Using the Inferior Oblique Muscle to Augment Implant Coverage in Enucleation Surgery

Alan W. McInnes, M.D., and Steven C. Dresner, M.D.*†*

**Eyesthetica Oculofacial and Cosmetic Surgical Associates, and †Department of Ophthalmology, University of Southern California, Keck School of Medicine, Santa Monica, California, U.S.A.*

Purpose: We present a technique modification for enucleation surgery that may decrease implant exposure or extrusion by using native tissue to reinforce the implant at the most susceptible area, specifically the anterior-most aspect.

Methods: An enucleation procedure is performed, and an implant is placed into the orbit. The horizontal rectus muscles are attached to the implant, and the vertical rectus muscles are attached directly to the horizontal muscles. The inferior oblique muscle is then spread over the anterior implant surface and sutured to the superior rectus and lateral rectus muscles.

Results: 15 patients underwent this procedure, with implantation of an SST porous polyethylene implant. The mean follow-up interval was 18 months with a range of 4–33 months. One patient suffered an implant exposure, and one experienced a post-operative orbital hemorrhage. Two patients required blepharoptosis surgery to achieve eyelid symmetry.

Conclusions: This retrospective series demonstrates the potential usefulness of the inferior oblique muscle to augment coverage of the orbital implant. Reinforcement of the anterior surface of the implant with vascularized tissue may improve the integrity and strength of the tissues anterior to the implant, and thereby reduce the likelihood of implant exposure.

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Despite recent advances in enucleation surgery, exposure remains a relatively common complication. Modern enucleations are performed for a variety of reasons including malignancy, infection, trauma, and blind, painful, or disfigured eyes. The goal of enucleation is removal the diseased or injured globe and the creation of a socket allowing proper fit and function of an ocular prosthetic. Replacement of the native eye with an orbital implant preserves the orbital volume and facilitates extraocular muscle attachment to allow natural movement of the prosthesis.

Many different implant materials have been used, such as porous polyethylene, hydroxyapatite, silicone, and acrylic. Additionally, wrapping techniques utilizing banked sclera or similar tissues and careful layered closures of Tenon's capsule and conjunctiva have been described[1] and used to help prevent exposures. Though different materials and techniques lead to variable degrees of success measured in terms of complications and prosthesis motility, exposure may remain problematic.[2–5] This report describes a technique that utilizes the inferior oblique muscle, a native, healthy, vascularized tissue, to provide an extra layer of reinforcement at the anterior aspect of the implant.

The inferior oblique originates at the maxillary bone behind the lacrimal sac fossa, slightly posterior to the orbital rim. It then inserts on the globe posterior to the equator with multiple and variable insertions. A healthy blood supply originates from the medial muscular branch of the ophthalmic artery. The muscle belly averages approximately 7 mm in width, thus providing a robust portion of tissue to cover the anterior aspect of the implant that is most susceptible to exposure and thus may help to mitigate the potential for exposure. Reinforcing the anterior aspect of the implant with a viable and vascular autogenous structure creates an anatomically and physiologically based barrier, the goal of which is to reduce the risk of exposure while still maintaining orbital volume and allowing good prosthesis movement.

METHODS

The procedure consists of a standard enucleation beginning with subconjunctival and retrobulbar injection of local anesthetic (with epinephrine for hemostasis) followed by a conjunctival peritomy, taking care to preserve as much conjunctiva as possible. Straight Stevens tenotomy scissors are spread under Tenon's capsule in the four quadrants between the rectus muscles to bluntly dissect in the retrobulbar space. The four rectus muscles are isolated with muscle hooks and a cotton-tipped swab is used to gently remove Tenon's capsule from the muscle. A double-armed 5-0 braided polygalactin suture with an S-14 needle (Ethicon, Cornelia, GA, U.S.A.) is passed and tied to tag each rectus muscle. The muscle is then divided from the globe with Westcott scissors. The sutures are left long with the needles attached and used to reflect the muscles out of the orbit with bulldog clamps or curved hemostats. The inferior oblique muscle is isolated with a muscle hook, tagged with another double-armed 5-0 braided polygalactin suture, and then divided from the globe and similarly reflected from the orbit. No dissection of lower eyelid retractors or associated structures is necessary. The superior oblique muscle is then identified with a muscle hook and clamped with a hemostat at the tendon. It is divided with monopolar cautery and allowed to retract in the orbit.

