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Heba M. Ali
Memorial Institute for Ophthalmic Research, dr.hebametwally12@gmail.com

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Bimedial recti slanted recession versus bimedial recti Y-split recession for surgical management of infantile-onset esotropia

Heba M. Ali

Department of Pediatric Ophthalmology and Strabismus, Memorial Institute for Ophthalmic Research, Giza, Egypt

Abstract

Context

Bimedial recti Y-split recession is a new intervention for the weakening of the medial recti muscle in patients suffering infantile-onset esotropia. Few studies assessed the efficacy and safety of this procedure compared with other procedures that have been in use.

Aims

To evaluate bimedial recti slanted recession versus bimedial recti Y-split recession for surgical management of infantile-onset esotropia.

Patients and methods

This cohort study included patients with infantile esotropia. Patients were divided into two groups according to the procedure performed (bimedial recti Y-split recession or slanted recession). Patients were followed up on the first postoperative day, the first week, first month, 3 months, 6 months, and 1 year. In each visit, deviation and full ocular motility assessments were performed.

Results

The Y-split recession group showed a higher success rate than the slanted recession group (93.4 vs. 53.4%). Consecutive exotropia was detected in 6.7% of the slanted recession group, but was not observed in the Y-split recession group.

Conclusions

Bimedial recti Y-split recession was superior to bimedial recti slanted recession as manifested by the higher success rate of the former and the stability of its results all over follow-up visits until 1 year postsurgery.

Keywords: Convergence excess, infantile esotropia, medial rectus muscle, slanted recession, Y-split recession

Introduction

Infantile-onset esotropia is a common form of esotropia that is characterized by its early onset during the first 6 months of life, a time that represents a sensitive period of binocular vision development. The disease is also characterized by a large angle, cross-fixation, and variability with or without convergence excess [1].

The presence of variability and convergence excess in some cases calls for special nonconventional techniques in weakening the medial rectus (MR) muscle to avoid undercorrection in some cases and consecutive intermittent exotropia in others. The different surgical strategies for strabismus address the torque that is exerted by each extraocular muscle on the eyeball. The torque is the product of multiplying the force exerted by the muscle with the lever arm. Weakening of the affected muscle will decrease its torque. Therefore, treatment of infantile esotropia involves the reduction of either the force or lever arm to correct the condition [2,3]. Reduction of the force is commonly achieved by bilateral large MR recession. However, this technique can increase incomitance [4]. One of the strategies that reduce the lever arm is a technique called the bimedial recti

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Correspondence to: Heba M. Ali, MD, Department of Pediatric Ophthalmology and Strabismus, Memorial Institute for Ophthalmic Research, Al Ahram Street, Giza 23314, Egypt. Fax number: +20237740487; Tel: +01124224861; E-mail: dr.hebametwally12@gmail.com

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Y-split recession. This technique involves the splitting of the MR muscle into two halves for 15 mm behind the insertion, then the two halves are recessed and reattached at an angle of 65° to each other, so the effective lever arm of this muscle can be significantly reduced without consecutive exotropia [5,6].

Another commonly used technique is the bimedial recti slanted recession that involves splitting the MR muscle into two halves to avoid reunifying both halves. The two halves are recessed on two different levels according to the angle of deviation, with a difference of 2 mm between the recessed two halves [7]. Several theories evolved to explain the therapeutic effect of bimedial recti slanted recession in patients with infantile esotropia, including the presence of separate innervation for the upper and lower halves of the MR muscle, as well as the induced difference in the MR length in upward and downward gazes [8].

The present study aimed to compare the postoperative ocular alignment after the slanted recession and the Y-split recession of MR muscle bilaterally in patients with infantile esotropia.

Patients and Methods

Study design, settings, and ethical considerations

This cohort study was conducted at our institute during 2018–2020. The study protocol was approved by the local ethics committee. Informed written consent was obtained from the legal guardians of the participant after explaining the nature of the study and the possible complications. The confidentiality of data was maintained by keeping the records anonymous after assigning a specific code for each patient that was known by the investigators.

Eligibility criteria

Patients who were diagnosed with infantile esotropia with variable large angles were included in this study. The esotropia was documented by an ophthalmologist before the age of 6 months and was characterized by a variable angle of esotropia deviation and alternation of fixation.

The criteria of exclusion were recurrent deviation, any element of incommitancy, abnormal head posture, nystagmus-blocking syndrome, refractive accommodative esotropia, and the presence of central nervous system disorders.

Methods

Patients were categorized according to the surgical procedure to be performed into two groups: patients who underwent the bimedial recti slanted recession technique and the bimedial recti Y-split recession technique.

