessary' visit, while thirty-seven (21.1%) reported 'Combined Functional and Cosmetic' concerns, and only nine patients (5.1%) identified purely 'Cosmetic' concerns as the reason for their visit. The majority of patients (93.1%, 163/175) were not currently following a doctor on a social media platform; however, if following a doctor already, Facebook was the most commonly used media platform (4.6%, 8/175). None of the patients reported that social media influenced their choice when selecting a physician. Patients were asked the likelihood of following a doctor on a particular social media platform on a scale of 'Never' (numerically calculated as '1') to 'Absolutely' (calculated as '5'). Patients were most likely to follow a doctor on Facebook with an average rating of 1.76, followed by Instagram with a rating of 1.49, then Twitter at 1.30, and lastly, Snapchat with a rating of 1.26. Cosmetic patients (n=9) were more likely to utilize Instagram with an average rating of 2.22 followed by Facebook with a rating of 2.11, then Snapchat at 1.44, and Twitter with a rating of 1.22. Combined functional and cosmetic patients (n=37) were more likely to use Facebook with an average rating of 1.92 followed by Instagram with a rating of 1.70.

**Conclusions:** Despite the prevalence of social media in our daily lives, we found that patients are unlikely to select or follow a doctor on any form of social media. Patients who used social media for that purpose were more likely to utilize Facebook with a trend for Instagram to be more popular among cosmetic patients. Consequently, consideration should be given to the various social media platforms as well as the target audience when utilizing social media.

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1. Ross NA, Todd Q, Saedi N. Patient seeking behaviors and online personas: social media's role in cosmetic dermatology. *Dermatol Surg.*2015;41(2):269-276.
2. Montemurro P, Cheema M, Hedén P. Patients' and Surgeons' Perceptions of Social Media's Role in the Decision Making for Primary Aesthetic Breast Augmentation. *Aesthet Surg J.* 2018 Feb 9.

2:40 - 2:55 pm

## Aesthetic Oculoplastic Surgery: Reality, Perception and Change

Guy G. Massry, MD

*Beverly Hills Ophthalmic Plastic Surgery, Beverly Hills, CA, United States of America*

**Synopsis:** The American Society of Ophthalmic Plastic and Reconstructive Surgery (ASOPRS) is an amazing organization, whose membership is filled with both brilliant people and forward thinkers. The society has grown from humble beginnings to become a world authority on surgery on the orbit, lacrimal system, eyelids and adjacent periorbital structures. It is an honor and privilege to be part of this organization. Given this, it's always prudent to take pause and re-evaluate where we are, if any potential weaknesses exist, how these limitations can be addressed, and what we can further accomplish moving forward. My experiences over the last decade has taught me much about the role "oculoplastic" surgeons have in the overall mix of aesthetic surgery. This includes how we, as a group, manage this subspecialty within our field, how we are perceived by others in this area, and the reality of where we stand in the overall aesthetic surgery community. The purpose of this talk is twofold. First, is to review what I feel if necessary to make an aesthetic practice in our specialty succeed. Second, is to provide a personal perspective and insights, a "gut-check" of sorts, about where we are in the "aesthetic world." Please note, nothing stated is meant to be dogmatic about: right or wrong, better or worse, or making big changes. In addition, I have no desire to ruffle any feathers. I do not have the leadership role, right, or desire to do so. I do, however, have insights from experience; and these observations come from someone who cares tremendously about our field, our society, our membership, our standing amongst closely related specialties, and most importantly, our future.

3:40 – 4:20 pm

## Lash Envy: Do Prostaglandin Analogue Eyelash Growth Products Harm Our Patients?

Kenneth D. Steinsapir, MD

### 2018 ASOPRS Henry Baylis Lecture

#### Lash envy: Do prostaglandin analogue eyelash growth products harm our patients?

Kenneth D. Steinsapir, MD

##### Introduction

In December of 2008, the FDA approved Latisse® (Bimatoprost ophthalmic solution, 0.03%, Allergan, Dublin) for the treatment of hypotrichosis of the eyelashes. This ushered a new era of thicker, darker eyelashes pitched to us by an expensive direct to consumer advertising campaign featuring aging celebrities Brook Shields and Claire Danes. Allergan sold \$60 million in Latisse in 2009. That same year, the FDA send a warning letter to Allergan in September 2009 warning Allergan about minimizing the risks associated with Latisse including increase iris pigmentation, eyelid pigmentation, growth of lashes out side the treatment area.<sup>1</sup> The possibility of an eye drop causing a permanent change of color in the iris caught the imagination of the press and the public.<sup>2</sup>

Now after a decade, it seems appropriate to review patient experience with Bimatoprost ophthalmic solution 0.03% as a lash growth product and ask if this product has proven safe or if side effects warrant advising our patients to avoid this product. In 2014 Allergan, Inc. and Duke University sued Actavis, Inc. and Watson Pharmaceutical, Inc now known as Actavis for violating the patent on Bimatoprost Ophthalmic Solution for eyelash growth. The outcome of this lawsuit was the invalidation of the patents upon which Latisse is based. For this reason we are now potentially going to see increasing numbers of lash growth products market. Ironically, Actavis acquired Allergan in 2016 and changed its name to Allergan. Also in 2016, Allergan acquired a dermatology company called Topokine that is investigating the use of bimatoprost for a chemical blepharoplasty. I will touch on the wisdom of that later in the lecture.

##### Lash Growth

Early clinical studies of latanoprost were noted to cause the growth of eyelashes and the periocular villus hairs. Treatment as brief as 2 to 17 days was found to induce dramatic growth of these hairs.<sup>3</sup> Not only were they longer but also they were also thicker and darker. The precise mechanism of activity is not known. All hairs grow in a rest/growth cycle. Lashes have a rest phase called telogen where the follicle is left with a small club hair. With signaling, the follicle undergoes anagen, the growth phase for the eyelash follicle. A new hair forms and dislodges the club hair. Human eyelash follicles grow for about 30 days before transitioning from anagen to telogen for about 15 days. Normally telogen or dormancy will last 100 days. The prostaglandin analogues appear to delay the cessation of anagen with increase lash growth, thickness, and increased melanin

production. In addition, medial and lateral canthal vellus hairs develop into terminal hair. The cellular basis for these effects are not known.

##### Early History of Prostaglandins

The story of prostaglandins began in the pre-World War II biochemical laboratories of the Karolinska Institute in Stockholm, Sweden with the work of Borgstrom, Samuelsson, and others. By the time Sune Bergstrom, Bengt Samuelsson, and John Vane were awarded the 1982 Nobel Prize in Medicine, over 5000 prostaglandin analogues had been isolated, synthesized or otherwise investigated.<sup>4</sup> Two main pathways of arachidonic acid metabolism are described. The cyclooxygenase pathway leads to the formation of prostaglandin and endoperoxides and ultimately, prostaglandins, thromboxanes, and prostacyclin. The other major pathway, via lipoxygenase, leads to the formation of 5-hydroperoxyeicosatetraenoic acid (5-HPETE) and the formation of the leukotrienes. These eicosanoids contribute to inflammatory and clotting cascades, and smooth muscle contraction in processes as diverse as uterine contraction and secretion in the gastrointestinal tract. They affected almost every tissue. The discovery that aspirin and nonsteroidal anti-inflammatories inhibit the synthesis of prostaglandin led to the 1982 Nobel Prize. The prostamides or prostaglandin analogues are synthetic members of the prostaglandin family of compounds.

##### Prostaglandins and Ophthalmology

Early studies of the ocular effects of prostaglandins lead investigators to conclude these products raised intraocular pressure and caused inflammation.<sup>5,6</sup> However, subsequent investigations in the early 1980's determined the these effects were dose dependent and smaller doses of PGE<sub>2</sub> and PGF<sub>2α</sub> could powerfully lower the intraocular pressure.<sup>7</sup> The effect in monkeys was profound and lasting in its clinical duration. This success encouraged additional research into the development of these compounds. The most successful of these agents were designed to overcome conjunctival and corneal irritation while maximizing the reduction of intraocular pressure. Compounds were customized to optimize these effects and formulated as esterified prodrugs that were lipophilic and activated in the tissue to their active forms. Investigators found that these compounds increased outflow of the aqueous humor through uveoscleral outflow.<sup>8</sup>

The need to find drugs with fewer side effects and an acceptable level of compliance with patients lead to the development of latanoprost, the first of the prostaglandin analogue to be FDA approved for the treatment of glaucoma.<sup>9</sup> It was approved in 1996. It is an ester prodrug that is activated in the cornea to its free acid form. It is a selective prostaglandin F receptor. Multiple clinical trials demonstrated that once a day latanoprost was more effective than twice a day timolol 0.5%.<sup>10</sup> Clinical studies found novel side effects with the use of latanoprost. It was found to increased iris pigmentation. Patients with hazel or heterochromatic eye color were more likely to have a pigmentary change.<sup>11</sup> Its

use also resulted in longer and darker eye lashes in many patients.<sup>12,13,14</sup> Other common side effects included conjunctival hyperemia, hyperpigmentation of the eyelids, eye irritation, puritus, and dry eye symptoms.

As noted, prostaglandin analogues function to increase uveoscleral outflow. Detailed cellular studies demonstrated that prostaglandin analogues increase the activity of matrix metalloproteinases (MMP) favoring a reduction in extracellular matrix including collagens, fibronectin, and hyaluronan.<sup>15,16</sup>

Unoprostone is also part of the prostanoid family of IOP lowering agents. It was developed by R-Tech Ueno, Ltd (Tokyo, Japan) and FDA approved in 2000. Compared to latanoprost, it has a lower affinity for the prostaglandin F receptor. This may explain its reduced efficacy compared to Latanoprost.<sup>17</sup> In clinical studies, it still produced increased iris pigmentation. Depending on the series this has been reported to vary from 1% of treated patents<sup>18</sup> to as high as a 30% incidence.<sup>22</sup> Bimatoprost and travoprost were FDA approved in 2001. More recently, tafluprost was approved for the United States market in 2012 as the first preservative free prostaglandin analogue glaucoma drop.

The prostaglandin analogues have become first line treatment for open angle glaucoma and ocular hypertension. There once per day application contribute to patient compliance with their topical use, a very important consideration for an eye drop product. All of these prostaglandin analogue anti-glaucoma drops share a similar profile of side effects with notable difference that we will discuss below in relation to specific side effects. First these drugs commonly cause conjunctival hyperemia or redness. The hyperemia of the conjunctiva appears unrelated to the FP receptor and studies implicate the nitric oxide pathways.<sup>19</sup> Generally the profile of side effects are an acceptable trade off for the convenience of once a day application and the effectiveness of intraocular pressure reduction. That means that patients live with side effects to preserve vision. The risk benefit balance is different when the only benefit is for cosmetic enhancement of eyelashes, as we will discuss below.

The prostaglandin analogue drops increase iris pigmentation. The reported incidence of this change varies widely depending on the drug studied and the grading system used to report a change in pigmentation. Wistrand and coauthors found that after one year of treatment with latanoprost increased iridial pigmentation was seen in 11%, 23%, and 12% of their study participants from Scandinavia, United Kingdom and the United States respectively.<sup>20</sup> Chiba and co-workers compared the incidence of increase iridial pigmentation between those on long-term latanoprost versus isopropyl unoprostone. They studied patients who had been treated for 30 or more months. The incidence of increase pigmentation was 60% in the latanoprost group and 30% in the unoprostone treated group.<sup>21</sup> The incidence of iridial pigmentation with latanoprost may be even higher. One study of glaucoma patients using latanoprost unilaterally for at least 12 months of follow up demonstrated that paired observers agree on iridial

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anisochromia in 69.8% of patients.<sup>22</sup> Inoue and co-workers<sup>23</sup> studied 52 glaucoma or ocular hypertension patients who used bimatoprost ophthalmic solution 0.03% for 6 months. They compared before and after photographs to conclude that 50% of their patients demonstrated increased iris pigmentation and 7.7% developed eyelid pigmentation.

Not all studies in the literature should be considered reliable. For example Sharpe and co-workers<sup>24</sup> purport to study the incidence of periorbital hyperpigmentation in glaucoma patients being treated with either latanoprost or bimatoprost for 12 months. They claim to have found an incidence of periorbital hyperpigmentation of 1% in patients treated with latanoprost and 6% in patients treated with bimatoprost. What is curious about this study is that it was performed without the benefit of any external photographs. At the end of the paper, the authors acknowledge: "a truer incidence and characterization of periorbital pigmentation might be obtained clinically using photographs and a masked reading center."

#### **Conjunctival Hyperemia**

Conjunctival hyperemia is commonly associated with the use of prostaglandin analogue drops and is the basis for the discontinuation or change in treatment in 63% of cases.<sup>25</sup> The actual incidence of hyperemia varies with the prostaglandin. In latanoprost, the incidence is reported to vary from 5 to 15%. In contrast, conjunctival hyperemia is more common with travoprost (35-50%)<sup>26</sup> and bimatoprost (15-45%).<sup>27</sup>

#### **Deepening of the Upper Eyelid Sulcus (DUES)**

In 2004, optometrists Peplinski and Smith reported 3 patients who developed deepening of the upper eyelid sulcus.<sup>28</sup> In each of their cases, the deepening of the sulcus was noticed after monocular Bimatoprost therapy for glaucoma. In one case, the effect occurred after a treatment interval of just 6 weeks. In the two other cases, the effect was noticed after 10 and 22 months of monocular treatment. In two cases, the patients agreed to use the drop in the contralateral eye duplicating the effect. Discontinuation of the drop appeared to reverse the hollowing of the upper eyelid sulcus. This was the first report of what has come to be called prostaglandin-associated periorbitopathy. It was previously reported that the prostaglandin  $PGF_{2\alpha}$  receptor agonists are potent inhibitors of adipose differentiation.<sup>29</sup> Others have confirmed these observations.<sup>30,31,32</sup> Park and co-workers reported the development of a deep orbital sulcus in 18 eyes of 11 patients (4 monocular and 7 binocular users).<sup>33</sup> Their patients were using bimatoprost, latanoprost, and travoprost for  $2.4 \pm 0.8$  years,  $5.9 \pm 3.6$  years, and  $4.8 \pm 2.3$  years, respectively. They biopsied the orbit fat of their patients and found that adipocyte density was increased. This effect was greatest for treatment with bimatoprost, followed by travoprost and latanoprost.

Inoue and co-workers studied the issue of deepening of the upper eyelid sulcus (DUES) in 250 patients diagnosed with primary open angle glaucoma or ocular hypertension.<sup>34</sup> One eye of each patient was treated with latanoprost, travoprost, tafluprost, bimatoprost or isopropyl unoprostone for glaucoma or ocular hypertension for  $5.0 \pm 2.7$ ,  $1.4 \pm 0.9$ ,  $0.9 \pm 0.5$ ,  $0.8 \pm 3.9$ , and  $3.4 \pm 2.5$  years respectively. There were 50 patients on each type of drop. The observed incidence of sulcus deepening was 24% (12/50), 50% (25/50), 18% (9/50), 60% (30/50), and 8% (4/50) for the latanoprost, travoprost, tafluprost, bimatoprost or isopropyl unoprostone groups respectively. Subjectively, patients were aware of deepening of the sulcus 12% (6/50), 24% (12/50), 10% (5/50), 40% (20/50), and 10% (5/50) of the time for the latanoprost, travoprost, tafluprost, bimatoprost or isopropyl unoprostone respectively. This demonstrates that patients are less aware of this deepening of the eyelid even when the effect is unilateral suggesting that studies that rely on self-reporting will tend to underestimate the incidence of upper eyelid sulcus deepening. Bimatoprost was found to have the highest incidence of sulcus deepening both objectively and subjectively among the five prostaglandin analogues.

Aihara and co-workers reported that among 25 patients switched from Latanoprost to bimatoprost in both eyes, 60% developed deepening of the upper eyelid sulcus (DUES) at 3 months and this number was unchanged at 6 months. Only 53% of their study patients were self-aware of the presence of DUES.<sup>35</sup> This same group studied recovery of DUES patients when switched from bimatoprost back to latanoprost.<sup>36</sup> Thirteen of their patients who had developed DUES and were disturbed by the change in eyelid appearance were switched back from bimatoprost to latanoprost and followed at 2-month intervals for 6 months. Eleven of 13 patients were reported to have fully recovered. However the two youngest patients (age 37 and 45) did not recover through 6 months of observation. Aydin, et al reported two bimatoprost patients who developed DUES. Despite withdrawing bimatoprost, one failed to recover even after 30 months and a second had DUES changes 5 months after discontinuing bimatoprost.<sup>37</sup> Sakata and co-workers suggest that the potential for recovery may be affected by duration of treatment. They recommend switch patients away from bimatoprost when DUES develops to latanoprost.<sup>38</sup>

Deepening of the upper eyelid sulcus is not the only eyelid change reported in association with the use of prostaglandin analogue drops. Custer and Kent presented a case series of 35 patients referred for assessment of prostaglandin orbitopathy.<sup>39</sup> The most prevalent change they reported was thinning of the eyelid margin with posterior migration of the eyelash line, which was seen in 34 of 35 cases. Other common changes in their series were hypertrichosis and horizontal eyelid shortening both of which were seen in 32 of 35 cases. Further consequences of eyelid tightening were lower eyelid retraction (18/35) and lateral canthal displacement, which they characterized as "acquired blepharophimosis." Deepening of the upper eyelid sulcus and periorbital erythema were both present in 24 of 35 patients, but skin pigmentation was not seen in their patients. In their

series bimatoprost, latanoprost, and travoprost was used by 14, 10 and 9 of their 35 patients respectively. Eleven of their patients discontinued prostaglandin analogue treatment with only partial resolution of the orbital changes.

Custer and Kent extended their observations with a rabbit model.<sup>40</sup> They instilled bimatoprost 0.03% or artificial tears into the eyes of rabbits daily for 3 and 6 months and compared changes with untreated animals. Animals treated for 3 months did not demonstrate significant tightening of the eyelids. In contrast, eyelids treated for 6 months did were significantly tighter as measured by eyelid distraction and canthus-to-canthus measurement consistent with the acquired blepharophimosis seen clinically. The histology demonstrated thinning of the treated eyelids. These eyelids also had increased staining for SMA a marker for activated fibroblasts that appears to play a role. This study left unaddressed the reversibility of the changes.

Goh and co-workers performed ultrasound backscatter microscopy (UBM) to study the eyelids on monocular prostaglandin therapy for glaucoma for at least 12 months (mean  $5.4 \pm 3.9$  years).<sup>41</sup> Compared to fellow eyes, the prostaglandin treated side had reduced dermal, orbicularis oculi muscle thickness, and skin to arcus marginalis depth. Out of 20 patients studied (mean age  $67.2 \pm 6.4$  years), only three did not show evidence of tissue thinning. In addition to these changes, evidence suggests that the chronic use of prostaglandin analogues increase the likelihood of meibomian gland dysfunction.<sup>42,43,44</sup>

#### **Bimatoprost Ophthalmic Solution (Latisse) for Eyelash Growth**

Latisse was FDA approved based on a single unpublished randomized, placebo controlled, double masked study of 278 patients treated for 4 months. In this study, Latisse was applied to the base of the eyelashes on the outside of the eyelid using a sterile brush for each application. Lash growth was assessed using a Global Eyelash Assessment photo scale rating lashes (1. Minimal 2. Moderate 3. Marked 4. Very Marked). The lashes were also assessed with digital imaging based on a standardized superior down view of the closed eyes. Of 137 patients treated with bimatoprost 78% demonstrated a one-grade improvement in the eyelid scale and 32.8% had a 2-grade improvement. In contrast, among vehicle treated patients, a 1-grade improvement was seen in 18% and a 2-grade improvement was seen in 1.4% of cases. Bimatoprost treated lashes increased an average of 1.4 millimeters compared to almost no growth (0.1mm) in the control group. In contrast to the glaucoma studies just discussed which describe an incidence of DUES and iridial pigmentary increase as high as 60%, the most common side effect described in this study was eye irritation attributed to the benzalkonium chloride preservation were seen in less than 4% of patients. No cases of DUES were noted. Conjunctival hyperemia, pruritus of the eye, eye irritation, dry eye, and erythema, increase skin and iris pigmentation were also noted in less than 4% of patients.

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Since the market approval of bimatoprost ophthalmic solution 0.03 for hypotrichosis, the literature has been dominated by Allergan-sponsored publications, many appearing in the peer reviewed journals of commercial publishers. These studies largely support the conclusions of the unpublished study that was the basis of FDA approval for Latisse with a very low incidence of observed side effects. These studies will be discussed in detail.

Yoelin and co-workers<sup>45</sup> reported an Allergan supported, prospective, open-label study of safety and efficacy of bimatoprost ophthalmic solution 0.03 applied to the upper eyelid margin once daily with a fresh applicator for 12 weeks in 28 female subjects. Patients were assessed at 1, 4, 8, 12 and 16 weeks. At each visit, each subject had an eye examination by an ophthalmologist including IOP, visual acuity, and biomicroscopy. Patients were also asked about adverse events and completed a questionnaire at 4, 8, and 12 weeks. Periorbital darkening was graded on a 0 to 4 scale. Photographs in included frontal view and side views with the eyes open, which were taken at each visit. A frontal picture with the eyes closed was taken starting with the week 1 visit. Photographs were going to be randomized for evaluation by masked investigators including the base line photos for grading the global appearance of the lashes for length, thickness, pigmentation, and number of lashes (0: no change, ½: little change, 1: mild noticeable change, 2: moderate noticeable change, 3: major noticeable change).

The authors report that during dataset analysis they made a post-hoc decision to assess the eyelash changes based on measurement of frontal eye-closed images. The authors relate that they performed a post hoc analysis of their data and had two raters assess frontal eyes closed images using the Global Eyelash Assessment (GEA) scale. One evaluator was a physician and the other was a "health outcomes researcher" employed by Allergan. Even though this study was published well after reports of prostaglandin associated periorbitopathy, the authors did not investigate the incidence of DUES using eye open frontal pictures. Subjects were asked to respond to structured questions regarding their treatment and its effects. The investigators found a base line intraocular pressure to be  $13.8 \pm 2.8$  mmHg. Intraocular pressure change was less than 1 mmHg at each time point and deemed not clinically significant. Adverse events did not cause any subjects to withdraw from the study. Periocular darkening was seen in 18% of cases (5/28). The authors did not find conjunctival hyperemia on slit lamp examination in any subject. Among patient questionnaire responses, 42% (8/19) reported that their eye stung or burned upon application of bimatoprost at 4 weeks. This number decreased over time with 27% reporting stinging and burning with application of bimatoprost at week 12 (4/15). By week 8, 56% (9/16) subjects were aware of lash changes. Four noticed changes in the first month. By week 12, 81% (12/16) noticed the eyelashes were longer, thicker, and darker. Using photographic imaging, 95% (18/19) were rated to have a GEA of 3 (marked) or higher. The increase in the GEA score was found to be statistically significant. The authors did not assess or comment on potential

changes in iris color. The authors attribute the relatively low incidence of side effects to the application of the bimatoprost 0.03% solution to the external eyelid.

Yoelin and co-workers<sup>46</sup> did a larger subsequent study that included 585 subjects with a mean duration of  $19.3 \pm 4.3$  months (range 12 to 31 months). This was a retrospective chart review of adults using bimatoprost ophthalmic solution 0.03% for at least 12 months sampled from 16 study sites. The authors sought to determine long-term patient satisfaction with bimatoprost for hypotrichosis. Only 24.6% were using the product on a daily basis. The balance (75.4%) had shifted to maintenance regimens of 3.2 applications per week. The majority surveyed 68% (n=398) used the applicators supplied with the product. However, 156 (27%) employed an eyeliner brush to apply the bimatoprost. Eleven patients discontinued treatment due to adverse events. Authors found that 92.5% of patient rated that they were satisfied or very satisfied with bimatoprost ophthalmic solution 0.03 for lash growth. There were 216 adverse events reported by 28% of patients (164/585 patients). Unfortunately the study states only that only 4 of these events were recorded in the patient charts including one case each of dry eye, eyelid erythema, eye pruritus, and low intraocular pressure. No effort was made in this study to assess these patients for DUES, corneal irritation, meibomitis, or loss of eyelid thickness. While none of the patient's self-reported changes in iris color, changes in iris color were also not specifically sought by investigators by reviewing iris photos.

Wirta and co-workers<sup>47</sup> reported on pooled safety data from six randomized, double masked clinical trials of bimatoprost ophthalmic solution 0.03% for hypotrichosis sponsored by Allergan. The underlying studies were based in the United States<sup>48</sup>, Canada, United Kingdom<sup>49</sup> and Japan<sup>50</sup> and conducted between 2007-2012. Adults with hypotrichosis were eligible. Study participants had idiopathic or post-chemotherapy hypotrichosis with minimal or moderate lashes rating based on the Global Eyelash Assessment scale. Five of the studies were 3 to 4 months in duration. One of the studies ran for 12 months. At 6 month all participants who were on vehicle were switched to bimatoprost 0.03%. Subjects who had been on bimatoprost for the first 6 months were randomized to vehicle or continued on bimatoprost so a small group had 12 months of bimatoprost exposure. In all, 680 were exposed to bimatoprost and 379 just to vehicle. Overall 619 bimatoprost treated patients (91%) completed the study and 341 (90%) vehicle treated patients completed the study. Overall eyes receiving up to 12 months of bimatoprost 0.03%, 47.4% had adverse events compared to 34.3% for subjects receiving up to 6 months of vehicle. Subjects with chemotherapy-induced hypotrichosis had a higher incidence of adverse events in both bimatoprost treated eyes and vehicle treated eyes. (67.8% vs 55%). Two subjects were removed from the study due to low intraocular pressure. One was treated with bimatoprost and the other was in a vehicle treatment group. Iris color was followed in study groups 1, 4, and 6. Mild iris color change was only noticed in 2 subjects and one subject treated with bimatoprost 0.03% reported DUES, which was noticed 58 days after initiating treatment. The authors noted an

increased incidence of blepharal pigmentation (8.1% vs. 0.9%) and eyelid pruritus (5.1% vs. 2.5%) in non-Caucasians using bimatoprost 0.03%.)

However, this may actually under report the incidence of conjunctival hyperemia, iris color change, and deepening of the upper eyelid sulcus. Unfortunately, as described in these studies, only standardized photos of the so-called superior view of the closed eye for use in digital image analysis of the eyelashes are described as being performed. That means that routinely there were no frontal photographs of the eyes open to use for the purposes of studying the incidence of deepening of the upper eyelid sulcus. The authors do not describe performing routine iris photographs. This would cripple their ability to assess these eyes for the development of iris pigmentation. Without frontal photographs of the closed eye, it would be difficult to follow these eyes for skin hyperpigmentation. Finally, they did not describe any means of systematically assessing the eyes for hyperemia. For these reasons, this set of industry sponsored studies likely substantially under reports the incidence of complications associated with the use of bimatoprost ophthalmic solution 0.03 % for eyelash growth.

Allergan sponsored studies of bimatoprost ophthalmic solution 0.03% for hypotrichosis claim that patients applying bimatoprost externally to the eyelid are only receiving 5% or less of the dose that is delivered when drops are placed in the eye for glaucoma treatment. This is based on an estimate that the brush only applies the 5% of the volume of bimatoprost ophthalmic solution 0.03% that is delivered to the ocular surface with an eyedropper.<sup>38,51,52</sup> as applied for glaucoma treatment. Unfortunately these authors cite unpublished Allergan data to support their claim. It appears to be based on anecdotal evidence illustrated by green stain in an eye where lissamine green has been dropped on the eye surface. Green stain is seen in the tear lake and on the eyelid. The contralateral eye reportedly shows a dermal application of the same lissamine green on the contralateral eyelids using the brush that comes in the Latisse package with next to no stain at the eye lash base. This evidence is not scientific evidence but rather a marketing gambit made to allay concerns that users who are otherwise normal but for sparse eyelashes are at risk of the same type of complications associated its use for glaucoma including increased iris pigmentation, conjunctival hyperemia, deepening of the upper eyelid sulcus, and thinning of the eyelid margin.

Determining the dose of bimatoprost solution applied to an eyelid should be straightforward and not a matter of guess work. A simple method would be to weigh applicator tips loaded with a drop of bimatoprost and weigh them after application to the eyelid margin. The difference in mean weight is the dose of bimatoprost.

It should be troubling that these studies appear methodologically flawed with a bias toward the under reporting of conjunctival hyperemia, eyelid hyperpigmentation, iridal hyperpigmentation, and deepening of the upper eyelid

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sulcus. Without access to baseline images and comparable images taken at each subsequent visit, these authors crippled their ability to identify increased conjunctival hyperemia, increased iris pigmentation, loss of eyelid margin thickness, or deepening of the upper eyelid sulcus. These authors claim that 1 subject developed DUES and two developed increased iris pigmentation. Without the appropriate photographs, how were these cases discovered? Was it by patient self-report? The authors failed to provide an explanation.

The authors of these studies emphasized that they were double masked, vehicle-controlled studies. It is reasonable to ask though how good was the concealment of treatment allocation? This was a study where 92% of patients receiving bimatoprost solution to their lash base demonstrated dramatic darker, thicker, and longer eyelashes after a few weeks of treatment. It is difficult to believe that patients receiving bimatoprost were not aware that they were in the treatment group. It is well known that awareness of allocation can affect the study outcome. Patients with lash growth may be reluctant to share side effects that may disappoint the investigator. We certainly understand that researchers who are paid employees of the company supporting the study are conflicted in maintaining equipoise and this will inevitably influence a study that lacks strong randomization.<sup>53</sup> After a few weeks of the study, investigators would be immediately aware of their study arm assignment. For that reason, these studies cannot be regarded as masked.

#### Conclusion

It is hard to believe that a treatment that so powerfully affects eyelash growth does not also affect conjunctival hyperemia, thinning of the eyelid and deepening of the upper eyelid sulcus. The effect of these changes in our glaucoma patients is that they look older. Does it make sense to subject a woman, whose desire is to appear more youthful with fuller eyelashes, to a drop that in fact causes changes to the eyelids that we associate with aging? Reversibility of these changes remains an unproven hypothesis.

We fundamentally need to know how safe are prostaglandin lash growth products for our patients. We have seen based on the glaucoma data that the chronic use of prostaglandin analogue drops for the management of intraocular pressure is highly effective. They are also associated with a wide array of significant side effects. Provided the patient is able to physically tolerate the side effects and the intraocular pressure lowering effect is preventing visual loss, the side effects may be acceptable. It is a risk/benefit analysis based on the preservation of vision. What is acceptable in that circumstance is not acceptable for an individual who is simply looking for darker, thicker, and longer eyelashes. No amount of expensive marketing and celebrity endorsements will change that.

Un-sponsored studies paint a different picture of patient tolerance for the bimatoprost for lash. Many patients who start bimatoprost ophthalmic 0.03 drops for lash growth soon give up on treatment because of eye irritation, lid margin

hyperemia, and dry eye symptoms.<sup>54,55</sup> The studies put forward by clinical investigators for Allergan have significant methodological weaknesses that are likely to under-report side effects. It appears clear that more data is needed before it should be assumed that the bimatoprost solution for lash growth is safe for our patients. No one should doubt the economic pressure on pharmaceutical companies to get their products to market. I personally have stopped recommending this product for my patients. The risk of iris hyperpigmentation is real and irreversible. I think that some may knowingly accept this risk for the benefit of thicker, darker, longer eyelashes. However, the risk of eyelid fibrosis, sulcus deepening, and potentially permanent thinning of the eyelid, changes associated with the aging eyelid are unlikely to be acceptable in exchange for better eye lashes. This product should not therefore be considered safe. Additional academic studies independent of the pharmaceutical manufacturer are needed for the benefit of public safety. As physicians we need to express our concern to the public about questions that exist regarding the safety of these products. It may not be necessary to follow intraocular pressure in patients who are using bimatoprost ophthalmic solution for lash growth but these patients most definitely need to be followed with photographs to determine if they are developing DUES, iris and palpebral hyperpigmentation, lid margin fibrosis and thinning.

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4:20 - 4:35 pm

4:22 - 4:26 pm

## Physical, Psychological, and Social Recovery after Enucleation

Sarah Jacobs<sup>1,2</sup>, J. Michael Bostwick<sup>3</sup>, Todd Cranmore<sup>4</sup>, Christopher Chambers<sup>2</sup>, Shu-Hong Chang<sup>2</sup>, A.J. Amadi<sup>2</sup>, Kristin Tarbet<sup>6</sup>, James Orcutt<sup>5</sup>  
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**Introduction:** The surgical removal of an eye represents a significant life event. This study aims to gain better insight to the impact of enucleation on visual function, depression, anxiety, and social interactions.

**Methods:** Cross-sectional study of adults with history of enucleation. Each participant underwent a standardized interview on the physical, psychological, and social experiences related to enucleation. Interview transcripts were analyzed using qualitative research methods to identify themes. Participants also completed the National Eye Institute Visual Function Questionnaire (NEI-VFQ), Facial Appearance Subscale, and Hospital Anxiety and Depression Scale.

**Results:** Among 43 participants, prominent interview themes included the importance of patient autonomy in decision-making, the role of pain relief in decision confirmation, and the roles of prosthesis and social support in recovery. Patient experiences differed substantially based on the reason for enucleation, which included primary enucleation after trauma, secondary enucleation of a blind painful eye after trauma, blind painful eye due to end-stage ocular disease, improvement of cosmesis for a blind comfortable unaesthetic eye, or intraocular malignancy (retinoblastoma or uveal melanoma). Enucleation cohort scores were equivalent to NEI-VFQ control group for general health and ocular pain, but with significantly poorer scores on driving, peripheral vision, dependency, and mental health. Patients enucleated after 65 years of age endorsed more dependency ( $p=0.018$ ) and were more likely to stop driving ( $p=0.003$ ). Pediatric trauma patients reported significantly more negative family dynamics than the rest of the cohort ( $p=0.007$ ).

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**Conclusions:** While each patient’s enucleation experience is unique, common themes arise. The reason for enucleation is an especially strong driver of patient narrative, which can help caregivers tailor patient management strategies. Prompt referral for ocular prosthesis is important for physical and psychosocial recovery. Patients enucleated after age 65 and those who suddenly lose a sighted eye may benefit most from physical therapy for activities of daily living, while those enucleated due to trauma, particularly children, may benefit from individual and family counseling services.

**Table 1**

**Table 1. Characteristics of enucleated patient cohort.**

Characteristic	
Sex	Female=22, Male 21
Age at enucleation	35.8 years (range 1 – 91 years)
Age at interview	59.3 years (range 26 – 91 years)
Time since enucleation	23.5 years (range 3 months – 73 years)
Elapsed time from onset of eye disease until enucleation	7.4 years (range 0 days – 64 years)
Elapsed time from onset of pain until elective enucleation*	1.56 years (range 1 week – 5 years)
Reason for enucleation	BCUE n=5 MM n=5 MRB n=3 NTBP n=9 T n=11 TBP n=10

BCUE=Blind comfortable unaesthetic eye, MM=Uveal melanoma, MRB=Retinoblastoma, NTBP=Non-traumatic blind painful eye, T=primary enucleation due to trauma, TBP=Traumatic blind painful eye  
\* Applies to TBP and NTBP subgroups only

**Table 2**

**Table 2. Enucleation cohort scores on the NEI-VFQ25 compared against other eye condition cohorts and normal reference controls.**

Subscales	Reference* (n=122)	Enucleation (n=43)	DR* (n=123)	AMD* (n=108)	Glaucoma* (n=77)	Cataract* (n=93)	CMVR* (n=37)	Low Vision* (n=90)
General health	69 ± 24	73 ± 25	46 ± 25	65 ± 25	62 ± 25	55 ± 25	45 ± 24	57 ± 27
General vision	83 ± 15	74 ± 26	62 ± 21	53 ± 20	71 ± 17	60 ± 17	76 ± 14	38 ± 18
Driving	87 ± 18	78 ± 29	55 ± 40	39 ± 36	75 ± 28	63 ± 30	80 ± 28	10 ± 23
Peripheral vision	97 ± 10	61 ± 33	78 ± 29	77 ± 27	76 ± 27	87 ± 21	78 ± 21	59 ± 32
Ocular pain	90 ± 15	88 ± 21	88 ± 17	87 ± 16	89 ± 14	86 ± 19	90 ± 16	83 ± 20
Vision specific								
Role difficulties	93 ± 13	78 ± 31	69 ± 31	61 ± 31	84 ± 23	76 ± 22	78 ± 24	44 ± 29
Dependency	99 ± 6	87 ± 29	77 ± 30	72 ± 30	92 ± 19	88 ± 20	89 ± 12	51 ± 31
Social function	99 ± 3	85 ± 22	81 ± 26	73 ± 29	89 ± 20	87 ± 19	96 ± 9	50 ± 31
Mental health	92 ± 12	76 ± 33	66 ± 29	58 ± 27	89 ± 20	77 ± 22	74 ± 22	46 ± 27

DR=Diabetic retinopathy; AMD=Age-related macular degeneration; CMVR=Cytomegalovirus retinitis

\*Data in these columns has been extracted from Mangione, et al, 2001.<sup>1</sup>

All p-value comparisons between Enucleation group and Reference group were statistically significant (p ≤0.05) except General health (p=0.369) and Ocular pain (p=0.571).

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4:26 - 4:30 pm

## Tumor Necrosis Factor Inhibition in the Acute Management of Traumatic Optic Neuropathy

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**Introduction:** Traumatic optic neuropathy (TON) is an uncommon but devastating cause of permanent visual loss following blunt force trauma to the orbit<sup>1,2</sup>. Using sonication shock as a means to induce TON (sonication-induced TON: SI-TON)<sup>3</sup>, we established an injury model that closely approximates the indirect clinical mechanism in TON. With SI-TON, we characterized the early molecular events following focal injury to the optic nerve and demonstrated that among the first signals for a reactive process ensuing in the nerve was the upregulation of pro-inflammatory cytokines, the most significant of which was tumor necrosis factor (TNF)<sup>3</sup>. The purpose of this study was to evaluate the effectiveness of etanercept, a non-selective TNF inhibitor, in conferring neuroprotection to RGCs and improving visual outcomes after optic nerve trauma with either ONC or SI-TON in mice.

**Methods:** Mouse optic nerves were unilaterally subjected to ONC (n=20) or SI-TON (n=20). TNF expression was evaluated using immunohistochemistry and quantitative RT-PCR (qRT-PCR) in optic nerves harvested 6 and 24 hours post ONC (n=10) and SI-TON (n=10). Mice in each injury group received daily subcutaneous injections of either etanercept (10 mg/kg of body weight; 5 mice) or vehicle (5 mice) for seven days. Pattern electroretinograms were performed on all mice at 1 and 2 weeks after injury. ONC mice were sacrificed at 2 weeks after injury, while SI-TON mice were euthanized at 4 weeks after injury. Whole retina flat-mounts were used for RGC quantification.

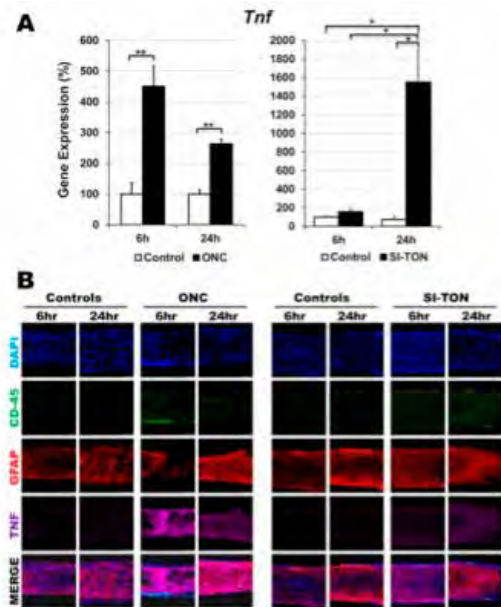
**Results:** Immunohistochemistry and qRT-PCR showed upregulation of TNF protein and gene expression within 24 hours after injury (Figure 1). In both models, etanercept use immediately following optic nerve injury led to higher RGC survival compared to controls, which was comparable between the two models (24.23% in ONC vs. 20.42% in SI-TON) (Figures 2 and 3). In both models, one and two weeks post-injury mice treated with etanercept had significantly higher a-wave amplitudes compared to untreated injured controls (Figure 4).

**Conclusions:** Treatment with etanercept significantly reduced retinal damage and improved visual function in both animal models of TON. These findings suggest that reducing TNF activity in injured optic nerves constitutes an effective therapeutic approach in an acute setting.

