A novel approach: Orbital augmentation using mersilene mesh in seeing eyes

Article *in* Canadian Journal of Ophthalmology · February 2018

DOI: 10.1016/j.jcjo.2017.12.009

Khalil Mahmoud Al-Salem
Mu'tah University

such orbital injuries were likely more prevalent. One well documented case was that of King Henry II of France, a jousting enthusiast, who arranged a tournament to celebrate the joint weddings of his daughter to King Philip II of Spain and his sister to the Duke of Savoy in early July 1559.[5] As he hurtled toward his opponent, Montgomery, the young captain of the King's Scots Guard, the captain's lance knocked the visor of the King's helmet open, and wood fragments penetrated his right orbit and forehead.[6] In spite of removal of some wooden fragments, egg white soaks by the court physicians, bloodletting, and expert consultation by the renowned anatomist Antonius Vesalius, the King's condition worsened over several days.[7]

Although our subject benefitted from advanced imaging, combined surgical techniques, and systemic antibiotics, these techniques were not available to the wealthy king, leading to his demise.

Disclosure: The authors have no proprietary or commercial interest in any materials discussed in this article.

Dannielle Tinker, Christopher Pollock, Daniel Mendelsohn, Peter J. Dolman
University of British Columbia, Vancouver, B.C.

Correspondence to:
Dannielle Tinker, HBA: dannielleleahtinker@gmail.com

References

1. Green BF, Kraft SP, Carter KD, Buncic JR, Nerad JA, Armstrong D. Intraorbital wood. Detection by magnetic resonance imaging. *Ophthalmology.* 1990;97:608-11.
2. Fulcher TP, McNab AA, Sullivan TJ. Clinical features and management of intraorbital foreign bodies. *Ophthalmology.* 2002;109: 494-500.
3. Floyd AM, Whipple KM, Lim LH, Korn BS, Kikkawa DO. A 55-mm object inside a 40-mm orbit. *Orbit.* 2013;32:309-11.
4. Sullivan TJ, Patel BC, Aylward GW, Wright JE. Anaerobic orbital abscess secondary to intraorbital wood. *Aust N Z J Ophthalmol.* 1993;21:49-52.
5. Eftekhari K, Choe CH, Vagefi MR, Eckstein LA. The last ride of Henry II of France: orbital injury and a king's demise. *Surv Ophthalmol.* 2015;60:274-8.
6. Martin G. The death of Henry II of France: a sporting death and post-mortem. *ANZ J Surg.* 2001;71:318-20.
7. Tainmont J. A historical vignette (19). An orbital trauma in the 16th century. *B-ENT.* 2010;6:229-36.

Can J Ophthalmol 2018;53:e196–e198
0008-4182/17/$-see front matter
https://doi.org/10.1016/j.jcjo.2017.12.007

A novel approach: orbital augmentation using mersilene mesh in seeing eyes

Enophthalmos can result from congenital malformation, oncologic resection, natural aging, or posttraumatic deformity. The cause can be related either to true volume loss (e.g., fat atrophy) or orbital volume expansion in cases of trauma or orbital wall destruction by a malignancy. This creates a relative soft-tissue deficiency, which leads to displacement of the periocular soft tissue and backward displacement of the globe. Rarely, enophthalmos can result from soft-tissue loss caused by human immunodeficiency virus lipodystrophy, linear scleroderma, and hemifacial atrophy.[1] Strategies for enophthalmos treatment involved either natural autologous tissue grafting, like bony framework, cartilage fragments, and fat injections[2–5] or volume deficit compensation using synthetic materials, like porous polyethylene wedge implants, prefabricated implants, non-animal stabilized hyaluronic acid, calcium hydroxyapatite, injectable hydrogel implant pellets, and titanium mesh.[6–9] Although these procedures are reported to be effective in correcting enophthalmos, they are time consuming, invasive, and the material being used is relatively heavy on the skull. In addition, the procedure might limit movement of the eye in some cases.[10]

