

Outcomes of Large Bimedial Rectus Recession in Large Angle Infantile Esotropia

Geniş Açılı İnfantil Ezotropyada Geniş Bimedial Rektus Geriletmesi Sonuçları

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ABSTRACT Objective: To evaluate the long-term follow-up results of augmented bimedial rectus recession in large angle infantile esotropia. **Material and Methods:** Patients with large angle infantile esotropia who underwent augmented bimedial rectus recession (6 to 7 mm) were retrospectively evaluated. The presence of latent/manifest nystagmus, dissociated vertical deviation, inferior oblique muscle overaction and convergence insufficiency were recorded. Surgical success was defined as a final horizontal alignment within 10 prism diopters of orthophoria. Final binocular status and stereopsis were evaluated in cooperating children. **Results:** Microtropia (within 10 pd of orthophoria) was achieved in 28 patients (65.1%) after the initial surgery, which was regarded as surgical success. Eleven patients (25.6%) were undercorrected and 4 (9%) were overcorrected. Convergence insufficiency was observed in 4 patients (9%). Spearman correlation test revealed that the response to horizontal surgery was related with the preoperative horizontal deviation angle in both bimedial 6 and 6.5 mm recession surgery groups ($\rho=0.484$, $p=0.008$ and $\rho=0.809$, $p=0.001$, respectively). **Conclusion:** Augmented bimedial rectus recession is an effective initial surgical treatment in large angle infantile esotropia, however secondary convergence insufficiency can be observed in the long-term follow-up.

Key Words: Esotropia; convergence, ocular

ÖZET Amaç: Geniş açılı infantil ezotropyada, artırılmış bimedial rektus geriletmesinin uzun dönem sonuçlarını değerlendirmek. **Gereç ve Yöntemler:** Geniş açılı infantil ezotropyada nedeniyle artırılmış bimedial rektus geriletmesi (6-7 mm) yapılmış hastalar retrospektif olarak değerlendirildi. Latent/manifest nistagmus, dissosiyasyon, alt oblik kası hiperfonksiyonu birlikteliği ve konverjans yetmezliği kaydedildi. Nihai horizontal kaymanın 10 PD esotropyaya ve 10 PD ekzotropyaya aralığında olması cerrahi başarı olarak tanımlandı. Koopere olablen çocuklarda nihai derinlik hissi ve binoküler görme durumu değerlendirildi. **Bulgular:** Yirmi sekiz (%65.1) hastada ilk cerrahiden sonra, cerrahi başarı olarak tanımlanmış olan mikrotropiya elde edildi. Onbir (%25.6) hastada az düzeltme ve 4 (%9) hastada fazla düzeltme saptandı. Dört (%9) hastada konverjans yetmezliği gözlemlendi. Spearman korelasyon testi hem bimedial 6 mm hem de bimedial 6.5 mm rektus geriletmesi yapılan gruplarda yapılan cerrahi miktarı ile elde edilen düzeltme miktarının cerrahi öncesi horizontal kayma açısı ile ilişkili olduğunu göstermiştir ($\rho=0.484$, $p=0.008$ ve $\rho=0.809$, $p=0.001$, sırası ile). **Sonuç:** Geniş açılı infantil ezotropyada artırılmış bimedial rektus geriletmesi ilk cerrahi tedavi olarak etkilidir, fakat uzun dönem takiplerde konverjans yetmezliği gelişebilir.

Anahtar Kelimeler: Ezotropyaya; konverjans

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The best surgical procedure and the timing of surgery for the treatment of large angle infantile esotropia is still controversial. There have been studies evaluating the outcomes of augmented bimedial rectus recessions up to 8 mm.¹⁻⁷ They all reported that augmented bimedial

al rectus recession was effective and safe, therefore should be preferred instead of three or four muscle surgery.

The purpose of this paper is to report our long-term results of augmented bimedial rectus recession in large angle infantile esotropia.

MATERIAL AND METHODS

Patients with large angle infantile esotropia who underwent augmented bimedial rectus recession (6 to 7 mm), in pediatric ophthalmology department of Hacettepe University Hospital, between 1993 to 2007 were retrospectively evaluated. Preoperative ophthalmologic examination findings, including findings regarding the fixation, cycloplegic refraction, ocular movements, angle of deviation and the presence of latent/manifest nystagmus, dissociated vertical deviation and inferior oblique muscle overaction were recorded from the charts of the patients. Since measuring the deviation angle at distance is nearly impossible for young children, the deviation angle at near was used. Surgical plan was based on the measurements with glasses. The timing and details of each surgery and the duration of the follow-up period were noted for each child. Bimedial rectus recessions were performed either by fixed, loop or hang-back suture technique. Inferior oblique muscle tenotomy, recession or anteriorization were performed in the same session. Records of the final ophthalmologic examination, including the above mentioned parameters, binocular status and stereopsis of the cooperating children were obtained. Binocular status and stereopsis were evaluated by Worth 4 dot and Titmus tests, respectively. Surgical success was defined as a final horizontal alignment within 10 prism diopters of orthophoria (microtropia) measured at distance with glasses. Esotropia and exotropia greater than 10 prism diopters, were defined as undercorrection and overcorrection, respectively.

