Original Article

Outcome of delayed adjustable strabismus surgery in children using a bow-tie optional adjustable technique

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Purpose: The aim of this article is to study the feasibility of a delayed adjustable technique of strabismus surgery in children using an optional adjustable suture technique. **Methods:** The retrospective study included patients <12 years of age. Recessions were done using an optional adjustable bow-tie technique and resections were done by the conventional technique. Patients were evaluated on the third postoperative day and adjustments done when needed. Statistical analysis was done using Microsoft Excel 2010®. **Results:** The study included 11 patients with exotropia and 16 patients with esotropia. The mean age of the patients was 5.2 years (range 1–11 years). The mean preoperative distance deviation was 46.7 ± 10.4 prism diopters (PD) for exotropic patients and 47.1 ± 16.9 PD for esotropic patients. The mean preoperative near deviation was 46.6 ± 11 PD for exotropic patients and 52.4 ± 17.1 PD for esotropia. Two patients with exotropia (18.2%) and four patients with esotropia (25%) were adjusted under intravenous ketamine in the operating room under anesthetist supervision. No difficulty was encountered in advancing/recessing the muscles. The success rate at 1 month was 100% for exotropia and 87.5% for esotropia. The success rate at the final follow-up was 81.8% for patients with exotropia and 68.7% for patients with esotropia. **Conclusions:** This delayed optional adjustable strabismus surgery technique provides good short-term results and lower adjustment rates.

Key words: Delayed optional adjustable, modified Bow-tie, strabismus surgery in children

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There are a number of publications on adjustable strabismus surgery in children. Better success rates have been reported with the use of adjustable sutures in children, though this did not always reach statistical significance.[1,2] The reluctance for using adjustable sutures in children stems from apprehensions of poor cooperation and difficulty in examining children in the postoperative period. There is also the increased time and cost involved. Various techniques have been suggested to get the child to cooperate for evaluation and possible adjustment.[1] Optional adjustable suture techniques permit the physician to discharge the child from the ward if adjustment is not needed. Most adjustments are done a few hours after surgery under intravenous sedation.[3] Chan *et al.* reported on delaying the adjustment to the next day to facilitate better patient cooperation. However, this publication used a bow-tie technique that mandated tying off even if adjustment was not needed.[4] An optional adjustable suture technique as suggested by Engel *et al.* would be valuable as this would permit the surgeon to discharge the child should adjustment not be needed.[3,5] We have modified the bow-tie technique similar to that described by Mark Engel. This is accomplished by burying the suture through additional scleral passes superior to the insertion and tying them off. Only children who were significantly misaligned and were judged likely to benefit from adjustment according to predetermined criteria underwent additional adjustment procedures under sedation. Our study aims to evaluate the outcome of a delayed adjustable technique [as proposed by Chan *et al*.[4] (to facilitate patient cooperation)] with a bow-tie optional adjustable technique (modeled on Mark Engel's slip knot technique[3]).

Methods

Institution review board approval was obtained for a retrospective study of patients <12 years old who underwent strabismus surgery for horizontal strabismus using a modified adjustable suture technique. The study included all patients who underwent strabismus surgery by the principal investigator between July 2016 and March 2017. Only patients who had a minimum of 4-week follow-up after surgery were included. An informed consent was taken from the child's legal guardian for a possible second visit to the operation theater for adjustment under intravenous sedation.

Preoperative assessment

All patients underwent a comprehensive ocular examination with measurement of visual acuity by age appropriate, anterior segment examination with slit lamp, dilated fundus examination, and cycloplegic refraction. The deviations

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were recorded for distance and near using accommodative targets (with the refractive correction when applicable). A cartoon viewed through a mirror placed 3 m away was used as a distance fixation target for children <4 years of age. Animations/Cartoons on the mobile phone were used for near fixation. For older children, the ETDRS chart for distance fixation and the Lang's stick for near fixation were used. A record of the ocular motility was made. Binocularity was assessed using Bagolini's striated glasses. Stereopsis was measured using Lang's stereo test for children <4 years of age. For older children, the Randot stereo test was used. A detailed examination of the anterior and posterior segments was done.

