Incomitant Esotropia Following Pterygium Excision Surgery

Noa Ela-Dalman, MD; Federico G. Velez, MD; Arthur L. Rosenbaum, MD

Objective: To report the clinical characteristics and treatment of subjects with incomitant esotropia following unilateral pterygium excision.

Methods: A retrospective review of 6 consecutive patients who developed incomitant esotropia, limited abduction, and diplopia following unilateral pterygium excision surgery.

Results: The mean preoperative deviation was 6 prism dipters (PD) (range, 0-25 PD) in the primary position and 13.8 PD (range, 6-25 PD) in the abducting field of the involved eye. Four patients underwent simultaneous surgery on the conjunctiva-perimuscular connective tissue complex and the medial rectus muscle. One subject had conjunctival-perimuscular connective tissue complex surgery alone. Postoperatively, all patients had orthotropia in the primary position and the deviation in the abducting field was improved to 5.2 PD (range, 0-14 PD).

Conclusions: Incomitant esotropia is an uncommon but serious complication following pterygium excision surgery. Medial rectus muscle recession combined with scar tissue removal is required to eliminate diplopia in the primary position. Conjunctiva-perimuscular scar tissue removal may suffice to improve diplopia in the abduction gaze position.

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Diplopia and strabismus are uncommon complications following pterygium excision surgery. Direct trauma to rectus muscles, scarring of the conjunctiva-perimuscular connective tissue complex, pterygium recurrence, and symblepharon formation may result in incomitant strabismus. Pterygium may be associated with monocular diplopia secondary to irregular astigmatism and horizontal flattening of the cornea in attempted contralateral gaze rotation.

Extraocular muscle disinsertion during pterygium excision surgery is more likely to occur when removing large, deep, and/or recurrent pterygium. Medial rectus muscle disinsertion following pterygium surgery is characterized by a small to moderate amount of exodeviation in the primary position, mild to moderate limitation of ocular rotations, and positive force generation test results because the muscle usually reinserts on the sclera, creating a pseudotendon.

Restricted full abduction is usually related to scar tissue formation and cictrization of the operated area, limiting ocular rotation in the contralateral gaze. Recurrent pterygium usually extends several millimeters onto the cornea. This may result in conjunctival loss, scar tissue formation, obliteration of the fornix, and mechanical restriction of extraocular movements. Recurrent pterygium excision has a higher chance of resulting in trauma or fibrosis of the rectus extraocular muscle adjacent to the pterygium and the connective tissue surrounding the affected rectus muscle.

Surgical treatment is challenging because it requires a combination of surgery on the conjunctival-perimuscular connective tissue complex and the medial rectus muscle.

The aim of this study was to report the clinical characteristics and treatment of subjects with incomitant esotropia following unilateral pterygium excision.

METHODS

This is a retrospective review of 6 consecutive patients who were seen in the strabismus clinic complaining of diplopia following nasal pterygium excision surgery between 1993 and 2005. Institutional review board approval was obtained from the institution.

All subjects underwent complete ophthalmological examination, including distance and near visual acuity, cycloplegic refraction (1% cyclopentolate hydrochloride), slitlamp ex-
amination, and dilated fundus examination. Motor alignment was determined by prism cover testing while the subject was fixing at a 20/70 target at 20 ft 30 cm. A prism bar (Astron International, Mount Dora, Fla) was held in front of the affected eye. An optical occluder was placed to cover the prism over the nonfixing eye. The patient was asked to fix at the target with the nonaffected eye. The optical occluder was moved away from the affected eye to cover the nonaffected eye. The angle of deviation was determined by the amount of prism required to neutralize the abducting movement of the nonfixing eye. In 1 subject with bilateral nasal pterygium, the prism bar was held in front of the eye with more limited abduction.

Surgery was performed using a standard conjunctival limbal incision with 2 relaxing radial incisions to gain maximal exposure. Scar tissue was excised as dissection progressed posteriorly. The medial rectus muscle was isolated on a muscle hook as soon as dissection progressed to a distance of 6 mm posterior to the limbus. With tension placed on the muscle hook by the assistant, scar tissue dissection continued as the surface of the medial rectus muscle was exposed. The first goal of the dissection was to expose the medial rectus muscle insertion and the muscle belly to prevent muscle transection. A headlight is useful for better visualization. We used 0.3% mitomycin C to prevent recurring scarring in 1 case with the most severe scarring from 3 previous pterygium excision operations. Pieces of cellulose sponge were soaked in mitomycin C and placed on the sclera for 2 minutes in the area where scar tissue had been removed. The sponges were removed and the area was irrigated with 60 mL of balanced saline solution. All surgeries were performed by an eye muscle surgeon. In 1 case, a cornera surgeon was present at the time of surgery; in all the other cases, a cornera surgeon was available at the time of the surgery for consultation if needed.

