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Two Muscles Versus Three Muscles Surgery for Treatment of Large Angle Constant Alternating Exotropia

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Abstract:

Objective: Evaluating outcomes of bilateral lateral rectus recession (BLR) surgery with BLR plus one medial rectus resection surgery for treating large angle constant alternating exotropia. **Methods:** 68 exotropic patients were included in this cross-sectional comparative study, that was conducted at Beni-Suef University Hospital. Patients were divided randomly into two equal groups (each group contained 34 patients): **Group (1):** who undergone bilateral large lateral rectus recession. **Group (2):** undergone bilateral lateral rectus recession with medial rectus resection. Patients were followed up for 1, 3, and 6 months postoperatively. **Results:** Insignificant difference was found between both groups regarding best corrected visual acuity and angle of deviation preoperatively. In contrast, a significant difference was documented regarding outcome of surgery and successful rate after ending the follow up period. **Conclusion:** Three-muscle techniques have shown higher successful rate than two-muscle surgeries. **Keywords:** Bilateral lateral rectus recession, Medial rectus resection, Exotropia

Introduction

Exotropia (XT) is an eye misalignment disorder that affecting about 1% of children less than 11 years in age **[1].**

Some surgeons prefer the unilateral recession resection (R&R) procedure, while others favor the bilateral lateral rectus recession (BLR) procedure. So, the precise

nature of this surgery is still up for debate. There isn't any solid proof to back up the benefits of the R&R procedure, despite the general consensus on this subject being that patients with XT should have it. Numerous efforts have been undertaken to address this matter; however, the findings of these investigations yield inconclusive results **[2].** Regarding the number of muscles to treat large angle strabismus, there is not a definite decision **[3].** The purpose of this study was to evaluate the outcomes of BLR surgery with that of BLR plus one medial rectus resection surgery for treating large angle exotropia.

Patients and Methods

68 exotropic patients participated in this cross-sectional comparative study, which was conducted at Beni-Suef University Hospital. The duration for conducting the study was between May 2022–April 2023. It was accepted by the Beni-Suef University Ethical Committee (No. 08052022 on May, 2022) and conformed to the Helsinki Declaration. Prior to their enrollment in the study, all patients provided appropriate written informed consent for their participation, data publication, and photo usage for publication.

Patients were arranged randomly into two equal groups (each group contained 34 patients): **Group (1):** who undergone bilateral large lateral rectus recession. **Group (2):** undergone bilateral lateral rectus recession with medial rectus resection.

Inclusion Criteria:

Patients suffering from large angle (40–60 PD) alternating exotropia.

Exclusion criteria:

Patients have a past history of strabismus operation, vertical strabismus, associated nystagmus, congenital ophthalmological disorders, or other ocular illness.

All patients underwent thorough ophthalmic assessment, including visual acuity, and intraocular pressure evaluation. Slit-lamp was used to check the anterior segment. Cycloplegic refraction, and extraocular motility were also evaluated. Dilated fundus was done using indirect ophthalmoscope with 20 D lens. Deviation angle was assessed in all directions of gazes (far and near) using hand-held prism bar and eye cover tool. The postoperative follow up period included first day, then after 1, 3, and 6 months.

Statistical analysis: The SPSS (Statistical Package for Social Sciences) version 26 for Windows® (IBM SPSS Inc., Chicago, IL, USA) was used to code, process, and analyze the data that were gathered. The Shapiro Walk test was used to determine if the data were normally distributed. Frequencies and relative percentages were used to display qualitative data. The difference between qualitative variables was calculated using chi square test ($\chi 2$) and Fisher exact. The standard deviation (SD) or mean ± SD was used to express quantitative data. For parametric data, the independent samples t-test was employed; for non-parametric data, the Mann Whitney U test was utilized. Statistical significance was defined as a P value of < 0.05.

