Original Research Article

The title of the article: Long-Term Results of Symmetrical and Asymmetrical Surgery for basic- type Intermittent Exotropia

Running title: Surgery for Intermittent Exotropia

ABSTRACT

Aim: To evaluate the long-term results of symmetrical (i.e., bilateral lateral rectus recession) (BLR rec) and asymmetrical (i.e., unilateral medial rectus resection and lateral rectus recession) (R-R) surgical treatment of patients with a diagnosis of basic-type intermittent exotropia (X(T))

Methods: The patient folders of a total of 65 patients with basic-type X(T) who visited the Ankara Ulucanlar Eye Education and Research Hospital Eye Clinic Strabismus Unit between January 2004 and January 2013 and underwent strabismus surgery were analyzed retrospectively. The patients were evaluated according to the applied surgical method: patients treated using the BLR rec method (Group 1= 25) and patients treated using the R-R method (Group 2= 40). During the last examination after the first postoperative year, a deviation ± 10 prism diopters (PD) was defined as successful. A 10-20 PD deviation was considered partially successful, and a PD of 20 or higher was considered unsuccessful. Controls were completed postoperatively after the 1st week, the 1st month, the 3rd month, and the 6th month and at 6-month intervals thereafter.

Results: The success rates were found to be 80.0% successful, 17.5% partially successful, and 2.5% unsuccessful in the R-R group and 44% successful, 32% partially successful, and 24% unsuccessful in the BLR rec group. The difference between the success rates of the groups was statistically significant (p=0.04)

Discussion: We found that the R-R method achieves more successful results than the BLR rec method in patients with basic-type X(T) .

Key Words: Exotropia, Strabismus, Surgery

INTRODUCTION

Strabismus is an ophthalmological disorder in which the eyes are misaligned.[1] Exotropia accounts for 15-20% of all strabismus cases, and two-thirds of cases are women. Intermittent exotropia [X(T)] is the most common cause of exodeviation in childhood.[2]

The recession or resection amounts of the muscles are determined based on the deviation angle in X(T) surgery. However, even with the same level of surgical intervention, the same correction cannot be achieved in all patients. Two of the most popular approaches (i.e., bilateral lateral rectus recession and unilateral lateral rectus recession–medial rectus resection) are recommend for the treatment of X(T).[3]

The aim of this study is to compare the long-term results of bilateral lateral rectus recession (binoculer) and unilateral lateral rectus recession with medial rectus resection (monoculer) and the pre-operative and post-operative factors that influence the long-term results and success of surgical interventions in basic type X(T) patients.

MATERIALS AND METHODS

The records of a total of 65 patients who were monitored for basic X(T) and received surgical treatment at Strabismus Unit between January 2004 and January 2013 were retrospectively reviewed. The hospital ethics committee of the Ankara Diskapi Yildirim Beyazit Training and Research Hospital approved this study.

Patients who previously underwent ocular muscle surgery or secondary exodeviation, who had paralytic strabismus, mental retardation, neurological disorders, congenital nystagmus and/or aniridia, amblyopia, profound inferior oblique hyperfunction (+3/4), dissociated vertical deviation, strabismus with an A or V pattern, or additional ocular pathology or who had a follow-up period of less than one year were excluded from the study.

A thorough cycloplegic refraction examination and refraction correction, which was based on the obtained findings, were performed during the follow-up appointments of the patients. A detailed fundus examination was performed for all patients. Visual acuity was recorded. Muscular functions were assessed in the primary and eight-look positions. During the strabismus examination, after determining whether the exodeviation was manifest or latent, the deviation angle was assessed by using an alternating cover prism test for near and distance. The cover-uncover test was not fully applicable in very young children, so the deviation assessed by using Krimsky and or Hirschberg test. Stereoacuity was measured using the vectographic Titmus in the cooperative.

For applicable cases, refraction defects were assessed primarily. Eyeglasses were prescribed at the highest value of best visual acuity in myopic patients and the lowest value of best visual acuity in hypermetrophic patients. Patients with amblyopia or weak fusion control were instructed to cover the non-dominant eye for half of a day if possible. The indications for surgery included manifest X(T) that was detected during at least two visits or X(T) and asthenopia that were noticed by the patient's relative for more than half of the patient's waking hours.

