

Surgical treatment of esotropia associated with high myopia: unilateral versus bilateral surgery

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PURPOSE. To compare unilateral versus bilateral surgical treatment of esotropia associated with high myopia.

METHODS. This retrospective study comprised patients who underwent surgery for esotropia with high myopia performed by the first author (Y.M.) between 2003 and 2008. Surgical results and complications were compared between patients who underwent unilateral versus bilateral surgery.

RESULTS. Nine patients were identified with average age of 44.9 years (range 8–70 years). All had bilateral high myopia (average –13.35 D, range –9.00 to –17.50 D) and esotropia of 20–75 diopters, together with hypotropia in 5 cases. Bilateral displacement of the lateral rectus inferiorly and superior rectus medially was demonstrated in each patient by computed tomography scan of the orbits and by observation during surgery. Five patients underwent bilateral surgery and 4 underwent unilateral surgery. After an average follow-up of 29 months (range 4–47 months), 4/5 patients who underwent bilateral myopexy achieved good results with postoperative esotropia of less than 8 diopters, as opposed to 2/4 patients who underwent unilateral surgery. No complications were noted.

CONCLUSIONS. Bilateral superior and lateral rectus myopexy is the preferred method of surgical correction of esotropia associated with high myopia. Additional unilateral or bilateral medial rectus recession is probably not indicated in most cases. Patients who prefer unilateral surgery can benefit from unilateral superior and lateral rectus myopexy together with medial rectus recession. This unilateral approach may yield good results particularly in young patients without markedly restricted and tight extraocular muscles. (*Eur J Ophthalmol* 2010; 20: 653-8)

KEY WORDS. Esotropia, Extraocular muscles, Heavy eye syndrome, High myopia, Ocular ductionsA

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INTRODUCTION

The heavy eye syndrome is a well-described phenomenon in patients with high myopia. These patients present with acquired esotropia, which is often accompanied by hypotropia of one eye and limitation of abduction (1-4). The pathogenesis and preferred surgical treatment for this entity has been a challenge for many years as conventional recession or resection procedures of the horizontal rectus muscle yielded disappointing results (1, 5). Magnetic resonance imaging of the orbits in these patients revealed that the esotropia is caused by dislocation of the large globe superiorly and laterally between the superior and lateral

recti, displacing the lateral rectus inferiorly and the superior rectus medially (6). Since most patients have bilateral high myopia, this displacement is usually bilateral. Treatment for this entity is aimed at restoring the globe and the rectus muscles to their normal anatomic position. This can be achieved by suturing the lateral and superior rectus to one another by a loop myopexy (7) or by suturing the upper half of the lateral rectus muscle and the temporal half of the superior rectus muscle together (8).

Many progressive high myopia patients have reduced vision in one or both eyes, due to either myopic macular changes or retinal detachment. In this situation, the patient as well as the surgeon may prefer unilateral surgery on the

worse-seeing eye, leaving the only seeing eye untouched. The aim of this study is to describe the results of unilateral surgery in patients with heavy eye syndrome and to compare the outcome to patients who underwent bilateral surgery.

METHODS

Charts were reviewed of all patients with heavy eye syndrome who underwent surgery by the first author at either a private clinic or at the Department of Ophthalmology, Assaf Harofeh Medical Center, Zerifin, Israel, from 2003–2008. Myopexy of the lateral and superior rectus was performed by loop myopexy or by suturing the muscles together. Initially the loop myopexy was performed as described by Wong et al (7). A 5-0 Ethibond suture was inserted behind the superior and lateral recti, about 12 mm distal to the insertion sites, and was tied above the muscles, joining them together. We have found this surgical procedure very inconvenient to patients: strangulation of the muscles produced marked chemosis and pain in the first postoperative days. Therefore, we switched to an alternative method, similar to that described by Yamada et al (9). A 5-0 Ethibond double-armed suture was sutured to the superior and lateral rectus muscle bellies, 10 mm distal to the insertion sites. Both ends of the double-armed suture were then tied to each other, at the superior end of the lateral rectus or at the temporal end of the superior rectus, leaving one suture

end free. Both free ends were then tied to each other, joining the muscles together.

Patients who underwent bilateral surgery had the myopexy procedure performed in both eyes. Patients who underwent unilateral surgery had the myopexy procedure performed in one eye, along with a 6-mm recession of the medial rectus in that eye.

