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Bilateral Lateral Rectus Resection in Patients with Residual Esotropia

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Unilateral or bilateral lateral rectus resection[1-5] is commonly performed for the correction of residual esotropia, but few results have been reported. Twenty-eight patients with residual esotropia underwent bilateral lateral rectus (BLR) resection. Six months after operation (n = 25), there were 17 (68%) successful cases, 7 (28%) cases of undercorrection, and 1 (4%) case of overcorrection. The success rate at the 24th postoperative month (n = 11) was 72.7%. The success rate for cases of infantile esotropia (n = 18) was higher than that for acquired esotropia (n = 7) at the 6th postoperative month (p = 0.156). The results were not significantly affected by the presence of other deviations (p = 0.387), the performance of other surgery (p = 0.393), the presence of amblyopia (p = 1.00), or the amount of residual esotropia (p = 0.604). Performance of BLR resection in patients with residual esotropia after bilateral medial rectus (BMR) recession is considered appropriate due to its high success rate and provision of a stable alignment during two-year follow up.

Key words: residual esotropia, bilateral lateral rectus resection

INTRODUCTION

Residual esotropia is common after bilateral medial rectus (BMR) recession with an incidence of 40%.[6-10] Patients are advised to wear prism glasses or to undergo additional surgery when residual esotropia greater than 10-15 prism diopters (PD) persists for longer than 6-8 weeks even after full correction of hypermetropia.

It is still controversial which method is most effective in treating residual esotropia, although studies have proposed various results and opinions. Unilateral or bilateral medial rectus re-recession could be performed when the amount of previous surgery is insufficient and the limitation of adduction is not observed.[1,11-14] Instead of re-recession, either faden operation,[15] marginal myotomy,[16] or marginal myotomy and lateral rectus resection in one eye[13,17] are recommended. Unilateral or bilateral lateral rectus (BLR) resection[10,13-16] is another technique commonly performed for the correction of residual esotropia, but few results have been reported.

In this study, we analyzed our results of BLR resection (or tucking) for residual esotropia after BMR recession and the factors associated with the results.

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SUBJECTS & METHODS

Patients who underwent BLR resection (or tuck-

ing) for residual esotropia in the St. Mary's Hospital and the Kangnam St. Mary's Hospital of the Catholic University of Korea between October 1991 and September 2002 were selected. The primary surgery for esotropia was BMR recession, and patients were followed up for a minimum of six months. Meanwhile, patients who had paralysis or limitation of eye movement, nystagmus or other neurologic abnormalities, and whose amount of previous surgery was not recognized were excluded.

The medical records of the patients were reviewed retrospectively for the type of esotropia, original esotropia angle, amount of recession, time to reoperation, angle of residual esotropia, amount of BLR resection, and postoperative angle of deviation. The presence of amblyopia, the presence of other deviations, and the performance of other surgery were also analyzed. Surgical dosage was determined based on the amount of residual angle, measured by alternate prism cover test with full hypermetropic correction (Table 1). The amount of previous recession was not considered in planning the amount of BLR resection.

Success was defined as alignment within 10PD of orthophoria. The success rate at the 6th, 12th and 24th month postoperatively and the factors associated with the success or failure were statistically analyzed using Fisher's exact test and K-W test.

Table 1. Surgical dosage of BLR resection

Lateral Rectus Resection of Both Eyes

Esotropia(PD)	Resection(mm)
15	3.5
20	4.5
25	5.5
30	6.0
35	6.5
40	7.5
45	8.5
50	9.0

RESULTS

Twenty-eight cases were reviewed. The mean age of the patients in BMR recession was 32.8 months (range, 9 months - 8 years), the angle of esotropia was 51.6 ± 15.5PD, and the BMR recession dose was 5.8 ± 0.7 mm. The interval between the 2 surgical procedures ranged from 3 months to 8 years (mean, 20.5months), the angle of residual esotropia was 26.7 ± 5.7PD, and the amount of lateral rectus resection was 5.69 ± 1.01 mm (Table 2).

The mean postoperative follow-up period was 35.2 months (range, 6 months - 11 years), Six months after surgery, there were 17 (68%) cases showing successful alignment, 7 (28%) undercorrected cases, and 1 (4%) overcorrected case, among 25 cases, while 3 cases did not complete follow-up. Successful eye alignment was achieved in 13 of 19 (68.4%) cases 12 months after the surgery and in 8 of 11 (72.7%) cases 24 months after (Table 3).

Among the 25 cases at the 6th month postoperatively, 18 were infantile esotropia and 7 acquired esotropia. The success rate of the former was higher than that of the latter (Table 4, p = 0.156, Fisher's exact test).

