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COMPARISON OF SURGICAL SUCCESS RATES AND AMOUNT OF CORNEAL ASTIGMATISM INDUCED BY HANG-BACK AND CONVENTIONAL MUSCLE RESECTION SURGERY IN HORIZONTAL STRABISMUS

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Abstracts:

Purpose: To compare surgical outcomes and astigmatism induced by Hang-back and conventional recession surgery in horizontal strabismus.

Methods: In a randomized, double blind, prospective trial, 40 patients of horizontal strabismus, (18 exotropia and 22 esotropia) were randomized into 2 groups according to the type of recession procedure performed. All ocular examinations were done pre and post-operatively including manual and automated keratometry, assessment of angle of deviation was carried out by a certified orthoptist. All patients were followed for a mean duration of 6 months.

Results: Among esotropia success rate (defined as post-operative deviation of < 10 PD 6 months post operatively) was 80 % in patients with Hang-back recession and 84 % in patients with conventional recession ($p=1$). For exotropia success rate was 60 % in patients with hang-back recession and 75 % among patients of conventional recession ($p>0.6$). 90 % of eyes operated with conventional recession technique showed significant changes in average keratometry readings (defined as change of > 0.50 D), while for eyes operated by Hang-back technique only 37 % showed same changes ($p<0.002$). Surgeons comfort score using visual analogue scale was also compared.

Conclusion: Hang-back recession is an effective alternative to conventional recession with an added advantage of decreased amounts of surgically induced astigmatism, especially in children with smaller globes, poor exposure and high myopia.

Key words: Esotropia, Exotropia, conventional recession, Hang-back recession, keratometry.

Key messages:

- 1) Surgical success rate of both conventional and Hang-back procedures were statistically similar.
- 2) Mean change of average keratometry readings were significantly smaller in Hang-back procedure.
- 3) Hang-back technique significantly decreases the total duration of surgery with an overall improvement of surgeons comfort scores.

Introduction

Surgical procedures involving recession and resections of involved muscles are an acceptable treatment option for correcting ocular deviations. One of the most common and dreaded complication of conventional recession surgery is globe perforation. Reported rate of which using

conventional recession surgery is 0.5%.^[1] Other disadvantages of conventional recession surgery includes longer surgical duration, increased incidence of retinal detachment and higher amount of surgically induced astigmatism.^[1,2] An alternative to this was introduced by Guyton and Repka known as suspension recession or Hang-back recession.^[3] Hang-back recession offers

several advantages including shorter surgical time, better exposure of surgical field, decreasing the incidence of globe perforation, retinal detachment and decreased amount of surgically induced astigmatism.^[2,4] Unpredictability of surgical outcomes especially in large angle deviations (> 50 PD), limitation in the amount of recession (upto 7 mm) and possible late over corrections especially in exotropic patients are few limitations described for Hang-back technique in past studies.^[3,4] Our aim of this study is to compare surgical success rates and changes in average keratometric readings of both techniques even in large angle deviations.

Materials and Methods

This study compares hang-back and conventional recession surgery in patients with horizontal deviations who presented in strabismus clinic between July 2010 – March 2012. In this prospective, double blind, matched clinical trial, after excluding any patient with neurological anomalies, incomitant strabismus, previous strabismus surgery, nystagmus, eccentric fixation, vertical deviations > 5 PD, any corneal condition precluding keratometry, 40 patients of horizontal strabismus were finally included. These patients were then randomized with the help of computer generated random number series to undergo either of the two recession procedures.

All patients undergoing surgery were followed for a mean duration of 6 months, with postoperative visits on day 1, day 7, then after every monthly till a minimum of six months. Following data were assessed and recorded preoperatively and on every follow up visit: best visual acuity using Snellen's chart, refraction under cycloplegia, keratometry using manual and automated keratometer, presence and severity of amblyopia which was defined as a difference of more than two snellen lines between two eyes in older children and in younger children by examination of their ocular behaviour. Ocular movements and amount of deviation for distance (6 m) and near (33 cm) was assessed by a certified orthoptist using prism and alternate cover test.

All surgeries were performed by single surgeon, under similar clinical and

surgical settings. The amount of muscle recession or resections performed on both groups (which was measured from original muscle insertion) was calculated according to the mean preoperative angle of deviation using the Park's table^[5] for conventional method and Repka and Guyton's table for Hang-back recession.^[3] All patients with amblyopia were given a trial of occlusion therapy preoperatively. For patients undergoing surgery a double-armed 6-0 polyglactin suture with spatulated needle was used to secure the muscles before disinserting. In conventional method, after measuring the amount of recession using a surgical caliper the muscle was pushed back and was sutured directly over the sclera behind its original insertion, while in Hang back technique the muscle was left hung back on bare sclera with the help of a suspension loop where the needles were passed intrasclerally at the original muscle insertion. After suturing the muscles conjunctiva was closed using 8-0 polyglactin. Intraoperatively total duration of surgery was recorded in every case. To record the surgeons comfort level during each surgery, a Visual Analogue Score (VAS) was devised based on three different criteria's : **a) Exposure of surgical area** which was graded from poor to optimal (a score of 0 was given to poor exposure and score of 10 was given for optimum exposure of surgical field), **b) difficulty in passing suture** which was graded from extremely difficult (score of 0) to very easy (score of 10), **c) overall comfort of surgeon during surgery** which was also graded from a score of 0 to 10. After finishing every surgery the main operating surgeon was asked to mark the appropriate score. Complications such as globe perforation, muscle slippage, up shoot, or down shoot were also recorded.