Subject data were tabulated using Excel (Microsoft Office Excel 2003 [11.5612.6360]; Microsoft, Redmond, Wash). A 2-tailed paired t test was used to compare preoperative and postoperative data.

RESULTS

Three male and 3 female subjects were included in the study (Table). The mean age at the time of initial examination was 39 years (range, 26-69 years). All subjects had recurrent pterygium; 5 of 6 subjects had undergone more than 1 previous pterygium excision surgery, 4 subjects (66%) had 2 previous pterygium operations, and 1 subject underwent 3 previous pterygium operations. All pterygium were nasal. Five of 6 subjects had unilateral pterygium. Previous pterygium surgery consisted of excision and graft in 4 subjects (66%) and excision and radiotherapy in 2 subjects (33%). The interval between the pterygium surgery and the onset of diplopia was 40 days (range, 4-90 days).

All subjects had incomitant esotropia, limited abduction, and horizontal binocular diplopia. No patient had vertical or monocular diplopia. All subjects had diplopia in the abducting field of gaze of the affected eye. Two subjects (33%) had diplopia in the primary position, 2 subjects (33%) had diplopia in the abducting field of the affected eye, and 1 subject (16%) complained of diplopia in the reading position.

The mean angle of deviation was 6 prism diopters (PD) (range, 0-25 PD) in the primary position, 13.8 PD (range, 6-25 PD) in the abducting field of gaze of the affected eye, and 5 PD (range, 0-25 PD) in the adducting field of gaze of the involved eye. The near angle of deviation ranged from exophoria of 6 PD to 20 PD of intermittent esotropia (mean, 3 PD).

Five subjects underwent surgery to correct diplopia. One subject chose not to have surgery despite 20 PD of esotropia in the abducting field of the affected eye (Figure 1). In all subjects, the operation involved release of restriction by excision of scar tissue between the limbus and the plica semilunaris. Three subjects required ipsilateral medial rectus muscle recession using adjustable suture. We used 0.3% mitomycin C in 1 subject to prevent scar tissue reformation (Figure 2). One subject who had extensive scar tissue formation involving the medial rectus muscle required exploration of the medial rectus muscle and scar tissue removal to release restriction.

The mean postoperative follow-up was 5 months (range, 2-6 months). All patients were orthotropic in the primary position and the adducting field of gaze postoperatively. Esotropia in the abducting field of gaze improved to 5 PD (range, 0-14 PD). At the last postoperative follow-up, all subjects were diplopia-free in the primary position. Two subjects had residual horizontal diplopia in lateral extreme gaze, 1 of them had bilateral nasal pterygium and improved from 25 PD to 8 PD of esotropia in the abducting field of gaze, and 1 subject had 2 PD of exophoria in the adducting field of gaze.

Strabismus and diplopia are serious complications rarely reported following pterygium excision surgery. The incidence of strabismus and diplopia following pterygium excision surgery is unknown. Pterygium recurrence increases the chances of postoperative diplopia. In subjects with postoperative diplopia following pterygium recurrence, the number of previous pterygium excision surgeries has been reported as 1.8 (range, 1-3). In our study, all subjects had pterygium recurrence and the mean number of previous pterygium excision surgeries was 2 (range, 1-3).

Postoperative diplopia in patients undergoing pterygium surgery may result from restricted ocular rotations, direct trauma to the extraocular muscle, and irregular astigmatism. Conjunctival damage, scar tissue formation, cicatrization of the operated area, conjunctival loss, and obliteration of the fornix result in restricted contralateral gaze rotation of the eye. Recurrent pterygium increases the chances of trauma and fibrosis of the rectus extraocular muscle adjacent to the pterygium and the connective tissue surrounding the affected rectus extraocular muscle. Conjunctival autograft transplantation reduces the rate of recurrence after pterygium excision. However, fibrosis of the graft harvest site may result in significantly restricted ocular motility. Vrabec et al reported 2 subjects who had adduction deficit due to scar formation at the graft harvest site on the superior lateral conjunctiva. In our study, all subjects had incomitant esotropia larger in the field of action of the ipsilateral lateral rectus muscle.

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Surgical treatment to release restriction following pterygium excision is challenging because it requires a combination of surgery on the conjunctival-perimuscular connective tissue complex and the medial rectus muscle. Kenyon et al\(^2\) reported a series of patients with advanced and recurrent pterygium who were treated with conjunctival autograft transplantation. Prior to the autograft transplantation, about 25% of these patients had limited abduction. Autograft transplantation and fornix reconstruction improved abduction. Walland et al\(^6\) reported 1 case of recurrent pterygium following simple excision, causing horizontal diplopia in the lateral gaze. There was extensive medial scarring dragging the caruncle and plica semilunaris. Abduction was limited to \(20^\circ\). Surgery consisted of pterygium removal from the area overlying the medial rectus muscle to the cornea and a conjunctival autograft covering the nasal limbus and the medial rectus muscle. No postoperative abduction was reported. In our study, all subjects operated on required conjunctival surgery and 60% required surgery on the adjacent medial rectus muscle. No patient required corneal surgery. Only 1 subject underwent conjunctival autograft. Two subjects underwent pterygium removal without conjunctival autograft. Both subjects had simultaneous medial rectus muscle recession with adjustable suture. Therefore, the conjunctiva was recessed to access the adjustable suture. None had pterygium recurrence at their last follow-up.

