

Modified adjustable suture hang-back recession: Description of technique and comparison with conventional adjustable hang-back recession

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Purpose: This study aims to describe and compare modified hang-back recession with the conventional hang-back recession in large angle comitant exotropia (XT). **Methods:** A prospective, interventional, double-blinded, randomized study on adult patients (>18 years) undergoing single eye recession-resection for large angle (>30 prism diopters) constant comitant XT was conducted between January 2011 and December 2015. Patients in Group A underwent modified hang-back lateral rectus recession with adjustable knot while in Group B underwent conventional hang-back recession with an adjustable knot. Outcome parameters studied were readjustment rate, change in deviation at 6 weeks, complications and need for resurgery at 6 months. **Results:** The groups were comparable in terms of age and preoperative deviation. The patients with the modified hang back (Group A) fared significantly better ($P < 0.05$) than those with conventional hang back (Group B) in terms of lesser need for adjustment, greater correction in deviation at 6 weeks and lesser need for resurgery at 6 months. **Conclusion:** This modification offers several advantages, significantly reduces resurgery requirement and has no added complications.

Key words: Comitant deviation, modified adjustable hang back, strabismus

Adjustable sutures are known to improve the surgical outcomes in several types of strabismus.^[1] Of the several techniques, hang-back recessions are the ones commonly practiced while using adjustable sutures.^[2] Muscle recessions done with the hang-back technique have advantages of better exposure and lesser risk of scleral perforation.^[3] However, recessed muscle has been demonstrated to migrate anteriorly following the procedure resulting in under correction.^[4] Modifications in hang-back technique such as taking an anchoring scleral bite have shown no added advantage and at the same time probably undermine the benefits of hang-back.^[5] In hemihang back, the sutures are tied to the sclera approximately half the distance between the original insertion site and the desired new recession position.^[6,7] In hemi hang-back, the readjustment is more uncomfortable as the technique requires more manipulation of globe and conjunctiva as the site of new insertion is away from the conjunctival wound.

A modification of adjustable hang-back recession that takes care of anterior migration of recessed muscle besides several other possible advantages is discussed and compared with conventional adjustable hang-back sutures.

Technique

For modified adjustable hang-back (Group A), preoperatively, a maximum and minimum recession requirement is estimated. It has been reported that the minimum correction expected from lateral rectus (LR) recession is 2.5 prism diopters (PD)/mm of surgery and the maximum is 4 PD depending on various

factors.^[8-11] These values were considered to decide the maximum and the minimum range of recession. For example, if 8 mm recession of LR is expected to nearly correct the deviation, the maximum requirement is taken as 10 and minimum as 6. Hence, a 6 (nonreducible) +4 (reducible) recession is performed as described [Fig. 1]. After securing knots at the ends of disinserted muscle with 6-0 vicryl, using a curved ruler, sclera is marked along the borders of original muscle at the desired length (6 mm). Small partial thickness bites are taken at this site [Fig. 2]. Muscle is brought anterior to rest against these bites. By this, in the event of pseudotendon formation or anterior migration or inadvertent extra pull during adjustment at least 6 mm of recession would be maintained. The muscle is then allowed to hang back for another 4 mm giving additional "adjustable" recession. Then, sutures are passed at the original insertion site. A bow-type adjustable knot is tied to achieve this modified hang-back recession [Fig. 3].

For conventional adjustable hang back (Group B), 8 mm recession would be performed in the above example. Conjunctiva is closed using fibrin glue in both groups. Readjustment (if required) is done on 3rd day postoperatively by minimal conjunctival manipulation.

Methods

After ethical clearance from the local ethical committee, a prospective, interventional, double blinded, randomized study

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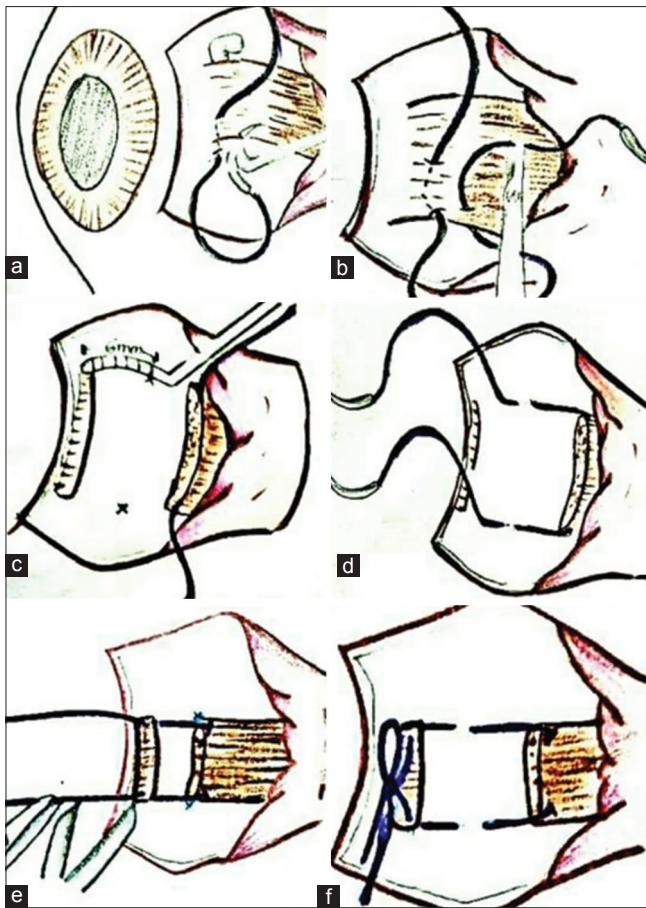