One case of undercorrection (#10) at the sixth month postoperatively had satisfactory eye position at the 46th month, which was the last follow up. Among three successful cases (#4, #9, and #23) at the sixth month postoperatively, two (#4, #9) turned into undercorrection and one (#23) into overcorrection at the 24th month of follow up. Meanwhile, three cases (#19, #27, and #28) who were not followed up at the sixth month postoperatively had satisfactory eye position at the last follow up.

The presence of other deviations (p = 0.387), the performance of other surgery (p = 0.393), and the presence of amblyopia (p = 1.00) were not associated with the success or failure (Fisher's exact test). Furthermore, the amount of residual esotropia (15-20PD, 21-25PD, 26-30PD, 31-40PD) did not affect the results significantly (p = 0.604, K-W test).

DISCUSSION

When the amount of previous BMR recession is insufficient and limitation of adduction is not observed,[1,11-14] medial rectus re-recession in one or both eyes can be performed. King et al[14] reported that re-recessions of both medial recti resulted in overcorrections in 18 of 32 patient, and in one undercorrection, for an overall success rate of 41%. Medial rectus re-recession resulted in overcorrections in 11.3% of patients as reported by Felius et

Table 2. Surgical treatment and follow-up of primary esotropia and residual esotropia

Bilateral lateral rectus resection(or tucking) for residual esotropia												
	Primary Surgery(BMR REC)							Reoperation				
Pt no.	Age(mo) at BMR REC	VA OD	VA OS	CPR	Diagnosis	Primary ET (PD)	Surgical dosage (mm)	Time to re-op. (mo)	Residual ET (PD)	W4D	Stereopsis	Other surgery
1	55	0.5	0.5	1.25	acquired	100	6.75	8	30	Alt. Supp	no	RSO expander
2	12			0.75	infantile, BIOOA	55	6.25	12	25		not tested	BIO REC
3	36	0.6	0.6	-0.75	infantile, LIOOA	70	6.25	6	25	Alt. Supp	no	LIO REC
4	13			1.75	infantile, RSOOA	70	6.25	3	20	OD Supp	not tested	LSR REC
5	41	0.7	0.5	-0.75	infantile, BIOOA	65	6.5	6	18		Fly(+)	BIO REC
6	28			1	infantile	35	5	96	30		not tested	RSR REC
7	12			0.25	infantile, BIOOA	65	6.25	12	30		not tested	BIO REC
8	16			0.25	infantile, BIOOA	60	6.25	12	40		not tested	BIO REC
9	16			1	infantile, BIOOA	50	6	23	20		not tested	BIO REC
10	18			0.5	infantile	55	6	23	35		not tested	
11	12			0	infantile, BIOOA	50	6	24	20		not tested	LIO REC
12	9			0.5	infantile, BIOOA	60	6	29	18		not tested	BIO REC
13	30			2	infantile, BIOOA	60	6.5	25	20		not tested	BIO myec tomy
14	25			2.25	infantile	65	6.5	7	30		not tested	
15	53	0.8	0.8	0.75	infantile	35	4.75	24	25	OS Supp	no	
16	20			0.5	acquired	40	5.5	14	25		not tested	
17	16			-0.75	infantile	45	6	7	30		not tested	
18	72	0.6	0.6	0	acquired	35	5.25	4.5	25	OS Supp	no	LIO Re-REC
19	69	0.7	0.3	3	acquired	50	5.5	48	35	OS Supp	no	
20	60	1.0	1.0	2.25	acquired	45	5	33	25	OS Supp	no	
21	26			6	acquired	45	4.75	34	30	Alt. Supp	no	
22	96	1.0	0.9	-3.5	acquired	30	4.5	29	20	OS Supp	no	
23	25			2	acquired	60	7	26	25	OS Supp	no	
24	18			-2	infantile	55	6.25	5	35		not tested	BIO REC
25	56	0.6	0.7	2	infantile	40	5.5	9	25	Alt. Supp	no	
26	15			0.5	infantile	35	4.75	17	30		not tested	BIO REC
27	36			3	acquired	40	6	16	25	Alt. Supp	no	
28	32				acquired	30	4.5	20	30		not tested	

BMR REC: bilateral medial rectus recession, CPR: cycloplegic refraction, W4D: Worth 4-dot test, RSO: right superior oblique, BIO: bilateral inferior oblique, LIO: left inferior oblique, LSR: left superior rectus, BLR RT: bilateral lateral rectus resection, Alt. Supp: alternate suppression.