RESULTS

We identified 9 patients who underwent either unilateral or bilateral surgery from 2003 to 2008 (Tab. I). Average age was 44.9 years (range 8–70 years). All patients had esotropia between 20 and 75 diopters, and 6 also had hypotropia of one eye. All patients had bilateral high myopia (average –13.35 D, range –9.00 D to –17.50 D). Bilateral displacement of the lateral rectus inferiorly and superior rectus medially was demonstrated in each patient by computed tomography scan of the orbits and by observation during surgery. Five patients had bilateral surgery and 4 had unilateral surgery due to poor vision in one eye.

After an average follow-up of 29 months (range 4–47 months), 4 patients who underwent bilateral myopexy achieved good results with postoperative esotropia of less than 8 diopters. Patient J.M. (Fig. 1), who had severe esotropia with almost no abduction movements, underwent bilateral myopexy together with medial rectus recession in the left eye on adjustable sutures. She had exotropia immediately

TABLE I - DEMOGRAPHIC AND SURGICAL DATA OF THE STUDY GROUP

Name/Gender/Age	Visual acuity	Spherical equivalence Right/Left	Preoperative alignment for Distance (diopters)	Postoperative alignment for Distance (diopters)
Bilateral surgery				
NL/F/40	RE: 6/9 LE: 6/9	-12.00/-13.5	50 ET	Ortho
TK/M/8	RE: 6/7 LE: 6/6	-10.75/-9.25	45 ET	8 ET
JM/F/68	RE: 6/18 LE: 6/24	-13.25/-12.50	70 ET+ 10 LHT	8 XT
BS/M/10	RE: 6/7 LE: 6/7	-10.00/-9.25	40 ET	Ortho
TM/F/68	RE: 6/9 LE: 6/9	-12.25/-10.50	20ET + 10 LHT	Ortho
Unilateral surgery				
MY/M/65	RE: 6/40 LE: 6/120	-14.00/-12.50	55 ET+ 6 LHT	25 ET + 6 LHT
FV/M/38	RE: 6/120 LE: 6/9	-14.50/-15.00	70 ET+ 4 RHT	Ortho
HT/F/34	RE: 6/30 LE: 6/10	-16.25/-17.00	40 ET	8 ET
FB/M/70	RE: HM LE: 6/60	-15.00/-15.50	60 ET + 16 RHT	14 ET + 12 LHT

ET= esotropia, HT= Hypotropia, XT = Exotropia, RE = Right Eye, LE = Left Eye, HM =Hand Movement

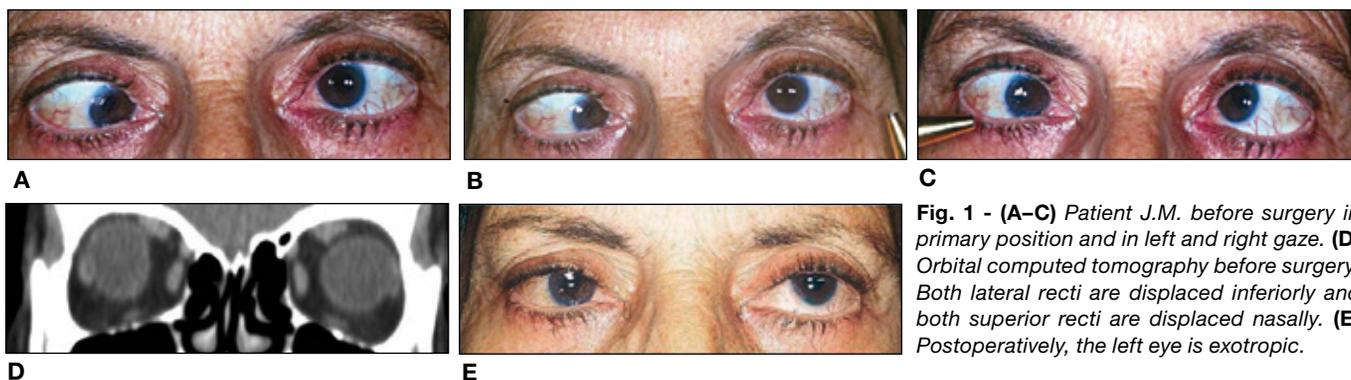


Fig. 1 - (A–C) Patient J.M. before surgery in primary position and in left and right gaze. **(D)** Orbital computed tomography before surgery. Both lateral recti are displaced inferiorly and both superior recti are displaced nasally. **(E)** Postoperatively, the left eye is exotropic.



