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Horizontal Rectus Muscle Plication in Children: An Effective Vessel Sparing Alternative to Resection

Dr. Zia Chaudhuri, Prof. Joseph L Demer

Plication by suturing extraocular muscle (EOM) to sclera is increasingly being adopted by strabismologists for rectus EOM strengthening. Resection, the historically preferred EOM strengthening method, has the disadvantage of irreversible removal of EOM tendon. Classically described tendon to tendon plication, as performed for the superior oblique (SO), may produce cosmetically unattractive tissue overlap visible through the conjunctiva, a particular historical concern when performed on rectus EOMs. The technique of EOM to sclera plication, however, reportedly does avoid conspicuous tissue prominence. Vertical rectus EOM plication reportedly has favorable results.

Plication to sclera can be performed through a small conjunctival incision. Studies in animals have demonstrated preservation of ciliary circulation after rectus EOM plication, an advantage that permits simultaneous operation of more than two rectus EOMs in one eye without risk of anterior segment ischemia.

Overall, in view of the decrease in trauma related to loss of tissue with this plication, preservation of anterior ciliary vessels, initial reversibility, and technical ease, EOM plication seemed advantageous in pediatric eyes. The important feature of initial reversibility is a boon in children in whom pre-operative assessment of the deviation may be very difficult. We therefore aimed in this prospective pilot study to evaluate the surgical effect of horizontal rectus EOM plication in children. We hypothesized that the surgical dose effect of plication would be similar to resection, as indicated by tables published by Parks et al.

MATERIALS AND METHODS

With IRB approval, we retrospectively analyzed the clinical records of consecutive children who underwent EOM plication and resection by a single surgeon (JLD) between 2005-2013 at the Jules Stein Eye Institute (JSEI), University of California Los Angeles (UCLA), USA.
Patients underwent complete clinical examination, including best-corrected visual acuity, refractive error, stereopsis, version examination, slit lamp and fundoscopic evaluation, and clinical examination of saccades. Heterotropia was measured at distance and near by prism and cover testing.

Eight children (3 esotropes, 5 exotropes) of average age 9.4±4.8 years underwent plication of the lateral recti (LR) and medial recti (MR) for correction of horizontal strabismus. Data was compared with that of 16 children (4 esotropes, 12 exotropes) of average age 9.8±3.8 years who underwent LR and MR resection for similar deviations (30 PD approximately). Surgical doses for plication and resection were taken as those recommended for resection by Parks et. al.²

All patients were operated under general anesthesia using either the limbal conjunctival incision or incision directly over the insertion.¹⁵⁻¹⁹ The plicated EOM was hooked and the connective tissues gently retroplaced with swab sticks. One suture (Vicryl 6-0, Ethicon) was placed at each EOM margin at the distance from the scleral insertion corresponding to the desired plication amount. The sutures were then passed partial thickness through the sclera adjacent to the corresponding poles of the tendon insertions. An iris sweep was temporarily placed between the tendon and the sutures, forming a fulcrum over which the anterior tendon was folded flat between the EOM and globe as the sutures were tied to approximate the posterior EOM to the sclera. The procedure was completed by suture closure of the conjunctiva (Vicryl, 9-0, Ethicon). Standard procedure was used for the alternative procedure of EOM resection. An antibiotic and steroid ointment was administered daily post-operatively for one week. Ciliary circulation observed at surgery remained preserved after plication.

Post-operative alignment was recorded at the first and at the most recent post-operative examination.

### RESULTS

An average of 5.6 ± 5.8 mm plication was performed versus 5.6 ±1.3 mm of resection for similar magnitudes of deviation (about 30 PD) over a follow up 120 ±130 days. Alignment results of EOM to sclera plication were similar to resection. The dose response relationship of plication was similar to resection, although modest augmentation was required for LR plication while planning routine horizontal EOM surgery with Park’s tables. No such augmentation was required for MR plication. Thus, both plication and resection are quantitatively equivalent, with the published tables of Park’s et. al., overestimating the effect of plication by about 10% and underestimating the effect of resection by about 10%, the effect of both probably negligible except for very large strabismus angles. The average post-operative alignment after plication was 0±0 PD in
both esotropes and exotropes versus $1.8\pm 3$ PD after resection on follow-up for $1148\pm 1513$ days (approximately average of 3 years). Plication resulted in qualitatively lesser inflammation.

**DISCUSSION**

Plication is a quick, simple surgery whose effect is quantitatively similar to resection, and has the advantage of causing lesser surgical trauma and preserving anterior ciliary circulation. This is of specific value where anterior segment ischemia is a consideration.\(^7,14\) Plication with minimal dissection through a small incision technique may have further advantages.\(^4,6,11\) Another possible advantage of plication is that it can be readily performed under topical anesthesia as it does not entail relatively painful crushing of EOMs as in resection. In a two-muscle surgery, the procedure can be performed using an adjustable slipknot in one eye. In any situation where increased post-operative inflammation is expected, e.g. thyroid ophthalmopathy, where resection has conventionally been avoided for fear of exacerbating inflammation, plication can be substituted.\(^20\) The situation is similar in children. We recommend horizontal rectus EOM plication as an effective and relatively reversible vessel sparing surgery in children for routine use.

**REFERENCES**


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**Clinical Profile of Patients with Microtropia in A Tertiary Eye Care Hospital**

**Dr. Sridevi, Dr. Srikanth R.**

Parks and Eustis introduced the term monofixational phoria which they later revised to monofixation syndrome, to describe an absence of bifoveal fusion with maintenance of normal retinal correspondence (NRC) associated with an enlarged Panum’s fusional area. Microtropia has been the subject of debate since Lang coined the term to describe a small angled strabismus with anomalous retinal correspondence (ARC), normal fusional amplitudes, and reduced stereopsis. Helveston and von Noorden initially reserved this term for cases in which the uniocular angle of eccentric fixation and the angle of anomaly were coincident, and therefore no movement was evident on the cover-uncover test. However, both sets of authors have now adopted the term “microtropia” to encompass both positive and negative cover-uncover test findings.
Microtropia is defined as a manifest deviation of less than 5° usually with harmonious ARC giving rise to abnormal binocular single vision (ABSV), normal motor fusion, and reduced or absent stereoacuity. In addition to amblyopia, a foveal suppression scotoma and uniocular eccentric fixation are present and there is a close association with anisometropia. The term microtropia “with identity” is used by most authors to describe patients with no manifest movement on cover test, the eccentric fixation point coinciding with the angle of ARC. Microtropia “without identity” describes patients in whom the manifest movement is demonstrated on the cover-uncover test. Microtropia may be primary, when there is no history of previous large angled strabismus, primary decompensating and consecutive microtropia or secondary following surgical or optical correction of a larger strabismus or associated with other ocular pathology.

