

Original Article

The use of one muscle recession for horizontal strabismus



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Abstract

Purpose: To evaluate the outcomes of one muscle recession for horizontal comitant strabismus at a major referral hospital in the Middle East.

Method: Retrospective charts review of postoperative outcomes of 90 patients who had undergone one muscle recession for small to moderate angle esotropia or exotropia. Data were collected for age, vision, amblyopia, previous surgery or botulinum toxin injection, preoperative deviation, amount and type of one muscle surgery, and postoperative deviation at the initial and last (six months or more) postoperative visit. Successful alignment was defined as ± 10 prism diopters (PD) of orthophoria.

Results: Sixty patients underwent medial rectus recession and 30 patients underwent lateral rectus recession. The average preoperative and last follow up deviation -respectively- was 24 ± 6.1 PD (15–35) PD and 14.62 ± 8.91 PD in the medial rectus recession group and 21.3 ± 5.1 PD (12–30) and 12.60 ± 8.74 in the lateral rectus recession group. The final success rates were 63.3% in both groups.

Conclusion: Single muscle strabismus surgery to correct horizontal strabismus had a variable outcome. Larger recession may help in achieving better outcomes. Properly designed prospective studies may help in identifying the factors affecting the outcomes of single muscle strabismus surgeries.

Keywords: One muscle recession, Strabismus

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Introduction

Historically, one muscle surgery for comitant strabismus was controversial due to concerns over the high percentage of cases that were under corrected.¹ However a recent literature review found that recession of the medial and lateral rectus for small to moderate angle strabismus and resection for under corrected strabismus produced good outcomes.¹ However, our clinical experience did not always support the use of one muscle surgery. Based on our observations we

evaluated the outcomes of one-muscle surgeries at a major referral hospital in the Middle East.

Methods

This is a retrospective study to evaluate the postoperative outcomes of patients who had undergone one muscle surgery at King Khaled Eye Specialist Hospital (KKESH), Riyadh, Saudi Arabia. The Institutional Review Board at KKESH approved this study. Potential cases for inclusion in the study

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¹ The co-author reviewed the study and agreed about the conclusion and all participated sufficiently in preparing it.

were identified using the hospital coding system for strabismus surgery. Inclusion criteria were any patient with esotropia or exotropia who had medial rectus or lateral rectus recessions from 2009 to 2013. Patients were excluded if they had a documented A or V pattern, documented in comitant strabismus, previous surgery on the same muscle or any previous strabismus surgery without clear documentation. Data were collected on age at initial surgery, vision and amblyopia if present, as per the treating physician diagnosis, refractive errors, previous surgery or botulinum toxin injection, preoperative angle of deviation for near and distance with the appropriate refractive correction, amount and type of one muscle surgery and postoperative deviation at the initial and last postoperative visit with the appropriate refractive

correction. In very young children or in patients with dense amblyopia, the Krimsky light reflex test was used only in primary gaze. Successful alignment defined as ≤ 10 prism diopters (PD) of orthotropia on primary gaze at distance for the patients with exotropia and near accommodative targets for esotropia patients. The angle measured at or after six months postoperatively was considered as the final outcome.

The results of each group (esotropia and exotropia) were analyzed separately. The preoperative near deviation for the ET group and distance deviation for the XT group were used for analysis. The correlation between variables was analyzed using the Chi square or Fisher’s exact test as appropriate. A *p* value less than 0.05 is considered statistically significant.

Table 1. Demographic data and mean follow up period for patients who underwent one muscle recession for horizontal strabismus.

		Type of Surgery	
		Medial rectus recession (n = 60 patients)	Lateral rectus recession (n = 30 patients)
Mean age in years (range)		11.1 (5–30)	18.3 (0–39)
Gender	Male	39 (65.0%)	22 (73.3%)
	Female	21 (35.0%)	8 (26.7%)
Amblyopia in the operated eye	Yes	22 (36.7%)	15 (50.0%)
	No	38 (63.3%)	15 (50.0%)
First postoperative visit in months		1.2 (0–4)	1.1 (0–3)
Last postoperative visit in months		16.9 (6–41)	17.0 (6–33)
Mean preoperative angle (range)		24 ± 6.1 PD (15–35)	21.3 ± 5.1 PD (12–30)
Previous surgery	Botox injection	18 (30.0%)	2 (6.7%)
	BMR resection	–	1 (3.3%)
Mean change in angle of deviation at last postoperative visit		14.62 ± 8.9 PD	12.6 ± 8.7 PD
Success rate at last visit		38 (63.3%)	19 (63.3%)

PD = Prism diopters; *p* < 0.05 is statistically significant.

