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Original article

Medial Rectus Muscle Combined Recession and Resection in Convergence-Excess Accommodative Esotropia

Mohammed F.Farid [a], Manar A.Ghali [b], Ibrahim A. ELSaadani [a], Hesham A.Abdelrazeq [a]

Abstract:

Purpose: The purpose of this study was to evaluate combined recession and resection of medial rectus muscles for the treatment of near-distance disparity esotropia. **Background:** Convergence excess esotropia is defined as esotropia that is greater for near fixation than for distance. An acceptable definition of convergence excess esotropia would be a convergent squint, which is greater for near fixation than distance fixation after full hypermetropic correction. Aim and objectives: To clearly illustrate how medial rectus muscles combined recession and resection surgery affects convergence-excess accommodating esotropia to produce the best possible binocular vision. **Patients and methods:** The prospective case-series study was conducted on 42 patients at Ophthalmology outpatient clinics in Benha University hospitals. **Results:** There was a high statistically significant difference between the near angle data and the stereopsis before and after operation $p<0.001$. The mean change in disparity was 26.33 ± 7.97 SD with range (3-35) degree and according to outcome there were 39 (92.9%) successful and 3 (7.1%) under correction. **Conclusion:** Convergence in accommodating esotropia undergoes considerable alterations before and after medial rectus combined resection and recession.

Key words: Medial rectus muscle; Recession; Resection; Convergence-excess accommodative esotropia; Esotropia.

[a] Ophthalmology Department, Faculty of Medicine Benha University, Egypt.

[b] Ophthalmology Department, Faculty of Medicine Zagazig University, Egypt.

Corresponding to:
Dr. Hesham A. Abdelrazeq.
Ophthalmology Department, Faculty of Medicine Benha University, Egypt.
Email: heshamatef041@gmail.com

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Introduction

Convergence excess esotropia is defined as esotropia that is greater for near fixation than for distance [(1)]. An acceptable definition of convergence excess esotropia would be a convergent squint, which is greater for near fixation than distance fixation after full hypermetropic correction [(2)]. Excessive convergence in response to an accommodative demand may be the cause; and this group of patients' accommodative convergence/accommodation (AC/A) ratio will be high [(3)]. However, some patients with normal, and even low, AC/A ratio may have this type of esotropia. When refractive accommodative factors contribute to the esotropia, but do not account for the entire deviation, we describe this condition as partly (or partial) accommodative esotropia (PAET) [(4).]

Medial rectus combined recession and resection procedure is that the medial rectus muscle was first resected by a given amount and was then reattached to the globe with the anterior edge of the muscle recessed from the original insertion or by an amount equal to or greater than the amount of resection. Many studies advocated the technique of bilateral combined resection and recession of medial rectus muscle for the treatment of convergence excess esotropia; this procedure depends on extirpating proprioceptive impulse at the myotendinous junction [(5,6)]

Palisade endings, which are found in myotendinous junction of medial rectus muscle is supposed to be the source of afferent feedback to the central nervous system. Therefore, their removal would, in theory, decrease centrally driven accommodative effort [(7).]

That technique allows weakening in the field of action of the medial rectus muscle. The combination of equal amounts of resection and recession serves to maintain the tension in the primary position. The extra amount of recession (near angle plus 1 mm) would allow more weakening in the field of action of a rectus muscle, corresponding to the medial rectus muscle. It is safe and easy in technique, has the advantage of employing a constant amount of augmentation and furthermore allows application of a similar approach to both patients with accommodative and non-accommodative convergence excess esotropia while achieving at least equal if not better short- and long-term clinical results. The main advantage is maintaining distance alignment while selectively reducing the near angle in patients with different levels of AC/A ratios [(7).]

In 1994, Scott described a technique in which a portion of the muscle is resected, and the muscle is simultaneously recessed for an amount equal to or greater than the amount of the resection. Therefore, the amount of recession must be at least the same as the amount of resection to produce a selective decrease in the function of the muscle in its field of action. Otherwise, the effect in primary gaze would be that of a resection, rather than of a posterior fixation. Scott used adjustable sutures in his patients in the same way they are used in standard adjustable rectus muscle surgery. He reported the use of this technique in 3 patients to correct horizontal gaze incomitance, with good results [(8).]

Thacker and colleagues reported that vertical and horizontal deviation managed with combined recess-resect procedures, recessing by double the amount of resection can significantly reduce incomitance and eliminate diplopia [(9).]