In three instances microtropia is important for the ophthalmologist

In assessment of amblyopia apparently without strabismus, in evaluation of strabismus treatment results and in evaluation of hereditary factors in strabismus. It is estimated that about 1% of general population has a microtropia.

MATERIALS AND METHODS

We performed a retrospective review of the database from the department of pediatric ophthalmology and adult strabismus. We identified patients who met the criteria for microtropia. Patients were considered to be monofixators if they had a deviation of less than or equal to 8 PD on simultaneous prism cover test (SPCT), demonstrated peripheral but not central fusion on Worth four- and had between 800 and 20 seconds of stereoacuity using Titmus stereoacuity and randot testing. We excluded any patients who did not meet the strict criteria for monofixation listed above.

The requirements for this study were fulfilled by 68 patients. Our patients ranged in age from 3 to 63 years (mean, 20.29 years). All the patients routinely underwent a full ophthalmologic examination including unaided visual acuity cycloplegic refraction, slit lamp examination, orthoptic evaluation and dilated fundus examination. The deviations were measured by the SPCT and the alternate prism and cover test in all fields of gaze by using accommodative targets at 6 m and 1/3 m while the patients were wearing their best optical correction. Presbyopic patients were corrected for near vision. Abnormalities in ductions and versions were recorded at near and distance. Sensory status was established by fusion on the Worth 4 dot test at distance (6m) and at near (1/3m) and by random dot test and Titmus stereotest at near. For Titmus stereoacuity testing, the patients wore their regular spectacles underneath the polaroid glasses.
The 4 PD base-out prism test was used for assessment of the presence of bifoveal fixation and to exclude monofixation syndrome. Patients were asked to look at a distant target. A 4 PD base-out prism was inserted rapidly before one eye and then quickly removed. The test was repeated on the other eye. A fast movement in the direction of the prism’s apex (inward) was considered as a positive sign for foveal fixation. The Worth 4-dot test was used to test for fusion at distance (6m) and near (33 cm). Anisometropia was defined as a difference of greater than 1.5 D between the 2 eyes in spherical equivalent.

RESULTS
Of the 68 patients who were included, 39 (57.35%) were males and 29 were females. Diminution of vision was most common presenting complaint in 75% of patients. 41.17% of patients were above 18 years of age. Left eye was more commonly involved (70.59%). Presenting Visual acuity in affected eye ranged from counting fingers close to face to 6/7.5. Stereopsis was less than 80 arc seconds in 72% of 50 recorded subjects. Anisometropia was present in 27.9% of patients

Patients were divided into the following groups
spherical hypermetropic anisometropia, spherical myopic anisometropia, cylindrical anisometropia, and combined spherical and cylindrical anisometropia; most common being spherical hypermetropic anisometropia (30.88%). Most of the patients were orthophoric (88.24%) esodeviation was seen in 2.94% while exodeviation in (2.94%). 55.88% patients received glasses while 54.41% received patching as treatment.

DISCUSSION
A few studies have shown that the stability of alignment in the monofixation syndrome is not permanent. Hunt considered that the monofixation syndrome would deteriorate over time by an increase in the ocular deviation and loss of fusion. Hyperopia was higher in the dominant eye in all these cases and can be associated with abnormal stereoacuity and “microstrabismus,” which supports the study done by Chu Sart-Tilman et al. Recent studies by Lepard and Leffertstra and others have shown that in unilateral strabismus there is a strong tendency for amblyopic eye to remain hyperopic, whereas the dominant eye becomes emmetropic or even myopic.

The prevailing hypothesis is that abnormal sensory experience leads to foveal suppression and, subsequently, secondary microstrabismus.

The type of microtropia with eccentric fixation without identity is mainly due to the wandering eccentric fixation. All patients with microtropia have abnormal fusion without fixation point scotoma because positive prism test response does not change to normal by using prisms of different strengths
and positions. Differences in fusion results are mainly due to the weakness of abnormal fusion rather than fixation point scotoma.

Assessment of sensory function in children may be subject to observer bias and patients’ suggestion in addition to performance variability. The sensitivity and specificity of the Worth 4-dot test in the detection of suppression have been reported to be 90% and 94%, respectively.

Left eye laterality goes in support with Multi-Ethnic Pediatric Eye disease Study (MEPEDS)\(^1\) which concluded that hyperopic anisometropia develops more frequently in left eye than the right eye. With occlusion treatment, amblyopia can be improved, whereas binocular defects of microtropia cannot be improved.

Treatment of microtropia centres on correction of any refractive error and conventional occlusion, particularly maintenance occlusion for amblyopia.

**Conclusion**

These results demonstrate the interest of the definition of microtropia as a specific strabismological entity, which can be congenital or acquired and be influenced by accommodative factor.

Amblyopia is the main treatable factor and the aim of treatment should be equal visual acuities. Microtropia may be an unrecognised cause of reduced visual acuity in all age groups.

**Literature Search**

PubMed was searched, without date restrictions, using the following terms and combinations: microtropia AND anisometropia; stereopsis AND microtopia; Worth 4-dot.

**REFERENCES**


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AS-20 Questionnaire in Duane's Refraction Syndrome

Dr. Rolli Khurana, Dr. (Mrs.) Vinita Singh, Dr. Siddharth Agrawal

Duane’s retraction syndrome (DRS) is a therapeutic challenge to strabismologists, with the decision to operate being one of the biggest dilemmas. No rigid rules exist regarding its surgical treatment and an individualised approach taking into account motility restrictions, palpebral fissure changes and co-existing deviations is necessary.¹

DRS is one of the many strabismic conditions that affects the quality of life. Clinical assessment of the impact of strabismus on quality of life has generally been informal and previous studies reporting the precise nature of the quality of life effects have focussed on psychosocial functioning²,⁴,⁵,⁶,⁷,⁸ personality traits⁵ and employment capability. Adults with large deviations have also been reported to suffer low self-esteem, have problems with inter-personal relationships and social anxiety²,³ While important, these psychosocial effects are only a part of overall health related quality of life (HRQOL). HRQOL measures are used in health care to help in clinical decision-making, in deciding policies⁹ and as an outcome measure for clinical trials.¹⁰

No study so far reports the use of AS 20 or any other HRQOL scoring system for DRS. Also, this is the first study where the authors have tried to study a correlation between subjective factors as assessed on HRQOL questionnaire and clinical decision making.
Aim of this study was to correlation of AS-20 with surgical management decision in DRS.

**MATERIALS AND METHODS**

All the patients of DRS attending the Pediatric Vision and Ocular Motility Clinic of our institute between October 2010 to July 2013 were included after informed consent. Thus, 29 patients were enrolled. Out of 29 patients, 21 were diagnosed as DRS 1, 5 had DRS 2 and 3 were suffering from DRS 3. Necessary ethical clearance from the committee of our university was taken prior to the study.