Table 2. Relationship of the previous strabismus surgery and success rate.

			Medial rectus recession			Lateral rectus recession		
			Status last visit			Status last visit		
			Success	Failure	Total	Success	Failure	Total
Previous strabismus surgery*	Yes	Count	9	9	18	1	2**	3
		%	50.0%	50.0%	100.0%	33.3%	66.7%	100.0%
	No	Count	27	15	42	19	8	27
		%	64.3%	35.7%	100.0%	70.4%	29.6%	100.0%
P-value			0.30			0.25		
Total	Count		36	24	60	20	10	30
	%		60.0%	40.0%	100.0%	66.7%	33.3%	100.0%

* All are Botox injections.

** Except one patient had bilateral medial rectus resection.

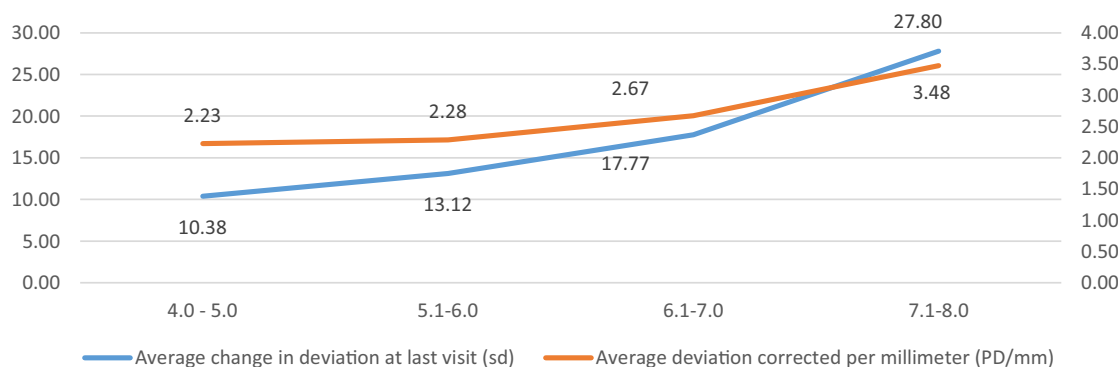


Fig. 1. The relationship between surgery dose and average change in deviation in prism diopter/millimeters for medial rectus recession.

Results

Medial rectus recession

60 patients had medial rectus recession ranged from 4.00 mm to 8.00 mm for a mean preoperative angle of deviation of 24 ± 6.1 PD (15–35) PD. 26 patients (43.33%) had recession in the range of 5.1–6 mm with final success rate of 61.5% and only 5 patients had recession ranged of

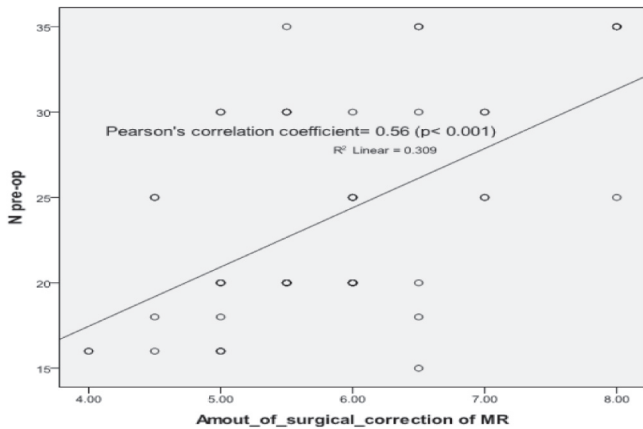


Fig. 2. Correlation between surgical correction of the medial rectus recession and preoperative angle of deviation. $p < 0.05$ is statistically significant.

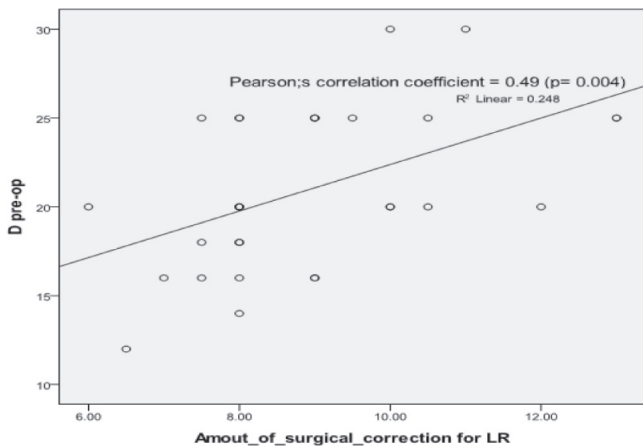


Fig. 3. Correlation between surgical correction of the lateral rectus recession and preoperative angle of deviation. $p < 0.05$ is statistically significant.

