Reexploration and inferior oblique myectomy temporal to the inferior rectus to treat persistent inferior oblique overaction

David M. Squirrell, FRCOphth, Katharine S. Sears, MRCOphth, and John P. Burke, FRCOphth

PURPOSE Persistent symptomatic inferior oblique (IO) muscle overaction (IOOA) after IO muscle weakening surgery is a common problem. We describe the results of reexploration and myectomy of the IO muscle using a standard inferotemporal approach to treat this clinical entity.

METHODS A retrospective noncomparative consecutive series of patients referred for treatment of persistent IOOA. The following preoperative and postoperative measurements were recorded in each case: (1) the ductions and versions of the overacting IO muscle and its antagonist superior oblique (SO) muscle; and (2) alternate prism cover test, using loose prisms at 6 m, in primary position and right- and leftgaze. The preoperative and longer term postoperative findings were compared.

RESULTS Eight patients were identified. Three had previously undergone a standard IO myectomy, and five had undergone a standard IO muscle recession. The median period of postoperative follow-up was 12 months (range, 7 months to 2 years). The IOOA was eliminated in three patients and a reduction of IOOA of at least 1 unit was achieved in all patients. Seven patients showed improvement of their SO muscle underaction on versions, postoperatively. All patients achieved a marked improvement in their alignment across the three standard horizontal positions of gaze. The mean vertical deviations pre- and postoperatively was 23^{Δ} versus 7^{Δ} in contralateral gaze, 17^{Δ} versus 4^{Δ} in primary gaze, and 7^{Δ} versus 1^{Δ} in ipsilateral gaze.

CONCLUSIONS Reexploration and myectomy of the IO muscle near to the temporal border of the inferior rectus muscle is a reliable and effective way of treating persistent IOOA. (J AAPOS 2007;11:48-51)

Recurrent and/or persistent inferior oblique (IO) muscle overaction (IOOA) is a potential complication of all weakening procedures currently employed to treat IOOA. Denervation and extirpation,[1,2] anterior transposition,[3] anterior and nasal transposition,[4] nasal myectomy,[5] and reexploration and myectomy[6] have all been used to further weaken a recurrent and persistently overacting IO muscle. Currently there is little long-term follow-up data for the effectiveness of many of these procedures. Such data are desirable for both planning the surgical management of such patients and counseling them preoperatively. This is important as patients may feel that they have already undergone a surgical procedure that was "unsuccessful." We present the longer term results of a series of patients in whom we performed a reexploration and myectomy of the IO muscle at the temporal border of the inferior rectus (IR) muscle to treat recurrent and/or persistent IOOA.

Author Affiliations: Department of Ophthalmology, Royal Hallamshire Hospital, Sheffield, England.

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Reprint requests: J.P. Burke, FRCOphth, Royal Hallamshire Hospital, Glossop Road, Sheffield, S10 2JF, England (email: Joyce.Antcliffe@sth.nhs.uk).

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Subjects and Methods

The surgical records of a single surgeon were reviewed. Eight consecutive patients were recruited over a 6-year period, and all had been referred for treatment of recurrent/persistent IOOA. A full orthoptic assessment was performed on each patient including visual acuity, cover test, and alternate prism cover test using loose prisms (Luneau, France) at 6 m. Ocular movements were recorded using diagrammatic representation and numerical evaluation.[7] The following pre- and postoperative measurements were specifically recorded: (1) based on a standard scale of 0 to +4, the ductions and versions of the overacting IO muscle and its antagonist superior oblique (SO) muscle; (2) the alternate prism cover test measurements using loose prisms (Luneau, France) at 6 m in primary position, and right- and leftgaze. The pre- and postoperative findings at the time of the last examination were used for the data analysis (Table 1).

Table 1. Pre- and postoperative data of patients who underwent reexploration and inferior oblique myectomy for persistent/recurrent inferior oblique overaction