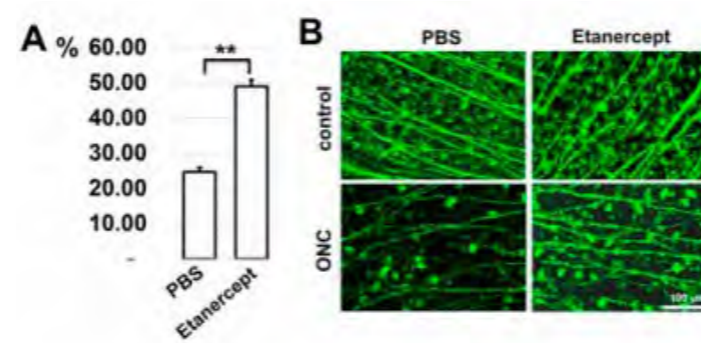
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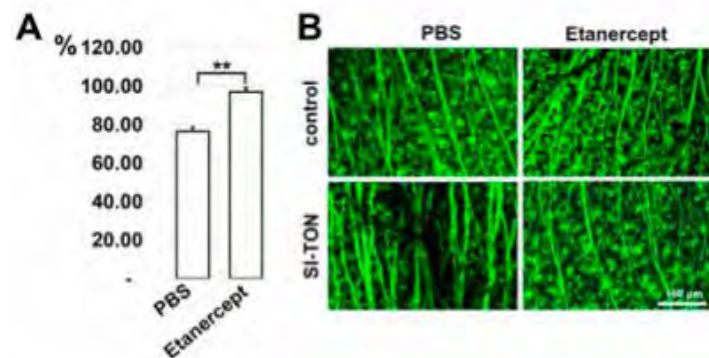
**Figure 1**



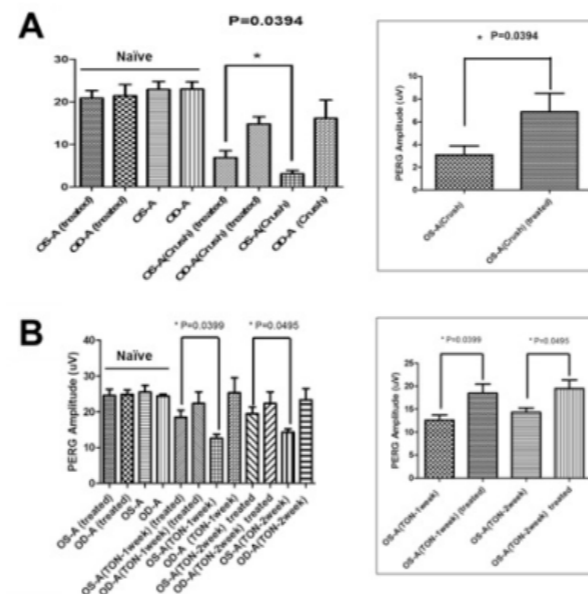
**Figure 2**



**Figure 3**



**Figure 4**



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4:30 - 4:34 pm

## Surgical Timing for Congenital Ptosis Should not be Determined Solely by the Presence of Anisometropia

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**Introduction:** Timing of surgery in children with congenital ptosis is a critical component of care, and anisometropia is frequently cited as an indication for early intervention.<sup>1,2</sup> The purpose of this study is to evaluate the change in refractive error following surgery for congenital ptosis to better inform decisions regarding the timing of surgery.

**Methods:** A retrospective review of clinical records was performed on patients who underwent surgical correction of congenital ptosis in an academic oculoplastic surgery practice from 2002 to 2017. Patients with complete pre- and post-operative refractive data were included in the study. Changes in refractive error following surgery were analyzed.

**Results:** Among 184 pediatric patients who underwent ptosis surgery during the study period, 56 patients (71 eyes) met inclusion criteria. The mean age at surgery was 5.1 years. Mean refractive error change in all the operated eyes was a 0.82 D decrease in spherical equivalent ( $p=0.1920$ ) and a 0.40 D increase in cylinder ( $p=0.0255$ ). The mean refractive change in the operated eyes in patients  $< 4$  years old was a 0.94 D decrease in spherical equivalent ( $p=0.1938$ ) and a 0.10 D increase in cylinder ( $p=0.6599$ ). The mean refractive change in the operated eyes in patients  $\geq 4$  years old was a 0.73 D decrease in spherical equivalent ( $p=0.4341$ ) and a 0.61 D increase in cylinder ( $p=0.0156$ ). There were no statistically significant changes in spherical equivalent or cylinder in the control eyes.

**Conclusions:** Our data did not show movement toward normalization of refractive error following ptosis surgery. In fact, it showed a statistically significant worsening of astigmatism following surgery. Since refractive error does not improve following surgery, anisometropia should not be the sole indication for early surgery in congenital ptosis.

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## T1 - Telemedicine in Oculoplastics: Effective Diagnosis and Triage of Emergency Department Consultations

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**Introduction:** The purpose of this study is to evaluate the accuracy, safety, and effectiveness of preliminary diagnosis and triage of Oculoplastic consultations in the Emergency Department using a HIPAA compliant remote image-sharing tool.

**Methods:** A retrospective case series of emergency department consultations evaluated by the oculoplastic division were reviewed. 60 consecutive patients with orbit, eyelid, or lacrimal pathology were included in the study. Case details, imaging and examination were compiled, and a blinded group of four Oculoplastic surgery faculty independently reviewed the simulated teleophthalmology encounter and completed a corresponding questionnaire, any faculty with prior knowledge of the patient were excluded. For each case, the questionnaire documented the differential diagnosis, the next steps of patient care management, and triaged the urgency of in-person examination by Oculoplastic surgery on a 5-point scale (1-PRN clinic follow up, 2-Non-urgent clinic follow up 1 week to 2months, 3-Urgent clinic 1day to 1week, 4-In hospital evaluation by oculoplastics, 5-need for in-hospital surgical repair/intervention). Additionally, using standard Likert 5-point scale they subjectively graded their confidence in diagnosis, safety of patient triage, and effectiveness of remote management tool. These responses were compared to a separately questioned Oculoplastic surgery faculty who performed in-person evaluation at the time of initial consultation. Statistical analysis on qualitative non-continuous data was performed with fisher-exact analysis.

**Results:** 60 patients were included in the study, and a total of 180 responses were recorded. The differential diagnosis based on the simulated teleophthalmology consultation correlated with the clinical diagnosis 98.8% of the time. Remote evaluators responded "confident" (13%) or "very confident" (87%) in the confidence of their diagnosis, with no difference from in-person evaluators ( $p=0.64$ ). The additional measures requested for improved diagnostic accuracy were tissue biopsy (15), further imaging (10), and probing (8). There was no difference in the determined triage location between remote and in-person evaluators ( $p$ -value = 0.89). For all patients, evaluators felt "confident" or "very confident" in the safety of their triage decision with no difference between groups ( $p$ -value 0.91). The remote evaluators correctly indicated need for hospital admission in 100% of patients admitted.

**Conclusions:** This preliminary study demonstrates that ophthalmic telemedicine in Oculoplastic surgery consultation from the Emergency Department may be an effective method for triaging patients via remote subspecialist consultation, including initiating a treatment plan and proposing additional workup to aid in diagnosis. An accurate differential diagnosis was made, and no patients requiring hospitalization or inpatient treatment were missed. Future prospective studies with increased patient numbers will be needed to validate these preliminary results.

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## T2 - A 30-Year Analysis of Gender Authorship Trends in the Ophthalmic Plastic and Reconstructive Surgery Literature

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**Introduction:** The number of women practicing medicine and entering ophthalmology residency has increased over the past several decades.<sup>1-4</sup> Previous studies of high-impact ophthalmology journals have demonstrated a subsequent increase in first and senior female authors publishing in the field.<sup>5</sup> Despite an increase in the number of female members in the American Society of Ophthalmic Plastic and Reconstructive Surgery (ASOPRS) over the past decade, women are still underrepresented within the subspecialty, with only 109/617 (17.7%) living ASOPRS members being female.<sup>3</sup> The purpose of this study was to analyze trends in gender authorship within the oculoplastic literature.

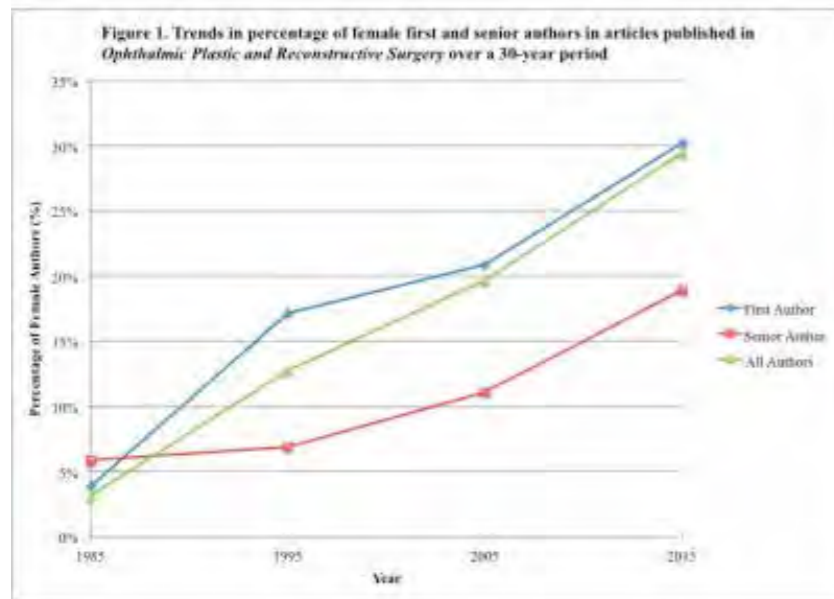
**Methods:** This was a retrospective observational study that sampled all articles published in *Ophthalmic Plastic and Reconstructive Surgery (OPRS)* during the years 1985, 1995, 2005, and 2015. Articles studied included original investigations, case reports, letters to the editor, review articles, and miscellaneous types such as surgical techniques and OPRS images. Articles citing previously published work such as "Aesthetic Abstracts and Citations" were excluded. Data reviewed included total number of authors and gender of the first and senior authors of each article. If the gender of an author was uncertain after inspection of first name, gender was verified through Google search engine and related sites (genderchecker.com) as in similar studies.<sup>1</sup> P-values were calculated using the Pearson  $\chi^2$  test, with significance set at  $p < .05$ . Statistics were conducted using statistical software.

**Results:** In total, 474 articles were analyzed including 219 (46%) original investigations, 119 (25%) case reports, 70 (15%) letters to the editor, 15 (3%) reviews, and 51 (11%) miscellaneous articles. Of 1582 total authors over the 30-year time period, 364 (23%) were female, including 108/474 (22.7%) first authors and 64/474 (13.5%) seniors authors. The percentage of articles with a female first author increased from 3.9% in 1985 to 30.2% in 2015, a difference of 26.3% ( $p = .0004$ ). The percentage of articles with a female senior author increased from 5.9% in 1985 to 18.9% in 2015, a difference of 13% ( $p = .01$ ). In a sub-analysis of original investigations alone, the percentage of articles with a female first author increased from 3.1% in 1985 to 31.9% in 2015 ( $p = .007$ ), while the percentage of female senior authors increased from 6.3% in 1985 to 15.3% in 2015 ( $p = 0.22$ ).

**Conclusions:** Despite a significant increase in female first and senior authorship over the past 30 years, women are still underrepresented within the oculoplastic literature. When considering original investigations alone, there has been a significant increase in female first authorship, but not in senior authorship during this time period.

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**Figure 1****References:**

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### T3 - Orbital and Eye Injuries from Self-Inflicted Gunshots: Patterns and Management

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**Introduction:** Self-inflicted facial gunshot (SIGSWs) typically result in severe injuries to facial structures including the orbit and globe. Roughly three-quarters of those who arrive to the hospital alive will survive their injuries, and recidivism is low<sup>1,2</sup>. Therefore, effective reconstruction is paramount to preserve vision and long-term quality of life. The objective of this study is to characterize the common injuries to the orbit, globe, and periorcular structures following SIGSWs, their management, and the eventual visual and reconstructive outcomes.

**Methods:** A retrospective review of trauma registry records at a Level 1 trauma center for patients who presented alive following SIGSWs involving the face from 2007- 2016.

**Results:** 69 patients presented with SIGSWs to the face. 47 of the 69 patients (68 %) sustained injuries that involved the orbit, globe, or periorcular tissue. Patients were predominantly male (87 %) and Caucasian (83 %). The most common entry site was submental entry directed cephalad (58 %). Three patterns of injury emerged: i) open globe (47 %) ii) orbital fractures without open globe injuries, and iii) optic nerve injury without globe injury.

Overall mortality was 30%. However, open globe injury was associated with increased odds of death (odds ratio [OR]= 5.8; p = 0.04) relative to orbital fractures without open globe injuries.

Majority of patients who sustained open globe injury or traumatic optic neuropathy had no light perception on initial exam, and visual acuity did not improve during the follow-up period.

On average, patients required multiple surgeries for reconstruction of the globe, facial bony and soft tissue dictated by the pattern of injury.

**Conclusions:** Following SIGSWs, injuries to the eye, orbit, and periorcular tissues are common and severe. Majority of patients survive and will require multiple orbital reconstructive and ophthalmologic procedures with long-term follow-up. Open globe injury is associated with higher mortality and poor visual outcomes.

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## T4 - Self-Inflicted Periorcular Foreign Bodies Injuries in Psychiatric Patients

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**Introduction:** The purpose of this study is to report on a recent trend of self-inflicted injuries involving embedded foreign bodies in the periorbital and orbital region seen at a major ocular trauma referral center.

**Methods:** A retrospective case review of intentional, self-inflicted insertion of metallic foreign bodies into the eyelid and orbit that presented to our institution from 03/2017 to 06/2018. Patient demographics, location of foreign bodies, associated complications, and surgical outcomes were recorded.

**Results:** We describe ten cases of periorbital injury in six patients, presenting from 03/2017 to 06/2018. All patients were male, with a mean age of 28.5 years old (range 20-43) and all were inmates at local prisons. Each patient underwent CT of the orbits without contrast to localize the foreign bodies and evaluate for infection or abscess formation (Figures 1 and 2). In all cases, paperclips (2), staples (4), or other small metallic wires (4) acquired from the prison facility were inserted into the periorcular region. In many cases, 2-3 foreign bodies were inserted at once (Figures 3 and 4). Eight cases (8/10) involved some form of self-injury to other body parts as well. All patients had a history of self-harm prior to the first presentation for periorbital injury. One patient had four separate cases of periorcular self-harm through the study period. All patients had at least one psychiatric condition, including depression, schizoaffective disorder, and borderline personality disorder. Motivation behind the self-injury was not determined definitively in most cases, but several patients expressed the hopes that self-injury would allow them to obtain mental healthcare they felt was lacking in the prison system. 9/10 cases had foreign bodies inserted into the upper eyelid through the palpebral conjunctiva such that no external tract was seen. 1/10 cases inserted staples into the posterior orbits bilaterally. Associated complications on presentation included eyelid edema (8) and corneal abrasion (1). Orbital or preseptal cellulitis were not seen at initial presentation in any case, and no case had globe involvement or retrobulbar hemorrhage. Intraoperative identification and retrieval of foreign bodies was successful in 8/10 cases. In all cases, initial eyelid edema and infection resolved by 1 week follow-up. No significant post-operative complications were noted at the latest follow-up in each case (mean 82 days, range 1-365 days), including no ptosis, lagophthalmos, or diplopia.

**Conclusions:** A recent rise in the number of self-inflicted periorbital insertion of foreign bodies has been seen presenting to our institution from the prison system. Tighter access to potentially harmful objects, even paperclips and staples, may help reduce occurrences. More than half of all prisoners in the USA have a mental health disorder<sup>1</sup>. Lack of access to mental healthcare was a common motivating factor reported among these periorbital injuries, and the intentional periorbital injury trend may reflect a need for improved mental healthcare in the prison system<sup>2</sup>.

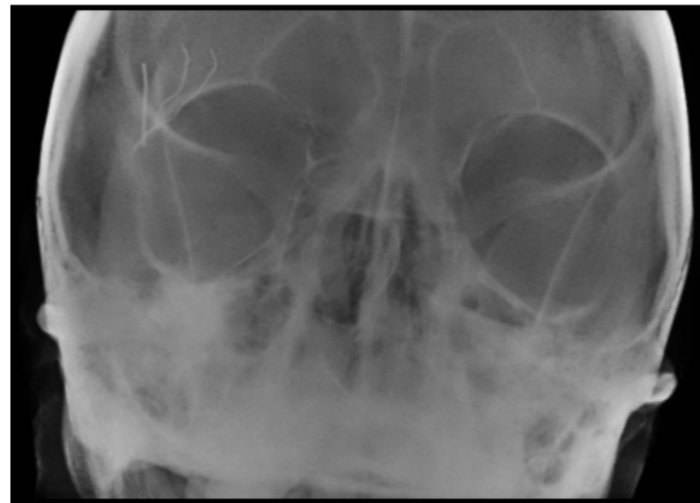
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**Figure 1**



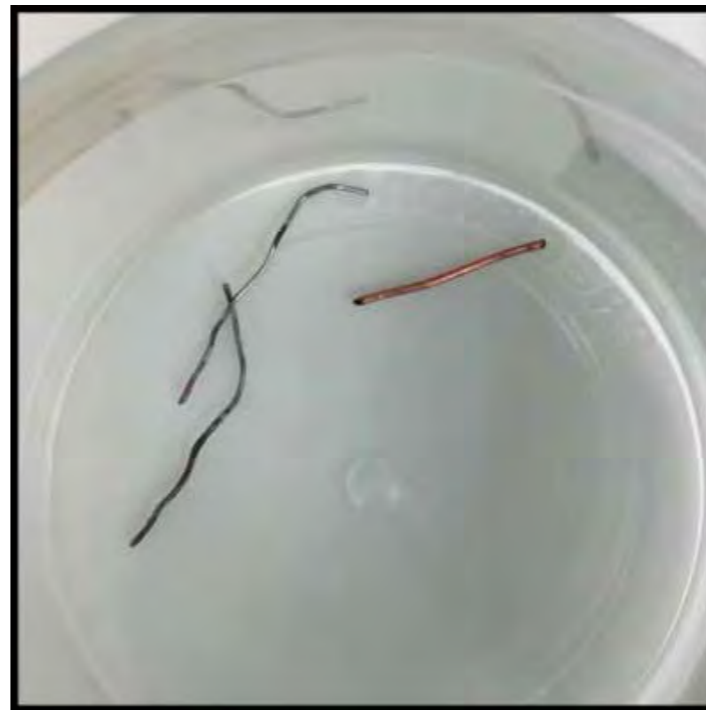
**Figure 2**



**Figure 3**



**Figure 4**



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## T5 - Blunderbuss - Orbital and Ocular Trauma Secondary to the Dysfunction of Muzzle-Loading Firearms

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**Introduction:** Injury to the eye and/or orbital and adnexal structures associated with antiquated muzzle-loading firearms has, to date, not been characterized. Unlike their modern counterparts, muzzle-loading firearms utilize an exposed propellant charge; as such we hypothesized that injuries resulting from the use of these antiquated firearms would be related primarily to dysfunction of the firearm. We further hypothesized that if dysfunction was primarily due to explosion of the firearm, we would observe injuries similar to blast injuries sustained with explosive weapons such as those used in warfare.

**Methods:** We conducted a retrospective chart review of seven patients treated at Vanderbilt University Medical Center between 2003 and 2017 who sustained traumatic injuries to the ocular and/or orbital and adnexal structures secondary to the discharge of a muzzle-loading firearm. Demographic data collected for each patient included the patients' age, sex, and race. Parameters obtained from hospital records were utilized to describe the mechanism of the injury included type of firearm, mechanism of the weapon's dysfunction, and the use of eye protection. The initial exam and imaging data were utilized to describe the injuries. Details of treatment and outcomes included: surgical procedures, survivability, and last known visual acuity.

**Results:** All seven individuals were white males between the ages of 19 and 68 (M = 43 years). Muzzle-loading rifles were implicated in six cases; one case involved a muzzle-loaded pistol. Six individuals were injured in the process of intentionally discharge of the firearm; one individual was injured by an unintentional discharge while attempting to clear the barrel of obstructing debris. In 6/7 cases, the firearm exploded due to dysfunction or misuse. No individuals were wearing eye protection at the time of injury. Foreign material deriving from the firearm was retained with the orbit in 2/7 patients. Initial examination of the orbit and adnexa revealed 5/7 individuals sustained orbital fractures and 6/7 sustained facial lacerations (including two sustaining eyelid lacerations); none had evidence of a lacrimal duct injury at that time. Three patients sustained globe injuries (one closed-globe; two open-globe). Visual acuity at last follow-up was better than 20/200 in 12/14 eyes examined. Surgical intervention was required in the treatment of 4/7 individuals (including 3/7 requiring intervention for sustained orbital fractures). All individuals survived their injuries.

**Conclusions:** The operation of muzzle loading firearms poses a unique risk of injury to the operator attributable not only to their nature as antiquated instruments, which may not benefit from strict quality control and materials standards afforded modern firearms, but also to the procedures involved in their operation. The resultant injuries in this case series were primarily attributable to the explosion of the firearm, which subsequently appear similar to orbital and ocular blast injuries caused by explosive weapons. Orbital lacerations and fractures are the most common injuries we observed in this limited case series, which may be attributable to the unique proximity of the primary blast injury to the orbit.

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**Figure 1**



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## T6 - Analysis of Correlation Between Orbital Fracture and Ocular Injuries in Blunt Orbital Trauma

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**Introduction:** Blunt trauma in the orbital lesion can cause ocular or periorbital injuries, which includes uncomplicated orbital contusion, blowout fracture, or ocular injuries. These injuries can be presented concomitantly; some of the blowout fracture patients sustain ocular injuries and some do not. To date, the influence of blowout fracture on the occurrence of ocular injuries has not been well established.

We wanted to evaluate the occurrence of ocular injuries and blowout fracture in the blunt orbital trauma patients in a controlled clinical setting. We also wanted to analyze whether the presence of blowout fracture affects the occurrence of ocular injuries in the blunt trauma patients.

**Methods:** Of 1,582 patients visiting emergency room at Samsung Medical Center with periorbital injury from Jan 2014 to Dec 2016, blunt orbital trauma patients examined by ophthalmologists and evaluated with CT scan were retrieved. The clinical data of patients' age, gender, cause of trauma, and ocular injury patterns were collected. The location of orbital fracture and morphologic parameters of the patients' CT scans were also reviewed. The amount of exophthalmos, the length of the orbital floor and the medial wall, the depth of the orbit, the height of ethmoid air cell were measured, and the area of the orbital floor and the medial wall, the volume of ethmoid air cell, and the cross-sectional area of the orbit were calculated. The patients were divided into two groups of orbital fracture and no fracture, and clinical data and CT parameters were compared.

**Results:** 200 patients (200 eyes) were retrieved: 157 of orbital fracture group and 43 of no fracture group (Table 1). Ocular injuries occurred in 18 of 43 eyes (41.9%) of the no fracture group, and in 28 of 157 eyes (17.8%) of the orbital fracture group (Table 2); ocular injuries were found significantly more often in the no fracture group ( $p=0.001$ ). Patients needing emergency surgery for eyeball rupture were 6 of 43 (14.0%) in the no fracture group and 5 of 157 (3.2%) in the orbital fracture group (Table 2); eyeball rupture was also found significantly more often in the no fracture group ( $p=0.014$ ).

There were no significant differences in all CT parameters between the patients with ocular injuries and without among all patients. The same findings were resulted between the patients with ocular injuries and without among the patients with orbital fracture.

**Conclusions:** The prevalence of ocular injuries was significantly higher in the no fracture group than in the orbital fracture group, and so was the rate of patients needing emergency operation for ocular injury. The presence of the orbital fracture may have protective role in the occurrence of ocular injury in blunt orbital trauma by providing instant decompressive effect on the orbital tissue.

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**Table 1**

	No fracture	Orbital fracture	p-value*
<b>Demographics</b>			
Number of eyes (patients)	43 (43)	157 (157)	
Age (years) (mean ± SD)	36.1 ± 19.6	40.6 ± 20.0	.192
Sex, M / F	35 / 8	119 / 38	.440
<b>Cause of trauma (%)</b>			
Traffic accident	2 (4.7)	22 (14.0)	.094
Assault	13 (30.2)	39 (24.8)	.475
Sports injury	13 (30.2)	31 (19.7)	.141
Occupational injury	9 (20.9)	19 (12.1)	.139
Fall-down	6 (14.0)	46 (29.3)	.042

**Table 2**

	No fracture (n=43)	Orbital fracture (n=157)	p-value*
<b>Ocular injury (%)**</b>			
Microhyphema (%)	9 (20.9)	17 (10.8)	.081
Gross hyphema (%)	2 (4.7)	2 (1.3)	.203
Iris sphincter tear (%)	4 (9.3)	10 (6.4)	.506
VH (%)	0 (0.0)	2 (1.3)	
Retinal hemorrhage (%)	2 (4.7)	2 (1.3)	.203
Traumatic MH (%)	0 (0.0)	1 (0.6)	
Eyeball rupture (%)	6 (14.0)	5 (3.2)	.014

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## T7 - Trends of Ocular Trauma

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**Introduction:** Ocular trauma is a preventable cause of ophthalmologic morbidity and preventable blindness<sub>2</sub>. As demonstrated in pediatric populations<sub>1</sub>, and reported by Ramirez et al, the volume of eye trauma increases in the spring and summer months. According to Anderson's Heat Hypothesis, hot temperatures can increase aggressive tendencies and behaviors<sub>6</sub>. Our goal is to establish a relationship between ocular trauma, seasonality, and temperature.

**Methods:** Primary call consults for the UTHSC Hamilton Eye Institute Ophthalmology residency (Memphis, TN) were recorded in the New Innovations database from 2006-2016 and analyzed retrospectively. ICD - 9 diagnosis codes were used to identify all cases of ocular trauma. Temperature data was obtained from the National Oceanic and Atmospheric Association. The main outcome measures were the monthly, seasonal, annual and temperature trends in ocular trauma in an emergency department setting necessitating an ophthalmology consultation.

**Results:** There were 8400 patients seen by ophthalmology residents in Memphis, TN from 2006-2016, 3540 of them were cases with a diagnosis of ocular trauma. Of the 3540 cases, 2290 were male (64.7%) with a mean age of 34.6 years, while 1250 were female (35.3%) with a mean age of 34.9 years. Of the 3540 patients seen, the most common diagnosis was orbital fracture (42%), followed by eyelid laceration (17%) and open globe injury (11.5%). Peak months of ocular trauma were July (37.3 cases/year) and September (36.6 cases/year) with trauma more likely to occur in non-winter months ( $p=0.0069$ ). Summer was defined as June, July and August. Fall was defined as September, October and November. Winter was defined as December, January and February. Spring was defined as March, April and May. With regards to season, trauma was more likely to occur in the summer/fall seasons ( $p=0.0014$ ). Summer and fall were found to have the highest mean temperature at 82.8°F and 64.6°F respectively. Winter was found to have the lowest mean temperature at 46.3°F.

**Conclusions:** Ocular trauma does exhibit an annual and temperature cycle, peaking in the summer and fall months which coincides with the beginning of the resident and fellow academic year. Special attention should be taken at the beginning of the academic year to prepare residents and fellows for the proper management of ocular trauma as most traumatic cases will require evaluation and surgical intervention by an oculoplastic surgeon.

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Figure 1

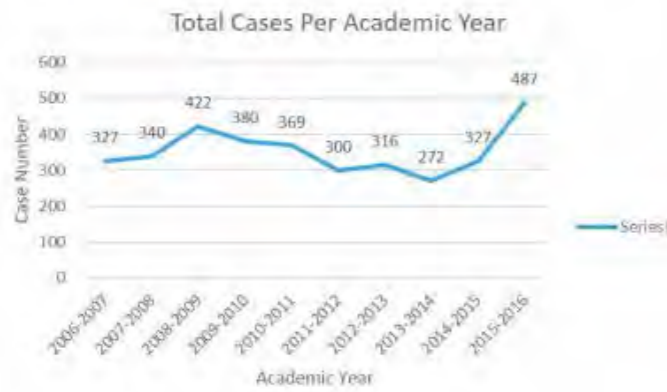


Figure 2

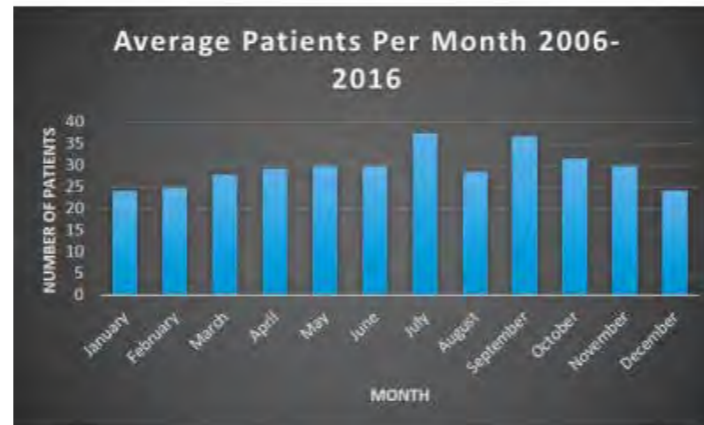


Figure 3

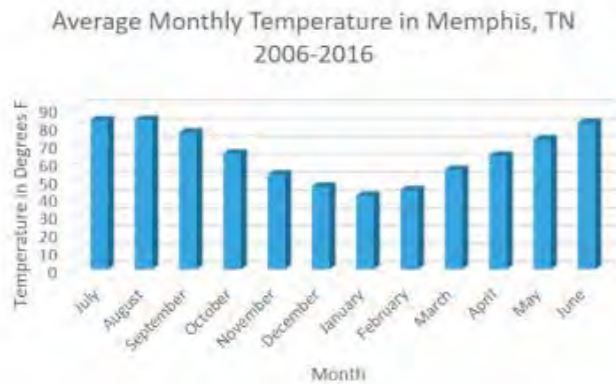
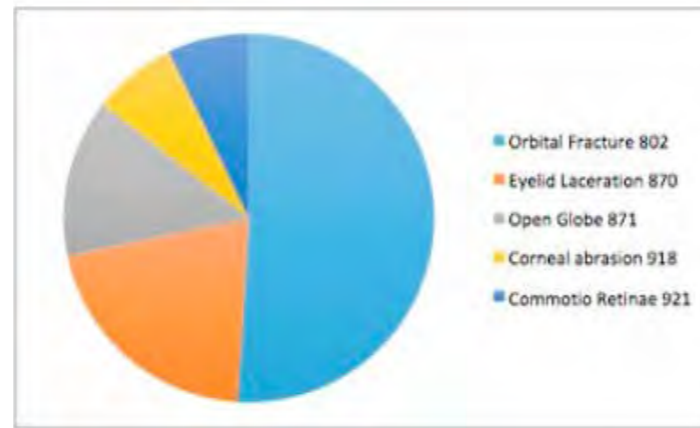


Figure 4



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## T8 - Association of Orbital Infection with Systemic Disease and Orbital Trauma

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**Introduction:** Reports of orbital infection in the setting of systemic disease and trauma are limited, and a comprehensive review of such cases has not been previously described. We aim to summarize the existing literature and investigate the relationship between orbital infection and underlying conditions including malignancy, human immunodeficiency virus/acquired immunodeficiency syndrome (HIV/AIDS), autoimmune disease, and orbital trauma.

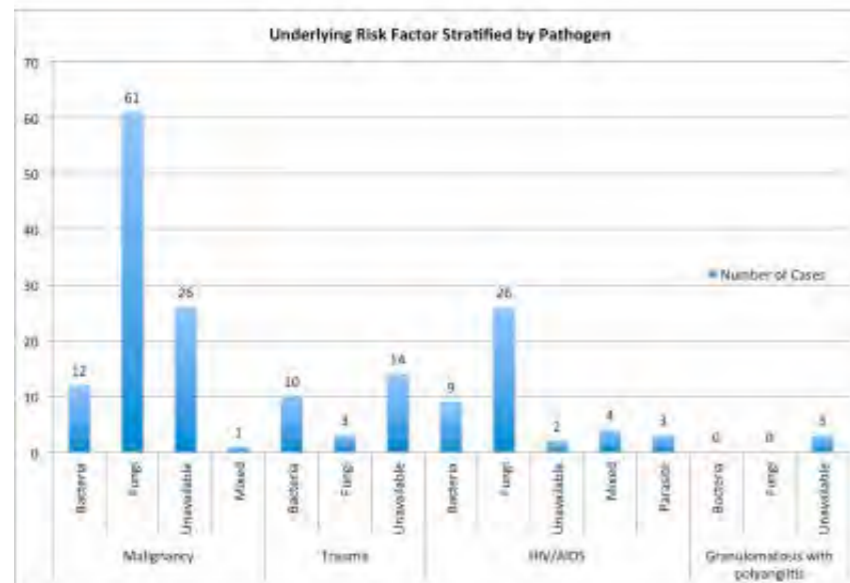
**Methods:** Reports of orbital infection in the setting of systemic disease and trauma are limited, and a comprehensive review of such cases has not been previously described. We aim to summarize the existing literature and investigate the relationship between orbital infection and underlying conditions including malignancy, HIV/AIDS, autoimmune disease, and orbital trauma.

**Results:** We identified 171 eligible cases of orbital cellulitis, manifestations of which included orbital aspergillosis (n=30), orbital mucormycosis (n=37), orbital abscess (n=17), subperiosteal abscess (n=8), dacryocystitis (n=3), and dacryoadenitis (n=1). Hematologic malignancies (n=70, 70.0%), including leukemia, lymphoma, and myelodysplastic syndrome, were the most commonly malignancies associated with orbital infection. Fungus was the most common underlying pathogen identified in orbital infection among patients with HIV/AIDS and malignancy. Among patients with malignancy, 61 patients (61.0%) had an underlying fungal etiology, while only 12 patients (12.0%) had underlying bacterial infection. In patients with HIV, fungal infections were most common (n=26, 59.1%,) while bacterial infections occurred less commonly (n=9, 20.5%.) Three parasitic infections (*Toxoplasma gondii*) in the setting of HIV/AIDS were identified. In contrast, of trauma patients, only 3 (11.1%) had a fungal pathogen isolated, while 10 patients (37.0%) patient had a bacterial pathogen identified.

**Conclusions:** Orbital infection is associated with secondary causes such as malignancy, HIV/AIDs, orbital fracture, and blunt trauma. Malignancy and HIV/AIDs are most commonly associated with fungal infections. Further elucidation of the relationship between orbital infections and underlying pathogens may help define the management of such patients.

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## T9 - Need for Immediate and Late Surgical Intervention in Pediatric and Adult Populations with Orbital Cellulitis using the Chandler Classification

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**Introduction:** The purpose of this study was to identify objective features of orbital cellulitis that could increase the likelihood of surgical intervention in pediatric and adult populations.

**Methods:** Charts of patients with orbital cellulitis at a tertiary care center from January 2010 to July 2017 were identified using ICD 9 and 10 codes. Patients with a clinical diagnosis of orbital cellulitis confirmed with CT or MRI were included in the review. Each of these patients was assigned into one of the Chandler classification groups based on the highest classification number recorded for that patient. These cohorts were analyzed for differences in rates of surgical intervention (Table 1). Patients with fungal infections were excluded from this review (1 pediatric, 2 adult).

**Results:** Of the 96 patients identified with orbital cellulitis, 46 were pediatric (average age: 7.7 years; range: 4 months - 17 years) and 48 adult (average age: 53.4 years; range: 25 - 83 years). Among the pediatric patients, 30 were male and 16 female ( $p < 0.01$ ); among adult patients 23 were male and 25 female. Forty-three (93%) pediatric and 32 (67%) adult patients had concomitant sinusitis confirmed with CT imaging

All patients were treated medically with I.V. antibiotics. In addition, 26 pediatric and 38 adult patients were also treated surgically. A higher proportion of adults (79%) was treated surgically when compared to pediatric patients (57%) ( $p < 0.05$ ).

None of the pediatric patients in Class II required surgery. On the other hand, 12 (63.2%) adult patients from Class II required surgical intervention. Of these, five had removal of an infected orbital implant, three had a recent orbital trauma, one had a post-operative infection from thyroid eye disease decompression, and one presented in diabetic ketoacidosis.

After the resolution of their orbital infections, two pediatric patients (4.3%) required further surgical treatment compared to nine (18.8%) adult patients ( $p < 0.05$ ). The two pediatric patients were from Chandler Class IV and V requiring dacryocystorhinostomy and strabismus surgery, respectively. Of the adult patients, four (44%) were from Chandler Class II (multiple sinus endoscopy/debridements; facial debridement; orbital reconstruction; enophthalmos/hypoglobus repair), one was from Class III (lysis of lid scar), three were from Class IV (scar lysis; sinus debridement; canthoplasty with orbicularis suspension) and one was from Class V (craniotomy for abscess evacuation).

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**Conclusions:** The results of this study indicate that adult patients with orbital cellulitis are more likely to require surgical intervention than pediatric patients. Additionally, adults are more likely to require more surgical intervention after the resolution of the orbital infection. Within both the pediatric and adult populations, a higher Chandler Classification (III, IV or V) appears to be associated with an increased likelihood for surgical intervention. However, in the adult population, the Chandler classification does not necessarily correlate with a protracted surgical course of treatment. This is likely due to the wider variety of etiologies of orbital cellulitis present in the adult population.

**Table 1**

Table 1: Chandler Classification of Patients with Orbital Cellulitis with Rates of Surgical Intervention

Chandler Classification	Pediatric (N=46)	Pediatric Patients Treated Surgically (N=26)	Adult (N=48)	Adult Patients Treated Surgically (N=38)
Class II	11 (23.9)	0	19 (39.5)	12 (63.2)
Class III	24 (52.2)	16 (66.7)*	9 (18.8)	9 (100)
Class IV	4 (8.7)	4 (100)	15 (31.3)	12 (80)*
Class V*	7 (15.2)	6 (85.7)*	5 (10.4)	5 (100)

Class II: Infection without abscess or intracranial extension; Class III: infection with subperiosteal abscess; Class IV: infection with orbital abscess; Class V: infection with intracranial extension

Age group columns show: n (%) in each Chandler classification

\* indicates statistically significant rates (p value <0.05) of surgical intervention within a specific class in the Chandler classification.

+ All patients in group V also had either SPA or OA on presentation

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## T10 - Review of Clinical Features, Practice Patterns, and Treatment Outcomes of Dacryoadenitis at Major Oculoplastics Referral Clinics in Toronto, Canada

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**Introduction:** To review the practice patterns and treatment outcomes of dacryoadenitis.

**Methods:** This multi-center chart review identified cases of dacryoadenitis treated at major Oculoplastics referral centers in Toronto between 2015-2018. Clinical features, radiologic findings, histopathology and treatment outcomes were evaluated to measure the rate of treatment response and disease recurrence. Data was analyzed using Fisher exact test (2-tailed) and Student t test (2-tailed) with statistical significance defined at p

**Results:** Thirty patients (78% women, mean age  $48 \pm 12$  years) with dacryoadenitis were included. 55% of patients presented with an acutely inflamed lacrimal gland, and 45% presented with a non-painful lacrimal gland mass. In the group of patients presenting with acute painful dacryoadenitis (n=18), 79% of patients were treated with empiric prednisone therapy, 8% with non-steroidal anti-inflammatory agents, 8% with conservative measures such as hot compresses, and a one patient had a diagnostic biopsy prior to initiation of therapy. Of the 19 who were treated with prednisone, 9 achieved complete resolution on prednisone alone (mean treatment duration 4.8 months, 95% CI 3-6 months). In cases where treatment did not result in complete resolution, a biopsy was recommended. These patients were then treated with either a longer course of tapering prednisone, combination treatment, radiation treatment, or treatment was discontinued despite incomplete response. Overall 83% achieved complete resolution, and 17% showed partial response.

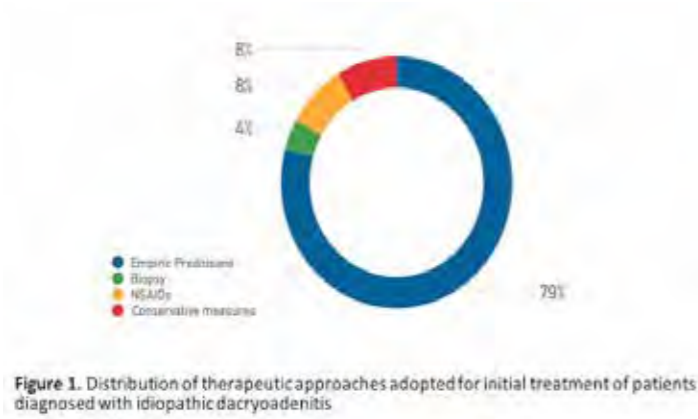
In patients presenting with a non-painful enlargement of the lacrimal gland (n=12), biopsy was recommended in all cases, unless a diagnosis to explain the lacrimal gland enlargement was already known. In this group, 10 were treated with prednisone, and 2 cases resolved spontaneously with no treatment. Of those who were treated with prednisone, complete resolution was only seen in 3 patients (25%), the remainder required long-term therapy with prednisone or combination treatment, and one required radiation treatment.