Methods

A retrospective chart review was conducted to find patients with extensive orbital and facial injuries, treated with orbital volume augmentation using mersilene mesh implants. The study was conducted at the Eye Specialty Hospital, Amman, Jordan. Ethics approval was granted by the ethics committee at Mutah University number (20178). Four cases were enrolled in the study. All patients have a preoperative and postoperative visual acuity record and enophthalmos assessment using Hertel exophthalmometry. The procedure, risks, alternatives, and benefits of the off-label use of mersilene mesh for orbital volume augmentation were explained to the patients on a preoperative visit. Informed consent was obtained from each of the subjects in accordance with the principles outlined in the Declaration of Helsinki. The privacy of health information was maintained as stated in the Health Insurance Portability and Accountability Act. The procedure was covered by private funding from the patients themselves. All procedures were performed by the authors of this correspondence. Mersilene mesh was implanted in the intraconal space in all cases.

All patients had the procedure done under general anesthesia. At the start of the operation, forced duction test was done to check for extraocular muscle fibrosis. The amount of muscle fibrosis was assessed according to the presence of extraocular motility limitation; if the eye was not passing midline, this was regarded as −4; if the eye had full range (limbus touching the angle of the eye), this was regarded as 0. All cases had no muscle entrapment confirmed by preoperative computed tomography (CT) scan. A 360 degree peritomy was performed and all extraocular muscles were separated and identified. Careful Tenon's capsule dissection was performed to create 4 pockets between the extraocular muscles. Mersilene mesh sheet was prepared into strips (10 × 25 mm). The approximate weight of mersilene mesh sheet was 6–9 g. All mersilene mesh implants were soaked in gentamycin antibiotic solution for 5 minutes before being inserted behind the eyeball.

The amount of mersilene mesh inserted in the retrobulbar space was tapered according to the desired axial eye position. One or 2 strips of mersilene mesh were inserted in each quadrant, to reach the back of the eye. During the operation, orbital pressure was estimated by digital method and retinal examination. Particular attention was given to the presence or absence of venous pulsations to make sure that mersilene mesh implants were not hindering the blood flow of the eye ball. The conjunctiva and Tenon's capsule were repaired using 8.0 Vicryl.

Statistics were done using SPSS (version 17.0; SPSS Inc, Chicago, Ill.). The visual acuity (logMAR), age, Hertel exophthalmometer (mm) readings, and the number of mersilene mesh used intraoperative were inserted as scale measure. Patient sex and presence of muscle fibrosis were inserted as nominal. Sample Student t test was used to compare the means between the preoperative and postoperative values for Hertel exophthalmometer and visual acuity. Linear regression was used to determine the correlation between the number of mersilene mesh strips and the presence of muscle fibrosis (Table 1).

Case 1

A 23-year-old female reported a sunken right eye and diplopia after a car accident in June 2008; she was in a deep coma for 3 months. On presentation, the best-corrected visual acuity was 6/18 OD due to a faint corneal scar and 6/6 OS. Hertel exophthalmometer measurements were 14 mm in the right eye and 19 mm in the left eye. Additional findings were the presence of posttraumatic (aponeurotic) ptosis and right elevation deficit of −2. The patient had left hypertropia of 15 prism diopter (PD) in primary position. Orbital magnetic resonance imaging showed a capacious orbit, with the presence of multiple old fractures involving the zygomatic, frontal, and the greater wing of sphenoid. There was no muscle entrapment. Repair of the fractures was not attempted because the fractures were already healed. In addition, surgical repair of the frontal and greater wing of sphenoid was beyond repair. The patient underwent surgery in December 2009. At the operation, her intraoperative forced duction test showed tethered right inferior rectus −2. After adequate peritomy a total of 8 strips of mersilene mesh (10 × 25 mm) was inserted (2 in each quadrant) to reach the back of the eye. The right inferior rectus was recessed 5 mm from insertion. Ptosis surgery was repaired at the end of the operation. At the 1-month postoperative visit, her visual acuity remained the same (6/18), but her Hertel exophthalmometer measurement improved to 16 mm. Ocular motility was full range with no diplopia. Since that date, the patient remained stable and Hertel measurements have stayed the same (Figs 1A and B).

