Pediatric Ophthalmology and Strabismus
Free Papers
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Fibrin Glue for Muscle Recession In Squint Surgery

Dr. Rakesh Bansal, Dr. Pratik Topiwala

Strabismus is a common problem in ophthalmology practice. Its prevalence in children has been estimated to be about 2.8%.\(^1\) It can have profound impact on physical, psychological and social status of the patient. Goals of treatment of strabismus include; improved aesthetic appearance, attainment of some grade of binocular single vision with peripheral fusion.\(^2\)

Surgery when indicated involves strengthening or weakening of the appropriate extra ocular muscle depending upon the type of strabismus. For esotropia, either bimedial recession or monocular recession of medial rectus muscle and resection of lateral rectus muscle is done. For exotropia, surgery depends upon the type of exotropia. Symmetrical surgery like bilateral medial rectus resection is done for convergence deficiency type and bilateral lateral rectus recession is done for divergence excess type. Unilateral resection of medial rectus and recession of lateral rectus is done for basic type of exotropia.

For attachment of muscle to the sclera after recession or resection a number of techniques have been used. Silk suture was first suture used to anchor the muscle to the sclera, however it was found to be leading to granuloma formation, conjunctival inflammation, hypersensitivity or allergic reaction and was more irritable to the patient.\(^3\) Later in 1974, 60 vicryl became available and was used for attaching the muscle to sclera.\(^4\) It is associated with less post-operative reaction compared to silk and it gets absorbed in a period of 2-3 weeks.

Over the last 25 years different glues have become available. These are being used for different types of surgical procedures in ophthalmology. Mulet et. al.\(^5\) used Adal-1 which is a mixture of ethyl carboxyacrylate and ethyl cyanoacrylate in 27 eyes in prospective randomised clinical trial. Adal-1 was able to withstand greater or equal tensile strength.

Darakshan A and Amitava AK\(^6\) used cyanoacrylate glue for re-fixing the recessed muscle in strabismus surgery and compared the results with the 6-0 vicryl suture. Cyanoacrylate glue was found to be safe and no muscle slippage was reported.

Fibrin glue has been used only in experimental studies on rabbit eyes for muscle recession.\(^7,8\) It has been found be efficacious for muscle resections exceeding 6mm. Its use in human eyes is limited to closure of conjunctiva in strabismus surgery.\(^9,10\) Its use for re-fixation of extra ocular muscle in human beings is not available to the best of our knowledge. Hence, the present study was carried out to study the safety and efficacy of fibrin glue for re-fixing the extra ocular muscle after its recession during strabismus surgery.
**MATERIALS AND METHODS**

Patients who presented to pediatric ophthalmology and strabismus clinic and required surgery were included in the study. Complete ophthalmic work up was done for all the patients. Glasses were prescribed after cycloplegic refraction where ever required and amblyopia was treated with occlusion therapy prior to surgery. Patients with incomitant squint, with history of any other ocular surgery or squint surgery in the past and patients with history of trauma to eye were excluded. The surgery was either done under general anaesthesia or under peribulbar block depending on the age of the patient. One eye or both eyes were operated depending upon the type of deviation. Limbal conjunctival peritomy was done and muscle to be recessed was isolated and held with muscle forceps before cutting from its insertion. The desired amount of recession was marked on the sclera. Fibrin Glue (Baxter Healthcare Corp, Deerfield II, USA) was prepared as per manufacturer guidelines 5-10 minutes before the surgery and both components kept in separate syringes. One component of the glue was applied to the sclera at marked place of recession and other component of the glue was applied to the cut end of the muscle. The muscle was kept in contact with the sclera till reattachment was achieved. The resection of the muscle was done as usual with 60 vicryl. The conjunctiva was closed with the same glue on both sides. Antibiotic ointment was instilled at the end of surgery and eye was patched. Postoperative antibiotic and steroid drops were given for a period of four weeks. Follow up was done at day one, 3, 6 weeks and 3 months. At each post operative visit alignment was measured with prism bar cover test. Pain, conjunctival congestion and chemosis were noted on a scale of 0-3 at each post operative visit, 0 being absence of any of the signs/symptom and 3 being maximum as used by Lee et. al.11

**RESULTS**

There were 30 eyes from 23 patients in the age range of 3-28 years (average 11.59±7.44). Twelve were males and 11 females. Thirteen patients were operated for esotropia and 10 for exotropia. There were a total number of 30 recessions with 7 patients undergoing bilateral recessions (5 bimedial recessions and 2 bilateral lateral rectus recessions). Average time taken for reattachment of recessed muscle to the sclera was 1.61±0.73 minutes (range 0.66-3.0 minutes). On postoperative day seven average score for conjunctival congestion, chemosis and pain were 1.40, 1.04 and 0.36 respectively. These values at 3 week were; 0.95, 0.72 and 0.13, and were 0.45, 0.11 and 0, at 6 weeks. At 3 months these values were 0 for conjunctival congestion, chemosis and pain respectively.

After 3 months of follow up 20 patients were orthotropic, 2 had residual esotropia and one had consecutive extropia. There was no complication from use of fibrin glue and no muscle slippage.
**DISCUSSION**

Fibrin glue is a biological adhesive and is derived from blood. It functions in a manner similar to the final stages of the coagulation cascade, when a solution of human fibrinogen is activated by thrombin. Fibrinogen is converted to fibrin which binds to collagen. Commercially available fibrin glues are; Tisseel VH (fibrin sealant, Baxter, USA), Beriplast (fibrin sealant, Nycomed, Denmark) and Hemaseel APR (fibrin sealant, Hemacure Corp, USA). Tisseel is commercially available in India. It includes a fibrinogen component and a thrombin component, both prepared by processing plasma. Two concentration of thrombin are provided; 4 NIH-U/ml for slow clotting and 500 NIH-U/ml for faster clotting. We used 500 NIH-U/ml for faster clotting. The components were mixed as per manufacturer guidelines 5-10 minutes before surgery. The resultant fibrin clot degrades physiologically. Fibrin glue also has its advantage of having anti bacterial properties and also has low incidence of allergic reaction.

Fibrin glue in has been used for many conditions in ophthalmology like; amniotic membrane transplant, autologus conjunctival transplant in pterygium surgery, scleral fixation of intraocular lens implant, managing hypotony in glaucoma surgery and wound closure in cataract surgery. Its use in strabismus surgery has been limited to closure of conjunctiva after the strabismus surgery.

There are few reports with regards to use of cyanoacrylate glue in strabismus surgery where it has been used for reattaching the muscle to the sclera after its recession. Adal-1 is a mixture of ethyl carboxyacrylate and ethyl cyanoacrylate and was used by Mulet et. al. in 27 eyes in prospective randomised clinical trial and comparison was done with 70 vicryl suture. The efficacy of sealing muscle to sclera and bio tolerance of surrounding tissues was evaluated. The degree of displacement of muscle and degree of inflammation in two groups did not reveal any statistically significant differences. The muscle sclera junction created with Adal-1 was able to withstand greater or equal tensile strength. There was no case of scleral perforation, whitening, or sclera/retinal burn in Adal-1 group, which confirmed minimal degree of exothermal reaction. There were no conjunctival ulcerations caused due to excessive hardness of the spicules of polymerised adhesive. Authors concluded that bio adhesive is good alternative to suture as it leads to better bio tolerability and reduced surgical time.

Darakshan et. al. compared suitability and bio tolerance of isoamyl cyanoacrylate with 60 vicryl suture for attaching muscle to sclera in horizontal muscle recession surgery. Time required for reattaching the muscle after disinsertion was noted in both the groups. The other parameters studied were;
conjunctival injection, chemosis, discomfort and discharge on a scale of 0 to 3 (none, mild, moderate and severe) on day one, two weeks and four to six weeks post operatively. Addition of all above score constituted as total score ranging from of 0 to 12. Analysis of individual inflammatory scores revealed no significant differences between two groups; however total inflammatory score was less in glue group on post operative day 1. No significant difference in total score was observed between two groups at 2, 4 and 6 weeks post operative. The mean time for reattachment in vicryl group was 5.04±1.70 minutes and 10.29±2.59 minutes in glue group indicating that glue took more time compared to vicryl for muscle reattachment. No complications were observed in either group. They concluded that strength of bond by cyanoacrylate glue was enough to overcome the contractile strength of muscle and there was no muscle slippage post operatively.

Use of fibrin glue for re-fixing extra ocular muscle after recession has been studied only experimentally in rabbit eyes. The efficacy of fibrin glue was found to be more if the muscle recession was 6 mm or more. The slippage of the muscle was found to be significantly less if recession exceeded 6 mm. No difference was found towards fibrous tissue reaction when compared with vicryl suture. Toneli et. al. in a comparative study on animal eyes found fibrin glue superior to cyanoacrylate in terms of tissue reaction and biocompatibility, however bonding strength was found to be superior with cyanoacrylate.

The present study highlights the efficacy of fibrin glue for re-fixing extra ocular muscle after its recession. Tissue reaction tends to subside quickly with fibrin glue. Patients reported no foreign body sensation or irritation in the operated eye. Further studies on large number of eyes are required to test the efficacy of fibrin glue for muscle recession.

REFERENCES


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**Demonstration of Loss of Binocularity and Stereoacuity (DLBS): A Novel Counseling Technique to Promote Parental Decision for an Early Surgical Correction of the Squint of their Ward!**

**Dr. Mihir Kothari**

Early restoration of alignment is imperative to achieve good binocularity and stereoacuity in strabismic children. However, we realized that a significant number of parents delay the surgical correction of their ward due to variable reasons.
This study was performed to assess whether demonstration of loss of binocularity and stereo-acuity (DLBS) can help to promote early surgical correction of the squint in children.

**MATERIALS AND METHODS**

This randomized controlled interventional trial was performed at a dedicated teaching Pediatric Ophthalmology Private practice in an urban Indian city (Thane). The study period, Sept 1st 2011 to March 31st 2012, included three long school vacations (Diwali, Christmas and Mini-Summer vacation).