The globe is removed by isolating the optic nerve with a curved hemostat or enucleation retractor and the optic nerve is divided as far posteriorly as possible to ensure a maximum segment of optic nerve is removed for pathologic examination. Hemostasis is achieved via a combination of direct pressure and bipolar cautery.

Orbital sizers are used to determine the proper implant size. An implant is selected to maximally fill the orbit yet allow

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Dr. Dresner is a paid consultant for Porex.
Address correspondence and reprint requests to Alan W. McInnes, M.D., 2121 Wilshire Blvd., Suite 301, Santa Monica, CA 90403, U.S.A. E-mail: awmcinnes@gmail.com
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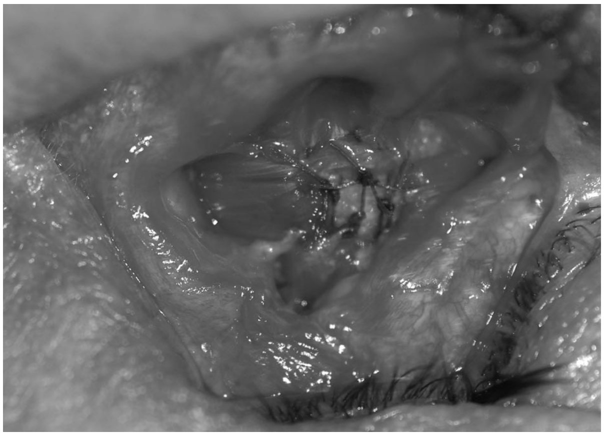

FIG. 1. The four rectus muscles are attached to the implant in the left socket with the anterior surface of the implant exposed.

a tension-free closure of the Tenon's capsule and conjunctiva. A smooth surface tunneled porous polyethylene in either conical or spherical shape is used.[6] The implant is soaked in an antibiotic solution and then agitated in the solution by placing the implant in a 60 cc syringe and drawing/depressing the plunger to penetrate the implant with the antibiotic solution and to remove the air in the pores. The implant is then placed in the intraconal space. The horizontal rectus muscles are attached to the implant by passing the needle through the tunnels in the implant and tying the suture. The vertical rectus muscles are sutured directly to the horizontal rectus muscles (Fig. 1). The inferior oblique is spread over the anterior surface of the implant and sutured to the superior rectus and lateral rectus muscles, spreading the inferior oblique over the anterior surface of the implant effecting good anterior coverage (Fig. 2).

Tenon's capsule is closed in interrupted fashion using 5-0 braided polygalactin suture, ensuring fastidious coverage of the implant. The conjunctiva is closed using a 6-0 absorbable suture in either interrupted or running fashion.

The charts of all patients who underwent enucleation procedures from May 2005 to July 2008 by one surgeon (S.C.D.) were reviewed. The patient age and reason for enucleation were noted. Additionally, the implant type, size, and muscle attachment technique were noted.

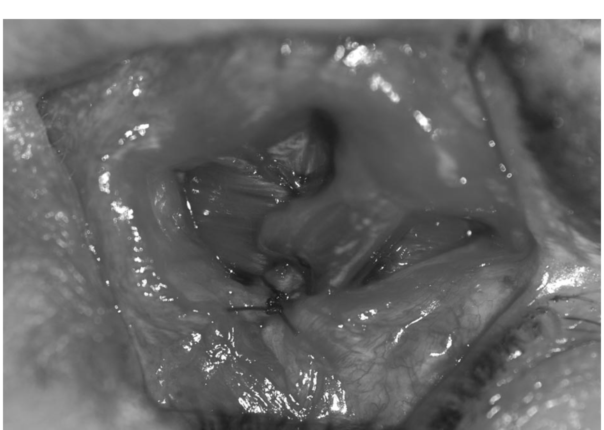

FIG. 2. The inferior oblique muscle is positioned over the anterior surface of the implant and sutured to the superior and lateral rectus muscles.

RESULTS

Fifteen patients underwent enucleation using our inferior oblique transposition technique. One patient underwent enucleation for intraocular malignancy and the other 14 had blind painful eyes subsequent to end-stage chronic eye disease including glaucoma, trauma, and endophthalmitis. All 15 had a smooth surface tunnel porous polyethylene enucleation implant placed. Three patients had the smooth surface tunnel porous polyethylene implant with attractor screws. The average follow up was 18 months (range, 4–33 months).

