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Comparison of Single Muscle Supra Maximal Lateral Rectus Recession with Bilateral Lateral Rectus Recession Surgery For Mild to Moderate Degree Exotropia

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ABSTRACT

Objective: To compare unilateral supra maximal lateral rectus recession (ULR) and bilateral lateral rectus recession (BLR) surgery in terms of efficacy and success rate in cases of mild to moderate degree exotropia.
Study Design: Quasi experimental study.
Place and Duration of Study: Combined Military Hospital Multan, Pakistan from Feb 2023 to Jan 2024.
Methodology: 60 patients having exotropia in the prism diopters (PD) range of 10–30 were included in the study. Randomized sampling was done, and the patients were divided into 2 groups. 30 patients with exotropia underwent unilateral lateral rectus recession surgery (Group-A) whereas other 30 patients underwent bilateral lateral rectus recession surgery (Group-B).
Results: After one week of surgery, the angle of deviation in PD was seen to be 3.33±4.17 PD in Group-A and 2.8±4.12 PD in Group-B (p= 0.801). Following each surgical procedure, there was a significant improvement in the angle of strabismus (p<0.05). At final evaluation (3 months after surgery) exotropia improved on average by 15.66±6.28 PD in Group-A & 16.86 ± 4.66 PD in Group-B (p <0.05)
Conclusion: Success rate range was high and comparable in both the groups. When correcting mild to moderate angle exotropia (≤30 PD), unilateral supra maximal lateral rectus recession is more beneficial than bilateral lateral recession because of reduced anaesthesia time, reduced surgical risks such as scleral perforation, retinal detachment and endophthalmitis. Furthermore, the rate of consecutive esotropia and over-correction is decreased.

Keywords: Bilateral, exotropia, lateral rectus, mild, moderate, recession surgery, supra maximal, unilateral

How to Cite This Article: *Ali K, Malik SM, Niazi MK, Ahmad F, Khan HA, Lodhi II. Comparison of Single Muscle Supra Maximal Lateral Rectus Recession with Bilateral Lateral Rectus Recession Surgery for Mild to Moderate Degree Exotropia. Pak Armed Forces Med J 2025; 75(Suppl-7): S1083-S1087. DOI: https://doi.org/10.51253/pafmj.v75iSUPPL-7.12700*

INTRODUCTION

For surgery-based correction of exotropia, there are numerous possibilities. Common procedures include bilateral medial rectus resection, bilateral lateral rectus recession and bilateral lateral rectus recession combined with medial rectus muscle resection in one eye.[1] Unilateral lateral rectus recession is an alternate method.[2] Although strabismus surgeons frequently conduct the former surgery, the results of latter are debatable.[3]

Extremely big horizontal strabismus is difficult to manage. Numerous surgical procedures, such as lateral rectus recession, three-muscle treatment and bilateral lateral rectus recession have been utilized in large-angle exo-deviations.[4] The most prevalent kind of exotropia is called intermittent exotropia, which can affect anywhere from 50% to 90% of individuals with exodeviation.5 While on one hand, the ocular misalignment can eventually correct itself, it may progress to persistent exotropia, which impairs stereo vision and may result in amblyopia in children.[5]

Both unilateral lateral rectus recession (ULR) and bilateral lateral rectus recession (BLR) are frequently used surgical techniques for treating mild to moderate degree exotropias6. Much research has examined the effectiveness of BLR, but few have directly compared the effectiveness of ULR and BLR. Therefore, this study was carried out to compare ULR and BLR efficacy to incorporate the evidence on the success rate and complications of these two types of procedures in cases of mild to moderate degree exotropia.

METHODOLOGY

The quasi experimental study was done to assess the people who had undergone surgery for mild to moderate degree exotropia. This study took place at CMH Hospital Multan, Pakistan on individuals having exotropia. The study endeavor was approved by institution's Ethical Review Committee (ERC No. 144/2023 dated 16th Jan 2023). The patients undergoing unilateral or bilateral lateral recessions between February 2023 and January 2024 were

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Received: 17 Sep 2024; revision received: 23 Dec 2024; accepted: 28 Dec 2024

recruited. Using the WHO sample size calculator, the sample size was determined with a level of confidence of 95% and 5% margin of error, the computed sample size was 60. Patients were randomly distributed into 2 groups. 30 patients undergoing unilateral lateral rectus recession were placed in Group-A while 30 patients with exotropia undergoing bilateral lateral rectus recession were placed in Group-B.

Data from the charts of each patient who underwent surgery for exotropia in the prism diopters (PD) range of 10-30 was recorded. Success rate was defined as the change or angle deviation of <10 PD following the final examination. Exotropia angle, lateral rectal muscle recession degree and overcorrection percentage in both groups along with postoperative complications were all measured and studied. For cooperative individuals, the Titmus fly test was used to assess stereopsis.

Inclusion criteria: Patients with good visual acuity in both eyes with either basic or divergent excess type exotropia, or alternate or unilateral exotropia, were included. The angle of deviation was 10-30 PD for inclusion in the study.