Table 2. continued

Bilateral lateral rectus resection(or tucking) for residual esotropia													
	Final Status												
Pt no.	Post-BLR RT 6mo		Post-BLR RT 12mo		Post-BLR RT 24mo		Last post-BLR RT		Follow up(mo)	VA		W4D	Stereopsis
	near	dist	near	dist	near	dist	near	dist		OD	OS		
1	14	12							6				not tested
2	20	18							6				not tested
3	4	XT 4	0	7					12	0.5	0.4	Alt. Supp	not tested
4	10	10	16	16	14	14			24	0.8	0.6	Alt. Supp	not tested
5	10	10	16	16	12	12	8	8	42	1.0	1.0	Alt. Supp	Fly(+)
6	0	0	0	XT 6			0	XT 6	12	0.8	0.8		Fly(+)
7	0	XT 20							6				not tested
8	7	7							6				not tested
9	0	6	10	0	25	20			24	0.5	0.7		not tested
10	14	14			10	5	0	0	46	0.2	0.1		not tested
11	0	10	5	5	8	10			24	0.6	0.6	OS Supp	not tested
12	6	6	5	5					12	0.6	0.7		not tested
13	0	0	0	0	0	0	0	0	132	1.0	1.0	OD Supp	animal 1/3
14	0	0					XT 15	0	120	0.2	0.2		not tested
15	20	20	20	25			14	14	72	1.0	1.0	OS Supp	not tested
16	15	15	15	15					12	0.6	0.7		not tested
17	0	0	0	XT 5					12	0.4	0.3		not tested
18	20	16							10	0.8	0.6	OS Supp	no
19			20	0					14	1.0	0.3	Fusion	no
20	12	6	12	6					12	1.0	1.0	Alt. Supp	no
21	8	4							7	0.7	0.7	Fusion	not tested
22	20	15	20	20					15	0.7	0.6	OS Supp	no
23	0	0	0	0	0	XT 20	XT 14	XT 12	103	0.8	1.0	Alt. Supp	no
24	0	0	0	0			0	0	16	0.4	0.2		not tested
25	10	0	10	4	10	4			24	1.0	1.0	Fusion	circle 7/9
26	6	6	0	0	10	XT 10	0	XT 8	65	1.0	0.6	Alt. Supp	no
27			20	14	8	0			24	0.7	0.7	Fusion	not tested
28					12	12	6	0	129	1.0	1.0	Fusion	

al.[1] Biedner et al[11] found that 8 (89%) of 9 patients were successful when single medial rectus was re-recessed 13.5 mm posterior to the limbus regardless of the deviation. However, three of their patients did not have normal medial rectus function after surgery. Instead of re-recession, either faden operation,[15] marginal myotomy,[16] or marginal myotomy and lateral rectus resection in one eye[13,17] could be also performed. Von Noorden[15] who performed faden procedure on both medial recti in 12 patients reported a success rate of 92%. However, these patients were followed up for a mean of only 11 months after surgery. Helveston and Cofield[16] described their success in marginal myotomy of previously recessed medial recti. Their report, however, covered only 2 cases.

McPhee et al[17] reported success in 51% of 70 patients when they used marginal myotomy of medial rectus, often in conjunction with BLR resection. Kim et al[13] used a similar approach, comparing the results with those of 2.0 mm medial rectus re-recession. They found that the former, in which the correction amount was relatively favorable (26-29PD) and no postoperative overcorrection was observed, was more effective and more stable than the latter which achieved the correction of 15PD in single eye re-recession and 20-25PD in both eye surgery.

Table 3. Results of BLR resection for residual esotropia at postoperative follow up

	Postoperative (months)		
	6(n = 25)	12(n = 19)	24(n = 11)
Success	17/25(68%)	13/19(68.4%)	8/11(72.7%)
Undercorrection	7/25(25%)	6/19(31.6%)	2/11(18.2%)
Overcorrection	1/25(4%)	0/19(0%)	1/11(9.1%)

Unilateral or bilateral lateral rectus resection[1-5] is another commonly used method. King et al[14] achieved successful alignment in 19 (59%) of 32 patients following BLR resection. They advocated that it was more accurate and more effective than medial rectus re-recession which sometimes showed gradual exotropic drift during follow up. However, they also reported a higher rate of undercorrection in BLR resection than in BMR re-recession.

Mims and Wood[2] performed BLR resection under the consideration of the amount of BMR recession and the size of residual esotropia. They reported that 52 (87%) of 60 patients were successful six months after surgery. Regardless of the amount of the primary surgery, Gunasekera et al[4] performed BLR resection under the consideration of the size of residual esotropia and reported that 15 (60%) of 25 patients were successful while there were 8 cases of undercorrection and 2 of overcorrection at a mean of 37 months after surgery. Shin et al[5] performed BLR resection for 30 patients. In the group whose angle of deviation was below 40PD (n = 22), 20 (90.9%) were successful, 2 (9.1%) were overcorrected, and none was undercorrected at the 1st year after surgery, while in the group whose angle of deviation was over 40PD (n = 8), the success rate was low (37.5%) and the eye alignments were not stable after surgery. They concluded that the method was effective when the angle was below 40PD.

