

New Varices Modalities in Management of Intermittent Exotropia

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Abstract

Purpose: To compare the surgical outcome of three treatment modalities used for correction of convergence insufficiency intermittent exotropia.

Materials and methods: An interventional prospective study that included 105 cases with convergence insufficiency intermittent exotropia. Study that was conducted at eye hospital in Muscat city Oman country region, KSA from May 2015 to April 2018. Patients were randomly allocated between three treatment groups according to their order of presentation: group A included patients treated with bilateral lateral rectus recession, group B included patients treated with bilateral medial rectus tucking and group C that included patients treated with bilateral medial rectus resection.

Results: No statistical significance difference ($P > 0.05$) was found between the 3 groups as regards postoperative orthophoria and recurrence of exotropia. Group A showed a statistical significant difference ($P < 0.05$) with both groups B and C as regards less postoperative overcorrection and higher postoperative under correction in older age group during the follow up duration of the study. Also, bilateral medial rectus resection or tucking were more effective in older age group but can induce overcorrection in younger age group.

Conclusion: The three approaches used in the study are equally effective for surgical correction of exotropia. However, bilateral lateral rectus recession could have significantly less postoperative overcorrection and higher postoperative under correction than bilateral medial rectus tucking or resection.

Introduction

Previous literatures suggest that 20.4% of strabismus is exotropia. However, this number is likely an underestimate because of the typical intermittency seen in exotropia [1]. Intermittent exotropia is the most frequent type of divergent strabismus and is a large exophoria that intermittently breaks down to an exotropia [2]. Occluding one eye breaks fusion and will manifest the exotropia. It is characterized by fluctuations in the visual sensory system when fusing, the eyes are straight involving binocular vision and stereo acuity is excellent, but when tropic, there is large hemi-retinal suppression of the deviated eye [3,4]. Intermittent exotropia expresses early in childhood and rarely associates neurological development anomalies [5,6]. Earlier literatures have classified intermittent exotropia into

three types, based on distance / near differences. The first type is basic intermittent exotropia in which the difference between distance and near deviation 10 prism diopters or less. The second type is divergence excess intermittent exotropia in which the distance deviation exceeded the near deviation by more than 10 prism diopter, it may be true divergence excess or pseudo in which near deviation increases within 10 prism diopters of the distance deviation after 60 minutes of monocular occlusion. The third type is Convergence Insufficiency in which the near deviation is higher and larger than the distance deviation more 10 prism diopters with/without low AC/C ratio [7,8].

Treatment of strabismus is directed toward following goals, obtaining a favorable appearance of eye alignment, eliminating suppression to obtain a normal visual acuity in each eye and lastly obtaining and/or improving fusion and binocular vision [9].

Despite nonsurgical treatment programs for intermittent exotropia in children such as patching, orthoptic therapy and optical correction, surgical correction has remained the cornerstone of therapy for this type of strabismus. Surgery for intermittent exotropia at younger ages may develop better postoperative binocular vision [10]. However, in more than 50% of patients who experience exotropia, deviation increases 10 or more diopters within few years from diagnosis, which means that half of patients with intermittent exotropia, shall undergo surgical treatment [11].

Clinical options regarding treatment of intermittent exotropia vary widely and there is controversy as to which treatment modality is the most successful. Nonsurgical treatment, is appropriate in many cases with various degrees of success for this type of strabismus, but the highest success rate (61%) was seen in patients undergoing strabismus surgery although quite frequently, more than one operation is needed to obtain stable orthophoria [12]. In spite of the disagreement regarding the best surgical approach; several surgical options exist for correction of exotropia. Due to the large variability of the results achieved with bilateral identical surgical procedures in patients with exotropia, with the same angle of deviation, the aim of this study was to compare the surgical results and to determine the stability of alignment between bilateral recession of the Lateral Recti (LR) bilateral medial rectus resection and lastly bilateral medial rectus

tucking for the correction of the convergence insufficiency type intermittent exotropia.