Fig. 2 - Patient H.T. before **(A)** and after **(B)** unilateral myopexy with medial rectus recession in the right eye.

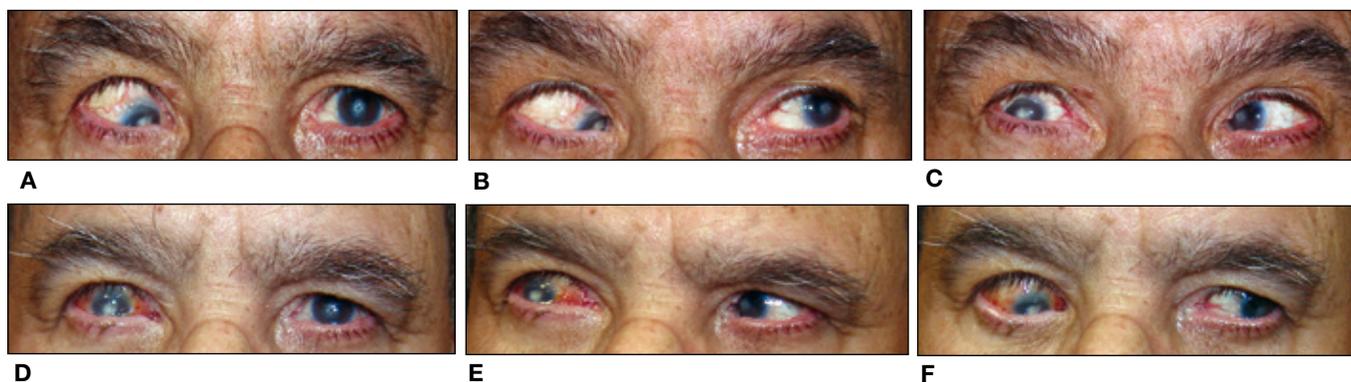


Fig. 3 - Patient F.B. in primary position and in left and right gaze. Before surgery **(A–C)** and after **(D–F)** unilateral myopexy with medial rectus recession in the right eye.

after the procedure, so the medial rectus was returned to its original insertion. However, she still had 8 diopters of exotropia at the last postoperative visit. Of the 4 patients who underwent unilateral myopexy together with medial rectus recession, 2 achieved good results (esotropia ≤ 8 diopters). One of these patients, patient H.T., is shown in Figure 2. Two patients still had esotropia of 14–25 diopters, with residual hypotropia in one case (Fig. 3). This patient, F.B., had additional inferior rectus recession 6

months later to further improve his alignment. All patients were satisfied after the first surgery, since their cosmetic appearance was much improved. An interesting observation was that in some patients, the surgical results improved gradually over several months postoperatively. For example, patient F.V. had 16 diopters esotropia immediately after surgery, which gradually improved to the ortho position 8 months postoperatively. A similar observation was seen in patients H.T. and N.L. The last patient

also reported postoperative horizontal diplopia, which resolved within 3 weeks. No other patient reported postoperative diplopia. Ductions also improved in all patients over time. There were no operative or postoperative complications.

DISCUSSION

The etiology of heavy eye syndrome as well as the appropriate method of treatment has been an enigma for decades. Many theories have attempted to elucidate the etiology for this phenomenon. It has been postulated that increased weight of the eyeball or forward movement of the center of mass of the globe results in a drop of its anterior half; hence the term heavy eye (10, 11). Parks and Mitchell believed that the medial rectus muscles were acting like fibrous bands which prevent abduction in these patients (12). Duke-Elder and Wybar suggested structural changes in the extraocular muscles as well as a shortening of the optic nerve as the source of the problem (13). Others postulated that the large globe compresses the lateral rectus against the orbital wall, possibly leading to ischemia and lateral rectus muscle atrophy (2, 14) or myositis (15). The demonstration of amyloid in histopathology studies of lateral rectus tissue samples led others to believe that heavy eye syndrome is a congenital myopathy (16). In the past, surgical treatment for this entity yielded disappointing results. Conventional medial rectus recession surgery often resulted in recurrence of the esotropia (17). This led to more extreme procedures such as medial rectus tenotomies (2), or disinsertion and myectomy of each medial rectus muscle, combined with resection and advancement of the lateral rectus muscles (18). While these extreme measures could reposition the eyes in primary position, full ductions were not restored.