7.1–8 mm and a final success rate of 80% and overall success rate of (63.3%). The mean change in the angle of deviation at the last postoperative visit was 14.62 ± 8.91 PD and this change is the maximum in group of 7.1–8 mm recession which is 27.80 ± 7.01 PD, Table 1 & 3.18 (30%) patients had previous botulinum injections to both medial recti with success rate of 50% at final follow up visit. 42 patients had no previous intervention with 64.3% success rate but this difference in success rate at 6 months follow up between the 2 groups was not statistically significant (p value = 0.30), Table 2. The dose effect of recession increased incrementally with the amount of recession (Fig. 1). There was a significant correlation in the amount of recession to the preoperative angle of deviation ($r = 0.56$; $p < 0.001$) (Fig. 2) i.e. patients with larger angles of deviation underwent larger recessions. The association of the preoperative angle of deviation to the success at final postoperative visit was not statistically significant ($p = 0.49$).

Lateral rectus recession

Thirty patients had lateral rectus recession which ranged from 6 mm to 11 mm for a mean preoperative deviation of 21.3 ± 5.1 PD (12–30). Ten patients (33.3%) underwent recessions ranging from 7.6 mm to 8.0 mm and the average change in the preoperative angle was 9.00 ± 8.55 PD compared to 16.43 ± 8.04 PD in the group of larger recession 9.6–11.0 mm which includes 7 patients, Tables 1 and 3. There was a tendency for late under correction, with the success rate dropped from (73.3%) at the first postoperative visit to (63.3%) at the final visit. 2 patients only had previous botulinum injections to both lateral recti and 1 had previous MR resections with residual exotropia, among them 1 patient succeeded at last follow-up., Table 2. There was a statistically significant increase in the amount of recession proportional to the increase in the preoperative angle of deviation ($r = 0.49$; $p = 0.004$), (Fig. 3). The amount of the preoperative angle of deviation was not statistically correlated to the final success rate ($p = 0.95$). Table 3 summarizes the outcomes of lateral rectus recession.

Discussion

Medial rectus recession

In 1971, Chamberlain reported single medial rectus recession for esotropia. Chamberlain reported unilateral medial rectus recession of 3.5 mm to 4 mm for 20 PD of esotropia,

Table 3. The surgical effect of one muscle surgery.

Type of Surgery	Amount of recession	Number of patient	Average change in deviation at last visit (sd)	Average deviation corrected per millimeter (PD/mm)	Number of patients classified as successful at:	
					First visit (%)	Last visit (%)
Medial rectus recession	4.0–5.0	16	10.38 ± 6.44	2.23 ± 1.40	6 (37.5%)	10 (62.5%)
	5.1–6.0	26	13.12 ± 8.45	2.28 ± 1.47	12 (47.2%)	16 (61.5%)
	6.1–7.0	13	17.77 ± 8.45	2.67 ± 1.20	6 (46.2%)	8 (61.5%)
	7.1–8.0	5	27.80 ± 7.01	3.48 ± 0.88	4 (80.0%)	4 (80.0%)
	Total	60	14.62 ± 8.91	2.45 ± 1.37	28 (46.7%)	38 (63.3%)
Lateral rectus recession	6.0–7.5	6	10.50 ± 9.31	1.49 ± 1.31	4 (66.7%)	5 (83.3%)
	7.6–8.0	10	9.00 ± 8.55	1.13 ± 1.07	8 (80.0%)	5 (50.0%)
	8.1–9.5	7	15.71 ± 8.24	1.74 ± 0.92	5 (71.4%)	4 (57.1%)
	9.6–11.0	7	16.43 ± 8.04	1.58 ± 0.78	5 (71.4%)	5 (71.4%)
	Total	30	12.60 ± 8.74	1.45 ± 1.01	22 (73.3%)	19 (63.3%)

Table 4. Correlation of the surgical dose of medial rectus recession to the mean change of postoperative angle deviation in three studies.*