Case 2

In 2010, a 30-year-old Iraqi male with a history of blast injury to the face reported a left sunken eye. The patient had undergone no previous operations since the injury in 2006. His best corrected visual acuity was 20/20 OD and 20/200 OS. Left visual loss was attributed to traumatic maculopathy secondary to chroidal rupture and severe commotio retinae. The patient had left exotropia 35 PD and right hypertropia of 15 PD in primary position. Left eye movement was limited in adduction (−3) and up-gaze movement (−2). Hertel exophthalmometer reading was 18 mm in the right eye and 12 mm in the left eye. Orbital CT showed old medial, inferior, and lateral wall fractures. The patient had poor primary care at the time of injury because of the Iraq war. Figure 2C shows the preoperative CT scan for the patient; notice the presence of an extensive inferior wall fracture and multiple fractures of both the medial and lateral walls. At the operation, forced duction test showed the presence of a restricted lateral rectus (−2) and a restricted inferior rectus (−2). A total of 8 strips of mersilene mesh were inserted behind the eye (2 in every quadrant). Left inferior rectus recession was done 5 mm from insertion and left lateral rectus recession of 9 mm from insertion. Postoperatively, Hertel exophthalmometer reading was 15 mm; his visual

Table 1—Full statistics and paired t test of the study

Case	Age (y)	Sex	Preoperative Visual Acuity	Postoperative Visual Acuity	Hertel Preoperative	Hertel Postoperative	Muscle Fibrosis	Other Problems	Follow-up/ Year
1	23	F	6/18	6/18	14 mm	16 mm	Yes	Ptosis	7
2	30	M	6/60	6/60	12 mm	15 mm	Yes	Squint	6
3	26	M	6/60	6/60	14 mm	18 mm	No	NLD obstruction	4
4	12	M	6/9	6/9	13 mm	16 mm	No	Squint	9

NLD, nasolacrimal duct obstruction.

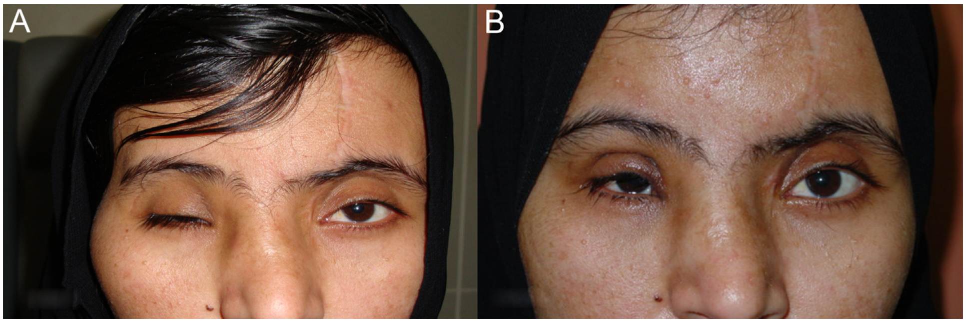

Fig. 1—(A) Preoperative picture of case 1. Patient has significant enophthalmos and ptosis in the right eye. (B) Postoperative picture. Patient has improvement in enophthalmos and ptosis.

acuity remained the same (20/200). Figures 2A and B demonstrate the improvement in patient 2. One month after operation, his extraocular motility showed limited up-gaze (−1) and full adduction. The patient had a residual exotropia of 10 PD in primary position. However, the patient was happy with the final result. The patient has followed up until now with no reported problems.