**Conclusions:** Dacryoadenitis can present as either a painless enlargement of the lacrimal gland (45%), or as an acute inflammatory condition (55%). Most patients with acute inflammatory dacryoadenitis are successfully treated with empiric medical therapy. In cases of non-painful lacrimal gland enlargement or when the lacrimal mass responds atypically to medical management, we recommend biopsy to confirm the diagnosis prior to considering prolonged prednisone treatment, initiating combination treatment, and/or radiation therapy.

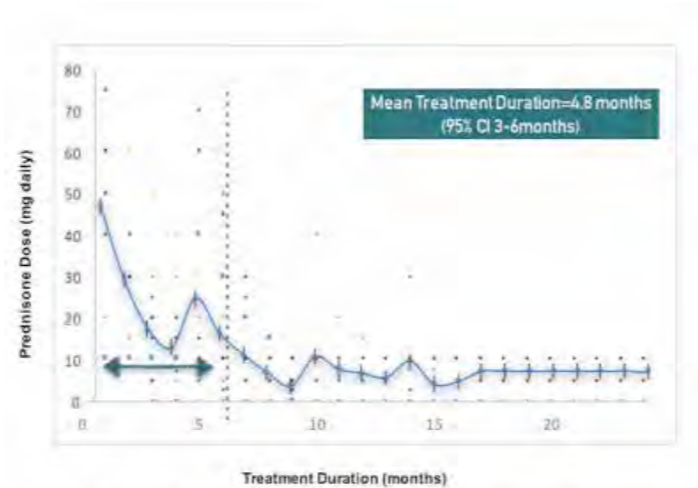
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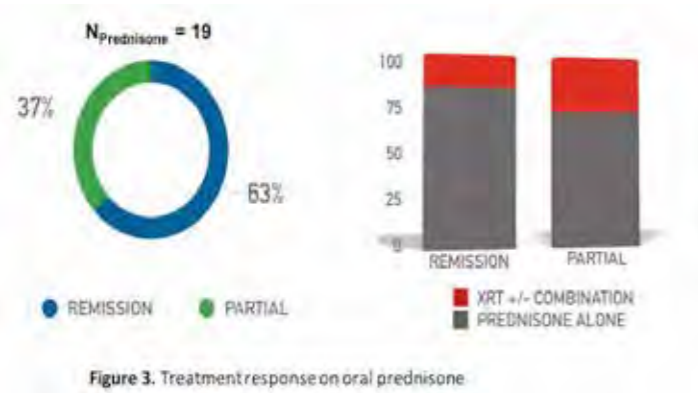
**Figure 1**



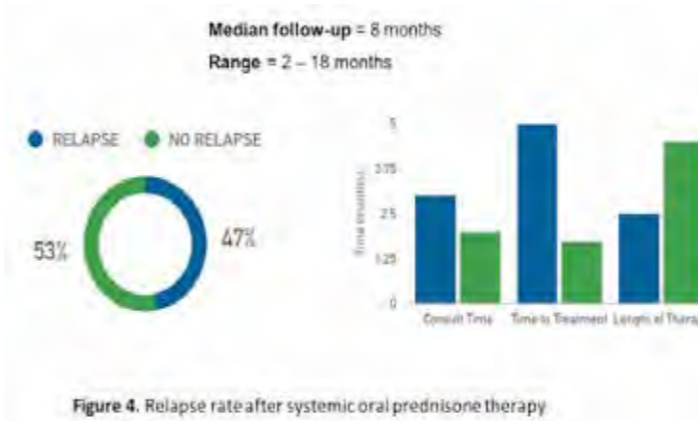
**Figure 2**



**Figure 3**



**Figure 4**



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## T11 - IgG4-Related Ophthalmic Disease (IgG4-ROD) in Hong Kong - Lessons from the First 10 Years

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**Introduction:** To report the first 10 years' experience of IgG4-related ophthalmic disease (IgG4-ROD) in Hong Kong.

**Methods:** Review of medical case notes, orbital images and pathology reports.

### Main Outcome Measures

Clinical features, radiological and histological characteristics of adnexal lesions, serological profiles, treatment response and association with poor outcomes defined as systemic involvement, visual loss and malignancy, and development of malignancy.

**Results:** 108 patients (45 female) with a mean age of  $57 \pm 15$  (range: 15-85) years on presentation were identified. The average follow-up period was  $56 \pm 72$  months. Bilateral or unilateral upper eyelid swelling ( $n=94$ , 87%), and lacrimal glands enlargement ( $n=86$ , 83% of 104 patients with orbital images available) were the most common clinical and radiological features respectively. 71 (87% among 82 tested) patients had raised pretreatment serum IgG4 level, and 34 (48%) showed levels over 5-fold upper limit of normal. 58 (88% among 66 tested) patients had persistent raised serum IgG4 level after excisional biopsy or a course of systemic steroid. 17 (15%) patients had eosinophilia and 16 (15%) patients with history of atopy (i.e. asthma or eczema). 26 (25%) patients had isolated orbital mass, and 11 out of the 17 (65%) with enlarged infraorbital nerves showed ipsilateral maxillary sinus involvement radiologically.

Systemically, 50 (46%) patients had lymphadenopathy and 43 (40%) patients suffered major salivary glands involvement (i.e. Mikulicz disease), 36 (33%) patients showed hepatobiliary, 28 (26%) patients renal and 13 (12%) patients pancreatic involvement. 10 (9%) patients developed lymphoma  $115.4 \pm 137$  month after diagnosis.

**Conclusions:** In this large cohort of biopsy-proven IgG4ROD, the most common presentation was bilateral upper lid swelling due to lacrimal gland involvement while up to one-fourth manifested as isolated orbital mass. 80% of our patients presented with extraorbital involvement, among which half suffered from Mikulicz disease and two-third had at least one visceral organ (liver, biliary system, pancreas, kidney) involved. One-tenth developed lymphoma.

## T12 - IgG4-Related Ophthalmic Disease - Clinical Profile and Outcome

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**Introduction:** IgG4-related ophthalmic disease is a relatively under-diagnosed inflammatory orbital entity that requires specific diagnostic parameters and responds differently to standard therapy. There is a relative paucity of Indian Data for this disease. Purpose of our study was to describe the clinical profile and outcome in patients with IgG4-related ophthalmic disease (IgG4-ROD).

**Methods:** Retrospective, noncomparative interventional case series of 19 consecutive patients with IgG4-ROD. All patients underwent orbitotomy and biopsy with histopathological and immunohistochemical confirmation, serum IgG4 levels and baseline systemic evaluation. Treatment was with 6 pulses of 500 mg intravenous methyl prednisolone (IVMP) and immunomodulation with oral azathioprine or mycophenolate mofetil, and intravenous pulse cyclophosphamide or Rituximab in patients with refractory disease. Treatment success was defined as complete resolution of inflammation or clinically stable partial resolution of inflammation without symptoms.

**Results:** Seven were male and 12 were female, with a mean age of 33 (range, 7-65) years. Presenting features were proptosis (68.4%), swelling (57.9%), restriction of eye movements (31.5%), diminution of vision (15.7%) and pain (15.7%). Two patients had bilateral involvement and 17 patients had unilateral involvement. Lacrimal gland (57.9%), orbit (31.5%), eyelids (15.7%), limbus (5.2%) and sclera (10.5%) were involved. All the patients met histopathological diagnostic criteria. Serum IgG4 levels were raised (>135 mg/dL) in 6 patients (31.6%), and were normal in the rest. Based on the diagnostic criteria, 6 were definite and 13 were probable IgG4-ROD. One patient had systemic manifestation (pancreatitis). Seven patients (36.8%) responded well to six pulses of IVMP, while 4 (21%) required 6-12 additional pulses. Two (10.5%) were treated with intravenous cyclophosphamide and one with intravenous rituximab. Eleven patients (57.9%) received oral azathioprine and 3 (15.7%) received mycophenolate mofetil for a mean of 7 months. Seventeen patients (89.5%) had treatment success, with complete resolution of inflammation in 6 (31.6%) and clinically stable partial resolution of inflammation without symptoms in 11 (57.8%) at a mean follow-up of 16 months.

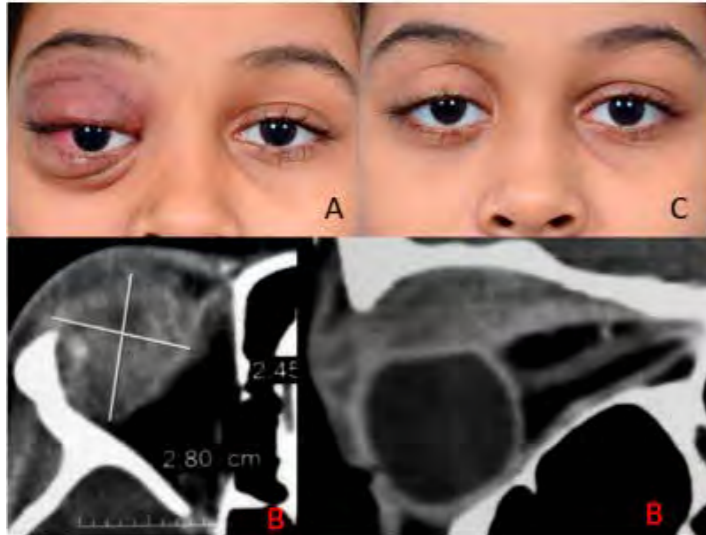
Figure Legend: A) 10-year-old female presented with right eye pain, proptosis, congestion and restriction of eye movements. B) CT scan revealed an isodense irregular orbital mass in the right supero-temporal orbit involving the lacrimal gland, indenting the right eye superiorly. Incision biopsy proved IgG4 related orbital disease. C) She received 12 cycles of intravenous methyl prednisolone and oral Azathioprine, following which she had complete resolution of inflammation with resolution of proptosis at last follow up one year later.

**Conclusions:** IgG4-related ophthalmic disease is complex, with variable response and is often refractory to standard treatment. Differentiation of this entity from other orbital inflammatory conditions using the specific diagnostic criteria, baseline evaluation, followed by customized aggressive immunomodulation seems to be the key to success.

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**Figure 1**



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## T13 - Long-Term Response of Oculofacial Erdheim-Chester Disease to Vemurafenib

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**Introduction:** Erdheim-Chester Disease (ECD) is a rare systemic xanthogranulomatous disease with potentially vision-threatening manifestations. Lesions expressing the BRAF V600E gene mutation may be treated with vemurafenib (BRAF serine-threonine kinase inhibitor) immunotherapy. This report documents the long-term effectiveness of vemurafenib in controlling orbital disease in ECD, as well as an effective approach for patients with hypersensitivity to the drug.

**Methods:** A 63 year old female with history of recent myocardial infarction and two prior cerebrovascular accidents presented to the oculofacial surgeon (NAR) with 3 months right retrobulbar pain. Vision was 20/20 in each eye, but motility was limited in all directions bilaterally. She had 3 mm of right relative proptosis (Figure 1A), with bilateral resistance and tenderness to globe retropulsion. Magnetic resonance imaging (MRI) revealed bilateral enhancing, T1 isointense, T2 hypointense masses within intraconal and extraconal retrobulbar fat (Figure 1B). Histopathology from lateral orbitotomy biopsy revealed a xanthogranulomatous inflammatory infiltration of orbital fat. Macrophages in the biopsy were S100 negative, CD68 positive, and Factor XIIIa positive. Femur X-rays showed ill-defined sclerotic densities in the left distal femur and proximal tibia. Diagnosis of ECD was made based on this patient's clinical history, histopathology, and imaging. A BRAF V600E gene mutation was confirmed on molecular testing of tumor tissue.

**Results:** The patient began taking vemurafenib at 4x120mg twice daily in May 2014. Within weeks, she experienced a serum-sickness-like hypersensitivity with pruritic rash. She briefly discontinued vemurafenib until the hypersensitivity reaction resolved. She was then able to build back to a 240mg twice daily dose over several months, though she required 10-30mg daily oral prednisone during this desensitization period to control refractory femur and orbital pain. Currently 48 months after starting vemurafenib therapy, she remains essentially symptom free from an ophthalmic standpoint. By her report, infrequent flares of retrobulbar discomfort are self-limited and resolve within 1-2 days. Her visual acuity remains stable at 20/20 in each eye, optic nerve function remains normal, and right eye proptosis returned to normal. Radiographic improvement of orbital lesions was modest on repeat MRI 38 months after starting vemurafenib.

**Conclusions:** This case presents the longest documented follow-up of any patient with orbital ECD, controlled with vemurafenib therapy despite initial hypersensitivity to the drug. Presentation may involve proptosis, dysmotility, decreased visual acuity, retrobulbar pain, and optic neuropathy. Management of ECD is accomplished through a combination of corticosteroids with immunotherapy and chemotherapy.<sup>1</sup> Our patient's BRAF V600E gene mutation allowed for additional therapy with vemurafenib. After 4 years, this patient's orbital disease remains essentially quiescent. Although marked radiographic improvement has been reported after starting vemurafenib,<sup>2</sup> our patient's post-treatment imaging showed modest change. Our patient's unique course highlights the importance of a closely coordinated multidisciplinary management team.

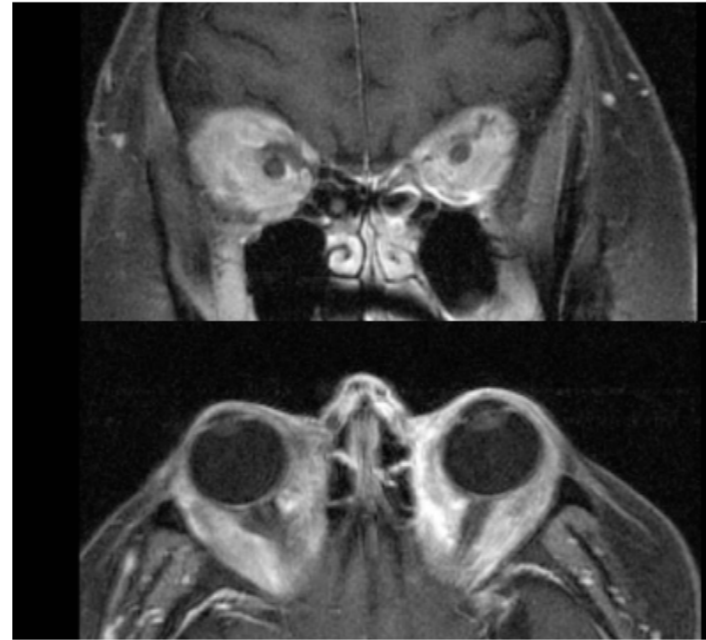
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**Figure 1**



**Figure 2**



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## T14 - Ocular and Systemic Features in 378 Chinese Patients with Blind Microphthalmia and Anophthalmia

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**Introduction:** To document the ocular and systemic findings and hereditary factors in 378 Chinese patients with blind microphthalmia and anophthalmia to gain insight into the underlying ocular developmental etiologies.

**Methods:** This retrospective consecutive case series was conducted at a tertiary referral center. Included in the study were 378 patients with blind microphthalmia and anophthalmia without a recognized syndromic etiology who attended the Beijing Tongren Hospital, Beijing, from 2011-2018. Cases were grouped into microphthalmic and anophthalmic. Both two groups were further subdivided into unilateral and bilateral. Associated ocular and systemic abnormalities and hereditary factors were assessed. Anophthalmic cases were confirmed by CT.

**Results:** Of 378 cases, 334(88.4%) were unilateral microphthalmia, 24 (6.3%) unilateral anophthalmia, 16(4.2%) bilateral microphthalmia and 4 (1.1%) bilateral anophthalmia. 30 (7.9%) had an associated systemic abnormality, most commonly cardiac. 190 (50.3%)cases were male. 149 (39.4%) patients were born in urban. The majority of patients(339, 89.7%) were Han Chinese. Only 31 patients got therapy before came to Beijing Tongren Hospital. 17 (4.5%)patients were premature infant. The average age of mother got baby patients was  $27.11 \pm 4.985$ , and father was  $28.5 \pm 5.146$ . Most of mothers (364, 96.3%) did not smoke. Only 20 mothers(5.3%) drunk sometimes. 112 (29.6%) mothers got sick during pregnancy, most commonly influenza. Cataracts were found in 34 eyes of patients with microphthalmia.

**Conclusions:** This series illustrate ocular and systemic features in Chinese patients with blind microphthalmia and anophthalmia.

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## T15 - Orbital Apex Syndrome: An Institutional Review

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**Introduction:** Orbital apex syndrome is a condition involving damage to cranial nerves III (oculomotor), IV (trochlear), VI (abducens), and V1 (branch of trigeminal), along with optic nerve dysfunction. It is a rarely seen entity even within tertiary care centers, and it has the potential to cause significant lasting impairment. Orbital apex syndrome has many etiologies with treatment for the syndrome being tailored to each specific etiology. The aim of this study was to conduct a review of the cases of orbital apex syndrome seen at a tertiary care hospital since January 1, 2010 in an effort to characterize the etiologies, presentations, and outcomes.

**Methods:** An IRB approved retrospective chart review was performed using ICD-9/ICD-10 diagnostic codes to identify patients diagnosed with orbital apex syndrome over a 7-year time span. Each case was screened for inclusion in the study, and then data was collected from the identified cases in order to evaluate cause, presentation, imaging and pathology findings, treatments, outcomes, and follow-up results.

**Results:** Twenty cases of orbital apex syndrome were found on chart review with the split between right and left eyes even at ten cases each. Categories of etiology included infectious, inflammatory, malignancy, and one case with an unknown cause. The most common etiology was infectious, accounting for 50% of the cases. This was followed by inflammatory and malignancy related etiologies with six and three cases, respectively. Sixty percent of the infectious cases were fungal in origin, and all inflammatory cases were categorized as nonspecific orbital inflammation. The one unknown case was consistent with an inflammatory process based on initial exam; however, the patient was lost to follow-up prior to any diagnosis being documented. Imaging played an important role in diagnosis, with magnetic resonance imaging being the modality of choice in the majority of cases. Presentation varied widely, and over half of the patients presented with a visual acuity of 20/200 or worse. Proptosis, chemosis, and conjunctival injection were the most common external exam findings noted. Final visual acuity had an extensive range, and a significant percentage of patients (35%) ended up with no light perception in the affected eye. All patients presented with motility deficits, while 35% had some residual motility deficit noted on the most recent documented exam.

**Conclusions:** Orbital apex syndrome, although rare, is a serious and potentially life threatening process that can lead to lasting impairment in affected individuals. In particular, our study found that a large percentage of patients suffered significantly decreased final visual acuity. Many patients presented to the tertiary care center with visual acuity that was already substantially decreased, highlighting the rapid progression of the syndrome. Both imaging and pathology played important roles in diagnosis and treatment guidance. Due to the many different possible etiologies of orbital apex syndrome, accurate and timely diagnosis is imperative for effective implementation of appropriate treatment.

## T16 - The Epidemiology of Periocular Malignancies in the California Cancer Registry: A Population-Based Cohort Analysis

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**Introduction:** Healthcare disparities have been demonstrated for some oncologic diseases. The authors describe the incidence and outcomes of malignancies of the orbit, eyelids, and lacrimal system based on race or socioeconomic status.

**Methods:** This is a retrospective population-based cohort study of malignant lacrimal, orbit, and eyelid cancer cases reported to the California Cancer Registry 1/1/1988-12/31/2012 (database excludes basal cell and squamous carcinoma of the skin). Age-standardized incidence rates of all tumors were examined by year of diagnosis, age at diagnosis, patient's race, gender and socioeconomic status. Tumor characteristics including behavior, stage, and histology grade were recorded. 5-year overall and disease-specific survival was stratified for socioeconomic status and race. Survival analysis was performed using the Kaplan-Meier estimate of survival probability and log rank tests.

**Results:** 3987 patients were identified including 447 lacrimal, 1236 orbital, and 2304 eyelid malignancies with an incidence rate of 5.33 (per 1,000,000). Of this cohort, 51.7% were female and 48.3% male. Patients most commonly were over 60 years of age at diagnosis (71.6%) and the majority were white (72.4%). Patients frequently presented with invasive tumors (78.9%), but most of the invasive tumors were only locally invasive (49.5%), compared to regionally (8.1%) or remote (12.9%). Socioeconomic group stratification showed that the highest socioeconomic group had a disproportionate number of cases (28.9%). 52.4% of all patients were in either the high middle or highest socioeconomic status. The lowest proportion of cases was seen in the lowest socioeconomic status at 10.9%. Survival analysis from Kaplan-Meier curves revealed that the 5-year survival was highest in the highest socioeconomic status and lowest in the lowest socioeconomic status ( $p < 0.0001$ ). When compared by race, blacks had the lowest survival rate (68.7%) followed closely by whites (69.4%) and Asian/Pacific Islanders had the highest overall survival (78.5%).

**Conclusions:** In this California-based cohort, malignant lesions of the orbit, lacrimal gland, and eyelids most commonly affected white, older patients (>60) with a higher socioeconomic status. Overall, blacks had the lowest survival rate with the Asian/Pacific Islanders having the highest survival rate. 5-year survival rates directly correlated with socioeconomic status. Malignant tumors also presented the least frequently in the lowest socioeconomic group. These data suggest discrepancies in periocular cancers based on race and socioeconomic status. Access to care may be key and we surmise that low socioeconomic patients face challenges obtaining medical care, resulting in diagnoses going unrecorded or presenting late in the disease course.

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## T17 - Anatomic and Demographic Trends in Squamous and Basal Cell Carcinomas of the Head and Neck in Virginia, 1998 to 2015

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**Introduction:** Keratinocyte cancers - basal cell carcinoma (BCC) and squamous cell carcinoma (SCC) - are the most commonly diagnosed malignancies in fair skinned populations worldwide. An understanding of the relevant anatomy and trends in the demographics of these cancers guides screening and treatment. The objective of this study was to describe the frequency and anatomic location of BCC and SCC lesions on the head and neck, and to examine demographic trends of patients diagnosed with BCC and SCC.

**Methods:** This is a single-center retrospective cohort study examining pathologic diagnoses and anatomy of head or neck skin incisional and excisional biopsies. Demographic data from 8,165 patients were culled from 10,804 pathology reports dated between January 5<sup>th</sup>, 1998 to June 1<sup>st</sup>, 2015. Collection of patient data was HIPAA-compliant and IRB approval was obtained prior to initiation of this study. Data analysis took place between December 1<sup>st</sup>, 2016 to February 28<sup>th</sup>, 2018. Patient demographics; lesion histopathology, anatomy and laterality; and rates of recurrence or incomplete excision were collected, anonymized and analyzed.

**Results:** 5,390 head or neck keratinocyte cancers (3,642 BCC [67%], 1,748 SCC [33%]) from 3,726 patients (2,242 males [60.1%], 1,484 females [39.9%]) were analyzed. The crude incidence (cases per 100,000 person-years) was 29.8 for BCC and 14.1 for SCC. Median [95% CI] age (y) was higher for SCC vs. BCC (73.8 [73.2-74.4, n = 1,256] vs. 71.3 [70.6-72.1, n = 2,645] p < 0.01, Mann-Whitney test). Per year, there was a statistically significant increase in the median (linear regression, significant non-zero positive slope, p < 0.05 for BCC and SCC) and mean age of first diagnosis (slope: SCC = 0.31, p < 0.01, BCC = 0.35, p < 0.01, ANOVA post-test for linear trend). Recurrences and incomplete excisions (R/IE) were more frequent for SCC vs. BCC (6.6 vs. 3.6%, p < 0.01) and were statistically more common in men (7.7 vs 3.5%, p < 0.01, Fisher's Exact Test). Excluding recurrences and incomplete excisions, the relative tumor density (RTD [CI]) of BCC was highest on the nose (8.00 [6.58-9.73]), cheek (5.66 [4.64-6.92]) and forehead (4.73 [3.86-5.80]); for SCC, RTD was highest on the nose (3.73 [2.76-5.04]), cheek (7.14 [5.38-9.50]) and forehead (4.18 [3.11-5.63]). BCC-to-SCC ratio [CI] was highest on the eyelid (2.39 [1.49-3.76]) and lowest on the scalp (0.35 [0.26-0.47]). Temple, ear and neck SCC were more frequent in men; nose and cheek SCC were more frequent in women. For BCC, scalp, temple and ear lesions showed male predominance, while brow, cheek, nose and chin lesions showed female predominance (p < 0.05 for all gender analyses, Fisher's Exact Test). Scalp, eyelid and neck BCC occurred more frequently in younger quartile patients and ear BCC was more common in older quartile patients. SCC of the temple and lip were more frequent in younger patients while chin SCC was more common in older patients (p < 0.05 for all age quartile analyses, Chi Squared Test). With respect to lesion laterality, left ear SCC and BCC were more common (p < 0.05, Fisher's Exact Test).

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**Conclusions:** This large cohort study examines demographic and anatomic features of head and neck keratinocyte cancers diagnosed at a single tertiary care center in Virginia. There was a trend toward increasing age of first diagnosis of both SCC and BCC. R/IE was more frequent for SCC than for BCC. There were anatomic, gender, and age specific differences in the anatomic distribution that comport with patterns of solar ultraviolet light exposure.

Figure 1

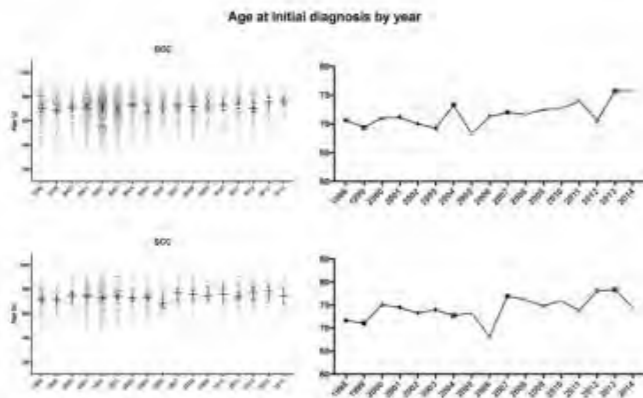


Figure 1. Left graphs show scatter plot of age at initial diagnosis, year over year, for SCC and BCC, demonstrating age of first diagnosis (bars represent median with 95% confidence intervals). There was a statistically significant difference between median age at diagnosis for both SCC and BCC, Kruskal-Wallis test,  $p < 0.01$  for both SCC and BCC. Right graphs show medians on a compressed Y-axis scale to highlight the upward trend. Linear regression of the medians revealed positive, significantly non-zero slopes for both BCC and SCC ( $p < 0.05$  for both analyses).

Figure 2

Location	SA (%)	BCC		SCC		
		No. (%) [95% CI]	RTD (95% CI)	No. (%) [95% CI]	RTD (95% CI)	
Scalp	48.2	87 (2.7) (1.85-3.9)	6.86 (6.28-7.47)	144 (4.7) (4.07-5.44)	8.77 (8.24-9.3)	8.37 (8.35-8.41)
Face	37.8	107 (3.28) (2.71-3.92)	5.79 (5.18-6.43)	197 (3.3) (3.11-3.50)	5.17 (4.91-5.43)	6.84 (6.68-6.97)
Forehead	28.8	383 (9.47) (8.48-10.5)	7.81 (7.36-8.27)	198 (3.4) (3.17-3.63)	3.89 (3.61-4.17)	1.31 (1.27-1.35)
Temple	2.8	164 (4.1) (3.51-4.7)	4.71 (4.34-5.08)	113 (1.9) (1.74-2.07)	4.28 (4.11-4.45)	1.51 (1.47-1.55)
Brow	2.0	162 (4.1) (3.51-4.7)	3.71 (3.34-4.08)	118 (2.0) (1.83-2.19)	2.76 (2.6-2.92)	2.76 (2.71-2.81)
Eye	2.0	46 (1.2) (0.8-1.7)	1.11 (0.83-1.39)	111 (1.9) (1.74-2.07)	4.08 (3.91-4.25)	2.85 (2.79-2.91)
Orbit	2.0	22 (0.5) (0.3-0.7)	0.53 (0.38-0.68)	44 (0.8) (0.65-0.95)	3.88 (3.68-4.07)	1.86 (1.81-1.91)
Orbit	2.0	164 (4.1) (3.51-4.7)	4.71 (4.34-5.08)	113 (1.9) (1.74-2.07)	4.28 (4.11-4.45)	1.51 (1.47-1.55)
Periorbital	1.8	17 (0.4) (0.2-0.6)	0.43 (0.28-0.58)	17 (0.3) (0.2-0.4)	1.81 (1.65-1.97)	1.47 (1.42-1.51)
Nose	2.0	164 (4.1) (3.51-4.7)	4.71 (4.34-5.08)	113 (1.9) (1.74-2.07)	4.28 (4.11-4.45)	1.51 (1.47-1.55)
Lip	2.0	164 (4.1) (3.51-4.7)	4.71 (4.34-5.08)	113 (1.9) (1.74-2.07)	4.28 (4.11-4.45)	1.51 (1.47-1.55)
Chin	2.0	164 (4.1) (3.51-4.7)	4.71 (4.34-5.08)	113 (1.9) (1.74-2.07)	4.28 (4.11-4.45)	1.51 (1.47-1.55)
Neck	27.8	27 (0.6) (0.4-0.7)	0.73 (0.58-0.88)	177 (3.0) (2.75-3.2)	4.39 (4.23-4.55)	6.64 (6.54-6.77)
Total	100.0	3581	1774			

Table 1. Number, frequency and relative tumor densities of BCC and SCC at various anatomic locations. Incompletely assessed lesions were excluded from this analysis. 95% confidence intervals (95% CI) are shown.  
 \*Surface area (SA) are shown as percentage of total surface area of the head and neck.  
 †Relative tumor density (RTD).  
 ‡includes 18 anatomic post-auricular regions.

Figure 3

Exposure	SA (%)	BCC		SCC		
		No. (%) [95% CI]	RTD (95% CI)	No. (%) [95% CI]	RTD (95% CI)	
High	13.7	2887 (9.38) (8.41-10.4)	4.99 (4.75-5.24)	948 (16.28) (15.91-16.63)	4.82 (4.55-5.06)	1.82 (1.81-1.83)
Moderate	15.8	1413 (38.2) (36.78-39.7)	1.76 (1.61-1.91)	484 (8.4) (8.26-8.54)	1.76 (1.55-1.97)	1.89 (1.84-1.93)
Low	3.3	244 (6.8) (6.33-7.27)	2.97 (2.67-3.26)	46 (0.8) (0.75-0.85)	0.81 (0.55-1.07)	2.56 (1.66-4.02)
Other	67.2	319 (8.9) (8.03-9.86)	6.13 (5.32-6.94)	238 (4.2) (3.93-4.49)	0.31 (0.18-0.54)	8.44 (6.54-10.77)
Total	100.0	3861	1774			

Table 2. Number, frequency and relative tumor densities of BCC and SCC at anatomic locations classified by sun exposure. Surface area (SA) are shown as percentage of total surface area of the head and neck. Incompletely assessed lesions were excluded from this analysis. 95% confidence intervals (95% CI) are shown. High = ears, nose, cheek (excluding nasolabial fold) and lips; moderate = chin, jaw, forehead, temple, post-auricular regions, and brow; low = axilla and nasolabial fold; other = scalp and neck.

Figure 4

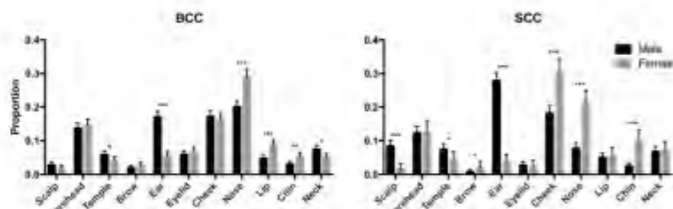


Figure 4. Gender-specific patterns in the incidence of keratinocyte cancer. Left panel shows BCC lesions and right panel shows SCC. Error bars represent 95% confidence intervals. Statistical significance is denoted by asterisks: \* =  $p < 0.05$ , \*\* =  $p < 0.01$ , \*\*\* =  $p < 0.001$ , Fisher's exact test.

Figure 5

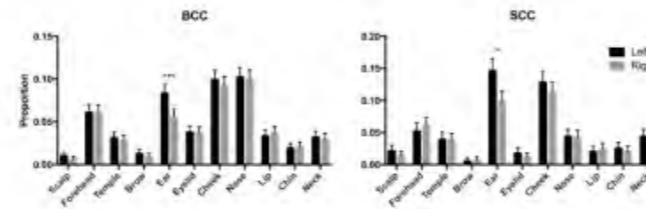


Figure 5. Laterality patterns in the incidence of keratinocyte cancer. Left panel shows BCC lesions and right panel shows SCC. Left ear and peri-auricular lesions were more common for both BCC and SCC. Error bars represent 95% confidence intervals. Statistical significance is denoted by asterisks: \* =  $p < 0.05$ , \*\*\* =  $p < 0.001$ , Fisher's exact test.

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## T18 - National Cancer Database (NCDB) Characterization of Sebaceous Adenocarcinoma

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**Introduction:** The factors that prognosticate survival in patients with sebaceous adenocarcinoma are not well characterized. We sought first to determine if there exists a difference in survival between patients with adenocarcinoma of the eyelid versus other head and neck sites, and second, to evaluate factors that prognosticate survival in patients with sebaceous adenocarcinoma of the eyelid.

**Methods:** A retrospective cohort study was performed using the National Cancer Database to query for cases of sebaceous adenocarcinoma with known vital status at point of last contact from January 1, 2010 to December 31, 2014. The National Cancer Database is a collaborative effort of the American Cancer Society and the Commission on Cancer of the American College of Surgeons containing 70% of the new cancer diagnoses made in the United States from more than 1500 Commission on Cancer accredited national cancer programs. Histology code (8410) was used to identify sebaceous adenocarcinoma lesions and site codes (C440-C444) were used to identify lesions located in the head and neck region. Patients were divided into two groups based on location of tumor: eyelid and extraocular.  $\chi^2$  analysis was performed to compare demographics between these two groups. Kaplan-Meier analysis and cox-regression was performed to identify any differences in survival between the two groups. Factors that prognosticated survival were evaluated for patients with tumors of the eyelid using cox-regression and Kaplan-Meier analysis.

**Results:** 1128 cases met inclusion criteria, of which 50.7% were located on the eyelid. Females were more likely to have tumors located on the eyelid (57.7%) compared to men (42.3%) ( $p < 0.0001$ ). Statistically significant differences were noted between patients with tumors of the eyelid and all other head and neck sites with regards to tumor grade, size of lesion, time from diagnosis to treatment, T stage, and overall clinical stage according to American Joint Committee on Cancer (AJCC) guidelines (**Figure 1**). There was no difference in overall survival between the two groups (HR 0.99; 95% confidence interval (CI), 0.96-1.24) (**Figure 2**). Among patients with tumors of the eyelid, 95.6% underwent surgery. The following were evaluated on cox-hazards regression to assess for survival: gender, race, tumor grade, overall clinical stage, patient age, patient comorbidities, tumor size, and time from diagnosis to surgery. On multivariate regression, Caucasian ethnicity (HR 1.84; 95% CI 1.01-3.35), overall AJCC clinical stage 3 (HR 6.43; 95% CI 1.31-31.63) and 4 (HR 16.98; 95% CI 1.90-151.81), age greater than 75 (HR 3.98; 95% CI 2.76-5.73), and less than 10 days between diagnosis and treatment (HR 1.44; 95% CI 1.02-2.01) were associated with worse survival outcomes. The average time of survival for patients with AJCC stage 4 disease was  $9.71 \pm 1.19$  (SD) months.

**Conclusions:** There is no difference in survival outcomes between patients with sebaceous adenocarcinoma of the eyelid versus sebaceous adenocarcinoma at other head and neck sites. In patients with sebaceous adenocarcinoma of the eyelid, Caucasian ethnicity, clinical stage 3 or 4, age greater than 75, and a shorter time from diagnosis to treatment were all factors that prognosticated poorer patient survival.

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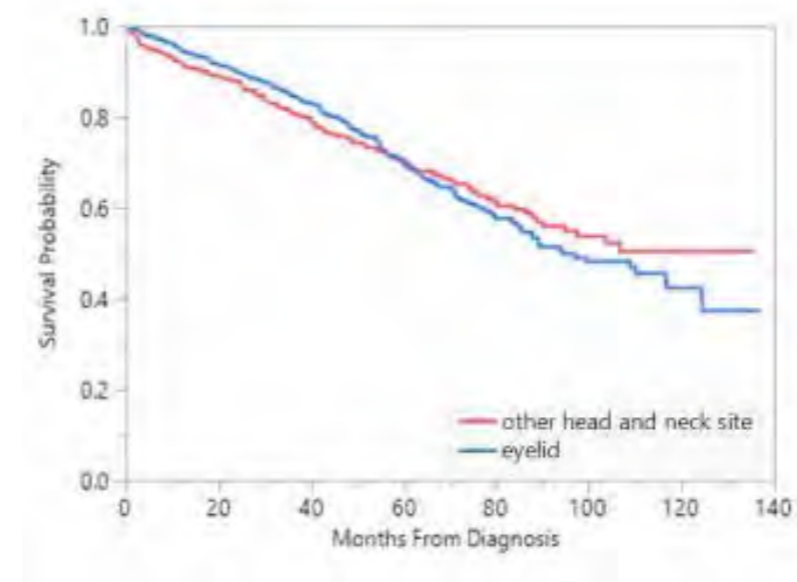


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Figure 1

	Other head and neck site (n=556)	Eyelid (n=572)	P value
<b>Sex</b>			
Male	340 (61.2%)	342 (43.3%)	<0.0001
Female	216 (38.8%)	330 (57.7%)	
<b>Race</b>			
Caucasian	448 (80.6%)	453 (79.2%)	0.603
Non-Caucasian	108 (19.4%)	119 (20.8%)	
<b>Grade</b>			
1	88 (15.8%)	28 (4.9%)	<0.0001
2	34 (6.1%)	69 (12.1%)	
≥3 or unknown	434 (78.1%)	475 (83.0%)	
<b>Age</b>			
< 75	339 (61.0%)	316 (55.2%)	0.054
≥75	217 (39.0%)	256 (44.8%)	
<b>Tumor Size</b>			
< 10 cm	199 (35.8%)	153 (26.7%)	<0.0001
≥ 10 cm	151 (27.2%)	117 (20.4%)	
Not recorded	206 (40.7%)	302 (52.9%)	
<b>Time from diagnosis to surgery</b>			
≤10 days	334 (65.5%)	303 (57.9%)	0.013
>10 days	176 (34.5%)	220 (42.1%)	
<b>AJCC T stage</b>			
Tx	0 (0%)	2 (1.3%)	0.002
T1	234 (77.5%)	110 (70.1%)	
T2	47 (15.6%)	18 (11.5%)	
T3	5 (1.6%)	10 (6.4%)	
T4	16 (5.3%)	17 (10.8%)	
<b>AJCC overall stage</b>			
X	258 (46.4%)	434 (75.8%)	<0.0001
1	233 (41.9%)	108 (18.9%)	
2	40 (7.2%)	22 (3.8%)	
3	19 (3.4%)	6 (1.0%)	
4	6 (1.1%)	2 (0.3%)	
<b>Number of comorbidities</b>			
0	468 (84.2%)	495 (86.5%)	0.529
1	68 (12.2%)	60 (10.5%)	
≥2	20 (3.6%)	17 (3.0%)	
<b>Nodal involvement</b>			
Present	366 (65.8%)	272 (47.5%)	0.657
None	11 (2.9%)	7 (2.5%)	

Figure 2



## T19 - Using Precision Medicine to Further Characterize Sebaceous Carcinoma of the Orbit

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**Introduction:** Sebaceous carcinoma is a rare cutaneous malignancy. It most commonly presents periorbitally, and represents about 1% of periorbital malignancies in the United States.<sup>1</sup> The pathogenesis is poorly understood, and the disease is characterized by metastatic spread and high rates of recurrence, even after excision.<sup>2</sup> With the increasing availability of molecular technology such as next-generation sequencing, precision medicine is becoming a rising paradigm in oncology. Here, we describe two cases of periocular sebaceous carcinoma who were managed with surgical excision and reconstruction, sentinel lymph node biopsy, and chemotherapy. They also underwent next-generation tumor sequencing to identify potential targets for therapy.