Patients were divided into two groups based on the amount of bimedial rectus recession; bimedial 6 mm (n= 29), 6.5 mm (n= 12) and 7 mm (n= 2) recession groups. Non-parametric Spearman rank correlation analysis was used to assess the association between the preoperative horizontal deviation

angle and response to horizontal surgery within 6mm and 6.5 mm surgery groups, separately.

RESULTS

Forty-three patients (21 males, 22 females; mean \pm SD 93.83 \pm 48.55 months, age range 16 to 180 months) were included in the study. The details of the preoperative ophthalmologic examination findings are summarized in Table 1.

TABLE 1: Details of the preoperative ophthalmologic examination findings.

Parameters	Number of patients
Fixation preference	
Grade 1 alternation	1
Grade 2 alternation	3
Grade 3 alternation	16
Grade 4 alternation	23
Cycloplegic refraction	
Myopia	1
Hyperopia	21
Astigmatism	12
Emetropia	9
Ocular Movements	
Limitation of abduction	
No limitation	40
-1	1
-2	2
Inferior oblique overaction	
No overaction	21
+1	4
+2	7
+3	9
+4	2
Angle of deviation	
50-60 PD	15
60-70 PD	13
70-80 PD	6
80-90 PD	8
90-100 PD	1
Presence of additional finding	
Latent/manifest nystagmus	
Positive	4
Negative	39
Dissociated vertical deviation	
Positive	9
Negative	34

PD: Prism diopters

TABLE 2: The details of the initial surgery.

Type of surgery	Number of patients
BMR Recession (6-7mm) (Fixed Suture)	21
BMR Recession (6-7mm) (Loop Suture)	1
BMR Recession (6-7mm) (Hang-Back Suture)	3
BMR Recession (6-7mm) (Fixed Suture)+bilateral IO tenotomy	5
BMR Recession (6-7mm) (Fixed Suture)+bilateral IO recession (10mm)	2
BMR Recession (6-7mm) (Fixed Suture)+bilateral IO anteriorization	7
BMR Recession (6-7mm) (Hang-back Suture)+bilateral IO anteriorization	2

The mean preoperative angle was 64.07 prism diopters \pm 10.47 (range 50 to 90 prism diopters). The mean age at the time of first surgery was 20.32 months \pm 12.61 (range 7 to 72 months). Patients underwent bimedial rectus recessions varying between 6 to 7 mm. The details of the initial surgery are outlined in Table 2.

The mean follow-up period was 46.88 months \pm 40.50 (range 7 to 132 months). Microtropia was achieved in 28 patients (65.1%) after the initial surgery, which was regarded as surgical success. Only 3 of the patients with microtropia underwent a second operation for a unilateral or bilateral inferior oblique muscle overaction. The details of the final ophthalmologic examination findings of patients with microtropia are outlined in Table 3. Eleven (25.6%) patients were undercorrected and 4 (9%) were overcorrected. A second operation was planned for only one of the patients with consecutive exotropia, however the family refused. Four of the undercorrected patients underwent a second operation while 2 of them were still undercorrected and required the third operation. The details of the ophthalmologic examination findings of patients with overcorrection or undercorrection and further surgeries required are outlined in Table 4. Secondary convergence insufficiency developed in 4 patients (9%), in 1 to 5 years after the initial surgery.

Spearman correlation test revealed that the response to horizontal surgery was associated with the

TABLE 3: Details of the final ophthalmologic examination findings of patients with microtropia after initial surgery.

Parameters	Number of patients (N= 28)
Presence of amblyopia	
Unilateral	11
Bilateral	1
None	3
No-cooperation	10
Cycloplegic refraction	
Myopia	2
Hyperopia	15
Astigmatism	8
Emetropia	5
Ocular Movements	
Limitation of convergence	
Positive	1
Negative	27
Inferior oblique overaction	
No overaction	20
+1	5
+2	
+3	2
+4	1
Inferior oblique underaction	
-2	1
Presence of additional finding	
Latent/manifest nistagmus	
Positive	3
Negative	25
Dissociated vertical deviation	
Positive	7
Negative	21
Worth 4 dot test	
Unilateral suppression	3
Alternating suppression	6
Peripheral fusion	1
No-cooperation	11
Stereopsis (Titmus)	
No-cooperation	10
None	9
3000 sec/arc	2
Further surgery	
Unilateral IO myectomy	1
Bilateral IO recession	1
Bilateral IO tenotomy	1

PD: Prism diopters, IO: Inferior oblique

TABLE 4: Details of the ophthalmologic examination findings and further surgeries of patients with overcorrection or undercorrection.