In 1999 Bock and colleagues applied Scott's technique on vertical and horizontal rectus muscles in 12 patients, with and without adjustable sutures. They modified Scott's technique by reducing the amount of resection. They obtained good results in four of five patients managed with adjustable sutures and in three of seven patients managed with fixed sutures [(5).]

Palisade endings are found abundantly in the insertional zone (at the extraocular

muscle myotendinous junction) of the lateral and medial rectus muscles, so resection of the insertional zone can lead to reduction in the number of palisade endings as well as the number of sarcomeres and motor endplates. Resection of the muscle tissue may be more proprioceptively "deafferenting" than recession due to disruption of palisade endings [7].

Patients and methods:

This was a prospective case-series study, interventional, randomized clinical trial on patients attending outpatient clinic of strabismus unit at Ophthalmology outpatient clinics in Benha University hospitals. The duration period was one year (from March 2022 to March 2023).

Inclusion Criteria: A total of 42 patients with convergence excess esotropia who have near esotropia that is greater than distance esotropia by 10 Δ or more who have worn spectacles incorporating full cycloplegic refraction for at least three months with failure of bifocal spectacles to correct this disparity for at least one month or failure of child to cope with bifocal glasses. Cooperative patients for preoperative and postoperative assessment and good mental conditions, aware and can express clear data for interpretation and for an accurate prism and cover testing at both near and distance fixation on an accommodative. Patients with high were included in this study.

Exclusion Criteria: Patients with other forms of esotropia; infantile, fully accommodative, sensory and incomitant esotropia, Patients with previous extraocular muscle surgery, Patients with co-existing horizontal and vertical , Patients with satisfactory alignment and binocular vision with bifocal add for near fixation, Patients with Amblyopia at the time of surgery, Patients with oblique muscle dysfunction, Patients with any media opacities, retinal disease, optic disc disease or other ocular problems deviations and un-cooperative patients; too young patients and the presence of mental disorder which interrupts patient's assessment.

Sample size: 42 Cases.

Sample Type: Random.

Methods: The following data has been obtained for each study participant:

Personal history taking:

1. Age.
2. Complete medical history.
3. Complete ophthalmic history including glass wear, ocular trauma or any ocular surgeries.

Ophthalmic examination:

1. Visual acuity and best corrected visual acuity measurement using the Landolt's broken ring chart or LEA chart.
2. Refraction measurements will be performed with cyclopentolate 1% instilled 30–40 minutes before retinoscopy or autorefractometer.
3. Motility examination in all directions of gaze for duction and version movements with assessment of under-actions or over-actions of each extra-ocular muscle if present.
4. Measurement of angle of deviation at near and at distance with glasses using prism and alternate cover test.
5. Slit lamp biomicroscopy.
6. Fundus examination using indirect ophthalmoscopy or non-contact lens slit-lamp biomicroscopy.
7. AC/A ratio was measured for cooperative patients by gradient method in near fixation, by measuring the difference between angle at near fixation with and without +3 lenses divided by +3 while wearing full cycloplegic correction. Patients were classified according to AC/A ratio into 3 categories:
    a. Normal AC/A ratio (range: 3-5:1).
    b. High AC/A ratio (>5:1).
    c. Low AC/A ratio (<3:1).

Surgical procedure:

Patients underwent combined bimedial rectus muscles resection 2.5 mm from the

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insertion end with recession based on near angle esotropia according to current surgical tables with 1 mm add of recession for each muscle.

Outcome measures

The primary outcome was orthophoria or esotropia less than 10Δ at near and distance fixation, and reduction of the near-distance disparity to less than 10Δ even if achieved using glasses (refractive glasses not bifocal or prismatic glasses if it maintains best corrected visual acuity at far and near without inducing asthenopia)

The patients have been followed up at 1 week postoperatively and then at 1, 3, 6 months for the stability of correction and incidence of consecutive exotropia.

The results were based on the deviation measured at the last follow-up examination.

Ethical Consideration

The study protocol was submitted for approval by the ethics committee, faculty of medicine, Benha University **{M.S.5.8.2023}.**

Informed consent was obtained from each participant in the study after assuring confidentiality.