<table>
<thead>
<tr>
<th>Inclusion Criteria</th>
<th>Exclusion Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Children &lt; 10 years</td>
<td>1. Patients with neurological impairment</td>
</tr>
<tr>
<td>2. Comitant squint</td>
<td>2. Ocular comorbidity</td>
</tr>
<tr>
<td>3. Potential for Binocularity present</td>
<td>3. Nystagmus</td>
</tr>
<tr>
<td>4. First time surgery</td>
<td>4. Systemic diseases / syndromic patients (with systemic features)</td>
</tr>
<tr>
<td>5. Living within 40 kilometers from the clinic</td>
<td></td>
</tr>
</tbody>
</table>

Randomization was performed using permuted blocks. The patients were divided into two groups. Group 1 (DLBS group) where DLBS was performed apart from conventional counseling for the squint surgery and Group 2 (No DLBS/Conventional group) where conventional surgical counseling was performed.

**Conventional Counseling**

1. Explanation was given regarding
   a. the causes of squint
   b. defects in binocularity and stereopsis due to squint
   c. treatment options and outcomes

2. Surgical procedure was explained with special emphasis on benefits of early correction and risks involved

3. Demonstration on muscle model

4. Written literature was given

5. Access to surgical videos of operations performed by the attending surgeon was given (youtube link / clinic’s website

**DLBS**

1. One parent was asked to wear Red Green goggles and look at worth four dot held at 40 cm. Presence of 4 dots with both eyes open and loss of half the information by occlusion of one eye was demonstrated to make them understand what happens to binocularity in children who have a squint

2. Then, the concept of stereoacuity and its loss was demonstrated by holding the LANG 1 card at 40 cm; initially with both eyes open followed by occlusion of one eye

3. The negative impact of loss of 3D vision was demonstrated by asking the parent to perform LANG two pen test with both eyes open followed by occlusion of one eye
All the parents were freely offered concessions on the surgical fees/free squint surgery, whichever was necessary according to their financial status.

The parents were contacted 3 months after the recommendation of the surgery and asked about the surgical status of the patient (operated/not operated). A child operated at a facility other than the study center / by some other ophthalmologist was considered in the operated group. Parents, who were not contactable/not willing to respond were included in nonoperated group (n=4).

**Sample size calculation:** For 80% power, 10% level of significance, 3.0 standard deviation and 20% effect size we needed $n=\left(\frac{Z_{1-\alpha/2} - Z_{1-\beta}}{\sigma_d} \right)^2 i.e. 91$ patients.

The difference in the mean between the two groups (p value) was calculated using a two tailed student t test (for continuous variable) / chi square test (for categorical variable).

**RESULTS**

Total 45 patients were included in the study.

**Table 1: Group 1 Vs Group 2**

<table>
<thead>
<tr>
<th>Variable</th>
<th>Group 1 (n=22) DLBS</th>
<th>Group 2 (n=23) No DLBS</th>
<th>p Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>3.3±2.1</td>
<td>4.2±3.0</td>
<td>t test = 0.3</td>
</tr>
<tr>
<td>Sex (F:M)</td>
<td>12:10</td>
<td>17:06</td>
<td></td>
</tr>
<tr>
<td>ET:XT</td>
<td>19:03</td>
<td>21:02</td>
<td></td>
</tr>
<tr>
<td>Average deviation</td>
<td>36±13</td>
<td>37±13</td>
<td>t test = 0.9</td>
</tr>
<tr>
<td>Education level</td>
<td>S10, G5, PG7</td>
<td>S13, G5, PG5</td>
<td></td>
</tr>
<tr>
<td>Economic level (P:C)</td>
<td>18:04</td>
<td>16:07</td>
<td></td>
</tr>
<tr>
<td>Surgery done</td>
<td>15 (68.2%)</td>
<td>13 (56.5%)</td>
<td>Chi square = 0.19</td>
</tr>
<tr>
<td>Delay in surgery</td>
<td>31.3±22.5 days</td>
<td>37±13 days</td>
<td>t test = 0.86</td>
</tr>
</tbody>
</table>

**Table 2: Surgery done Vs Surgery Not done**

<table>
<thead>
<tr>
<th>Variable</th>
<th>Done (n=28, 62.2%)</th>
<th>Not Done (n=17, 37.8%)</th>
<th>p Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>3.3±2</td>
<td>4.6±3.4</td>
<td>t test = 0.1</td>
</tr>
<tr>
<td>Sex (F:M)</td>
<td>17:11 (60%)</td>
<td>6:11 (35%)</td>
<td>Chi square = 0.1</td>
</tr>
<tr>
<td>ET:XT</td>
<td>25:03:00</td>
<td>12:05</td>
<td></td>
</tr>
<tr>
<td>Average deviation</td>
<td>36</td>
<td>37</td>
<td>t test = 0.9</td>
</tr>
<tr>
<td>Education level</td>
<td>S10G12PG6</td>
<td>S11G3PG3</td>
<td></td>
</tr>
<tr>
<td>Economic level (P:C)</td>
<td>24:4 (14.2%)</td>
<td>11:6 (35%)</td>
<td>Chi square = 0.1</td>
</tr>
<tr>
<td>DLBS</td>
<td>16 (57%)</td>
<td>6 (35%)</td>
<td>Chi square = 0.1</td>
</tr>
</tbody>
</table>
**DISCUSSION**

In this study we found greater number of parents, 68.2%, in DLBS group had the surgery compared to parents who were in the conventional group - 56.5%. This difference was clinically significant. However, since the sample size was small, this difference did not reach a higher level of significance. We also found, male gender, lower socioeconomic status and older age of the child to be other factors associated with reduced acceptance of early surgery.

In a survey of 13 Pediatric ophthalmologists across the country, we found an average acceptance rate of 54% (±15.5, range 25%-80%) which was close to what we found in our No DLBS group.

It is obvious that the acceptance of the parents for an early surgical restoration of strabismus is variable. Three of our patients’ parents informed us the cause of non compliance. One parent was trying Ayurvedic treatment (Indian traditional medicine), one was trying eye yoga and one family was told to avoid the surgery for a few years by an ill informed general ophthalmologist.

In conclusion, DLBS can significantly improve the parental acceptance to seek surgical restoration of ocular alignment of their ward.

Parents having a male child with strabismus/ lower socioeconomic status/ older child at the time of presentation may need more counseling or an alternative approach to increase the acceptance for an early surgical restoration of ocular alignment of their child.

Further study with larger sample size is needed to confirm the conclusions of this study.

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**Magnetic Resonance Imaging (MRI) Demonstrates Marked Elongation of Rectus Extraocular Muscles in Sagging Eye Syndrome (SES)**

Dr. Zia Chaudhuri, Dr. Joseph Demer

Rectus pulley displacement due to age-related orbital connective tissue degeneration is proposed to cause SES, which manifests as divergence paralysis esotropia (DPE) in cases of symmetrical displacement or hypotropia of the more affected eye in cases of asymmetrical displacement.  

However, it has been perplexing that surgery for esotropia in SES required higher surgical dosage than that for other forms of esotropia. Mathematical modeling of the pulley displacement without elongation of the extra-ocular...
muscle (EOM) demonstrated a large exotropia (Orbit 1.8 Gaze mechanics simulation programme, Eidactics, CA). As the patients primarily presented with esotropia, the model demanded EOM elongation. This study used high-resolution surface coil MRI to investigate possible muscle length changes in SES.

**MATERIALS AND METHODS**

T2-weighted fast spin echo (FSE) MRI (2mm slices, 312 micron resolution) was obtained in patients with SES between 2003-2011, using surface coils in target-controlled central gaze. Lateral (LR) and medial rectus (MR) lengths were measured (Image J, NIH, USA) using axial planes in 24 orbits of 12 patients with SES of average age 70±9 years, and compared with 28 orbits of 17 young (average age 24 ±4 years) and 7 orbits of five age-matched elderly normal subjects (average age 58 ±25 years).

Superior Rectus (SR) and inferior rectus (IR) lengths were measured in planes parallel to the orbital axis (quasi-sagittal planes) in 18 orbits of 9 patients with SES (average age 64.3±4.5 years), and in 64 orbits of 33 young (24±4 years) and 15 orbits of 9 elderly age-matched normal subjects (62±5 years).

Statistical analysis was performed with the Microsoft Excel package.

**RESULTS**

In younger and elderly controls, LR length measured 30-32 mm, while in SES, LR length at 45-46 mm was about 40% longer (P<0.001). MR length at 37-39 mm and SR length at 41-43 mm were about 25% longer in SES than controls (P<0.001). Table 1 provides a synopsis of the actual lengths of the EOM. IR length was similar in SES and controls.

It was an unusual finding to observe that the EOM lengths remained similar in both, young and age matched controls without SES, while patients with diagnosed SES had elongated muscles. The differential elongation with the LR demonstrating almost a 40% elongation followed by the MR and SR is difficult to extrapolate as is the fact that the IR does not demonstrate a significant elongation. This differential elongation may further explain the clinical symptoms of esotropia and hypotropia in this condition and also have marked implications for appropriate surgical rehabilitation.

<table>
<thead>
<tr>
<th>Group</th>
<th>MR length</th>
<th>LR length</th>
<th>SR length</th>
<th>IR length</th>
</tr>
</thead>
<tbody>
<tr>
<td>SES</td>
<td>38±5.5 mm</td>
<td>46±4 mm</td>
<td>43±4 mm</td>
<td>41±6 mm</td>
</tr>
<tr>
<td>Young controls</td>
<td>31±5.5 mm</td>
<td>33±6 mm</td>
<td>36±3 mm</td>
<td>39±5.5 mm</td>
</tr>
<tr>
<td>Older controls</td>
<td>29±7 mm</td>
<td>31±14 mm</td>
<td>37±4 mm</td>
<td>39±4 mm</td>
</tr>
</tbody>
</table>
DISCUSSION

Orbital connective tissues degenerate with age, creating a clinical picture of blepharoptosis, deep superior sulcus syndrome and limited supraduction due to inferior displacement of horizontal rectus pulleys, with the patient presenting with sudden onset horizontal or vertical diplopia.\(^1\)\(^-\)\(^6\) The clinical characteristics of this condition is specific enough, even without the use of surface coil orbital MRI delineating the anatomical and structural changes occurring in this condition, for this entity to warrant a separate nomenclature.\(^3\)\(^,\)\(^7\)\(^,\)\(^8\)

Thus, categorized as a separate clinical syndrome called the sagging eye syndrome (SES) by the authors, its role as a cause of acquired diplopia in the elderly is of paramount importance, not only because the knowledge of this condition does away with the requirement of making the patient undergo costly investigation suggestive of an acute neurological event, it also presents a more favorable prognosis for surgical treatment.\(^1\)\(^,\)\(^2\)\(^,\)\(^7\)

This paper demonstrates that the LR, MR and SR muscles are markedly elongated in SES, suggesting that rectus muscle elongation and laxity represents a new, previously unreported pathophysiological mechanism underlying the relative insensitivity of SES to routine nomograms followed for strabismus surgery for similar magnitudes of deviations.\(^1\) Recurrences of the deviation and the resultant diplopia may also be common because of the degenerative etiology of the condition.