Case 3

A 26-year-old male with a history of a road traffic accident in 2010 presented with enophthalmos in the left eye in 2012. His best corrected visual acuity was 20/20 OD and 20/200 OS. The patient's poor vision was attributed to the presence of traumatic retinal detachment that was repaired twice in 2010 and 2011. Extraocular motility was full in both eyes. Hertel exophthalmometer reading was 20 mm in the right eye and 14 mm in the left eye. The patient had nasolacrimal duct obstruction (NLDO) in this left eye, secondary to the same accident in 2010. Orbital CT scan showed the presence of a large orbit because of a large medial wall fracture and inferior wall fracture. We felt that the fracture was beyond repair with a titanium plate because there was insufficient medial bone in the orbit to attach the titanium plate. In turn, this would make the titanium plate very unstable inside the orbit. At the operation, 4 strips of

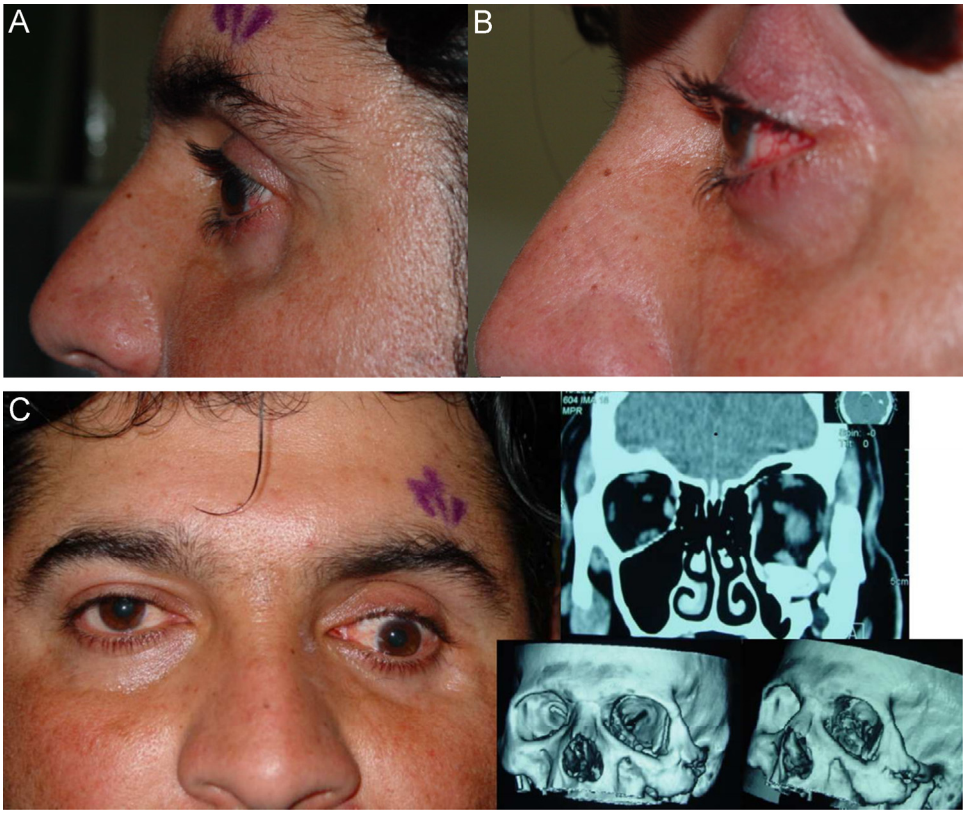

Fig. 2—(A) Side picture preoperative assessment case 2. Patient has significant enophthalmos in the left eye. (B) Postoperative picture. Patient has improvement in enophthalmos. (C) Patient 2's preoperative CT scan showing severe inferior wall injury along with medial and lateral wall.