Statistical analysis

The data entered the computer was analyzed using the IBM SPSS software package version 20.0. New York, Avon: IBM Corp2011 . Qualitative facts were expressed in terms of numbers and percentages. The distribution's normality was confirmed using the Kolmogorov-Smirnov test. Quantitative data were described using the following metrics: range (minimum and maximum), mean, standard deviation, median, and interquartile range (IQR). The findings were deemed significant at the 5% level. The used tests were paired t-test: For numerical variables that are normally distributed, to compare two measures that were taken more than once. This study looked at 42 outpatients at Benha University's Ophthalmology Hospital. It was a prospective case-series study.

Results

Fifty-three patients were enrolled in this study, 11 of them were excluded (7 didn’t meet our inclusion criteria and 4 declined to participate), so we were left with 42 cases included in the study (Figure 1).

This study was a prospective case-series study that was performed in Ophthalmology outpatient clinics in Benha University over 42 outpatients.

The main results of the study revealed that:

- The mean age of the studied cases was 10.98 (±5.29 SD) with range (3-20) and according to sex among the studied cases there were 23 (54.8%) females and 19 (45.2%) males. (Table 1)
- The mean spherical equivalent refraction (OD) of the studied cases was 3.25 (±2.03 SD) with range (0.5-8), mean spherical equivalent refraction (OS) was 3.23 (± 1.82 SD) with range (0.5-8), the mean BCVA (OD) was 0.26 (±0.33 SD) with range (0-0.9) and the BCVA (OS) was 0.2 (±0.26 SD) with range (0-0.6). The mean change in disparity was 26.33 (±7.97 SD) with range (3-35) degree and according to outcome there were 39 (92.9%) successful and 3 (7.1%) under correction. (Table 2).
- There was a high statistically significant difference between the angle data for near before and after operation. There was high statistically significant difference between the stereopsis before and after operation. (Table 3)

Table 1: Distribution of the studied cases according to personal data

	Subjects (n = 42)	
Age (yrs)		
Range	3 – 18	
Mean ± SD	8.81 ± 4.51	
Sex	No.	%
Female	23	54.8
Male	19	45.2

Data are presented as frequency (%) unless otherwise mentioned, SD: standard deviation.

- The mean age of the studied cases was 8.81 (±4.51 SD) with range (3-18) and according to sex among the studied cases there were 23 (54.8%) females and 19 (45.2%) males as shown in table 2.
All the cases had a high AC/C ratio.

Table 2: Distribution of the studied cases according to risk factors and outcome.

	Subjects (n = 42)	
Spherical equivalent refraction (OD)		
Range	0.50 – 8 (diopters)	
Mean ± SD	3.25 ± 2.03d	
Spherical equivalent refraction (OS)		
Range	0.50 – 8 (diopters)	
Mean ± SD	3.23 ± 1.82d	
BCVA (OD) (Log MAR)		
Range	0 – 0.9	
Mean ± SD	0.26 ± 0.33	
BCVA (OS) (Log MAR)		
Range	0 – 0.6	
Mean ± SD	0.2 ± 0.26	
Collapse in disparity		
Range	3 – 35 degrees	
Mean ± SD	26.33 ± 7.97 degrees	
Outcome	No.	%
Success	39	92.9
Under correction (Residual esotropia)	3	7.1

Data are presented as frequency (%) unless otherwise mentioned, SD: standard deviation, presented as mean ± SD, SD: Standard Deviation.