Surgical procedure

All surgeries were done under general anesthesia with endotracheal intubation. An inferior fornix incision was used in all patients except when superior oblique weakening needed to be done in which case a superior fornix incision was used. After incising the conjunctiva and button-holing the tenon's, the horizontal rectus muscle (to be recessed) was cleared of intermuscular septum and check ligaments and secured with two 6-0 Vicryl sutures at either end. The central ends were tied off. The muscle was disinserted and the needles were passed through the insertion using a crossed swords technique allowing the muscle to hang back at the desired recession distance. A bow-tie knot (4 + 2) was tied without cutting either suture. Additional suture passes were made superior to the muscle insertion and tied off [Video 1]. The additional passes were made superiorly for inferior fornix incisions (and inferiorly for superior fornix incisions). A traction suture was placed superior to the insertion with 6-0 Vicryl suture to allow mobilization of the globe and access to the adjustable sutures if needed – the bucket handle suture. Muscle resections were done by the conventional method. One or two horizontal rectus muscles were placed on adjustable sutures based on the discretion of the author. The surgical dosing was planned to allow a leverage of at least 10 prism diopters (PD) either way. The conjunctiva was closed with a single 10-0 vicryl suture over the recessed muscle (placed on adjustable sutures). Superior fornix incisions and fornix incisions that extended during surgery were also closed with a single 10-0 vicryl suture. All other fornix incisions were left unsutured.

Postoperative assessment

All surgeries were done on Friday. The operating surgeon visited all patients in their wardrooms after the surgery. All patients were evaluated in the doctor's consultation room on the first postoperative day and an attempt made to inspect the wound and assess the deviations for distance and near. Children who did not cooperate were sent to the department play area with their parents and efforts made to examine them. A drop of topical proparacaine was instilled for children who still did not open their eyes and another attempt made for examination. All children including those who did not cooperate with the above attempts (or were very restive to preclude all attempts at examination) were discharged. The children returned for review on the third postoperative day (Monday). This was to allow the child to recuperate at home over the weekend. Deviations were measured for both distance and near. Patients who were satisfactorily aligned (decided based on the target angles and the examiner's discretion) were sent home without adjustments. The target angles were 0–8 PD residual esotropia for esotropes and 6–8 PD esotropia for exotropes older than 4 years of age and near orthophoria for younger children. Children outside of the target angle (based on the examiner's discretion) were taken up for adjustment.

Technique for adjustment

Adjustment when needed was done under sedation with intravenous ketamine (1 mg/kg body weight) and intravenous midazolam (0.05 mg/kg) in the operating room with anesthetist supervision and ECG monitoring along with instillation of proparacaine in the conjunctival sac. The fornix incision was opened and the traction suture used to mobilize the globe. A Steven's hook was used to retract the conjunctiva. The sutures distal to the additional scleral passes were cut and the sutures pulled out. The muscle was advanced/recessed further as per the deviation after opening the bow-tie knot [Video 2]. The patients were retained in the operating room and subsequently in the ward under supervision of a trained nurse until the ketamine effect wore off and discharged the same day. They were reviewed the next day, 1 month, 3 months, and 6 months thereafter.

Results

The mean age of the patient was 5.2 years (range 1–11 years). The study included 11 patients with exotropia and 16 patients with esotropia. The mean age of patients with exotropia was 6.4 years (range 3–11 years) and the mean age of patients with esotropia was 4.4 years (range 1–10 years). The relevant clinical characteristics are mentioned in Supplementary Tables 1 and 2. All children were noted to be asleep/drowsy in their wardrooms after surgery and no attempt was made to awaken the children for measurements. All patients cooperated for examination on the third postoperative day. Overall, 4 of 16 patients with esotropia (25%) and 2 of 11 patients with exotropia (18%) underwent adjustment. All adjustments except one involved advancing the recessed muscle. No difficulty was encountered in accessing the muscle, untying the knots, and slipping/advancing the rectus muscle. No significant adhesion that hindered muscle repositioning was noted in any patient. The operating room in time for adjustment ranged from 8 to 14 min. No oculocardiac reflex was noted during the adjustment procedure. None of the patients reported hallucinations/bad dreams postadjustment. Five patients with exotropia and 10 patients with esotropia were 5 years of age or younger at the time of surgery. Reliable distance measurements could not be obtained in two patients with esotropia on the third postoperative day. No suture granulomas, excess inflammation, or prominent scarring was noted in any of the patients (including those who were not adjusted) during the postoperative follow-up. The authors have since omitted the bucket handle suture and switched to a traction suture during the adjustment process because of better familiarity with the technique. However for the purpose of the study, the bucket handle suture was used in all cases. No patient had gaping of the conjunctival incisions/exposure of the sutures/tenon's prolapse in the postoperative period.