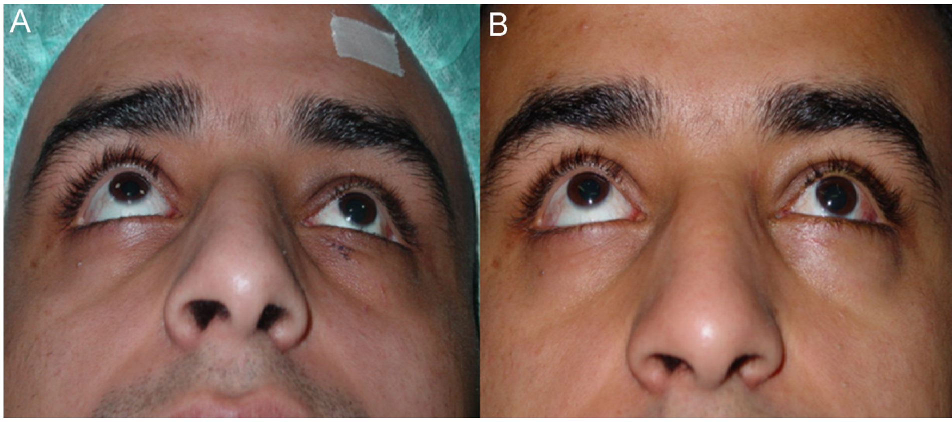

Fig. 3—(A) Preoperative picture of case 3. Patient has significant enophthalmos and nasolacrimal duct obstruction in the left eye. (B) Postoperative picture. Patient has improvement in enophthalmos, and his nasolacrimal duct obstruction (NLDO) is repaired.

mersilene mesh (10 × 25 mm) were inserted behind the globe. The patient had this NLDO repaired at the same operation by performing external dacryocystorhinostomy to the left side. One month postoperatively, the patient's Hertel reading improved to 18 mm (4 mm difference); his visual acuity remained the same (20/200). His extraocular motility remained full in all quadrants (Figs. 3A and B).

Case 4

A 12-year-old male was brought by his parents for left eye outward deviation. The patient had a history of a road traffic accident with significant basal skull fracture in 2003. On examination, his best corrected visual acuity was 20/20 OD and 20/30 OS. The patient experienced left exotropia (around 45 PD). No specific pattern was noted, and there was no limitation of extraocular motility at the time of examination. His Hertel exophthalmometer reading was 13 mm preoperative in the left eye and 17 mm in the right eye. Intraoperatively, forced duction test was normal and showed no limitation of extraocular motility. The patient underwent surgery through a transcutaneous medial orbitotomy incision. The patient had medial orbital fracture repair and orbital volume augmentation by mersilene mesh. The patient had left lateral rectus recession of 10 mm and medial rectus resection of 6 mm. Six mersilene mesh fragments (10 × 25 mm) were inserted, 2 strips in both medial quadrants (upper and lower). Only 1 strip was inserted in each lateral corner. One month postoperatively, visual acuity was 20/20 OD and 20/30 OS. His Hertel exophthalmometry was 16 mm postoperative in the left eye (a change of 3 mm from the preoperative baseline), ocular motility was full, and the patient is straight in primary position. The patient has been followed up until now (Fig. 4).

Results

Three males and one female were involved in the study; all cases had intraconal mersilene mesh implantation. The mean sample age was 22.75 ± 3.86 years. The preoperative Hertel exophthalmometer reading (mean ± SD) was 13.25 mm ± 0.96 mm. The postoperative mean was 16.25 mm ± 1.26 mm. Sample *t* test was applied to

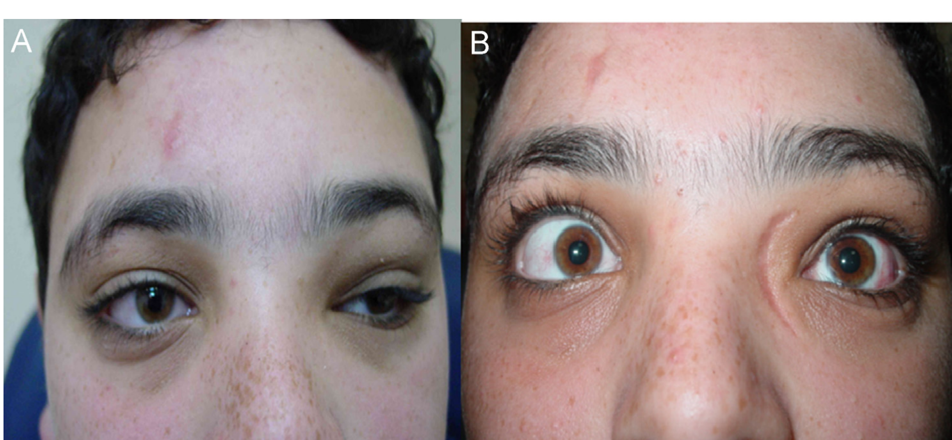

Fig. 4—(A) Preoperative picture of case 1. Patient has significant enophthalmos and esotropia in the left eye. (B) Postoperative picture, patient has improvement in his enophthalmos.

compare the means in the preoperative and postoperative Hertel exophthalmometer values and showed a significant difference ($p = 0.0001$).