The combination of this differential elongation of EOM along with the almost universal rupture of the LR-SR band delineates the anatomical and structural changes in SES, which correlate well with clinical findings. Further mathematical modeling of strabismus surgical procedures based on this model of strabismus in SES, may provide evidence based insights into the appropriate amelioration of this condition.

REFERENCES

Improving Tolerance and Effectiveness of Cyclopentolate in Children with Addition on HPMC 1%

Dr. Kaushik Murali, Dr. Mahesh Shanmugam Palanivelu, Dr. Rajesh Ramanjulu, Dr. Rashmi Vaidya, Dr. Diwakar Rao

Childhood blindness is a public health problem and one of the focus areas of the “Vision 2020- Right to Sight” initiative. Refractive errors continue to be a major cause of avoidable blindness in children. Atropine, cyclopentolate, and tropicamide are the most commonly used cycloplegic agents. A majority of paediatric Ophthalmologists use cyclopentolate eye drops for cycloplegia in children. The most common fear in children while visiting the ophthalmologist is the burning and stinging associated with the drop.

The standard regimen in most practices is to use 2 drops of cyclopentolate, 5 minutes apart. Side effects both ocular and systemic have been reported with cyclopentolate. Rare adverse and hypersensitivity reactions including skin eruptions and psychosis have been reported with the usage of the drop.

Many modalities of using a sprayer with cyclopentolate and addition of proparacaine have been tested to reduce the stinging and also increase the duration of action of the drug. However the unavailability of a commercial spray to dispense the drop and the decrease in the dosage due to the blink response does not allow widespread use of a sprayer. The inherent stinging due to paracaine negates any benefit to the child from combining the same with cyclopentolate.

Hydroxypropylmethylcellulose (HPMC) has been used as a vehicle in many commercial ophthalmic formulations and has also been shown to increase the effectiveness of the formulation by increasing the contact time in the conjunctiva. Bio-adhesive polymers have been proposed to be a part of ophthalmic medications especially antiglaucoma formulations to reduce ocular toxicity, improve drug efficacy and protect the ocular surface.
In an effort to create a child friendly cycloplegia, we looked to compare tolerance and effectiveness of cyclopentolate in children undergoing routine examination with the addition of 1% HPMC drops.

**MATERIALS AND METHODS**

The study was approved by the hospital ethic committee and an informed consent was recorded from the parents of the children.

Thirty children with refractive errors attending paediatric ophthalmology outpatient department were randomized into 2 groups:

1. **Study group (regime A)** 30 eyes: A 1:1 combination of commercially available cyclopentolate (1%) (Pentolate–sunways) with 2% Hydroxypropylmethylcellulose (Aurovisc) was prepared under laminar flow with complete aseptic precaution. A single drop of this combination was applied twice, at 0 minutes and 5 minutes to one eye.

2. **Control group (regime B)** 30 eyes: Commercially available aqueous preparation containing cyclopentolate 1% (Pentolate – sunways) was applied twice at 0 minutes and 5 minutes to the other eye.

The Faces Pain Scale – Revised score (FPS-R) was recorded after 2 minutes of instillation of the second drop in each eye. An optometrist blinded to the nature of drop instilled, measured amplitude of accommodation (primary outcome) at 10 minute intervals up to 30 minutes using VTS 3 computerised orthoptics. In addition, pupil response to light and self-reported side effects were documented. For analysis, findings at 30 minutes were used.

**RESULTS**

Mean age was 11.3 +/-3.2 years (range 6–18 years). Mean pupil size was 6.0 mm for the study group and 5.0 mm for control group.

Cyclopentolate with HPMC produced comparable reduction in amplitude of accommodation (3.79D +/-1.18) as cyclopentolate (3.81D+/11.17) (p value <0.0001). A paired T – test showed that at 30 minutes, the difference in the mean of the NPAs of Drug A and Drug B was not statistically significant (p value: 0.4). Correlation between NPA for Study and control at the end of 30 min was 0.99.

The most frequently recorded observation (mode) in the pain scale for the control group was 6 whereas that for Study Drug was 4. Also, considering a score of 0 – 4 as tolerant, tolerability was 64% in the study group as against 43% in the control group. There were no adverse events in the study population with either drug.
DISCUSSION

Cycloplegic refraction is one of the critical steps in a complete eye examination of a child presenting to an ophthalmologist as it enables more accurate prediction of the refractive error by inhibiting accommodation during refraction.

Carboxymethyl cellulose and HPMC have film forming properties and HPMC is specifically able to interact with the tear film increasing its stability. Previous studies have demonstrated a significant improvement in bioavailability in vehicles in the viscosity range between 1 and 15cP. Here we have used a higher viscosity drug (HPMC 2%) and not noted any significant reduction in the cycloplegic effect. A high correlation in the results was noted.

The tolerability of the drug increased significantly in a majority of the children with addition of HPMC to the active drug. The use of HPMC could find a role in other mydriatics and ocular drugs used in the outpatient clinic to increase their tolerance.

The use of the Facial Pain Scale is a subjective measure of the tolerability. The Faces Pain Scale-Revised (FPS-R) has strong positive correlations with other well established self-report pain intensity measures. It has been recommended for measuring pain intensity in school-aged children (4 years and older). We may need to further study the polymer concentration to optimize the efficacy of the drug with maximum tolerance to enhance the comfort of the drug when applied.

In conclusions addition of 1% HPMC to cycloplentolate was clinically equivalent to plain cyclopentolate for achieving effective pupil dilation and cycloplegia. Tolerability improved with the addition of HPMC as a carrier as the stinging caused by the cyclopentolate reduced.

REFERENCES


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**Long-Term follow-up of “Bag-in-the-Lens” Pediatric Cataract Surgery**

**Dr. Marie-José Tassignon, Dr. Daisy Godts**

The treatment of cataract in the pediatric population has long been known to pose difficulties beyond that of adult surgery. The anatomy is naturally smaller and although the lens itself is typically removed easily by aspiration, the elasticity of the capsular bag can make performing a rhexis more unpredictable. The timing and target refraction of implanted lenses is also controversial. Despite the difficult nature of the surgery, the main cause of postoperative decline in vision is from posterior capsular opacification (PCO). If the posterior capsule is left intact at the time of surgery, PCO occurs in up to 80% of cases.

Performing a primary posterior continuous curvilinear capsulorhexis (PPCCC) to prevent PCO is now a standard approach in pediatric cataract surgery. Despite removal of the posterior capsule however, the visual axis may...
yet opacify. Lens epithelial cells (LEC) have a high proliferative capacity in children so even in the absence of a posterior capsule LECs that gain access to the anterior vitreous can proliferate and obscure vision. Proliferation of fibrous membranes across the visual axis in the absence of a posterior capsule is a phenomenon typically seen in children and termed visual axis opacification (VAO). In high-risk PCO cases such as children, 23-40% will experience partial or complete closure of the PPCCC. In vitro evidence supports this observation by showing that LECs cells retain the capacity to proliferate even in the absence of a capsular scaffold.

MATERIALS AND METHODS
The “Bag-in-the-lens” (BIL) technique is an advance in intraocular lens design that addresses the high risk of VAO. The BIL is designed as a bi-convex monofocal lens composed of hydrophilic material (Morcher). The lens features a unique perpendicular plane haptic alignment whereby the posterior haptics lie on the horizontal meridian and the anterior haptics on the vertical (Figure 1). Between the two haptics lies an interhaptic groove. When sited, the lens is supported by the anterior and posterior capsular blades, which tightly encircle the lens in the interhaptic groove. By apposing the anterior and posterior capsules, the lens design creates a seal that prevents LECs from migrating to the anterior vitreous.

One-year prospective study
Based on validation of the hypothesis in the adult population, a prospective case series was commenced. Thirty-four eyes in twenty-two children were included with an age range of 2 months to 14 years. Participants were followed up for an average of 17.45 months (range: 4-68 months). Four cases included were found to have persistent fetal vasculature (PFV) preoperatively. PFV forms as a sequelae of an unregressed hyaloid vessel. The fibrovascular material forms an adherent interface between the anterior hyaloid and the lens complicating the PPCCC and increasing the risk of VAO. In cases with PFV, an anterior vitrectomy was performed at time of cataract surgery until the vascular cord was retracted. Vitrectomy was not performed as standard in any other case.

All patients showed a clear visual axis immediately postoperatively. Six eyes however, required secondary surgical procedures. One lens dropped due to oversizing of the anterior and posterior capsulorhexes. A second patient dislocated the lens anteriorly which was resolved by resiting the IOL. In a case where only the anterior rhexesis was inserted into the groove during surgery, a subsequent pars plana vitrectomy allowed the posterior capsule to be fitted into the IOL. Iris capture occurred in one child and glaucoma occurred in another with concomitant anterior segment dysgenesis. Visual clarity was maintained in 93.8% of patients. Failure to prevent VAO was due to complications in BIL
Figure 1: BIL implant schematic

Figure 2: Positioning of the lens relative to anterior and posterior rhexes

Figure 3: Cases of pediatric BIL surgery who completed the 5-year follow up period

Figure 4: Follow up periods for 46 cases of pediatric BIL technique

Figure 5: Age of child at time of primary surgery

Figure 6: Visual acuity results in bilateral BIL surgery

Figure 7: Visual acuity results in unilateral BIL surgery

Figure 8: Post-operative spherical equivalent results 5 years after surgery
insertion. Children in whom the lens was sited perfectly at time of primary surgery maintained clarity in 100% of cases.

**Five-year follow up data**
Here we present the follow-up data to that original prospective study. All pediatric cataract surgeries that were performed using the BIL implant technique between July 1999 and September 2007 were included. All surgeries were performed by a single surgeon. A wide range of cataract types was treated, including nuclear fetal cataract and spherophakia. Forty-six eyes from 31 children completed the full 5-year follow-up period (Figure 3). Sixteen cases were unilateral and fifteen were bilateral.