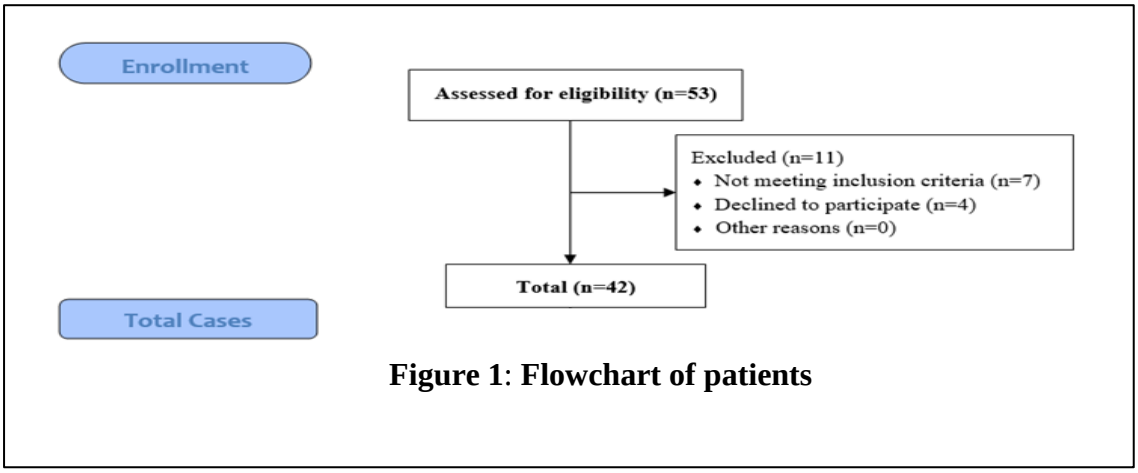

Figure 1: **Flowchart of patients**

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- The mean spherical equivalent refraction (OD) of the studied cases was 3.25 (±2.03 SD) with range (0.5-8), mean spherical equivalent refraction (OS) was 3.23 (± 1.82 SD) with range (0.5-8) , the mean BCVA (OD) was 0.26 (±0.33 SD) with range (0-0.9) and the BCVA (OS) was 0.2 (±0.26 SD) with range (0-0.6) as shown in table 2.
- According to the decision all cases had bilateral combined recession and resection of medial rectus muscles.
- The mean change in disparity was 26.33 (±7.97 SD) with range (3-35) degree and according to outcome there were 39 (92.9%) successful and 3 (7.1%) under correction.
- As shown in Table 2 successful reduction of near-far disparity was achieved in 39 cases.

Table 1: Comparison between pre-operative and post-operative angles in all cases and they are often measured in degrees (°) stereopsis

	Cases		t	P
	Pre-Operative	**Post-Operative**		
Near (With glasses)				
Range	15 – 40	0 – 10	21.571	<0.001*
Mean ± SD	32.26 ± 7.35°	4.29 ± 3.55°		
Distance (With glasses)				
Range	5 – 15	0 – 5	1.432	0.15 NS
Mean ± SD	10.36 ± 3.84°	0.61 ± 1.62°		
Distance Near Disparity				
Range	10 – 35	0 – 5	20.76	<0.001*
Mean ± SD	27.64 ± 7.6°	1.31 ± 2.19°		
Stereopsis				
Range	300 – 800	60 – 200	16.176	<0.001*
Mean ± SD	559.52 ± 178.1°	112.38 ± 55.16°		

Data are presented as mean ± SD, SD: Standard Deviation .NS: non-significant (P>0.05) *: Significant (P<0.05) **: Highly significant (P<0.001)

- There was high statistically significant difference between the angle data before and after operation.
- There was high statistically significant difference between the stereopsis before and after operation as shown in table 3.

Discussion

Convergence excess esotropia is larger at fixation than distance. Convergent excess esotropia is a convergent squint higher for close fixation than distance fixation following full hypermetropic correction. Excessive convergence in response to accommodating demand may produce this group of patients' high AC/A ratio. However, patients with normal or low AC/A ratio may have this type of esotropia [10]. A satisfactory result was defined as orthophoria or esotropia of, 10 Δ at near and distance fixation, with reduction of the near-distance disparity to, 10 Δ. The patients were followed up 1 week postoperatively and then at 1, 3, 6, 12, 18 and 24 months for stability of correction and incidence of consecutive exotropia. The results were based on deviation measured at the last follow-up examination.

The main results of our study were as following:

This study was performed on 42 patients who underwent combined recession resection for both MR muscles.

Demographic data

Our study showed that the mean age of the studied cases was 10.98 years (±5.29 SD) with range (3-20 years) and according to sex among the studied cases there were 23 (54.8%) females and 19 (45.2%) males.

Pre-operative angle measurements

Regarding pre-operative angle measurements in our study:

The mean distance angle for all cases was (10.36±3.84 pd). This was higher than [11] whose mean value was (9.75±7.50 pd) and lower than studies which showed that ([12]) mean value was (12 pd). This was probably because parents of children whose distant deviations were small were less likely to accept surgery, so they were less likely to be included in our study.

The mean near angle for all cases was (32.26±7.35 pd), This is lower than [12] who found it to be (36 pd) and higher than [13] who found it to be (30.50±7 pd).

The Mean distance-near disparity for all cases was 27.64 ± 7.6 pd. This is higher than [7, 11, 12, 14 ,15], who found it to be (20.5±5, 23, 24, 20.3±6.5) and (16.5 pd) respectively.