According to the reports mentioned above, abnormal function of medial rectus was intermittently observed and the success rate declined during follow up after medial rectus re-recession. Marginal myotomy of medial rectus was rarely performed. Faden operation had a short follow up period. The occurrence of exotropic drift was less in BLR resection, when compared to medial rectus re-recession, despite of its higher risk in undercorrection, and the development of abnormal medial rectus muscle function was rare. Moreover, lateral rectus resection offers the advantages of surgery following standard surgical table on previously unoperated muscle. However, few results have been reported and the relevant studies have yielded various results.

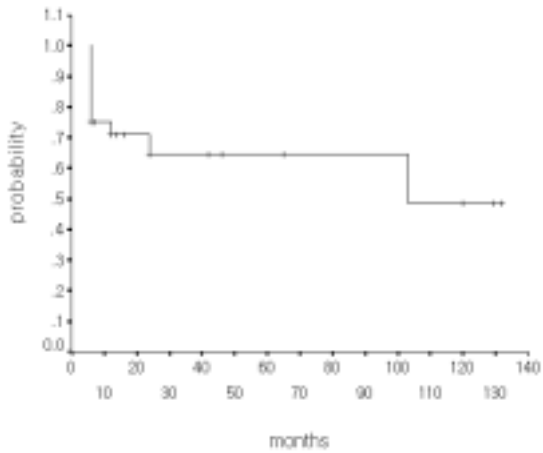

Fig. 1. Survival curve demonstrating alignment success following bilateral lateral rectus resection for residual esotropia (Kaplan-Meier survival analysis). Up to 70% of patients had successful eye alignments, which were stable during two-year follow up.

We performed BLR resection (or tucking) for residual esotropia following BMR recession. The success rate reached 70%, and the eye alignments of the patients were stable during two-year follow up (Table 3, Fig. 1). Of 2 overcorrections, one (#7) showed mild limitation of adduction in the left eye six months after surgery and was not followed up thereafter, while the other (#23) achieved satisfactory eye alignment six months after surgery but later showed exotropic drift. Among 7 patients of undercorrection six months after surgery, one (#10) achieved successful alignment during follow up. In 2 patients (#4 and 9) with satisfactory alignment six

Table 4. Results of BLR resection according to esotropia type

		Preoperative (months)		
		6(n = 25)	12(n = 19)	24(n = 11)
Infantile ET	Success	14/18(77.8%)	10/13(76.9%)	6/8(75%)
	Undercorrection	3/18(16.7%)	3/13(23.1%)	2/8(25%)
	Overcorrection	1/18(5.6%)	0/13(0%)	0/8(0%)
Acquired ET	Success	3/7(42.9%)	3/6(50%)	2/3(66.7%)
	Undercorrection	4/7(57.1%)	3/6(50%)	0/3(0%)
	Overcorrection	0/7(0%)	0/6(0%)	1/3(33.3%)

months after surgery, esotropia developed later. Unilateral or bilateral medial rectus re-recession was performed for 2 patients among those who experienced undercorrections.

Considering that the difference in the success rate based on the size of residual esotropia was not statistically significant (p = .604), it is reasonable to follow "Cooper's dictum" when BLR resection is performed as secondary surgery for residual esotropia following BMR recession. The presence of amblyopia (p = 1.00), the presence of other deviations (p = 0.387), and the performance of other surgery (p = 0.393) were not associated with success or failure (Fisher's exact test).

Of 10 cases of acquired esotropia, 6 were partially-accommodative esotropia and 4 were nonaccommodative esotropia. We suspect that patients with acquired esotropia showed more cases of undercorrection because the amount of surgery was not augmented, which might be the reason for the lower success rate in acquired esotropia (p = .156, Fisher's exact test). Further studies of a larger group would be necessary to identify the reason.

In this study, the subjects who had undergone BLR resection showed a success rate of up to 70% during 2-year follow up and only one of them showed exotropic drift, which indicates that BLR resection for residual esotropia was appropriate as the secondary surgery. Its appropriateness is also supported by other studies[1,11,13,14] reporting that medial rectus re-recession did not have a high success rate or produced more cases of abnormal medial rectus muscle function. Moreover, it is more difficult to determine the amount of surgery in performing re-recession of medial rectus, the previously operated muscle. However, 7 patients were undercorrected at six months after surgery and the patients whose angle of deviation was over 40PD were not included in this study. A larger series of cases with longer follow up period will be helpful to provide stronger evidence for the effectiveness of this surgical method.

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