Exotropia

Eleven patients had exotropia in this series [Supplementary Table 1, Fig. 1a and b, 2a-c]. The mean preoperative deviation was 46.7 ± 10.4 PD for distance and 46.6 ± 11 PD for near. Three patients had essential infantile exotropia (of which two patients had periventricular leukomalacia) and the remaining patients had intermittent exotropia. One patient

did not cooperate for examination on the first postoperative day. Only near measurements could be obtained in three patients and approximate deviations were obtained in patient no. 4, Supplementary Table 1 (total five patients). On the third postoperative day, the median deviation was 9 PD esotropia (range 0–25 PD esotropia) for distance and 3 PD estropia (range 2 PD exotropia–25 PD esotropia) for near. Two patients had overcorrections of more than 10 PD esotropia and they were managed by advancement of the lateral rectus (patient 1 and 4; Supplementary Table 1). The first-day deviations were approximate because of poor cooperation and substantially less than the third-day deviations in either patient. The lateral rectus was noted to be at the originally placed recession distance during adjustment. In both patients, the consecutive esotropia after advancement was 10 PD or less on the next day. One month after surgery, the median deviation for distance and near was 0 PD (range 4 PD exo–7 PD eso for distance and 5 PD exo–8 PD eso for near). All patients were aligned to within 10 PD at 1-month review. The mean follow-up was 8.2 ± 4.3 months (range 3–18 months). The median deviation at the final follow-up was 0 PD for distance and near (range 14 PD exo–8 PD eso for distance and 10 PD exo–14 PD eso for near). Two patients had deviations more than 10 PD (neither patient had an adjustment), thereby yielding a success rate of 81.8%. The numbers were too small to permit an intergroup comparison between patients who were adjusted and those who were not.

Esotropia

Sixteen patients had esotropia in this series [Supplementary Table 2 and Fig. 3a-c]. Nine patients had infantile esotropia

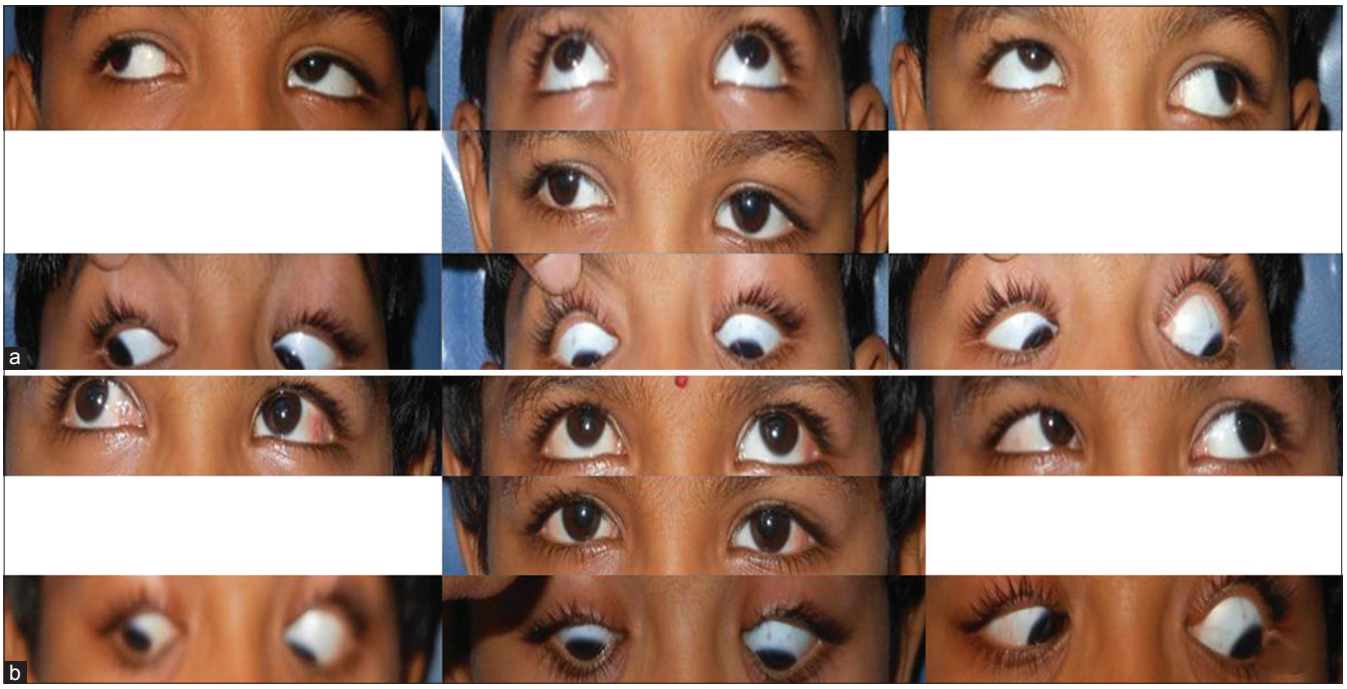

Figure 1: (a) Preoperative photograph of patient no. 1 [Supplementary Table 1] with intermittent exotropia with V pattern with bilateral inferior oblique overaction (b) Postoperative photograph of patient no. 1 [Supplementary Table 1]