Figure 1: (a) The muscle is isolated on a muscle hook. (b) Border locking suture passes are made with vicryl 6/0 and muscle is disinserted. (c) Sclera is marked along the borders of original muscle at desired length. (for example to perform a 6+4 mm recession, markings are done 6mm from original insertion) (d) Small partial thickness scleral bites are taken at the marked sites and needles are advanced towards muscle stump. (e) The needles are then passed through the episclera & muscle stump and the muscle is brought anteriorly (f) The muscle is then allowed to hang back for 4 mm and a bow type adjustable knot is tied

on adult patients (>18 years) undergoing single eye recession-resection for large angle (>30 PD) constant comitant exotropia (XT) was conducted between January 2011 and December 2015. After informed consent, patients were randomized by computer generated tables into two groups. Patients in Group A underwent modified hang-back LR recession with adjustable knot while those in Group B underwent conventional hang-back recession with an adjustable knot. Nonadjustable 6.5 mm medial rectus (MR) resection was done in all cases for both groups. The surgical dose estimated to fully correct the deviation was calculated according to preoperative deviation by the same nomogram with 3–3.5 PD correction expected per mm of LR recession and 1.5 PD/mm of MR resection.^[12] An additional 25% correction was expected with both procedures being performed simultaneously.^[11,13] However, the point of maximum and minimum recession of LR was estimated in Group A, as detailed by the technique.

The adjustment of sutures was done in patients outside ± 10 PD of orthotropia on the 3rd day. The preferred position of alignment

after adjustment was 5–10 PD of esotropia (ET).^[14] The patient and the orthoptist were blind to the type of intervention. The patients were followed up on the 3rd day, after 1 week, 6 weeks, and 6 months. Outcome parameters studied were readjustment rate, change in deviation at 6 weeks, complications and need for resurgery at 6 months. In case of variability, the largest deviation in primary gaze was considered for calculations. Resurgery was advised for clearly unacceptable outcome, i.e., >20 PD of deviation at 6 months.

Statistical analysis

Statistical analysis was done by Mann–Whitney U-test for numeric data and Pearson's Chi-square test for categorical data, $P < 0.05$ was considered statistically significant.

Results

A total of 26 patients were randomized into Group A and 22 to Group B. The groups were comparable in terms of age and preoperative deviation. Mean change in deviation at 6 weeks was 41.53 PD (range 24–49 PD) in Group A and 31.55 PD (range 26–50 PD) in Group B. This difference was statistically significant and persisted till the last follow-up at 6 months. The results are summarized in Table 1. The patients in Group A fared significantly better ($P < 0.05$) than those in Group B in terms of lesser need for adjustment, greater correction in deviation and lesser need for resurgery at 6 months.

Six patients in Group A and seven in Group B required pulling up of the LR for consecutive ET >10 PD on the 3rd day. Of these, four patients in each group had a coexistent significant limitation of abduction before adjustment. After adjustment, the limitation in abduction was resolved in all patients. At 6 weeks, the overcorrection was within acceptable limits (<20 PD) in all except one patient in each group, which persisted till the last follow-up.

Similarly, one patient in Group A and six in Group B were adjusted for residual XT >10PD. At 6 weeks, five patients in Group B had a clearly unacceptable outcome with XT >20 PD. This was expected, as it has been well proven that during adjustments, increasing the recession is difficult and less effective than reducing it.^[15] By 6 months, another patient in Group B had a deviation with acceptable limits, probably because of better sensory status.

Thus, at 6 months resurgery was advised to one patient in each group for unacceptable consecutive ET and to four patients in Group B because of unacceptable residual XT.