Results

Demographic data of patients are presented in **Table 1.** Patients in both groups were matched for age and sex, p value was statistically insignificant between the two groups ($P > 0.05$).

Table 1: Demographic data of patients

	Group (1)		**Group (2)**		**t-test**	**P value**
Age (years)						
Mean ± SD	8.3±2.03		8.7±1.46		0.0035	0.824
Range	10 – 50		10 – 50			
	No.	**%**	**No.**	**%**	**χ^2-test**	**P value**
Gender						
Males	16	47	16	47	0.000	0.999
Females	18	53	18	53	0.000	0.999
Total	34	100	34	100		

Figure 1 shows preoperative best corrected visual acuity (BCVA) of the two studied groups. Insignificant difference was found between both groups.

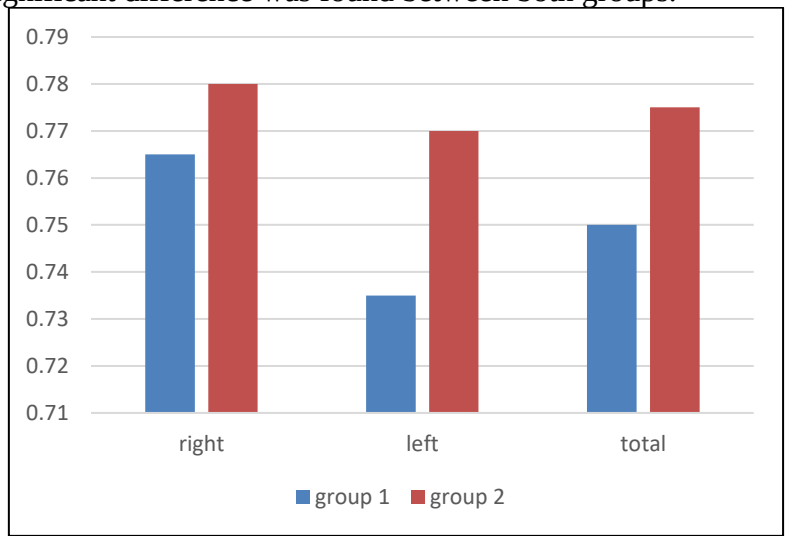

Figure 1: Preoperative BCVA of the two studied groups

Preoperative deviation angle of both groups is illustrated in **Figure 2**. The mean value was 44.75 ± 2.85 in group 1 and 46.75 ± 3.25 in group 2

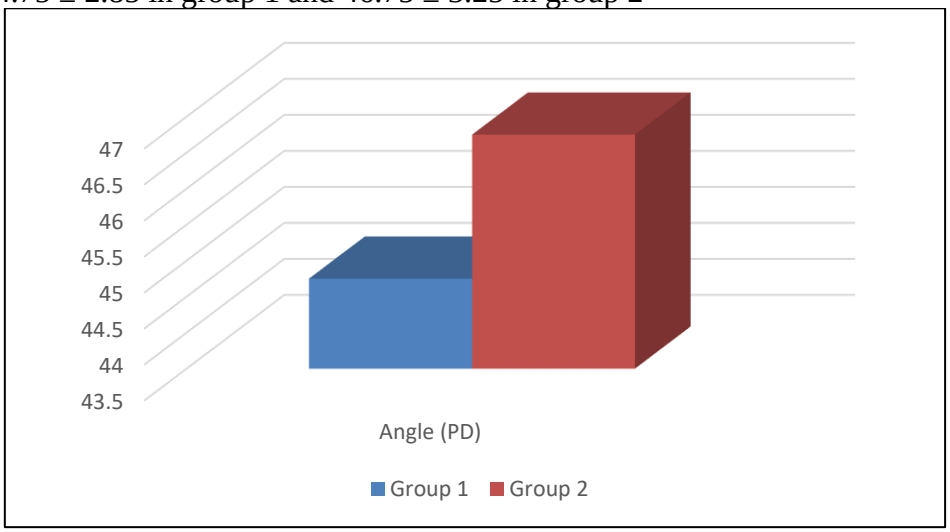

Figure 2: Preoperative angle of deviation of the two groups

Regarding the outcome of surgery after following the patients up, a highly significant difference was documented between groups 1 and 2 (P < 0.001) **(Figure 3).**