The follow-up periods ranged from 60 months to 157 months, with a mean follow-up period of 78 months (Figure 4). The age at time of primary surgery ranged from 2 months to 14 years with a mean of 6 years (Figure 5). Fourteen of the reported cases were performed on seven children under the age of 1 year. The following criteria were assessed at each follow-up assessment; refraction, best corrected visual acuity (BCVA), intraocular pressure (IOP), anterior and posterior segment evaluation, axial length measurement, corneal topography, and orthoptic assessment.

**RESULTS**

**Postoperative best corrected visual acuity**
Fifteen children (30 eyes) who underwent bilateral BIL surgery showed significant improvement from a range of baseline of visual acuities of a mean of 0.2 with a range of 0.0 - 0.4 (decimal) to a postoperative mean of 0.83 with a range of 0.2-1.0 (Figure 6). One patient showed no improvement and no patient showed a worsening of vision. Visual acuity of greater than 0.5 was achieved in 86.7% (26/30). Sixteen children who underwent unilateral BIL surgery showed a range of improvement from a preoperative mean of 0.07 with a range of 0.0 – 0.4 (decimal) to a mean of 0.27 with a range of 0.0–0.7 postoperatively (Figure 7). Patients who underwent unilateral surgery had poorer preoperative visual acuities than bilateral cases and no unilateral patient achieved a postoperative visual acuity of 1.0. Five children (31.2%) achieved a visual acuity of 0.5 or better. This represents a significant improvement in baseline visual acuity, however, it was not comparable to the level of improvement seen in the bilateral cases.

**Postoperative refraction: spherical equivalent**
Due to inability of the younger children to comply with subjective refraction, refractive data was not available for the full cohort. Refractive outcomes were available for 37 children and showed a normal distribution. The mean refraction was -0.89 (SD 2.14) and 70% of cases (26/37) achieved a spherical equivalent within -2 dioptres to +2 dioptres.
DISCUSSION

During the period of optimizing the surgical technique for children, a number of complications were encountered. Children are prone to aggressive inflammatory responses to anterior segment surgery. Two cases of anterior synechiae were observed, requiring lysis at the one-month postoperative period. One case of glaucoma was detected in the presence of severe PFV. This child ultimately required cyclophotocoagulation and Baerveldt valve drainage surgery. VAO was detected in 6.5% of cases (3/46 eyes). The reopacification was due to improper placement of the BIL at the time of primary surgery. Visual axis clarity was restored in all three by a secondary surgery.

In conclusion, the “bag-in-the-lens” implantation approach is safe and well tolerated in the pediatric population. When correctly sited at the time for primary surgery it forms a seal restricting proliferation of lens epithelial cells. In this manner it prevents the occurrence of VAO, which can significantly delay visual rehabilitation in the critical early years. Although this represents a step forward, it must also be noted that unilateral cataracts still have a high predilection for amblyopia and therefore still have a more guarded prognosis. Earlier surgical intervention and follow up may yield more promising results in the future.

REFERENCES


Comparison of Outcome of Implantation of Hydrophobic Acrylic Versus Hydrophilic IOLs During Pediatric Cataract Surgery: Prospective Randomized Study

**Dr. Suresh Pandey, Dr. Vidushi Sharma**

With refinements in microsurgical techniques, improvisation of intraocular lenses biomaterial/design and better understanding of growth of the pediatric eye, in the coming years intraocular lens implantation is gradually becoming an established mode of treatment of children even in the youngest age group. Modern IOLs are produced from PMMA, HEMA, silicone, hydrophobic and hydrophilic acrylic copolymers and collamer (polymer of collagen and HEMA). At present hydrophobic acrylic and hydrophobic acrylic IOLs are commonly used during adult as well as pediatric cataract surgery. Published reports compared outcome of silicone vs hydrophobic acrylic foldable IOLs or PMMA versus hydrophilic acrylic foldable IOLs. However, to the best of our knowledge no published report available comparing hydrophilic acrylic versus hydrophobic acrylic IOLs in children. The aim of this study was to compare the intra-operative and postoperative performance of hydrophobic acrylic and hydrophilic acrylic intraocular lenses during pediatric cataract surgery.
**MATERIALS AND METHODS**

This was a prospective randomized study. Forty eyes of 20 children (age 6 month to 4 years) with congenital or developmental cataract were included. Exclusion criteria consisted of monocular patients and cataracts associated with ocular abnormalities (microphthalmos, microcornea, glaucoma, uveitis, posterior lenticonus, and colobomas) or systemic diseases, and traumatic or complicated cataracts.

Children were randomly divided into 2 groups. All participants underwent phacoaspiration, primary posterior capsulotomy, and anterior vitrectomy. Group A (n=20) eyes were implanted with hydrophobic acrylic (AMO TECNIS 1 Piece) intraocular lenses (IOLs), and those of Group B (n = 20) were implanted with hydrophilic acrylic IOLs (IOC Intraocular Care). The children were evaluated for anterior chamber reaction, IOL position, visual axis opacification, intraocular pressure, best-corrected visual acuity (BCVA), corneal status, and refractive errors.

**Surgical Technique**

All the surgical procedures under general anaesthesia by a single surgeon (SKP). After the patient had been cleaned and draped, Steridrape and speculum were applied. Two side port incisions 180 degree apart were made with the help of a 15 degree keratome to enter the anterior chamber. Viscoelastic material (Alcon Viscoat) was injected into the anterior chamber through 1 of the side ports. A clear corneal incision was made temporally with a 2.8 mm keratome.

Continuous curvilinear capsulorhexis of approximately 5 mm was made with the help of a capsulotomy needle and capsulorhexis forceps. This was
followed by multipoint hydrodissection and phacoaspiration of the cortical matter. Phacoaspiration of the soft nucleus or cortical material was primarily performed with a bimanual irrigation–aspiration system using AMO Signature phacoemulsification system. Primary posterior capsulorhexis (PPC) was performed in each case.

The size of the PPC was approximately 4 mm. Limited anterior vitrectomy was performed in the area of the PPC. This was followed by IOL implantation in the bag with an injector system. The remaining viscoelastic substance was evacuated using irrigation and aspiration, and the incisions were hydrated with a balanced salt solution plus fluid to seal the wound. The main and side-port incisions were was closed using 10-0 nylon suture. Intracameral injection of preservative free moxifloxacin (Vigamox, Alcon Labs) and triamcinolone acetonide (Aurocort, Aurolab, India) were injected intracameraly, and the eye was patched.

**Postoperative Treatment**
In the immediate postoperative period 24 hours after surgery, topical antibiotics (moxifloxacin 0.5%) were used 4 times and corticosteroid drops (prednisolone 0.1%) were used 4 times a day (the frequency was titrated according to the severity of the inflammation). Cycloplegics (homatropine 2%) were used once a day for 6 weeks. Children were evaluated on day 1, at 1 week, 4 weeks, 12 weeks, and 24 weeks postoperatively, then every 6 months. The parameters evaluated were anterior chamber reaction (synechiae, fibrin), IOL position and PCO, intraocular pressure, BCVA, corneal status, and refractive error. Visual acuity was measured in older children and children who cooperated with Snellen’s visual acuity chart.

The intraocular pressure was taken by noncontact tonometer or Goldmann’s applanation tonometer whenever feasible. The corneal status, anterior chamber reaction, and IOL position was assessed with the help of slit-lamp biomicroscopy. Retinoscopy was done and BCVA was assessed in cooperative children. In younger or uncooperative children, detailed examination was carried out in the operative room with operating microscope under anaesthesia.

**RESULTS**
Mean age- 2.2±1.8 years in the hydrophobic acrylic group and 2.7±1.3 in hydrophilic acrylic group. Mean follow-up period was 18.6±5 (12-28) months. Postoperatively, all IOLs were in the capsular bag. None of the eyes showed glaucoma. Mean postoperative spherical refractive error was +3.25±1.50 (D) in the hydrophobic acrylic group and +3.50±1.25 D hydrophilic acrylic in the group. Visual axis opacification/LECs on posterior capsule at 1 year follow-up was more common in eyes implanted with hydrophophilic acrylic IOLs (8 eyes) than hydrophobic acrylic IOLs (2 eyes).
**DISCUSSION**

IOL fixation, material and size are important determinants of immediate and long-term outcome in pediatric cataract surgery.\(^5\,^7\) In-the-bag fixation is the most preferred site of IOL implantation. PMMA IOLs have remained the IOL of choice for many years but the current opinion favors the use small incision surgery and implantation of foldable acrylic IOLs using injector system. Hydrophilic acrylic IOLs are soft and have excellent biocompatibility because of their hydrophilic surface and 18%-38% water content. These IOLs show little or no surface alterations or damage from folding because of their soft flexible surface. Low surface energy and hydrophilic nature are major reasons for good uveal biocompatibility. However, hydrogel IOLs seem to have lower capsular biocompatibility as compared to other biomaterials, resulting in more LEC outgrowth, anterior capsule contracture and PCO formation following adult cataract surgery when compared to hydrophobic acrylic IOL. In our study, both hydrophilic and hydrophobic IOLs performed well in term of achieving secure in the bag fixation using injector system. Hydrophobic acrylic IOL was found suitable for minimizing LECs proliferation and therefore maintaining a clear visual axis.

**REFERENCES**

Comparison of Applanation Biometry under General Anesthesia Versus Partial Coherence Interferometry (IOL Master) in Pediatric Indian Population

Dr. Virender Sachdeva, Dr. Vaibhev Mittal, Dr. Mamtha Seepathi, Dr. Rekha Gunturu, Dr. Merle Fernandes, Dr. Ramesh Kekunnaya

One of the most recent advances in pediatric cataract surgery is an increasing emphasis on the accuracy of the IOL power calculation thus necessitating an accurate biomtery. In adults, partial coherence interferometry (IOL Master, Carl Zeiss, Meditec) is considered gold standard. However, in children applanation/ contact biomtery and hand held keratometry are commonly practiced due to requirement of general anesthesia. There are limited studies in literature comparing these techniques which suggest that IOL master may give slightly more steeper readings than handheld keratometer and may slightly over-estimate the axial length than other biomtery techniques.¹,²,³,⁴

To correlate biomtery findings with auto-handheld Keratometer and applanation biomtery under general anaesthesia versus IOL Master in pediatric Indian patients

Inclusion Criteria
Children aged 5–16 years undergoing examination under anesthesia/ strabismus/ extra-ocular surgery under general anesthesia.

Exclusion Criteria
History of previous intra-ocular /prior strabismus surgery/ presence of dense media opacity/ corneal scar/unco-operative patients and parents not willing to give informed consent.