On the other hand, there was no change in the best corrected visual acuity preoperative and postoperative. The mean logMAR for both values was 0.68 ± 0.39, and the p value was not significant ($p = 0.51$).

Linear regression was done between the presence or abscess of muscle fibrosis and the number of mersilene mesh strips being implanted in the back of the eye to see if muscle fibrosis was a risk factor for the higher need to implant more strips of mersilene mesh. Linear regression test showed no correlation between the numbers of strips implanted and the presence of muscle fibrosis ($p = 0.25$) ($p > 0.5$).

Discussion

The globe's anteroposterior position within the orbit is controlled by the ratio of bony orbital volume to the volume of the orbital contents posterior to the globe's equator. An increase in the bony vault or a decrease in the postequatorial soft-tissue content can create an enophthalmos.[2] In cases of posttraumatic enophthalmos, Ramieri et al. have found that the human orbit tends to take on a more rounded shape and that there is fragmentation and displacement of the retrobulbar soft tissue.[11]

Posttraumatic enophthalmos with late presentation is a frequent consequence of blow out fractures. Poor initial management of these cases might result in secondary large orbital cavity orbit due to a distorted zygoma or an extensive medial wall fractures.[11] Reconstruction of the orbital wall fracture in such cases can be very difficult technically and might have great complications that can blind the patient or result in permanent motor nerve dysfunction.[12,13] Although a few reports with limited number of patients encourage surgical repair on old blow out fractures,[14] most surgeons prefer orbital augmentation procedures over operating on bone, especially in the presence of contracted muscles secondary to muscle fibrosis.[3]

Choosing the best method for correction of enophthalmos is a challenge for the surgeon. The eye is surrounded by very delicate muscles, and the orbit contains a myriad of sensory, motor, and sympathetic and parasympathetic nerves in addition to a plexus of veins and arteries.

Mersilene mesh has a wide use in surgery; examples are chest surgeries, chin augmentation, and repair of hernia. Some ophthalmologists are wrapping orbital implants with mersilene mesh after enucleation,[15,16] not to mention the use of mersilene mesh in frontalis suspension for treating congenital ptosis.[17,18]

The advantages of mersilene mesh might be the light weight and the ability to mold in orbital space; thus, there will be no solid substance to hinder extraocular motility or cause a visual threat by compressing the optic nerve, like SynPOR implants or titanium mesh.[10] In addition, the substance is cheap, readily available, and stable in the body. Mersilene mesh is not biodegradable by body enzymes, unlike fillers and fat.[5,9]

The ability to implant intraconal mersilene mesh gives the advantage of better cosmetic effect while using little material. Hence, the correction of enophthalmos is much more predictable. Most of the other techniques like filler and fat or pellets are implanted extraconal. This makes results less predictable.[5,9]

To our knowledge, this is the first time mersilene mesh was used in orbital volume augmentation. We have a limited number of cases; however, the results are very promising. We feel the only limiting factor for an optimal surgical outcome might be the presence of muscle fibrosis, although linear regression did not show a direct correlation between the presence of muscle fibrosis and the number of mersilene mesh use. Statistics might be misleading because of the limited data in the study. We feel that the surgeon might be forced to put more mersilene mesh in the orbit to achieve a 3–4 mm postoperative difference. Thus, there will be a potentially induced complication caused by high intraorbital pressure.