		Preoperative findings			Postoperative findings					
Patient	Age (y)	IOOA	SOUA	Measurements R/M/L	IOOA	SOUA	Measurements R/M/L	Sensory fusion (preop)	Follow-up (mo)	Primary procedure
1	6	+3	D = 0 V = −2	LHT 35/LHT 25/LHT 15	+1	D = 0 V = −1½	LHT 14/LHT 6/Ø	Absent	12	IO myectomy
2	49	+3	D = −½ V = −2	LHT 20/LHT 14/LH 3	+2	D = 0 V = −1½	LHT 14/LH 7/Ø	Absent	24	IO myectomy
3	27	+3	D = 0 V = −2½	LHT 30/LHT 18/LH 2	+½	D = 0 V = −½	LH 4/LH 1/Ø	Absent	7	IO myectomy
4	9	+4	D = −1 V = −3	RHT 2/RHT 25/RHT 35	0	D = 0 V = −1	Ø/RHT 2/RHT 4	Absent	10	IO recession
5	38	+1	D = −½ V = −1	LHT 25/LHT 25/LHT 20	+½	D = 0 V = 0	LH 6/LH 4/LH 4	Present	18	IO recession
6	6	+3	D = 0 V = 0	LH 4/LH 4/Ø	0	D = 0 V = 0	LH 2/LH 3/LH 3	Present	18	IO recession
7	7	+2	D = 0 V = −1½	RH 9/RH 10/RHT 14	+½	D = 0 V = −½	Ø/RH 4/RH 4	Present	24	IO recession
8	8	+3	D = 0 V = −2	RHT 8/RHT 12/RHT 20	0	D = 0 V = −½	Ø/RHT 4/RHT 8	Absent	11	IO recession

IOOA: inferior oblique overaction; *SOUA*: superior oblique underaction; *LHT*: left hypertropia; *RHT*: right hypertropia; *LH*: left hyperphoria; *RH*: right hyperphoria; *Ø:* orthophoria; *D*: duction, *V*: version. Measurements in prism diopters. Measurements: *R*: dextro version; *M*: primary position; *L*: Levoversion; *IO*: inferior oblique.

All patients at the time of reoperation underwent IO myectomy as the sole procedure where the proximal incision through the IO muscle was adjacent to the temporal border of the IR muscle via an inferotemporal quadrant approach. In brief, a limbal conjunctival incision was made in the inferotemporal quadrant between the inferior and lateral rectus muscles with relaxing incisions at either end. A 6-0 silk limbal traction suture, positioned midway between the inferior and lateral rectus muscles, was used to rotate the globe into elevation and adduction. The inferior and lateral rectus muscles were hooked to confirm their locations and integrity. A Desmarres (John Weiss Ltd., London, UK), or where appropriate a Fisons (John Weiss Ltd., London, UK), retractor was used to reflect the conjunctiva and the subconjunctival tissues from the globe. The IO muscle was identified in the inferotemporal quadrant following dissection. The exact location of the IO muscle and the degree of adhesions in the inferior temporal quadrant varied considerably between patients. The residual IO muscle was then cleared of surrounding adhesions and intermuscular septa, from its insertion to the temporal border of the IR muscle. The muscle was clamped at this position and transected temporal to the clamp. The proximal stump was then cauterized prior to removing the clamp. Care was taken to avoid the neurovascular bundle, which attaches to the IO muscle some 2 mm temporal to the IR muscle. Under direct observation the IO muscle was allowed to retract into the Tenon's capsule overlying the IR muscle so that its stump was no longer in direct contact with the sclera. The distal end of the myectomized IO muscle was then removed and the conjunctiva and Tenon's fascia were closed using interrupted 8-0 polyglactin 910 sutures.

Results

Follow-up ranged from 7 months to 2 years, with a median of 12 months. The age range of patients was 6 years to 49 years, with a median of 9 years. In six cases the original indication for IO surgery was diplopia and/or psychosocially noticeable decompensated vertical strabismus. In one case the original diagnosis was infantile esotropia with IOOA (Case 4). In the remaining case the original diagnosis was a partially accommodative esotropia with bilateral IOOA (Case 8). The pre- and postoperative findings are shown in Table 1. The IOOA was eliminated completely in three patients and a reduction of IOOA of at least one unit was achieved in all patients. No patient showed a worsening of their IOOA postoperatively. The mean reduction of the manifest hypertropia in primary position postoperatively was 16^{Δ} (range, $14–19^{\Delta}$) in the three patients who had previously undergone myectomy and 11^{Δ} (range, $0–25^{\Delta}$) in the five patients who had previously undergone an IO muscle recession. All patients achieved a marked improvement in their alignment across the three standard horizontal positions of gaze.

In two of the three patients who underwent a myectomy as the first procedure, minute thin bands of IO muscle fibers were found in the vicinity of the original IO muscle insertion, while the myectomized fibromuscular proximal stump was adherent to the sclera, approximately midway in the inferior temporal quadrant posterior to the equator (Cases 2 and 3). In the third patient a previously unrecognized, presumed bifid insertion was identified (Case 1).