	5 mm (No. of pt)	6 mm (No. of pt)	7 mm (No. of pt)	8 mm (No. of pt)
Stack et al	11.5 ± 6.6 (4)	13.2 ± 9.3 (9)	16.4 ± 7.7 (11)	20.3 ± 8.5 (16)
Wang and Nelson	16.00 ± 2.83 (2)	23.79 ± 6.19 (44)	29.57 ± 6.77 (14)	–
Current study	9.8 ± 7.6 (10)	12.21 ± 9.5 (14)	17.20 ± 4.1 (5)	27.80 ± 7.0 (5)

* At six months of follow up or more.

and achieved a success rate of only 43%.² Grin & Nelson limited the amount of recession to 6 mm for 30 PD and 6.5 mm for 35 PD and succeeded in 80% of cases.³ In our study, the amount of recession was variable for a given preoperative angle of deviation according to each surgeon decision. Zak et al. performed 6 mm recession in 53 patients for preoperative angle of deviation ranging from 14 PD to 20 PD and reported a 100% success rate.⁴ More recently, Wang and Nelson graded unilateral medial rectus recession of 5 mm, 5.5 mm, 6 mm, 6.5 mm and 7 mm for near angles of deviation of 15 PD to 18 PD, 19 PD to 20 PD, 21 PD to 25 PD, 26 PD to 30 PD, and 31 PD to 35 PD of esodeviation, respectively.⁵ Wang and Nelson reported a success rate of 96.5%.⁵ The retrospective nature of our study and inclusion of surgical outcomes from different surgeons make it difficult to standardize the amount of recession per specific pre-operative angle of deviation. Stack et al. compared the change in deviation achieved per millimeter of recession between unilateral and bilateral medial rectus surgeries. The magnitude of recession, in Stack study, for unilateral medial rectus recession ranged from 5 mm to 8 mm for preoperative near angles of 12 PD to 50 PD. And recession for bilateral medial rectus cases ranged from 4.5 mm to 8 mm for near deviation of 16 PD to 90 PD. However, they did not match the amount of recession to the magnitude of the preoperative angle of deviation. Stack et al. reported better outcomes with bilateral medial rectus recession compared to unilateral medial rectus recession. Stack recommended unilateral medial rectus recession for preoperative angles less than 25 PD.⁶ Table 4 presents outcomes of Wang and Nelson's study⁵, Stack et al. study⁶ and the current study with 5 mm, 6 mm, 7 mm and 8 mm of recession and the change in the postoperative angle of deviation. Although botulinum injection to the extraocular muscle changes their tension length effect,⁷ we did not find difference in success between those who had previous botulinum injection and those who had not, Table 2.

Lateral rectus recession

In 1992, Nelson reported a 94% success rate in 55 patients with a moderate angle of exotropia (15 PD to 20 PD) managed with graded unilateral recession of 7 mm, 7.5 mm and 8 mm.⁸ Their study reported no drift toward under correction during follow-up of (6 months to 30 months) and most subjects maintained orthotropia⁸ in this study, the maximum angle of preoperative deviation is double that in Nelson's study and the success rate is lower than Nelson' but we found no statistical correlation between the success rate and preoperative angle of deviation. This may points to other factors that isn't included in this study. Feretis used larger recession of 11.5 mm to 12 mm for small angle exodeviation (15 PD to 16 PD) in 10 patients.⁹ They found all cases were overcorrected on the 1st postoperative day.⁹ However, orthophoria was achieved in all cases by the 4 weeks postoperatively.⁹ Recently, Wang and Nelson matched specific magnitudes

of recession (7 mm to 10 mm) to specific magnitudes of deviation (15 PD to 35 PD) and succeeded in 76% of cases. Wang and Nelson reported a significant correlation between preoperative angle of deviation and success at the final visit, which differs from our results.¹⁰ However, different inclusion criteria and different definitions of success between our study and Wang and Nelson's¹⁰ and different magnitudes of surgical dose for a specific amount of preoperative deviation may explain the lack of correlation between studies.

Conclusion

Single muscle strabismus surgery to correct horizontal strabismus had a variable outcome for variable surgical doses. Larger recession may help in achieving better outcomes. The results of current study should be viewed with limitations of being retrospective study with different surgeons and different plans. Properly designed prospective studies may help in identifying the factors affecting the outcomes of single muscle strabismus surgeries.

Conflict of interest

The authors declared that there is no conflict of interest.

Financial disclosure

No financial interest in any substance of this research or part of it for any of the authors.

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