

Original Article

Outcome of Strabismus Surgery by Nonadjustable Suture among Adults Attending a University Hospital of Saudi Arabia

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ABSTRACT

Objective: To describe the outcome and safety of surgical treatment of Saudi adult patients with strabismus by nonadjustable suture and to evaluate the prevalence of diplopia and binocularity after strabismus correction. **Materials and Methods:** Retrospective analysis of medical records of 96 patients above the age of 16-years old with strabismus seen at the King Fahd Hospital of the King Faisal University (KFUH) from July 1st, 2000 to June 30th, 2007 who were underwent strabismus correction surgery. The demographic variables: pre- and post-operative alignment, binocularity, and visual acuity were analyzed. **Results:** A total of 96 patients of whom 63 (66%) patients were male and 33 (34%) patients were female, aged 16 years and above underwent strabismus correction, 83 (86%) patients ended with postoperative orthophoria, 13 (14%) patients ended with postoperative residual deviation, 83 patients (86%) had defective vision with amblyopia. Improvement of binocularity and binocular visual acuity postoperatively was achieved in 32(33%). Forty (42%) of our patients developed transient diplopia postoperatively which disappeared within 6 weeks while only three developed permanent diplopia. The main cause of adult strabismus was childhood squint in 83 (86%) patients and traumatic in 3 (13%). **Conclusion:** Surgical treatment of strabismus in Saudi adult with nonadjustable suture is safe and effective procedure with low risk of complication and the incidence of diplopia is rare with better binocularity and binocular visual acuity.

KEYWORDS: *Adult patients, binocularity, diplopia, strabismus*

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INTRODUCTION

Strabismus or misalignment of the eyes is a condition that occurs at all ages. In children, strabismus is frequently associated with amblyopia and lack of binocular fusion. Surgical treatment of childhood strabismus is frequently recommended to restore normal ocular alignment and facilitate development of binocularity.^[1] However strabismus surgery in adults can be more challenging than similar surgery in children, both in preoperative planning and intraoperative technique. There are various surgical techniques available, including the use of adjustable or nonadjustable sutures for the eye muscles. However there is uncertainty as to which of these suture techniques results in a more accurate alignment of the eye.^[2] There are a lot of studies evaluating the result of strabismus surgery and showed that strabismus surgery has functional benefit and is not just a cosmetic surgery.^[3] Surgical complications may differ between

surgery performed during early childhood and surgery performed on visually mature adult strabismus patients. Postoperative diplopia may occur in younger patients, but this complication is most likely to occur and bothersome in visually mature patients.^[4]

There are many studies showing the outcome of strabismus surgery by nonadjustable suture among adults. However according to our best knowledge, no such studies have been conducted in Saudi Arabia and so the result is largely unknown. This will be the first study to be conducted in a university based hospital of Al-Ahsa region of Saudi Arabia.

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METHODS AND MATERIALS

After signed consent of each patient and ethical approval from King Faisal University's ethical committee, a retrospective study of 96 adult patients who underwent strabismus surgery in King Fahd Hospital of King Faisal University from July 1st, 2000 to June 30th, 2007 was undertaken.

All the patients included in this study were above 16-years old with range of 16- to 61- years old. Full eye examination including the best corrected visual acuity (BCVA) by Snellen chart, visual acuity improvement with Log MAR, type of refractive error, auto-refraction, subjective refraction pre- and postoperatively, and binocularity with Worth 4-dot and stereoacuity were performed in all patients. In addition to the usual testing of ocular motility and sensory status, all patients with constant strabismus were tested while wearing an appropriate optical correction. Mild refractive error was equal to or better than 6/18 while moderate and severe refractive error were 6/118 to 6/60 and 6/60 to 3/60, respectively. The patients were then told to fixate on a Snellen optotype close in size to the vision threshold in their better-seeing eye. The deviations were then neutralized by placing prisms over the deviating eye (Krimsky Test). The patients were asked if he or she sees double. Regardless of the response to this test, the prism was removed and reintroduced with increasing power using either a prism bar or rotary prism. Beginning with 0 prism diopter (PD) the amount of prism was increased till it overcorrected the deviation by 5-10 PD. The patients were instructed to report if and when diplopia occurs as the prism power is increased. The prism power were successively decreased and again increased (perhaps several times) to determine at what point the diplopia can be eliminated and if the findings are reproducible the point the patients reported seeing double.

If patients did not see double with any of these tests, it was assumed that they would not see double after surgery, and no further testing was done. Patients who did report diplopia were told that there was a small risk of their having persistent postoperative diplopia.

Anisometropia were considered if 1D \geq myopia, 1.5D \geq hypermetropia, and 1.5D \geq astigmatism was found.^[5]

Extraocular muscle (EOM) movements, deviation at near and distance by prism and cover testing with and without correction, Ocular alignment and fixation pattern pre- and postoperatively were assessed. Anterior segment and fundus examination were done. Cases with history of previous strabismus surgery were excluded. Minimum postoperative follow-up for all patients was 6 months. The data were entered and processed using SPSS version 16 (SPSS Inc Chicago, IL, USA). A *p*-value of <0.05 was considered as statistically significant. For categorical data, proportions and percent were used for expression.