Study Design: Prospective, comparative, non-randomized study.

MATERIALS AND METHODS

- Patients meeting study criteria were evaluated during the pre-operative hospital visit using the IOL Master.
Auto-Handheld keratometry was performed preoperatively under general anesthesia. Three readings were taken and Corneal curvature was recorded along steepest and flattest corneal meridia.

Axial length (AL) was measured with applanation biometry under general anesthesia.

Readings for keratometry (K1 and K2), axial length (AL) and IOL power from both the techniques were compared.

Main Outcome Measures
1) Difference in the Keratometry reading using two techniques.
2) Mean difference in the axial length measurements using two techniques.
3) Mean difference in the IOL power calculation using the two techniques.

Statistical Analysis
- Statistical analysis was done using a STATA 11.0 version software using a paired t-test for normally distributed data and Wilcoxon rank sum test for non-parametric data to assess the difference in the observations.

RESULTS
- 51 eyes of 51 children were included in the study. Mean age of the patients was 9.78 (SD: 3.04) years. 70% were males and 30% were females. Table 1 summarizes the distribution of the biometry readings across the two groups.

Mean difference in the biometry reading with IOL master vs applanation biometry were not significant (Table 2 and Figure 2).

Patients with an estimation difference of ≥ 0.5D in Keratometry between two techniques was 47.05% (24/51), and 33.33% (17/51) for K1 and K2 respectively only none of the patients and 2/51 (3.92%) patients had an estimation difference more than 0.5 mm for ACD and AL respectively.

Figure 1: Distribution of difference in biometry readings IOL Master and applanation biometry under GA

Figure 2: Distribution of the difference in the IOL power calculated using different formulae with two techniques
In Primary Open Angle Glaucoma & Angle Closure Glaucoma

**LATOPROST-RT**

BKC-Free Latanoprost Ophthalmic Solution, 0.005% (Microemulsion)

**Stable at Room Temperature**

- Free from BKC
- Less toxic to ocular tissues
- Longer adherence to therapy
- Controls IOP effectively

Technology that transforms
Figure 2 shows the distribution of the difference in the IOL power calculation using the two techniques by different formulae. Mean Differences in the IOL power estimation using 2 techniques were 0.12±1.01 D for SRK T; 0.07±0.90D for SRK II; 0.15±1.07D for Holladay II and 0.24±1.12D for Hoffer Q formula. Discordancy with > 0.5D difference in IOL power calculated by two modalities was minimum with SRK II formula 25.49% (13/51) followed by SRK/T 35.29% (18/51), Hoffer Q 41.17% (21/51) and maximum with Holladay formula 47.05% (24/51).

**Agreement and correlation analysis**

There was no significant effect of age and gender for the Keratometry K2, Axial length and ACD, however, gender significantly affected Keratomerty K1 readings ($\beta=0.60$, p=0.003).

**DISCUSSION**

We compared IOL Master with A scan and with hand held keratometer in children and found good agreement between the two devices.

Axial length by IOL Master was longer than applanation biometry under GA, by 0.11mm (95% confidence interval:0 – 0.42), although this difference was not statistically significant. This was consistent with a previous study on 20 eyes of 20 children (< 16 years). Moreover the limits of agreement for this comparison were comparable (± 0.21mm).²

There are very few studies which compared IOL Master and RK-F1. Our data showed a trend whereby keratometry readings (K1 and K2) by PCI was
steeper than hand held keratometer, by 0.34D for K1 and 0.06D for K2 although this difference was not statistically significant (P = 0.36 for K1 and 0.88 for K2). This is in contrast to a study by Huynh et. al.¹ who analyzed the corneal power along the flattest and steepest meridians in 447 children of 6 years and found significantly (P < 0.0001) steeper readings with IOL master as compared to RK-F1 for both the flattest corneal meridian, 0.29 D (95% LA, -0.08, 0.66 D), and the steepest corneal meridian, 0.18 D (95% LA, -0.29, 0.65 D).

In addition, the measurement of the difference in the IOL power calculation using both techniques were not significantly different. However, least discordancy between the two techniques were obtained using the SRK II formula.

**Summary**

Because of poor cooperation in children, it is not possible always to do IOL Master in clinical settings. Handheld keratometry under anesthesia is the best possible practical approach to getting K values. Current study has shown that there is no statistical difference between keratometry values by two modalities, so both these modalities can be opted for measuring keratometry and Axial length as per the clinical situation.

**REFERENCES**


**Efficacy and Safety of Tacrolimus Ointment (0.03%) in Children with Severe Recalcitrant Vernal Keratoconjunctivitis**

**Dr. Praful Chaudhary**, Dr. Anand Kumar, Dr. Vidhi Majithia

Vernal keratoconjunctivitis (VKC) is a chronic, bilateral, at times asymmetrical, seasonally exacerbated, allergic inflammation of the...
ocular surface, involving tarsal and/or bulbar conjunctiva. Though the allergic nature of this entity has been accepted for a long time, the accumulation of a large amount of immunological data has proved that the pathogenesis of VKC is much more complex than a mere type 1 hypersensitivity reaction. It is more common in children and young adults having an atopic background. Although the allergic nature of this entity has been accepted for a long time, its exact aetiology and pathogenesis is still unclear.

In the past several years, many clinical and experimental studies about the cells and mediators involved in initiating and perpetuating the ocular allergic inflammation have shown that T helper type 2 cells and their cytokines, corneal fibroblasts and epithelium along with various growth factors play an important role in the pathogenesis of VKC. Based on this information about the pathogenesis of VKC newer, more selective drugs like anti-chemokine receptor antibodies and leukotriene receptor antagonists are under evaluation.

Several therapies with varied results have been proposed in the treatment of VKC such as corticosteroids, nonsteroidal anti-inflammatory drugs, mast cell stabilizers, antihistamines, Cyclosporine A, and surgical intervention. However, the chronic course of the disease and possible treatment side effects make the treatment of VKC a challenge for the ophthalmologist. Therefore there is need for an alternative, effective, safe drug which can decrease the morbidity from this potentially blinding disease.

Tacrolimus, also known as FK506, is a macrolide antibiotic isolated from the soil fungus Streptomyces tsukubaenis. It is a potent immunosuppressive agent that inhibits the transcription of interleukin-2, which inhibits T-lymphocyte proliferation. Topical tacrolimus ointment is commercially available in two strengths 0.03% and 0.1%. Topical tacrolimus 0.03% skin ointment has been used effectively for inflammatory conditions of the anterior segment.

In this case study, we describe our successful experience in treating refractory VKC with topical Tacrolimus 0.03% ointment.

**MATERIALS AND METHODS**

Twenty eight eyes of 14 children with severe recalcitrant VKC were started on topical Tacrolimus (0.03%) ointment. Subjective and objective scoring was done before and 1 month after starting the therapy. All cases had been previously treated with a variety of topical drops in the form of mast cell stabilizers, antihistamines, anti-inflammatory drugs and steroids for variable periods before enrollment and all were refractory to this mode of treatment. Patients aged more than 16 years and with associated ocular or systemic diseases were excluded from the study.
All patients underwent a detailed ophthalmic examination with specific note being made of redness of the eyes, itching, watering, photophobia and pain. Specific signs looked for on slit lamp bio microscopic examination included conjunctival hyperemia, papillary reaction, severity of limbal hyperplasia, and punctuate keratitis.

Topical tacrolimus 0.03% ointment was applied into the lower fornix starting with two times a day and then tapered based on response. Signs and symptoms were recorded at the end of 1 month, 3 months, 6 months and 12 months of starting the ointment.

Subjective and objective scoring was done before and 1 month after starting the therapy. Subjective parameters included redness of the eyes, itching, watering, photophobia and pain.

Each of these was scored on a scale from 0 to 10. Objective parameters, scored on a scale from 0 to 4 included conjunctival hyperemia, papillary reaction, severity of limbal hyperplasia, and punctuate keratitis. Paired t test was used to assess the difference between pre-treatment and post-treatment scores.

Adverse effects if any and the need for top-up steroid eye drops were noted during the course of follow-up. Retreatment with topical steroids (loteprednol 0.2%) eye drops was started if severe symptoms or signs were observed by the examiner excluding the preexisting tarsal giant papillae in the observation period.

RESULTS

Fourteen patients met the criteria for inclusion in this clinical trial. There were twelve males and two females. Mean patient age was 9.56 years (range 7-13). Average follow up duration was 12.36 months. At the end of 1 month, both the subjective and objective scores reduced significantly (p=0.002 and p=0.022 respectively).

Significantly greater improvement was observed for Redness (P =0.000), Itching (P=0.000), Watering (P =0.000), Pain (P =0.003), photophobia (P =0.001), Hyperemia (P =0.000), Limbal papillae (P =0.008) Tarsal papillae (P =0.000) and Punctate keratitis (P =0.007).

 Burning of the eyes after instillation of the ointment, reported in 7 patients was the most common side effect. This was observed only in the initial few days after initiating the therapy and resolved within a couple of weeks in. All patients maintained good control of the eye allergy with none requiring steroid eye-drops during the course of the follow-up. At follow up several weeks later all patients had minimal inflammation and the tacrolimus eye ointment was tapered to once daily and subsequently stopped.
The present trial suggests that Tacrolimus 0.03% eye ointment is beneficial in severe VKC. Significant improvement was observed both in the signs and symptoms.

Topical Tacrolimus has been used in the management of atopic dermatitis. It has an immunosuppressive effect in the inflammatory cascade. Tacrolimus inhibits T-lymphocyte activation, although the exact mechanism of action is not known. In this case series, we describe our successful experience in treating refractory VKC with topical tacrolimus 0.03% ointment. It binds to an intracellular protein, FKBP-12. A complex of tacrolimus–FKBP-12 and calcineurin is formed, and the phosphatase activity of calcineurin is inhibited. The net result is the inhibition of T-lymphocyte activation (i.e., immunosuppression).