All these patients (or parents of children <12 years) were asked to complete the AS 20 questionnaire. The questionnaire was completed unsupervised as recommended. Their subsequent management was performed by a team of orthoptists and ophthalmologists who were blinded to the responses on AS 20. Surgery was advised for grossly abnormal palpebral fissure, troublesome head posture or obvious ocular deviation in primary position.

Results on AS-20 were compared with management decision by retrospective analysis using paired t test.

**RESULTS**

Out of 29 patients, 8 were advised surgery. The mean AS 20 composite score of the patients who underwent surgery was 24.6 whereas it was 79.2 in those managed conservatively. The overall score of the two groups was compared using paired t test. A two sided ($\alpha=2$ with confidence interval of 95%) with p value<0.05 was considered significant. The mean score of the surgically treated group was significantly lower than the conservatively managed group. ($79.20 + 11.24$ Vs. $24.60 + 3.18$; $Z_{adj}=4.10$; $p<0.001$).

Reporting composite AS-20 scores alone could be problematic because there may be large offsetting changes in subscales which may result in a composite score that may not show a change in response to treatment or may dilute the strength of composite score. Thus the 2 sub scales were analysed separately as well. The psychosocial sub scale showed larger infit and outfit errors than the functional sub scale. The responses by patients with almost similar morbidity marked similar responses on the latter whereas marked variability was observed in their responses to former sub scale.

**DISCUSSION**

It is doubtful that a single mechanism is responsible for disturbance of ocular motility in DRS. This variable etiology also explains the broad spectrum of severity of the disease ranging from orthophoria in primary gaze to large eso or exo deviations, with or without restrictions in adduction or abduction.
or both, which may or may not be associated with grotesque upshoots or downshoots. Infact, there is much phenotypic variability among individuals within families with hereditary DRS.¹⁴

The first time ever attempt of correlating AS-20 to clinical decision making in DRS is rationalized by the fact that indications for surgery in DRS are complicated and rather controversial, with varied opinions which rely mostly on subjective analysis by surgeons based on their experiences with the disease process.

Those with a severe form of the disease are more likely to have a poorer QOL and also more likely to be advised surgery, which thus proves the validity of the scoring system to the management decision in this disease.

The psychosocial sub scale is more subjective and shows a larger variability in responses depending on individual awareness towards the disease and his/her level of self consciousness.

The functional sub scale is more objective wherein responses solely depend on the individual’s ability to perform a specific task in presence of the disease. Hence, it is more closely related to the surgical decision.

Hence the functional sub scale can be used as a guide to surgical decision making when in dilemma.

**Conclusion**

The AS-20 scoring system, though being a subjective tool, correlates well with surgical decisions in DRS. The functional sub scale correlates better and may be used to guide management decisions in difficult cases of DRS.

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**Surgical Strategy in Third Nerve Palsy with Aberrant Regeneration: Harnessing the Aberrant Power**

**Dr. Shweta**, Dr. Pradeep Sharma, Dr. Abhijit Rasal

Paradoxical patterns of lid, pupillary and eye movement may follow oculomotor nerve palsy or they can develop spontaneously in patients with no known history of oculomotor palsy. The mechanism of this condition, known variously as aberrant regeneration of the third nerve, oculomotor misdirection or acquired oculomotor synkinesis, is not known, although the prevailing opinion has held that it occurs when sprouting axons regenerating within broken axonal cylinders of oculomotor nerve become misdirected and innervate muscles for which they were not intended.

During regeneration of a damaged third nerve, axons which were originally destined for the levator may in some instances reach that muscle, but other such axons may reach the medial or inferior rectus.

In a classical case of regeneration of the third nerve characterized by misdirection of regenerated fibres, the upper eyelid is elevated when the eyeball is adducted, voluntarily or involuntarily. It is this elevation of the upper eyelid which is so frequently described as the pseudo-Graefe phenomenon.
Review of literature

Surgery for correction of oculomotor paralysis is a challenging and to make it even worse if there is associated synkinesis. There is no effective way to deal surgically with the aberrant regeneration. Authors have described supramaximal recession of the lateral rectus muscle, and supramaximal resection of the medial rectus muscle to improve the exotropia along with their upward shift. If no medial rectus muscle function exists, a transposition of the superior oblique tendon insertion to a position adjacent to the medial rectus insertion might be attempted. Ptosis surgery is done after completion of the strabismus surgery.

Few authors have described use of posterior fixation sutures on the contralateral eye to increase innervational drive to the yoke muscles and emphasized on adjustable sutures particularly for vertical deviation. Also, contralateral recession and resection have also been described.

Lacunae in present management

But there is no case series available comparing effectiveness of different management strategies with surgical outcome in post traumatic non resolving or partial 3rd nerve palsy with aberrant regeneration. There is no Indian literature illustrating the effect of contralateral recession or both recession and resection in improvement of ptosis along with or without vertical rectus surgery to correct hypotropia or ptosis.

Aim of this study was to varied clinical profile and management strategies in post traumatic third nerve palsy with aberrant innervation.

MATERIALS AND METHODS

5 patients with post traumatic third nerve palsy with signs of aberrant regeneration were followed over 1 year and analyzed for different surgical strategies and their post-operative outcome. All patients had pseudo von Graefe’sign.

Case 1

30 year old female presented with drooping of right lid and diplopia in upgaze for two years. She had history of (h/o) RTA with loss of consciousness following that she developed complete drooping of RE lid with limitation of movements. Gradually over 2 months she recovered partially with funny lid movements in different gaze. Motility examination in the primary position revealed 30pd exotropia and 60 pd right hypotropia. Affected eye had recovered medial rectus but there was no recovery of superior or inferior rectus Ptosis in right eye improved on adduction. There was virtually complete limitation of elevation in up, up and left, and up and right gaze, both on ductions and on versions.
Fig. 1: Misdirected regeneration of right third nerve following trauma (secondary aberrant regeneration) Note elevation of right upper lid on attempted downgaze and on attempted adduction of right eye (pseudo-Graefe sign).

Fig. 2: LE LR recession 12mm and SR recession 5mm was done Post op picture showing alignment in primary position without ptosis.

To correct for the exotropia, a fixation duress in the left eye was created, the left lateral rectus was recessed 10mm. To correct hypotropia, Superior rectus of left eye was further recessed 7 mm The result after surgery was an residual exotropia of 8 PD, residual right hypotropia of 6 PD, and no residual ptosis in primary position. Postoperatively although the intrapalpebral fissure was wider in the non-involved eye than in the other eye, suggesting lid retraction, there was no visible sclera above the cornea. This result has remained stable over a 1 year period.

Fig. 3: Pre op picture of 9 year old boy with RE ptosis and RE exotropia and hypotropia in primary gaze. Ptosis improve on RE adduction and levodepression (secondary aberrant innervations)

Fig. 4: Post op picture showing alignment in primary position without ptosis after LE LR recession 15mm LE SR recession 7mm with faden at 14mm.
Case 2

9 year old boy with Right exotropia of 35pd and hypotropia of 20pd had improvement of ptosis on RE adduction underwent fixation duress LE LR recession 15mm and LE SR recession 7mm with faden at 14mm (Fig. 3 and 4).