Patients & Methods

A prospective interventional study that was conducted at eye hospital in Muscat city Oman country region, KSA from May 2015 to April 2018. It included 105 patients suffering from convergence insufficiency intermittent exotropia. Informed consent was obtained from all patients or their parents before enrollment in the study. The approach and the demand for re-operation were explained to all patients before surgery. Patients were randomly allocated between three groups according to their order of presentation. Group A: included patients treated with bilateral lateral rectus recession. Group B included patients treated with bilateral medial rectus tucking. Group C included patients treated with bilateral medial rectus resection. All surgeries were performed by the author. All patients were subjected to full ophthalmic examination especially the cover tests, ocular motility, cycloplegics refraction and visual acuity with and without glasses. The angle of exodeviation was measured using the prism and alternate cover test at 1/3 meter

and 6 meters before and after monocular occlusion for at least one hour to quantify the deviation. Adding + 3.0 D did not affect the deviation in all patients, indicating normal or low AC / A ratio. *Inclusion criteria* were convergence insufficiency type of intermittent exotropia with exodeviation angle 15 - 50 prism diopter (treated by two muscle surgery), near deviation is more 10 prism Diopters than the distance deviation, normal or low AC / A ratio, Best Corrected Visual Acuity (BCVA) at least 20/30 in both eyes with no amblyopia and a follow up for at least 9 months postoperatively. *Exclusion criteria* included angle of exotropia more than 50 PD which in need to three muscle surgery, previous strabismus surgery, amblyopia, vertical muscle dysfunction or A or V - pattern, other types of exotropia (basic, divergence excess, sensory and consecutive) angle of deviation more than 50 prism diopter as it in need for three muscle surgery, previous retinal detachment treated with conventional scleral buckle surgery. The indications for surgery were deterioration of the frequency and /or amplitude of the exotropia, as well as for cosmetic reasons. The quantity of surgical dosage. The amount of lateral rectus recession and the amount of medial rectus resection used in this study were determined according to the popular surgical formula used by previous investigators [14,15] (Table 1).

Table 1: The surgical formula used

Angle of deviation prism diopter(Δ)	Récession LR (OU), mm.	Resection or tucking MR, mm.
15	4.0	3.0
20	5.0	4.0
25	6.0	5.0
30	7.0	5.5
35	7.5	6.0
40	8.0	6.5
50	9.0	7.0

The main outcome measure was successful alignment which is defined as orthotropia, exophoria ± 10 PD or esophoria ± 5 PD at both distance and near measurements on the final examination. Postoperative incomitance was diagnosed when alignment changed more than 10 Δ from primary to side gaze. Data were analyzed using SPSS version 16, and the result was considered statistically significant if P ≤ 0.05.

Results

Group A included 35 patients; 19 males (48.7%) and 16 females (41.3%) The mean age of the patients at onset of exotropia was 7.2 ± 19.8 years (range: 4 - 29 years), while the mean age at time of surgery was 13.4 ± 15.3 years (range: 9 - 45 years). 12 patients were ≤ 14 years and 23 patients were > 14 years old. The mean preoperative deviation was 30.0 ± 8.66 prism diopters (PD) and the mean follow-up period after surgery was 6.3 ± 4.2 (6 -11 months). Group B included 35 patients; 20 males (57.1%) and 15 females (42.9 %). The mean age of the patients at onset of exotropia was 6.8 ± 14.9 years (range: 3 - 25 years), while the mean age at time of surgery was 12.9 ± 18.9 years (range: 8 - 40 years). 12 patients were ≤ 14 years and 23 patients were > 14

years old. The mean preoperative deviation was 32.53 ± 10.42PD and the mean follow-up period after surgery was 7.5 ± 3.8 (6 -10 months). Group C included 35 patients; 9 males (25.7 %) and 26 females (74.3%). The mean age of the patients at onset of exotropia was 6.4 ± 11.3 years (range: 3 - 25 years), while the mean age at time of surgery was 11.4 ± 17.1 years (range: 8 - 41 years). 13 patients were ≤ 14 years and 22 patients were > 14 years old. The mean preoperative deviation was 29.73 ± 9.81PD and the mean follow-up period after surgery was 7.1 ± 3.2 (6 -11 months). No statistically significant differences were found between the three groups as regards the preoperative data and mean follow up period. The mean refractive errors (spherical equivalent) in patients of the three groups are shown in (Table 2), with no significant differences between the three groups (P > 0.05).