Currently, there are 2 FDA-approved concentrations of tacrolimus—0.1% and 0.03% (for children <2 years of age). Recent studies in children showed that both concentrations of tacrolimus are safe and effective for use in moderate to severe atopic dermatitis.8,9

For ophthalmic use, topical tacrolimus ointment has been used in atopic keratoconjunctivitis,6,8–11 blepharokeratoconjunctivitis, chronic follicular

**Table 1: Observation**

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<td>Punctate keratitis</td>
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<td><strong>0.50</strong></td>
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</table>
conjunctivitis, and vernal keratoconjunctivitis.\textsuperscript{12} Herpes simplex keratitis was reported as a potential adverse effect of topical tacrolimus in the case series described by Joseph \textit{et. al}.\textsuperscript{6}

Although mast cell stabilizers, steroids are the first line therapy of severe VKC we recommend use of topical Tacrolimus ointment (0.03\%) in recalcitrant and severe cases of VKC not responding to other drugs rather than increasing the dose and strength of topical steroids.

Side effects are minimal and there is marked improvement in the signs and symptoms of VKC. Once the acute phase of severity of symptoms and signs of the disease is controlled by use of topical Tacrolimus, patients can be switched to mast cell stabilizers for maintenance.

In conclusion, Tacrolimus ointment (0.03\%) was found to be effective and safe in cases of severe recalcitrant VKC. No side effects were reported except a minor burning sensation during ointment application in the initial few days. Future prospective studies with further follow-up and more cases are necessary regarding the long-term efficacy of this therapeutic approach for patients with VKC.

\textbf{REFERENCES}


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**Aggressive Posterior Retinopathy of Prematurity: Risk Factors for Retinal Detachment Despite Confluent Laser Photocoagulation**

**Dr. Neha Kumari, Dr. Mangat Dogra, Dr. Gaurav Sanghi, Dr. Deeksha Katoch, Dr. Amod Gupta**

Aggressive posterior retinopathy of prematurity (APROP) was recognized as a separate clinical entity by the international committee for classification of retinopathy of prematurity (ICROP) in the year 2005 because of its distinct clinical features in the form of a more posterior location, presence of plus disease in all four quadrants and an ill-defined peripheral retinopathy that included flat neovascularization at the junction of the vascular and avascular retina, intraretinal shunts, hemorrhages and circumferential vessels. APROP directly progresses to retinal detachment in absence of treatment. Recent studies have reported the anatomical outcome after laser treatment of APROP. Refractive errors, especially myopia and high myopia have been reported in eyes treated for ROP. However, none of these studies have reported the refractive status following treatment of APROP. Refractive errors need appropriate management as they may limit long term functional outcomes despite anatomic success in ROP.

**MATERIALS AND METHODS**

We prospectively enrolled infants undergoing successful laser treatment for APROP at a tertiary center from January 2006 to December 2010. APROP was defined in accordance with the revised international classification of ROP. Birth weight, period of gestation (POG), post conceptional age at presentation
were noted for each infant. Zone of involvement (zone 1 or posterior zone 2), character of neovascularization, clock hours of ROP, hemorrhages and presence of tunica vasculosa lentis was also noted. Ret-cam documentation was done wherever possible. All infants underwent laser photocoagulation with diode laser (IRIS Medical Oculight SL, 810-nm Infrared laser, Iris Medical Inc., Mountain View, CA) delivered through the indirect ophthalmoscopic system. Confluent laser burns (less than half burn width apart) were applied to the entire avascular retina upto the ora serrata and within the vascular loops. Infants were followed up weekly and additional laser was applied to any skip areas or new avascular areas which appeared once the neovascularization began to retract. Infants were monitored weekly for regression or progression of disease. Structural outcomes were assessed at 3 and 6 months corrected age. At 6 months, an attached posterior pole (without additional surgical intervention) was considered as successful outcome and a criterion for inclusion into the study. Extensive stage 4a (3 or more clock hours) requiring vitrectomy, stage 4b and stage 5 and falciform fold were considered as unfavorable outcome.

Eyes with successful outcome were examined at 1 year corrected age. At this visit detailed examination of visual axis, presence of any nystagmus or strabismus was documented. Detailed fundus examination was carried out. Posterior pole findings were noted as: normal, narrowing of arcade or macular ectopia. Peripheral fundus findings including peripheral localized traction (1-2 clock hours) and vitreous membranes were noted. Refractive errors were determined by cycloplegic retinoscopy with 1% atropine ointment. Spherical equivalent (SE) was determined. Low myopia was defined as SE ≥0.25 to <5D of myopia and high myopia as SE ≥ 5D of myopia. Data was analyzed to determine the association of myopia and high myopia with baseline parameters and posterior pole status at 1 year. Chi square test and Fischers’ exact test were used as appropriate. P value <0.05 was considered statistically significant.

RESULTS
Forty five infants (86 eyes) were enrolled in the study based on successful outcome at the 6 month follow up visit. Three infants (6 eyes) were lost to follow up at one year. Forty two infants (80 eyes) were included in the final analysis. The mean birth weight and the mean gestational age were 1395 ±388.85g (range 660-2600 grams) and 29.57±2.19 wks (range 25-33 weeks) respectively. All eyes had 12 clock hours of involvement. Thirty six eyes (45%) had zone 1 and 44 eyes had (55%) had posterior zone 2 disease. Six eyes (7.5%) had preretinal hemorrhages and 26 eyes (32.5%) had tunica vasculosa lentis. All eyes underwent treatment at mean post-conceptional age of 34.28±2.25 weeks (range 28-38 weeks). The mean number of laser spots applied was 2286.58 ± 871.92. 11 eyes (13.9%) eyes required re-treatment. The mean time for the regression of APROP was 5.18 ±2.761 weeks.
At one-year follow up, Strabismus was noted in five (12.82%) infants. Two infants had exotropia and three had esotropia. None had nystagmus. Fifty-five eyes (68.75%) had myopia. Thirty-five eyes (43.75%) had low myopia (range -0.25 to <-5D) and twenty eyes (25%) had high myopia (range -5D to -15.75D). The median magnitude of myopia was -3.5 D (range -0.25 to -15.75 D). Twenty-two eyes (27.8%) had hypermetropia (range +0.25 D to +2.75 D) and three eyes (3.8%) were emmetropic. Sixty-six eyes (82.5%) had a normal posterior pole and fourteen eyes (17.5%) had narrowing of arcade. Localized peripheral stable TRD was noted in four eyes (5%), vitreous membrane was seen in one eye (1.25%). The frequency of myopia decreased with increasing birth weight (Table 1). However, this association did not reach statistical significance. The incidence of myopia was 80-90% for infants ≤ 30 weeks gestation and decreased to 58.8% for infants >30 weeks gestation. The prevalence of myopia (88.9% vs. 52.3%, p<0.001) and high myopia (41.7% vs. 11.4%, p=0.004) was significantly higher in eyes with zone 1 APROP as compared to posterior zone 2 APROP. The prevalence of myopia was higher (92.9% vs. 63.6%, p=0.053) and high myopia significantly higher (50% vs. 19.7%, p=0.042) in eyes with narrow temporal arcade than in eyes with normal posterior pole.

DISCUSSION

Refractive errors following treatment of ROP can significantly limit long-term functional outcomes. Various series have reported myopia as the most common refractive error in eyes treated for ROP. Recent studies and subgroup analysis of ETROP study report myopia in 64.5% eyes treated at high risk prethreshold and nearly 80% of the eyes treated at threshold. However, none of the previous studies have studied the refractive outcome in eyes treated for APROP. In the present series myopia was present in 68.34% eyes. Previous studies have shown a higher incidence of myopia in lower birth weight infants. Although not statistically significant, the incidence of myopia increased with decreasing birth weight [(100% in infants <1000 g birth weight to 50% with birth weight >1500g, and lesser gestational age. Myopia was more common in eyes with zone 1 APROP (88.9%) as compared to posterior zone 2 disease (52.3%). This difference remained significant even when eyes with a normal posterior pole status were analyzed (88% for zone 1 vs. 45% for posterior zone 2) excluding eyes with a narrow arcade. This suggests that a more posterior location of APROP had a significant correlation with development of myopia. A greater severity of zone 1 APROP may be one of the plausible explanations for this observation. However, this may not be valid as ETROP study enrolled infants based on a computer-generated algorithm. Moreover, ETROP study did not analyze APROP as a separate entity. Nevertheless, zone 1 eyes with plus disease and stage 3 receiving early treatment had 86.7% incidence of myopia in ETROP study, which is comparable to 88.6% for zone 1 eyes in the present study.
Previous studies have reported a greater incidence of myopia in eyes with abnormal narrowing of arcade or macular ectopia.\textsuperscript{10,11,14} In the present study the incidence of myopia (92.86\% vs. 63.6\%) and high myopia (50\% vs. 19.7\%) was higher in eyes with narrow temporal arcade as compared to normal posterior pole.

The limitation of the present study is the lack of long-term follow up. ETROP trial showed that myopia increased from 55.5\% at 9 months to 71.3\% at 3 years in the early treatment group and from 61.4\% to 71.6\% in the conventionally managed group.\textsuperscript{15} Recent studies suggest that myopia in children with ROP is influenced by anterior segment components like a short anterior chamber depth and a thicker lens. We have not evaluated the keratometry and biometric parameters like anterior chamber depth, axial length and lens thickness in the present study.

In conclusion, Myopia and high myopia are common in eyes treated successfully for APROP. Myopia is more likely to develop in zone 1 disease even with a normal vascular arcade. Further studies with a longer follow-up are required.

REFERENCES


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**Comparison of Lateral Rectus (LR) Recession with Y Split to LR Anchor in Duane Retraction Syndrome**

**Dr. Jaspreet Sukhija, Dr. Swati Phuljhele**

Duanes syndrome is a complex strabismic syndrome which occurs in 1 out of 50 patients with strabisms.1 The surgical goal is to correct the deviation and the head posture and ameliorate as much of the anomalous movements as possible. Upshoots and downshoots which are a common finding in Duanes1 are likely to occur due to slippage of the shortened lateral rectus muscle superiorly or inferiorly over the crest of the globe on attempted adduction (“bridle effect”). Many surgical modalities have been described for their correction including - recession of lateral and medial rectus muscles, posterior fixation suture of horizontal recti or of the lateral rectus muscle alone, lowering of insertion of lateral rectus muscle and vertical rectus recession.2,3

We have recently described an alternative technique in patients with exotropic DRS.4 The aim of this study was to compare our new technique with the commonly used Y split in patients with exotropic DRS.
MATERIALS AND METHODS
This study included patients of unilateral exotropic DRS who presented to advanced eye centre, PGIMER, Chandigarh. The patients were divided into two groups. Group 1 comprised of patients of exotropic Duane’s treated with Y splitting and recession of the lateral rectus. Group 2 comprised of patients treated by anchoring of lateral rectus to lateral palpebral ligament. Patients with history of prior strabismus surgery and active adnexal or ocular pathology were excluded. Both the groups were analysed and compared in terms of amount of deviation and face turn, upshoots and downshoots preoperatively and post operatively. Upshoot and downshoot were measured on a 3 point scale. Grade 1 defined as minimal upshoot or downshoot, while grade 3 involved rotation of the globe such that the cornea was no longer visible.

