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Strabismus Surgery with Adjustable Suture Technique in Patients with Horizontal Strabismus

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ABSTRACT

Objective: To evaluate the outcomes of squint surgery with adjustable sutures in patients with horizontal Strabismus.
Study Design: Quasi-experimental study.
Place and Duration of Study: Department of Pediatric Ophthalmology and Strabismus, Al-Shifa Trust Eye Hospital, Rawalpindi Pakistan, from Jul 2016 to Jun 2018.
Methodology: Adult patients with horizontal Strabismus and co-operative enough were selected for squint surgery with adjustable sutures. Squint surgery was performed under general anaesthesia. The recessed muscle was attached to the insertion site with hang back technique with a bow tie knot if required adjustment (further recession or advancement) was performed on the first post-operative day under topical anaesthesia. Preoperative, pre and post-adjustment and final post-operative orthoptic assessment were recorded.
Results: One hundred thirty-two patients were selected for strabismus surgery with adjustable sutures. Eighteen patients (13.6%) had a history of previous strabismus surgery. 75(56.8%) patients required post-operative adjustment of sutures. Orthophoria was achieved in 107(81.1%) and residual exotropia of less than 10pd in 25(18.9%) patients. Desired surgical outcome of orthophoria or the residual squint of less than 10 prism diopters was achieved in 100% of patients.
Conclusion: A positive surgical outcome was observed in our patients, and the second surgery for residual or consecutive squint was avoided.

Keywords: Adjustable Sutures, Horizontal Squint, Ocular Deviation, Strabismus.

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INTRODUCTION

Strabismus, also known as squint, is the deviation of the visual axis from an impeccable point of fixation.[1] Strabismus can be categorized as horizontal or vertical, comitant or non comitant.[2] Management of Strabismus is categorized into conservative treatments and strabismus surgeries. Conservative treatments include correcting refractive errors, orthoptic exercises, prismatic glasses, and botulinum toxin injections. Strabismus surgery can be performed with either adjustable or non-adjustable sutures.[3,4]

Despite advances in surgical techniques, the optimal management of the Strabismus remains a topic of debate among ophthalmologists.[4,5] The surgical management of Strabismus can be challenging since, despite the experience of the surgeon and the best possible care; the surgical outcome can still be unpredictable.[6] especially in cases with high degrees of squint or with restrictive or paralytic aetiology. The technique of adjusting sutures postoperatively in strabismus cases where the outcome of surgery was unpredictable was first described by Jampolsky in the late 1900s.[7] Strabismus surgery aims to align the eyes to improve cosmesis, promote fusion, restore single binocular vision, relieve diplopia, especially in primary gaze, or relieve abnormal head posture.[8,9]

Despite the high prevalence of Strabismus in Pakistan, there is a definite scarcity of studies evaluating the results of squint surgeries with adjustable sutures.[9] The majority of the studies published evaluated the outcomes of squint surgeries with fixed sutures. There was an evident limitation of the local literature. Henceforth, this study was undertaken. The present study aimed to evaluate the outcome of strabismus surgery using adjustable sutures in the management of adult patients with horizontal Strabismus.

METHODOLOGY

The quasi-experimental study was conducted at the Department of Pediatric Ophthalmology and Strabismus, Al-Shifa Trust eye hospital, Rawalpindi Pakistan, from July 2016 to June 2018 after approval from the Ethical Committee (ERC-31/AST-15). The sample size was calculated using the WHO calculator, taking a reported success rate of 77.7%.[10]

Inclusion Criteria: Patients with horizontal Strabismus who have been advised strabismus surgery with adjustable sutures at our hospital were included in the

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study. Adult patients with horizontal Strabismus, either esotropia or exotropia, with or without a history of previous strabismus surgery and co-operative enough to undergo surgery with adjustable sutures, were considered for the procedure.

Exclusion Criteria: Patients with a history of cardiac disease, diabetes, hypertension, or coagulopathy were not considered for adjustable surgery.

Informed written consent was acquired from participants who were thoroughly guided about the procedure and adjustment the next day. Sampling was done through the non-probability consecutive sampling technique. For each patient, a detailed preoperative work-up was done, including the visual acuity, refraction, anterior and posterior segment examination and orthoptic assessment, including measurement of the angle of deviation for near and distance using prism cover test or kromesky test (depending upon fixation), fixation preference, extraocular movements, stereopsis, and post-op diplopia testing.