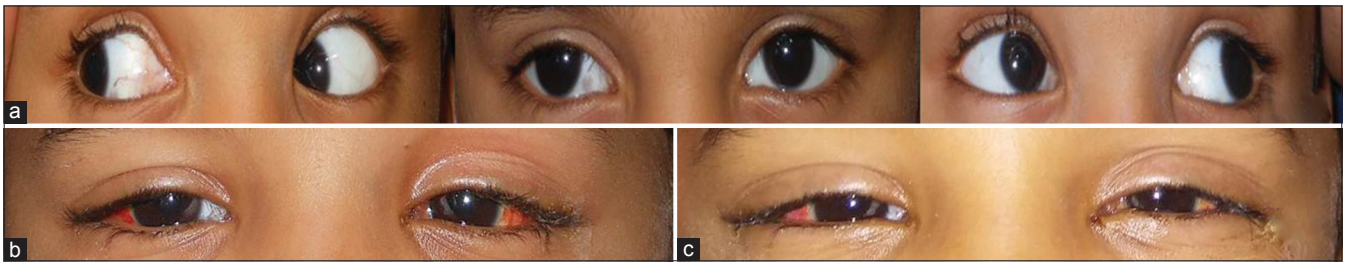

Figure 2: (a) Preoperative photograph of patient with exotropia. (b) Third-day postoperative photograph of same patient showing consecutive esotropia. (c) Fourth-day photograph of patient after lateral rectus advancement showing orthophoria in primary position

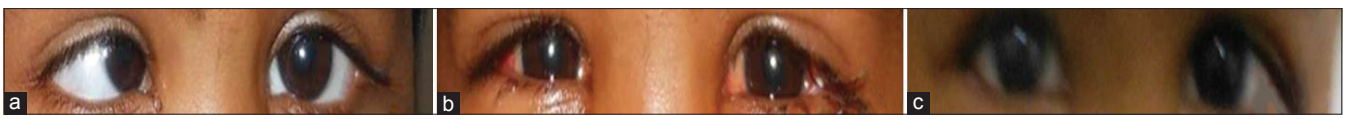

Figure 3: (a) Preoperative photograph of patient no. 3 with infantile esotropia [Supplementary Table 2]. (b) Third-day postoperative photograph of patient no. 3 [Supplementary Table 2]. (c) One-month postoperative photograph of patient no. 3 [Supplementary Table 2]

and seven patients had acquired comitant esotropia. In patient no. 12, the onset of esotropia could not be dated accurately by history and a review of the patient photographs. The mean preoperative deviation was 47.1 ± 16.9 PD for distance and 52.4 ± 17.1 PD for near. Three patients were very uncooperative and no measurements could be obtained on day 1. In six patients, only the near deviation could be obtained. Another 2 patients were poorly cooperative for measurements on postoperative day 1 and approximate deviations could be obtained (total 11 patients). The median distance deviation on day 3 was 0 PD (range 16 PD esotropia–7 PD exotropia) and the median near deviation was 1 PD esotropia (range 14 PD exotropia–20 PD esotropia). Three patients underwent advancement of the medial rectus for a consecutive exotropia. In two of these patients (no. 9 and 11 in Supplementary Table 2), the third-day deviation was substantially different from the first-day deviation and influenced the decision to adjust. Patient no. 15 in Supplementary Table 2 had a large residual deviation (16 PD esotropia for distance and 20 PD esotropia for near) on the third postoperative day. The medial rectus recession in both eyes was increased by 2.0 mm each and this reduced the deviations to 6 PD esotropia for distance and 12 PD esotropia for near. Here again, the third-day deviation was substantially different from the first-day deviation and was the deciding factor for adjustment. The muscle was at the intended position in all patients and no patient had a muscle slip. Fourteen patients were aligned to ≤10 PD at 1-month review (87.5%). All four patients who underwent adjustment on the third postoperative day were aligned to within 10 PD. The differences were however not statistically significant ($P = 0.38$). At the final review, 11 of 16 patients (68.7%) were aligned to within 10 PD. None of the patients with larger residual deviations had a significant hyperopia. Three patients who had undergone adjustment met the criteria for success. The differences were not statistically significant ($P = 0.75$).