By the end of the follow up, correction within 10 Δ of orthotropia was found in 26 (74.28%) patients in group A. 26 (74.28%) patients in group B and 28 (80 %) in group C, with no statistically significant difference between groups (P > 0.05) Most cases of orthotropia in the group A occurred in younger age group

Table 2: The mean refractive error (spherical equivalent) in patients of the three groups

Refractive error (Spherical equivalent)	Number of patients		
	Group A	Group B	Group C
- 3.0 to + 3.0 D or emmetropia	25	20	28
Hyperopia > + 3.0 D	4	6	1
Myopia > - 3.0 D	6	9	6

*D = Diopter.

(≤ 14 years), but in group B and C occurred in older age group (> 14 years). Consecutive overcorrection occurred in 1 patients (2.85 %) in group A and 5 patients (14.28 %) in group B, and 6 patients (17.14%) in group C, the differences between group A with group B and group C were statistically significant (P < 0.05). All cases of overcorrection in the three groups occurred in younger age group (≤ 14 years). Under correction was reported in 8 patients (22.85%) in group A and 4 patients in group B (11.47%) and

all occurred in older age group (> 14 years). one case (2.85 %) recorded case of under correction in group C. The differences between group A with group B and group C were statistically significant (P < 0.05). Recurrence of exotropia recorded in two cases (5.71 %) in group A and one case (2.85 %) in each one of group B and C. the differences between groups are statistically insignificant (P > 0.05) (Table 3).

Table 3: Postoperative outcome 9 months after surgery in group A, B and group C

Anatomical Outcome	Group A	Group B	Group C	P Value
Within 10 Δ of Orthotropia	26	26	28	> 0.05
Overcorrection > 10 Δ	1	5	6	< 0.05
Under correction > 10 Δ	8	4	1	< 0.05
Recurrence	2	1	1	> 0.05

Re surgical correction for persistent residual exotropia or overcorrection cases with consecutive esotropia was done after three months from the primary surgery. For residual exotropia in group A all cases was subjected to unilateral medial rectus resection and in group B and C was subjected to unilateral lateral rectus recession. For overcorrected cases all cases in the three groups subjected to alternate patches for 4 hours/day for two weeks which control the condition only in one case in group B persistent cases after two weeks subjected to possible change in glasses e.g. temporary discard of minus lenses, or increase in any plus correction or temporary base out prism if persistent cases for more than two months after surgery all patients subjected to re surgical correction in form of lateral rectus anterior advancement in one case of group A and medial rectus recession in the five cases in group B and six cases in group C. Management of recurrent cases was the two case in group A subjected to one medial rectus resection and the other patients one case in each group B and C was subjected to unilateral lateral rectus recession. Postoperative results of all residual, consecutive and recurrent cases was satisfactory with 10 diopter orthotropia in all cases all over the follow up period.

Incomitance complication with some sort of abduction limitation in the operated eyes occurred in two patients (5.71 %) in group A had -1 degree limited abduction, in two patients (5.71 %) in group B had also -1 degree limited abduction and lastly in three patients (8.57%) in group C two cases had -1 degree limited abduction and one case had -2 degree limited abduction. This restricted motility occurred mostly in cases with preoperative big angle of exotropia deviation 45-50 prism diopters in the three

groups. The difference between the three groups was statistically insignificant (P > 0.05)

Discussion

The best surgical procedure for treatment of convergence insufficiency type of intermittent exotropia is still unclear [16]. The principle of orthotropia or a residual intermittent tropia less than 10 diopters to determine success in the present study nearly the same like the studies by Richard and Parks [17] and, more recently, Stoller and colleagues [18] but this in disagreement with The previous study by Pratt-Johnson and associates [19] or Ing et al [20] who chose no residual tropia to be the criterion of success in the treatment of intermittent exotropia. Patients with convergence insufficiency intermittent exotropia could be treated equally satisfactorily by bilateral LR recession, bilateral medial rectus resection or a unilateral recess / resect surgery, depending on the surgeon's preference [22]. The results of this study proved that the surgical outcome of the different procedures in the three groups is not related to a differential effect on the distance versus near deviation as [23,24] have reported before. The main issue in the surgical treatment of convergence insufficiency intermittent exotropia is the presence of the tenacious proximal fusion mechanism, which helps to maintain alignment after surgery [25,26]. Kushner [8] stated that patients with intermittent exotropia have a tenacious proximal fusion (TPF) mechanism that helps to maintain alignment after surgery. Accordingly, he proposed that those patients could be treated either by bilateral lateral rectus recession, bilateral medial rectus resection or a unilateral recess / resect procedure in agreement with our study.