P	Sex	Age (IS)	Preoperative DA/presence of DVD, L/MN, IOOA	Initial surgery	DA and presence of DVD, L/MN, IOOA and CI after IS	Further Surgery	Final DA and presence of DVD, L/MN, IOOA and CI	Worth and titmus	Amblyopia	FUD
1	F	1 y	70-80 PD	BMRR (6 mm) FS	25 PD XT	-	30 PD XT 20 PD RHT; RIOOA +2	NC	b/l	4 y
2	M	1.5 y	60-70 PD	BMRR (6 mm) HB	35 PD XT	Refused	35 PD XT;CI	NC	b/l	1.5 y
3	M	2 y	50-60 PD;DVD,L/MN, BIOOA +1	BMRR (6 mm) FS	20 PD XT; DVD, L/MN, BIOOA +1	-	20 PD XT 16 PD RHT, DVD BIOOA +2, L/MN	NC	NC	2 y
4	M	1.5 y	50-60 PD; LIOOA +1	BMRR (6 mm) FS	20 PD XT; DVD, LIOOA+1	-	20 PD XT 6 PD RHT, DVD, LIOOA+1,CI	RS,3000 sec/arc (?)	u/l	10 y
5	M	2 y	50-60 PD	BMRR (6mm) FS	18 PD ET	-	18 PD ET	NC	NC	1 y
6	M	2 y	50-60 PD; BIOOA +3	BMRR (6 mm) FS + BIOT	40 PD ET	2-7 mm RLR Resection 3-LMRE*	4 PD ET 4 RHT	LS,NS	b/l	8 y
7	M	2 y	70-80 PD; 20 PD LHT; BIOOA +3	BMRR (6 mm) FS + BIOT	30 PD ET	2- 6.5 mm BLR Resection	14 PD ET, BIOOA +1	RS,NS	u/l	11 y
8	M	7 m	60-70 PD	BMRR (6 mm) FS	35 PD ET	2- 7.5 mm RLR Resection 3-7 mm LLR Resection	8 PD ET	AS,NS	None	8.5 y
9	F	1 y	90-100 PD	RMRR (6.5 mm)+ LMRR (6 mm) FS	30 PD ET	2- 5 mm LLR Resection+LMRE*	10 PD ET; BIOOA +2	NC	b/l	4 y
10	F	14 m	50-60 PD;14 PD LHT;BIOOA+2+3	BMRR (6 mm) FS + BIOT	25 PD ET	-	25 PD ET, CI	NC	NC	1.5 y
11	F	15 m	80-90 PD;DVD,L/MN, BIOOA +3	BMRR (6 mm) FS + BIOA	20 PD ET	-	20 PD ET	NC	NC	1 y
12	M	13 m	70-80 PD;DVD, BIOOA +3	BMRR (6 mm) HB + BIOA	16 PD ET	-	16 PD ET	NC	b/l	4 y
13	F	1.5 y	60-70 PD	BMRR (6.5 mm) HB	14 PD ET	-	14 PD ET; BIOOA +2	AS, NS	b/l	3.5 y
14	F	2 y	60-70 PD;DVD,L/MN, BIOOA +3	BMRR (6.5 mm) FS+ BIOA	25 PD ET	-	25 PD ET	NC	NC	9 m
15	M	11 m	70-80 PD; BIOOA +3	BMRR (6.5 mm) FS+ BIOR	20 PD ET	-	20 PD ET;6 PD LHT;DVD;LIOO+1	NC	NC	1.5 y

P: Patient, F:Female, M: Male, y:year, m:month, IS:Initial surgery, DA: Deviation angle, DVD: Dissociated vertical deviation, L/MN:Latent/Manifest nistagmus, IOOA: Inferior oblique overaction, BIOOA:Bilateral Inferior oblique overaction, LIOOA: Left inferior oblique overaction, RIOOA: Right inferior oblique overaction, PD: Prism diopters, LHT:Left hypertropia, RHT: Right hypertropia, BMR:Bimedial rectus recession, FS: Fixed suture, HB:Hang-back, BIOT: Bilateral inferior oblique tenotomy, , BIOR: Bilateral inferior oblique recession, , BIOA: Bilateral inferior oblique anteriorization, ET: Esotropia, XT:Exotropia, CI: Convergence insufficiency, LLR: Left lateral rectus, RLR: Right lateral rectus, BLR: Bilateral lateral rectus, LMRE: Left medial rectus exploration, NC: No cooperation, RS: Right supression, LS: Left supression, AS: Alternating supression, NS: No stereopsis, u/l:unilateral, b/l:bilateral
*Left medial rectus was explored and re-recessed. (measured 11.5 mm from the limbus)

preoperative horizontal deviation angle in both surgery groups ($\rho= 0.484$, $p= 0.008$ for bimedial 6 mm resection and $\rho= 0.809$, $p= 0.001$ for bimedial 6.5 mm resection groups, respectively). This result showed that, the greater the preoperative horizontal deviation angle, the greater surgical response to the same amount of bimedial rectus recession was.