A breakthrough in the understanding of the etiology of this entity was achieved by Krizok et al, who evaluated magnetic resonance scans of the orbit of these patients (6, 19). They demonstrated that the large globe is dislocated temporally and superiorly between the lateral and superior rectus muscles, displacing the lateral rectus downwards and the superior rectus medially. They suggested that alignment could be achieved by performing a large recession of the medial rectus and anteropositioning of the lateral rectus to its physiologic meridian via suturing it to the sclera with a nonabsorbable suture (19). Hiyashi et al later suggested that a partial Jensen procedure would restore alignment in these

patients (3), and Yokoyama et al were the first to suggest performing lateral and superior rectus myopexy (20).

The results of our study, as well as of others (7-9, 20), suggest that bilateral surgery has fairly good results in these patients. This is not surprising since we are dealing with patients with normal binocular vision, whose globe was surgically restored to its normal position within the muscle cone. Adding a medial rectus recession in one case (patient J.M.) was probably not necessary, and resulted in postoperative exotropia.

The outcome of unilateral surgery was more variable. As seen in the Table, 2 of the 4 patients achieved good results while another 2 had less than favorable results. The difference between these patients may be related to their history. Patients H.T. and F.V. (good results) were relatively young. They first noticed esotropia at the age of 10-15 years, about 20 years before undergoing the operation. During surgery, forced duction testing did not reveal extremely tight medial recti. On the other hand, patients F.I. and M.Y. were much older (age 70-65 years). They had esotropia since early childhood, which increased over time. Both of these patients had bilateral corneal scars, likely secondary to untreated keratitis during childhood. This resulted in severe myopia, possibly due to form deprivation. In both patients, the medial recti were extremely tight and in one (F.I.) the inferior rectus was also tight (this patient underwent additional surgery 6 months later in which the inferior rectus was recessed and his vertical deviation was normalized). We believe that tight muscles due to longstanding strabismus in these 2 patients prevented normalization of the alignment.

Other reports in the literature confirm the observations made in our study. Rowe and Noonan reported on a 43-year-old woman who underwent bilateral myopexy together with medial rectus recession in one eye. Similar to our case J.M., this resulted in marked exotropia immediately postoperatively and the medial rectus was resutured to its original position, leaving the patient with 6 diopters of exotropia (8). Similar exotropia was also reported by Wong et al, who performed bilateral myopexy on a patient who had previous bimedial recession (7). Basmak et al also reported on a case in which they performed bilateral myopexy with bilateral medial rectus recession (21). Although they did not report the postoperative alignment, the postoperative picture in their report shows a patient with what perhaps appears to be slight exotropia. These reports support our observation that medial rectus recession is probably not necessary in

most cases when bilateral surgery is performed.

The reports on unilateral surgery in highly myopic patients also confirm our results. Yamada et al reported on a 69-year-old woman with longstanding strabismus fixus (9). They performed unilateral surgery consisting of hemitransposition of the superior rectus and lateral rectus combined with a recession of medial rectus. Similar to our cases F.I. and M.Y., the patient still had postoperative esotropia. They performed a second similar surgery on the fellow eye several months later, which yielded good results. Unilateral surgery was also reported by Larsen and Gole (22), who operated on a 57-year-old woman who had undergone previous unsuccessful bimedial recession. Unilateral partial Jensen procedure produced good results in this case, and similar to our observation, her eye movements and alignment improved over time.

The hypotropia seen in our patients J.M., M.I., F.V., and F.I. was only partially corrected by the procedure. In fact, patient F.I. still had marked right hypotropia postoperatively, which normalized only after additional inferior rectus recession in that eye. Hoerantner et al (23) noted that highly myopic patients with marked hypotropia have an atrophic inferior oblique in the hypotropic eye. Using a computer model, they demonstrated that the hypotropia is related to overaction of the ipsilateral superior oblique. Superior oblique weakening did improve the hypotropia in one of their patients. Since we relied on orbital computed tomography

and not magnetic resonance imaging scans in our study, we cannot comment on this observation. However, the fact that hypotropia was seen in all of our elderly patients with longstanding esotropia may support the theory on atrophic inferior oblique changes.

In conclusion, our study demonstrates that bilateral superior and lateral rectus myopexy is the preferred surgical method for correction of esotropia associated with high myopia. Additional unilateral or bilateral medial rectus recession is probably not indicated in most cases. Patients who prefer unilateral surgery can benefit from unilateral superior and lateral rectus myopexy together with medial rectus recession. This unilateral approach may yield good results especially in young patients without markedly restricted and tight extraocular muscles. Gradual improvement in alignment and ductions can be expected over time.

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