Exclusion criteria: The study excluded participants who had paralytic or restrictive strabismus, had exotropia angle > 30 PD or had previous strabismus surgery.

The angle of exotropia was calculated for all gaze directions, near (30 cm) and far (6 m) fixation, and with the appropriate refractive adjustment using the prism and cover test. The calculations used the average angle of each person's near and distant readings. Younger people's strabismus was evaluated with the Krimsky test.

One ophthalmologist handled all surgeries. A limbal based incision was used to accomplish lateral rectus recession. After the muscle was disinserted, the recession was calculated from the original insertion location. The muscle was bound at the new site by taking partial thickness bite of sclera with 6.0 vicryl suture. General anaesthesia was used for the entire surgical procedure. Patients were split into two groups: individuals with unilateral lateral rectus recession made up Group-A, while individuals with bilateral lateral rectus recession made up Group-B. The lateral rectus recession varied from 7 to 9 mm (mean: 8 mm) in Group-A and from 3 to 5.0 mm (mean: 4 mm) in Group-B. The recession measurements were calculated and executed according to the degree of squint. More recession for a larger squint and less recession for a small exotropia. The post operative ocular alignment was evaluated at 1 week post-surgery and final evaluation was done 3 months post operatively.

To contrast the two groups' success rates, a chi-square analysis was employed. The two-tailed independent samples run between the two groups' numerical data were compared. To compare the preoperative and postoperative data in each group, the student's t-test was employed. Due to the minimal participant numbers, the analysis test was utilized to assess each group's binocular vision before and after surgery. Version 25 of SPSS was used for statistical analysis. *p*-value of ≤ 0.05 was considered as statistically significant.

RESULTS

The study population consisted of sixty patients. Of these, 30 underwent ULR in Group-A while 30 patients with exotropia underwent BLR in Group-B. Both groups' mean refractive errors and visual acuities were comparable. Every patient had normal fundoscopy and anterior segment evaluation. Table-I provides a summary of the patient demographics.

Table-I: Demographic characteristics of patients in Group-A and Group-B (n=60)

Variables	Group A (Mean, Range)	Group B (Mean, Range)	*p*-value
Age at surgery (years)	20 (1030)	18 (8-28)	0.326
Visual acuity left eye (Log MAR)	0.25 (0.15 to 0.35)	0.27 (0.17 to 0.37)	0.291
Visual acuity right eye (Log MAR)	0.25 (0.16 to 0.34)	0.21 (0.13 to 0.29)	0.384
Refractive error on the left eye (DS)	-0.25 (-0.92 to 0.42)	-0.05 (-0.84 to 0.74)	0.946
Refractive error on the right eye (DS)	.08 (-0.86 to 0.70)	-0.15 (-0.83 to 0.53)	0.410

The average angle of deviation±SD was measured before surgery for each group. In Group-A, it was 20.2±5.51 PD while in Group-B it was 20.53±5.29 PD. The average angle of exotropia or esotropia at one week following surgery and at the final follow-up exam 3 months post-surgery is displayed in Table-II. The change in deviation in PD from one week following surgery to the final assessment is known as postoperative drift. It was found to be 1.13±2.33 PD XT in Group-A and 0.93±2.21 PD XT in Group-B (*p*=0.896).

Table II: Preoperative and postoperative parameters comparison among Group-A and Group-B

Variable	Group-A (Mean, Range)	Group-B (Mean, Range)	*p*- value
The angle of XT or ET 01 week post-surgery in PD	3.33 (0 to 7.5)	2.8 (0 to 6.9)	0.801
The angle of XT or ET 03 months postoperatively in PD	4.53 (0.3 to 8.8)	3.6 (0.4 to 7.3)	0.233
Postoperative drift in PD	1.13 (-1.2 to 3.5)	0.93 (-1.3 to 3.1)	0.896

PD= prism diopters, SD= standard deviation, ET=esotropia, XT= exotropia

The angle of the strabismus significantly improved after each surgical procedure (p<0.05). Exotropia corrected on average by 16.86±5.88 PD (p<0.05) and 17.73 ±4.79 PD (p<0.05) in Group-A and Group-B respectively, one week following surgery. Exotropia improved on average by 15.66±6.28 PD in Group-A and 16.86±4.66 PD in Group-B at the final evaluation (p<0.05).

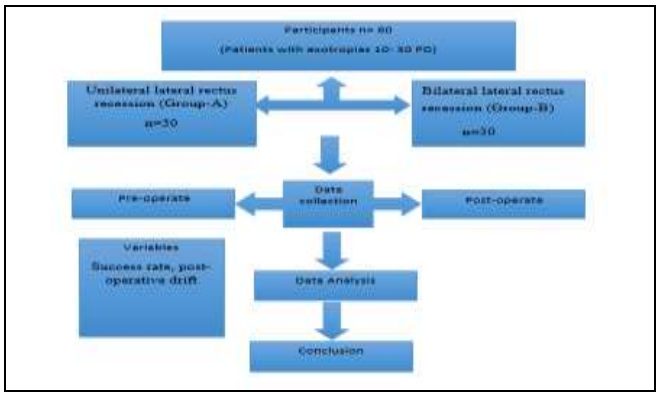

Figure-1: Flowchart of the study methodology (n=60)