RESULTS

Data from a total of 96 patients were collected. Sixty three (66%) of patients were male and 33 (34%) were female. The age of all these subjects was in the range of 16-61 with a mean of 23 years \pm 8 years [Table 1]. Out of 96 patients, 23 (24%) were with unilateral esotropia (ET), 17 (17%) with alternating esotropia [ET], 29 (30%) with unilateral exotropia [XT], 26 (27%) with alternating exotropia, and 1 (1%) patients with hypotropia [Table 2]. Eighty three (86.45%) patients had squint since childhood [52 (63%) congenital and 31 (37%) with anisometropia], 11 (11.45%) patients with a history of trauma [9 (70%) with penetrating and 2 (15%) with nonpenetrating eye trauma], and 2 (2.1%) patient with postsinus surgery [Table 3]. Forty (42%) out of 96 patients had normal vision (6/6 on Snellen chart) while 56 (58%) patients

Table 1: Demographic information

Sex	Number
Male	63
Female	33
Age	Range of 16-61 with a mean of 23 years \pm 8 years

Table 2: Types of strabismus

Type of strabismus	No. (%)
Esotropia	23 (24%)
Unilateral	17 (18%)
Alternating	29 (30.0%)
Exotropia	26 (27%)
Unilateral	1 (1%)
Alternating	96 (100%)
Hypotropia	
Total	

Table 3: The onset time of strabismus

Gender	Onset				Total
	Childhood strabismus		Adult onset		
	Congenital	Anisometropia	Traumatic	Post sinus surgery	
Male	32 (33%)	21(22%)	9 (9.4%)	2 (2.1%)	64 (66.5%)
Female	20 (21%)	10 (10.4%)	2 (2.1%)	0	32 (33.5%)
Total	52 (54%)	31 (32.4%)	11 (11.5%)	2 (2.1%)	96 (100%)

Table 4: Type of strabismus and their visual status

Type of strabismus	Total no. (%)	Defective vision /No.	Level of refractive error	Refractive error					Normal vision (6/6 on Snellen chart)	
				Type						
				Hypermetropia	Anisometric hypermetropia	Myopia	Anisometric Myopia	Emmetropia		
Esotropia	Unilateral	23 (24%)	22		6	4	5	6	1	1
				Mild	1	0	0	0		
				Moderate	2	3	4	1		
	Severe	3	1	1	5					
	Alternating	17 (18%)	2	0	0	0	0	2	15	
Exotropia	Unilateral	29 (30%)	28		4	12	3	9	0	1
				Mild	0	1	0	0		
				Moderate	3	8	0	6		
	Severe	1	3	3	3					
	Alternating	26 (27%)	6	0	0	6	0	0	20	
	Mild				0					
	Moderate				2					
	Severe				4					
Hypotropia		1 (1%)		0	0	0	0		1	
Total		96 (100%)	58 (60.4%)		10 (10.42%)	16 (16.67%)	14 (14.58%)	15 (15.63%)	3 (3.1%)	38 (39.6%)

Table 5: Classification of deviation among the study subjects preoperatively and postoperatively

Type of strabismus	Number of patients	Degree of deviation pre operatively	Improvement after surgery
Unilateral Esotropia	0	10-20 PD	
	8	21-30 PD	<20PD
	12	31-40 PD	[20<] PD
	3	41-50 PD	20-30PD
	23	Range 25-50 PD and mean of 35.8 PD	
Total			
Alternating Esotropia	0	10-20 PD	
	4	21-30 PD	<20PD
	8	31-40 PD	<20PD
	2	41-50 PD	20-30PD
	2	51-60 PD	20-30PD
	1	61-70 PD	20-30PD
17	Range 20-70 PD and mean of 43.9 PD		
Total			
Unilateral Exotropia	0	10-20 PD	
	14	21-30 PD	<20PD
	18	31-40 PD	<20PD
	2	41-50 PD	20-30PD
	3	51-60PD	20-30PD
	37		
Total		Range 30-60 PD base in and mean of 44 PD	

Table 5 Continue...

Type of strabismus	Number of patients	Degree of deviation pre operatively	Improvement after surgery
Alternating Exotropia	0	10-20 PD	
	11	21-30PD	<20PD
	12	31-40 PD	<20PD
	1	41-50 PD	20-30PD
	24	Range 20-50 PD and mean of 35.8 PD	
Total			
Hypotropia	2	30 PD	<20PD
Total	96		

Table 6: Showing the outcome of strabismus surgery in our study

Outcome of strabismus surgery	No. of patients	% of patients
Improved Binocular vision		
On LogMAR		
No improvement	64	67
One line improvement	22	23
Two lines improvement	10	10
Total	96	100
Improved binocularity		
No improvement	64	67
Improved worth dot tests	23	24
Improved stereo (titmus fly test)	96	100
Total		
Postoperative diplopia		
No diplopia	53	55
Temporary	40	42
Permanent	3	3
Total	96	100
Postoperative improvement in alignment		
Successful realignment		
Unplanned reoperation	83	86
Total	13	14
	96	100

had defective vision. Among the patients with defective vision, 22 (37.9%) were with unilateral ET, 2 (3.5%) with alternating ET, 28 (48.3%) with unilateral XT, and 6 (10.3%) with alternating XT [Table 4].