Case 3

15 year old girl with h/o fall in childhood had RE exotropia 50-60pd and hypotropia of 40pd with elevation of lid on RE adduction. She underwent fixation duress LE LR recession 15mm and LE SR recession 5.5mm which improved her ptosis but as exotropia was large it was supplemented with large recession resection in RE depending on FDT (RE LR recession 18mm with RE MR resection 7mm) Also faden was added in LE SR and IR to make the incomitant squint in up and downgaze comitant (Fig. 5 and 6).

Fig. 5: Pre-op picture of 9 year old boy with RE ptosis and RE exotropia and hypotropia in primary gaze. Ptosis imporove on RE adduction and levodepression (secondary aberrant innervations).

Fig. 6: Post op picture showing snal residua exotropia in primary position without ptosis after RE LR recession 18mm and MR resection 7.0mm and LE SR recession 5.5mm, LE LR recession 15mm with post fixation suture LE SR and IR.

Case 4

This was 28 year old patient who was different from other patients as he had acquired Marcus jawwinking phenomenon and also improvement of ptosis on downgaze. He had large exotropia 90pd in LE with hypotropia of 40pd. He underwent LE LR periosteal fixation with MR resection 8.5 mm with fixation duress RE IR recession to correct ptosis.
<table>
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Case 5

He was 50 year old patient with partial recovered third nerve palsy with small ptosis which improved on adduction He had exotropia of 30pd without vertical squint. He underwent fixation duress R and R in good eye.

DISCUSSION

All 5 patients were acquired cases(post traumatic) with exotropia and ptosis in primary position. None of the patients were able to fix with involved eye in up or downgaze. There was improvement of ptosis on adduction in all patients except one patient (case 4) which had additional improvement of ptosis on downgaze. Mean deviation was exotropia of 30 degrees and 4 patients had hypotropia of 15-20 degrees in primary gaze. Partially recovered cases with exotropia underwent fixation duress recession or both recession and resection in normal eye combined with recess - resect in the involved eye if required depending on amount of deviation.

This fixation duress in the good eye by hering’s law transmitted extra innervation to involved eye medial rectus which caused LPS misinnervation to elevate lid in primary position. Patients with hypotropia had SR recession in normal eye. The fixation duress is proposed to decrease the elevation of the non-involved eye, thereby creating similar forces of duress in both eyes when fixation takes place. Using this technique, the extra stimulus needed to elevate the fixing eye creates transference of neuromuscular stimuli to the yoke muscles in the paretic eye in accordance with Hering’s law. In one patient (case 4) we did good eye IR recession because in that patient aberrant supply was going to LPS on downgaze. So we utilized fixation duress of good eye to correct ptosis and this did not increased hypotropia in affected eye as there was complete IR paralysis in affected eye.

So this aberrant supply was harnessed to correct ptosis in primary position. Furthermore Faden on SR and IR decreased incomitance in up and downgaze. Thus post-operatively excellent outcome was achieved with good alignment (mean 10 pd exotropia) and improved ptosis in primary position.

Conclusion

Individualization of case and FDT are key parameters. Utilizing the fixation duress of good eye to harness the aberrant power is our principle where ever possible. Surgery should be staged depending on amount of deviation preferably with adjustable surgery where ever possible. Pseudoptosis part and aberrant supply to LPS during adduction is utilized and further reinforced by weakening the normal eye LR and SR and strengthening normal eye MR so that by Hering’s law MR and SR of affected eye gets additional innervation and this corrects both ptosis and exotropia in primary gaze.
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Anterior and Nasal Transposition of the Inferior Oblique for Superior Oblique Palsy

Dr. Pramod Kumar Pandey, Dr. Bhawna Piplani, Dr. Bhanu Pratap Singh Pangtey, Dr. Shagun Sood

Anterior transposition of inferior oblique (ATIO) has been widely used for over-elevation in adduction (IO Overaction) associated with superior oblique palsy (SOP) and dissociated vertical deviation (DVD).\(^1\) Anti-elevation syndrome, described by Kushner is a known complication and results in decreased elevation in adduction and overelevation of contralateral inferior oblique (IO).\(^2\)

Stager\(^3\) postulated that functional origin of posterior temporal fibers of IO muscle after ATIO is formed by the myoneuronal junction of neurovascular bundle. The new insertion is temporal to y axis of Fick (torsional movement), anterior to x axis (vertical movement), and temporal to z axis (horizontal movement). Stager suggested placing the new IO insertion nasal to inferior rectus insertion, this anterior and nasal transposition of inferior oblique (ANT) places the new insertion on the y axis and anterior to x axis, thereby converting IO from an elevator and extorter in adduction to an intorter and tonic depressor in adduction. ANT may be potentially useful for congenital SOPs, DVD, primary inferior oblique muscle overactions, upshoots in Duane’s Retraction Syndrome and y pattern exotropias.
Purpose

This study was undertaken to report surgical outcomes of ANT of IO for unilateral congenital SOPs with very lax or absent tendons on exaggerated traction testing with primary position (PP) hypertropia (HT) of >20 prism diopters (PD) or cases of SOP whose prior IO weakening procedures had failed to produce optimum results with residual PP HT of 8 PD or more.

MATERIALS AND METHODS

Six patients with diagnosis of congenital SOP and having PP HT of 20 PD or more were included. SOP was diagnosed by HT increasing in contralateral gaze and a positive head tilt test on ipsilateral head tilt. Exaggerated traction test was used to assess tendon laxity in all cases. An additional 4 cases of congenital SOP having undergone IO weakening procedure earlier and having residual PP HT of 8 PD or more were also included. Deviation in PP, at near, in side and up and down gazes was measured by PACT. Pattern strabismus was evaluated by taking measurements at 25 degrees up and down gazes while patient fixated at distant object. Fundus torsion was evaluated objectively by fundus photography and subjectively by Double Maddox Rod Test. V pattern of 15 PD or more was taken as significant in patients undergoing primary surgery. Head tilt test was performed by tilting the head 45 degrees to either shoulder.

After isolating IO muscle on a hook, IO was dis-inserted and reattached to sclera using double armed 6/0 vicryl suture with posterior temporal fibers attached 2 mm nasal and 2 mm posterior to he nasal extent of inferior rectus muscle insertion. Anterior fibers were attached 2 mm nasal to it and both ends tied. Conjunctive was closed by 8/0 vicryl sutures and force duction test performed. Results were evaluated for PP deviation anti-elevation syndrome, pattern strabismus and torsion at 12 weeks.