**Methods:** This is a retrospective case report of two patients.

**Results:** A 66-year-old female who presented with bloody epiphora and left upper lid swelling. She has a past medical history of bilateral breast cancer and endometrial cancer. Her examination revealed a papillomatous lesion in the temporal region of the tarsal conjunctiva of her left upper lid. A biopsy of the lesion revealed sebaceous carcinoma, and MAP biopsy showed tumor diffusely in the left upper lid and area over the lacrimal gland. A PET-CT showed nonspecific activity in the cervical lymph nodes, but no distant metastases. Sentinel node biopsy revealed one positive node. Radical neck dissection and left parotidectomy showed metastases including extracapsular extension, lymphovascular space invasion, and tumor deposition in vessels. The lesion was excised with wide excision and closed with Cutler Beard reconstruction in two stages. The patient underwent adjuvant chemoradiation therapy with cisplatin and external beam radiation. Molecular sequencing of the tumor revealed a nonsense mutation in RAD51C gene, missense mutations in the TP53 genes, and deletions in the CREBBP and RB1 genes.

A 68-year-old male presented with a left upper eyelid lesion. The patient reported that the lesion had been present for years and has been draining for the past few months. On examination, the lesion was a papillomatous lesion at the medial lateral canthus associated with eyelash loss. A biopsy of the lesion revealed sebaceous carcinoma, and MAP biopsy showed extension into the upper lid conjunctiva and upper eyelid. PET-CT, sentinel node biopsy, and lacrimal gland biopsy were negative. The patient proceeded with MOHs excision and composite graft reconstruction. He received four rounds of topical mitomycin C. Gene sequencing of the tumor found a missense variant mutation in TP53.

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**Conclusions:** Sebaceous carcinoma is a rare, aggressive cancer that commonly metastasizes and locally recurs. This case report reviews two cases of sebaceous carcinoma that were surgically and medically managed. Our first case had a positive sentinel node biopsy, which appears to be the third case of positive node identification to our knowledge.<sup>3</sup> Both patients underwent molecular sequencing of their tumors, although they revealed mutations that currently do not have targeted therapies. Given the rarity of this tumor however, sequencing these tumors may help lead to precision cancer medicine. In the future, identifying mutations of these rare tumors through precision medicine may provide better understanding of their pathogenesis as well as better, more targeted treatment options.

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## T20 - Outcomes of Frontotemporal Orbitozygomatic Craniotomy for Multidisciplinary Resection of Spheno-Orbital Meningiomas

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**Introduction:** Advances in surgical approaches have improved access for total or near total resection of spheno-orbital meningiomas. The frontotemporal orbitozygomatic (FTOZ) craniotomy is a standard technique for skull base tumors. Herein, we evaluate the outcomes of this multidisciplinary approach at a single institution.

**Methods:** A retrospective chart review was performed of all patients with spheno-orbital meningioma who underwent joint neurosurgical and orbital resection via FTOZ craniotomy between June 2012 and December 2017. Demographic data, clinical presentations, risk factors for meningioma, histopathological findings, post-operative outcomes and surgical complications were reviewed. The outcome measures assessed included visual acuity, pupillary function, proptosis and ocular motility. The paired t-test was used to compare within-subject means. McNemar's test was used to compare within-subject proportions.

**Results:** Twenty-three patients were identified having had FTOZ craniotomy for spheno-orbital meningioma (Table). A mean follow-up of  $23.9 \pm 20.4$  months (range 1 - 60) was achieved. The mean age of patients at presentation was  $54.0 \pm 15.6$  years (range 32-80) with a female to male ratio of 4.8:1. There were 17 patients who underwent primary resection and 6 patients who had prior resection elsewhere. The main presenting complaints were proptosis (83%), reduced vision (13%), headache (9%) and seizure (9%). Of the 23 patients, 4 patients had risk factors for meningioma: cranial radiation (2), family history (1) and breast cancer (1). Gross total resection was performed in five patients (22%) while near total or sub-total resection was performed in the remainder. Histologic analysis revealed WHO grade I meningioma in 70% of tumors, grade II in 26% and grade III in 4%. Mean visual acuity (decimal) was  $0.76 \pm 0.23$  pre-operatively and  $0.87 \pm 0.17$  post-operatively ( $p=0.119$ ). An afferent pupillary defect was found in 55% of patients prior to surgery, and 25% after surgery ( $p=0.041$ ). Surgery improved proptosis, with a change in mean Hertel exophthalmometry from  $23.0 \pm 3.8$  mm to  $18.0 \pm 4.3$  mm ( $p<0.001$ ). Among the 8 patients with ocular motility measurements available for review, a deficit was found in 38% before surgery and 24% after surgery ( $p=0.099$ ); 5 of 8 patients with a pre-operative ocular motility deficit had resolution while 1 patient developed a deficit post-operatively. Temporalis muscle atrophy (13%) and blepharoptosis (13%) were observed after surgery. Twelve patients required postoperative fractionated radiotherapy. Tumor recurrence was observed in two (8.7%) patients with one requiring repeat resection. No mortality was recorded.

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**Conclusions:** Frontotemporal orbitozygomatic craniotomy for resection of speno-orbitalmeningioma is a safe and effective means of tumor removal. It has favourable outcomes with regard to relieving optic neuropathy and improving proptosis, while preserving visual acuity and ocular motility.

Figure 1

Table: Demographic and Clinical Characteristics of Patients

Patient	Age (years)	Sex	Presenting Complaint	Pre-operative Visual acuity	Type of Resection	WHO Grade	Additional Radiotherapy	Post-operative Visual Acuity	Late Complications	Recurrence
1	35F	Right	Proptosis	20/20	GTR	I	No	20/20	Exophthalmos	No
2	36F	Left	Headache	20/25	NTR	II	Yes	20/20	None	No
3	40F	Left	Headache	NLP	STR	I	No	NLP	None	No
4	31F	Right	Proptosis	20/20	GTR	I	No	20/20	None	No
5	37F	Right	Reduced vision	20/40	GTR	I	No	20/20	Temporalis muscle atrophy	No
6	40F	Right	Proptosis	20/200	STR	I	No	20/20	None	Yes
7	31F	Right	Proptosis	20/30	GTR	I	No	20/25	Temporalis muscle atrophy	No
8	43F	Left	Proptosis	20/40	GTR	I	No	20/20	Headache/fatigue	No
9	48M	Left	Proptosis	20/30	NTR	II	Yes	20/20	None	No
10	31F	Right	Reduced vision	20/50	NTR	I	Yes	20/30	None	No
11	49F	Right	Proptosis	20/20	NTR	I	No	20/30	None	No
12	32F	Left	Proptosis	20/20	STR	I	Yes	20/40	CN IV palsy, Temporalis muscle atrophy, Exophthalmos	No
13	36F	Left	Proptosis	20/20	NTR	I	Yes	20/20	None	No
14	44F	Right	Proptosis	20/30	NTR	I	Yes	20/20	None	No
15	20M	Left	Proptosis	20/20	STR	I	Yes	20/20	Exophthalmos	No
16	31F	Left	Proptosis, Seizure	NLP	STR	I	Yes	NLP	None	No
17	34F	Left	Proptosis, Seizure	HM	STR	I	No	HM	None	Yes
18	28M	Left	Proptosis	20/20	STR	II	Yes	20/20	None	No
19	29F	Right	Proptosis, Headache	LP	GTR	I	No	20/30	None	No
20	33F	Right	Proptosis	20/20	GTR	II	No	20/20	None	No
21	35M	Right	Proptosis	20/25	NTR	II	Yes	20/25	None	No
22	29F	Left	Proptosis	20/40	GTR	II	Yes	20/30	None	No
23	36F	Right	Proptosis	20/40	GTR	II	Yes	20/30	None	No

HM: Head Motion, LP: Light Perception, NLP: No Light Perception, GTR: Gross Total Resection, NTR: Near Total Resection, STR: Sub-Total Resection

Figure 1

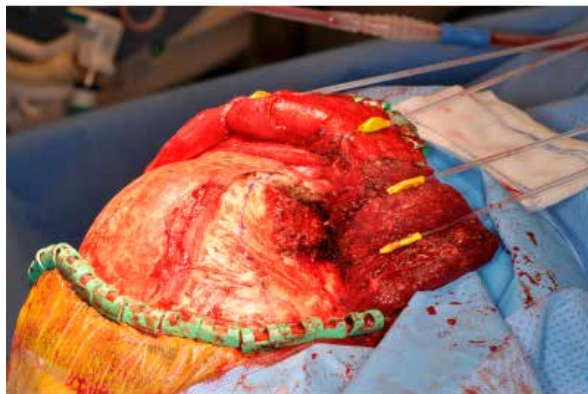


Figure 2

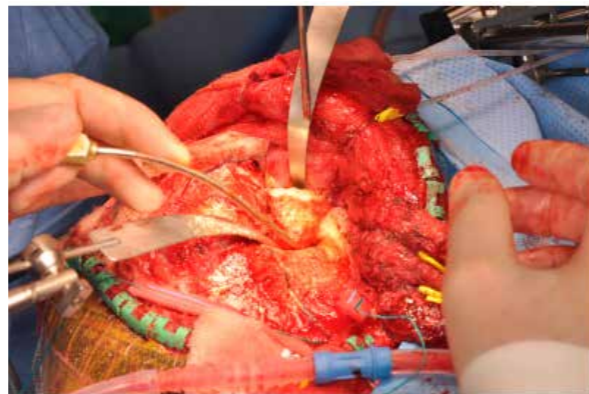


Figure 3

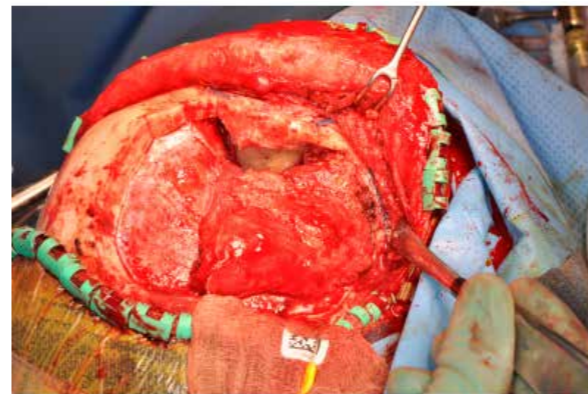
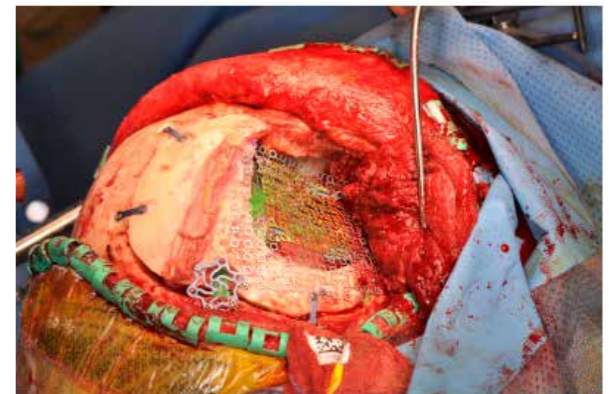


Figure 4



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## T21 - Rodent Xenograft Model of Lacrimal Gland Adenoid Cystic Carcinoma

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**Introduction:** Lacrimal gland adenoid cystic carcinoma (LGACC) is the most common malignant epithelial tumor of the lacrimal gland with a poor prognosis.<sup>1</sup> In previous studies, patient-derived xenograft models of salivary gland ACC served an important role in the genomic characterization of ACC with identification of potential targets associated with tumor progression.<sup>2-3</sup> We sought to establish our own mouse xenograft model to investigate the pathways involved in the oncogenesis and progression of LGACC, as well as to identify new therapeutic targets in its treatment.

**Methods:** Harvested human LGACC cells were propagated in tissue cultures and injected into the flank of immunocompromised NSG mice. Normal saline was injected in the same fashion in the control group. The weight of the mice was recorded weekly. Twelve weeks later, the mice harboring the tumors were euthanized and the tumor mass removed for histologic and immunohistochemical analysis.

**Results:** The LGACC tumor xenograft model was established from three different cells lines. The mice with tumors became cachectic with decreasing weight. Histopathological analysis of the xenograft was consistent with LGACC. Immunohistochemical analysis revealed that the representative molecular markers of LGACC including E-CAD, N-CAD, KI67, C-MYB, Ck-5, Ck-8, GATA4, and human mitochondria expressions were positive in the harvested xenograft tissue.

**Conclusions:** Propagation of human LGACC in immunocompromised mice generated a tumor xenograft with histopathological and molecular properties similar to human LGACC. Our results highlight the ability to create an animal model for LGACC, which will have wide-ranging implications in future *in vivo* and preclinical studies.

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## T22 - Presentation and Management of Rare Endocrine Mucin Producing Sweat Carcinoma - Multicenter Case Series

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**Introduction:** To report the presentation and histological features of sixteen patients with endocrine mucin-producing sweat gland carcinoma (EMPSGC) involving the eyelid. Our case series aims to further characterize the clinical and histological presentation as well as management of this underreported malignancy.

**Methods:** A multicenter retrospective chart review of sixteen patients with a diagnosis of EMPSGC from nine institutions

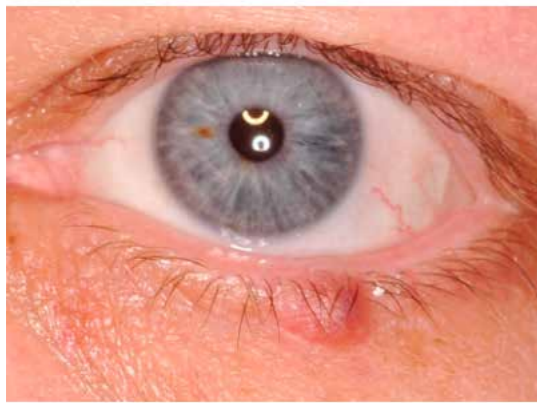
**Results:** Eight were male, eight female. The mean age at initial presentation was 65-years-old. Presentation ranged from a painful, rapidly progressive growth (Fig. 1), slowly progressive nodules (Fig. 2), mild irritation, to an asymptomatic lesion. All the lesions were described as either red or skin colored. H&E slides showed nests of cells with pseudopapillary arrangement surrounding a cystic space. Extracellular mucin was seen within the cystic spaces between tumor cells (Fig 3). All patients had immunohistochemical staining performed, some of which included cytokeratin 7, synaptophysin, chromogranin, progesterone and/or estrogen receptor, smooth muscle actin, CD 56 or 57, S100, cytokeratin 20, and neuron specific enolase. The majority of the patients showed positivity for cytokeratin 7 (Fig. 4A), synaptophysin (cytoplasmic staining; Fig 4B), and progesterone receptor (nuclear staining; Fig. 4C). Smooth muscle actin (SMA) highlighted myoepithelial cells surrounding the large lobules of the in-situ component (Fig. 4D). Management in eight of sixteen patients included complete resection by slow Mohs surgery to achieve negative margins followed by reconstruction. The remainder underwent conventional surgical excision with confirmed negative margins. Three of the 16 patients had systemic work up, including colonoscopy, and imaging of head, neck, chest, and abdomen; all such testing was negative. Four of the 6 female patients had a mammogram ordered following diagnosis or had a current negative study on file.

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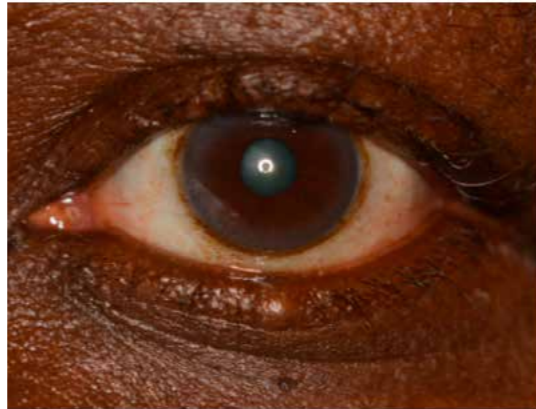
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**Conclusions:** This cohort of sixteen patients with EMPSGC and seven with features of invasive mucinous carcinoma provides information on under-recognized entity. These sixteen cases present with cystic or nodular appearing lesions of lower lid, consistent with other case series.<sup>1</sup> Our case series demonstrates EMPSGC with invasive mucinous carcinoma showed a more rapid onset and painful progression compared to EMPSGC alone. Due to the malignant potential of invasive mucinous carcinoma, colonoscopy, imaging of head, neck, chest, and abdomen has been recommended.<sup>2</sup> Many cases in this multicenter study did not undergo recommended systemic evaluation. Reasons for this are unclear. Early detection and appropriate management are critical to achieve best outcomes with this rare eyelid malignancy.

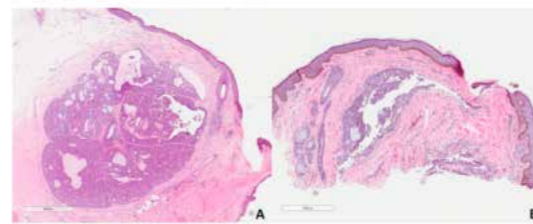
**Figure 1**



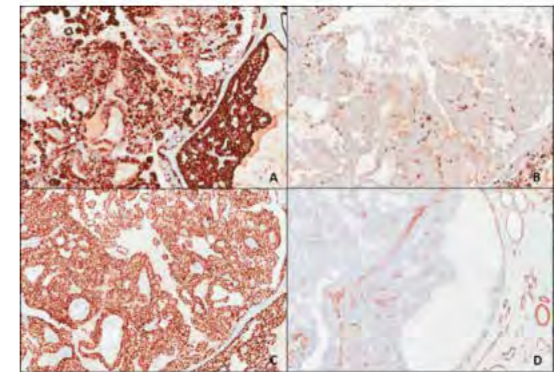
**Figure 2**



**Figure 3**



**Figure 4**



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## T23 - Orbital Myeloid Sarcoma in Children: A Case Series

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**Introduction:** Myeloid Sarcoma (MS), also known as chloroma, is a rare acute myeloid leukemia (AML) tumor found in the orbit<sup>1</sup>. Fewer than two hundred cases have been reported over the last century<sup>1-3</sup>. We present three cases of orbital MS with unique presentations at our institution over the past decade.

**Methods:** Three patients, ages 6 months to 8 years, presented with acute onset proptosis following upper respiratory infection. Imaging studies included Computed Tomography, Magnetic Resonance Imaging, and bone scans. Bone marrow biopsy and biopsy of the orbital mass, including adjacent bony fragments, were performed. Tissues were examined for histological markers and chromosome abnormalities. Lumbar punctures were completed to determine central nervous systems (CNS) spread. Complete ophthalmic exams were performed on presentation and throughout the treatment.

**Results:** Two patients had bilateral orbital masses with osseous proliferation at the apex concerning for optic nerve impingement. Bone marrow biopsy in these patients showed abnormal blast population commonly expressing CD33, CD38, CD56, and CD71. These cells were commonly negative for CD8, CD14, CD16, CD19, CD20, TdT and myeloperoxidase. A patient with AML M4-5 showed approximately 10% of nuclei having three copies of MYC at 8q24.1 and RUNX1T1 at 8q22. Another patient with AML M7 showed add (11)(q23) but with intact MLL gene. The third patient had unilateral mass with scalloping of the left superior and lateral aspects of the orbital wall. Tissue biopsies from the greater wing of sphenoid bone and the orbital tumor showed cells expressing CD34, CD43, CD45, myeloperoxidase, WT-1 and FLI-1. Cytogenetic analysis was limited by the process used in fixation. Bone marrow biopsy was negative for any leukemic processes. In this patient, a lateral upper eyelid skin crease approach was used to reveal the inner aspect of the lateral perisoteal rim with subsequent identification of a thick white fibrous tissue in the orbit. Two patients were determined to have CNS involvement. No extramedullary metastasis other than the skull was found on bone scan in all patients. Three patients received topical intraocular pressure (IOP) lowering drops. They also received topical dexamethasone eye drops per chemotherapy protocol. One patient had bilateral trace optic nerve pallor on presentation but resolved within 3 months. Excellent visual acuity with normal intraocular exam was maintained in all patients at 7 months on average. Two patients were treated under AAML 1031 protocol standard arm while one patient received AAML 0531 protocol standard arm. Improvements in the size of orbital mass and osseous infiltrations were found after induction chemotherapy. Two patients achieved remission state at 5 months on average. One patient died after multiple relapses despite aggressive chemotherapy and bone marrow transplant within 2 years.

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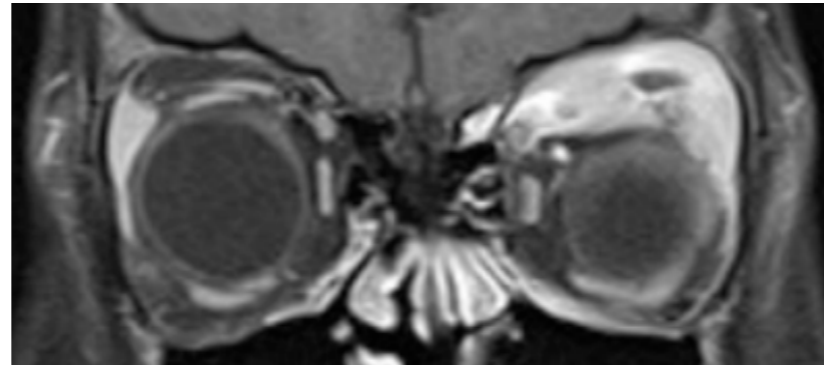
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**Conclusions:** This study adds to growing evidence for bilateral proptosis as an initial presentation in orbital MS. This is the first reported case of orbital MS found in the sphenoid bone with negative bone marrow findings. Topical IOP lowering drops may be indicated in acute proptosis from orbital MS and while on steroid drops during chemotherapy.

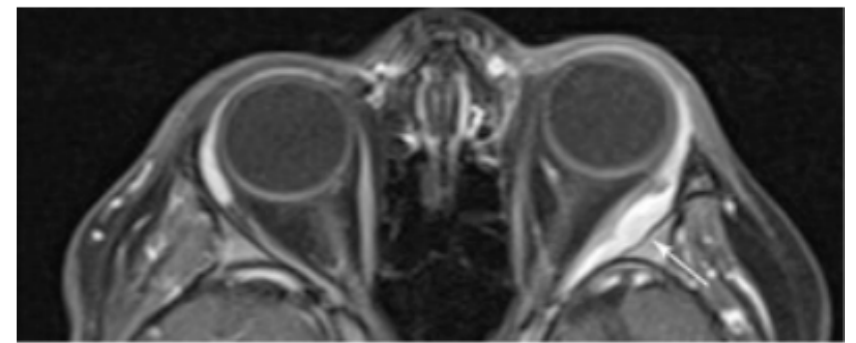
**Figure 1**



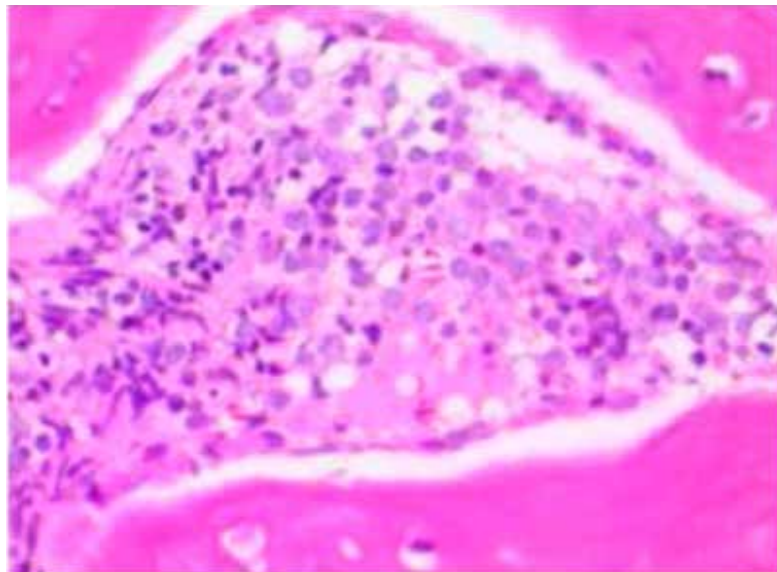
**Figure 2**



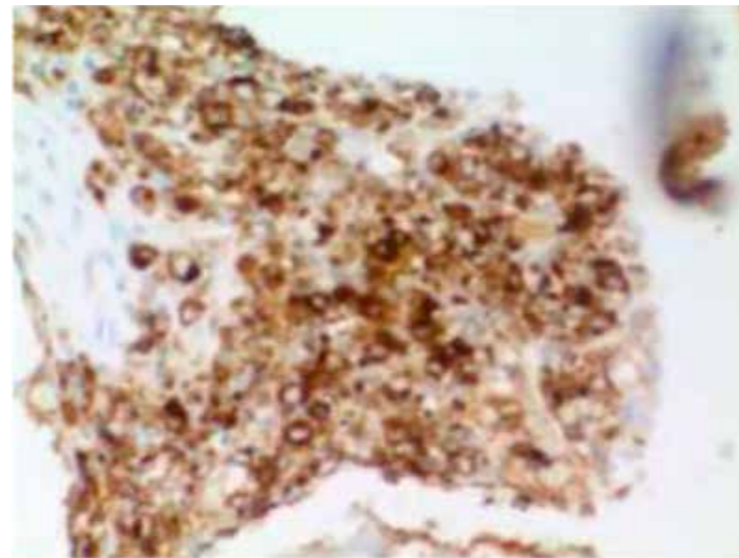
**Figure 3**



**Figure 4**



**Figure 5**



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## T24 - Imaging Findings in Agenesis of the Lacrimal and Salivary Glands (ALSG)

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**Introduction:** Agenesis of the lacrimal and salivary glands (ALSG) is an autosomal dominant disorder associated with mutations in the fibroblast growth factor 10 (FGF10) gene.<sup>1,2</sup> ALSG has variable expressivity, and the clinical findings include both lacrimal outflow abnormalities and aplasia or hypoplasia of the parotid, submandibular, sublingual, and lacrimal glands.<sup>1</sup> The purpose of this report is to describe the imaging findings in a patient with ALSG.

**Methods:** Case Report

**Results:** A 30-year-old patient presented with a chief complaint of a “blocked tear duct” bilaterally resulting in ocular irritation and discharge. The patient reported that for decades, he was unable to make tears or saliva and that he lost all of his teeth by the age of 20 years. The patient noted that his mother, sister, and nephew all had similar findings. Schirmer testing revealed 0 mm of wetting bilaterally. Palpation of the lacrimal sac showed a dacryocystocele with reflux bilaterally. ALSG was suspected, and computed tomography (CT) maxillofacial was ordered as part of the work up. Imaging (figures) demonstrated complete absence of the lacrimal and major salivary glands. In addition, the patient was edentulous, and there was a bony obstruction of the nasolacrimal duct with dacryocystoceles. The patient elected to undergo bilateral dacryocystectomies, which alleviated his symptoms.

**Conclusions:** FGF10-related disorders include ALSG (OMIM 180920) and lacrimoauriculodentodigital syndrome (LADD; OMIM 149730).<sup>1-3</sup> Patients affected by ALSG present with hypoplasia or aplasia of the lacrimal and salivary glands and ducts.<sup>4</sup> From the absence of lacrimal glands, symptoms may include ocular irritation and recurrent eye infections.<sup>4</sup> Patients with NLDO may also note increased ocular irritation and discharge, which is optimally treated with dacryocystectomy.<sup>3,4</sup> The absence of the salivary glands can lead to dental caries and dental erosions.<sup>4</sup> The patient described satisfies the clinical criteria associated with ALSG, and the imaging findings demonstrate absent lacrimal and salivary glands, lack of teeth, and nasolacrimal duct obstruction.

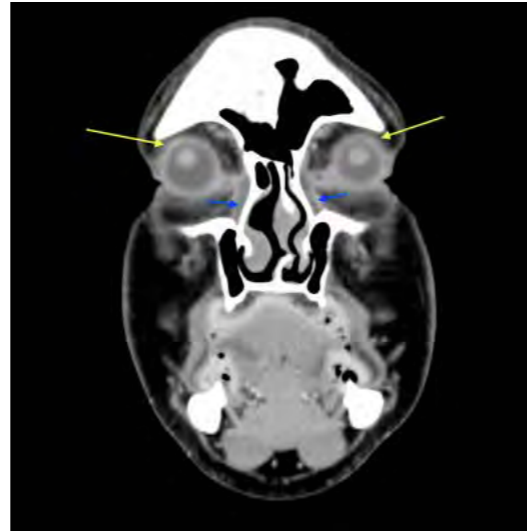
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**Figure 1**



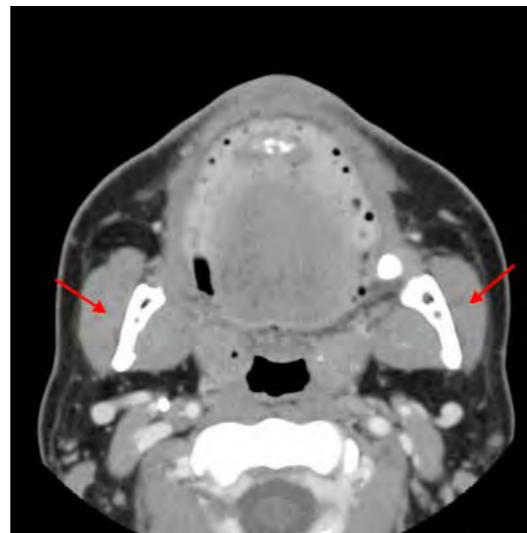
**Figure 2**



**Figure 3**



**Figure 4**



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## T25 - Nasolacrimal Obstruction Following the Placement of Maxillofacial Hardware

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**Introduction:** The purpose of this paper is to review cases of nasolacrimal obstruction secondary to maxillofacial hardware placement and to discuss the responsible mechanisms.

**Methods:** A retrospective review was performed at a single institution from 2012 to 2017 of patients with nasolacrimal obstruction following maxillofacial reconstruction. Patients were included if external dacryocystorhinostomy (DCR) confirmed previously placed orbital and microplate fixation hardware as the primary contributor to lacrimal outflow obstruction. Patient demographics, symptoms, exam findings, imaging, and intraoperative observations were collected for individuals with at least three months of follow-up.

**Results:** Of 420 patients that underwent external DCR during the period under review, six cases of implant-related nasolacrimal obstruction were identified. The mean age was 47.3±9.6 years (range 25-80 years) and 66.7% of patients were male (Table 1). All patients presented with epiphora, and 50% of patients also had chronic dacryocystitis. Patients had prior maxillofacial reconstruction with hardware placement for paranasal sinus tumors (66.7%) or facial fractures (33.3%). All patients with paranasal sinus tumors had partial resection or transection of the nasolacrimal system. All patients had revision or removal of implants that were found to be impeding lacrimal outflow by two mechanisms: 1) an orbital implant was impinging the lacrimal sac or nasolacrimal duct (cases 1-6) and/or 2) maxillofacial screws were placed into the bony nasolacrimal duct or nasolacrimal fossa (cases 3 and 4). In addition to revision or removal of the obstructing implant, all patients underwent an external DCR. Five out of six patients (83.3%) had complete resolution of symptoms and patency of the nasolacrimal system on probing and irrigation at their last follow-up visit. The average follow-up period was 13.5 months (range 3-30 months).

**Conclusions:** Although infrequent, nasolacrimal obstruction secondary to hardware placement is likely underreported. Two mechanisms of hardware induced epiphora were encountered in this case series. This source of obstruction can be minimized with specific attention to nasolacrimal anatomy at the time of maxillofacial and orbital reconstruction.

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Figure 1



Figure 2

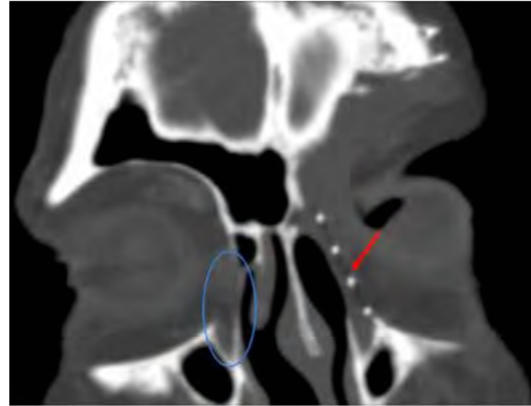


Figure 3

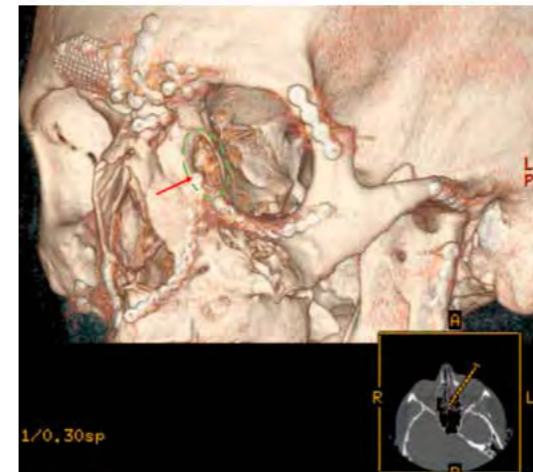


Figure 4



Figure 5

Table 1: Demographic and Clinical Characteristics

Case	Age	Gender	Laterality	Chief Complaint	Diagnosis for primary surgery	Pain reliever	Pre-operative	Implant Position	Status of Maxilla (Damage/extent)	IVAC during PLC	Outcome	Follow up (mo)
1	60	Male	Left	Chronic dacryocystitis + Epithelioma	Fronto-orbital MCC	Yes	Yes	Medial wall implant inserted to PLC	Resected L/S	No	Success	18
2	22	Female	Right	Epithelioma	Ocular Intra-ocular melanoma	Yes	Yes	Fluorapatite wall implant substituted to LSP	Resected L/S	No	Success	81
3	32	Male	Left	Chronic dacryocystitis + Epithelioma	BCC (Hidradenoma)	No	Unknown	Medial wall implant inserted to PLC + covered by NLD (used)	Equal	No	Success	4
4	29	Male	Left	Epithelioma	Facial fracture	No	Unknown	Floor implant medial to LSP + covers to L/S	Equal	No	Success	8
5	46	Male	Left	Chronic dacryocystitis + Epithelioma	Mandibular MCC	Yes	No	Fluorapatite wall implant substituted to L/S	Resected L/S	Yes	Failure	22
6	72	Female	Left	Epithelioma	Mandibular ACC	Yes	Yes	Fluorapatite wall implant substituted to L/S	Transcured MLD	Yes	Success	5

Abbreviations: MCC = maxillary carcinoma; LSP = lacrimal sac; L/S = lacrimal sac; MMC = maxillary carcinoma; NLD = nasal lacrimal duct; NFD = nasal lacrimal duct; PLC = posterior lacrimal crest; R/L = right/left eye; S = superior; I = inferior

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## T26 - Nasal Pepsinogen and PH in Primary Acquired Nasolacrimal Duct Obstruction (PANDO)

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**Introduction:** Primary acquired nasolacrimal duct obstruction (PANDO) results from inflammation of unknown etiology that eventually leads to fibrosis and occlusion of the nasolacrimal duct. Gastro-esophageal reflux disease (GERD) has been found to be associated with conditions such as rhinopharyngitis and rhinosinusitis. The purpose of this study was to determine whether the presence of nasal pepsinogen and altered pH levels are associated with PANDO.

**Methods:** This was a prospective case control study. The Reflux Disease Questionnaire (RDQ) was used to diagnose new GERD patients. Three patient groups were included in the study: patients with PANDO and GERD, patients with PANDO without GERD, and a control group with neither condition. PANDO was diagnosed prospectively or in patients who had undergone dacryocystorhinostomy for this condition. A strip of litmus pH paper was applied to the nasal floor for 1 minute and read, followed by irrigation and collection of nasal lavage fluid. The latter was submitted for pepsinogen assay. Statistical group comparison was performed using statistical software.

**Results:** 52 patients were included in the study; 21 controls, 15 patients with PANDO+GERD, and 16 patients with PANDO without GERD. The median pepsinogen values respectively were 7.6ng/ml, 12.5ng/ml and 35ng/ml. The median pH values respectively were 9.0, 8.0 and 8.0 ( $p < 0.058$ ). In the three groups, the number of patients in either the low or high pepsinogen range were: control group 15 low and 6 high, PANDO+GERD 10 low and 5 high, PANDO without GERD 6 low and 10 high ( $p = 0.107$ ).

**Conclusions:** Pepsinogen may be normally present at the nasal floor of the general population. We found pepsinogen levels to be raised in patients with PANDO, whether or not the patient had clinical evidence of GERD. We found pH values to be reduced in patients with PANDO. The pathological consequence of gastric contents such as pepsinogen in the development of PANDO needs to be further investigated.

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## T27 - Comparison of Pupillary Light Reflex Between Essential Blepharospasm and Reflex Blepharospasm with Photophobia

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**Introduction:** We evaluated the pupillary light reflex in blepharospasm patients with photophobia.

**Methods:** Twenty-three essential blepharospasm (EBS) patients and 43 dry eye disease (DED)-related reflex blepharospasm (RBS) patients with photophobia were examined. Maximum and minimum pupillary diameter (MAX and MIN), latency (LAT), change of diameter (CH%), constriction velocity (CV), maximum CV (MCV), and dilation velocity (DV) during pupillary light reflex were measured in mesopic (10 lux) and photopic illuminance (150 lux) using infrared pupilometer. Eyelid function (severity of spasm, eyelid closing force, and functional visual status), DED-related parameters (tear break-up time, Schirmer I test score, corneal staining score, and the ocular surface disease index), and photophobia grade were assessed in all subjects.

**Results:** The age, sex predominance, eyelid function, DED-related parameters, and photophobia grade were not significantly different between the EBS and the RBS patients. The EBS patients showed greater CV and MCV ( $3.26 \pm 0.56$  and  $5.27 \pm 0.90$  mm/s, respectively) in mesopic conditions than the RBS patients ( $2.86 \pm 0.62$  and  $4.59 \pm 1.00$  mm/s,  $P = .182$  and  $.0129$ ). The mesopic CV and MCV correlated positively with the photophobia grade ( $r = .525$  and  $.617$ ,  $P = .025$  and  $.006$ ).

**Conclusions:** The pupillary constriction response was enhanced in EBS patients with photophobia. This finding indicates that retinal light sensitivity may be altered in EBS and may be involved in the disease pathophysiology.

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## T28 - The Safety Profile of High-Dose Therapeutic IncobotulinumtoxinA for Blepharospasm and Hemifacial Spasm

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**Introduction:** IncobotulinumtoxinA (Xeomin) is a purified, freeze-dried botulinum toxin-A free from complexing proteins, and is rapidly gaining use in the medical treatment of upper and lower limb spasticity, pectoralis spasm, sialorrhea, writer's cramp, hyperkinesia, and truncal dystonia. Although frequently used for blepharospasm and hemifacial spasm (HFS), it is only FDA approved for blepharospasm, with the maximum dose studied at below 60 units (average dose approximately 20-44 units in reported studies). Current company label recommendations are for a maximum treatment dose of 60 units. This study was performed to evaluate the doses of incobotulinumtoxinA at higher doses of 60 units and above, to assess for therapeutic outcome and adverse effects.

**Methods:** A chart review was performed on all patients who received 60 or more units of incobotulinumtoxinA for either blepharospasm or HFS. Patients were derived from 2 practices at an academic institution that required a university-wide conversion from therapeutic onabotulinumtoxinA to incobotulinumtoxinA, and from a separate private practice. Data collected included dosage/interval of treatments, symptomatic improvement, duration of effect, allergic reaction, complications. A literature search was also performed.

**Results:** All patient charts from 3 practices were reviewed who had treatment with incobotulinumtoxinA for blepharospasm or HFS. 25 patients total were found to have had doses of 60 units or greater per session. Age ranged 37-92 years old, with a gender distribution of 10 males:15 females. 13 patients were treated for blepharospasm, 12 for HFS. Total treatment dosages per session ranged between 60 -192 units. The total number of treatment sessions using incobotulinumtoxinA per patient ranged 1-33 times, given every 8-14 weeks (average every 12 weeks).

Average time frame of onabotulinumtoxinA injections prior to conversion to incobotulinumtoxinA was from 1 month to 12 years. No patients reported allergic reaction, ptosis, headache, intractable pain, diplopia.

Average time frame of onabotulinumtoxinA injections prior to conversion to incobotulinumtoxinA was from 1 month to 12 years. There were no reported complications such as allergic reaction, ptosis, headache, intractable pain, diplopia.

**Conclusions:** There is limited literature to demonstrate the appropriate dosages for incobotulinumtoxinA, specifically for blepharospasm and the off-label use in HFS. Many studies report safety and good effectiveness for incobotulinumtoxinA in limb spasticity, dystonia, and hyperkinesia, with dosages ranging in the hundreds to thousands of units due to the large muscles involved. These cases suggest that while high doses of incobotulinumtoxinA are likely safe, they have not been specifically studied in the oculoplastic realm for its safety profile.