One patient suffered an exposed implant 2 months postoperatively. This patient had a magnetic attractor screw placed in the implant with a subsequent erosion at the site of the attractor screw. He underwent a second procedure to remove the screw with successful patching utilizing a dermis fat graft. At the time of the patch repair, the screw was found to have been inadequately countersunk in the implant. The subsequent uneven surface, combined with increased friction and pressure from the magnet, likely contributed to the exposure.

One patient suffered a significant postoperative orbital hemorrhage. The subsequent cicatricial changes in the orbit led to restricted implant motility and poor prosthesis movement.

Finally, two patients required upper blepharoptosis repair to achieve symmetry, one of whom had a preexisting upper blepharoptosis on the affected side.

CONCLUSIONS

Implant exposure is a potential complication of enucleation with any exogenous material. By reinforcing the anterior aspect of the implant with well-vascularized tissue, adequate implant coverage with strong vitalized tissue may be markedly improved. The more common method of enucleation with attachment of just the four rectus muscles to the implant results in the inferior oblique retracting in an anterior-medial position in the orbit.[7] Additionally, attaching only the four rectus muscles leaves the anterior-most portion uncovered (Fig. 1). Careful closure of Tenon's capsule and conjunctiva certainly helps reduce the possibility of exposure. However, preserving the inferior oblique muscle and placing it anteriorly over the implant rather than allowing it to fall in the orbit may provide additional anterior reinforcement for the implant, creating an additional barrier and simultaneously carrying healthy vascularized tissue to an area that is prone to exposure. One may speculate that similar benefits may be extrapolated to other implant types, as all implant types are susceptible to anterior exposure. However, this study was limited to one type of implant, specifically, a smooth surface tunneled porous polyethylene type.

While the primary action of the inferior oblique muscle is excyclotorsion, the secondary action is elevation, and the tertiary action is abduction, in practice, the loss of these actions does not adversely affect prosthesis movement, nor does attachment of the inferior oblique cause adverse movement of the implant or prosthesis. Furthermore, despite a theoretical risk of foreshortening of the inferior fornix, this was not seen in any of the patients and prosthesis fit was excellent in all patients. Indeed, the position of the inferior oblique muscle, as it originates from the maxillary bone, appears to provide better volume and reinforcement in the inferior fornix for prosthesis support without causing any significant loss of the inferior fornix. Moving the inferior oblique anteriorly and superiorly may prevent long-term ptosis of the prosthesis by buttressing the inferior fornix. Indeed, in this small series there have been no any cases of prosthetis ptosis to date.

Utilizing the inferior oblique muscle for anterior implant coverage may improve the integrity and strength of the tissues anterior to the implant and, therefore, may reduce the likelihood of anterior exposure or extrusion without adding significant negative side effects. It therefore represents a potentially viable alternative augmentation to traditional enucleation techniques that incorporate attachment of the rectus muscles to an implant.

REFERENCES

1. Dutton JJ. Coralline hydroxyapatite as an ocular implant. *Ophthalmology* 1991;98:370–7.
2. Custer PL, Kennedy RH, Woog JJ, et al. Orbital implants in enucleation surgery: a report by the American Academy of Ophthalmology. *Ophthalmology* 2003;110:2054–61.
3. Li T, Shen J, Duffy MT. Exposure rates of wrapped and unwrapped orbital implants following enucleation. *Ophthal Plast Reconstr Surg* 2001;17:431–5.
4. Chalasani R, Poole-Warren L, Conway RM, Ben-Nissan B. Porous orbital implants in enucleation: a systematic review. *Surv Ophthal* 2007;52:145–55.
5. Blaydon SM, Shepler TR, Neuhaus RW, et al. The porous polyethylene (Medpor) spherical orbital implant: a retrospective study of 136 cases. *Ophthal Plast Reconstr Surg* 2003;19:364–71.
6. Woog JJ, Dresner SC, Lee TS, et al. The smooth surface tunnel porous polyethylene enucleation implant. *Ophthalmic Surg Lasers Imaging* 2004;35:358–62.
7. Goldberg RA, McCann JD, Truong S, Yuen VH. Inferior oblique muscle location after enucleation and evisceration. *Am J Ophthalmol* 2001;132:798–9.