Previous authors have reported trauma to the medial rectus muscle during pterygium excision surgery, resulting in exotropia. Raab et al\(^3\) reported 3 subjects who had noncomitant exotropia, marked adduction deficiency, and horizontal diplopia following nasal pterygium excision surgery. Two of the 3 subjects had recurrent pterygium. Trauma to the medial rectus muscle resulted in disinsertion, transection with partial extirpation, or slip-

### Table. Patient Data

<table>
<thead>
<tr>
<th>Case</th>
<th>Age, y</th>
<th>No. of previous pterygium surgeries</th>
<th>Associated treatment</th>
<th>Side</th>
<th>Onset of diplopia, postoperatively</th>
<th>Diplopic field</th>
<th>Alignment</th>
<th>Version (scale range, +4 to −4)</th>
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<th>Follow-up</th>
<th>Pterygium recurrence</th>
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<td>4 d</td>
<td>LG</td>
<td>PP</td>
<td>Limited abduction</td>
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<td>6 mo</td>
<td>No</td>
<td>OS</td>
<td>Limited abduction</td>
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<td>RG</td>
<td>ORTHOTROPIA</td>
<td>ET 14 PD</td>
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<td>LG</td>
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<tr>
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<td>ORTHOTROPIA</td>
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<td>RG</td>
<td>ORTHOTROPIA</td>
<td>LG</td>
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Abbreviations: adj sut, adjustable sutures; DG, downgaze; EP, esophoria; ET, exotropia; LG, left gaze; LLR, left lateral rectus; LMR, left medial rectus; OD, right eye; OS, left eye; OU, both eyes; PD, prism diopters; PP, primary position; RG, right gaze; RLR, right lateral rectus; RMR, right medial rectus; UG, upgaze; XP, exophoria.
All medial rectus muscles were reattached near the original insertion with or without resection and ipsilateral lateral rectus muscle recession. Postoperatively, all subjects had orthotropia in the primary position. More severe trauma to the medial rectus muscle was seen in subjects who had recurrent pterygium surgery. Ugrin and Molinari\(^4\) reported 2 subjects with recurrent pterygium who had incomitant exotropia, diplopia, and limited abduction. In both cases, the medial rectus muscles were found inserted on the sclera near the equator of the eye.

Figure 1. Diplopia onset 4 days after the second pterygium excision surgery with amniotic membrane graft on the left eye (case 1). Note the limited abduction (−2 [scale range, +4 to −4]) in the left eye (arrow). The patient refused any further surgery.

Figure 2. Diplopia following the third pterygium excision surgery in the right eye (case 4). Note scar tissue formation (A) (arrow) and esotropia with limited abduction in the right gaze (B) (arrow). Diplopia and abduction improved (C) (arrow) after scar tissue removal, mitomycin c application, plicaplasty, conjunctival recession, and right medial rectus recession (D).
Fibrous tissue was observed between the original insertion and the new insertion of the muscle. Surgery consisted of scar tissue removal and reinsertion of the medial rectus muscle to its original insertion. Alignment and adduction improved. However, no data on the postoperative abduction was reported. In our study, all subjects had fibrosis and scar tissue formation surrounding the medial rectus muscle but no subject was found to have direct trauma to this muscle. Release of scar tissue with or without medial rectus muscle recession was required to improve abduction rotation and ocular alignment.

In our study, we found that patients with diplopia in the primary gaze position required medial rectus muscle recession combined with scar tissue removal to eliminate diplopia, whereas for patients with diplopia only in the abduction gaze position, conjunctiva-perimuscular scar tissue removal may suffice to improve diplopia. If there is severe scarring medially, especially after 2 or more previous surgeries, a conjunctival graft from the opposite, uninvolved eye may be considered as part of the surgical treatment.

This study has the limitations of a retrospective review. It is a small group sample. A longer follow-up is required to evaluate possible late recurrence. The surgical technique was not standardized and varied with the type of scar tissue formation and the deviation.

In conclusion, combination of conjunctiva-perimuscular connective tissue complex and muscle surgery is required to improve ocular alignment and motility in subjects with incomitant esotropia following pterygium excision surgery. Surgery is effective in improving the primary position deviation, though some restricted abduction may persist.

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Correspondence: Arthur L. Rosenbaum, MD, Department of Ophthalmology, Jules Stein Eye Institute, 100 Stein Plaza, UCLA, Los Angeles, CA, 90024 (rosenbaum@jsei.ucla.edu).

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REFERENCES