Complications of mersilene mesh use in orbital disorders was evaluated by Yalaz et al. The study included 72 patients who had mersilene mesh implantation inside the eyelid or the orbit. Patients were followed up for 15 to 62 months. The complications were summarized for orbital implant exposure, when wrapping the implant with mersilene mesh, in 10 out of 35 cases. Suture granuloma was seen in 3 cases, and 2 had extrusions when mersilene mesh was used for frontalis sling. In their study they discouraged the use of mersilene around the eye.[19] In our cases, we did not encounter complications regarding extrusions. This might be attributed to two factors. First, orbital implantation in the previous studies was never used alone; it was used as a wrapping material for mobile orbital implants. Hence, extrusion might be a result of other unstudied factors (confounding factors). It is well known that 3.1% of silicone implants and 2.1% of hydroxyapatite mobile orbital implants will extrude[20,21]; hence, it will be very hard to blame mersilene mesh as the sole cause of extrusion in the previous study. The other factor might be the surgical technique: Being too superficial with mersilene mesh will increase the risk of the implant to extrude. It is important to keep mersilene under the muscles. In our case, the implant was intraconal, making extrusion and granuloma formation an unlikely event to happen with our current technique.

Putting the right amount of mersilene mesh in the orbital cavity can be tricky, as it is a crucial factor for a successful surgery. Overstuffing the material inside the orbit might lead to vascular events like central retinal vein occlusion or central retinal artery occlusion. This is why it is advised to dilate the fundus preoperatively and check venous pulsations during insertion of the material. Finally, although rare, if implant infection ever occurs, it will be important to remove the mesh as soon as possible, as antibiotics penetrate poorly through synthetic material.

In summary, mersilene mesh might play an important role in orbital augmentation surgeries because the material is safe, inert, and relatively cheap. Further studies should be done on the subject with a larger number of patients to confirm our results.

Khalil M. Al-Salem (MD, FRCS, FICO)*
Mahmoud K. Al-Salem (MD, FRCS, FRCOphth)†
*Department of Ophthalmology and Visual Sciences, Mutah University, Al-Karak, Jordan; †Eye Specialty Hospital, Ibn Alhythalm Hospital, Amman, Jordan.

Correspondence to:
Khalil M. Al-Salem, MD, FRCS, FICO::
khalil_alsalem@hotmail.com