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Based on our study, incobotulinumtoxinA can be used safely in doses much greater than reported in the literature. Larger studies are necessary to determine the maximal doses safe for these smaller muscles involved in blepharospasm and HFS. Even when applied in high doses, they did not result in any complications such as therapeutic failure, allergic reaction, pain, ptosis, or diplopia. Duration of effect was similar. Using a conversion ratio of 1:1 onabotulinumtoxinA and incobotulinumtoxinA, there appeared to be similar if not improved response to treatment in patients that had previous onabotulinumtoxinA and were required to change medication, thus consistent with the Jankovic study that demonstrated non-inferiority to onabotulinumtoxinA. Long-term and repeated high-dose use also did not reveal additional safety relevant aspects. No patients lost therapeutic efficacy during continued management.

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## F1 - Adverse Events with Hyaluronic Acid Gel: Training Doctors, Nurses Support Staff and Emergency Departments

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**Introduction:** Dermal fillers represent one of the fastest growing areas of aesthetic enhancements. Vascular occlusions represent some of the most serious complications and may present quickly, before the patient leaves the office, or several hours after the injection. At present, there is no consensus on the management of these complications.

**Methods:** We reviewed the current literature concerning adverse events with hyaluronic acid gel injections. Furthermore, we reviewed one hundred cases of adverse events ranging from bruises, edema, misplacement, granulomas, infection and inflammation, to the more serious and rare vascular events treated in our clinic.

**Results:** A vascular occlusion is an emergency, and office staff must understand the presenting signs and symptoms, so that patients with an emergency may be appropriately triaged. Training of the staff to recognize potential complications of a filler over a phone consultation is vital to the subsequent management of the patient's symptoms. Our experience of training office staff on the recognition of adverse events improved the outcomes of these complications. Training the staff and the creation of appropriate office protocols, implementation of a post filler questionnaire for telephone calls and after hour's phone coverage may result in a better prognosis for the patient.

**Conclusions:** Complication management is critical in aesthetic medicine. It is important to support the patient both medically and emotionally. Established office staff action protocols may help in the early recognition of a complication and set the stage for timely treatment to achieve the best result.

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## F2 - Histologic Analysis of Malar Festoons: Dermal Edema and Increased Lymphatic Channels and Caliber

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**Introduction:** Malar festoons have been described as hammocks of lax skin and orbicularis muscle.<sup>1</sup> The underlying mechanism for their development is not known, but it is thought that chronic malar edema eventually leads to the development of festoons.<sup>2</sup> While there has been a prior histologic study to assess dermatochalasis, there have not been similar studies to assess the histological changes in festoons.<sup>3</sup> Our aim was to evaluate the histologic changes in patients who underwent direct excision of their festoons in an effort to determine how to best manage this complex problem.

**Methods:** We performed a histopathologic analysis on two patients who underwent direct excision of lower eyelid festoons and compared these specimens to two normal cheek tissue specimens, which were obtained from Moh's reconstruction cases involving redundant cheek tissue.

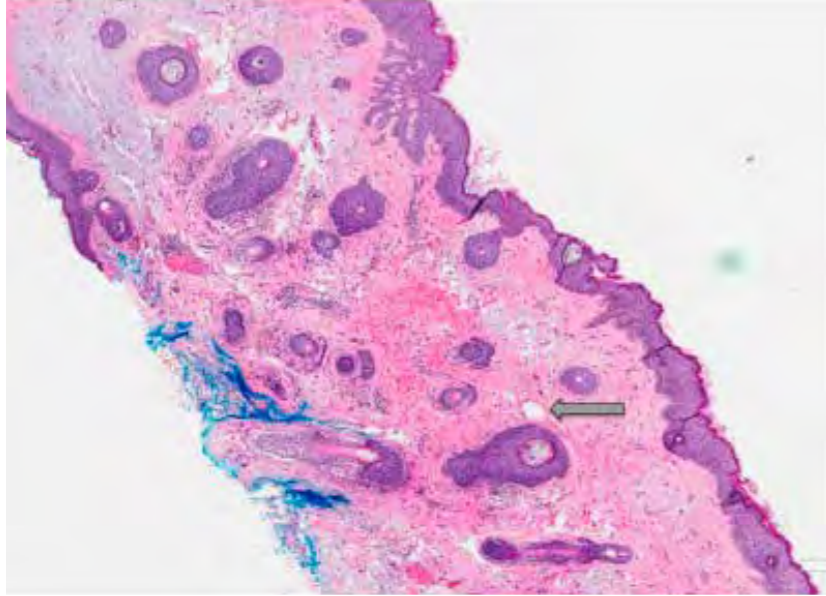
**Results:** When comparing the festoon tissue to normal cheek tissue, there was an increase in the number of capillaries, increased size and number of small veins, an increase in the number and size of lymphatic channels, presence of edema in the dermis and between muscle fibers of the orbicularis muscle and mild chronic inflammation. The most prominent finding was the presence of dermal edema along with an increased number of lymphatic channels that were very dilated compared to normal lymphatic channels in the control patients (Figures 1-3).

**Conclusions:** The most prominent histologic changes in festoon tissue was an increase in the number and size of lymphatic channels, along with the presence of dermal edema. There is an additional increase in the number of capillaries and small veins in this tissue, which may also contribute to the dermal edema and pathophysiology of festoon development.

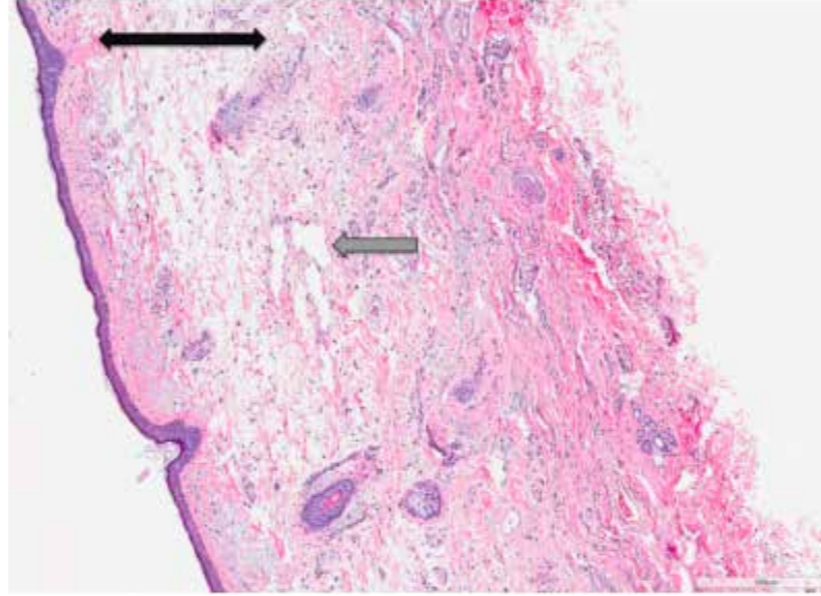
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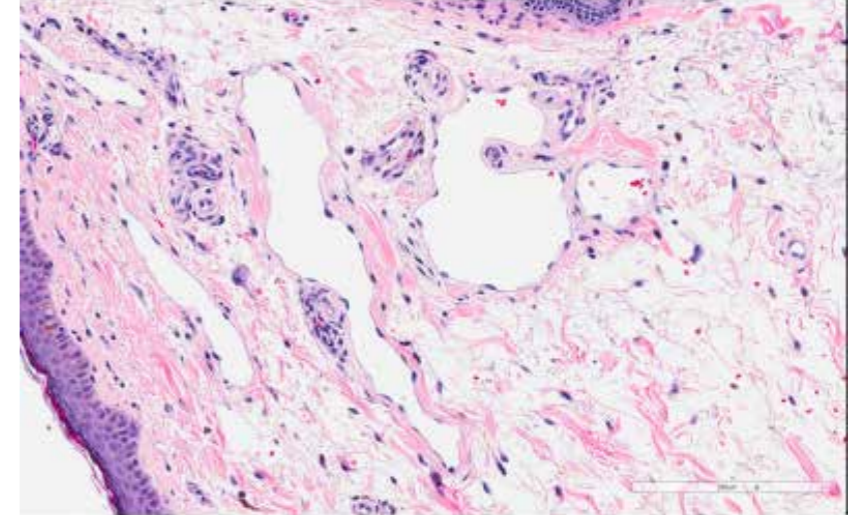
**Figure 1**



**Figure 2**



**Figure 3**



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### F3 - Nine Year Review of Endoscopic Brow Lift Polymer Fixation Device Forehead Implants

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**Introduction:** Since its introduction in 2003, the biodegradable Polymer Forehead fixation device has been used for secure, multipoint fixation of forehead and eyebrow<sup>1</sup>. The device is a polymer composed of poly-lactic acid (PLA) and poly-glycolic acid (PGA) that is designed to absorb over the course of a year<sup>1</sup>. The device has a triangular platform with a dowel on the undersurface that is inserted through a drill hole in the skull. The overlying tines that secure the forehead soft tissue vary in size from 3.0 to 3.5 mm<sup>1</sup>. In 2007, two separate retrospective studies<sup>2,3</sup>, confirmed the safety and efficacy of the Polymer fixation device; however, these studies were limited in size (n=31). We reviewed all patients over the past nine years who underwent endoscopic brow and forehead lifting using the Polymer Forehead fixation device to establish a long-term safety profile.

**Methods:** This is a retrospective review of all patients from January 2010 to March 2018 who underwent an endoscopic brow and forehead lift using an Polymer fixation device. Patients with the following were excluded: insufficient follow-up time (less than three weeks), complication(s) due to comorbid conditions, and those with insufficient data in the medical record. The data collected included age, sex, medical history, date of surgery, length of post-operative follow-up, presence of a complication(s), date of complication(s), and intervention (if applicable).

**Results:** Two hundred fifty-six (256) patients with a total of 500 Polymer Forehead fixation devices met inclusion criteria. Of these, 243 were female (95%) with a mean age of 60 (range: 32-86). Four patients (1.5%) required explanation of the device due to either infection (n=1, 0.4%) or subjective patient pain and discomfort (n=3, 1.1%). The infection was associated with a wound dehiscence that occurred 43 days post-operatively. Polymer fixation device removal due to pain or discomfort occurred 115 days post-operatively on average. One patient (0.4%) experienced dislocation of the device requiring replacement of the device in the operating room. Eleven patients (4.3%) underwent revision surgery due to subjective dissatisfaction with the cosmetic outcome.

**Conclusions:** This is the largest reported series of patients for whom the Polymer Forehead fixation device was used for fixation during endoscopic brow and forehead lifting. There was only one infection requiring explantation of the device, and three cases of pain or discomfort that necessitated the removal of the device. The majority of patients (95.7%) of patients were satisfied with the brow and forehead lift provided with the use of the Polymer fixation device. In our experience, the Polymer Forehead device has been a very safe and effective fixation device for use in endoscopic brow and forehead lifting.

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## F4 - The LIFT Study: An Interim Report on the First-In-Human Use of A Novel Tissue Anchor in Brow Lifting

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**Introduction:** The **LIFT** study (eLevatlon of Facial Tissue Clinical Study) is a study evaluating patient and physician satisfaction with the Zift tissue anchor in brow lifting surgery. The Titanium fixation device implant was designed to accomplish the repositioning of the dermis and underlying fascial layers relative to the skull through a small incision under local anesthesia, with 2 to 4 implants used per side. The clinical intent of this study is to evaluate patient and physician satisfaction with this novel tissue anchoring device.

**Methods:** The Titanium fixation device is a tissue anchor system made up of two main components, a central Titanium pin and a Nitinol hypotube with sub-ostial barbs, holes for osseointegration and sub-dermal (supra-ostial) petals (Figure 1). The implant is secured 3.6 mm into the bone through a 1-2 mm incision using a sterile delivery system without pre-drilling. The supra-ostial petals capture the surrounding galea frontalis or fascial layers to the periosteum. The Titanium fixation device is designed to provide a minimally invasive alternative to current forehead and brow lifting procedures.

The Lift Study documents the First-In-Human clinical use of the device using a single arm, IRB approved, open label, multicenter study design to evaluate the safety and efficacy of the Titanium fixation device System. Twenty subjects were enrolled in the study, divided into three tranches. The groups varied based on time from date of enrollment, number of implants per side and the utilization of preoperative botulinum toxin. Standard photographs were obtained at 7 days, 30 days, 90 days and 180 days. Brow elevation measurements were obtained based on standard photographs. Physician satisfaction with delivery was evaluated based on survey. Patient satisfaction was obtained using a Face-Q Survey Module.

**Results:** The preoperative target % of elevation was achieved in all 20 patients at 7 days postoperative. The second tranche of patients were performed with initial over-correction and more implants than the first tranche. At 90 days it was the second tranche of patients that had longer lasting results of greater than 3 mm of elevation, compared to the first tranche that achieved less than 1 mm at 90 days (Table 1, Appendix A). Enrollment in the trial is complete. Longer term follow-up of all patients, including the third tranche those treated with neurotoxin prior to surgery, is currently underway.

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Physician satisfaction with delivery was evaluated using a survey postprocedure.

Patient satisfaction was scored by Face-Q Survey- a standardized and validated tool. In general, there was a trend to improvement in each survey, defined as a change in tercile score from pre-procedure to last follow-up.

Side-effects include pain at the site of implantation, palpability of the implant, dimpling of the skin, need for removal (4 patients), poor healing with scar formation.

**Conclusions:** This is the First-in-human use of the Titanium fixation device in a brow-lift procedure. These 20 patients have generated considerable data.

Procedure optimization between the first tranche and second tranche of patients resulted in more sustained elevation. The follow-up data in the third tranche of patients that received neurotoxin to immobilize the frontalis during the healing phase is currently underway.

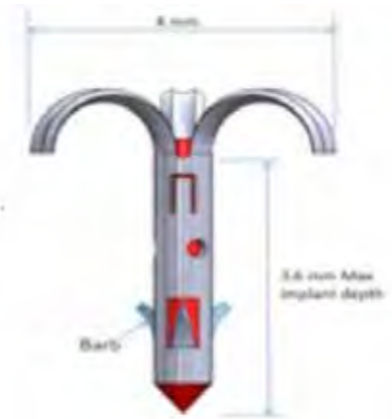
The delivery system, while capable of use in a supervised FIH study, is not sufficient for broad use and will require redesign.

Through this initial trial we have observed that the Titanium fixation device can be implanted in patients using local anesthesia alone with a high degree of patient comfort, no serious adverse events and acceptable acute results.

**Figure 1**



**Figure 2**



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Figure 3



Figure 4



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## F5 - Lateral Eyebrow Elevation with the Porous Polyethylene Implant

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**Introduction:** Implantation of the Porous polyethylene implant is a minimally invasive approach to achieve eyebrow elevation in patients with mild to moderate temporal eyebrow ptosis. The implant is fashioned from a high-density porous polyethylene, which we hypothesize facilitates bio-integration, permitting broad tissue incorporation and resultant sustained eyebrow elevation and volume enhancement. The purpose of this study is to assess the effectiveness, longevity, and complications associated with eyebrow ptosis repair using this technique.

**Methods:** To assess the results of lateral eyebrow elevation using the Porous polyethylene implant, both objective and subjective scales were employed. Measurements of the lateral canthus to eyebrow distance were made on pre- and post-operative photographs, blinded observers judged the eyebrow position and shape pre-and post-operatively, and patients reported on their satisfaction. All complications were also tabulated.

**Results:** This study was conducted retrospectively, assessing all patients implanted with the Porous polyethylene implant by a single surgeon between May 2017 and May 2018. The study included 64 eyebrows in 32 patients, with follow up ranging from one to five months. Objectively, all patients experienced temporal eyebrow elevation post-operatively. Subjectively, patient satisfaction scores were high, and both patients and investigators reported improvement in eyebrow height, shape, arch, and contour as well as sub-brow fat position. There were no incidences of over-elevation of the eyebrows. No frank surgical complications were noted, though two patients reported the ability to palpate the implant on one side.

**Conclusions:** Many techniques for eyebrow elevation exist and are commonly used, each with its own challenges and limitations. This is the largest study to date examining the effectiveness of Porous polyethylene implantation for lateral eyebrow elevation, and demonstrates that it is an effective technique that may be added to the oculofacial surgeon's armamentarium for addressing both functional and cosmetic issues related to eyebrow ptosis.

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## F6 - Post Ptosis Repair Change in Lower Eyelid Retraction in Unilateral Myogenic and Aponeurotic Blepharoptosis; A Prospective, Controlled, Before and After Study

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**Introduction:** To compare associated lower lid retraction (LLR) with control fellow eyelid in patients with unilateral myogenic (MP) and aponeurotic (AP) ptosis before and after the ptosis repair and analyze factors affecting them.

**Methods:** Patients of >5 years old were included from June 2015 to April 2017. Other types of ptosis, associated strabismus and previous eyelid surgery were excluded. Eyelid examination, lower lid margin reflex distance (MRD2), and photography were performed before and at least 6 months after ptosis repair. MRD2 of >0.5mm from the control eyelid was considered as LLR. All procedures (levator resection) were performed by or under supervision of one oculo-facial plastic surgeon.

**Results:** Seventy-eight cases with MP (58) and AP (20) with mean age of 19.2 (MP) and 49.5 (AP) years and median follow up of 10 months were included. Mean MRD2 was 5.5 mm in MP (5 on the non-ptotic side) and 5.6 in AP (4.8 on the non-ptotic side) (P=NS). LLR was observed in 56.9% (33/58) of MP and 80% (16/20) of AP (P=0.06). Preoperative MRD2 was significantly (P=0.01) and negatively (r=-0.3) correlated with MRD1. Mean MRD2 was significantly (P=0.001) decreased from 5.5 to 5 in the MP and 5.6 to 4.9 mm in the AP group. All MP (33/33) and 80% (15/16) of AP group showed  $\geq 0.5$  mm improvement in MRD2 at last follow up (P=NS). No variable was significantly associated with mean post-operative MRD2 as well as its success.

**Conclusions:** LLR are commonly associated with both MP and AP in which the more severe the ptosis the higher the LLR. LLR was improved in all MP and majority of AP, postoperatively.

## F7 - The Diagnostic Yield of Investigations in Ocular Myasthenia Gravis Presenting as Ptosis

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**Introduction:** Ptosis is the most common clinical presentations of Ocular Myasthenia Gravis (OMG). Often, a battery of investigations are requested in order to confirm the diagnosis. The aim of this study was to assess the diagnostic yield of various diagnostic tests employed in cases of OMG presenting as unilateral ptosis

**Methods:** In this retrospective study, charts of 37 consecutive patients of OMG who presented with unilateral ptosis between September 2014 - December 2016 were analysed. The parameters studied were clinical history and outcomes of ice test (IT), single fibre electromyography (SF-EMG), neostigmine test (NT) & anti-acetylcholine receptor antibodies (AChR-Ab).

**Results:** The mean age was 46.7 years. The mean duration of the symptoms was 13.3 months and 18/37 were females. Ice Test positivity was seen in 94.6% cases (34/37); SF-EMG positivity was seen in 59.5% (22/37) of the cases. Neostigmine test was positive in 56.8% (21/37) of the patients and AChR-Ab was positive in 45.9% (17/37). Neostigmine test ( $p=0.008$ ) and AChR-Ab ( $p=0.007$ ) were more likely to be positive in those with a history of ptosis for a duration  $\geq 1$  year. Among all tests, SFEMG had a significantly higher rate of positivity ( $p=0.04$ ) among those whose age  $\geq 45$  years and those who had a prior history of an episode of diplopia ( $p=0.02$ ).

**Conclusions:** Among the screening tests in suspected OMG presenting as ptosis, ice test has the highest sensitivity followed by SFEMG and Neostigmine Test. Duration of history, age of the patient and history of diplopia are factors that should be considered while deciding which investigation should be performed in order to maximise diagnostic yield.

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## F8 - Safety and Efficacy of Resident Performed Functional Upper Lid Blepharoplasty

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**Introduction:** We hypothesized that functional upper lid blepharoplasty surgery performed by ophthalmology residents under direct supervision would have a similar complication rate, percentage of dissatisfied patients, and percentage of revision procedures, compared to functional upper lid blepharoplasty surgery performed by an attending oculoplastic surgeon.

**Methods:** After obtaining Institutional Board Review approval, a retrospective chart review of functional upper lid blepharoplasty surgery performed under the supervision of one oculoplastic attending at the University of California Davis Eye Center from 2014 - 2018 was performed. Patient demographics, associated procedures, patient satisfaction, postoperative complications including revision procedures were collected. All patients had postoperative follow-up. Eyes that had any other combined upper lid or brow procedure were excluded. Chi squared tests were used for statistical analysis.

**Results:** 813 eyelids of 441 patients were included in the study. The primary surgeon was a resident on 446 eyelids, and an attending on 367 eyelids. 70.1% of the patients were female, and the mean age was 66.1. There were no major complications in either group. The most common minor complications were inclusion cysts (26, 3.20%), wound dehiscence (9, 1.11%), and hypertrophic scars (5, 0.62%). The most common revision procedures were removal of inclusion cyst(s) (10, 1.23%), suturing or placement of topical skin adhesive for wound dehiscence (9, 1.11%), and further skin removal (3, 0.37%), which were all performed in the clinic. Comparing surgeries performed by residents to surgeries performed by an attending, there was no difference in the rate of minor complications (7.40% vs 6.81%,  $P = 0.745$ ), percentage of patients who were initially dissatisfied with the procedure (2.24% vs 1.36%,  $P = 0.354$ ), or percentage of patients requiring a revision procedure (3.14% vs 2.72%,  $p = 0.725$ ).

**Conclusions:** There were no significant differences in complication rate, percentage of initially dissatisfied patients, or percentage of revision procedures between resident and attending surgeries for functional upper blepharoplasty. Complication rates were similar to those previously reported in the literature by residents in plastic surgery and otolaryngology programs.<sup>1-3</sup> Ophthalmology residents can perform functional upper lid blepharoplasty safely and effectively under the direct supervision of an attending physician.

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## F9 - Lagophthalmos and Corneal Exposure Resulting from Facial Burn Injury: Strategies for Management

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**Introduction:** Facial burns and their sequelae can lead to significant acute and chronic ophthalmic morbidity. Aggressive management is often necessary to prevent permanent disfigurement and vision compromise.

Here we review complications of periocular and facial burns and outline strategies for management. We describe a patient with severe burns and development of marked cicatricial lagophthalmos whose condition deteriorated to corneal ulceration. Treatment for orbital compartment syndrome may have contributed to severe eyelid retraction. This case highlights challenges and approaches unique to periocular burn management.

**Methods:** Case report describing the ophthalmologic care of a patient with facial burns in the burn ICU at an academic hospital from March 2017 to September 2017.

**Results:** A 26 year old female in a house fire was found to have burns comprising 71% total body surface area (TBSA), with 9% involving the head and face. She received bilateral lateral canthotomy/cantholysis on presentation due to concern for imminent orbital compartment syndrome. She developed cicatrizing changes which resulted in lagophthalmos (Figure 1), and despite aggressive lubrication and moisture chambers developed corneal exposure and ulceration. Tarsorrhaphies were placed.

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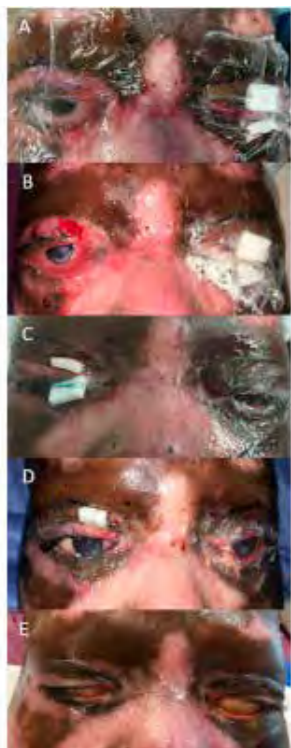
**Figure 1: Cicatricial ectropion of lower eyelids with lateral canthal dehiscence**



The cicatricial eyelid retraction became so severe that the tarsorrhaphies tore through on both sides numerous times. She underwent upper and lower eyelid scar tissue release with full thickness skin grafts (FTSG) and tarsorrhaphy on both sides (Figure 2). Finding suitable skin for grafting was challenging given a lack of donor sites, but sufficient skin grafts were harvested from the groin. After surgery, the lids were initially well apposed.

**Figure 2: Surgical Management. A: Moisture chambers with left tarsorrhaphy. B: Right tarsorrhaphy torn through with exposure, left ulcer management with natamycin/tarsorrhaphy. C and D: Post FTSG bilaterally. E: Recurrent lagophthalmos after FTSG placement.**

**Figure 2**



**Figure 3**



Adjuvant management included the use of a custom-fitted silicone face mask, facial exercises and massage. After two weeks the lagophthalmos recurred. With multidisciplinary input, additional therapy was attempted with tension-bearing tape to elevate the lower eyelids and cheeks bilaterally and depress the left upper lid. Silicone-lined tape failed to provide enough support. Elastic therapeutic tape was applied and found to have a modest effect (Figure 3). This was combined with the mask, moisture chambers, and new tarsorrhaphies (Figure 4).

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**Figure 4: Facial Mask.** A: Silicone mask, heat modifiable and made from a plaster of the patient. B & C: undergoing mask fittings. D: Combination therapy. Note: The cicatricial changes of the face also affected her ability to close her lips.



The combination of these structural support devices, scar tissue therapy and surgical closure ultimately generated satisfactory resolution of the lagophthalmos after 6 weeks (Figure 5).

**Figure 5: Corneas healed, good closure, trace residual lagophthalmos nasally left eye.**



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**Conclusions:** Patients suffering facial burns may demonstrate progressive cicatricial changes and severe lagophthalmos. Early canthotomy and cantholysis may worsen lagophthalmos. In severe cases a multifaceted approach is necessary to preserve vision. This includes surgical and medical therapies, a committed multidisciplinary team, and creative use of adjuvant devices such as the fitted mask and tension-bearing tape.

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## F10 - The Effect of Topical Periocular Steroid Use on Intraocular Pressure: A Retrospective Analysis

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**Purpose:** To study the effect of periocular steroid use on intraocular pressure (IOP).

**Methods:** Charts of adult patients with atopic dermatitis or eczema treated from January 1st, 2007 to October 1st, 2017 were reviewed. Patients with the following were excluded: glaucoma, ocular hypertension, known systemic/topical/injectable steroid history, and lack of documented IOP prior to or during treatment with periocular steroid ointment. Patient data was collected regarding gender, treatment regimen, as well as IOP prior to and during treatment. Steroid responders were identified. Statistical analysis was performed using linear mixed effects models adjusting for follow-up time to test the relationship between pre- and post-treatment IOP change adjusting for inter-eye correlations.

**Results:** Thirty-one patients were identified. Twenty-one were treated bilaterally and ten unilaterally. Five patients were glaucoma suspects. The mean treatment period was 14.2 weeks with a range of 0.1 to 83.9 weeks. Patients were treated with fluorometholone (42%), loteprednol etabonate (23%), dexamethasone-neomycin-polymyxin B (13%), hydrocortisone 1% or 2.5% (3%), and tobramycin-dexamethasone (19%). In the combined sample, there was no significant IOP change even after adjusting for follow-up time (mean change: +0.44 mmHg,  $P=0.126$ ). However, eyes with baseline IOP  $\geq 14$  mmHg had a significant increase (+0.73 mmHg/year,  $P=0.032$ ). Individual steroid responses included: 1 intermediate and 30 low responders, of which 19 patients had an IOP change less than 1 mmHg. One patient had an intermediate steroid response of 7 mmHg.

**Conclusions:** Periocular steroid treatment causes a statistically significant rise in IOP in eyes with higher baseline measurements, the risk of which increases with follow-up. While not always clinically significant, clinicians should monitor more closely patients at greatest risk of steroid response.

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## F11 - A Conjunctival Sparing Surgical Technique for Lower Eyelid Cicatricial Entropion Repair in Ocular Cicatricial Pemphigoid

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**Introduction:** We present 5 cases of lower eyelid cicatricial entropion secondary to ocular cicatricial pemphigoid (OCP) successfully repaired with a minimally invasive, conjunctival sparing surgical technique of infraciliary rotation via suture fixation of the orbicularis oculi muscle to the tarsus, plus or minus lateral tarsal plication or orbicularis oculi debulking.

**Methods:** Cases from one ophthalmic plastic surgeon (SKF) were identified who had cicatricial entropion secondary to OCP who underwent repair with a conjunctival sparing technique. The medical records were reviewed and extracted data included: age, gender, past medical history, current medical and OCP status, clinical examination and details of entropion repair surgery.

**Results:** Five patients were included: a 44-year old female, a 60-year old male, an 80-year old male, a 90-year old female, and a 93-year old female. All had biopsy proven OCP, which was in remission at the time of surgery, and all were currently receiving immunomodulatory medications. All patients were symptomatic from cicatricial entropion secondary to OCP with resultant trichiasis. Each underwent successful lower eyelid entropion repair with a herein described conjunctival sparing technique. Other contributing mechanisms of eyelid malposition including horizontal eyelid laxity and orbicularis muscle override were addressed simultaneously, resulting in 100% anatomic success and relief of symptoms with no cases of OCP reactivation, and with good durability with an average 10.8-month follow up.

**Conclusions:** Successful lower eyelid cicatricial entropion repair in immunomodulated OCP patients can be achieved without disease reactivation using a minimally invasive surgical technique that does not breach the conjunctiva.

## F12 - Full Thickness Tarsal Fracture and Lid Margin Rotation for the Repair of Cicatricial Upper Eyelid Entropion

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**Introduction:** Cicatricial entropion is the inward turning of the eyelid margin caused by scarring of the posterior lamella, conjunctiva and tarsal plate. Multiple procedures have been proposed to manage this condition with variable cosmetic and functional success rates. These procedures include posterior lamellar rotation technique, posterior tarsal margin rotation technique, anterior tarsal flap rotation combined with anterior lamellar repositioning, tarsal fracture, Wies procedure, anterior tarsal V-wedge resection, tarsotomy and lid margin rotation, anterior lamellar recession with buccal mucous membrane graft or hard palate mucous membrane graft.<sup>1,2,3,4,5</sup> Our technique was previously described by Antonio Augusto with excellent results.<sup>2</sup> Our aim is to describe a modified full thickness tarsal fracture and lid margin rotation technique in the repair of upper eyelid cicatricial entropion and report on the long term success rate, cosmetic outcome and associated complications of the procedure.

**Methods:** Retrospective chart review of 27 patients (45 eyelids) undergoing this procedure from January 2015 until May 2018 in a tertiary eye unit in Abudhabi (SKMC) performed by one surgeon, looking into demographics, pre-operative presentation, previous eyelid procedures, post op follow up, complications and recurrence rate. Patients excluded from the data were those with lower eyelid entropion. Success was defined as no recurrence of the entropion and resolution of the symptoms subjectively reported by the patients at least 6 months following the procedure.

**Results:** One patient was lost to follow up and was excluded from the final results. Twenty six patients (44 eyelids) were included. Eighteen patients had bilateral procedure. Mean age of the patients 70.8 (range, 56-96) years old. Gender distribution was 52.3% (23 eyelids) males and 47.7% (21 eyelids) females. Overall success rate was 95.5%. Two eyelids had undercorrection of the entropion. There was no complete recurrence of the condition. Five eyelids had previous eyelid surgeries; two blepharoplasty, one levator palpebrae superioris resection and one with unknown procedure. Five of the patients had previous entropion repair surgery. The complications included: Suture conjunctival granuloma (three eyelids), "overhanging excess skin" just above the lashes that needed minimal surgical intervention (two patients), inadvertent injury of the lid margin with subsequent minimal notch formation (one patient). Mild asymmetry was common, two of which were cosmetically unacceptable but due to symptoms relief patients did not request redo surgery. One cases of severe postoperative haematoma (autoimmune low platelet level) that resolved with conservative management (platelet infusion).

**Conclusions:** Our described procedure results in excellent functional success rate with very acceptable cosmetic result. This technique has been previous described.<sup>2</sup> However our follow up is longer (6 months). The complications are self limiting and often do not further intervention

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## F13 - Effect of Lower Lid Epiblepharon Surgery on Asymmetric Margin Reflex Distance 1

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**Introduction:** The prevalence of ptosis was 1.41% in children aged 7 years.<sup>1</sup> However, the prevalence of concurrent ptosis in lower lid epiblepharon patients were higher (20.7%) in children aged 6 years.<sup>2</sup> With the attention to the association between lower lid epiblepharon and ptosis, we experienced the resolution of the margin reflex distance 1 (MRD1) asymmetry after lower lid epiblepharon surgery.

**Methods:** Patients who underwent lower lid epiblepharon surgery were recruited from November, 2015 to September, 2017. Their medical photos before and 2 weeks, 2 months and 6 months after surgery were evaluated. The MRD1 asymmetry was defined as MRD1 difference more than 2mm between both eyes. Postoperative MRD1 difference less than 1mm between both eyes was regarded as the resolution of the MRD1 asymmetry.

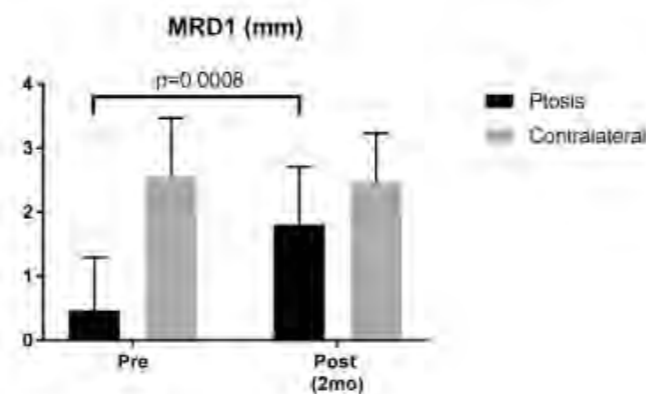
**Results:** Among 432 patients, the MRD1 asymmetry was evident in 18 patients with the mean difference of 2.1mm. Thirteen patients had more severe epiblepharon in eye with smaller MRD1 (Figure 1). After epiblepharon surgery, the MRD1 asymmetry was resolved in 12 patients (Figure 2). All the patients with normal levator function (9/11; 82%) showed the resolution of MRD1 asymmetry, and all the patients with resolved MRD1 asymmetry had normal levator function.

**Conclusions:** In lower lid epiblepharon patient with asymmetric MRD1, MRD1 difference can be diminished after epiblepharon surgery, especially when patient has normal levator function.

Figure 1



Figure 2



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## F14 - Orbital Fat: The Fourth Dimension of Entropion

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**Introduction:** Surgical failures of entropion repair are more likely to have lower lid steatochalasis (1). The authors sought to assess the recurrence rate of involutional entropion in patients treated with a combined surgical approach including a modified Bick procedure, excision of preseptal orbicularis muscle and conservative resection of prolapsed orbital fat.

**Methods:** A retrospective chart review of patients undergoing repair of involutional entropion including orbital fat resection was performed. Only patients with follow-up greater than 6 months were included in the study to improve the prediction of long-term surgical success. The recurrence rates were calculated as well as surgical outcomes.

**Results:** Fifty-eight (58) eyelids in thirty-eight (38) patients met the minimal required follow-up criteria and were included. Average follow-up time was 46 months. Of the 58 eyelids undergoing the procedure over an 8-year period from 2009 to 2016, there was a recurrence in 1 eyelid (1.7%). The recurrence occurred two years after the initial surgery and the patient was found to have residual horizontal lid laxity at that time. One eyelid had dehiscence of the lateral canthal insertion within the first week, requiring repair. The remaining 56 eyelids had successful subjective and objective results without a need for any additional procedures.

**Conclusions:** While multiple approaches exist for repair of involutional entropion, the authors demonstrate good surgical success with a combined approach of a modified Bick procedure, preseptal orbicularis excision, and conservative orbital fat resection. Prolapsed orbital fat is felt to be a contributing biomechanical force in involutional entropion which is not included in conventional descriptions of entropion pathogenesis. The authors demonstrate that in select patients with moderate to severe steatochalasis, conservative resection of orbital fat as part of a combined procedure for surgical entropion repair results in a high success rate with minimal recurrence.

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## F15 - Ocular Pyogenic Granulomas Treated with Topical Timolol - Updated 4-Year Follow Up Results

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**Introduction:** Pyogenic granulomas (PG) are common acquired benign vascular lesions that occur on cutaneous and mucosal surfaces. Ocular PG usually occur as a sequela of inflammation from ophthalmic surgery, trauma or chalazia. They can cause foreign body sensation, spontaneously bleed or be cosmetically bothersome. Treatment options include topical steroids, excision, cryotherapy, electrocautery and laser ablation. Recent reports have revealed that timolol, a non-selective  $\beta$ -blocker, may be an alternative, non-invasive treatment option<sup>1,2,3</sup>. The authors herein describe our 4-year follow-up using this treatment strategy in treating ocular PG.

**Methods:** Prospective interventional study of 26 consecutive patients with ocular PG who were treated with topical 0.5% timolol given twice daily between 7/2010 and 10/2017. All patients were followed weekly with serial exams, measurement and photography. Treatment was aborted after 6 weeks if resolution was not noted and surgical excision was undertaken. Exclusion criteria included: pregnancy, recurrent disease on presentation or follow-up < 6 months.

**Results:** A summary of patient data is illustrated in Figure 1. Twelve females and 14 males had a mean age of 25.5 years (range, 3-68). Eight (31%) of the patients were children.

**Conclusions:** Topical timolol seems to be a safe and effective non-surgical treatment of ocular PG in both children and adults. The authors believe this to be the largest series of PG treated with timolol to date. Similar to their known success in the treatment of infantile hemangiomas,  $\beta$ -blockers may cause vasoconstriction within ocular PG and inhibit vascular growth factors and induce apoptosis. Clinicians may wish to consider its use as a first line agent rather than topical steroids, given their inherent risk of ocular hypertension and glaucoma, or surgical excision. This may be especially true in children in whom accurate intraocular pressure is difficult to measure and follow, and in whom excision may require sedation or general anesthesia. Future comparative studies using controls would help elucidate treatment superiority.

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(continued)

Figure 1

Case No.	Age	Sex	ICD-10	ICD-9	ICD-10-CM	ICD-9-CM	ICD-10-PCS	ICD-9-CM-PCS	ICD-10-PCS	ICD-9-CM-PCS	ICD-10-PCS	ICD-9-CM-PCS
1	1	F			Chalazion	SP	NA	NA	NA	NA	NA	NA
2	1	F			Chalazion	SP	Strab g2	NA	NA	NA	NA	NA
3	1	M			Trauma	NA	NA	NA	NA	NA	NA	NA
4	11	F			Chalazion	SP	Strab g2	NA	NA	NA	NA	NA
5	11	M			Chalazion	SP	NA	NA	NA	NA	NA	NA
6	1	M			Strabismus	NA	NA	NA	NA	NA	NA	NA
7	11	F			Chalazion	SP	Strab g2	NA	NA	NA	NA	NA
8	41	F			Chalazion	SP	Strab g2	NA	NA	NA	NA	NA
9	11	M			Lacerat	SP	NA	NA	NA	NA	NA	NA
10	11	M			Strabismus	NA	NA	NA	NA	NA	NA	NA
11	11	F			Chalazion	SP	NA	NA	NA	NA	NA	NA
12	11	M			Lacerat	SP	NA	NA	NA	NA	NA	NA
13	11	M			Chalazion	SP	NA	NA	NA	NA	NA	NA
14	11	F			Chalazion	SP	Strab g2	NA	NA	NA	NA	NA
15	11	M			Chalazion	SP	NA	NA	NA	NA	NA	NA
16	11	F			2nd Stage Epithel	SP	NA	NA	NA	NA	NA	NA
17	11	M			Chalazion	SP	NA	NA	NA	NA	NA	NA
18	11	M			Chalazion	SP	Strab g2	NA	NA	NA	NA	NA
19	11	M			Chalazion	SP	NA	NA	NA	NA	NA	NA
20	11	F			Lacerat	SP	Strab g2	NA	NA	NA	NA	NA
21	11	F			Lacerat	SP	NA	NA	NA	NA	NA	NA
22	11	F			Chalazion	SP	NA	NA	NA	NA	NA	NA
23	11	F			Chalazion	SP	Strab g2	NA	NA	NA	NA	NA
24	11	F			Chalazion	SP	NA	NA	NA	NA	NA	NA
25	11	M			Chalazion	SP	Strab g2	NA	NA	NA	NA	NA
26	11	M			Chalazion	SP	Strab g2	NA	NA	NA	NA	NA

Figure 2



Figure 3



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## F16 - Modifications of Cutler Beard Procedure: Surgical Outcomes

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**Introduction:** The Cutler-Beard procedure is a time-tested modality for reconstruction of eyelid defects involving > 50% of the eyelid, and it provides excellent cosmetic and functional outcome. Its complications include bridge necrosis, infection, trichiasis, eyelid malposition and symblepharon. We describe certain modifications of the classical Cutler-Beard procedure for reconstruction of eyelid defects involving > 50% of the eyelid, and our surgical outcomes.