The details of the refractive error and visual status of the patients is shown in Table 4. They underwent squint correction surgeries between July 1st, 2000 and June 30th, 2007. Surgery was performed for the first time in all these patients. The postoperative follow-up period was between 6 and 47 months, the mean of 11.4 ± 12.8 months and median of 7 months. Anterior segment and

fundus examinations were all normal except in one patient (traumatic), who had right Marcus Gunn pupil with central corneal opacity and macular scar in the same eye. Preoperative deviations were the same for near and distance with correction for all the patients, Twenty three patients with unilateral ET of range 25-50 PD and mean of 35.8 PD, 17 patients with alternating ET of range 20-70 PD, and mean of 43.9 PD, 29 patients with unilateral XT of range 30-60 PD base in and mean of 44 PD, 25 patients with alternating XT of range 20-50 PD and mean of 35.8 PD, and 2 patients with hypotropia 30 PD [Table 4]. Improvement of binocular visual acuity

postoperatively (tested on Log MAR) was observed in 32 (55%) out of 58 patients with defective vision after correction. The visual acuity could not improve in cases of amblyopia. Improvement in binocularity was also observed in those cases whose binocular vision improved [Table 5]. The improved binocularity may be due to better alignment of the eyes. Hypotropia 1 (1%) patients were operated with inferior rectus recession-(6 mm). Forty (42%) patients developed transient diplopia postoperatively (they were treated during the follow-up and the diplopia disappeared within 6 weeks). While 3 (3%) patients developed permanent diplopia. Eighty three (86%) patients improved with postoperative orthophoria (<20 PD), with preoperative deviation average 25-50 PD and mean of 36 PD. Fourteen (14%) patients improved with postoperative residual deviation 20-30 PD and mean of 25.3 with preoperative deviation average 45-70 PD and mean of 55.7.

DISCUSSION

The primary objective of most strabismus surgery in both children and adult is to normalize the ocular alignment. Surgery is capable of improving ocular alignment in the majority of patients as reported by various studies. The successful surgical alignment rate of 67-85% has been reported in these studies.^[1,3,7-9] We studied 96 patients with adult strabismus who underwent surgical correction, 83 (86%) of them had excellent alignment [Table 6]. This result is comparable to Flanders and Hastings's^[10] study where success rate was 82%. Fourteen (14%) patients ended with postoperative residual deviation and most of them were in high angle with average of 55 PD which might benefit more with adjustable suture where you can go for higher number and not afraid from over correction. One of the important benefits of surgical correction of strabismus in adult is postoperative binocularity. Cynthia Beauchamp *et al.*^[11] in their study has found that 30 (42%) out of 72 patients aged 16- to 80-years old had postoperative improvement in the binocularity, Kushner and Morton^[12] studied group of patients who were 21 years and older underwent strabismus surgery, 80% of their patients demonstrated improvement in the binocularity, In our study 32 (55%) out of 58 patients with defective vision achieved postoperative improvement of binocularity which is in between of previous studies.

Postoperative diplopia is mostly temporary which is evident from Kushner's study who studied 424 strabismus adult patients without preoperative diplopia. In his study he found that 40 (9%) patients had temporary diplopia which resolved in all cases by 6 weeks postoperatively and 3 developed persistent diplopia.^[13] Scott *et al.*

reported temporary postoperative diplopia in 3 (0.8%) of 338 patients while 5 (1%) patients had persistent diplopia.^[6] Likewise Gill and Drummond described temporary postoperative diplopia in 2 (1%) out of 137 patients while 4 (3%) had persistent diplopia.^[14] In our study, we had 40 (42%) patients with temporary postoperative diplopia, so postoperative diplopia is a rare complication of strabismus correction in patients who did not have preoperative diplopia. Choi and Rosenbaum^[15] reported 5 (24%) of 21 patients needed unplanned reoperation, Gonzales and Jaros^[16] reported 3 (23%) of 13 patients needed reoperation, and Wallace *et al.*^[17] reported 1 (25%) of 4 patients were needed unplanned reoperation, compared to that of the previous studies, our result showed 13 (13%) patients who needed unplanned reoperation.

CONCLUSION

This study confirms that that surgical treatment of strabismus in adult Saudi patients with fixed suture is safe and effective and is capable of realigning the eyes with a high rate of success. The results of the success and benefits after surgical correction of adult have shown that adult strabismus is more than just a cosmetic problem, and the surgical correction is therefore essential, because some recorded improvement in the binocularity and binocular vision.

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Conflicts of interest

There are no conflicts of interest.

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