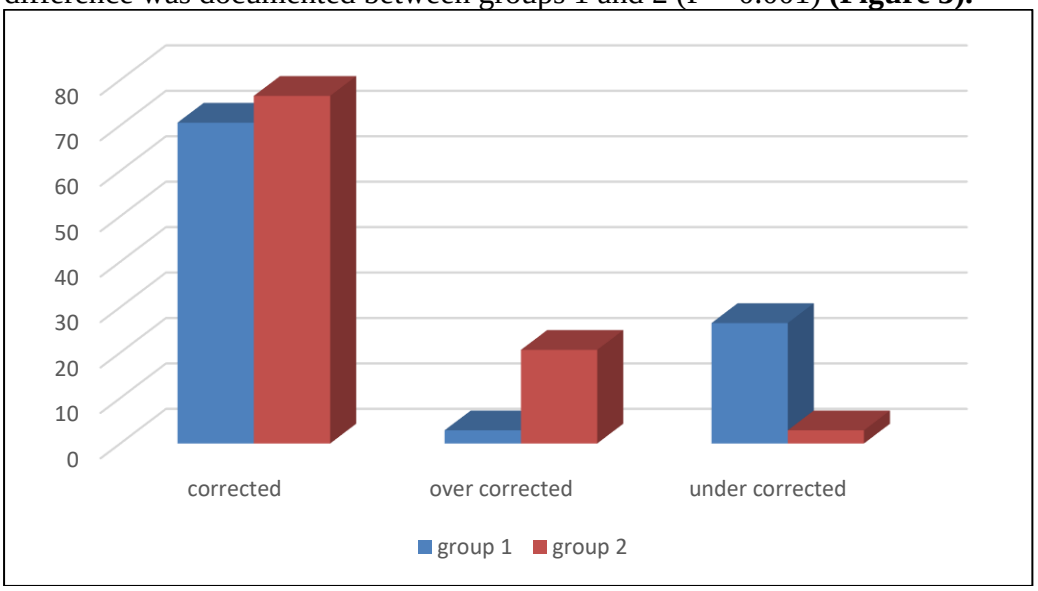

Figure 3: Surgery outcome after ending the follow up period.

Successful rate of surgery is illustrated in **Table 2.** It was higher in group (2) than group (1) with a significant difference between them (P = 0.0231).

Table 2: Successful rate of surgery

Successful rate	**Group (1) (n = 34)**		**Group (2) (n = 34)**		**Statistical test of**	
	No.	**%**	**No.**	**%**	**χ^2-**	**P value**
Successful (<10PD)	24	70.6	30	88.2	4.897	0.0231
Unsuccessful (>10PD)	10	29.4	4	11.8	-	0.0572
Total	34	100	34	100		

Figure 18: Preoperative and postoperative case in group (1).

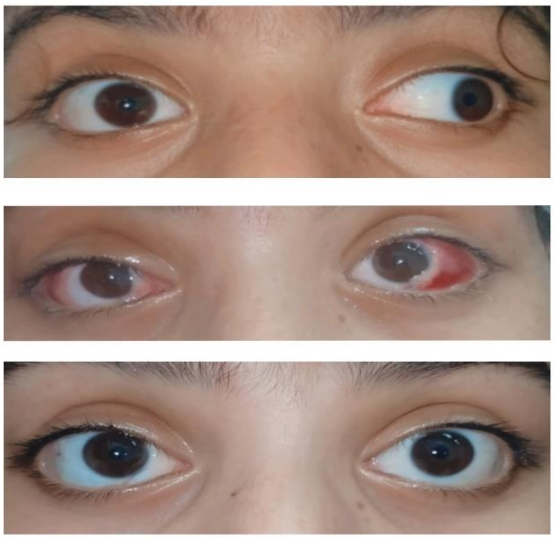

Figure 18: Preoperative and postoperative case in group (2).