RESULTS

In patients undergoing primary ANT, mean pre-operative PP HT was 22 PD. V pattern was present in 4 patients and all had extorsion between grades 2 to 4 by Guyton's grading system. Exaggerated traction test revealed very lax / absent SO tendons in all 6 cases undergoing ANT as primary procedure. At 12 weeks follow up post-operatively PP HT was corrected by 18 to 24 PD, mean 20 PD, extorsion was ameliorated by 2 grades by fundus photography, V pattern improved in all and no A pattern strabismus was induced. Ipsilateral hypotropia in abduction of 2 and 6 PD was induced in 2 patients. Head tilts also improved.

In re-surgery group with congenital SOPs having undergone an IO weakening procedure previously, comprising of 4 patients, IOOA improved. PP HT was improved by 6 to 8 PD. No anti-elevation syndrome was induced.
Comment

The action of IO in PP is elevation and extorsion. Stager proposed that the functional origin of posterior temporal fibers of IO muscle after anteriorization is located where neurovascular bundle attaches to the muscle, leading to depression, extorsion and abduction of the globe on IO contraction. ANT places IO nasal to y axis and anterior to x axis of Fick, thus placing the posterior temporal fibers of IO muscle in a direction that is anterior and nasal from the ancillary origin, causing the globe to intort and adduct on contraction and transforming the muscle into a tonic depressor and anti-elevator.

There are certain risks though, ANT limits elevation, more pronounced in upgaze, which may lead to esotropia nad intorsion in upgaze. ANT has been used successfully in large DVD by the author and seems to be an excellent procedure even in comitant DVD. PIOOA may be another situation where it may prove to be extremely useful. It may not be very successful in y pattern XT implying that disorder may not primarily be due to an IO abnormality.

Our results show that ANT can be performed successfully unilaterally as well as bilaterally without inducing any unwanted effects, other than mild HT of opposite eye in upgaze. Some limitation of elevation nevertheless may be noted in both unilateral and bilateral cases.

In re-surgeries ANT works quite well and is simple to perform without any untoward consequences. ANT may be appropriate for congenital unilateral SOPs with absent / lax tendons having PP HT upto 20 PD with significant extorsion and V pattern and may offer an alternative to tucks which have high complication rate or it may not be possible to perform them due to absent / very lax SO tendons, tuck effect is known to wane with time. IO may also be transposed closer to MR for more effect, however one has to be cautious as it may engender unwarranted consequences. ANT converts IO into a depressor and intorter and holds promise for large HTs including congenital SOPs with absent SO tendons, DVD, PIOOA, Duane’s Retraction syndromes with significant upshots and Y pattern XT. ANT may also have it’s place in resurgeries The efficacy and safety of the procedure needs to be refined till it finds it’s niche in the surgical armamentarium of vertical strabismus.

REFERENCES

Superior Rectus Transposition Versus Medial Rectus Recession for Esotropic Duane Retraction Syndrome

Dr. Ramesh Kekunnaya, Dr. Shailja Tibrewal, Dr. Virender Sachdeva

Medial rectus recession (MRC) and vertical rectus transposition (VRT) are the commonly described surgical procedures for treatment of esotropic DRS. Recently superior rectus transposition (SRT) combined with Medial rectus recession have been shown to align the eyes as well as improve abduction. The purpose of this study was to compare the results of SRT with or without MRC with medial rectus recession alone for treatment of esotropic DRS.

MATERIALS AND METHODS

A retrospective comparative interventional case series involving esotropic DRS subjects who underwent surgery between May 2007 and Feb 2013. The surgical procedure involved fornix or limbal based unilateral or bilateral medial rectus recession in the MRC group. The superior rectus transposition was performed via the fornix approach. Foster’s augmentation was done in all cases. The main outcome measures were change in the amount of esotropia, correction of abnormal head posture and improvement in the abduction. Success was defined as postoperative primary position deviation within eight Prism Dioptres of orthotropia and anomalous head posture less than five degrees.

RESULTS

There were eight and 16 subjects in the SRT ± MRC and MRC group respectively. Mean age of the subjects at the time of surgery was 12 ± 7.1 and 12.5 ± 8.4 years in SRT ± MRC and MRC groups respectively. The two groups were comparable in terms of age distribution, preoperative deviation, abnormal head posture and abduction limitation and duration of follow up. Table 1 shows the preoperative characteristics of the two groups.

Seven subjects (44%) in the MRC group underwent unilateral recession whereas nine subjects (56%) underwent bilateral asymmetrical recession. The average amount of MR recession performed was 5mm/eye (range 3.5 – 7mm). In three subjects lateral rectus Y-split was done for correction of associated overshoot. In the SRT group six subjects underwent additional ipsilateral medial rectus recession procedure, with the average amount of MR recession being 5mm/eye (range 3.5 – 6mm). Mean preoperative esotropia reduced from 20 ± 13 prism diopters (PD) and 24 ± 9 PD to 3 ± 3 PD and 4 ± 6 PD in the SRT ± MRC and MRC group respectively. The abnormal head posture reduced from a mean of
14 ± 5 degrees and 18 ±10 degrees to 2 ± 3 degrees and 3 ± 5 degrees in the SRT ± MRc and MRc group respectively. Success rate was 87% and 81% in the SRT± MRc and MRc group respectively (p=0.99). However, abduction limitation improved from 3.6 ± 0.7 to 2.4 ± 0.5 (1.2 units) in the SRT group as compared to no improvement in the MRc group (p=<0.001). No new vertical deviations were seen in any subject following augmented SRT. One subject had a small (-0.5) limitation of elevation at three weeks postoperative follow up.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>SRT ± MRc group (Mean ± S.D.)</th>
<th>MRc group (Mean ± S.D.)</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (years)</td>
<td>12 ± 7.1</td>
<td>12.5 ± 8.4</td>
<td>0.93</td>
</tr>
<tr>
<td>M:F</td>
<td>3:5</td>
<td>8:8</td>
<td></td>
</tr>
<tr>
<td>Pre op esotropia (Prism Dioptres)</td>
<td>20.4 ± 13.2</td>
<td>23.7 ± 8.9</td>
<td>0.54</td>
</tr>
<tr>
<td>Pre op head posture (degrees)</td>
<td>13.5 ± 5.4</td>
<td>17.7 ± 9.9</td>
<td>0.54</td>
</tr>
<tr>
<td>Pre op abduction limitation</td>
<td>3.6 ± 0.7</td>
<td>3.6 ± 0.6</td>
<td>0.71</td>
</tr>
<tr>
<td>Follow up (months)</td>
<td>5.3 ± 7.1</td>
<td>6.4 ± 5.1</td>
<td>0.34</td>
</tr>
</tbody>
</table>

**DISCUSSION**

The current study showed that addition of augmented SRT to MRc for esotropic DRS not only corrected the deviation but improved the abduction also. This was comparable to previous study by Mehendale et. al.³ wherein ten subjects of esotropic DRS were treated with SRT± augmentation and MRc. None of the subjects in their study developed vertical deviation or subjective torsion. Torsional changes could not be evaluated in the present study due to its retrospective design.