Of the five patients who underwent a primary IO muscle recession, in two cases the fibromuscular stump

was found in the standard position for a 10-mm IO muscle recession (Cases 5 and 7), and a third patient had the main fibromuscular stump in a similar location to Cases 5 and 7 but with a second smaller fibromuscular scleral insertion nearer to the IO muscle insertion (Case 6). The other two patients had a fibromuscular scleral attachment more posterior and more temporal to the standard 10 mm IO muscle recession site (Cases 4 and 8).

Discussion

Although the strategies for dealing with a persistently overacting IO muscle have recently been reviewed, the published evidence base for these strategies is not robust.[6] It is now widely accepted that residual IOOA after an IO myectomy is often the result of either unidentified posterior fiber remnants, the IO muscle reattaching itself to the globe somewhere in the inferotemporal quadrant, or reconnection of the two cut ends of the muscle through a fibrous band. Reexploration and myectomy of any residual fibers or bands, ensuring that the myectomized muscle retracts through Tenon's capsule, is recommended as the procedure of choice in this scenario.[6] Our data support this recommendation. Interestingly, the mean improvement in the manifest primary position hypertropia (16^{Δ}) seen in this current study compares favorably to other published data for primary IO myectomy.[8] This finding illustrates the powerful effect that can be exerted by disinserting these residual fibers of the IO muscle and performing a large myectomy. It also supports the recommendation that intraoperative traction testing of the oblique muscles[9] be conducted if there is any doubt as to whether any posterior fibers remain after the primary IO muscle surgery.[6] We cannot say that the same postoperative effect would have been obtained had we only cut the residual posterior fibers, but we suspect not.

Reexploration and myectomy through a standard inferotemporal approach,[6,10] nasal myectomy,[5] and anterior transposition of the IO[3] have all been advocated to treat recurrent/persistent IOOA after an IO muscle recession. In our series, of the five patients who had previously undergone IO muscle recession to treat IOOA, the persistent IOOA was eliminated in three patients and greatly reduced in the remaining two patients. The mean improvement in the manifest primary position hypertropia (11^{Δ}) seen in this cohort was notable given that the muscle in four of the five patients was found in the correct place for a standard recession without any other fiber remnants. To our knowledge there is no other published longer term data on the results of a myectomy, adjacent to the temporal border of the IR muscle, to treat persistent IOOA after an IO muscle recession. Previously we have reported that primary myectomy of the IO muscle tends to produce a variable self-titrating amount of correction of the hyperdeviation postoperatively.[8] It is interesting that the results of our current study suggest that this is also true when reoperating on a muscle that has previously been recessed (Table 1).

The proponents of nasal myectomy of the IO muscle,[5] and anterior transposition of the IO muscle,[3] have reported similarly encouraging results for operating on recurrent and persistent IOOA after IO muscle recession. Our report does not address the problem of recurrent IOOA in patients who underwent anterior transpositions of the IO muscle for dissociated vertical deviation. Stager et al[5] reported that, of the eight patients' who underwent a nasal myectomy to treat recurrent IOOA, the recurrent IOOA was eliminated in six patients and improvement was noted in the remaining two. Numerical details (prism diopters) of the postoperative hyperdeviation across the three standard horizontal positions of gaze were not included. These data and that from our current study suggest that, in cases of recurrent IOOA after a previous IO muscle recession, myectomizing the muscle nasal, or just temporal to the IR muscle will effectively weaken it further. Elliot and Nankin[3] also reported that none of the seven patients in their cohort who underwent anterior transposition to treat recurrent and persistent IOOA exhibited an overacting muscle after surgery. No other measurements on this cohort of patients were provided. However, on a cautionary note, the authors also reported that a -1 to -2 elevation deficiency occurred postoperatively in 70% of their cases when a unilateral anterior transposition was performed.

In conclusion, we found that, in this small consecutive series with a median follow-up of 12 months, reexploration and myectomy of the IO muscle with the proximal incision near to the temporal border of the IR muscle can offer a reliable and effective way of treating recurrent/persistent IOOA. This was the case both immediately postoperatively and in the longer term when the pre- and postoperative SO ipsilateral muscle duction was either normal or reduced by no more than 1 unit. Our results suggest that the majority of such patients with recurrent IOOA after previous IO myectomy or recession can expect a marked improvement in both IOOA and vertical alignment across the three standard horizontal positions of gaze and furthermore this effect is sustained over time. Myectomy of the IO muscle at the temporal border of the IR muscle tends to produce a variable, self-titrating amount of correction of the hyperdeviation postoperatively in patients where the ipsilateral SO muscle duction is full.

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First Person

Four-year-old McKenna was about to enter the operating room for strabismus surgery. She beckoned me close with her index finger and said she had a secret to tell me. I leaned my ear toward her face and she said, "I have a crush on you."

—Burton J. Kushner, MD