Discussion:

Surgeons encounter less consensus regarding the number and amount of extraocular rectus muscles operated when deviation exceeds 50 prism diopters (PD), despite the fact that two-muscle surgery has been widely accepted for exodeviation <50 PD. Although some surgeons use two-muscle surgery but with maximal or supramaximal doses **[4, 5],** others reinforce recession with central tenectomy and Botox injections targeting to recessed muscles **[5].** Another approach is to operate on three muscles at the same time (unilateral medial rectus resection and bilateral lateral rectus recession).

In the present work, mean age in group 1 and group 2 was 8.3 ± 2.03 and 8.7±1.46, respectively. **Johnson et al. [6]** reported satisfactory outcomes with early intervention to avoid overcorrection in visually immature newborns, while others **[7]** reported good results when intervention is made on 4 and 5 years.

In the current study, angle of deviation showed insignificant difference between both groups preoperatively. **Farid and Abdelbaset** [**8**] compared 3 different surgical operations, including, slanting LR recession, improved unilateral R&R, and augmented LR recession. There was no statistically significant difference (P > 0.05) between groups after a year of follow-up regarding correction of distant exodeviation, near exodeviation, and collapse of near distant disparity.

Following the completion of the six-month follow-up period, the following surgical outcome was documented: In groups 1 and 2, there were corrections for: 24 (70.6%) and 26 (76.5%) patients; overcorrection for one (2.9%) and seven (20.6%) patients; as well as under correction for nine (26.5%) and one (2.9%) patient respectively. Prior studies after three muscle surgeries on those suffering large angle strabismus have revealed under correction rates in exotropic patients ranging from 25 to 58%. Following three muscle surgeries, exotropic patients had overcorrection rates of 0−6.7% **[9–11].** Three (16%) of the exotropic patients in the **Cifuentes et al. [12]** had under corrections; there were no overcorrections. Out of the three (16%) exotropic patients who needed correction, two had adjustable suture surgery; one patient had orthotropia immediately after surgery, while the other had 10Δ esotropia. However, neither patient had their sutures adjusted.

Regarding surgical success, there were 70.60% in group 1 and 88.2% in group 2, with the success rate of surgery being accepted at less than 10 PD deviation after the

follow-up period. Conversely, 29.4% in group 1 and 11.8% in group 2 were not successful, which was in line with the findings of the study conducted by **Khairy et al., [13],** who found that the success rate was 70 and 80% in groups 1 and 2, respectively, while 30 and 20% were unsuccessful in groups 1 and 2, respectively. The results of **Cifuentes et al. [12]** corroborate our findings and show that patients with large angle strabismus can achieve good alignment through three muscle surgeries. Regarding motor alignment, all exotropic patients had successful outcomes; in the XT group, success rates were 82% (14/17) with 6% (1/17) produced incomitance and 22% showed (2/9) recurrence.

The success rates across earlier literatures pertaining to various surgical approaches are under dispute. 128 patients with basic type XT were included in a retrospective study, and the results showed success rates of 27.4% for R&R and 58.2% for BLR **[14]. Song and Lee [15]** compared the success rate of slanting BLR with classic BLR, finding that the former had a higher success rate in the three muscle group when compared to the latter's 7%.

Conclusion:

Inspite of effectiveness of both surgery in treating large angle exotropia, three-muscle techniques have shown higher successful rate than two-muscle surgeries. Both surgeries have low lateral incomitance complication.

Conflicts of Interest: The authors declare that they have no conflict of interest.

Authors' Contributions: All authors had equal role in design, work, statistical analysis and manuscript writing. All authors have approved the final article work.

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