Discussion

Adjustable sutures are primarily indicated in strabismus surgeries with unpredictable results.^[16] These include long-standing strabismus with secondary contractures, large angle strabismus, incomitant strabismus, thyroid ophthalmopathy, blow-out fractures, paralytic strabismus, and more recently in comitant deviations.^[17] Strabismus surgery with adjustable sutures has a statistically significant better result with good long-term patient satisfaction without additional problems.^[18–20] Suture knots placed near the original insertion cause less discomfort during readjustment. Hang-back recession technique offers this benefit. However, with the subsequent formation of pseudotendon, or anterior migration, the effect of recession is often reduced.^[13,21] We have conducted

Table 1: Patient data in 2 groups. Group A (modified adjustable hang-back recession) and Group B (conventional hang-back recession)

	Group A (modified) (n=26)	Group B (conventional) (n=22)	P
Mean age (years)	24.1±4.5	25.9±3.7	0.473*
Preoperative deviation in PD	48.07±3.5	46.0±4.19	0.325*
Adjustment done for overcorrection (ET >10 PD)	6	7	
Adjustment done for under correction (XT >10 PD)	1	6	
Number of patients not requiring adjustment, n (%)	19 (73.07)	9 (40.90)	0.0001**
Change in deviation (PD) at 6 weeks	41.53±6.06	31.55±7.88	0.003*
Unsatisfactory motor outcome (deviation >20 PD) at 6 weeks			
Residual XT	0	5	0.000**
Consecutive ET	1	1	
Unsatisfactory motor outcome (deviation >20 PD) at 6 months			
Residual XT	0	4	0.000**
Consecutive ET	1	1	
Need for re surgery at 6 months (unsatisfactory motor outcome), n (%)	1 (3.8)	5 (22.7)	0.000**
Complications	0	0	

*Mann-Whitney U-test, **Pearson's Chi-square test. PD: Prism dioptres, ET: Esotropia, XT: Exotropia

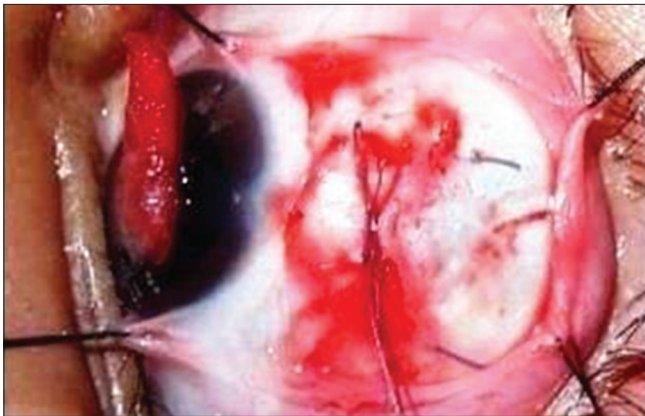


Figure 2: Small partial thickness bites are taken at the marked site

this study only on constant comitant XT to reduce bias, keep the groups homogeneous, and to make the results reproducible. A simple modification of hang-back recession by taking an additional scleral bite at the point of minimum required recession has improved the surgical outcome, as can be seen by significantly lower resurgery rates. The significant difference in adjustment requirement and resurgery for undercorrection can be attributed to frequent anterior migration of the muscle.^[12] Undercorrection as a result of anterior migration or anterior pseudotendon attachment is expected to occur with greater frequency when increasing length of sutures is left for larger hang back. It would logically be lower when the same suture length is anchored to the sclera in Group A. The lesser mean correction in Group B is possibly because of anterior migration to various degrees (of the LR tendon) in different patients and slightly lesser amount of recession performed in this group as explained under 'technique'. Other advantages of taking the scleral bite in the suggested modification would be in case the adjustable knot accidentally opens. This additional anchor would prevent muscle slippage. However, there is no data in the current study to support or refute this claim.



Figure 3: The sutures are passed at original insertion site with a bow type adjustable knot to achieve modified hang-back recession

The middle anchor also makes the pulling up of the suture during adjustment more comfortable for the surgeon as accidental over pull is restricted by it. Two patients in Group B initially adjusted for overcorrection eventually ended up with undercorrection, probably due to over pull during adjustment. This is a significant advantage as the adjustment is done under topical anesthesia, and often with compromised patient cooperation. If adjustments are being done on the 3rd day, as in our case, this discomfort is often significant. The cinch knot overcomes this disadvantage to some extent at the cost of discomfort to the patient because of extra suture material required to form the "cinch."^[12]

As we send the findings of this study for publication, we have realized some of its limitations. The sample size was small with follow-up for 6 months only. Knowing the recurrent nature of XT, a longer follow-up would be desirable. We have not been able to document and correlate the deviation immediately after adjustment to the final deviation. As we were dealing with large angle constant adult strabismus, the assessment of preoperative binocular functions was not

stressed on. Assessment of binocular potential would be useful, considering that several patients demonstrated binocularity postoperatively.^[22] Of the six patients who were advised resurgery at 6 months, only two underwent the procedure. Of these, only one was reoperated for undercorrection and she had about 2.5 mm anterior migration of insertion. It would be interesting to know the position of the tendon in other patients with an unsatisfactory outcome.

Conclusion

This simple modification in adjustable hang-back recession offers several advantages, significantly reduces resurgery requirement and has no added complications.

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Conflicts of interest

There are no conflicts of interest.

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