**Methods:** Fifteen consecutive patients with upper or lower eyelid defects involving > 50% of the horizontal eyelid extent were evaluated. Reconstruction was carried out by Cutler-Beard procedure for upper eyelid and reverse Cutler-Beard procedure for lower eyelid with the following modifications:

1. Reattachment of levator aponeurosis to the posterior lamina of the eyelid flap in stage I of procedure during upper eyelid reconstruction, and in stage II of the procedure during lower eyelid reconstruction by the reverse Cutler-Beard procedure
2. Fixing the height of eyelid in stage I of procedure before completion of complete suturing of vertical aspect of defect.
3. Maintaining contour of eyelid by placing a convex incision on the flap in stage II of procedure
4. Differential division of the eyelid lamina in stage II of procedure, to allot maximum possible conjunctiva to the recipient lid with the defect
5. Creation of smooth upper eyelid margin with conjunctival lining

The patients were evaluated for contour of eyelid, eyelid malposition, trichiasis, corneal condition and local tumor recurrence.

**Results:** Among the 15 patients, 7 were female and 8 were male with a mean age of 46.7 years (range 1-72 years). Cause for eyelid defect included trauma (4) and excision of tumors (sebaceous gland carcinoma in 4, squamous cell carcinoma in 3, Merkel cell carcinoma in 1, non-Hodgkins lymphoma in 1, mucoepidermoid Carcinoma in 1 and juvenile xanthogranuloma in 1). Ten (66.6%) patients had undergone a prior surgery to the same eyelid - excision biopsy in 7, incision biopsy in 1, and prior attempted eyelid reconstruction in 1. Thirteen Patients underwent Cutler-Beard procedure and 2 underwent reverse Cutler-Beard procedure. Mean follow-up was 14.3 (range 4 to 60 months) months. Complications included trichiasis in 3 (20%), lagophthalmos

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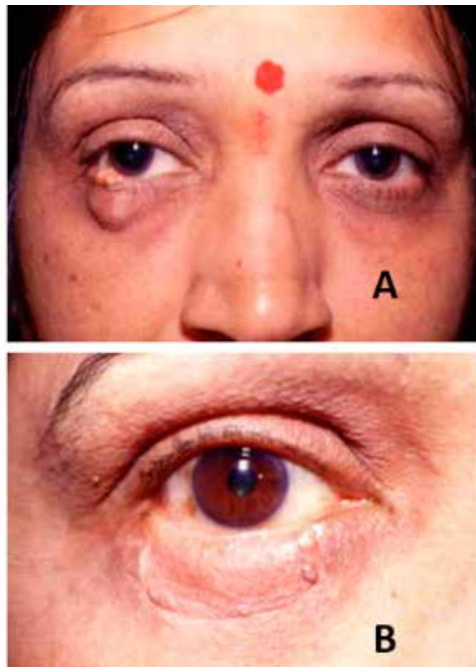
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**Figure 1**



A) 35 year-old-male presented with Left Upper lid sebaceous gland carcinoma which was better evident on B) Lid eversion. C). Patient underwent wide surgical excision with intraoperative frozen section margin control and reconstruction by Modified Cutler Beard procedure Stage I.D), Following Cutler Beard Stage 2 procedure The patient had excellent cosmesis.

**Figure 2**



A) 40 year-old-female with Right lower lid sebaceous gland Carcinoma, treated by wide surgical excision and reconstruction by reverse Cutler-Beard procedure B) following Stage 2 of Procedure, she had good cosmesis.

**Conclusions:** Cutler-Beard Procedure and reverse Cutler-Beard procedure are reliable and effective procedures to reconstruct large upper or lower eyelid defects respectively. Our described modifications help augment cosmetic and functional results.

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## F17 - Long term Outcomes of Slipped or Lost Rectus Muscles During Strabismus Surgery

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**Introduction:** Slipped or lost rectus muscles are an infrequent complication during strabismus surgery. Oculofacial surgeons are called upon emergently to identify and repair muscles that have prolapsed into the orbit. While several studies have explored mechanisms to retrieve and re-attach these muscles intra-operatively, the postoperative courses of these patients have not been well studied. The purpose of this study is to investigate the long term outcomes related to intraoperative slipped or lost muscles during strabismus surgery.

**Methods:** The case logs of oculofacial and strabismus surgeons were culled to identify all cases of slipped rectus muscles during strabismus surgery. Demographic and background health information as well as the type of strabismus surgery, primary intervention or re-operation, how the muscle was lost, if and how the muscle was retrieved, pre- and post-operative deviation, muscle function, complications, and follow-up were collected. T-tests were used to test for statistical significance.

**Results:** In total, 10 patients (9 female, 1 male) were included in this study. Average age was 35.8 years (range 6-75). Ten rectus muscles were recessed and 6 were resected. Eight (80%) were primary interventions. These patients were followed, on average, for 18 months. The muscle slipped within the capsule in 6 (60%), torn in 3 (30%), and disinserted in the immediate post-operative period in 1 (10%). The muscle was recovered and re-attached in 8 (77.8%) patients. Seven (87.5%) of these 8 patients ultimately maintained normal muscle function and orthophoria, whereas the two patients in whom the muscle was not retrieved did not achieve orthophoria. Overall, three (30%) patients required a second surgery. Three (30%) patients experienced suboptimal outcomes that differed from pre-operative expectation; of these, 1 was undercorrected and 2 were overcorrected due to irretrievably lost muscles. Patients in whom the muscle was identified and repaired were statistically more likely to achieve orthophoria ( $p < 0.05$ ). There were no other intraoperative or post-operative complications reported.

**Conclusions:** Slipped muscles during strabismus surgery is a rare but potentially serious complication. If this problem is properly identified and addressed, most patients can achieve normal motility and ocular alignment. Patients in whom the muscle cannot be identified and reattached are less likely to achieve orthophoria and normal muscle function. This report represents the first documentation of postoperative courses in patients who undergo this orbital intervention, and this data may be used to provide postoperative counseling to patients who face this problem.

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## F18 - A Pathological Void: Air Under the Upper Eyelid

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**Introduction:** Introduction: Orbital conditions which result in significant enophthalmos may predispose the patient to the trapping of air under the upper eyelid. Here, we review three cases of air with enophthalmos from multiple etiologies; all cases demonstrate the deleterious effect of air under the eyelid. From the cases described, we highlight three points: air under the lid is a cause of visually significant ocular surface disease, the air under the lid frequently goes unrecognized on imaging, and, in certain cases, air under the lid resulted in removal of the eye.

**Methods:** Methods: We present a case series of three patients, with associated imaging which reflects air with enophthalmos.

**Results:** Results: Three patients are presented with three different etiologies of enophthalmos: silent brain syndrome, silent sinus syndrome, and status post reconstruction after maxillectomy. All three patients developed significant ocular surface disease. All patients had undergone imaging (Figures 1 and 2) which demonstrated enophthalmos. In addition, review of the imaging showed the trapping of air under the upper eyelid. Of note, the specific finding of air under the lid in the setting of enophthalmos was not reported on the official radiology read in any of the cases. Two of the patients' conditions had significant progression of surface disease, ultimately requiring removal of the eye. Of the three patients, one patient was able to retain the eye following surgical correction of the enophthalmos. The use of lung windows is useful to highlight air under the eyelid (Figure 3).

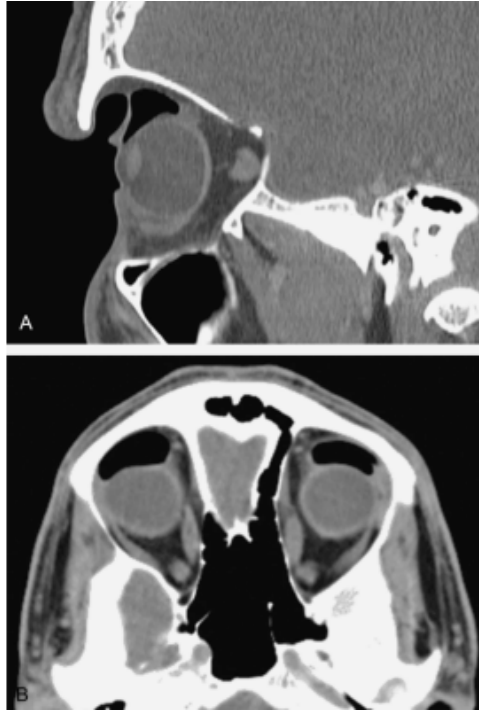
**Conclusions:** Conclusion: Optimal orbital reconstruction restores orbital anatomy and volumetric relationships. The trapping of air under the eyelid is a sign of enophthalmos and may result in significant ocular surface disease, potentially resulting in loss of the eye. Air under the lid has been previously reported in silent sinus syndrome, silent brain syndrome, and giant fornix syndrome.<sup>1,2</sup> Patients with chronic ocular irritation, especially after surgical reconstruction of the orbit should be imaged, particularly in instances where the etiology of the ocular irritation cannot be determined or does not respond to standard treatment. Clinicians should have suspicion for air with enophthalmos; of note, in all patients presented, imaging was performed but diagnosis was still delayed as the air with enophthalmos was not commented on in formal radiology reads. In all three patients, the radiology reports did not note air under the lid; this omission from the formal read is a potential cause of delay in the determination of the etiology of the ocular surface disease. Our figures demonstrate the use of lung windows to highlight air with enophthalmos and should be routinely checked in this patient population. Although this has been reported as a "normal" finding,<sup>3</sup> the authors believe that air under the eyelid should be investigated especially in patients with associated ocular irritation.

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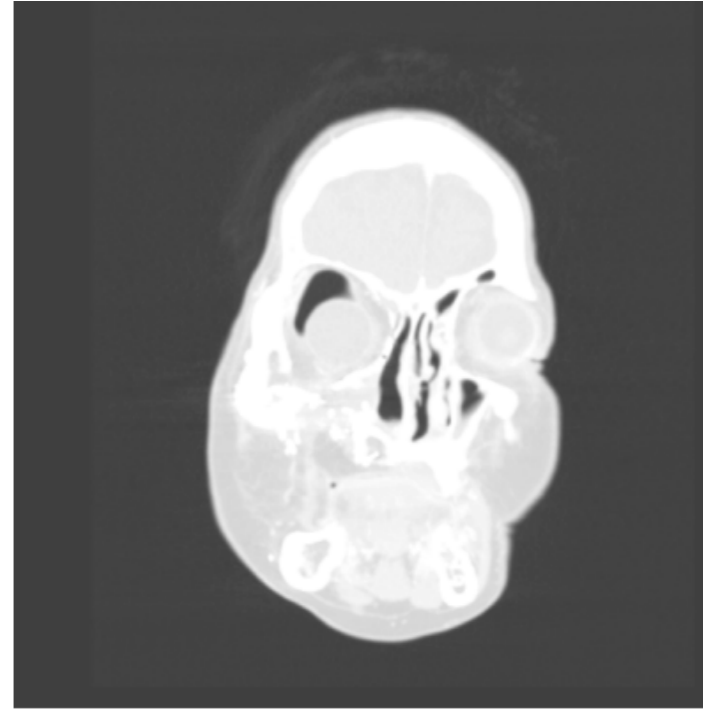
**Figure 1**



**Figure 2**



**Figure 3**



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## F19 - "Braving Graves" Smartphone Application for Thyroid Eye Disease Patients

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**Introduction:** Smartphone applications may be a useful tool in the management of chronic disease. In collaboration between our Orbital Research Group at Columbia University and The International Thyroid Eye Disease Society (ITEDS) a first of its kind application has been developed for patients with Thyroid Eye Disease (TED). The app allows patients to track their symptoms, lifestyle habits, medications, treatment methods, and doctors' appointments. This new technology will not only help patients manage their chronic disease, but will facilitate deidentified data collection for future investigations of TED.

**Methods:** An iPhone and android compatible application has been developed for patients with TED. The app is scheduled to be released to the public in the fall of 2018. Patients are able to log into the app and upload personal information as well as photos. The core of the app consists of five key sections: Reminders and individualized patient goals, Laboratory testing and future appointments; Education including literature and website links; Symptom trackers; Support Groups which include links to online forums, social media sites, and blogs; and Donations. Symptoms can be tracked on a daily, weekly, or monthly basis, depending on the patient's preference. Symptoms tracked follow the ITEDS classifications and include vision, pain behind the eyes, lid edema, lid erythema, chemosis, red eyes, diplopia, lid retraction, photophobia, proptosis, epiphora, eye irritation, quality of life using a standardized 3 question questionnaire, and finally an option to add custom individualized symptoms. Patients are able to use the app to connect with other TED patients through online groups, forums, and other social media networks. Clinic appointments can be updated in the app and patients can message their provider if symptoms change or the need for a new appointment arises.

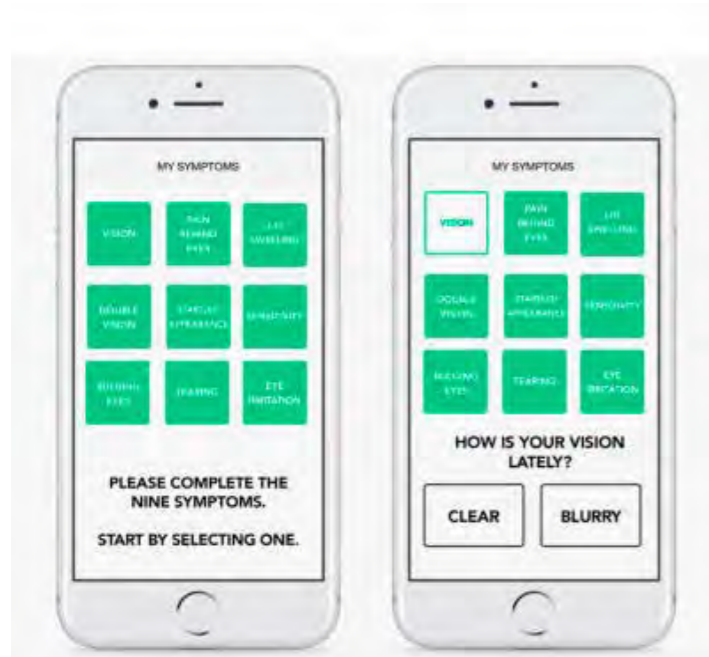
**Results:** The application will be presented in the fall of 2018 and its functionality will be demonstrated to patients and providers. Preliminary data from initial users will be presented. Data collected from the application over time will be collected for future research of TED.

**Conclusions:** This is the first smartphone application for patients with TED. The goal of the app is to allow TED patients track changes in symptoms, lifestyle habits, medications, treatment, methods, and doctor's appointments that can provide insight into one's personalized treatment.

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**Figure 1**



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## F20 - Clinical and Radiologic Predictors of Dysthyroid Optic Neuropathy in Thyroid Eye Disease

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**Introduction:** To evaluate the relationships between clinical and anatomical findings in thyroid eye disease (TED) and their contribution to the development of dysthyroid optic neuropathy (DON).

**Methods:** In this cross-sectional cohort study, all patients affected with TED seen by two specialists over a 7-year period were screened for study entry. Eligible participants were adults with clinical evidence of TED and either CT or MRI of the orbits. Exclusion criteria included prior history of decompression surgery and/or medical or other ophthalmic pathology affecting orbital anatomy.

The primary outcome was the development of DON. Clinical factors assessed for their contribution to DON included: duration of TED, age, hertel exophthalmometry, clinical activity score (CAS) and the presence of strabismus. Radiologic factors assessed for association with DON included: fat volume, muscle volume, the presence of medial wall bowing and apical crowding. A crowding index was created by calculating the bony orbit to muscle volume ratio in the posterior third of the orbit.

Both orbits from patients with TED were included except in one patient who previously had decompression surgery on one orbit. The generalized estimating equation was used in this study to increase statistical power and account for the correlation between orbits.

**Results:** The final sample included 59 orbits from 30 patients. Thirteen orbits were diagnosed with DON. Analysis of clinical characteristics (table 1) for the patients showed that DON was not associated with age ( $r = 0.219$ ,  $p = 0.11$ ), CAS ( $r = 0.00$ ,  $p = 0.324$ ), strabismus ( $r = 0.027$ ,  $p = 0.185$ ), hertel exophthalmometry ( $r = 0.013$ ,  $p = 0.193$ ) nor duration of the disease ( $r = 0.015$ ,  $p = 0.12$ ).

In radiological analysis (table 2), fat volume ( $\beta = -0.0173$ ,  $p = 0.62$ ), muscle volume ( $\beta = -0.0125$ ,  $p = 0.68$ ) and crowding ( $\beta = 0.0319$ ,  $p = 0.32$ ) were not associated with DON. Medial wall bowing was significantly associated with DON ( $\beta = 1.6272$ ,  $p = 0.01$ ).

**Conclusions:** The identification of medial wall bowing on CT or MRI is significantly associated with the occurrence of DON. Traditionally cited risk factors such as a crowded apex and increased soft tissue volume did not correlate with DON.

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Table 1

	r	p Value
Age	0.219	0.11
Cas	0.00	0.324
Strabismus	0.027	0.185
Exophthalmometry	0.013	0.193

Table 1: A multivariate model of clinical characteristics and their association with DON.

Table 2

	Estimate	Std. err	Wald	Pr(> W )
Muscle Volume	-0.0125	0.0303	0.17	0.68
Fat Volume	-0.0173	0.0348	0.25	0.62
Medial Wall Bowing	-1.6272	0.6491	6.28	0.01
Apex Crowding	0.0319	0.0323	0.98	0.32

Table 2: A multivariate model using the generalized estimating equation (GEE).

## F21 - Visual Field and Orbital Computed Tomography Correlation in Compressive Optic Neuropathy Due to Thyroid Eye Disease

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**Introduction:** The pathogenesis of compressive optic neuropathy (CON) in thyroid eye disease (TED) is thought to be compression of the apical optic nerve by hypertrophied extraocular muscles.<sup>1,2</sup>

**Methods:** Records of adults with TED CON evaluated from January 1, 2013 to January 1, 2018 were retrospectively reviewed. The visual field from each patient with the worst mean deviation (MD) was selected. Visual fields were classified as primarily inferior defect, primarily superior defect, central defect, scattered defect, enlarged blind spot, or total loss.

Orbit CT scans were reviewed. Reformatted oblique coronal images were created perpendicular to the axis of the optic nerve. The cross sectional surface area (CSA) of the orbit and of each muscle group at 10 mm from the optic canal was measured. The CSA of the superior, inferior, medial, lateral muscle groups, and all of the muscles combined were expressed as ratios of the CSA of the orbital apex. Univariate predictors of HVF mean deviation were analyzed using linear regression. Multivariate analysis was performed on the variables found to correlate with MD ( $p < 0.05$ ).

**Results:** A total of 34 orbits in 19 patients with TED CON were analyzed. The average age was 58 (range 28-77 years). Female patients accounted for 68.4% ( $n=13$ ). On orbital CT, the superior muscle complex occupied on average 15% of the orbital apex (range 6-26%), the inferior 18% (range 6-33%), the lateral 10% (range 4-18%), and the medial 17% (range 8-27%), with the sum of all muscles occupying 61% (range 28-80%) of the apex. The five muscular ratios were compared to the MD in linear regression univariate analyses. Increasing total muscle mass and increasing superior muscle complex size correlated with worsening visual field MD (Pearson R -0.49;  $p=0.0027$  and Pearson R -0.60;  $p=0.0002$ ). In multivariate linear regression, the superior muscle complex remained a significant predictor of MD ( $p=0.01$ ) over total muscle size ( $p=0.25$ ).

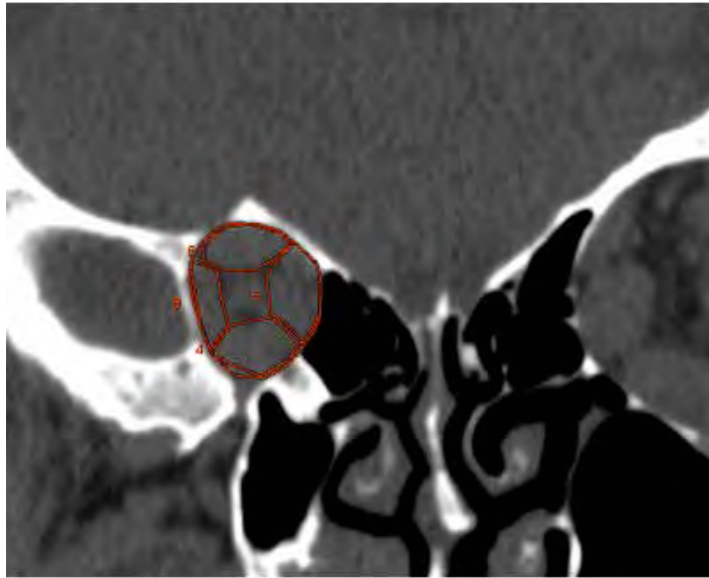
**Conclusions:** CON is a potentially blinding complication of TED. Enlargement of extraocular muscles is common, present in 90.5% of patients<sup>9</sup>, however, CON occurs in only 6%<sup>4</sup>. Numerous methods of quantifying extraocular muscle changes in TED have been developed.<sup>3-9</sup> This study was designed to quantify apical compression in TED CON. The findings demonstrate that as CON worsens, as measured by MD, the CSA of the orbit occupied by the extraocular muscles increases. In the multivariate model, the superior muscle complex size retained significance over total muscle mass. Compression of the superior optic nerve (fibers relaying the inferior visual field) by the superior muscle complex is consistent with typical visual field findings in TED CON, which involve the inferior visual field.<sup>1,9,10</sup> In this study, 73.5% of fields were inferior field defects.

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These findings suggest that the extent of hypertrophy of the superior rectus and levator palpebrae superioris complex is predictive of the degree of optic neuropathy in advanced TED. Extra-ocular muscle enlargement may begin as a more generalized process, but involvement of the superior muscle complex may correlate with the most serious outcomes.

**Figure 1**



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## F22 - Non-Linear Visual Field Improvement in Radiotherapy for Thyroid Eye Disease and Compressive Optic Neuropathy: A Radiation Rebound Effect?

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**Introduction:** Radiation therapy (RT) for thyroid eye disease (TED) involves a number of postulated mechanisms, such as the stunning of over-active fibroblasts as a method to stall progressive disease. It is particularly effective in TED with compressive optic neuropathy (CON) when combined with oral corticosteroids. While several studies have illustrated the efficacy of RT on visual field (VF) at distant end-points, few have assessed response as a time course. This is the first study to examine the pattern of improvement found in TED-CON treated with RT.

**Methods:** We conducted a retrospective analysis of 25 patients (47 orbits) with TED-CON who were both, treated with RT (20Gy/10fx), and had VFs taken at 4 consecutive time intervals; 1) pre-treatment, 2) 5-10wks post-treatment, 3) an additional 3-6mo later, and 4) an additional 4-8mo after that. No interval in time was pre-treatment values (PT).

**Results:** 70.2% of the 47 orbits showed an overall VF improvement at the last follow up (avg. 214 days) when compared to pre-treatment. Two distinct patterns of improvement were identified [Figure 1]. Pattern 1, which comprised 54.5% of these orbits, showed initial improvement followed by significant worsening, then rebound improvement. Pattern 2 showed consecutive improvement with late worsening. Only one orbit showed consistent linear improvement. 5 orbits did not demonstrate either pattern and were defined as Other. There was no significant difference in improvement (Pattern 1: +70.1%, Pattern 2: +39.2%, Other: 50.5%,  $p=0.22$ ). There was no significant difference in steroid dose between groups [Figure 2], color plates ( $p=0.81$ ), and visual acuity ( $p=0.43$ ).

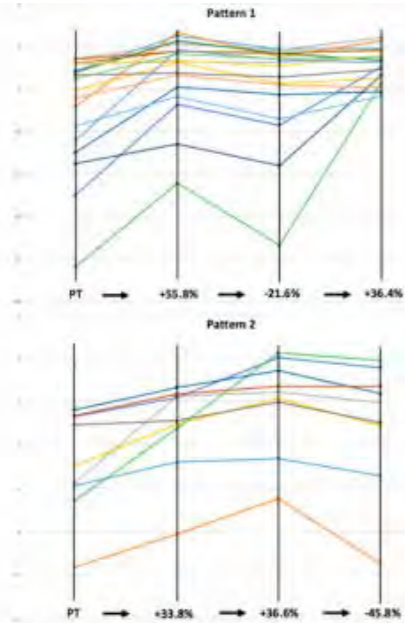
**Conclusions:** As noted in several previous studies, tissue response to radiation is dynamic, with both inflammatory and fibrotic stages [1]. Our analysis of VFs in RT for TED-CON demonstrate a similar non-linear process. An RT rebound effect may explain pattern 1 with transient inflammation (and consequent worsening) as a good prognostic sign for overall improvement. These differences could also represent genetic predispositions to radiation sensitivity or differences in response amongst certain TED sub-types (fat vs. muscle predominant) [2-3]. The utility of repeat VFs in providing a better picture of patient response could help tailor treatment. Intermediate worsening may not reflect treatment failure and warrant additional steroids. A larger study with additional time intervals, histopathology, and CT or MR imaging may better categorize these patients.

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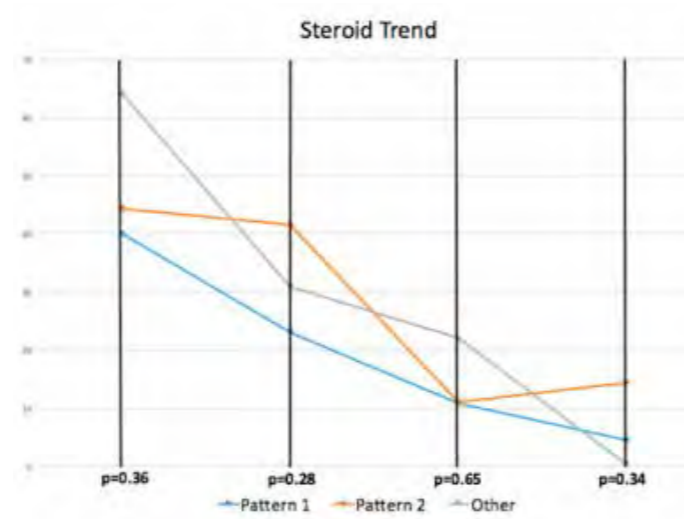


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**Figure 1**



**Figure 2**



LEGEND: Percentages shown are the percent change between time intervals, with pre-treatment indicated by PT. In Pattern 1, half of the orbits showed an overall VF improvement greater than their first follow up. No post-treatment VF deficit was worse than pre-treatment values (i.e. time point 2).

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## F23 - A Retrospective Analysis of Clinical Findings in Patients with Thyroid Eye Disease who Develop Choroidal Folds

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**Introduction:** Chorioretinal folds (CRF) are a rare entity in thyroid eye disease (TED) that can be seen in patients with or without compressive optic neuropathy (CON).<sup>1</sup>We describe the clinical course and characteristics of 15 eyes in 9 patients with TED who developed CRF.

**Methods:** We conducted a multi-center retrospective case series of 9 patients with TED who developed CRFs. A comprehensive review of TED course, treatment, review of clinical symptoms and radiographic findings were performed.

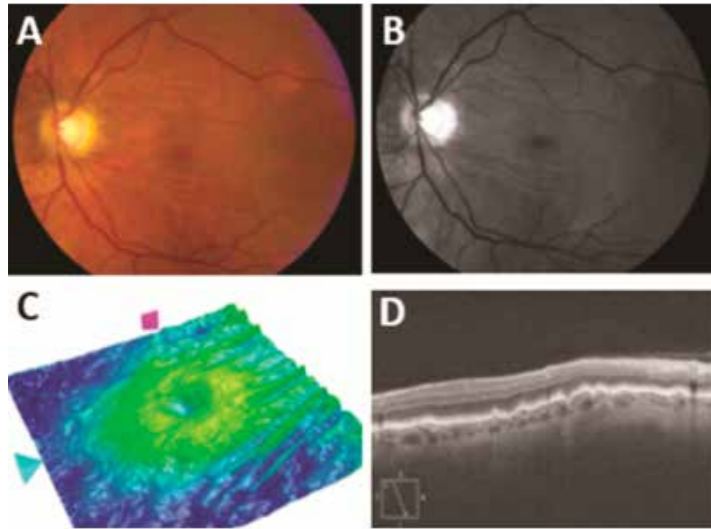
**Results:** Nine patients with 15 eyes at 7 different centers were identified who had developed CRF related to TED. The mean age at presentation was  $58.6 \pm 8.5$  years of age. The majority of patients were hyperthyroid (67% of patients), hyperopic (60% of eyes) and had a history of radioactive iodide treatment (56% of patients). Most commonly enlarged extraocular muscles were medial rectus (73% of eyes), inferior and superior rectus (60% of eyes) followed by lateral rectus (27% of eyes). The average axial length and distance from the optic nerve to optic strut was  $23.92 \pm 1.08$  mm and  $3.56 \pm 0.33$  cm, respectively. The average clinical activity score was  $3.5 \pm 2.2$  in each eye at the time of presentation. Over 53% of eyes had signs of CON. The range of time from diagnosis of TED to onset of CRF ranged from 4.0 to 231 months. Treatment included orbital decompression (60% of eyes), oral prednisone (78% of patients), thyroidectomy (11% of patients) and tocilizumab (11% of patients). In 66 percent of eyes, the CRF did not resolve despite treatment over a follow up period of  $18.6 \pm 12.2$  months of which 75% had improved vision by two lines on Snellen chart at the final visit.

**Conclusions:** The relationship between CRF and TED remains unclear but is hypothesized to be related to vascular engorgement, traction of the optic nerve or posterior pressure on the globe.<sup>2</sup>Shorter axial length and hyperopia have been described as features in patients with CRF and optic neuropathy.<sup>3</sup>For many patients, visual acuity improved with treatment of TED; however, the CRF persisted.

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**Figure 1**



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## F24 - The Association of Risk of Obstructive Sleep Apnea and the Severity of Thyroid Eye Disease

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**Introduction:** We aim to determine the association between the severity of thyroid eye disease (TED) and the risk of obstructive sleep apnea (OSA). We hypothesize that the increased risk of OSA is correlated with increased severity of TED.

**Methods:** The institutional review board approved this investigation. All new patients with TED referred to the Principal Investigator were invited to participate. Their risk of OSA was assessed with the STOP-Bang questionnaire (a validated screening tool) where three points or higher indicated high risk. [1] (see figure 1, [2]) The patients were divided into two groups based on high or low risk of OSA. These groups were compared using the two-sample t-test and Wilcoxon rank-sum nonparametric test to assess the severity of TED as measured by decreased visual acuity, degree of proptosis, restriction of extraocular movements, diplopia, decreased color vision, presence of an afferent pupillary defect (APD), scleral show and mean deviation on Humphrey visual field for the worst eye.

**Results:** A total of 66 patients were included in the study. Twenty subjects showed a high risk of OSA based on their STOP-Bang score (3 or higher). Color vision loss ( $p=0.0007$ ), greater proptosis ( $p=0.0267$ ), diplopia ( $p=0.0382$ ) and greater visual field mean deviation ( $p=0.0338$ ) were significantly associated with those patients with high-risk STOP-Bang scores. Additionally, decreased visual acuity, reduced ocular ductions and the presence of an APD were more common in the higher risk STOP-Bang group, but did not reach statistical significance.

**Conclusions:** This study demonstrates that the more severe clinical manifestations of TED were found at a statistically high rate among patients at high risk for OSA. These measures include loss of color vision, diplopia, and loss of visual field. These results suggest the potential for the favorable modification of the clinical behavior of TED through the identification and treatment of patients coincidentally at risk for OSA. Increasing the number of subjects could elicit further statistically significant relationships between OSA and the severity of TED. Moreover, a prospective treatment trial of patients with TED and OSA confirmed by polysomnography would serve to further test our hypothesis.

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**Figure 1**

STOP-Bang Questionnaire	
<b>S</b> noring	Do you snore loudly (louder than talking or loud enough to be heard through closed doors)?
<b>T</b> ired	Do you often feel tired, fatigued, or sleepy during the daytime?
<b>O</b> bserved apnea	Has anyone observed you stop breathing during your sleep?
<b>B</b> lood Pressure	Do you have or are you being treated for high blood pressure?
<b>B</b> MI	BMI more than 35 kg/m <sup>2</sup> ?
<b>A</b> ge	Age over 50 years old?
<b>N</b> eck Circumference	Are you a male with a neck circumference greater than 17 inches, or a female with a neck circumference greater than 15 inches?
<b>G</b> ender	Are you a male?

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## F25 - Identification of Age-Stratified Clinical Features of Active Thyroid Eye Disease

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**Introduction:** Thyroid eye disease (TED) is a phenotypically heterogeneous autoimmune inflammatory disease that presents variably at different ages. As treatment decisions are guided by disease activity, it is valuable to better understand how TED manifests and evolves during the active phase based on the age of the patient. Prior studies have suggested that older patients present with more clinically significant soft tissue swelling, vision loss, and extraocular muscle involvement as well as a longer active phase of disease.<sup>1-3</sup> These studies have not investigated which clinical measures of disease activity are featured most prominently in young, middle age, and older patients. The purpose of this study was to characterize differences in TED clinical activity among multiple age stratified cohorts.

**Methods:** After IRB approval, a single institution, retrospective chart review was performed. TED patients were included in the analysis if they were evaluated at least twice during the active phase of their disease. Patients were excluded if they received corticosteroid, radiotherapy, immunotherapy, or surgical intervention for TED prior to presentation, or presented during the quiescent phase of their disease. Clinical data collected included age at onset of endocrinopathy, age at onset of orbitopathy, smoking history, endocrinopathy treatment history, and visual acuity, extraocular motility, Hertel exophthalmometry, intraocular pressure, caruncular edema, chemosis, conjunctival injection, diplopia, presence of diurnal fluctuation, eyelid erythema, eyelid edema, and vertical fissure height at each follow up visit. Patients were divided into four cohorts: ages 19 and under, 20-39 years, 40-59 years, and over 60 years old. Analysis of variance was used to compare differences in time to onset of TED after onset of endocrinopathy among all four age groups; the same was done for the time of active disease before quiescence and each sign of TED; separate ANOVA tests were conducted for each TED sign studied.

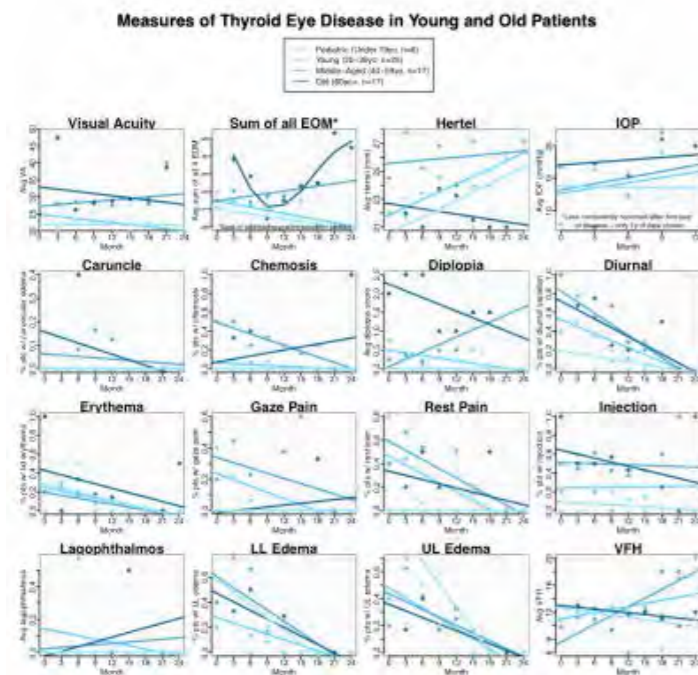
**Results:** 125 TED patient charts have been reviewed to date; 65 patients met inclusion criteria and 60 were excluded. There were 6, 25, 17, and 17 patients in the youngest through oldest age cohorts (mean ages were 13, 30.4, 46.6, and 66.3 years at TED onset, respectively). Younger patients demonstrated shorter active phase disease (12.8, 13.9, 16.0, and 15.9 months, respectively). Younger patients also demonstrated a longer interval between the onset of endocrinopathy and the onset of TED (0.50, 2.23, 2.78, and 5.56 years to onset, respectively). The younger cohorts demonstrated better visual acuity, lower intraocular pressures, and less chemosis, diplopia, caruncular edema, diurnal symptoms, gaze pain, rest pain, injection, and lower eyelid edema compared to older cohorts throughout the entirety of their active phase (Figure 1).

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**Conclusions:** In this ongoing study, younger patients demonstrated a shorter active phase of TED and had a shorter average interval between the onset of endocrinopathy and the onset of TED. Also notable were the findings that inflammatory features were nearly absent in the youngest patients, and that the oldest patients demonstrated the most significant restriction of extraocular motility and subjective diplopia, but less exophthalmos. Although statistical significance thresholds have not yet been met, further patients are being collected to adequately power logistic panel regression analysis toward the ultimate goal of developing an age-adjusted clinical activity score.

**Figure 1**



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## F26 - Effect of Systemic Steroid and Orbital Radiotherapy on Dry Eye Parameters in Thyroid Associated Orbitopathy (TAO)

Kelvin Kam Lung Chong<sup>1,2</sup>, Nicole Tsim<sup>1,2</sup>, Joyce Chin<sup>1,2</sup>, Regine Chan<sup>1,2</sup>, Chi-Lai Li<sup>1,2</sup>, Antony Law<sup>2</sup>, Lok Y Yeung<sup>2</sup>, Kenneth Wong<sup>2,3</sup>, Alvin Lerrmann Young<sup>1,2</sup>

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**Introduction:** More than two-third of the patients with TAO suffer from various degree of dry eye (DE). While pulse intravenous glucocorticoid (GC) therapy is the first-line treatment in active or progressive TAO, additional orbital radiotherapy (OR) was shown to improve diplopia, lower recurrence and reduce chance of optic neuropathy. However, potential effect of GC and OR on DE remains unknown. We evaluate their effects on dry eye parameters in TAO patients.

**Methods:** In a prospective cohort, patients were managed either conservatively (Group A), with GC (Group B) or GC and OR according to the clinical activity score (CAS) and degree of diplopia, assessed by the same oculoplastic surgeon. GC was given as 12 weekly pulse methyl-prednisolone infusion according to the EUGOGO protocol. OR were given in 20 Gy fractionated over 10 days. DE was evaluated by Ocular Surface Disease Index (OSDI), Tear Breakup Time (TBUT), and corneal staining at baseline, 3 and 6 months after treatment. Parameters were compared between time-points and treatment groups.

**Results:** Mean age of patients in Group A (n=86) was 50±15, Group B (n=20) 48±14 and Group C (n=136) 59±11 (p < 0.05). More male patients were in Group C (30%, 35% and 50% respectively, p < 0.05). CAS was significantly higher in Group B (3.8±0.2) and C (2.4±1.6) compared to Group A (1.4±1.2) (p < 0.01). Baseline DE was evident in 87% patients when defined by OSDI score of ≥ 13, 53% were severe when defined with OSDI score ≥ 33. OSDI and degree of corneal staining were comparable between groups at baseline (p > 0.05). Significant improvements were found at 6 months in Group B and C compared to baseline (both p < 0.05) but not in Group A. Group B showed significant improvement in TBUT at 3 months compared to Group A and C (p > 0.01) while Group C showed significant improvement in OSDI at 6 months compared to Group A (p < 0.05).

**Conclusions:** Dry eye is highly prevalent in this cohort and improved significantly after GC with or without RT compared to baseline. Additional use of OR may have negative impact on TBUT at 3 months compared to those treated by GC alone, but no difference was found at 6 months or on OSDI. Patients should be advised on potential short-term worsening of DE when receiving additional OR for active or progressive TAO.



## F27 - Metabolic Signature of Orbital Fat in Thyroid Eye Disease Patients

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**Introduction:** Thyroid eye disease (TED) is a multi-system auto-immune disease with various orbital and adnexal manifestation, and the cellular and molecular processes of pathogenesis in orbital fat tissues are not fully understood. In this study, we aim to identify the metabolomic signature of orbital fat in patients with and without TED.

**Methods:** Orbital fat samples were collected from TED patients who had undergone orbital decompression and from non-TED patients who had undergone blepharoplasty with fat removal. Metabolites were extracted and analyzed for targeted metabolites that covering major metabolic pathways using ultrahigh-performance liquid chromatography and high-resolution mass spectrometry. Principal component analysis and multivariate regression were performed to assess differences in the metabolomic profiles of TED patients versus controls. Significantly changed metabolites were further enriched for specific metabolic pathways using MetaboloAnalyst.