All patients were subjected to a complete ophthalmic examination to assess their eligibility for the procedure. Preoperative assessment included the measurement of ocular deviation at near and far using the alternate prism-cover test or Krimsky test in uncooperative patients. Ductions, versions, and oblique overactions were recorded. Cycloplegic refraction was done in all cases to exclude accommodative esotropias. Sensory evaluation, as well as examination of the anterior and posterior segments, was done in all cases.

All surgeries were performed under general anesthesia. After surgery, patients were followed up on the first postoperative day, the first week, the first month, 3 months, 6 months, and 1 year. In each visit, deviation and full ocular motility assessments were performed. The success of the surgery was defined as the presence of orthophoria or a residual angle of esotropia of 10Δ or less at distance and near fixation.

Statistical analysis

Data were analyzed using the Statistical Package for Social Science (SPSS), version 15.0 for Windows (SPSS Inc., Chicago, Illinois, USA). Quantitative data were normally distributed and expressed as mean ± SD. Qualitative data were expressed as frequency and percentage. Independent samples *t* test was used for comparing continuous numerical data, while the χ^2 test was used for testing the association between qualitative variables. A *P* value less than 0.05 was considered significant.

Results

Thirty patients were included in the present study. Fifteen patients underwent the bimedial recti Y-split recession, while the remainder underwent the bimedial recti slanted recession. Table 1 summarizes the patients' baseline characteristics. The two groups were comparable regarding their age, sex, and visual acuity ($P > 0.05$).

Table 2 demonstrates the findings at follow-up visits after surgery. The Y-split recession was associated with a significantly higher success rate than the slanted recession. Orthotropia was achieved in 86.7% in the Y-split recession group compared with 26.7% in the slanted recession group ($P = 0.003$). Residual angle was detected in 13.4% in the Y-split recession compared with 66.7% in the slanted recession technique. Consecutive exotropia was detected in one (6.7%) patient in the slanted recession group, while none was recorded in the Y-split recession group.

Discussion

In this study, we compared the results of Y-split recession with the slanted recession of bilateral MR in children with

Table 1: Comparison of baseline characteristics between the studied groups (total *n*=30)

Variables	Y-splitting (*n*=15)	Slanting (*n*=15)	*P*
Age (years)			
Mean±SD	3.2±1.2	3.4±1.4	0.7
Sex [*n* (%)]			
Male	7 (46.7)	8 (53.3)	0.8
Female	8 (53.3)	7 (46.7)	
VA, right			
Mean	0.5±0.13	0.6±0.12	0.1
VA, left			
Mean	0.7±0.12	0.6±0.11	0.6

Table 2: Comparison between the studied groups as regards follow-up (total *n*=30)

Variables	Y-splitting (*n*=15) [*n* (%)]	Slanting (*n*=15) [*n* (%)]	*P*
1st day			
Ortho	13 (86.7)	4 (26.7)	0.03*
Residual angle	1 (6.7)	6 (40)	
Residual angle + ortho with glasses	1 (6.7)	4 (26.7)	
Consecutive	0	1 (6.7)	
1st week			
Ortho	13 (86.7)	4 (26.7)	0.03*
Residual angle	1 (6.7)	6 (40)	
Residual angle + ortho with glasses	1 (6.7)	4 (26.7)	
Consecutive	0	1 (6.7)	
1st month			
Ortho	13 (86.7)	4 (26.7)	0.03*
Residual angle	1 (6.7)	6 (40)	
Residual angle + ortho with glasses	1 (6.7)	4 (26.7)	
Consecutive	0	1 (6.7)	
3rd month			
Ortho	13 (86.7)	4 (26.7)	0.03*
Residual angle	1 (6.7)	6 (40)	
Residual angle + ortho with glasses	1 (6.7)	4 (26.7)	
Consecutive	0	1 (6.7)	
6th month			
Ortho	13 (86.7)	4 (26.7)	0.03*
Residual angle	1 (6.7)	6 (40)	
Residual angle + ortho with glasses	1 (6.7)	4 (26.7)	
Consecutive	0	1 (6.7)	
1st year			
Ortho	13 (86.7)	4 (26.7)	0.03*
Residual angle	1 (6.7)	6 (40)	
Residual angle + ortho with glasses	1 (6.7)	4 (26.7)	
Consecutive	0	1 (6.7)	

**P* value less than 0.05 is considered significant.

infantile variable-angle esotropia. The goal of our study was to evaluate the efficacy of both techniques on the postoperative angle for far and for near, as well as evaluating the stability of postoperative results over a follow-up period of 1 year.