Following were the main outcome measures of this study: surgical success rate defined as postoperative deviation of < 10 PD with prolonged alternate cover tests under dissociated conditions 6 months after surgery, mean change of average keratometry readings in two principle corneal meridians, mean decrease in the total duration of surgery, and over all comfort score of both procedures. *t*-test for independent samples was used to compare continuous parameters and paired samples *t*-test was used to compare between the

mean preoperative and postoperative angle of deviations. Chi-square analysis was done to compare the success rates between two surgical procedures. All the data was analysed using SPSS (version 11.5; SPSS, Chicago, IL, USA) software. During data analysis p value of < 0.05 was considered statistically significant.

Results

Comparison of base line characteristics of both the groups are shown in Table 1, which shows no significant difference in the distribution of patients, sex and prevalence of amblyopia in both the groups. Mean age of presentation in conventional group was 13 (± 6.5) years (5yrs – 22 yrs.), while in Hang-back group the mean age was 15.5 (± 6) years (6yrs – 22 yrs.).

The difference between mean preoperative deviations for exotropia and esotropia under both conventional and Hang-back recessions was not significant statistically (Table2).

No significant difference was found in the amount of bilateral symmetrical Medial Rectus (MR) or Lateral Rectus (LR) recessions performed for eso or exotropia under both conventional and Hang-back group. For patients who underwent a combination of unilateral recession and resection for correction of eso or exotropia, the amount of muscle resections performed were kept statistically similar in both conventional and Hang-back group, thus eliminating any influence of muscle resection in post-operative deviations (Table 3).

Table 1				
Pre-operative Data				
	Conventional (SD)	Hang - Back (SD)	p value ; t value	SS,NS*
Total number of cases	20	20	1	NS
Mean age at surgery (yrs)	13 (± 6.5)	15.5 (± 6)	0.221 ; 1.243	NS
Sex				
Males	2	6	0.235 ; 1.300	NS
Females	18	14		
Amblyopia	8	8	1	NS
* SS = statistically significant, * NS = non- significant				

Table 2							
Pre-operative Data							
	exo-deviations			eso-deviations			SS , NS*
	conventional	hang- back	p value	conventional	hang- back	p value	
Number of cases (N)	8	10	0.751	12	10	0.751	NS
Mean Preoperative Deviation (Δ PD)	51 ± 8	45 ± 7	0.125	58 ± 17.5	57 ± 18.5	0.892	NS
* SS = statistically significant, * NS = non-significant							

Table 3						
Mean Recession and Resection						
	Conventional		Hang- Back		p value	N
	exo deviation (n)	eso deviation (n)	exo deviation (n)	eso deviation (n)		
Bilateral MR recession		7 mm (6)		6.9 mm ± .45 (8)	0.5069	14
Bilateral LR recession	7.5 mm ± 1.2 (4)		6.75 mm ± .29 (4)		0.2545	8
MR recession + LR resection		6 mm ± 0.8 + 8 mm ± 1.8 (6)		5 mm + 8 mm (2)	0.134 ; 1.000*	8
LR recession + MR resection	9 mm ± 1.2 + 6.5 mm ± .6 (4)		8.82 mm ± .68 + 6.5 mm ± .45 (6)		0.778 ; 1.000*	10
* p value of respective muscle resection						

Table 4

Comparison of Pre and Post operative deviations with success rates of both procedures						
	exo-deviations			eso-deviations		
	conventional	hang- back	p value	conventional	hang- back	p value
Number of cases (N)	8	10	0.751	12	10	0.751
Mean Preoperative Deviation (Δ PD)	51 ± 8	45 ± 7	0.125	58 ± 17.5	57 ± 18.5	0.892
Mean Postoperative Deviation (Δ PD)	9.5 ± 4	7.2 ± 5	0.3058	13.7 ± 16	13.6 ± 13.9	0.9915
Pateints having successful oucome (%)*	75	60	0.638	84	80	1

* successful result : post operative deviation of < 10 PD

Table 4 compares the pre-operative and post-operative deviations and also compares the success rates between conventional and Hang-back groups. Esotropia improved from 57.2 (± 18.6) PD preoperatively to 13.6 (± 13.9) PD postoperatively for hang-back recession (n=10) and for conventional recession from 58.3 (± 17.5) PD preoperatively to 13.7 (± 16) PD postoperatively (n=12) .Success rate (defined as post-operative deviation of < 10 PD 6 months post -operatively) was 80 % in patients with hang-back recession and 84 % in patients who underwent conventional recession (p value = 1). Patients with Exotropia deviation improved from 45.2 (± 7) PD preoperatively to 7.2 (± 4.9) PD postoperatively for hang-back recession (n=10) and for conventional recession deviation improved from 58.3 (± 17.5) PD preoperatively to 9.5 (± 4.1) PD postoperatively (n=8). Success rate was 60 % in patients with hang-back recession and 75

% among patients who underwent conventional recession (p value > .6).