Post-operative angle measurements

Regarding post-operative angle measurements in our study.

Mean distance angle for all cases was (0.61±1.62 pd) more than others [11 , 12] who found it to be 0.5 and 0 respectively.

Mean near angle for all cases was (4.29±3.55 pd) was less than [12] who found it to be (6 ±3 pd).

The mean distance-near disparity for all cases (1.31±2.19 pd) was lower than [11] (3.5±3 pd) and [7] who found it to be (4.5 pd)

The mean reduction of distance-near disparity for all cases was 26.33 (±7.97 SD) was more than [11] who found it to be (17 pd), **[7]** who found it to be (18.5 pd) and [12] who found it to be (18.8 pd).

Convergence excess esotropia is larger at fixation than distance. Convergent excess esotropia is a convergent squint higher for close fixation than distance fixation following full hypermetropic correction. Excessive convergence in response to accommodating demand may produce this group of patients' high AC/A ratio. However, patients with normal or low AC/A ratio may have this type of esotropia. [10]

Medial rectus combined recession and resection procedure: the muscle was first resected by a given amount and then reattached to the globe with the anterior edge recessed from the original insertion or by an equal or greater amount. Many research recommended bilateral simultaneous excision and recession of medial rectus muscle for convergence excess esotropia, which involves removing proprioceptive impulse at the myotendinous junction. [10]

In the myotendinous junction of medial rectus muscle, palisade terminals provide afferent feedback to the CNS. Thus, their elimination should reduce centrally driven accommodating effort. [13]

Medial rectus muscle weakness is achieved with this approach. Equal amounts of resection and recession maintain primary position tension. Extra recession (near angle plus 1 mm) would diminish the medial rectus muscle's field of action. **[10]**

The aim of our study was to precisely demonstrate the effect of medial rectus combined resection and recession surgery on the convergence-excess accommodative esotropia to achieve maximum possible binocular vision.

In a study done previously [12] five patients with true convergence excess esotropia were surgically managed with combined resection and recession of the medial rectus muscles. This technique was chosen to address the near/distance angle disparity. Five patients, two girls and three boys, were treated with the combined resection/recession procedure. The mean age of the study group was 5.88 years (median, 4.2 years).

In a study by [11] performed prospective study included 28 patients diagnosed with convergence excess esotropia who had

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worn their full cycloplegic refraction and/or bifocal glasses for at least 6 months and still had near-distance disparity esotropia. The patients were divided into 2 groups; Group I underwent combined bimedial rectus muscles resection 2.5 mm from the insertion end with recession based on near-angle esotropia according to current surgical tables with 1 mm add of recession for each muscle, while Group II underwent bimedial recession based on far angle combined with retro equatorial myopexy at 13–14 mm from insertion. In Group I (14 patients; 8 girls and 6 boys) ages (6.36±1.75) ranged from 3.5–9 years. While in Group II (14 patients; 7 girls and 7 boys) age (6.43±2.09) ranged from 3.5–10 years.

The mean spherical equivalent refraction (OD) of the studied cases was 3.25 (±2.03 SD) with range (0.5-8), mean spherical equivalent refraction (OS) was 3.23 (± 1.82 SD) with range (0.5-8), the mean BCVA (OD) was 0.26 (±0.33 SD) with range (0-0.9) and the BCVA (OS) was 0.2 (±0.26 SD) with range (0-0.6).

In a study [16] the mean spherical equivalent refraction was +2.7±1.6 (range: 0-5) diopters, and the average follow up was 28.6 ± 12.1 months (range: 3.5–48 months).

Our study showed that there was high statistically significant difference between the near angle data before and after operation

In Group I, it was shown [11] that 7 patients with high AC/A ratio (50%), 6 patients with normal AC/A ratio (43%) and 1 patient with low AC/A ratio (7%). Preoperative near-distance disparity (22.21±6.03) ranged from 15 Δ–27 Δ. The preoperative angle at far was (8.43±7.03) and at near (30±6.79). As regards the refractive error; 8 (57%) patients were bilateral hypermetropic (2D–6.5D) and 6 patients (43%) were bilateral emmetropes with no myopic patients.