DISCUSSION

The efficacy and safety of exceeding the traditional 5 mm maximum recession of each medial rectus muscle to correct large angle esotropia was first described by Hess et al.⁶ Their results indicated that alignment to within 10 prism diopters with one

procedure was more likely by large recessions of the medial rectus than by other approaches.

Szmyd et al evaluated the outcomes of large (6 and 7 mm) bimedial rectus recessions in congenital esotropia with a deviation angle greater than 50 prism dioptres.⁴ They reported a success rate of 91% with an average follow-up period of 13 months. They concluded that large bimedial rectus recessions were an effective surgical treatment for congenital esotropia and the procedure did not significantly alter adduction. Their findings showed that initial surgery on three or more muscles was unnecessary in congenital esotropia.

Nelson et al reported a success rate of 83.5% with large (6 and 7 mm) bimedial rectus recessions in congenital esotropia with deviations greater than 50 prism dioptres.¹ Their average follow-up duration was 23.4 months. They also clarified that large bimedial rectus recessions for congenital esotropia did not significantly alter adduction.

Weakley et al reviewed the surgical records of 77 patients who had undergone 7-mm bilateral medial rectus recessions for large-angle congenital esotropia.⁵ The mean age at the time of surgery was 12.9 months. The mean preoperative deviation was 69 prism diopters. They reported a satisfactory horizontal alignment in 47 (61%) patients at their latest follow-up examination (mean, 27 months). The esotropia was undercorrected in 21 (27%) patients and overcorrected in nine (12%). Amblyopia was noted in 30%, oblique muscle dysfunction in 44%, and dissociated vertical deviation in 36% of the patients. Regression analysis of multiple variables showed alignment at 6 weeks to be the only predictor of the final outcome ($R = .83$). Extramacular fusion was achieved in 10 of 11 patients for whom reliable sensory data were available. The mean age at surgery of these patients was 9.7 months. They concluded that seven-millimeter bilateral medial rectus recessions were an effective alternative to three- and four-muscle procedures in the initial treatment of large-angle congenital esotropia.

Weakley et al reported a success rate of 75% in another study in which they evaluated the results of 7 mm bilateral medial rectus recessions by the cul-de-sac approach in large angle infantile es-

otropia.⁷ The average deviation angle was 74 prism diopters. Five (14%) patients were undercorrected and four (11%) patients were over-corrected. The mean follow-up duration was 18.2 months.

Damanakis et al evaluated the results of 8 mm bimedial rectus recession in large angle infantile esotropia.² There were sixteen patients with deviations of 80-90 prism diopters. The mean age at the time of surgery was about 2 years and the mean follow-up duration was 16.3 months. They reported a success rate of 75% after the initial surgery. Four (25%) patients were undercorrected. They did not observe clinically significant limitation of adduction or convergence postoperatively in any of the patients. Consecutive exotropia was not encountered. Their results suggested that 8 mm recession of the medial recti was an effective procedure for the correction of large angle infantile esotropia of 80-90 prism dioptres and could be considered as an acceptable alternative to operations on three or four muscles.

In our series, the success rate of the initial surgery was 65.1%. Despite the results of previous studies, we observed convergence insufficiency in 4 (9%) patients after bimedial recessions of 6 to 7 mm. Secondary convergence insufficiency was detected in these patients between 1 to 5 years after the initial surgery. The mean follow-up duration was 46.88 months \pm 40.50 (range 7 to 132 months) in our study which was greater than that of all of the mentioned studies above. However, only the greater follow-up duration may not be a satisfactory explanation for such a difference.

We analyzed that the response to horizontal surgery was associated with the preoperative horizontal deviation angle. In other words, the more the preoperative horizontal deviation angle, the more response to the same amount of bimedial rectus recession was. This result definitely showed that the same amount of bimedial rectus recession would correct more in a larger preoperative deviation.

In conclusion; augmented bimedial rectus recession is an effective initial surgical treatment in large angle infantile esotropia, however secondary convergence insufficiency can be observed as an undesired outcome in the long-term follow-up, which should be kept in mind.

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