References

1. Balan P, Gogineni SB, Shetty SR, D'souza D. Three-dimensional imaging of progressive facial hemiatrophy (Parry-Romberg syndrome) with unusual conjunctival findings. *Imaging Sci Dent*. 2011;41:183-7.
2. Clauser L, Galie M, Pagliaro F, Tieghi R. Posttraumatic enophthalmos: etiology, principles of reconstruction, and correction. *J Craniofac Surg*. 2008;19:351-9.
3. Hazani R, Yaremchuk MJ. Correction of posttraumatic enophthalmos. *Arch Plast Surg*. 2012;39:11-7.
4. Matsuo K, Hirose T, Furuta S, Hayashi M, Watanabe T. Semi-quantitative correction of posttraumatic enophthalmos with sliced cartilage grafts. *Plast Reconstr Surg*. 1989;83:429-37.
5. Brown M, Lee M, Zwiebel S, et al. Augmentation of intraorbital volume with fat injection. *Plast Reconstr Surg*. 2014;133:1098-106.
6. Kashkouli MB, Pakdel F, Sasani L, Hodjat P, Kaghazkanani R, Heirati A. High-density porous polyethylene wedge implant in correction of enophthalmos and hypoglobus in seeing eyes. *Orbit*. 2011;30:123-30.
7. Magana FG, Arzac RM, De Hilario AL. Combined use of titanium mesh and resorbable PLLA-PGA implant in the treatment of large orbital floor fractures. *J Craniofac Surg*. 2011;22:1991-5.
8. Nkenke E, Vairaktaris E, Spitzer M, et al. Secondary reconstruction of posttraumatic enophthalmos: prefabricated implants vs titanium mesh. *Arch Facial Plast Surg*. 2011;13:271-7.
9. Vagefi MR, McMullan TF, Burroughs JR, Georgescu D, McCann JD, Anderson RL. Orbital augmentation with injectable calcium hydroxylapatite for correction of postenucleation/evisceration socket syndrome. *Ophthal Plast Reconstr Surg*. 2011;27:90-4.
10. Czyz CN, Fisher EL, Kalwerisky K, Foster JA. Severely decreased ocular motility and dystopia secondary to repeated orbital volume augmentation. *Ophthal Plast Reconstr Surg*. 2015;31:e48.
11. Ramieri G, Spada MC, Bianchi SD, Berrone S. Dimensions and volumes of the orbit and orbital fat in posttraumatic enophthalmos. *Dentomaxillofac Radiol*. 2000;29:302-11.
12. Susarla SM, Nam AJ, Dorafshar AH. Orbital compartment syndrome leading to visual loss following orbital floor reconstruction. *Craniomaxillofac Trauma Reconstr*. 2016;9:152-7.
13. Kim YJ, Choi WK. Delayed superior orbital fissure syndrome after reconstruction of blowout fracture. *J Craniofac Surg*. 2016;27:e8-10.
14. Kim JS, Lee BW, Scawn RL, Korn BS, Kikkawa DO. Secondary orbital reconstruction in patients with prior orbital fracture repair. *Ophthal Plast Reconstr Surg*. 2016;32:447-51.
15. Kilic D, Findikcioglu A, Bilen A, Hatipoglu A. Mersilene mesh-methyl methacrylate sandwich graft reconstruction for repair of chest wall defects [in Turkish]. *Tuberk Toraks*. 2006;54:363-9.
16. Owji N, Mosallaei M, Taylor J. The use of mersilene mesh for wrapping of hydroxyapatite orbital implants: mid-term result. *Orbit*. 2012;31:155-8.
17. Mehta P, Patel P, Olver JM. Functional results and complications of Mersilene mesh use for frontalis suspension ptosis surgery. *Br J Ophthalmol*. 2004;88:361-4.
18. Salour H, Aletaha M, Bagheri A. Comparison of mersilene mesh and autogenous fascia lata in correction of congenital blepharoptosis: a randomized clinical trial. *Eur J Ophthalmol*. 2008;18:853-7.
19. Yalaz M, Demircan N, Yağmur G, Haciyakupoğlu G. Mersilene mesh: long-term results in oculoplastic surgery. *Orbit*. 1997;16:217-23.
20. Potter JK, Ellis E. Biomaterials for reconstruction of the internal orbit. *J Oral Maxillofac Surg*. 2004;62:1280-97.
21. Yoon JS, Lew H, Kim SJ, Lee SY. Exposure rate of hydroxyapatite orbital implants a 15-year experience of 802 cases. *Ophthalmology*. 2008;115:566-72.

Can J Ophthalmol 2018;53:e198–e203
0008-4182/17/$-see front matter
https://doi.org/10.1016/j.jcjo.2017.12.009

Novel mutation in the *RNASEH1* gene in a chronic progressive external ophthalmoplegia patient

Chronic progressive external ophthalmoplegia (CPEO) is a clinical syndrome often associated with multiple mitochondrial DNA deletions and is most commonly seen in adults.[1] Patients present with slowly progressive paralysis of the extraocular muscles and sometimes general proximal muscle weakness.[1,2] The authors describe a male patient with the novel genetic finding of an *RNASEH1* mutation that has not yet been reported in association with CPEO.

A 37-year-old male described a 24-year history of progressively worsening bilateral ptosis, reduction in all extraocular movements, and reduction in best-corrected visual acuity from 6/6 to 6/9 OU. He also experienced mild unsteadiness and proximal weakness of his leg muscles. His medical history included type II diabetes and hypertension. There was no family history of note. Based on clinical findings, a diagnosis of CPEO was made.

The patient underwent biopsy and histologic analysis of his proximal leg muscles, which revealed florid, ragged, red fibres. Subsequent molecular analysis in 2009 with long-range polymerase chain reaction and Southern blot testing revealed multiple mitochondrial DNA deletions. The patient was diagnosed with mitochondrial myopathy, and follow-up in mitochondrial, neurology, and ophthalmology clinics was arranged.

Extensive genetic testing for pathogenic variants, including common mitochondrial DNA mutations and sequencing of 14 nuclear genes associated with disorders of the mitochondrial