While in Group II it was shown [11] that (43%) patients with high AC/A ratio, 7 (50%) patients with normal AC/A ratio and 1 (7%) patient with low AC/A ratio with preoperative near for disparity (20±3.86) ranging from 15 Δ to 26 Δ. The preoperative angle at far was 11.07±8.00 and at near was 31.07±7.12. Among Group II, 7 (50%) patients were bilateral hypermetropic, with error ranging from 1.5 to 5.5 D; 6 (43%) patients were bilateral emmetropic; and 1 patient (7%) was bilateral myopic with refractive error of −2D.

At last visit postoperatively it was proved [11] that the postoperative angle at far in Group I was 0±0 and at near was 3.57±2.85, with reduction of near-distance disparity to 3.57±2.85. However, in Group II, the postoperative angle at far was 0±0 and at near was 9.21±5.75, with reduction of near-distance disparity to 9.21±5.75.

In a recent study [16] the mean angle of esotropia before the operation was 31±10 PD and 45±11.3 PD for distance and near deviations, respectively, with a distance-near disparity of 14±4.5 PD. These values decreased to 2.4±3 PD, 3.6±3.8 PD, and 1.3±1.8 PD at the final follow-up, respectively. These values did not significantly differ between earlier postoperative visits versus the final follow-up.

Our study showed that there was high statistically significant difference between the stereopsis before and after operation

In a recent study [16], there was no change in adduction or abduction in this series after operation. The mean corrected visual acuity before the operation was 0.2 ± 0.2 log MAR that improved to 0.1 ± 0 log MAR at the final visit ($p = 0.015$). While no patients had stereopsis in this series before the operation, 5 subjects showed some degrees of stereopsis at the final visit.

The same recent study done 2021 [16] an analysis comparing 5 cases who gained stereopsis with the rest of patients, was performed. This analysis showed that duration of strabismus before operation in the first group was significantly shorter than the second group (37.2 ± 29.5 months

compared to 72.9 ± 21.7 months, p = 0.02). Furthermore, in patients who gained stereopsis the distance near disparity (clinical AC/A ratio) and the improvement in disparity were both significantly higher (19.0 ± 2.2 PD versus 11.2 ± 2.4 PD, p < 0.001 and 18.0 ± 2.7 PD versus 9.8 ± 2.6 PD, p < 0.001, respectively)

Our study showed that the mean change in disparity was 18.9 (±6.84 SD) with range (3-30) degree and according to outcome there were 39 (92.9%) successful and 3 (7.1%) under correction.

A study [(12)] reported that one patient developed consecutive exotropia for distance. This was controlled for a period of 6 months following a botulinum toxin injection to the lateral rectus muscle. At 6 months follow-up the strabismus had decompensated. The medial rectus muscle was readvanced with good effect, i.e., binocular control of the deviation was achieved at both near and distance fixation distances. In all other patients there were no intraoperative, early postoperative or late postoperative complications. At final follow-up all patients were asymptomatic and showed good long-term stability in sensory and motor outcomes. Binocular single vision was demonstrable at distance fixation by the presence of an esophoria with good recovery to straight ocular alignment and in near fixation by the presence of fusional vergences and stereoacuity.

In a case series all patients underwent recessions that were equal or slightly larger than the resections. A resection of 4 or 5 mm with an equal or slightly greater recession corrected the near-distance disparity that ranged from 16 to 38. The aim was to maintain the distance measurement while selectively reducing the near measurement [(12)].

Two patients in the previous study [(12)] had no distance esotropia when surgery was scheduled; however, in the 1- to 2-month interval that elapsed before the date of surgery, the alignment decompensated at distance. This new onset distance esotropia was not considered when surgery was planned; therefore, these two patients were not excluded from their study. The one patient who required further surgery for a consecutive distance exotropia had less hypermetropia than the other patients in this study. This may have contributed to the overcorrection in this case. One other concern with this technique was the possibility of creating a difficult reoperation scenario in the event of overcorrection. While large resections can cause difficulty in readvancement of the muscle, large recessions can produce problems with locating and suturing the muscle during a repeat surgical intervention.

In a study done in 2017, Group I, showed that all cases showed satisfactory results (100%) with orthophoria or esotropia of 10Δ at near and far with reduction of the near-distance disparity to 10Δ with no cases of latent exotropia and, stability throughout the follow-up period. While in Group II, 4 cases showed under-correction and near angle of deviation >10 Δ, and near–far disparity >10 Δ with satisfactory results of only 71.4% [(11)]

In a study done in 2017, Group II underwent recession according to far angle of deviation. Their results showed no incidence of exotropia at far, but the success rate was 71.4%, with 4 cases with near-distance disparity >10 PD [(11)].

