A modified technique for attaching the lateral rectus muscle to the orbital periosteum through a skin incision over the lateral orbital rim

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BACKGROUND The traditional approach for periosteal fixation of the lateral rectus muscle involves securing the muscle using nonabsorbable sutures by exposing the orbital periosteum 5 mm to the inside of the orbital margin. We present a simplified approach that exposes the orbital periosteum through a skin incision, providing more room and avoiding extraconal fat manipulation.

METHODS We used our technique to expose the lateral orbital periosteum and suture the lateral rectus muscle to the periosteum using nonabsorbable sutures in 2 patients with exotropic Duane retraction syndrome and 1 patient with congenital oculomotor nerve palsy.

RESULTS All 3 patients had satisfactory postoperative alignment, with abduction limitation of 3−. Adduction improved in all patients. The patient with oculomotor nerve palsy had a small overcorrection in primary position that remained stable during follow-up of 18 months. There were no intraoperative complications.

CONCLUSIONS This modified approach to extraocular muscle periosteal fixation may be simpler than the standard approach. Further evaluation in a larger series of patients is warranted. (J AAPOS 2019;23:141.e1-4)

Attachment of the lateral rectus muscle to the periosteum of the lateral orbital wall has been described in the management of exotropic Duane retraction syndrome and oculomotor nerve palsy. The procedure is a profound and potentially reversible weakening procedure of the lateral rectus muscle. Traditionally the technique involves exposing the lateral rectus muscle through a conjunctival limbal or fornix incision and clearing the muscle of intermuscular tissue. The muscle is secured with 5-0 polyester sutures. The globe is retracted medially, and blunt dissection is performed outside the muscle cone to expose the periosteum 5 mm posterior to the lateral orbital rim. The muscle is then attached to the periosteum of the lateral orbital wall and Tenon's fascia is closed over the lateral rectus muscle to prevent reattachment of the muscle to the globe.[1-3] This technique requires careful manipulation of the extraconal orbital fat.[4] Furthermore, there is little room to pass the sutures for attachment to the periosteum of the lateral orbital wall, making the procedure technically difficult. Other procedures have been described, including fixation of the lateral rectus muscle to the posterior Tenon's capsule and the lateral canthal tendon,[4,5] but there is little long-term data on the outcomes of either of these procedures. We describe a simple technique for lateral orbital wall fixation of the lateral rectus muscle that provides more space for passing the sutures through the orbital periosteum and involves minimal manipulation of the extraconal orbital fat.

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Submitted August 28, 2018.
Revision accepted January 2, 2019.
Published online May 16, 2019.
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1091-8531/$36.00
https://doi.org/10.1016/j.jaapos.2019.01.015

Subjects and Methods

This study adhered to the tenets of the Declaration of Helsinki and was approved by the Institutional Review Board of The Eye Foundation, Coimbatore, India. The medical records of all patients who underwent this modified procedure under local or general anesthesia between January 2015 and January 2017 were reviewed retrospectively.

Visual acuity and ocular motility were tested in all patients prior to surgery. Intraoperatively all patients underwent forced duction testing, graded on a scale of 1-4. Postoperative results were assessed on the first postoperative day, 1 month after surgery, and every 6 months thereafter.

Surgical Technique

Under local or general anesthesia with surgical asepsis, a limbal incision is made to expose the lateral rectus muscle. The muscle

is cleared of intermuscular septa and surrounding fascia and secured with two 5-0 polyester sutures. The lateral orbital rim is palpated, and a mixture of 1 cc of lignocaine 2% and 1:10,000 adrenaline is injected in the area of the orbital rim. A skin incision is then made over the lateral orbital rim and the orbital periosteum is exposed by blunt dissection. An artery clamp is inserted through the skin incision and directed medially to the area over the lateral rectus muscle. A small cut is made over the artery clamp from the conjunctival side using Wescott's scissors, and the tip of the artery clamp is bared. The needles of the 5-0 polyester sutures are then placed longitudinally along the clamp (to prevent the sharp needles from damaging the orbital soft tissue), and the artery clamp together with lateral rectus muscle are brought out toward the lateral orbital wall. Two bites are taken on the orbital periosteum, with the 5-0 polyester sutures just inside of the lateral orbital rim, and tied to hitch the lateral rectus muscle. The orbital soft tissue is closed with 8-0 polyglactin 910 suture. The Tenon's fascia over the lateral rectus muscle is closed with 8-0 polyglactin 910 sutures to prevent the lateral rectus muscle from attaching to the globe again. The conjunctiva and skin incision is closed with 8-0 polyglactin 910 sutures or fibrin glue. Postoperatively, the patient is treated with topical steroid antibiotic eye drops twice daily for the first 5 days and once daily for the next 5 days. Topical betadine ointment is applied over the skin incision twice daily for a week.