All patients were examined on the first postoperative day, then at 1 week, 1 month, 3 months, and then 6 months later. In each follow-up visit, we measured the best-corrected visual acuity, refraction, and ocular alignment for near and far, with and without glasses, and in upward and downward gaze in cooperative patients to detect any postoperative pattern.

We found out that the bilateral Y-split recession of MR muscles had a superior result over the slanted recession technique for the management of large variable-angle infantile-onset esotropia. At the first month postoperatively, the success rate was 93.4% in the Y-split recession group (86.7% orthotropic and 6.7% esotropic within 10Δ that was corrected with glasses). Only one (6.7%) patient had a residual angle of esotropia more than 10Δ for far and near. These results were superior to those obtained in the bilateral slanted MR recession as the success rate was 53.4% (26.7% orthotropic and 26.7% esotropic within 10Δ). No patterns have been detected. The results were stable over the period of follow-up.

Consecutive exotropia may occur after surgical interventions for esotropia. None of the patients who underwent the Y-split recession developed consecutive exotropia, while it was encountered in one patient only in the slanted recession group. The Y-split recession of MR causes reduction of the lever arm of the muscle (and consequently of its torque), without resulting in pulling the eyeball radially due to the lack of posterior attachment of the muscle to the globe [9,10].

In agreement with these findings, a success rate of 80% was reported by Gupta *et al*.[6] who assessed a modified Y-split recession in patients with infantile esotropia. Moreover, Badawi and Ismail[11] compared the Y-split recession to the Faden technique in infantile esotropia. They found that the two techniques had a success rate of 80% immediately after surgery, which increased to 88% in both groups by the end of the first postoperative month. They observed a lower rate of consecutive exotropia in the Y-split recession group (4 vs. 16%).

On the other hand, Badawi and Hegazy[9] compared the Y-split recession to the bilateral MR recession for the management of infantile esotropia and reported that the success rate of the Y-split recession immediately after surgery was 73 versus 67% in the other technique. However, they found that the rate of consecutive exotropia was higher in the Y-split group (13 vs. 6%). They also found that two patients in the Y-split group had worsening of their outcome at 6 months postsurgery. The discrepancy of these results with the results of the present study and other similar previous studies could be attributed to differences in baseline patients' characteristics (their age and presence of patterns), as well as the study design.

Regarding the slanted recession of Rajavi *et al*.[12] reported a success rate that was approximate to that of the present study (58%) in their subset of patients with esotropia with abnormal accommodative convergence to accommodation ratio.

However, other previous studies have reported a higher success rate of the slanted recession of the MR muscle. Ahadzadegan[13] stated that 69% of their patients showed a satisfactory reduction in deviation discrepancy. Gharabaghi and Zanjani [14], as well as Khalifa (2011) [15], evaluated three techniques (augmented MR recession, MR recession plus Faden, and slanted MR recession) in patients with convergence excess. They both reported a success rate of 70% for the slanted recession technique. Their results were constant over a follow-up period of 6 months. However, these three studies included only 10 patients in the slanted recession group, which could explain the reported higher success rate than ours (69 and 70% vs. 53.4%). Meanwhile, Bayramlar *et al*.[16] reported a rate of 87.5% in 16 patients, with one patient having overcorrection.

The Y-split recession of the MR muscle is considered an easier technique than the Faden operation in cases of infantile-onset esotropia [17]. However, the technique is more difficult than the MR recession as it comprises more steps and calls for the performance of a steeper limbal incision up to the intended refixation points with the splitting of the MR muscle about 15 mm from its insertion. We did not encounter any intraoperative complications with our cases, a finding that is shared also by previous studies. The safety of the Y-split recession technique, despite its difficulty, could be explained by the fact that all steps are performed on the anterior segment of the eye globe, with no need for accessing the posterior segment [17].

Despite its relative difficulty, the Y-split recession of MR has been reported to be stable and did not cause scarring at the site of operation, which facilitates the performance of another operation if needed [6,17]. Another advantage of a single Y-split procedure is sparing the lateral rectus and oblique muscle, which permits the conduction of other surgeries on them if further correction is required.

Up to the best of the authors' knowledge, the present study is the first to compare the bimedial recti Y-split recession to the bimedial recti slanted recession technique. The study was subject to some limitations, including its small sample size and the lack of randomization. We recommend the conduction of a randomized clinical trial with a larger sample size to further assess the efficacy and safety of both techniques relative to each other.

In conclusion, the bimedial recti Y-split recession had a higher success rate than the bimedial recti slanted recession in patients with variable-angle infantile-onset esotropia. Although the Y-split recession is more technically difficult, it is safe and no complications were encountered.

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Conflicts of interest
There are no conflicts of interest.

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