The presence of amblyopia and anisometropia was investigated. Amblyopia was defined as a difference in visual acuity of at least 2 Snellen lines between the eyes.

Muscle interventions for patients whose surgical session was scheduled were performed according to the tables provided by the American Academy of Ophthalmology (AAO) "Basic and Clinical Science Course" series (Table 1).

General and local anesthesia were administered in 47 and 18 patients, respectively. Based on the surgical technique, the patients were classified into the bilateral recession (Group 1, n=25) and unilateral recession-resection (Group 2, n=40) groups.

Recession and resection surgery were performed in all cases using conventional techniques. A 4-10 mm lateral rectus recession and a 4-8 mm medial rectus resection were performed in the recession-resection group (monocular), and a 6-9 mm bilateral lateral rectus recession was performed in the bilateral recession group (binocular).

In both of these groups, tobramycin and prednisolone containing drops were administered 5 times per day postoperatively. Based on the clinical course, these drugs were slowly reduced and discontinued within two weeks. The patients were scheduled for postoperative follow-up visits during the first week, the 2nd week, the first month, and the 6th month and at 6-month intervals thereafter.

A postop deviation of ± 10 PD or smaller deviation during the last postoperative examination were considered successful, postop deviation of 10-20 PD was

considered to be partial success, and patients with greater than a 20 PD deviation were considered unsuccessful.

The data was analyzed using the SPSS 15.0 software. Descriptive tables, means and standard deviations, and frequency tables were prepared using the results from the data. The Chi-Square and Mann-Whitney tests were used for statistical analyses. The results were considered using a 95% confidence interval, and statistical significance was defined as a p value of less than 0.05.

RESULTS

Sixty five patients were included in this study. In first group Fifteen (60%) patients were female and ten (40%) patients were male. The mean age was 24.5 ± 11.7 years (5-48 years) in this group (Table 2). In second group Twenty-six (65%) patients were female and fourteen (35%) patients were male. The mean age was 25.7 ± 14.5 years (5-60 years) in this group. No statistically significant differences were observed between these two groups according to age or gender (p=0.68).

When the 25 patients in the first group were classified according to the age of onset, the onset age for 7 patients (28%) was between 0-1 years, for 11 patients (44%) was between 1-7 years and for 7 patients (28%) was more than 7 years old. The youngest age was ten months, and the oldest detection age was 30 years. When the 40 patients in the second group were assessed for the age of onset of the deviation, 17 patients (42.5%) were 0-1 years, 15 patients (37.5%) were 1-7 years and 8 patients (20%) were more than 7 years old. The youngest detection age was 0 years, and the oldest detection age was 35 years. No statistically significant differences in the onset age of deviation were observed between these two groups (p=0.48).

In the first group during surgery there were 3 patients (12%) less than 10 years old and 22 patients (88%) more than 10 years old. At the time of surgery, the youngest age was 4 years, and the oldest was 43 years. When the operation age of the 40 patients in the second group was assessed, there were 6 patients (15%) less than 10 years old and 34 patients (85%) more than 10 years old. The youngest operation age was 4 years, and the oldest operation age was 56 years. No statistically significant differences were observed in the operation ages of these two groups (p=0.73). In the first group during surgery mean age was 21.28 ±11.02 years (4-43 years),in the second group during surgery mean age was 22.80±14.29 years (4-54 years).

The refractive errors of the patients were also considered as spherical equivalents. In the first group (n=25), 6 eyes (24%) had 0/+2 hypermetropia, 1 eyes (4%) had more than +2.00 hypermetropia, 14 eyes (56%) had 0/-2 myopia, and 4 eyes (16%) had more than -2.00 myopia as the right eye spherical equivalent. In addition, 6 eyes (24%) had 0/+2 hypermetropia, 1 eyes (4%) had more than +2.00 hypermetropia, 14 eyes (56%) had 0/-2 myopia, and 4 eyes (16%) had more than -2.00 myopia as the left eye spherical equivalent.