**Results:** 21 patients (11 with TED and 10 controls) were included. Mean age was 54.4 (SD1 = 5.8) in patients with TED and 67.9 (SD1=13.1) in non-TED patients. 18 patients (86%) were female. Smoking was present in 36.4% of patients with TED and 20% of patients without TED. 54.5% of patients with TED had radioactive iodine treatment, and average CAS was 2.5. Among the detected 130 metabolites, 25 metabolites were significantly different between TED patients and controls. Most of these metabolites (60%, n=15) belonged to the purine metabolism, urea cycle, betaine metabolism, glutathione metabolism, arginine and proline metabolism (Figure 1). A significant enrichment of urate and histamine was identified among these metabolites ( $P=2.05 \times 10^{-9}$  and  $p=1.1475 \times 10^{-9}$ ) among these metabolites (Figures 2&3).

**Conclusions:** This pilot study reveals previously unidentified metabolite differences in the orbital fat of patients with TED compared with controls. Specifically, the findings suggest that TED patients have altered urate and histamine metabolism that may be associated with the pathogenesis of TED. Metabolomics biomarkers may prove useful in understanding the pathogenesis of TED.

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Figure 1

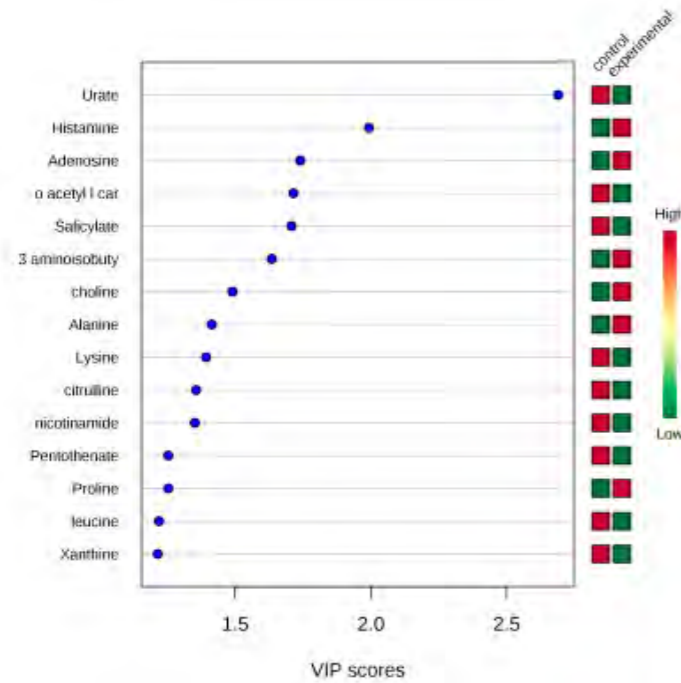


Figure 2

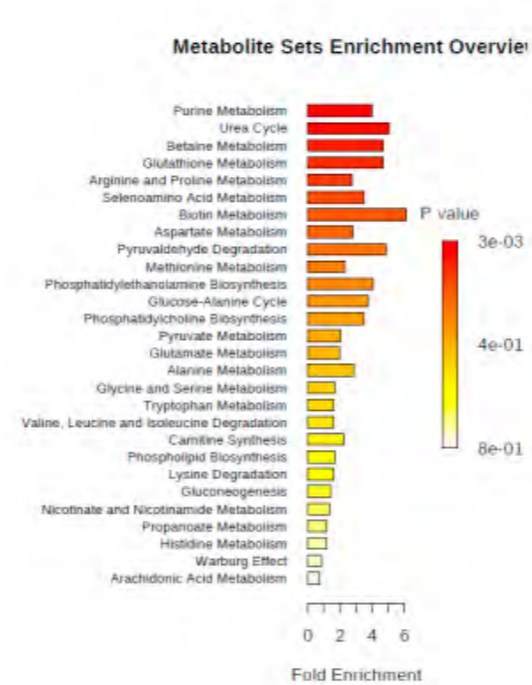
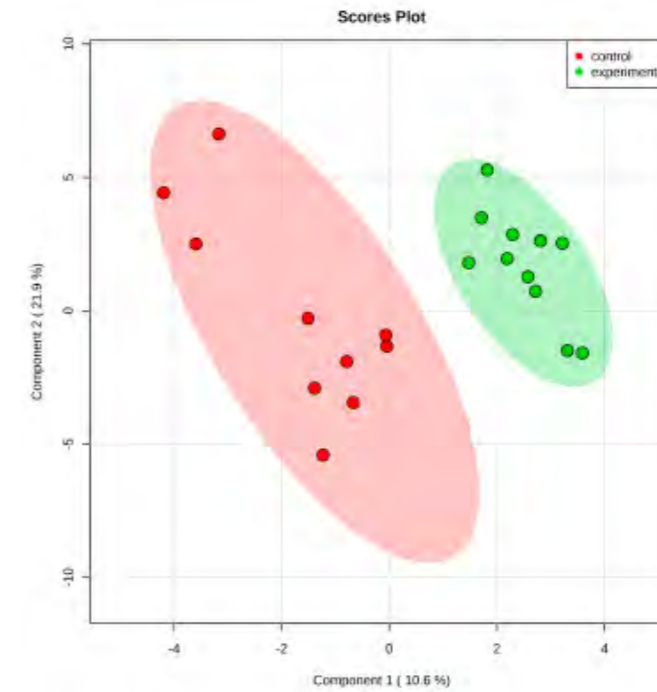


Figure 3



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## F28 - Elevated BMP4 Expression Implicated in Site-Specific Adipogenesis in Thyroid Associated Orbitopathy

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**Introduction:** Periorbital adipose tissue expansion is a key pathological change in thyroid-associated orbitopathy (TAO). Bone morphogenetic protein 4 (BMP4) is instrumental in adipogenesis. We compared site-specific BMP4 expression and its effect on adipogenesis using donor-matched adipose tissue-derived stromal cells (ADSC) from TAO patients.

**Methods:** ADSC were generated from periorbital (eyelid, orbital) and subcutaneous (abdominal) adipose tissue. BMP4 expression was characterized by RT-PCR and immunofluorescent staining and compared among ADSC from the three anatomic depots. Effects on adipogenesis after knocking down endogenous BMP4 were quantified by adipogenic markers PPAR $\gamma$  and perilipin. Exogenous BMP4 protein was added after BMP4 knockdown to study the role of BMP4 in adipogenesis.

**Results:** BMP4 staining in periorbital adipose tissue was stronger than those in subcutaneous. BMP4 mRNA expression was higher in eyelid (4.4-2489.4-fold) and orbital (6.9-1811-fold) than that of subcutaneous ADSC, whereas expression fell during induced adipogenesis. After BMP4 knockdown, both adipogenic markers PPAR $\gamma$  (eyelid: 1.7-fold, p=0.038; orbital: 1.4-fold, p=0.126) and perilipin (eyelid:1.7-fold, p=0.001; orbital:2.6-fold, p=0.066) increased in periorbital ADSC upon induction. These increased expression fell after adding exogenous BMP4 protein.

**Conclusions:** Higher BMP4 expression was found in periorbital ADSC and adipose tissue compared to donor-matched subcutaneous counterparts, which fell during adipogenic induction. Lowering BMP4 expression further enhanced adipogenesis in periorbital ADSC. This effect was reversed by exogenous BMP4 protein. We suggested a novel role of BMP4 in modulating site-specific adipogenesis in TAO patients.

### V1 - Silicone Intubation Versus Packing in ENdonasal Dacryocystorhinostomy (SPEND) for Primary Nasolacrimal Duct Obstruction

Joyce Chin<sup>1</sup>, Vincent Lam<sup>2,3</sup>, Regine Chan<sup>1</sup>, Luke Yeung<sup>2</sup>, Antony Law<sup>2</sup>, Alvin Lerrmann Young<sup>1</sup>, Hunter Yuen<sup>4</sup>, Mohammad Javed Ali<sup>5</sup>, Kelvin Kam Lung Chong<sup>2,1</sup>

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**Introduction:** This was a retrospective comparative study to evaluate the efficacy and safety of stenting versus packing in endoscopic dacryocystorhinostomy for primary acquired nasolacrimal duct obstruction.

**Methods:** Single referral centre, consecutive patients aged  $\geq 18$  with uncomplicated PANDO undergoing mucosal-sparing, mechanical endoscopic dacryocystorhinostomy (MMED). Patients received one of the following in tandem after MMED without topical mitomycin: no stenting or packing (group 1, n=25), 1-week ostium packing by ribbon gauze (group 2, n=29) or non-medicated absorbable gelatin sponge (group 3, n=25), 8-week bicanalicular stenting (group 4, n=28). Efficacy, based on anatomical and functional success, and safety data on treatment-related complications were evaluated.

**Results:** 113 patients (90 female) aged  $61.3 \pm 11.3$  (29-86) underwent 116 MMED. 104 patients (92%) provided 12-month outcomes. Number of patients, age, gender, surgeon, and osteotomy size were comparable among groups (all  $p > 0.4$ ). Marginal significance was found in anatomical (group 1: 80%, group 2: 96.6%, group 3: 96%, group 4: 96.4%,  $p = 0.05$ ) but not functional success (group 1: 85%, group 2: 85.7%, group 3: 83.3%, group 4: 88.9%,  $p = 0.75$ ) at postoperative 12-month. Patients receiving any packing or stenting achieved better anatomical (96.3% versus 80%,  $p = 0.015$ ) but not functional success (85% versus 86.1%,  $p = 0.90$ ) compared to those receiving none. More patients receiving stenting developed postoperative granuloma than those who did not (87% versus 63.4%,  $p = 0.04$ ).

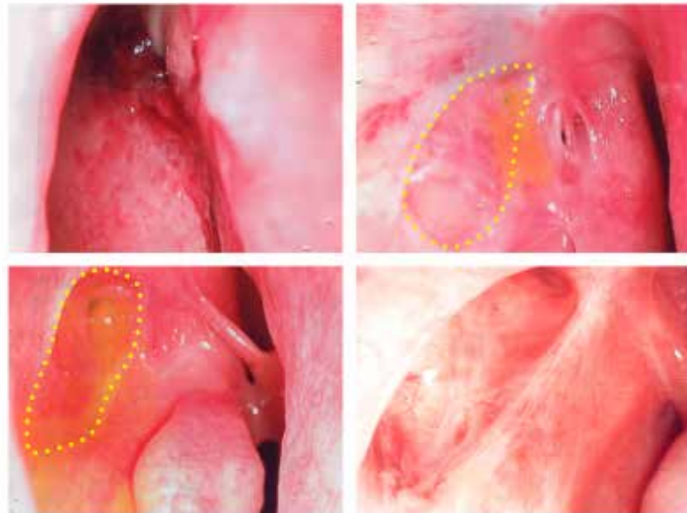
**Conclusions:** 1-week ostium packing was found to be as effective a mechanical adjuvant as 8-week bicanalicular intubation in improving anatomical outcome after MMED for PANDO.

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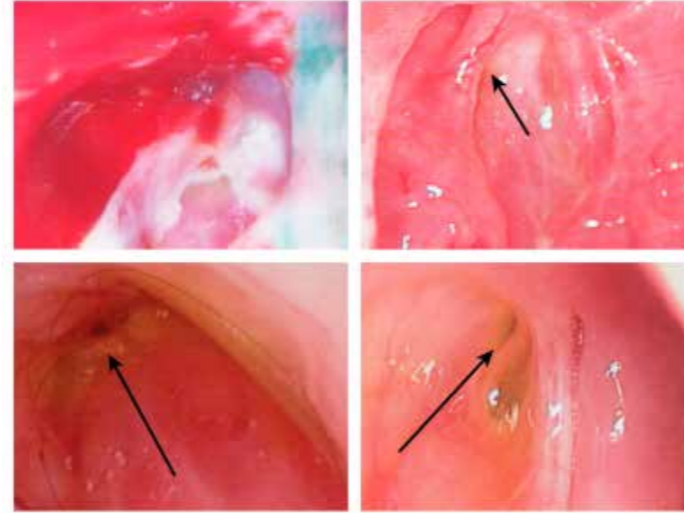
# VIDEOS

(continued)

**Figure 1**



**Figure 2**



**References:**

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### V2 - Dacryoceles: A Nick in Time Saves Nine

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**Introduction:** Dacryoceles or Dacryocystoceles are a rare manifestation of congenital nasolacrimal duct obstruction. This video demonstrates the clinical presentation and endoscopic surgical management of a rare case of bilateral dacryoceles (dacryocystoceles) with intranasal cysts.

**Methods:** Dacryocel presents as a bluish swelling over the medial canthus. When seen endoscopically through the nose, there usually is an intranasal pus-filled cyst present in such cases. These cysts can be large enough to block the airway passage in the nose on the affected side. In our video, we describe the case of an 18 day old child with bilateral congenital dacryoceles. The case was treated surgically by endoscopic intervention where cruciate marsupialisation of the intranasal cysts was performed along with probing.

**Results:** Cruciate marsupialisation of the intranasal cysts associated with dacryoceles gives satisfactory outcomes.

**Conclusions:** Infants are obligate nasal breathers and in bilateral dacryoceles, the nasal passages on both sides is blocked and the child may present with respiratory distress. During breastfeeding there is a possibility of the baby choking as well. Therefore intervention in bilateral dacryocel is essential. In this video, we discuss the pathology, etiogenesis of dacryoceles and show the correct endoscopic technique of marsupialization of dacryoceles. Ophthalmologists must be aware of the possible complications that may arise from dacryoceles.

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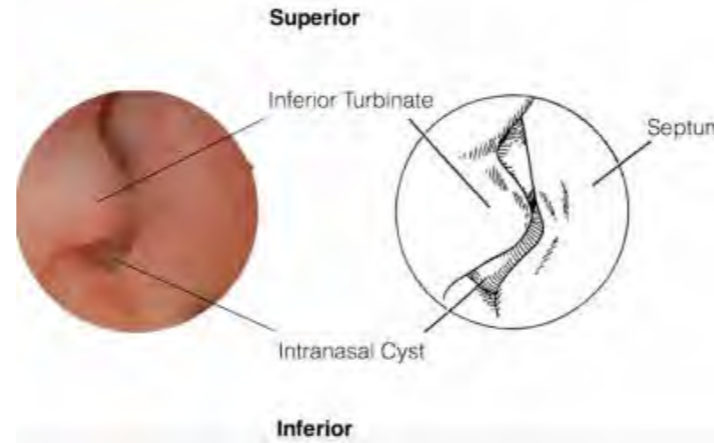
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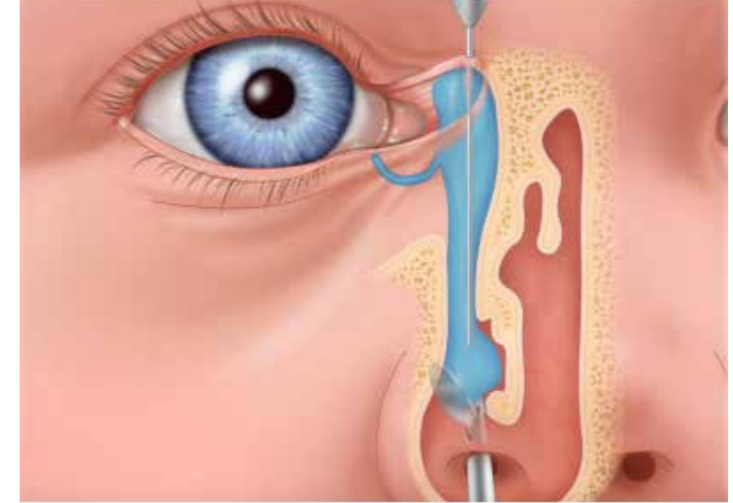
**Figure 1**



**Figure 2**



**Figure 3**



**Figure 4**



**Figure 5**



## References:

1. Ali MJ, Singh S, Naik MN. Long-term outcomes of cruciate marsupialization of intra-nasal cysts in patients with congenital dacryocoele. *Int J Pediatr Otorhinolaryngol.* 2016;86:34-6.

### V3 - Secondary Repair of Upper Eyelid Laceration with Canalicular Laceration, Right

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**Introduction:** Canalicular laceration is common in the pediatric age group and frequently accompanies other ocular injuries, including eyelid and globe lacerations.<sup>1</sup>

**Methods:** This is a case of an 11-year old male who sustained trauma to the right eye after accidentally hitting a metal clothes hanger while playing at a store which resulted to an upper lid laceration with canalicular laceration. Primary repair was done in a local clinic and was then seen at our institution 5 days post injury. A secondary repair was done using the “one stitch technique” by doing a single pericanalicular horizontal mattress suture which was described by Dr. Kersten and gives an anatomical success rate of 100%.<sup>4</sup> A Masterka monocanalicular stent was used to bridge the transected canaliculus. The Masterka silicone tube with punctal fixation, pre-mounted on an introducer to facilitate insertion is placed within the lumens of the canaliculi to bridge the lacerated areas. Monocanalicular stents minimize the risk of injury to the intact canaliculus, compared to bicanalicular silicone stent. The Masterka needs no nasal recovery thus, making it a less traumatic procedure.

**Results:** In a study by Tavakoli, MD, the outcomes showed high effectiveness with functional and anatomic success were 100% and 87% respectively.<sup>1</sup> The most common complication of using this stent was tube loss secondary to manipulation which did not happen in our case.<sup>1</sup>

**Conclusions:** Intubation of lacerated canaliculi with a Masterka monocanalicular stent for canalicular repair was safe, effective and simple with minimal complications.

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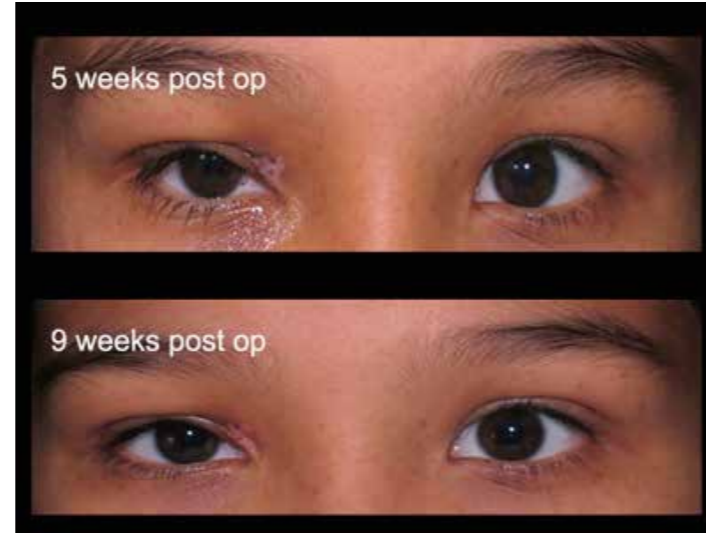
# VIDEOS

(continued)

**Figure 1**



**Figure 2**



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## V4 - Corneal Neurotization with Infraorbital Nerve: Minimally Invasive Surgical Technique

Ilya Leyngold<sup>1</sup>, Michelle Latting<sup>2</sup>, Michael Yen<sup>3</sup>

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**Introduction:** Corneal neurotization has been shown to restore corneal sensibility and ocular surface integrity in patients with neurotrophic keratopathy. Originally described techniques are lengthy, require multiple specialists to perform, and pose significant risks of alopecia, subgaleal hematoma, long scars, facial nerve injury, prolonged anesthesia, and donor site morbidity. The authors describe a minimally invasive technique to circumvent these shortcomings while achieving successful restoration of corneal sensibility and ocular surface integrity in patients with intact ipsilateral infraorbital nerve suffering from corneal anesthesia.

**Methods:** An acellular nerve allograft was coapted to an intact ipsilateral infraorbital nerve in the end-to-side fashion through an inferior transconjunctival incision (Figures 1,2). The nerve allograft was then tunneled to the corneoscleral limbus in the sub-Tenon's space.

**Results:** Successful corneal neurotization was performed with this technique in 2 patients.

**Conclusions:** Corneal neurotization with infraorbital nerve coapted to the acellular nerve allograft appears to be a viable alternative to more invasive techniques in patients with intact ipsilateral infraorbital nerve.

**Figure 1**



**Figure 2**



(continued)

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## References:

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2. Bains RD, Elbaz U, Zuker RM, Ali A, Borschel GH. Corneal neurotization from the supratrochlear nerve with sural nerve grafts: a minimally invasive approach. *Plast Reconstr Surgery*. Feb 2015;135(2):397e-400e.
3. Terzis JK, Dryer MM, Bodner BI. Corneal neurotization: a novel technique for the anesthetic cornea. *Cornea*. Jul 2010;29(7):812-819.
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## V5 - Minimally Invasive Endoscopic Corneal Neurotization: Surgical Technique

Ilya Leyngold

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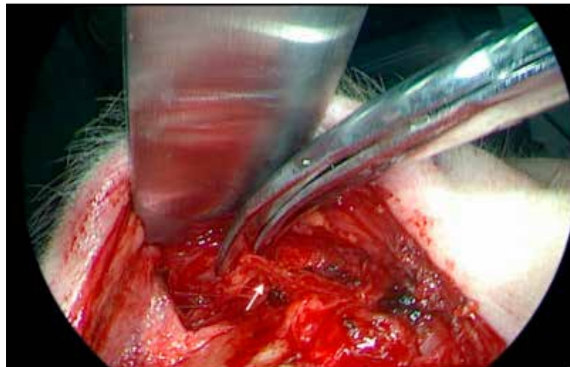
**Introduction:** Although corneal neurotization has been shown to restore corneal sensibility in patients with neurotrophic keratopathy, the described techniques are lengthy, require multiple specialists to perform, and pose significant risks of alopecia, subgaleal hematoma, long scars, facial nerve injury, prolonged anesthesia, and donor site morbidity. The author developed a minimally invasive endoscopic technique to circumvent these downsides while achieving successful restoration of corneal sensibility and ocular surface integrity.

**Methods:** The procedure involves an endoscopic harvest of a sensory donor nerve through an eyelid crease incision and its transfer to the affected cornea.

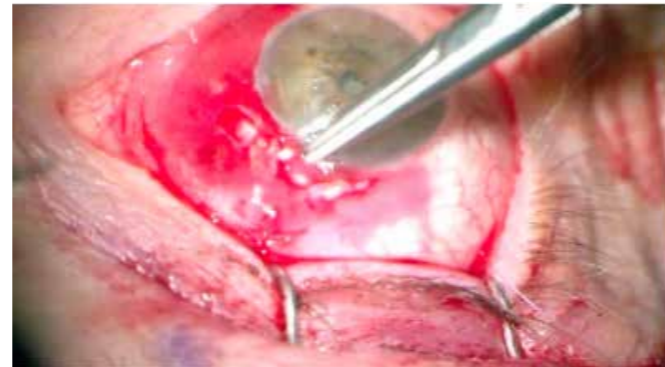
**Results:** Successful endoscopic transfer of the donor nerve was achieved with this minimally invasive technique (Figures 1,2).

**Conclusions:** The use of the endoscope allows for a safe and efficient operation with successful restoration of corneal sensibility and epithelial integrity.

**Figure 1**



**Figure 2**



### References:

1. Elbaz U, Bains R, Zuker RM, Borschel GH, Ali A. Restoration of Corneal Sensation With Regional Nerve Transfers and Nerve Grafts: A New Approach to a Difficult Problem. *JAMA ophthalmology*. Jul 10 2014.
2. Bains RD, Elbaz U, Zuker RM, Ali A, Borschel GH. Corneal neurotization from the supratrochlear nerve with sural nerve grafts: a minimally invasive approach. *Plast Reconstr Surgery*. Feb 2015;135(2):397e-400e.
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### V6 - The Sutureless Müllerectomy

Juliana Gildener-Leapman, Ran Stein, Iyar Sheps, Morris Hartstein  
*Ophthalmology, Yitzhak Shamir Medical Center, Tzrifin, Israel*

**Introduction:** Müller's-muscle conjunctival resection (MMCR) is a well-known approach for ptosis repair. In its standard fashion, it involves resection of Müller's muscle and conjunctiva, followed by suturing of the conjunctiva to the tarsus with absorbable or non-absorbable sutures. We herein present our experience in performing MMCR without sutures.

**Methods:** The study was conducted as a retrospective review of 18 patients (32 eyelids) undergoing sutureless MMCR. 30 eyelids had acquired ptosis and two eyelids had congenital ptosis. Surgery consisted of a standard approach and placement of a Putterman clamp. A hemostat was then placed below the clamp prior to excision of the clamped tissues between the instruments with a 15 blade. Following application of gentle cautery the hemostat was removed and no internal sutures were placed. Preoperative and postoperative upper margin to reflex distances (MRD1) were measured and patients were evaluated for symmetry within 1 mm and the incidence of any complications.

**Results:** 31 of 32 eyelids (96.9%) showed some improvement in MRD1, with an average improvement of 1.4 mm (range 0 to 3.5 mm, SD = 0.64). Of the 18 patients, 14 had bilateral surgery and 4 had unilateral surgery. 17 of the 18 patients (94.4%) showed postoperative symmetry of MRD1 within 1 mm. One unilateral case resulted in an MRD1 difference of 1.5 mm, with a 3 mm improvement on the operated side and a Hering's phenomenon noted on the other side. There was one case of corneal abrasion seen post-operatively. One of two congenital ptosis cases requested additional eyelid elevation although she was improved from preoperative assessments.

**Conclusions:** We find that the sutureless technique is a rapid and effective method for performing a Müller's-muscle conjunctival resection. This technique is especially useful as an adjunct to blepharoplasty where mild ptosis exists for an added rejuvenating effect. It is low-risk and potentially corneoprotective when compared to the standard suture technique. Further studies could determine if a modified algorithm needs to be applied.

(continued)

## VIDEOS

(continued)

**Figure 1**



Figure 1: Patient before (left) and after (right) bilateral sutureless mullerectomy with upper blepharoplasty.

### References:

1. Lewis Laring. Blepharoptosis Correction With the Sutureless Fasanella-Servat Operation. Arch Ophth. 1977 Vol 95; 671-674.
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6. Putterman AM, Urist MJ. Müller's muscle-conjunctival resection ptosis procedure. Ophthalmic Surg. 1978 Jun;9(3):27-32.

### V7 - The Single-Stitch Müllerectomy

June Geng<sup>1</sup>, Mark Prendes<sup>1,2,3</sup>, Austin Gerber<sup>1,2,3</sup>, William Nunery<sup>1,2,3</sup>, Hui Bae Harold Lee<sup>1,2,3</sup>

<sup>1</sup>Eugene and Marilyn Glick Eye Institute, Indiana University School of Medicine, Indianapolis, Indiana, United States of America, <sup>2</sup>Oculofacial Plastic and Orbital Surgery, Indianapolis, Indiana, United States of America, <sup>3</sup>Department of Ophthalmology and Visual Sciences, University of Louisville, Louisville, Kentucky, United States of America

**Introduction:** The results of a modified Müller's muscle-conjunctival resection (MMCR) using a single central horizontal mattress stitch are reviewed, and the technique is described.

**Methods:** A retrospective review of eight (8) consecutive patients undergoing twelve (12) MMCR for ptosis was performed. The procedure was performed by placing a central upper eyelid traction suture and then everting the upper lid over a Desmarres retractor. The amount of resection desired was measured and marked and a silk suture was passed through conjunctiva and Müller's muscle at the desired point above the superior border of tarsus. This tissue was then clamped with a Putterman clamp and the silk suture was removed. A single double-armed 5-0 chromic gut suture was placed just inferior to the clamp along the central 6mm of tarsus, and then externalized and tied in a horizontal mattress fashion. Excess tissue was excised. Post-operative notes were reviewed to assess lid height, contour, and subjective patient satisfaction.

**Results:** Eight (8) patients underwent twelve (12) procedures using a single-stitch müllerectomy. Post-operatively, all eyelids demonstrated improved MRD1 with good lid contour and height. All patients were subjectively satisfied with improvement and no revisions were required.

**Conclusions:** Preliminary results from single-stitch müllerectomies on eight (8) patients indicate that this modified technique of MMCR using a single central horizontal mattress stitch may be effective for treating ptosis among patients who are candidates for MMCR.

(continued)

# VIDEOS

(continued)

**Figure 1**



**Figure 2**



**Figure 3**



**References:**

1. Putterman AM, Urist MJ. Müller's muscle-conjunctival resection ptosis procedure. *Ophthalmic Surg.* 1978 Jun;9(3):27-32.



## V8 - Single Suture Mueller Muscle Conjunctival Resection (ssMMCR): A Modified Technique for Ptosis Repair

Lilangi Ediriwickrema<sup>1</sup>, Archana Nair<sup>1,2</sup>, Patrick Yang<sup>1</sup>, Bobby Korn<sup>1,3</sup>, Don Kikkawa<sup>1,3</sup>

<sup>1</sup>UC San Diego Department of Ophthalmology, Division of Oculofacial Plastic and Reconstructive Surgery, Shiley Eye Institute, La Jolla, California, United States of America, <sup>2</sup>New York University Langone Health, Department of Ophthalmology, New York City, New York, United States of America,

<sup>3</sup>UC San Diego Department of Surgery, Division of Plastic and Reconstructive Surgery, La Jolla, California, United States of America

**Introduction:** To evaluate the efficacy in degree of ptosis correction achieved by single suture Mueller muscle conjunctival resection when compared to that of traditional MMCR.

**Methods:** A retrospective chart analysis of patients who underwent either ssMMCR or traditional MMCR at a single institution. Single suture MMCR was performed after using a ptosis clamp to imbricate conjunctiva and Mueller's muscle. Margin-to-reflex distance 1 (MRD1) was measured pre and post-operatively, and the change in MRD1 was analyzed for both groups. Patients were monitored in follow-up for post-operative complications including: lagophthalmos, corneal abrasions, and change in visual acuity. Statistical analysis was performed using the Microsoft Excel and Stata software programs.

**Results:** Twenty-eight patients (48 eyelids) who underwent single suture Mueller muscle conjunctival resection over five months were compared to eleven patients (20 eyelids) who underwent traditional MMCR over the antecedent two month period. Patients who underwent simultaneous surgery for other vertical lift procedures such as brow elevation surgery were excluded.

The ssMMCR and MMCR groups were followed post-operatively for approximately 2.1 (range: 1-4) and 4.55 (1.5-10) months, respectively. On average, the MRD1 increased by 2.86 mm (range: 0.5-4.5, standard deviation (SD) 0.97 mm) and 2.95 mm (range: 0-5.5, SD 1.65 mm), respectively, between the ssMMCR and traditional MMCR groups. Notably, there was no statistically significant difference in the means identified by t-test (t-value 0.267, standard error (SE) 0.32, p-value 0.395). None of the 39 patients developed lagophthalmos or corneal abrasions post-operatively. Of the sixty-eight eyelid surgeries evaluated, one (0.021%) ssMMCR and two (0.095%) MMCR eyelids required further surgical revision. Operative times were reduced using the ssMMCR technique.

**Conclusions:** Single suture MMCR is an efficient and effective method for ptosis repair. It results in comparable outcomes including elevation in MRD1, safety profile, and re-operation rates, when compared to traditional MMCR.

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**Figure 1** Pre and postoperative images following bilateral ssMMCR.



**Table** Comparison between ssMMCR and traditional MMCR techniques.

**Table.** Comparison between ssMMCR and traditional MMCR techniques.

	n (patients)	n (eyelids)	change in MRD1 (mm)	SD (mm)	Rates of lagophthalmos	Rates of re-operation
ssMMCR	28	48	2.86	-0.97	0	1 (0.021%)
MMCR	11	20	2.95	1.65	0	2 (0.095%)
T-test			t 0.267	SE 0.32	p-value 0.395	

**References:**

1. Allen RC, Saylor MA, Nerad JA. The current state of ptosis repair: a comparison of internal and external approaches. *Curr Opin Ophthalmol.* 2011 Sep;22(5):394-9.
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## V9 - Efficiency in using Locking Forceps as a Replacement for Retraction Sutures in Posterior Ptosis Surgery

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**Introduction:** In posterior ptosis surgery, it is very common for surgeons to utilize additional sutures to retract and tent upward both the conjunctiva and Mueller's muscle prior to placing the ptosis clamp. We present our experience with utilizing two locking forceps as replacement for retraction sutures prior to placing the ptosis clamp.

**Methods:** An IRB chart review from 2010 to 2018 was performed to review posterior ptosis cases performed at one academic institution by one surgeon. All cases in the series were performed with a surgical technique modification of utilizing two locking forceps instead of retraction sutures prior to placing the ptosis clamp (See Figures). Outcomes and complications to be reported.

**Results:** 246 cases were reviewed. No adverse outcomes were noted. Specifically, there were none of the following potential adverse outcomes: no wound dehiscence, pyogenic granulomas, or symblepharon formation. On average, unilateral cases took four minutes; bilateral cases took between eight to ten minutes.

**Conclusions:** We recommend utilizing two locking forceps as a replacement for retraction sutures prior to placing the ptosis clamp in posterior ptosis surgery. In our experience, utilizing the locking forceps saves not only the cost of additional traction sutures, but it also saves the additional cost of operating room time. Additionally, the locking-forceps modification makes the procedure run more smoothly.

**Figure 1**



**Figure 2**



**Figure 3**



**References:**

1. Putterman AM, Urist MJ. Müller muscle-conjunctiva resection. Technique for treatment of blepharoptosis. *Arch Ophthalmol.* 1975 Aug;93(8):619-23.
2. Dresner SC. Further modifications of the Müller's muscle-conjunctival resection procedure for blepharoptosis. *Ophthalmic Plast Reconstr Surg.* 1991;7(2):114-22.

### V10 - Lateral Rectus Muscle Enlargement in Congenital Fibrosis of Extraocular Muscles

Salma Yassine<sup>1</sup>, Ramzi Alameddine<sup>2</sup>

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**Introduction:** Present a case of congenital strabismus and proptosis of the left eye with lateral rectus muscle enlargement on imaging.

Biopsy revealed normal skeletal muscles with associated benign fibrosis.

**Methods:** 3-month-old boy presented with congenital left eye proptosis associated with left exotropia and hypotropia. Outside imaging including CT scan and MRI of orbit were pertinent for diffuse thickening of the left lateral rectus muscle with no evidence of infiltration of the adjacent fat planes or bony erosion.

**Results:** Clinical examination showed left eye proptosis and upper eyelid retraction. There was also left exotropia (>50 D) and hypotropia (>50 D) with restriction in ad-duction, ab-duction and supra-duction. Laboratory tests including CBC, TSH and CPK were normal. Left lateral orbitotomy and biopsy of the lateral rectus was performed. Pathology showed significant fibrosis of the muscle without any evidence of inflammation or necrosis or neoplasm. Patient subsequently underwent multiple strabismus surgeries with residual misalignment to date.

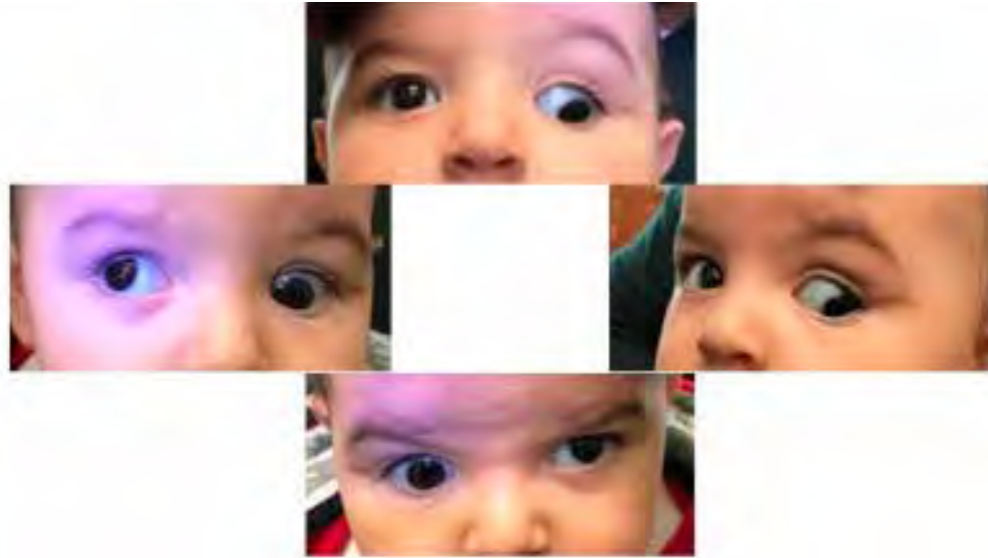
**Conclusions:** Congenital fibrosis of extraocular muscles encompasses a wide phenotype of non-progressive restrictive ocular disorders. The classically described five clinical subtypes include (1) generalized fibrosis syndrome, (2) inferior rectus fibrosis with blepharoptosis, (3) strabismus fixus, (4) vertical retraction syndrome, and (5) unilateral fibrosis, blepharoptosis, and enophthalmos<sup>2-3</sup>. We present a case of congenital extraocular muscle thickening instead of atrophy that does not fit the current classification.

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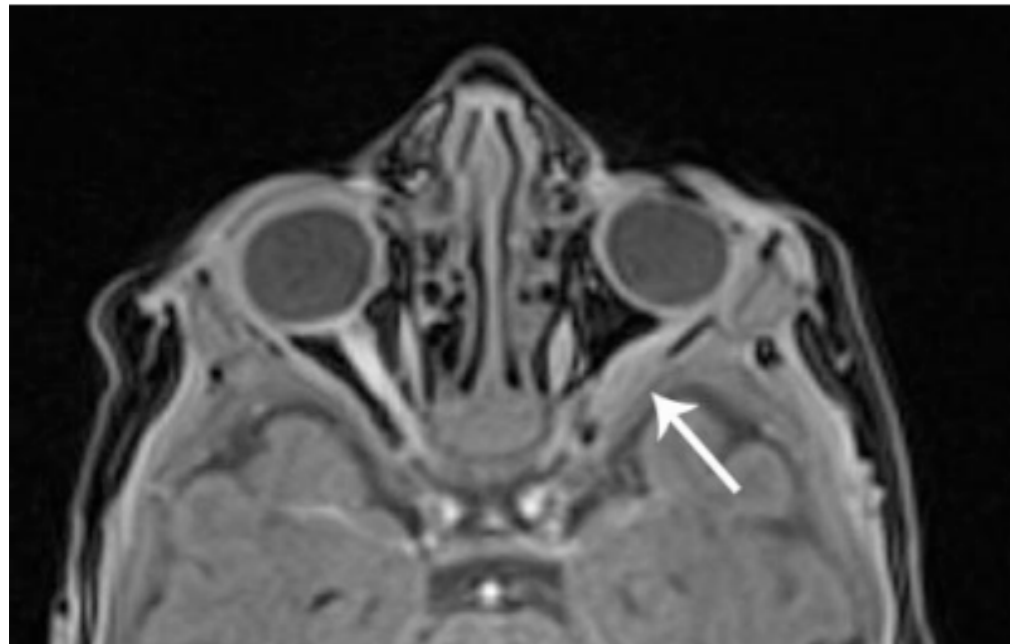
**Figure 1**



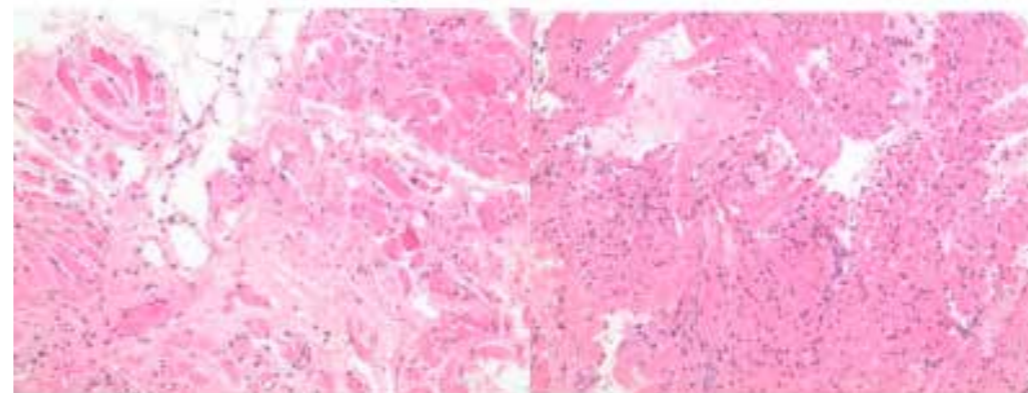
**Figure 2**



**Figure 3**



**Figure 4**



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## V11 - Choroidal Thickness in Thyroid Associated Orbitopathy

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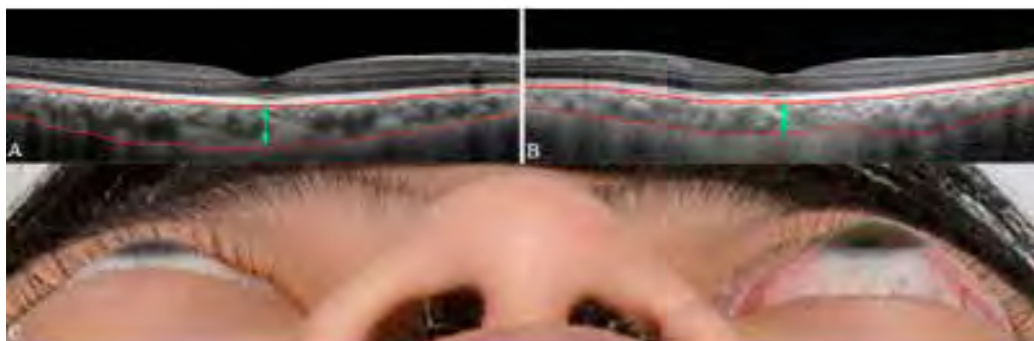
**Introduction:** To evaluate the choroidal thickness (CT) in patients with thyroid-associated orbitopathy (TAO).