**Conclusion**

Medial rectus recession alone can correct esotropia in DRS, however addition of Superior rectus transposition has additional advantage of improving abduction without inducing vertical deviation. Also, SRT alone may be the choice of procedure in small angle esotropic DRS.

**REFERENCES**

Effect of Bilateral Superior Oblique Split Lengthening on Torsion

Dr. Jitendra Nenumal Jethani, Dr. Kuntal Shah, Dr. Sonal Anuj Amin

Superior oblique (SO) split lengthening is a known SO weakening procedure for superior oblique overaction. The split lengthening reduces the A pattern along with the reduction in SO overaction. There is however, scarcity of data regarding its effect on the intorsion which is also associated with superior oblique overaction. We did a study to find out effect of superior oblique split lengthening on intorsion of the eye.

MATERIALS AND METHODS

A prospective study by performing superior oblique split lengthening in 5 patients with superior oblique overaction to note its effect on intorsion and “A” pattern between January 2012 and September 2012. The indications for superior oblique surgery were the presence of a clinically significant “A” pattern (defined as a 10 PD or greater difference in the horizontal deviation between up and down gaze) with superior oblique overaction. All patients underwent a complete ocular examination including visual acuity, cycloplegic refraction, anterior segment, and dilated posterior segment examination. Motility evaluation included measurement of horizontal and vertical deviations by alternate prism and cover test at 6 m and 1/3 m with 9 position cardinal field measurements performed at either 6 m or 1/3 m. Fundus photographs and clinical photographs of all the 5 patients were taken pre- and postoperatively to observe for the amount of intorsion and “A” pattern. The amount of intorsion was measured with help of fundus photograph, by measuring disc foveal angle (DFA).

Surgical technique

The superior oblique muscle was approached through a superior temporal fornix conjunctival incision. The superior rectus muscle was isolated first and then the superior oblique at its insertion with a small Stevens muscle hook. Care was taken to make sure that all superior oblique tendon fibers were contained on the hook. The isolated superior oblique tendon was then passed to a second small Stevens muscle hook on the nasal side of the superior rectus.
muscle. The superior oblique tendon was then spread out on 2 larger muscle hooks for a distance of 8 to 10 mm. In addition to being spread lengthwise to expose about 10 mm of the tendon, the tendon was also flattened between the hooks to aid in splitting it. One blade of blunt-tip Wescott scissors was then pushed through the flattened tendon making every effort to split the tendon in the middle. Using 2 small Stevens hooks, the split was teased and extended as gently as possible in each direction for a distance of 5 mm. It is best to cut as little as possible in extending the split because any cutting tends to sever fibers causing their loss. The goal is to have as many tendon fibers as possible in each of the split segments to join together after the Z-cut is completed. After the split was extended as comfortably as possible, single armed 5-0 prolene sutures were placed. One was placed through the posterior split segment of the tendon as far distal as possible and the other was placed in the anterior split segment as far proximal or nasal as possible. Each suture was tied after being passed twice through the tendon. To complete the Z-cut, the posterior tendon was cut distal to the preplaced suture and the anterior piece of tendon was cut proximal or nasal to the suture. After the tendon was cut, a Guyton exaggerated forced traction test 13 was performed to make sure that the entire superior oblique tendon had been severed. If the Guyton traction test indicates residual tendon is present, it must be identified and severed. The 2 cut ends were then connected with the needle from each suture being passed through the opposite tendon just behind the preplaced suture. The sutures were then tied producing an 5 mm split Z-tendon lengthening of the superior oblique muscle.

**RESULTS**

Three patients were males and 2 were females. The mean age was 14.3 +/- 7.5 years. All of the 5 patients underwent bilateral SOST and none of them had residual intorsion post operatively with complete normalization of superior oblique muscle action. The mean change in the DFA for right eye was 3.9 +/- 1.3 degree and for left eye was 4 +/- 1.6 degree. The patients with clinically significant “A” pattern preoperatively was totally eliminated or brought to clinically insignificant level postoperatively. All the patients were aligned horizontally within 6 pd and no pattern and no diplopia postoperatively.

**DISCUSSION**

The commonly done superior oblique weakening procedures include posterior tenectomy of superior oblique (PTSO), tendon expanders (spacers), tenotomy and split lengthening of superior oblique. Only two procedures that are spacers and split lengthening of SO could be graded and hence can be controlled. There is very scarce literature on the results of split lengthening of superior oblique and almost none on its effect on the torsion of the eye.
Bardorf et al. and Souza Diaz et al. did suggest that it was a good procedure for weakening of the superior oblique and its effect on the A pattern too. However, the effect on torsion has never been studied.

In our study we did a standard 5 mm superior oblique split lengthening and then measured its effect on disc foveal angle (torsion). It was obvious (Figure 1 a and b) that both eyes when operated for split lengthening of superior oblique show around 4.0 deg of extorsion that is the Disc foveal angle increases postoperatively. It is a valuable piece of information where the patients do need correction of torsion too.

**Conclusion**

We report the effect of SOST on intorsion and “A” pattern. The SOST reduces intorsion post surgery and is therefore a valuable procedure in SOOA where both pattern and intorsion needs to be corrected.

**REFERENCES**


2. Jethani J, Seethapathy G, Purohit J, Shah D. Measuring normal ocular torsion and
Comparison of Corneal Astigmatism and Success rates in Hang-Back and Conventional Strabismus Surgery

Dr. Ishan Yadav, Dr. Virendra Pratap Singh, Dr. Sandeep Sharma, Dr. Abhishek Chandra

Conventional recession surgery involves dis-insertion of the muscle and suturing it back to the sclera posteriorly. This inadvertently can lead to globe perforation. Reported rate of globe perforation using conventional recession surgery is 0.5%. Conventional recession surgery takes longer time as compared to hang-back surgery; it increases the overall exposure to anaesthesia. Increased incidence of retinal detachment and higher amount of surgical astigmatism are other disadvantages of conventional recession. Hang back surgery, an effective alternative to conventional recession was introduced by Guyten and Repka for the first time in 1989 also known as suspension recession, in which the involved muscle was suspended on an absorbable suture to its original site of insertion. Changes in refractive error are known to occur after ordinary strabismus surgery, which occurs secondary to changes in corneal curvatures. Previous studies have found that recession of a single rectus muscle usually causes a decrease in the corneal power along the meridian of the recessed muscle. Also decreased overall variability of astigmatism change and decreased surgically induced astigmatism postoperatively after hang-back recession surgery have been reported.

Purpose

To compare the surgical outcomes and amount of astigmatism induced by Hang-back and Conventional recession surgery for horizontal strabismus.