Consultant paediatric ophthalmologists performed all surgeries in operating theatres under general anaesthesia. Adjustable squint surgery was performed following the conventional hang-back technique. The recessed muscle was reattached to the eyeball at the site of the original insertion with hang-back sutures and sutures secured with a bow-tie knot (Figure). On the first post-operative day, an orthoptic assessment, including prism cover test, ocular motility and diplopia testing, was performed, and adjustment was planned if required.

Figure: Lateral Rectus Muscle Recessed Via Bow Tie in place for Postoperative Suture Adjustment.

The adjustment of sutures was performed under topical anaesthesia, in a minor operation theatre, following aseptic measures. The conjunctival suture was released. Bow-tie knot was explored, and the muscles were either advanced or further recessed or tied at the same point, depending on the result of the prism cover test, extraocular motility, and post-op diplopia. After adjustment (further recession or advancement), the prism cover test was repeated, and extraocular movements and diplopia were checked. A permanent knot was applied when the target was achieved and the conjunctiva was closed. Topical antibiotic eye drops were instilled. Patients were discharged on topical antibiotics and steroids for a month.

Surgical success was achieved by post-operative orthophoria or residual deviation within ten prism diopters. All the details of the patient, including age and gender, laterality, type of squint and angle of deviation, were noted. Surgical details were also documented, including the type of surgery, pre-adjustment outcome, degree of deviation, adjustment performed and post-adjustment outcome.

SPSS ver 21 was used for the data analysis. Quantitative variables were expressed as Mean±SD and qualitative variables were expressed as frequency and percentages. Chi-square test was applied to explore the inferential statistics. The *p*-value of ≤0.05 was considered statistically significant.

RESULTS

During the study, squint surgery with adjustable sutures was performed in 132 patients with horizontal Strabismus. Seventy-nine patients (59.4%) were male. Out of 132 patients, 123(93.2%) had exotropia, and 9(6.8%) had esotropia. 56(45.5%) patients with exotropia and 6(66.7%) with esotropia had alternating Strabismus. 18(13.6%) patients had a previous history of strabismus surgery (Table-I).

Table-I: Demographic and Clinical Profile of Patients in the Study (n=132)

Variables	Mean±S.D
Age in years (Range 17-52 years)	25.8±6.1
Characteristics	**n(%)**
Gender	
Male	79(59.8%)
Female	53(40.2%)
Exotropia	
Alternating	56(45.5%)
Unilateral	67(54.4%)
Esotropia	
Alternating	6(66.7%)
Unilateral	3(33.3%)
Type of surgery	
Primary Surgery (First squint surgery)	114(86.4%)
Second surgery (History of previous squint surgery)	18(13.6%)

Postoperatively, 45(34.1%) patients with no residual deviation and 12(9.1%) patients with residual exotropia less than ten pd were not adjusted, and the fixed knot was tied at the same point. Out of 132 pat-3.

Table-II: Summary of the Outcome of after Surgery and After Adjustment in 132 Patients

Surgical Outcomes		Pre Adjustment Outcome	Adjustment Performed	Post Adjustment Outcome
Orthophoria		45(34.1%)	No	107(81.1%)
Residual Exotropia	<10PD	12(9.1%)	No	25(18.9%)
	≥10PD	48(36.3%)	Yes	-
Residual Esotropia	<10PD	-	-	-
	≥10PD	3(2.3%)	Yes	-
Consecutive Esotropia		24(18.2%)	Yes	-
Consecutive Exotropia		-	-	-

Overall, in 132 pati-ents after strabismus surgery with an adjustable suture technique, orthophoria was achieved in 107(81.1%), and there was residual exotropia of less than ten pd in 25(18.9%) patients. Therefore, in all our patients (100%) desired post-operative outcome of orthophoria or the residual squint of <10pd was achieved (Table-II). The outcome of adjustment was compared with the severity of the angle of deviation; most of the patients with post-adjustment residual exotropia had an angle of deviation more significant than 70pd (p<0.01) (Table-III).