Surgical procedures
All surgeries were performed by the same surgeon (JS). The lateral rectus muscle recessed 10-12 mm with Y splitting based on the primary position deviation and face turn. The split ends of the muscle were secured separately with two double armed Vicryl sutures with a gap of 10 mm and re attached to the sclera in a Y configuration.

For anchoring the lateral rectus to the lateral palpebral ligament a limbal conjunctival incision was made in the area of the rectus muscle undergoing surgery. The rectus muscle was attached to the lateral palpebral ligament with 5-0 Dacron suture. Both the groups were followed up for a period of one year.

Statistical Analysis
Statistical analysis was performed using statistical software SPSS. The preoperative and post operative data was compared using Wilcoxon Signed Ranks Test and the two groups were compared using paired t test.

RESULTS
The mean age was 14.9 ± 7.9 years. There was no significant difference between the two groups in terms of age, sex, laterality or best corrected visual acuity. Six patients were treated by Y splitting of the lateral rectus (group 1) and 6 patients by anchoring of lateral rectus to the lateral palpebral ligament (group 2). The mean preoperative deviation in primary position was comparable in both groups. (Mean 26.7±5.56 PD in group 1 and 25.8±5.3 PD in group 2). All patients had retraction of globe on attempted adduction. An upshoot was found in 12 patients on attempted adduction of the affected eye and downshoot in 7 patients preoperatively. The average amount of lateral rectus recession done was 10.27 mm in group 1. Mean preoperative face turn was 31.3 and 33.8 degrees respectively (p=0.07). Postoperatively, there was no exotropia in 4 patients (66.7%) in group A and 5 patients (83.3%) in group B. Residual
exotropia was present in 2 patients in group A (10 prism dioptres each) with residual face turn (10 degrees) in one case. In group B, 1 patient had residual XT of 15 prism dioptres, and 2 had a consecutive esotropia (mean 13.5 p.d.). Post operative face turn was present in 1 patient. Upshoots and downshoots improved significantly in all patients in group A, but did not completely disappear. In group B, no patient had postoperative upshoot and downshoot. Globe retraction improved significantly in all patients in both groups. The average operating time in group 1 was 15.34 minutes compared to 8.26 minutes in group 2

**DISCUSSION**

Upshoots and down shoots in patients of Duane’s are believed to be due to co-contraction of the medial and lateral rectus muscles and a taut lateral rectus muscle. Due to the disappointing results with oblique muscle surgery, the search for an authentic and reproducible procedure to correct face turn and the upshoots and down shoots is still on in patients of Duane retraction Syndrome. Splitting of a lateral rectus muscle leads to reduction of torque as well as weakens the muscle by recession.

The splitting of the ends of the lateral rectus muscle into a Y-configuration is a unique idea first advocated by Jampolsky. The bifurcation of the muscle decreases the upward or downward rotation of the globe because the halves are positioned to stabilize the muscle’s position on the eye.

Disinsertion of the lateral rectus and fixation to the periosteal wall is a more aggressive approach to exo-Duane syndrome. This procedure similarly removes the lateral rectus from the crest of the globe, thereby diminishing slippage and up- or downshoots, and also addresses exotropia.

Our study reflects the two procedures as equivalent as far as the correction of the horizontal position deviation and head posture is concerned. Although not statistically significant, the up and the down shoots were better corrected cosmetically with the anchoring procedure of lateral rectus. Anchoring of the lateral rectus to the palpebral ligament is a relatively simple procedure with very short operating time. In our study two patient developed consecutive esotropia.

However this patient had primary position deviation much less as compared to other in the same group. Unlike a recession, this procedure might be reversible to some extent. There were no intraoperative or postoperative complications from the procedure. The advantages of palpebral ligament anchoring over Y split recession are complete deactivation of the muscle, shorter operating time, technically easy and reversible besides being a very effective procedure.
REFERENCES


Use of Anterior Segment Optical Coherence Tomography in Localizing the Vertical Recti Muscle Insertions in Patients with Strabismus

Dr. Anand Kumar, Dr. Ritika Dalal

The knowledge of the position of the insertion of the extra-ocular muscle (EOM) is important in planning strabismus surgery. This is more so in cases of strabismus re-surgeries or in cases where the insertion may be expected to be at a variable position.

Various imaging modalities such as A Scan Ultrasonography (USG), B Scan USG, computed tomography, MRI, MR fluoroscopy have all been used to assess the location and size of extra-ocular muscles. However, only ultra biomicroscopy (UBM) has been reliably used to measure the distance of the EOM insertion from the limbus. It has also been used reliably for vertical muscles and re-surgeries.

More recently Anterior segment Optical Coherence tomography (AS-OCT) has been used to measure the limbus-insertion distance in horizontal recti muscles in adults undergoing strabismus surgery. In this study we evaluated the accuracy of the AS-OCT in measuring the limbus insertion distance for the vertical recti muscles by comparing it with intra-operative caliper measurements. To our knowledge, this is the first study to evaluate the accuracy of AS-OCT in determining vertical rectus muscle position.
MATERIALS AND METHODS

Thirty one vertical recti muscles (23 inferior recti and 8 superior recti) in 20 patients undergoing primary strabismus surgery were evaluated. Patients with any ocular surface anomaly where the limbus was not easily recognized or with structural abnormalities such as microphthalmia that could affect the accuracy of the AS-OCT or surgical measurements were excluded. The eyes of each patient underwent measurements of the limbus-insertion distance on vertical EOM with AS-OCT preoperatively and calipers intra-operatively. All AS-OCT measurements were performed by one operator (RD), and all intraoperative measurements were performed by one surgeon (AK). Both examiners were masked to the other’s measurements.

Pre-operatively, an AS-OCT scan of the vertical recti muscle was done with the patient in a sitting position. The patient was asked to rotate the eyes upwards by about 15 degrees to scan the inferior rectus and downwards by the same amount to scan the superior rectus. Three consecutive scans were taken and the images saved. Using the inbuilt caliper function of the AS-OCT, the angle-insertion distance was measured. The insertion was defined as the anterior most extent of the cleft seen between the EOM and the sclera. As the limbus is not well defined in AS-OCT image, the anterior chamber angle was used as an alternate landmark. The limbus-insertion distance was then calculated by adding 0.75mm to the angle-insertion distance. Anatomic studies have reported that the iris root (the anterior chamber angle) lies approximately 0.75 mm posterior to the limbus in the vertical meridian.7

During surgery, the vertical recti muscle were exposed, isolated and hooked using a Jameson muscle hook. The distance from limbus to the midpoint of the muscle insertion at the muscle hook was then measured by the surgeon using the Castroviejo’s surgical caliper. Three measurements were taken and the mean calculated.

The degree of agreement between the two sets of measurements was evaluated using the Pearson’s correlation coefficient (PCC), Intra-class correlation (ICC) and Bland Altman Analysis.

RESULTS

The mean limbus-muscle insertion measured intra-operatively using surgical calipers was 6.76±0.78 mm for inferior rectus and 7.48±0.73 for superior rectus muscle. Similar readings using AS-OCT pre-operatively were 6.44±0.74 mm and 7.31±0.94 respectively. For both the inferior and the superior recti, the limbus-insertion measurements showed a high correlation coefficient (0.72 and 0.81 respectively). The ICC was 0.72 and 0.78 respectively, indicating a “good” correlation between the two measurements (Table 1). The Bland Altman
analysis showed a total of 30 out of 31 (96.7%) AS-OCT-caliper differences to be within the 95% confidence interval of the mean difference. This is an indication of good agreement between the two methods (Figure 1).

**DISCUSSION**

Our data shows that the AS-OCT is fairly reliable in localizing the insertion of the vertical recti muscles in patients having strabismus. The AS-OCT measurements showed good correlation with intra-operative surgical caliper measurements for both the superior and inferior recti muscles.

The AS-OCT is recently being employed more and more to image anterior segment structures, especially for anterior chamber angle evaluation and the corneal pachymetric mapping. It uses an infrared light of 1310nm wavelength and is able to generate a high resolution, two dimensional image. Its properties of faster scanning, high penetration and low scattering make it ideal to image various anterior segment structures.

Till very recently, the UBM was the only imaging modality which could accurately localize the insertion of the extra-ocular muscles. It has been reliably used to localize not only the horizontal recti muscles, but also the vertical recti and cases of re-surgeries. In a study by Solarte et al.,6 the UBM and the surgical measurements showed “very good” correlation, indicating that the UBM is a good predictor of the position of the vertical recti muscles. The AS-

<table>
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<th>Table 1: Level of Agreement between Two Methods by Pearson's Correlation Coefficient and Intraclass Correlation Coefficient</th>
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<tr>
<td><strong>Pearson's correlation coefficient</strong></td>
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**Figure 1:** Bland-Altman plots for combined IR and SR measurements. The differences between AS-OCT measurements and intraoperative readings (AS-OCT reading minus surgical reading) are plotted against the mean of the two distance measurements.
OCT scores over UBM in being a non contact imaging modality, thereby being suitable for children and post operative examination. Further, there is no risk of conjunctival or corneal abrasions as may be seen with the contact probe of UBM.

Till date, there has been just one study evaluating the use of AS-OCT in measuring the limbus insertion distance for extra ocular muscles. Liu and colleagues showed that AS-OCT can image the structure of horizontal rectus muscles well and provide good reliability and accuracy in measurement of the limbus-insertion distance for horizontal recti in patients with strabismus. Using a surgical caliper intra-operatively, they measured the distance between the corneoscleral limbus and the posterior edge of the muscle insertion after the muscle was disinserted from the globe. This may, however lead to an under-estimation of the limbus insertion distance as the insertions are known to creep anteriorly towards the limbus after the tendons are disinserted from the globe. Hence we took the measurements with the muscle hook isolating the muscle before being disinserted from the globe.

The ability of the AS OCT in localizing the extra-ocular muscle insertions can be of utility to improve the surgical plan in strabismus patients. This method can potentially be used in reoperation of strabismus cases where records of previous surgery may not be available. It may also be of immense utility in post operative or traumatic strabismus cases where a differentiation between muscle paresis and muscle slippage needs to be done.