MATERIALS AND METHODS

This was a prospective, double blind, matched clinical trial which included 40 patients of horizontal strabismus. After excluding patients having neurological anomalies, incomitant strabismus, previous strabismus surgery, nystagmus, eccentric fixation, vertical deviations > 5 PD, any corneal condition precluding its variation by fundus photography in children between 5-15 years of age. Indian J Ophthalmol 2010;58:417-9.

keratometry, all patients were randomized with the help of computer generated random number series to undergo either of the two recession procedures. All patients undergoing surgery were followed for a mean duration of 6 months, with postoperative visits on day 1, day 7, then monthly for a minimum period of six months.

Following data were assessed and recorded preoperatively and on every follow up visit: best corrected visual acuity using Snellen’s chart, refraction under cycloplegia, keratometry using manual and automated keratometer, presence and severity of amblyopia. Ocular movements and amount of deviation for distance (6 m) and near (33 cm) was assessed by a certified orthoptist using prism and alternate cover test. All surgeries were performed by single surgeon (VPS), under similar clinical and surgical settings. The amount of muscle recession or resections performed on both groups (which was measured from original muscle insertion) was based on same standard surgical dose tables 4. All patients with amblyopia were given a trial of occlusion therapy preoperatively. For patients undergoing surgery a double-armed 6-0 polyglactin suture with spatulated needle was used to secure the muscles before disinserting. After suturing the muscles conjunctiva was closed using 6-0 polyglactin. Intraoperatively total duration of surgery was recorded in every case. To record the surgeons comfort level during each surgery, a Visual Analogue Score was devised based on three different criteria’s : a) Exposure of surgical area b) difficulty in passing suture c) overall comfort of surgeon during surgery. Complications such as globe perforation, muscle slippage, up shoot, or down shoot were also recorded.

T-test for independent samples was used to compare continuous parameters and paired samples t-test was used to compare between the mean preoperative and postoperative angle of deviations. Chi-square analysis was done to compare the success rates between two surgical procedures. All the data was analysed using SPSS (11.5) software.

RESULTS
Out of 22 patients of esotropia 8 patients undergone a unilateral surgery involving simultaneous muscle resection. Among 18 patients of exotropia 10 patients had simultaneous muscle resections. For all the patients who undergone a combination of recession and resection to correct the deviation, the amount of muscle resections performed along with either of two recession procedures were statistically insignificant in both the groups (Table 1).

There were no statistically significant differences between pre- and postoperative deviations regardless of the type of recession performed (Table 2). Success rates among patients with exotropia was 75% in conventional group while that in hang-back this success rate was 60 % (p value=0.638). In esotropic
Table 1: Type of surgical procedure

<table>
<thead>
<tr>
<th></th>
<th>Esotropia</th>
<th></th>
<th>Exotropia</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Conventional (n=12)</td>
<td>Hang-back (n=10)</td>
<td>Conventional (n=8)</td>
</tr>
<tr>
<td>B/L MR recession</td>
<td>50 %</td>
<td>80 %</td>
<td></td>
</tr>
<tr>
<td>B/L LR recession</td>
<td></td>
<td>50 %</td>
<td>40 %</td>
</tr>
<tr>
<td>U/L MR recession + LR resection</td>
<td>50 %</td>
<td>20 %</td>
<td></td>
</tr>
<tr>
<td>U/L LR recession + MR resection</td>
<td>50 %</td>
<td>60 %</td>
<td></td>
</tr>
</tbody>
</table>

Table 2: Comparision of Pre and Post-operative deviations with success rates of both procedures

<table>
<thead>
<tr>
<th></th>
<th>Exo- deviations</th>
<th>Eso- deviations</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Conventional</td>
<td>Hang-back</td>
</tr>
<tr>
<td>Number of cases</td>
<td>8</td>
<td>10</td>
</tr>
<tr>
<td>Mean pre op deviation (PD)</td>
<td>51 ± 8</td>
<td>45 ± 7</td>
</tr>
<tr>
<td>Mean post op deviation (PD)</td>
<td>9.5 ± 4</td>
<td>7.2 ± 5</td>
</tr>
<tr>
<td>Patients having successful outcome (%)*</td>
<td>75</td>
<td>60</td>
</tr>
</tbody>
</table>

*Successful result : post operative deviation of < 10 PD

Table 3: Post operative data

<table>
<thead>
<tr>
<th></th>
<th>Conventional</th>
<th>Hang-Back</th>
<th>P- value</th>
<th>SS,NS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total number of patients (N)</td>
<td>20</td>
<td>20</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean duration of surgery</td>
<td>33.30 min ± 2.94</td>
<td>28.70 min ± 2.05</td>
<td>0.0001</td>
<td>SS</td>
</tr>
<tr>
<td>Mean visual analogue score</td>
<td>13.1</td>
<td>21.3</td>
<td>0.0001</td>
<td>SS</td>
</tr>
<tr>
<td>Mean change in K- readings</td>
<td>0.675 ± (0.194)</td>
<td>0.427 ± (0.242)</td>
<td>0.0006</td>
<td>SS</td>
</tr>
</tbody>
</table>
patients the success rates were 84% in conventional recession and 80% in hang-back recession (p value= 1).

There were no differences between primary position and right and left gaze deviations pre- and post operatively. No overcorrections or complications were found in any of the patients. Mean duration of surgery for conventional recession was 33.30 ± 2.94 mins and in hang-back surgery the mean duration was 28.70 ± 2.05 mins (p value < 0.0001).

After calculating VAS for every surgery based on three different criteria’s the overall mean VAS score in conventional recession was 13.1 and 21.3 in hang-back group (p value < 0.0001). Mean change in average keratometry readings which occurred in two principle corneal meridians was 0.694 ± 0.194 D in patients who undergone bilateral conventional recession, for patients who undergone bilateral hang-back recession this difference was 0.427 ± 0.242 D (p value < 0.0006) (Table 3).

**DISCUSSION**

We found no difference in surgical success rate (post-operative residual deviation > 10 PD) between patients having surgery for horizontal deviations using hang-back suture recession and those with conventional direct scleral attachment. With 4 out of 10 patients undergoing hang-back recession had postoperative deviations of >10 PD, a success rate of 60 % was calculated in this group which was lower than the success rate of 75 %, found in the patients undergoing conventional recession for treating exotropia.

However this difference was not statistically significant. We found a success rate of 80 % in patients who undergone hang-back recession for esotropia. Another important advantage of hang-back surgery is the decreased amounts of induced astigmatism immediately following an operation.

To assess the change in corneal keratometry readings only eyes which underwent either of the two recession procedures were included. All eyes with simultaneous muscle resections in the same eye were excluded. In our study we found that out of 24 eyes which underwent hang-back recession only 9 eyes showed a significant change in average keratometry readings, while in 20 eyes which were operated with conventional recession technique 18 eyes a change of > 0.50 D.