Results

A total of 3 patients were operated on using this technique during the study period. No difficulty was encountered in exposing the orbital periosteum or in bringing the muscle toward the skin incision. As seen in Video 1 (available at jaapos.org), suturing the lateral rectus muscle to the orbital periosteum was uncomplicated. No orbital fat prolapse was noted during surgery. None of the patients experienced postoperative eyelid swelling. The scar on the lateral orbital margin healed completely and was barely noticeable 3 months postoperatively. No suture granulomas were noted in any patient during follow-up. All 3 patients completed 1.5 years of follow-up. None of our patients developed lateral canthal dystopia.

Patient 1 was a 18-year-old man with exotropic Duane retraction syndrome in the left eye. He had a primary position deviation of 30^{Δ} and significant up- and downshoot (Figure 1A). Visual acuity was 20/20 in each eye. Forced duction testing for adduction revealed a tight lateral rectus muscle. He underwent left eye lateral rectus muscle periosteal fixation. Postoperatively the patient was orthophoric in primary position, with a left abduction limitation of 3−. The left eye up- and downshoot had substantially improved, and the adduction substantially improved (Figure 1B). Forced duction testing for adduction was negative 1 month postoperatively.

Patient 2 was a 35-year-old man with bilateral exotropic Duane retraction syndrome. He had a primary position exotropia of 60^{Δ}, bilateral adduction limitation (right eye adduction limitation of 4− and left eye adduction limitation 2−), and bilateral up- and downshoots (Figure 2A). Visual acuity was 20/20 in each eye. Forced duction testing revealed bilaterally tight lateral rectus muscle muscles (right eye, 3−; left eye, 2−). He underwent bilateral lateral rectus muscle periosteal fixation under local anesthesia in each eye separately, the right eye 6 months after the left eye. Postoperatively, the adduction and up- and downshoots had improved greatly, and the patient had a small-angle residual exotropia of 14^{Δ} in primary position (Figure 2B). The abduction was limited (3−), and the adduction had improved substantially in both eyes.

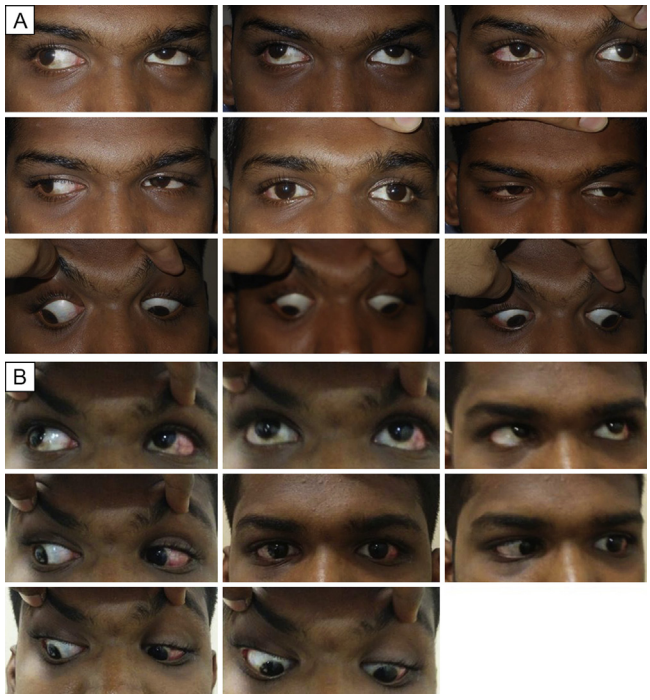

FIG 1. A, Preoperative photograph of patient 1, with left exotropic Duane retraction syndrome with adduction limitation and up- and downshoot on attempted adduction. B, Postoperative photograph showing orthotropia in primary position and improvement in adduction and up- and downshoot. Abduction is limited 3−.