The three approaches used in this study are nearly equally effective for surgical correction of exotropia with no statistically significant difference between them. Medial rectus tucking procedure has privilege of safe approach with no chance of muscle loss or scleral perforation in addition to preserve anterior ciliary vessels with decrease chance of anterior segment ischemia but with disadvantage of persistent mass at place of muscle insertion in cases with big angles of exotropia. However, bilateral lateral rectus recession could have significantly less postoperative overcorrection with better orthotropia results in younger age group less than 14 years old but with higher postoperative under correction in older age group more than 14 years old. Bilateral medial rectus tucking or resection is recommended with good results in older age group while increase chance of overcorrection in younger age group less than 14 years old.

The results achieved in this study are better than the results of the study performed by [27] who compared 103 cases of X (T) of the basic type and pseudo-divergence excess, considering orthotropia ± 10 DP as surgical success, after 1 year follow up period. They obtained success in 26 (56%) out of the 46 patients submitted to recession of the lateral recti, and in 34 (60%) out of the 57 patients submitted to monocular recess/resect procedure.

In comparable with our study which revealed success rate (74.28%) after bilateral lateral rectus recession, [28] reported 80% success rate 1 year after bilateral LR recession surgery in their study that included 41 patients, while Kushner [22] reported 81% success rate in a study of 68 patients and Ing et al [20] (62%) in their study which included 52 patients. The difference in success rates may be because they included other types than convergence insufficiency type of intermittent exotropia in their studies.

In agreement with our study some [29] have advocate medial rectus resections to enhance convergence in Convergence Insufficiency type of exotropia patients, but [30] has other opinion as rectus muscle resections, do not probably increase muscle function as resections create a leash. Thus, medial rectus muscle resections do not improve convergence; they limit divergence and usually create a distance esotropia and postoperative diplopia for distance fixation.

Slight overcorrection (more than 10°) was found in one patients (2.85 %) in group A, in 5 (14.28 %) cases in group B and lastly in 6 (17.14%) cases in group C at the end of 6 months. In agreement with [31] who found that not all patients with desirable amounts of initial overcorrection have good final outcomes. We did not aim to overcorrection in the early postoperative period to avoid amblyopia and adverse effects on binocular vision, as it is known that esodeviation is more amblyogenic than exodeviation for that all cases of over correction subjected to second session of re surgical correction.

There was no statistically significant difference between the early and late alignment in the three groups in conformity and harmony with other studies [32,33] reported that no significant correlation was found between the early and late alignment. This

indicates that overcorrection in the early postoperative period should not be the goal of surgery in all cases, although it was recommended by some investigators [34,35].

Postoperative incomitance occurred only two patients (5.71 %) in group A, two patients (5.71 %) relative tethering effect of the procedure, which usually results in esotropia in the field of action of the recessed LR muscle or resected or tucked medial rectus for a prolonged period after surgery [36,37].

As far as our knowledge with most previous authors [38,39] preserve only medial rectus tucking or resection only for recurrent, residual or consecutive cases of exotropia but in our study we used this procedure as a primary treatment of intermittent exotropia.

In incongruity with our study, [23,24] had recommended recess/resect (asymmetric) surgery for treatment of this type of exotropia because they believed it affects both the near and far deviations equally; unlike the bilateral lateral rectus recession (symmetric) surgery which affects far deviation more than the near deviation or bilateral medial rectus resection which affect near than far deviation.

We used only non adjustable sutures in our study in the three groups as according to [41,42] there were no statistically significant differences in the mean preoperative and postoperative deviation angles between the adjustable and non adjustable sutures.

This study addressed only the surgical outcome 9 months after surgery, but this is not a disadvantage as [43] have found that successful alignment at 6 months postoperatively, correlated significantly with the long – term success.

Conclusion

The three approaches used in the study are equally effective for surgical correction of exotropia. However, bilateral lateral rectus recession could have significantly less postoperative overcorrection with better orthotropia results in younger age group less than 14 years old but with significantly higher postoperative under correction in older age group than bilateral medial rectus tucking or resection which could have significantly higher overcorrection in younger age group. Medial rectus tucking is more cosmetically recommended in small angel of exotropia.

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