**Methods:** CT of TAO patients and healthy subjects were measured with enhanced-depth imaging optical coherence tomography (EDI-OCT) at the subfoveal, macular and peripapillary regions. CT were compared between eyes with TAO and controls. Multivariate linear regression was used to evaluate the associations of subfoveal CT with systemic and ocular variables among TAO eyes.

**Results:** 104 eyes of 52 TAO patients and 52 eyes of 26 healthy subjects were analyzed. When TAO eyes were compared to control eyes, CT was significantly increased at the subfoveal region, 1 and 2mm from the fovea nasally, temporally, and superiorly, and 1mm inferior to the fovea (all  $p < 0.05$ ). No significant difference was found in CT at 2mm inferior to the fovea ( $p = 0.094$ ) and all four quadrants of the peripapillary region (superior,  $p = 0.096$ ; nasal,  $p = 0.732$ , inferior,  $p = 0.179$ ; temporal,  $p = 0.052$ ). Among TAO eyes, thinner subfoveal choroid was associated with worsening exophthalmos ( $p = 0.043$ ), poorer visual acuity ( $p = 0.017$ ), increasing age ( $p = 0.040$ ) and axial length ( $p < 0.001$ ). There was no association between CT and clinical activity score ( $p = 0.239$ ).

**Conclusions:** TAO patients showed thicker choroid than controls over the macular, but not the peripapillary regions. Thinner subfoveal choroid was associated with worsening exophthalmos and poorer vision. EDI-OCT provides a non-invasive tool to monitor choroidal vascular changes associated with TAO and its complications.

**Figure 1**



### V12 - Small Incision Vertical Lid Split Orbitotomy

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**Introduction:** Vertical lid split orbitotomy has been applied for medial orbitotomy from anterior to posterior orbital lesion in the last few decades. The split is classically at the junction of medial and central one third of upper lid. Good cosmesis have been documented postoperatively.

**Methods:** This video demonstrates that through a small skin incision splitting at the tapering end of medial tarsus (Fig 1) is enough to enter superior and medial orbit and provides excellent exposure. The conjunctival incision is extended to the fornix superoposteriorly for a deeper lesion (Fig 2A) or downward toward the retrocaruncular region (Fig 2B) for a lower medial orbital lesion.

**Results:** Vertical lid split allows minimal separation of nasal levator aponeurosis and Müller's muscle. Moving the incision nasally also avoid transecting or disinsertion of aponeurosis from the tarsal plate. Wound incision is small and closure is simple with good healing (Fig 4).

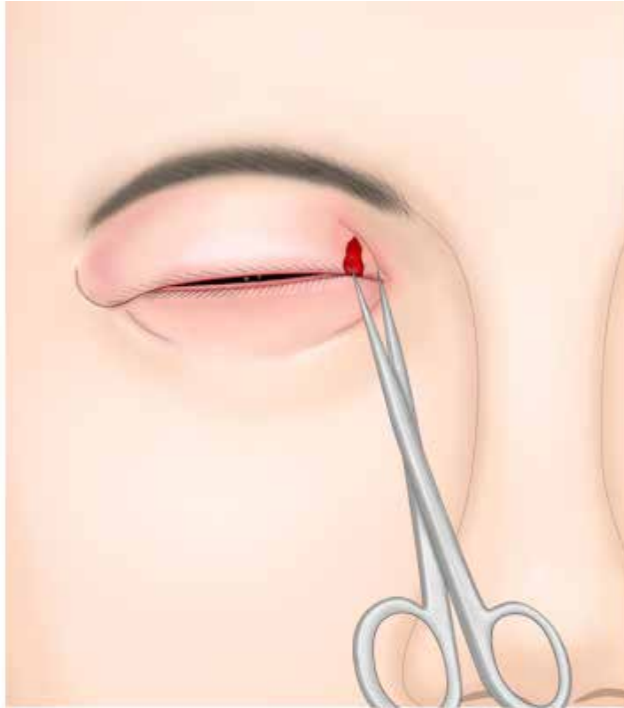
**Conclusions:** Limiting the skin incision more nasally especially below the upper lid crease not only gives a better healing and cosmesis, but also deeper access to the orbital space.

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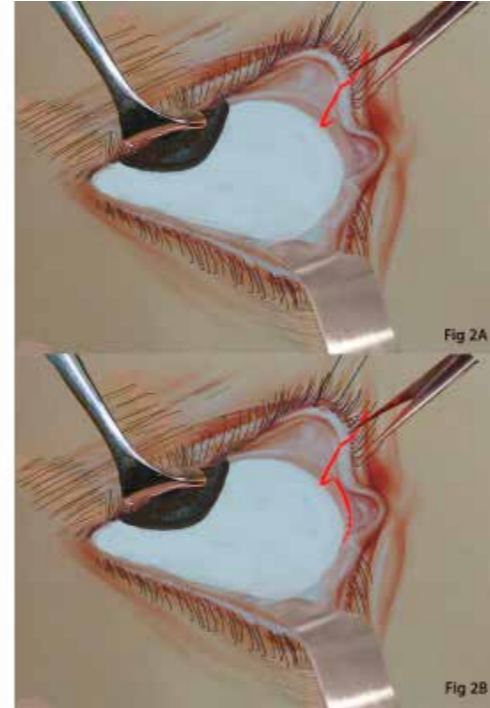
# VIDEOS

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**Figure 1**



**Figure 2**



**Figure 3**



**Figure 4**



**References:**

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### V13 - Scarless Reduction of Proptosis and Periocular Swelling

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**Introduction:** Orbital decompression and blepharoplasties are integral part of surgical rehabilitation for patients with thyroid associated orbitopathy (TAO) suffering from proptosis and periocular swelling. Various designs of skin incision has been reported which may cause problems in selected group of patients.

**Methods:** Here we showed bone and fat removal decompression and blepharoplasties performed through conjunctival and endoscopic approach. Conjunctiva is incised at the lateral fornix and extend superiorly and inferiorly Incision is deepened until the arcus marginalis is exposed and incised at the lateral orbital rim. Subperiosteal dissection is carried out to expose bone for removal by high-speed drill over the lacrimal keyhole, sphenoid diploe and basin of the inferior orbital fissure. Periosteum is opened and intraconal fat is removed. Additional anterior fat can be removed through inferior and superior forniceal incision. Endoscopic transethmoidal medial wall decompression is performed for additional proptosis reduction. Endoscopic fat removal is done over the incised periosteum over the retrobulbar region to reduce postoperative diplopia. Conjunctiva is realigned and left unsutured or with a few buried absorbable sutures if soft tissue prolapse is significant.

**Results:** We will compare representative examples of TAO patients undergoing rehabilitative orbital decompression using standard upper lid crease, lateral canthotomy and forniceal incisions.

**Conclusions:** Scarless approach is a technically viable and valuable alternative to further enhance the surgical armamentarium in TAO patients, particularly among those with concern of cutaneous incisions.

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**Figure 1**



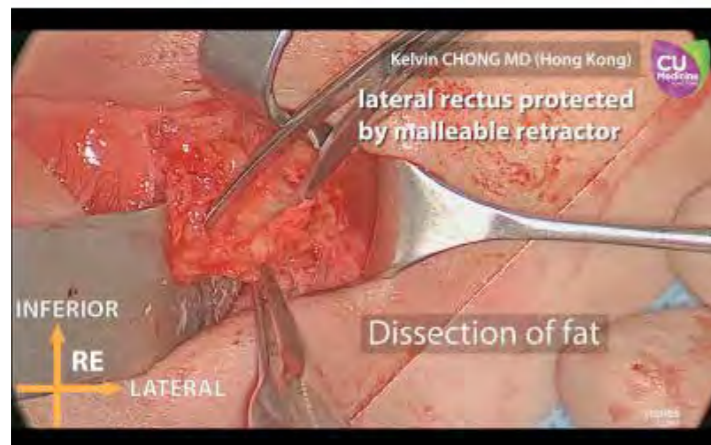
**Figure 2**



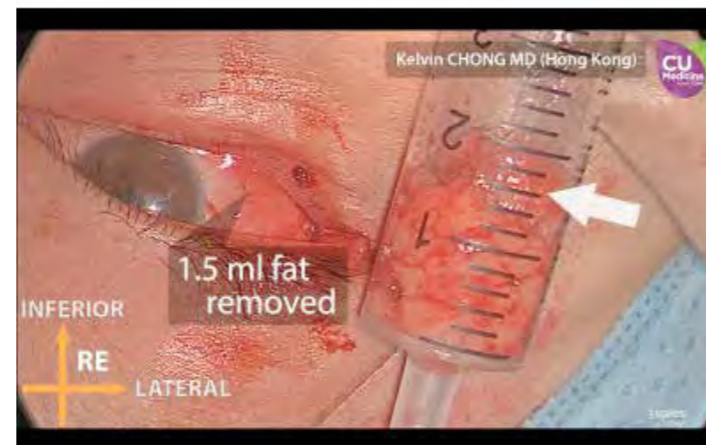
**Figure 3**



**Figure 4**



**Figure 5**



### V14 - Various Fixation of the Insertion Plate in Reconstruction of Orbital Wall Fracture

Seong-Won Yang<sup>1</sup>, Jin-Sook Yoon<sup>2</sup>, Hwa-rang Lim<sup>3</sup>

<sup>1</sup>Ophthalmology, Chosun University Hospital, Gwangju-Metropolitan City, South Korea, <sup>2</sup>Ophthalmology, Severance Hospital, Yonsei University College of Medicine, Seoul, South Korea, <sup>3</sup>Chosun University Hospital, Gwangju-Metropolitan City, South Korea

**Introduction:** In reconstruction, while an implant is inserted, it can be sutured or screwed. We will introduce various methods of fixation on the fracture surface.

**Methods:** We retrospectively reviewed 380 patients who underwent medial and/or inferior blow-out fracture from January 2013.

The plate was mainly inserted with Porous polyethylene (210 cases) and u-HA + PLLA (170cases) sheet using a conventional surgical procedure.

The plate fixation was performed, sutured with polyglactin 910 6-0 (121 cases), screw fixation (3 cases). Wedge shape fixation (256 cases)

The V-wedge shape and the U-wedge shape were mainly produced for fixation of the implanted plate.

Authors used various wedge fixation types : V type, Jagged E type, Sharpened jagged E type, and Central jagged E type.

In the case of a wide inferior wall fracture, the central jagged E type in the middle of the plate was produced while reinforcing the thickness.

**Results:** The wedges for fixation in the 4 cases were broken meanwhile bending the wedge, and sutured with polyglactin 910 6-0. the plates were somewhat subluxated, but there were no further clinical problem.

There was no distorsion or dislocation with the new fixation method even in wide fractures.

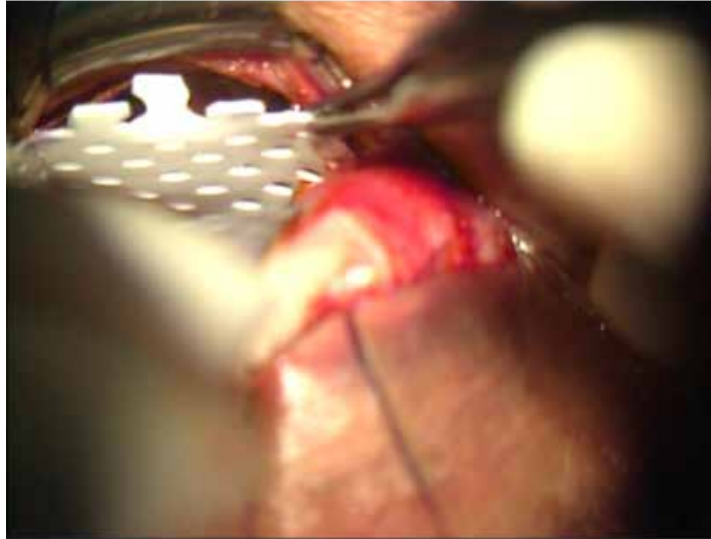
**Conclusions:** Wedge fixation is faster and easier to make wedge for concrete fixation, even without screw in large inferior blow-out fracture. Various types fixation were time-saving, more cost-economic, and well tolerated method in reconstruction of Blow-out fracture.1

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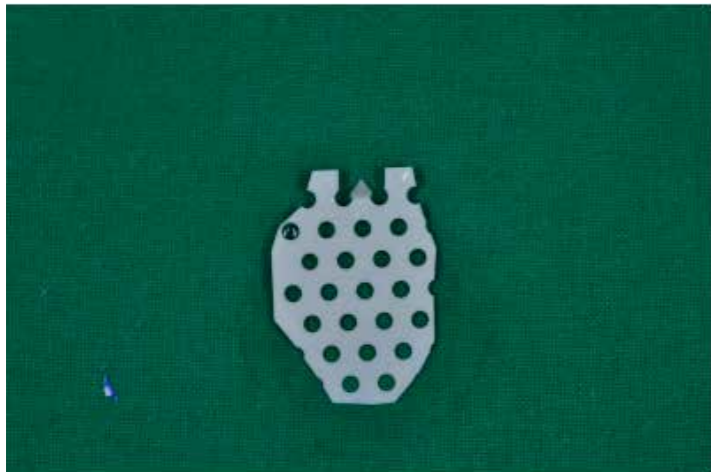
**Figure 1**



**Figure 2**



**Figure 3**



**Figure 4**



## V15 - Graded, Guided and Guarded Ophthalmic Approaches to Endoscopic Medial Wall Orbital Decompression

Kelvin Kam Lung Chong<sup>1,2</sup>, Joyce Chin<sup>2</sup>, YienChing Regine Chan<sup>2</sup>, Alvin Lerrmann Young<sup>2</sup>

<sup>1</sup>Department of Ophthalmology and Visual Sciences, The Chinese University of Hong Kong, Hong Kong, <sup>2</sup>Department of Ophthalmology and Visual Sciences, Prince of Wales Hospital, Hong Kong, Hong Kong, Hong Kong

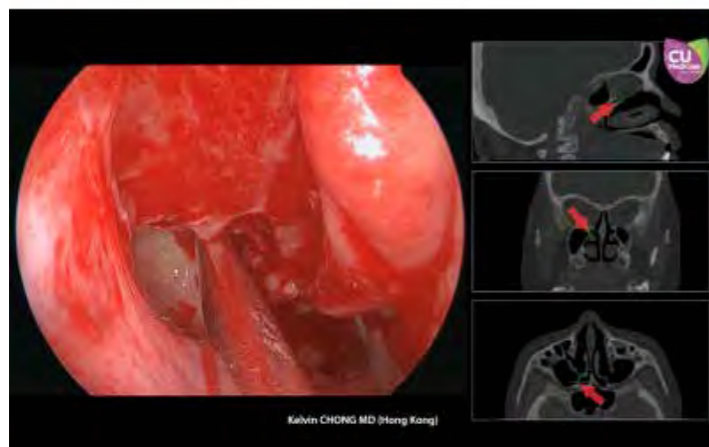
**Introduction:** Traditionally medial wall decompression has been performed by oculoplastic surgeons through transcaruncular or transcutaneous approach.

**Methods:** Here we demonstrated how endoscopic medial orbital decompression was performed by oculoplastic surgeons alone using orbital but not powered sinus instruments.

**Results:** "Graded" and "Guided" (under image-guidance) bone and soft tissues removal can be tailored by surgical indications: (1) limited: retrobulbar removal and opening of lamina papyracea and periorbita for mild to moderate proptosis (2) standard: complete medial wall removal for compressive optic neuropathy (3) extended: inferomedial decompression including posterior ethmoidomaxillary strut and orbital floor for additional proptosis reduction (4) repeated: operation opening up to anterior sphenoid sinus for persistent or recurrent optic neuropathy. Complications can be "Guarded" by limiting to retrobulbar decompression (diplopia), endoscopically enlarging maxillary antrum (sinusitis) and real-time monitoring with navigation (skull-base injury). Finally suction punch can be used to manually remove orbital fat under direct visualization in a controlled manner.

**Conclusions:** Using a graded, guided and guarded approaches we demonstrated how oculoplastic surgeons with endoscopic experience can safely perform and individualize medial wall orbital decompression.

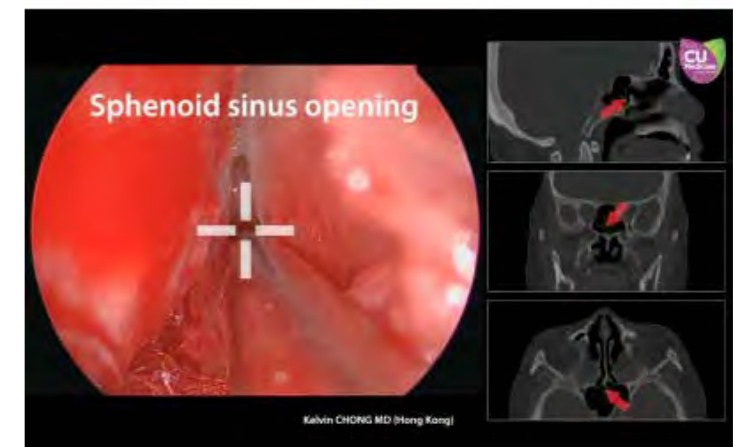
**Figure 1**



**Figure 2**



**Figure 3**

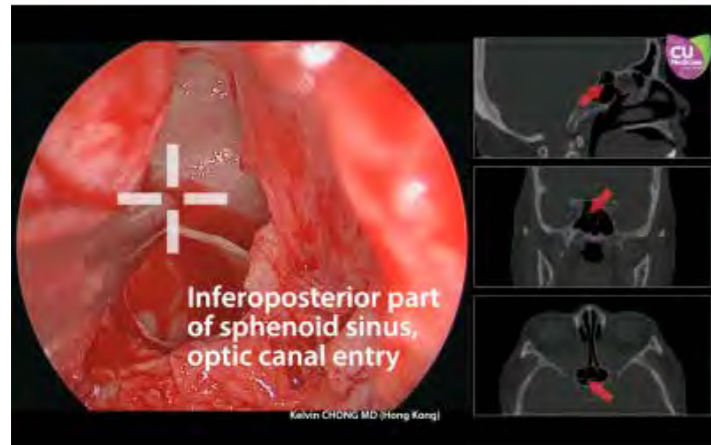


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**Figure 4**



**Figure 5**



## V16 - Floppy Eyelid Syndrome Associated with Subconjunctival Orbital Fat Prolapse: A Consecutive Case Series of 6 Patients

Kelsey Roelofs<sup>1</sup>, David Plemel<sup>1</sup>, Jaime Badilla<sup>1</sup>, Ezekiel Weis<sup>2</sup>, Andrew Ting<sup>1</sup>

<sup>1</sup>University of Alberta, Edmonton, Alberta, Canada, <sup>2</sup>University of Calgary, Calgary, Alberta, Canada

**Introduction:** To report a consecutive case series of 6 patients who presented for assessment of subconjunctival orbital fat prolapse (SOFP) and were found to have concurrent floppy eyelid syndrome (FES).

**Methods:** Demographic data, past medical and surgical history, medications and details regarding ocular-adnexal examination were recorded from patient charts. Computerized tomography (CT) scans of the orbits and pathology reports were reviewed if available.

**Results:** The mean age ( $\pm$  SD) of all patients included in this study was  $76.3 \pm 8.4$  years. With regards to past medical history, half (3/6; 50%) of the patients had diabetes and the majority (5/6; 83%) had hypertension. On examination, all patients were noted to have full extraocular movements. Orbital fat prolapse was found to be bilateral in one third (2/6; 33%) of patients. Four patients (67%) were diagnosed with obstructive sleep apnea, one was in the process of undergoing sleep study and one patient reported a history of snoring at night, but had not undergone sleep study or pulmonary medicine consult (Figure 1). Three patients had CT scans of the orbits performed. Imaging revealed bilateral (2/3; 67%) or unilateral (1/3; 33%) subconjunctival/prominent orbital fat of normal density with no underlying mass or additional orbital pathology for patient 1 (Figure 2 A and B), patient 2 (Figure 2 C and D) and patient 3 (Figure 2 E and F). This correlated with clinical findings with respect to laterality. External pre-operative photos of patient 1 demonstrated an example of bilateral prolapse of orbital fat (Figure 3 A). Following excision of prolapsed orbital fat there is a small amount of residual subconjunctival hemorrhage OD (Figure 3 B) and vertical lid traction demonstrates significant floppy eyelids (Figure 3 C). Three patients in this series underwent excision of orbital fat. Representative histopathological slides were available for patient 4 (Figure 4). At 40X, the majority of the specimen appears to be composed of mature adipocytic cells (Figure 4 A). Examination of a smaller portion of the specimen reveals collagenous tissue at 40X (Figure 4 B) and 400X (Figure 4 C). Staining for elastin showed an absence of elastin fibers (Figure 4 D).

**Conclusions:** This is the first report documenting a potential association between FES and SOFP. As may be expected, the patients included in this case series represent a similar demographic seen in the majority of cases of FES. The lack of elastin seen in the histopathological specimen may provide a potential pathophysiological link, however this requires further validation and comparison with matched normal controls. Further study of a larger group of patients with SOFP is required to confirm an association with FES and to document the overall incidence of FES in patients with SOFP.

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**Figure 1**

Patient number	Gender	Age	HTN	DM	OSA	Bilateral SCOF
1	M	71	Y	N	Y	Y
2	M	71	Y	Y	N*	N
3	M	78	N	N	Y	Y
4	M	68	Y	Y	Y	N
5	M	79	Y	N	N*	N
6	M	91	Y	Y	Y	N

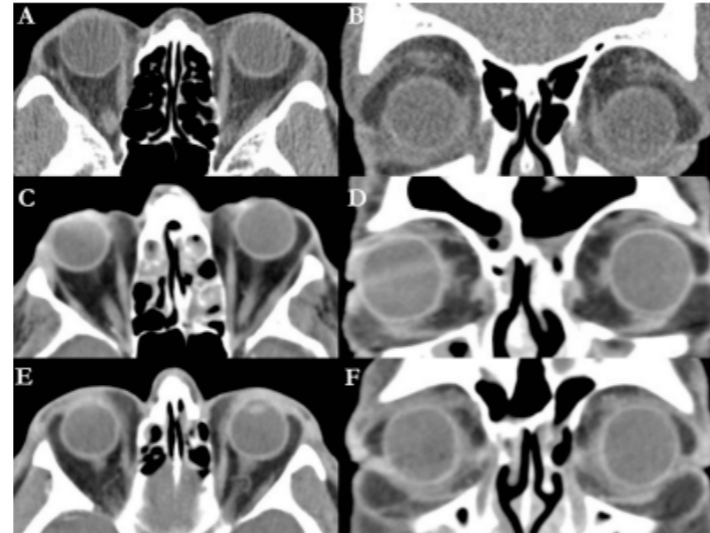
HTN = Hypertension

DM = Diabetes mellitus

OSA = Obstructive sleep apnea

\* these two patients endorsed a history of significant snoring while sleeping, however refused formal investigation with a sleep study or referral to pulmonary medicine.

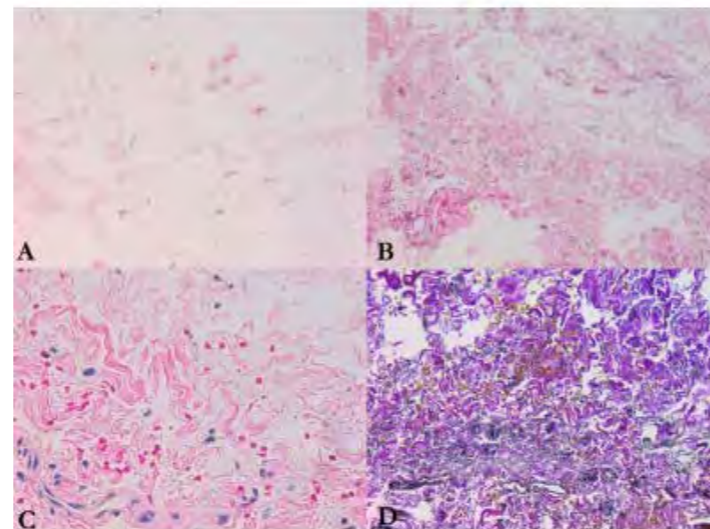
**Figure 2**



**Figure 3**



**Figure 4**





### V17 - Correction of Medial Canthal Laxity using Fascia Lata for Floppy Eyelid Syndrome

Mark Prendes<sup>1,2,3</sup>, Austin Gerber<sup>1,2,3</sup>, William Nunery<sup>1,3,5</sup>, Hui Bae Harold Lee<sup>1,2,3</sup>

<sup>1</sup>Oculofacial Plastic and Orbital Surgery, Indianapolis, Indiana, United States of America, <sup>2</sup>Department of Ophthalmology and Visual Sciences, University of Louisville, Louisville, Kentucky, United States of America, <sup>3</sup>Eugene and Marilyn Glick Eye Institute, Indiana University School of Medicine, Indianapolis, Indiana, United States of America

**Introduction:** Multiple surgical approaches exist for the repair of floppy eyelid syndrome. Many of these focus on excision of a large amount of tarsus in an attempt to tighten the eyelid. Previous studies have suggested that excessive removal of tarsus may present the greatest risk for recurrence of floppy eyelid syndrome due to eyelid instability<sup>1</sup>. Techniques have been previously described to perform combined medial canthopexy and lateral tarsal strip to decrease the amount of tarsal shortening required<sup>2</sup>. The authors describe a technique that utilizes banked fascia lata for a medial canthopexy which results in decreased medial canthal laxity and increased long term stability.

**Methods:** Local anesthetic is injected into the medial canthus, the upper and lower eyelid. A #15 blade is used to make 2mm vertical incisions inferior to the lower lid punctum, superior to the upper lid punctum and another vertical incision just anterior to the medial canthal tendon. Dissection is carried out subcutaneously between the two incisions to create a connection between them. A 6-0 polyglactin 910 suture is then used to suture a 5cm long by 3mm high piece of banked fascia lata to the anterior surface of the medial canthal tendon and underneath the skin bridge to the medial border of tarsus of the upper and lower lid. This is sutured into position with the lid in a natural position without lateral or medial traction. This effectively creates an inferior limb of the medial canthal tendon with minimal laxity that allows the punctum to sit at a desired position relative to the medial canthus.

**Results:** In a preliminary case of a surgical technique utilizing banked fascia lata for a medial canthopexy, the patient experienced resolution of preoperative symptoms and improved lid position with a decreased need for lateral lid shortening via lateral tarsal strip. The authors feel this novel surgical technique may preserve more tarsus and therefore improve eyelid stability in patients with floppy eyelid syndrome. Furthermore, experience with fascia lata for other uses suggests that this technique will likely have excellent long term stability.

**Conclusions:** Using fascia lata as a medial tether helps reduce the elasticity of the medial canthal tendon in patients with floppy eyelid syndrome. This procedure can be an adjunct in treating patients with significant punctal distraction and severe lower lid laxity.

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**Figure 1**



**Figure 2**



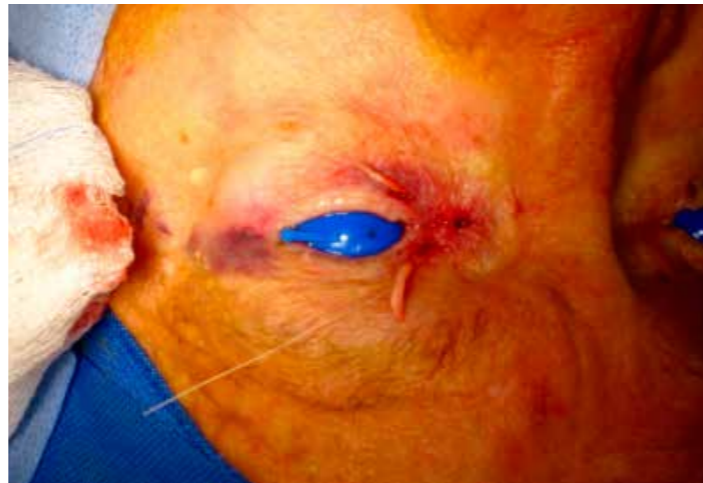
**Figure 3**



**Figure 4**



**Figure 5**



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### V18 - Upper Blepharoplasty; When and How to Reposit a Prolapsed Lacrimal Gland

Mohsen Kashkouli

*Eye Research Center, Rassoul Akram Hospital, Iran University of Medical Sciences, Tehran, Iran*

**Introduction:** To demonstrate signs suggesting lacrimal gland prolapse and technique for its reposition during upper blepharoplasty procedure.

**Methods:** Video presentation of lacrimal gland dissection and then reposition during upper blepharoplasty.

**Results:** A good preoperative examination to detect and surgical anatomical knowledge to reposit the prolapsed lacrimal gland are essential for the surgeons dealing with upper blepharoplasty procedures.

**Conclusions:** Prolapsed lacrimal gland can simply be repositated during upper blepharoplasty procedure.

## V19 - Upper Eyelid Transposition Blepharoplasty

Alison Huggins, Marie Somogyi, Vikram Durairaj, Tanuj Nakra  
*TOC Eye and Face, Austin, Texas, United States of America*

**Introduction:** Facial aesthetic rejuvenation has transformed over time, particularly in regards to the importance of volume restoration. Our appreciation of the importance of volume is readily evident in the evolution of approaches to lower eyelid blepharoplasty, specifically with implementation of orbicularis retaining ligament release and transposition of orbital fat into the tear trough region.<sup>1</sup> Autologous fat transfer has demonstrated a similar value of volume restoration to the brow and upper eyelid region.<sup>2</sup> Massry<sup>3</sup> and Sozer<sup>4</sup> have explored the role of transposition of the nasal and central fat pads respectively, in the upper eyelid. Herein, we describe the novel transposition of the central, upper eyelid preaponeurotic fat pad into the sub-brow pre-periosteal plane with full release of the brow during upper eyelid blepharoplasty.

**Methods:** A retrospective review was conducted to include all patients who underwent transposition of the upper eyelid central fat pad with placement into the sub-brow space after full brow release for augmentation of sub-brow volume. The review yielded ten patients, and a total of twenty eyelids.

**Surgical Technique:** This technique is employed at the time of standard upper eyelid blepharoplasty. After performing the upper eyelid blepharoplasty, attention is drawn to the superior orbital rim and dissection carried down to the preperiosteal plane with monopolar cautery. A freer elevator is then used to release the attachments beneath the retro-orbicular oculi fat at the zygomatico-frontal suture and extending medially to the supraorbital neurovascular bundle. The septum is then incised to expose the central, preaponeurotic fat. This fat pad is then transposed superiorly as a pedicle and placed in the aforementioned sub-brow pocket. It is then secured in place using 4-0 plain gut suture which is passed trans-cutaneously to secure the fat pad in the desired site of volumization.

**Results:** Ten patients (n=20 eyelids) successfully underwent this procedure and have demonstrated conservative brow elevation with the additional benefit of volume restoration to provide a more youthful appearance. No complications or adverse events related to this procedure were observed. All patients were satisfied with their outcome.

**Conclusions:** Transposition upper eyelid blepharoplasty with brow release is a safe, effective method of upper eyelid and periorbital rejuvenation that enhances the brow-eyelid contour.

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### V20 - Examination of Patients of Acquired Ptosis with Myasthenia Gravis and Chronic Progressive External Ophthalmoplegia

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*Ophthalmic Plastic Surgery and Ocular Oncology, Centre for Sight, Hyderabad, India*

**Introduction:** Ptosis may be congenital or acquired. Acquired ptosis may be myogenic, neurogenic, aponeurotic, traumatic or mechanical. Myogenic ptosis arises from an inherent defect in the muscle fibre ultrastructure or neuromuscular junction abnormalities. Notably, myasthenia gravis and chronic progressive external ophthalmoplegia (CPEO) are more commonly encountered causes. They are two special cases of myogenic ptosis that can be diagnosed on clinical examination. The purpose of this video is to demonstrate the ophthalmic manifestations and tests for myasthenia gravis and CPEO

**Methods:** Myasthenia gravis is an autoimmune neuro-muscular junction disorder that results from [antibodies](#) against [nicotinic acetylcholine receptors](#). It is characterised by variable, progressive ptosis, aggravated by exertion and improved with rest with or without extraocular movement restriction.

The ptosis worsens with fatigue; demonstrable on repetitive squeezing, prolonged upgaze, and repetitive stimulation in this video. There is rapid recovery on resting, application of ice and on injection of intravenous anticholinesterase.

CPEO is a disorder of mitochondrial inheritance characterised by slowly progressive bilateral symmetric ptosis, limitation of extraocular movements with relative preservation of the pupillary and ciliary muscle function. Demonstration of progressive symmetric bilateral ptosis and limitation of extraocular movements which shows no diurnal variation or fatigability favours a diagnosis of CPEO. This video demonstrates a case of CPEO showing severe non variable ptosis and associated symmetric limitation of extraocular movements with a poor Bell's phenomenon.

**Results:** Patient of Myasthenia gravis demonstrated Worsening of Ptosis with fatigue and improvement with rest. Patient with CPEO showed non-variable ptosis with restricted eye movements and preservation of Pupillary and ciliary muscle function.

**Conclusions:** Myasthenia gravis and CPEO are both entities that are progressive, may involve both eyelids, and extraocular muscles to varying degrees. They each have different systemic ramifications and distinct modalities of treatment. They may sometimes be confused with each other. Careful clinical examination helps easily distinguish between the two and plan management as appropriate.

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### V21 - A Modified Palpebral Spring Technique for Facial Nerve Palsy Management

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**Introduction:** Cranial nerve seven (CN VII) palsy is a debilitating condition affecting 30 to 40 people out of 100,000 each year. Several surgical techniques have been demonstrated to protect the cornea and prevent corneal insult secondary to exposure. In 1990, Dr. Levine re-popularized the palpebral spring technique with his “enhanced” palpebral spring, however, due to technical issues with springs including complexity of insertion and migration, gold weights continue to be the most popular gold standard treatment for persistent lagophthalmos. Our study describes and illustrates, with video, a newly modified palpebral spring surgical technique that utilizes an internal fixation screw to improve mechanical function of the spring and reduce migration.

**Methods:** Two consecutive patients undergoing palpebral spring insertion met the inclusion criteria. Both patients had paralytic lagophthalmos secondary to CN VII palsy. Both had standard palpebral springs inserted previously utilizing Levine’s “enhanced” palpebral spring technique, but had required frequent adjustments due to spring migration and poor function. Our modified technique, which was subsequently performed on these two patients, secures the fulcrum of the palpebral spring to the lateral orbital rim with a titanium screw.

The main outcome variables of the study include lagophthalmos (in millimeters), Margin reflex distance test 1 (MRD1), corneal staining following topical fluorescein placement on the cornea, and requirement for spring revisions. Additionally, the subjective outcome variables of patient identified need for eye lubrication with artificial tears and/or ointment, closure and rapid blink, and symptoms of comfort and dryness.

Video and photographic demonstration of the modified surgical technique is illustrated.

**Results:** With the addition of titanium screw stabilization of the palpebral spring, there is improvement in lid position, blink speed and upper eyelid excursion, and thus far, in our small series, no cases of spring migration. Quantitative data, described in the methods section of this abstract, is currently being collected and formalized for presentation in addition to the video and photographic illustration of the technique and results.

**Conclusions:** Although technically more complex, palpebral spring insertion does produce more dynamic, rapid and complete lid closure, with less corneal exposure and better visual acuity than gold weight insertion in patients with paralytic lagophthalmos (Salloum et al, presented at the ASOPRS Fall Meeting, New Orleans, 2017). Despite this better function, the need for subsequent adjustments and revisions of springs has reduced their popularity amongst surgeons. We have demonstrated an improvement in the technique for inserting palpebral springs in the management of paralytic lagophthalmos with improved spring function, more complete lid closure and more long-term stability.

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# VIDEOS

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**Figure 1**



**Figure 2**



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### V22 - Double Cotton Tip Pinch Removal of Eyelid Pyogenic Granulomas under Topical Anesthetic

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**Introduction:** Conjunctival pyogenic granulomas, also known as lobular capillary hemangiomas, are often found following eyelid and conjunctival surgeries. They are associated with pain, bleeding, irritation, and poor cosmesis. Initial management includes topical corticosteroids, but many require surgical resection with sharp dissection. Here we present (with video) an in office, blunt removal technique using cotton tip applicators.

**Methods:** Retrospective chart review of 18 consecutive pyogenic granulomas after oculoplastic surgery in 18 patients treated with the following, in office chair, technique (VIDEO from 2 representative cases): After instilling topical anesthetic (proparacaine or tetracaine) into the lower eyelid cul de sac, two cotton tip applicators are applied to the base of pedunculated pyogenic. Using the cotton tips, mild force is applied in a bimanual, twisting fashion to the stalk until it severs. The lesion is removed and hemostasis is achieved with gentle compression.

**Results:** In all except 4 cases, the pyogenic granuloma was removed without difficulty. These 4 cases required sharp surgical resection with injection of local anesthetic. 1 granuloma recurred that was subsequently treated with sharp surgical resection. Other than mild and temporary bleeding, there were no cases and surgery was averted in 13 cases.

**Conclusions:** The double cotton tip pinch was very effective in managing post-surgical conjunctival pyogenic granulomas. Occasionally, the attachments are too robust and sharp dissection is necessary, however, the technique offers a noninvasive, office chair treatment option that obviates another surgical procedure.

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# VIDEOS

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**Figure 1**



**Figure 2**



**Figure 3**



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### V23 - Management of Grade 4 Symblepharon using Amniotic Membrane and Mucosal Grafts with Fibrin Sealant Glue

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**Introduction:** Management of grade 4 symblepharon in a single session is difficult.

This video demonstrates the surgical management of Grade 4 symblepharon by combined use of amniotic membrane and oral mucosa grafts with Fibrin sealant glue.

**Methods:** Eyelid tissue was carefully dissected off the bulbar surface preserving as much bulbar conjunctival tissue as possible. It is imperative to dissect off any attachments and release the inferior rectus muscle.

A 4-0 silk suture is passed through the scar tissue for a better exposure of the field and ease dissection by putting traction on the fibrotic bands. Dissection is carried down to the orbital rim. After releasing the fibrotic bands, most of the dissection should be blunt preserving the septum by all means. Scar tissue is excised horizontally once all the release is provided and the eyelid tissues are freely mobile.

Oral mucosa is then harvested from the interior of the lower lip using Westcott scissors and attached to the eyelid margin using 7-0 polyglactin 910 suture in running fashion. This will be the new epithelial lining for the interior of the eyelid.

Fibrin sealant glue is applied to the wound surface and the back of the graft. Mucosal graft attachment will be sutureless after this point. Muscle hooks are extremely helpful tools for pushing the graft against the eyelid and the fornix. Approximately 20 seconds will be sufficient for strong and tight bonding.

Next, amniotic membrane is introduced to the bulbar surface with its stromal side facing down. Only 2 7-0 polyglactin 910 sutures placed at 4 and 7 o'clock positions were used to secure the upper ends of the graft. Fixation of the amniotic membrane graft to the scleral surface will then be carried out using Fibrin sealant glue aided by muscle hooks. Amniotic membrane should be long enough to overlap the mucosal graft at the level of the fornix.

Tubing cut off the butterfly blood collection needle treated by 3 double-armed 5-0 polypropylene sutures was inserted to the fornix. The needles were passed full thickness through the distalmost portion of mucosal graft and tied on the skin on bolsters.

**Results:** The patient has a permanent smooth internal mucosa and a deep fornix postoperatively.

**Conclusions:** Management of Grade 4 symblepharon using mucosal graft on tarsal side and amniotic membrane on the bulbar side without stitches but only Fibrin sealant glue seems to be a very effective and elegant surgical option.