Patient 3 was a 8-year-old boy with a left congenital oculomotor nerve palsy with amblyopia (visual acuity was 20/20 in the right eye and 20/120 in the left eye). The eye deviated down and out (Figure 3A). He underwent left eye lateral rectus muscle periosteal fixation with medial rectus resection of 6.0 mm and superior oblique tenotomy under general anesthesia. Intraoperatively, forced duction testing was positive adducting the eye and normal abducting the left eye. Postoperatively, the patient had a consecutive esotropia of 14^{Δ}, with a left abduction limitation of 3− (Figure 3B). The overcorrection was possibly the result of residual medial rectus function. The left eye ptosis was managed by crutch glasses (Figure 3C), and part-time occlusion of the right eye was recommended.

FIG 2. A, Preoperative photograph of patient 2, with bilateral exotropic Duane retraction syndrome with bilateral adduction limitation. B, Postoperative photograph showing marked improvement in primary position deviation and bilateral improvement in adduction. Abduction is limited 3−.

FIG 3. A, Preoperative photograph of patient 3, with congenital complete oculomotor nerve palsy. The left eye is deviated down and out, with limitation of adduction 4−. B, Postoperative photograph showing consecutive esotropia. The left eye adduction has improved to 2−. C, Pre- and postoperative photograph; the ptosis is corrected with crutch glasses.

Discussion

Lateral rectus muscle periosteal fixation is a profound, potentially reversible weakening procedure that has been described in the management of exotropic Duane retraction syndrome and complete oculomotor nerve palsy. It has been shown that even with supramaximal recession of the lateral rectus muscle, the muscle retains adequate force to prevent adduction in Duane syndrome. Supramaximal recession of the lateral rectus muscle is not very effective in complete oculomotor nerve palsy either. As opposed to a free myectomy of the lateral rectus muscle, this procedure precludes the possibility of spontaneous reattachment of muscle to the globe.[1-6]

All of our patients had good correction of the deviation in primary gaze. Abduction was markedly limited in all patients postoperatively due to severe weakening of the lateral rectus muscle. Surgical success was maintained in all patients until the last follow-up. Forced duction testing was normal in patients 1 and 2; it could not be checked postoperatively in patient 3 because of poor patient cooperation. All patients showed substantial improvement in adduction. Patient 1 had a good correction of deviation in primary position (Figure 1B). Patient 2 declined to undergo a simultaneous lateral rectus muscle periosteal fixation in both eyes under general anesthesia; hence, a sequential surgery was performed under local anesthesia. However, the procedure takes around 10-15 minutes using our modified approach, and we believe that a bilateral procedure under general anesthesia would not be difficult. Patient 3 had a 4− limitation of adduction; hence, a lateral rectus muscle periosteal fixation rather than a lateral rectus muscle recession was performed. He developed a consecutive esotropia with limitation of adduction 2−, suggesting residual left medial rectus action (Figure 3B). The alignment was stable through the last follow-up examination.

Traditional approaches to rectus periosteal fixation involve exposing the orbital periosteum outside of the muscle cone. In our experience, this technique is challenging. The operative space is quite restricted, and it is difficult to take an adequate bite with the needle. We felt that use of a skin incision over the lateral orbital rim would make the procedure simpler and found that simply extending the incision provides more room for suturing the muscle. This may also improve the potential reversibility of the procedure, because the scar on the skin would be a guide to locating the muscle.

We did not encounter the lateral canthal tendon during surgery. The artery clamp (see Video 1) proceeds in a track inferior to the lateral canthal tendon. We attach the lateral rectus muscle to the orbital periosteum just inside of the orbital rim, without having to dissect until the Whitnall's tubercle. None of our patients had lateral canthal dystopia.

Potential complications of our approach are probably the same as those encountered using traditional approach

and could include hemorrhage, suture granulomas, orbital inflammation, and orbital infection. Although we have not used this approach for the other rectus muscles, we believe that the approach would be very similar. Further studies with a larger number of patients are warranted to fully assess the technique.

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