**Conclusion**

Hang-back recession provides an effective alternative to conventional recession in treating patients with horizontal strabismus with an added advantage of decreased amounts of surgically induced astigmatism, especially in children with smaller globes, poor exposure and high myopia.
Myopic Strabismus Fixus is a rare, restrictive ocular motility problem characterised by severe esotropia and hypotropia with limitation of abduction and elevation.1 This is also called ‘Heavy eye syndrome’.1 Usually there is refractive error since childhood and these patients are high myopes. The strabismus is noticed at the end of the first decade and becomes stable at the end of the second decade. The lateral rectus was found to be inferiorly displaced and scleral ectasia was proposed to be a cause of downslip of the muscle in relation to the globe.2 This change of the muscle path leads to limitation of abduction and a depressing effect. The currently accepted theory was given by Yokoyama, who suggested that the enlarged globe herniates superotemporally through the muscle cone.3 On MRI the superior rectus is seen to be nasally deviated and the lateral rectus muscle inferiorly deviated.

In order to compensate for the inferolateral displacement of the lateral rectus muscle, Yokoyama et. al. performed a loop myopexy of the lateral and superior rectus muscles, bringing the muscles back to their normal position.3 Marked improvement in eye movement was noted. This is probably the best procedure as it addresses the problem of deviant muscle paths. Since this is a rare condition it is difficult to arrive at tables and nomograms as in routine exotropias and esotropias. In this paper we attempt to work out a graded approach to treat this condition.

**Purpose**

To describe the approach to surgical correction of myopic strabismus fixus.

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**REFERENCES**

MATERIALS AND METHODS

A retrospective study of 12 eyes of 6 patients with myopic strabismus fixus was performed from the year 2009 to 2012. There were 5 females and one male. The age group ranged from 36 years to 59 years. The myopia ranged from -8 to -18 dioptres. Based on the clinical presentation a diagnosis of myopic strabismus fixus was made. MRI scan or CT scan was performed to understand the nature of the muscle paths; If there was a deviation of the muscle paths, the lateral rectus inferiorly and the superior rectus medially, a diagnosis of myopic strabismus fixus was confirmed.

Inclusion Criteria
1. CT scan or MR imaging confirmation of deviant muscle paths
2. High myopia ≥ 8 D

Exclusion Criteria
1. Any form of esotropia other than myopic strabismus fixus like long standing infantile esotropia

All patients underwent loop myopexy as the deviant muscle paths of the lateral and superior rectus was noted in all. We used a silicon band to perform the myopexy in all patients as described by Wong et. al. The esotropia ranged from 25 PD to 90 PD, hypotropia from 20 to 45 PD. Medial rectus recession was performed in 5 patients where the esotropia was more than 30 PD along with loop myopexy at the same sitting. Complications if any were noted on table. The forced duction test revealed tight medial rectus muscles in all patients. Evaluation of the outcome revealed residual deviation less than or equal to 10 PD in all patients. In addition there was improvement in the ductions in all patients. No significant complications were noted in our study.

<table>
<thead>
<tr>
<th>Patient</th>
<th>Eye</th>
<th>Age (years)</th>
<th>Gender</th>
<th>Myopia (D)</th>
<th>Visual acuity</th>
</tr>
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<tbody>
<tr>
<td>1</td>
<td>Right</td>
<td>42</td>
<td>Female</td>
<td>-12</td>
<td>6/24</td>
</tr>
<tr>
<td></td>
<td>Left</td>
<td>42</td>
<td>Female</td>
<td>-11</td>
<td>6/18</td>
</tr>
<tr>
<td>2</td>
<td>Right</td>
<td>48</td>
<td>Female</td>
<td>-14</td>
<td>6/36</td>
</tr>
<tr>
<td></td>
<td>Left</td>
<td>48</td>
<td>Female</td>
<td>-11</td>
<td>6/36</td>
</tr>
<tr>
<td>3</td>
<td>Right</td>
<td>36</td>
<td>Female</td>
<td>-8</td>
<td>6/12</td>
</tr>
<tr>
<td></td>
<td>Left</td>
<td>36</td>
<td>Female</td>
<td>-9</td>
<td>6/12</td>
</tr>
<tr>
<td>4</td>
<td>Right</td>
<td>48</td>
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<td>6/24</td>
</tr>
<tr>
<td>5</td>
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<td>6/24</td>
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<td>Right</td>
<td>52</td>
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<td>6/12</td>
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<td></td>
<td>Left</td>
<td>52</td>
<td>Male</td>
<td>-12</td>
<td>6/18</td>
</tr>
</tbody>
</table>
Table 2: Pre-operative deviation, surgery performed and outcome

<table>
<thead>
<tr>
<th>Esotropia(PD)</th>
<th>Hypotropia(PD)</th>
<th>Procedure</th>
<th>Outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. 40</td>
<td>30</td>
<td>Loop myopexy + 4 mm MR recession</td>
<td>8 PD esotropia</td>
</tr>
<tr>
<td>2. 25</td>
<td>25</td>
<td>Loop myopexy</td>
<td>10 PD esotropia</td>
</tr>
<tr>
<td>3. 60</td>
<td>20</td>
<td>Loop myopexy + 6 mm MR recession</td>
<td>8 PD esotropia, 5 PD hypotropia</td>
</tr>
<tr>
<td>4. 90</td>
<td>30</td>
<td>Loop myopexy + 7 mm MR recession</td>
<td>10 PD esotropia, 8 PD hypotropia</td>
</tr>
<tr>
<td>5. 70</td>
<td>30</td>
<td>Loop myopexy + 6 mm MR recession</td>
<td>10 PD esotropia, 8 PD hypotropia</td>
</tr>
<tr>
<td>6. 45</td>
<td>25</td>
<td>Loop myopexy + 5 mm MR recession</td>
<td>8 PD esotropia, 8 PD hypotropia</td>
</tr>
</tbody>
</table>

DISCUSSION

Loop myopexy appears to be a useful procedure for the management of myopic strabismus fixus. Getting the eyes straight is a life changing event for these patients who are incapacitated due to the extreme deviation of the eyes. In patients where the rectus muscles are displaced, performing a recession resection is not adequate. Getting the rectus muscles in the correct path is essential. The loop myopexy procedure can be performed with sutures or with the silicon band. This procedure causes minimal trauma to the extraocular muscles and is also readily reversible. The ciliary vessels are unlikely to be damaged by this procedure. In addition this procedure can be performed quite quickly as there is minimal dissection and handling of tissues. We noted in cases where the medial rectus muscle is tight, performing a myopexy alone without medial rectus recession does not seem to be adequate.

Conclusion

We suggest that loop myopexy be performed for all cases of myopic strabismus fixus where there is deviation of the muscle paths. Medial rectus recession should be considered as an additional procedure in the same sitting in all patients where the deviation is more than 30 PD.

REFERENCES