One week following surgery, 3(10%) of the 30 patients in Group-A had esotropia, 23(76.66%) were orthophoric and 4(13.33%) still had exotropia. In Group-A, at the time of the last follow-up assessment (at 3 months) 5 patients (16.66%) still had exotropia, 25(83.33%) were orthophoric, and none of the individuals had overcorrection. While in Group-B one week post-surgery, 5 patients (16.66%) had esotropia, 23(76.66%) were orthophoric, and 2(6.66%) still had exotropia. 3 patients (10%) still had exotropia, 25(83.33%) had no strabismus, and 2(6.66%) had overcorrection (esotropia) at the last follow-up in Group-B.

The success rate for Group-A was comparable with Group-B (p =1, chi-square) with 25 orthophoric patients in each group. There were no cases of lateral incomitance or operative complications in both groups.

DISCUSSION

Based on the identical success rates in both groups, the present research suggests that ULR and BLR may be equally beneficial in treating mild to moderate angle exotropia. The preoperative average angle of exotropia varied between the two groups. However, for every angle of deviation, an appropriate amount of recession was executed (i.e., for a bigger angle, a larger recession was executed). These restrictions imply that for the treatment of mild to moderate angle exotropia, ULR is just as successful as BLR.

We found that individuals who underwent bilateral surgery had similar correction in PD compared to those who underwent unilateral surgery when contrasting the quantitative improvement (PD) attained with surgery in the two groups. There was no statistically significant difference between the two groups in all measures including the angle of exotropia at the last assessment. The results of our study are comparable with a study published by Choi *et al*., in 2019 who contend that both BLR and ULR groups had comparable success rates following surgery.[8] Gurland et al in 2018 reported eight individuals with small-angle exotropia who had good surgical outcomes with unilateral recession surgery.[9] A recent study done by Wang et al. in July 2023 also showed successful results in resolution of exotropia, with success rates ranging from 72% to 87% in cases of ULR surgery.[10] Lee *et al* (2020) and Kim *et al* (2019) in their studies concur that exotropia of 15 to 20 PD benefit from unilateral lateral rectus recession.[11,12] Spierer et al in a study published in 2021 suggested unilateral exotropia surgery for up to 30 PD.[13] The results of these studies support and validate our study for performing ULR surgery in patients of exotropia up to 30 PD and getting comparable results with BLR surgery.

In our study, neither group reported postoperative problems. There were two cases of overcorrection (esotropia) during the final evaluation in the bilateral group, whereas there was none in the unilateral group. Postoperative lateral incomitance may develop after some cases in unilateral lateral rectus recession surgery. In some recent studies by Spierer et al in 2021, Joo et al in 2022 and Donhue *et al*

in 2019.[13,14,15] this issue was disregarded, but in some other studies by Nelson *et al* and Dadeya *et al,* it was confirmed only in cases where the lateral rectus muscle was recessed by more than 9 to 10 mm.[16,17] In our study even in individuals whose lateral rectus muscle was recessed by 9 mm, none of them showed signs of lateral incomitance. The postoperative drift toward exotropia observed in both groups in our study was slightly more in Group-A but statistically non-significant. For optimal long-term alignment, slight overcorrection in cases of supramaximal unilateral lateral rectus recession can be safely opted as shown by Al-Haddad *et al* in their study published in 2020.[18] Spierer *et al* and Al-Haddad *et al*. in their studies have come to the conclusion that with unilateral supramaximal lateral rectus recession surgery, postoperative overcorrection is not seen.[13,18] For effective long-term outcomes, overcorrection thus becomes much more important in unilateral surgery than it is in bilateral surgery.

The results of these studies match and support our study's statistics of comparable results of ULR and BLR surgery. According to our research study, performing surgery on a single muscle rather than two offers the benefit of reducing anaesthesia time and surgical risks such as scleral perforation, retinal detachment and endophthalmitis. Furthermore, the rate of consecutive esotropia and over-correction is decreased in cases of ULR surgery.

CONCLUSION

For each group in the present research, the success rate range was high. Unilateral supra maximal lateral rectus recession is as useful in treating mild to moderate angle exotropia (≤30 PD) as bilateral lateral recession. However, performing surgery on a single muscle rather than two offers the benefit of reducing anesthesia time and surgical risks such as scleral perforation, retinal detachment and endophthalmitis. Furthermore, the rate of consecutive esotropia and over-correction is decreased. Nevertheless, more conclusive results can be obtained from prospective, controlled long term studies that compare these two approaches.

Conflict of Interest: None.

Funding Source: None.

Authors' Contribution

Following authors have made substantial contributions to the manuscript as under:

KA & SMM: Data acquisition, data analysis, critical review, approval of the final version to be published.

MKN & FA: Study design, data interpretation, drafting the manuscript, critical review, approval of the final version to be published.

HAK & IIL: Conception, data acquisition, drafting the manuscript, approval of the final version to be published.

Authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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