Mean duration of surgery for conventional recession was 33.30 ± 2.94 mins and in hang-back surgery the mean duration was 28.70 ± 2.05 mins. This shows a mean decrease of 4.6 mins in the total surgical duration, which was found to be statistically very significant (p value < 0.0001). After calculating VAS for every surgery based on three different criteria's the overall mean VAS score in conventional recession was 13.1 and 21.3 in hang-back group (p value < 0.0001). Mean change in average keratometry readings which occurred in two principle corneal meridians was 0.694 ± 0.194 D in patients who undergone bilateral conventional recession, for patients who undergone bilateral Hang-back recession this difference was 0.427 ± 0.242 D (p value < 0.0006) (Table 5).

Table 5

Post Operative Data				
	Conventional	Hang - Back	p - value	SS , NS*
Total number of patients (N)	20	20	0.0001	SS
Mean duration of surgery in min (S.D.)	33.30 min ± 2.94	28.70 min ± 2.05		
Mean visual analogue scale reading (VAS)	13.1	21.3	0.0001	SS
Mean change in keratometric readings (S.D.)	0.427 ± (0.242)	0.675 ± (0.194)	0.0006	SS
* SS = statistically significant, NS = non significant				

There were no differences between primary position and right and left gaze deviations pre- and post -operatively. No overcorrections or complications were noted in any of the patients.

Discussion

We found no difference in surgical success rate (post-operative residual deviation < 10 PD) between patients having surgery for horizontal deviations using hang-back suture recession and those with conventional direct scleral attachment.

Although the incidence of scleral perforation during strabismus surgery has been decreased over time with a recently reported incidence of less than 0.4%^[1,6], muscle recessions are still associated with more perforations than other types of strabismus procedures. Olsen et al found that the sclera was thinnest near equator, and less thin around the area of rectus muscle insertions.^[7] As hang- back technique involves placing the scleral suture site more anterior, near the ora this theoretically reduces the risks of scleral perforation and retinal damage. This also improves the overall exposure of operative field, which may be particularly helpful with surgeries on younger patients with smaller globes, when large amount of recession are necessary, or in patients with thinned sclera secondary to any cause.

There is no sexual predilection for strabismus as shown in previous literature, but in our series there were higher number of females in both the groups. This finding can be attributed to our geographical location and different social norms where proper facial cosmesis is essential before marriage, which is reflected by the fact that most of our female patients presented at a later age, nearing the age of marriage. In our study we found an incidence of 45 % for exotropia and 55 % for esotropia.

With 4 out of 10 patients undergoing hang-back recession had postoperative deviations of >10 PD, a success rate of 60 % was calculated in this group which was lower than the success rate of 75 %, found in the patients undergoing conventional recession for treating exotropia. However this difference was not statistically significant, a decreased success rate in the former group can be attributed to the fact that two patients in hang-back group had extremely large angle of deviations (> 90 PD) and they presented at a very late age (mean age of 22 years) this led to development of severe amblyopia which could explain a poor surgical outcome in this group. Previous studies have reported success rates of 75 – 85 % for Hang-back recession. Lower success rates in our study may have been caused by the fact that we have also included patients with large amount of deviations, with a range of deviation between 20 PD – 90 PD in both the groups. Our mean preoperative deviations were significantly

higher than the deviations present in similar studies from past.^[8,9,10]

Another important advantage of Hang-back surgery is the decreased amounts of induced astigmatism immediately following an operation.

To assess the change in corneal keratometry readings only eyes which underwent either of the two recession procedures were included. Eyes with simultaneous muscle resections were excluded. In our study we found that out of 24 eyes which underwent Hang-back recession only 9 eyes showed a significant change in average keratometry, while in 20 eyes which were operated with conventional recession technique 18 eyes showed similar change. These findings clearly show that all the patients undergoing strabismus surgery using a suspension recession technique may be less likely to notice a change in their vision in immediate postoperative period.

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These results are similar to results reported in past.^[2]

Among limitations of this study is the fact that we decided to check the surgical results in each patients 6 months after surgery because this is an acceptable time for stabilization of alignment of eyes. Although longer follow-up may reveal some changes in the success rates of one or both groups. Another limitation was the sample size which was small.

Conclusion

To conclude we can say that under these limitations hang-back recession provides an effective alternative to conventional recession in treating patients with horizontal strabismus with an added advantage of decreased amounts of surgically induced astigmatism, especially in children with smaller globes, poor exposure and high myopia.