REFERENCES
Comparision of Effectivity of Inferior Oblique (IO) Recession and total Anteropositioning on Torsion Correction in Patients with Inferior Oblique Overaction (IOOA) with V Pattern

Dr. Rekha Singhal, Dr. Audich Kamini Laxmiprasad, Dr. Ravindra Vhankade, Dr. Manan Jariwala, Dr. Srishti, Dr. Ruchika Pattanaik

Various surgical procedures are described for correcting IOOA but the effect on torsion correction is not the same with all procedures. The purpose of this study is to compare effectivity of different IO weakening procedures and to know if pre-operative torsional evaluation helps in management of V pattern with IOOA.

MATERIALS AND METHODS

In 47 eyes of 44 patients torsion was assessed for torsional anomaly pre and postoperatively by objective method of fundus photography after measurement of the disc-fovea angle. 33 eyes were subjected to IO recession (Fink’s method) and 14 eyes underwent IO Anteropositioning (total).

RESULTS

Of the 47 cases, there were 27(57.44%) males and 20(42.55%) females. All patients had IOOA. Isolated IOOA was found in only 2(4.25%) eyes. IOOA is associated with horizontal deviation in 26(55.31%) eyes, vertical deviation in 5(10.63%) eyes and mixed (horizontal, vertical, dissociated vertical deviation) in 14(29.78%) eyes. Grade 1 IOOA is seen in 33 patients (70.12%) eyes. On analysis of change in action of IO after IO weakening surgery, it is observed that in 41(87.25%) eyes IOOA disappeared. In 5(10.63%) eyes IOOA persisted postoperatively, these all 5 patients had grade 2 and 3 IOOA preoperatively.
In recession group mean preoperative and postoperative extorsion was 7.27° and 2.88° respectively. The differences in torsion achieved was statistically highly significant by z test (3.514) for all patients with recession (P =<0.01). Mean preoperative extorsion of 8.78° in the anteropositioning(total) group had changed to 5.14° extorsion post operatively. The difference being statistically significant in anteropositioning group by paired t test (4.17) at p value(<0.001).

Effectivity of procedure {Mean of index of surgical effect= (torsional correction achieved in degrees/preoperative torsion in degrees) ×100} was 47.6% (Z test=3.514, p<0.01) in recession group and 36.78% (t test, p<0.001) in anteropositioning group.

On comparing the procedures by standard error of difference between two means, it is seen that recession and anteropositioning gives similar results for correcting the torsion but recession being better than anteropositioning.

DISCUSSION

Uncontrolled oblique muscle surgery in cases of horizontal strabismus with well-adapted cyclodeviations may induce torsional disparities through over or under corrections. If these disparities exceed the cyclofusional reserve, the patient may become symptomatic for cycloddiplopia. It may also hinder the development of fusion and finer stereopsis. Hence, it is important to know the cyclotorsional changes produced by the different surgical procedures on the oblique muscles.

Recession is a generalized weakening procedure, weakening all the functions (elevation, abduction and extorsion) of the inferior oblique equally. Anteropositioning procedure is also a generalized weakening procedure but was expected to have an increased effect on weakening the elevation.

We conclude that significant torsional changes are seen while evaluating cyclotorsion by objective method (fundus photography) in patients with V pattern with IOOA.

The torsional changes produced by different oblique muscle weakening procedures vary, with the maximum effect seen in recession of the inferior oblique.

Availability of graded weakening procedure of the oblique muscle to precisely correct amount of the cyclodeviation has made quantitative evaluation of cyclotorsional changes before and after IO surgery an important tool and pre-operative torsional evaluation helps in tailoring the particular surgical procedure to the individual patient.

REFERENCES

Silicone Band Loop Myopexy in Treatment of Myopic Strabismus Fixus: Surgical outcome of A Novel Modification

Dr. Bhamy Shenoy, Dr. Ramesh Kekunnaya, Dr. Virender Sachdeva

Myopic strabismus fixus (MSF) or the heavy eye syndrome is a rare condition characterised by esotropia and hypotropia associated with restricted elevation and abduction in eyes with axial high myopia.¹ In advanced cases the involved eye is fixed in extreme adducting position and no eye movement is possible. Although mostly acquired, the condition can sometimes be congenital.² Various surgical techniques for management of MSF have been described, including disinsertion or large-angle recession of the MR muscle, and recession–resection procedures.³⁴ These have generally been shown to have limited success.⁵ With better understanding of the pathophysiology of this condition muscle belly union of superior and lateral rectus is now procedure of choice for management of MSF.⁶ Loop myopexy using absorbable/ non-absorbable sutures with or without scleral fixation is currently most popular and preferred technique for management of MSF.⁷⁸ We prefer a silicone band with scleral fixation for management of such cases. We conducted this study to evaluate safety profile and surgical outcomes of a novel modification of loop myopexy with silicone band for myopic strabismus fixus.

MATERIALS AND METHODS

After obtaining an institutional review board approval, a retrospective chart review of patients who underwent modified silicone band loop myopexy
between January 2008 and December 2011 for MSF was performed. We used the standard definition of high myopia as being a spectacle prescription of greater than 6D in the least minus meridian of the eye. Only patients with minimum of 2 months post-operative follow-up were included. Patients who had undergone suture loop myopexy, patients having concurrent active orbital disease or incomplete records were excluded.

Parameters studied were patient demography, age of onset of strabismus, extraocular movement (EOM) limitation at presentation and last follow-up, horizontal and vertical deviation with and without glasses at presentation and each follow-up visit, axial length and keratometry readings and complications at each visit. The main outcome measures were improvement in alignment, improvement in EOM and intra- and postoperative complications.

In short, a supero-temporal fornix based incision was placed to approach the muscles. The lateral rectus and superior rectus muscles were isolated separately. A scleral tunnel was constructed for scleral fixation approximately 14 mm posterior to the muscle insertion. A silicone band was passed around the superior and lateral rectus muscles and also through the scleral tunnel and tightened. Conjunctiva was closed routinely.

RESULTS

Nineteen eyes of 11 patients, 7 males and 4 females (M: F=1.75:1) were analysed. Mean age at presentation was 31.45±17.43 years (11-72 years). Mean age of onset of Strabismus was 21.45±18.34 years (2-57 years). Mean axial length was 32.95±2.87mm (26.8-36.46mm) and mean spherical equivalent refraction of the involved eyes was -15.3±6.98D (-27 to -4.5D).

Three of the 11 patients had horizontal binocular diplopia at presentation. All but 2 patients had nasalisation of superior and inferior rectus and Inferiorisation of lateral rectus on MRI orbit. Nine of the 11 patients underwent bilateral loop myopexy and 15 of 19 eyes underwent an additional medial rectus recession of 5-7.5mm. Mean abduction limitation at presentation was -3.1±1.28 (-6 to -1) which improved to -2.05±1.5 (-5 to 0), p=0.02 at the last follow-up. Mean amount of esotropia at presentation was 84.54±35.53 prism diopeters (PD) (30 to 130 PD), which improved to 19 ±19.87PD (0 to 50), P=0.000.

Success (deviation within 20PD) was achieved in 54% (95% CI: 23.4-83.25%) at the last follow-up. Mean hypotropia at presentation was 8.92±10.06PD, which improved to 0.64±1.33PD, p=0.0069. One patient had minimal diplopia persisting at last follow-up. Mean follow-up was 8.54±9.3 months (2-28 months). Two patients had foreign body sensation due to silicone band which was removed in 2 eyes. There was no incidence of anterior segment ischemia or other adverse event in any patients.
DISCUSSION

Myopic strabismus fixus is a rare severely debilitating condition seen in patients with high myopia. Various factors like abducens nerve palsy, mechanical restriction due to globe elongation, and displacement of the muscular pulleys have been implicated in the pathogenesis of this condition. However, recent studies using high-resolution magnetic resonance imaging (MRI) have shown that inferior dislocation of lateral rectus and medial dislocation of the superior rectus (SR) paths secondary to supero-temporal herniation of the globe causes this condition. Various surgical techniques have been tried to correct this condition in the past with limited success. The conventional recess-resect procedure has been shown to be ineffective in management of MSF with high rate of recurrence and also lateral rectus resection may augment the muscle displacement. The current procedures aim at realigning the muscle paths with loop myopexy being the most successful procedure. Loop myopexy not only corrects the altered muscle paths of superior and lateral rectus but also helps place the supero-temporally herniated globe back into the muscle cone. Conventionally loop myopexy is performed using a non-absorbable suture with or without scleral fixation.

Most authors prevent scleral fixation due to the fear of inadvertent globe perforation due to the stretched thin sclera in high myopia. Suture loop myopexy has been proven to be safe and effective in management of MSF in various studies with small sample size. Disadvantages of suture loop myopexy however are high risk of muscle cheese wiring and strangulation of anterior ciliary circulation also the procedure is non-reversible. Modified silicone band loop myopexy that has been the standard procedure for management of MSF has the advantage of causing less strangulation of the anterior ciliary circulation, no cheese wiring of the muscles and is reversible. The scleral fixation of the band prevents migration of the band post-operatively. Wong et al. have performed silicone band loop myopexy without scleral fixation in one patient and have reported good immediate post-operative outcomes without adverse events. Silicone band has been used in various ophthalmic surgical procedures like retinal detachment and browns syndrome and has been proven to be safe without any incidence of extrusion or infections of the band. Foreign body sensation was recorded in 3 eyes post-operatively and 2 required removal 4 to 6 months after the procedure. Both patients are well aligned after the removal. There were no incidence of scleral perforation and anterior segment ischemia or silicone band related complications in any of our patients.

A satisfactory alignment was achieved post-operatively in all our patients with 54% achieving a deviation within 20PD. Three patients had diplopia
at presentation. Rest of the patients had a poor visual acuity due to myopic retinal degeneration and hence had no diplopia. In these patients the surgery was performed for psychosocial benefit. At the last follow-up one patient had minimal diplopia which was not affecting his day to day activities. Hence our technique could also benefit those with intractable diplopia due to MSF.

Our study was limited by its retrospective nature. Also potential observational bias of the postoperative results could have been there although the deviation was measured by a senior optometrist and the senior author.

In conclusion, modified Loop myopexy with silicone band moderately improves alignment and is a safe and effective procedure for management of myopic strabismus fixus.

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