In the second group (n=40), when the right eye spherical equivalent was considered, 14 eyes (35%) had 0/+2 hypermetropia, 1 eyes (2.5%) had more than +2.00 hypermetropia, 24 eyes (60%) had 0/-2 myopia, and 1 eyes (2.5%) had more than -2.00 myopia. When the left eye spherical equivalent was assessed, 14 eyes (35%) had 0/+2 hypermetropia, 1 eyes (2.5%) had more than +2.00 hypermetropia, 24 eyes (60%) had 0/-2 myopia, 1 eyes (2.5%) had more than -2.00 myopia. No statistically significant differences were observed between the right spherical equivalents of these two groups (p=0.22).

When the pre-operative deviation angle of the patients in the first group was assessed, the obtained value was 10-18 PD in 1 patient (4%), 20-25 PD in 6 patients (24%), 30-35 PD in 9 patients (36%) and 40-50 PD in 8 patients (32%) and more than 50 PD in 1 patients (%4). When the pre-operative deviation degrees of the second group of patients were assessed, the obtained value was 10-18 PD in 3 patients (7.5%), 20-25 PD in 6 patients (15%), 30-35 PD in 12 patients (30%), 40-50 PD in 14 patients (35%) and more than 50 PD in 5 patients (12.5%). No statistically significant differences were observed between the pre-operative deviation degrees of these two groups (p=*0.66*). The pre-operative deviation angle of the patients in the first group was mean deviation 33.60±8.95 PD, in the second group was mean deviation 37.65±12.50 PD.

The distance and near deviations of all of our cases were thoroughly calculated pre-operatively and post-operatively after the first day, the first month, the sixth month and the first year. When the distance deviation of the first group (n=25) was assessed after the first post-operative year, the mean rank was 39.98 PD (0.0-30.0 PD). When the distance deviation of the second group (n=40) was assessed, the mean rank was 28.64 PD (0.0-35.0 PD). A statistically significant relationship was observed between the first and second groups in terms of the distance deviation after the first post-operative year ($p<0.05$) (Table 1).

When the near deviation of the first group (n=25) was assessed after the first post-operative year, the mean rank was 40.10 PD (0.0-30.0PD). When the near deviation of the second group (n=40) was assessed after the first post-operative year, the mean rank was 28.56 PD (0.0-35.0 PD) A statistically significant relationship was observed between the first and the second groups in terms of the near deviation after the first post-operative year ($p <0.05$).

In the BLR rec. group (n=25), 11 patient (44%), 8 patients (32%), and 6 patients (24%) were considered successful, partially successful and unsuccessful, respectively. In the R-R group (n=40), 32 patients (80%), 7 patients (17.5%) and 1 patients (2.5%) were considered successful, partially successful and unsuccessful. When these groups were compared with each other, a statistically significant difference in success rates was observed (p=*0.04*).

Among 65 patients, Patients exhibited stereoacuity with Tıtmus before (%75) and after (%89) surgery. A statistically significant difference or increase was observed between and after surgery ($p <0.05$).

The mean amount of 7.00±0.95 mm recession in the first group(BLR rec group). The mean amount 7.37±1.60 mm recession, the amount of resection was 5.90±1.30 mm in the second group(R-R group).

The preoperative and postoperative characteristics of the patients in the bilateral lateral rectus recession group and the unilateral medial rectus resection and lateral rectus recession group are shown in Table 2.

DISCUSSION

Surgical intervention is currently the standart treatment for basic-type X(T). A number of different factors might affect surgical succes. These factors include the onset age of the deviation, the age at the surgery, the time elapsed before surgery, the visual acuity, the degree of anisometropia, refraction errors, the pre-operative deviation angle, the presence of a pattern, and the presence of amblyopia and binocular visual function.

A number of previous studies indicated that exodeviation is more prevalent in girls than boys. [3-7] In our study, the number of girls with basic X(T) was 41 (63.1%), and the number of males was 24 (36.9%).