Table-III: Summary of the number of Cases with different degrees of Squint in Prism Diopters (pd) Pre-Operative, Post-Surgical and Post Adjustment (n=132)

Variables	Angle of Deviation			p-value
	30-49pd	50-70pd	>70pd	
Squint (Pre-operative)				
Exotropia	46(34.85%)	65(49.24%)	12(9.09%)	<0.01
Esotropia	2(1.52%)	1(0.76%)	6(4.55%)	
Pre adjustment Outcome				
Consecutive Esotropia	12(9.09%)	11(8.33%)	1(0.76%)	0.34
Orthophoria	17(12.88%)	20(15.15%)	8(6.06%)	
Residual Exotropia	17(12.88%)	34(25.76%)	9(6.82%)	
Residual Esotropia	2(1.52%)	1(0.76%)	0(0%)	
Adjustment required				
Yes	31(23.48%)	35(26.52%)	9(6.82%)	0.38
No	17(12.88%)	31(23.48%)	9(6.82%)	
Post adjustment Outcome				
Orthophoria	47(35.61%)	56(42.42%)	4(3.03%)	<0.01
Residual Exotropia	1(0.76%)	10(7.58%)	14(10.61%)	
Residual Esotropia	-	-	-	

Overall, the desired surgical outcome was successfully achieved in all our patients. The adjustable suture technique was more successful in patients with less than 70pd deviation. No intra-operative and post-operative complications were observed in any patient.

DISCUSSION

In this study, patients with horizontal Strabismus were treated with strabismus surgery using adjustable sutures. The goal of the procedure is to achieve orthotropic eye alignment and prevent the patient from reoperation due to residual or consecutive squint. Post-operative adjustment is performed to improve the outcome of surgery.[11] We evaluated the outcome of squint surgery with adjustable sutures in the horizontal Strabismus. Our 56.8% of patients required adjustment. Orthophoria, or the residual squint of <10pd, was achieved in all our (100%) patients. Our patients were saved from a second surgery under general anaesthesia for the residual or consecutive Strabismus, which was successfully addressed with suture adjustment.

In a study by Chan *et al.* successful alignment was achieved in 74% of pediatric patients after squint surgery with adjustable sutures.[12] However, they reported certain complications, including slipped muscles and difficulty in recession, but their study was conducted on the pediatric population. The findings of the current study are in line with the data earlier published.[13,14] Nevertheless, the technique has been improvised, resulting in better patient outcomes and satisfaction.[15] We did not encounter any slipped muscle, and we did not face any significant difficulty in performing muscle adjustment. Our group of patients were adults, and before booking them for the procedure, we had a detailed session of counselling with them to make them understand the procedure and to get their maximum cooperation during the muscle adjustment.

Another study by Vasconcelos and Almeida compared outcomes of adjustable and non-adjustable squint surgery. They reported that the adjustable suture technique produced statistically significant and better surgical outcomes for patients with exotropia and esotropia.[13] Bishop and Doran evaluated the outcome of strabismus surgery with adjustable sutures retrospectively. They reported successful outcomes in 81% of patients.[14]

In the present study, 56.8% of patients required adjustment. Similarly, in a 19-year study by Kassem *et al*. 63% required adjustment postoperatively due to over or under-correction.[10] Since their study population consisted of infants and children, they used topical Proparacaine and intravenous Propofol during adjus-

tment. Topical Proparacaine is considered superior to other anaesthesia for adult strabismus surgery.[16] The safety and efficacy of Proparacaine and Propofol in the pediatric population had been established.[17] The present study used topical Proparacaine; it was easy to administer and associated with lower side effects.In the literature, complications such as severe pain, keratitis, infection, conjunctival injury, corneal abrasion, granuloma, or cysts have been reported.[18] Slipped muscle during muscle adjustment has also been reported. Our study encountered no complications during squint surgery and postoperatively adjustment.

In this study, we performed adjustments within 24 hours of strabismus surgery. Literature showed that there is no optimal timing for the adjustment postoperatively.[19]

Overall, squint surgery with adjustable sutures allows the surgeon to improve the outcome. The procedure is beneficial in complicated cases with restrictive and paralytic cases, especially when there is a risk of post-operative diplopia.

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CONCLUSION

Strabismus surgery with adjustable sutures was found to be safe and effective. A positive surgical outcome was observed in our patients, and the second surgery for residual or consecutive squint was successfully avoided. More studies on using adjustable sutures in restrictive or paralytic Strabismus should be considered to evaluate the outcome and complications in those cases.

Conflict of Interest: None.

Author's Contribution

Following authors have made substantial contributions to the manuscript as under:

SH & SN: Data acquisition, data analysis, drafting the manuscript, critical review, approval of the final version to be published.

SJ & NZ: Study design, drafting the manuscript, data interpretation, critical review, approval of the final version to be published.

MUS: Concept, critical review, data acquisition, drafting the manuscript, approval of the final version to be published.

Authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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