A study **[(16)]** showed that the success rate of this procedure in terms of ocular alignment was 78.6%. All patients except one (92.9%) could ultimately remove the bifocal glasses, and stereopsis was improved in five patients (35.7%) after the surgery.

Conclusion

Convergence in accommodating esotropia undergoes considerable alterations before and after medial rectus combined resection and recession which is an easy and safe technique that shows better results in the treatment of near–far disparity, though

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large sample size and longer follow-up periods are still needed.

Conflict of interest

None of the contributors declared any conflict of interest.

References

1. Donders FC and Moore WD. On the anomalies of accommodation and refraction of the eye: With a preliminary essay on physiological dioptrics. Vol. 22. New Sydenham Society; 1864.
2. Garretty T. Convergence excess accommodative esotropia: a descriptive review of patients presenting over a period of 10 years. British and Irish Orthoptic Journal. 2011;8:23–8.
3. Metwally H. Comparative Study of the Faden Technique versus the Y split recession in management of Esotropia with Near-Distance disparity. Minia Journal of Medical Research. 2019;30(1):267–74.
4. Wygnanski-Jaffe T, Trotter J, Watts P, Kraft SP and Abdolell M. Preoperative prism adaptation in acquired esotropia with convergence excess. Journal of American Association for Pediatric Ophthalmology and Strabismus. 2003;7(1):28–33.
5. Bock Jr CJ, Buckley EG and Freedman SF. Combined resection and recession of a single rectus muscle for the treatment of incomitant strabismus. Journal of American Association for Pediatric Ophthalmology and Strabismus. 1999;3(5):263–8.
6. Lienbacher K, Mustari M, Ying HS, Büttner-Ennever JA and Horn AKE. Do palisade endings in extraocular muscles arise from neurons in the motor nuclei? Invest Ophthalmol Vis Sci. 2011;52(5):2510–9.
7. Somer D, Cinar FG, Oral B and Ornek F. Combined recession and resection surgery in the management of convergence excess esotropia with different levels of AC/A ratio. Journal of American Association for Pediatric Ophthalmology and Strabismus. 2017;21(1):7-e1.
8. AB S. Posterior fixation: adjustable and without posterior sutures. Update on strabismus and pediatric ophthalmology. 1994;
9. Thacker NM, Velez FG and Rosenbaum AL. Combined adjustable rectus muscle resection—recession for incomitant strabismus. Journal of American Association for Pediatric Ophthalmology and Strabismus. 2005;9(2):137–40.
10. Awadein A, Gouda J, Elhilali H and Arnoldi K. Convergence Excess Esotropia. J Binocul Vis Ocul Motil. 2023;73(4):131–59.
11. Ghali MA. Combined resection–recession versus combined recession–retroequatorial myopexy of medial rectus muscles for treatment of near-distance disparity Esotropia. Clinical Ophthalmology. 2017;1065–8.
12. Ramasamy B, Rowe F, Whitfield K, Nayak H and Noonan CP. Bilateral combined resection and recession of the medial rectus muscle for convergence excess esotropia. Journal of American Association for Pediatric Ophthalmology and Strabismus. 2007;11(3):307–9.
13. Al-Hayouti H, Awadein A, Gawdat G and Elhilali H. Augmented medial rectus muscle recession versus medial rectus recession with posterior scleral fixation in partially accommodative esotropia: a randomized clinical trial. Journal of American Association for Pediatric Ophthalmology and Strabismus. 2020;24(5):274-e1.
14. Bayramlar H, Ünlü C and Dag Y. Slanted medial rectus recession is effective in the treatment of convergence excess esotropia. J Pediatr Ophthalmol Strabismus. 2014;51(6):337-340.
15. Khalifa YM. Augmented medial rectus recession, medial rectus recession plus Faden, and slanted medial rectus recession for convergence excess esotropia. Eur J Ophthalmol. 2011;21(2):119-124.
16. Bagheri A, Abbasnia E and Tavakoli M. Modified Y-split and recession of medial rectus muscles in convergence excess esotropia. Eur J Ophthalmol. 2021;31(6):3386–93.

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