The onset age of exodeviation was 1 year or younger in 37% of the cases, between 1 and 7 years in 40% of the cases and older than 7 years in 23% of the cases. These rates were considered to be consistent with other studies that reported the early development of EX and its progression over time. [3-4,8-10]

In our cases, the time from the onset of strabismus to surgery was mean age 16.33± 11.50 years (1-48 years). In our study, 11 patients (17%) underwent surgery within 5 years, 37 patients (57%) underwent surgery after 6-20 years and 17 patients (26%) underwent surgery after 20 years. Delayed surgical treatment was associated with delayed referral.

Some authors suggested that surgery should be used only before the age of four if other methods fail to provide fusion and the deviation becomes permanent. [3,8,10] The distribution of our cases according to operation age was as follows: 9 patients (14%) had an operation age of less than 10 years, and 56 patients (86%) had an operation age of more than 10 years. The frequency of operation prior to 10 years of age (86%) suggests that patients are likely being referred for cosmetic concerns. We recommend an age of four years for surgical treatment, but surgery can be scheduled earlier for patients with fixated or rapid progressive deviation. In our cases, the operation age was mean 22.30±13.00 years.

Kim et al. [11] found that the distribution of the refractive error does not differ from that of the normal population. We found a mild refraction error (+/-2 diopter) in most of our cases (90%). The frequency of eyes with a refractive error more than +/-2 was approximately 10%. No statistically significant differences were observed between left and right eyes in terms of the refractive defect ($p>0.05$). Our findings concerning refraction were consistent with the literature. [8,11-12]

Many studies concerning surgical success rate for the basic type of X(T) are available in the literature. Some of those studies. [4,6,8,10-18] suggest that the unilateral recession-resection technique is more effective; however, other studies [9,18-21] suggest that bilateral lateral rectus resection is more effective. In addition, some studies suggest that both techniques are effective. [3,22-23]

Kargı et al. [4] demonstrated that among patients with basic-type X(T), the group that underwent symmetrical lateral rectus recession had a 55% success rate and the group that underwent unilateral recession-resection had a 93% success rate. Although the group that underwent bilateral lateral rectus recession had a lower preoperative deviation rate than the other group, the results obtained after bilateral lateral rectus recession were less successful than those of the group that underwent recession-resection. Kushner et al. reported that the most important factor affecting surgical outcome is preop deviation. [24] Both groups were classified according to the amount of the preop deviation In our study. Success rates in pre op over 50 PD deviation patients were lower in both groups

In our study, we evaluated two groups that were considered homogeneous. We concluded that the unilateral recession-resection technique is more successful than the bilateral lateral rectus recession technique for basic-type X(T), so this method should be the preferred method.

4. REFERENCES

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Table 1. **Surgical dosage used for basic-type ıntermittent exotropia**

Monoocular surgery			**Bilateral surgery**
Prism Diopters	Lateral Rectus Recession	Medial Rectus Resection	Bilateral Lateral Rectus Recession
15	4 mm	3 mm	4 mm
20	5 mm	4 mm	5 mm
25	6 mm	5 mm	6 mm
30	7 mm	6 mm	7 mm
40	8 mm	6 mm	8 mm
60	10 mm	8 mm	
70	10 mm	9 mm	
80	10 mm	10 mm	

Table 2 Preoperative patient characteristics in the bilateral lateral rectus recession group and the unilateral lateral rectus recession–medial rectus resection procedure group of basic-type ıntermittent exotropia

Patient characteristics	BLR Group	R-R Group	P values
Number of patients	25	40	
Sex, F:M	15:10	26:14	0.68
Age at onset of deviation, mean (range), years	8.24 ±9.54 (0-30)	4.68±6.35 (0-30)	0.48
Age at surgery, mean (range), Years	21.28 ±11.02 (4-43)	22.80±14.29 (4-54)	0.73

Spherical equivalent, mean (range), diopters OD, mean (range) OS, mean (range)	 -0.031 ±1.74 +0.091 ± 1.77	 +0.017 ±2.40 +0.095 ±2,50	0.22
Preoperative angle of deviation, mean (range), prism diopters At distance At near	 33.60 ± 8.95 33.60 ± 8.95	 37.65 ±12.50 37.65 ±12.50	0.66

BLR: bilateral lateral rectus recession;
F:female; M :male;
OD: right eye; OS: left eye;
R-R: unilateral lateral rectus recession–medial rectus resection procedure