Postoperative drift (calculated as the difference between final postoperative deviation and the first month postoperative deviation)

The details of the postoperative drift are mentioned in Table 1. Patient nos. 7–10 [Supplementary Table 2] had relatively large esotropic drifts.

Binocularity and stereopsis

At the last review, four patients with exotropia and three patients with esotropia had measurable stereopsis.

Discussion

We have modified the bow-tie technique by burying the pole sutures with additional scleral passes. This precluded the need to manipulate the sutures should adjustment not be needed. We also used additional throws on the suture to prevent spontaneous untying of the knot. No complications, for example, muscle slippage and suture granulomas, were noted during the postoperative period with the use of this technique. The additional passes in addition to providing more suture for adjustment would also facilitate muscle recovery should the bow-tie knot untie (by eye rubbing) and prevent the suture from prolapsing out of the fornix incision. We did not however encounter any unintentional untying of the bow-tie knot in our study. Although we do not believe that the bow-tie technique is in any way superior to the slip-knot technique, the findings of our study may be of relevance to those who are comfortable with the former technique. The extra suture material under the conjunctiva did not evoke more inflammation. This is in agreement with other studies.[3]

We did not encounter any difficulties in manipulating the sutures or untying the bow-tie knot [Video 2] during adjustment. But it must be admitted that most of the adjustments involved advancing the recessed muscle, which may be simpler than slipping it back. No muscle adhesions were noted during the adjustment process. This is in agreement with another large series of 440 patients published by Robbins *et al.* The mean time to adjustment in his study was 2.5 days (0.96–5.8 days) and no early scleral adhesions were noted.[6] As we have previously mentioned, it may be easier to examine very young children a day or two after surgery. All children went home the day after surgery. This may also have played a role in getting a good patient cooperation. The other theoretical advantage of a delayed adjustable suture is to allow time for sensory adaptation.[6] The third-day deviations were the deciding factor in both patients with exotropia and in three out of four patients with esotropia who underwent adjustment; Supplementary Tables 1 and 2. Relying on the first-day deviations would have been misleading. We believe that the differences between first- and third-day deviations were primarily because of issues in cooperation. None of the patients was noted to have a slipped muscle at the time of adjustment.

Dawson *et al.* had reported an overall success rate of 76% with the use of adjustable sutures in children.[7] Our success rates for exotropia (81.8%) compare favorably with other studies (on strabismus surgery in children with adjustable sutures) by Awadein (80%) and Chan (65% – exotropia primary surgery).[1,4] Engel reported a higher success rate of 91%.[3] The success rate for esotropia (68.7%) was substantially lower than that reported by Awadein (78%), Engel (86%), and

Table 1: Postoperative drift

Diagnosis	Adjustment done - Yes/No	No. of patients	Mean postoperative drift distance	Mean postoperative drift near
Exotropia	Yes	2	0.5 PD exotropia	4.5 PD exotropia
	No	9	0.9 PD esotropia (7 PD exotropia-8 PD esotropia)	2 PD esotropia (8 PD exotropia-14 PD esotropia)
Esotropia	Yes	4	12.5 PD esotropia (4-30 PD esotropia)	8.75 PD esotropia (0-25 PD esotropia)
	No	12	2.7 PD esotropia (8 PD exotropia-10 PD esotropia)	2.8 PD esotropia (2 PD exotropia-14 PD esotropia)

The postoperative drift was calculated by subtracting the final postoperative deviation from the third-day postoperative deviation (fourth-day postoperative deviation for adjustables)

Chan (84% – esotropia primary surgery).[1,3,4] The number of patients in our study is less than the other studies. It has been shown that a good initial alignment does translate into a better long-term success in adults, though there are no similar studies in children.[8] Other studies have shown that the use of adjustable sutures improves success and reduces resurgery rates for horizontal recti.[1,2,9] Only two patients in the esotropia group and no patient in the exotropia group had a significant residual deviation at 1-month review. This increased to five patients (esotropia group) at the last review. It is likely that sensory factors played a role. Further, the number of patients in our series was small and cannot be directly compared with results of other studies.

Engel *et al.* mentioned an exotropic drift for all his patients.[3] In our series, patients with exotropia who underwent adjustment in the postoperative period had a small exotropic drift. The other groups had an esotropic drift [Table 1]. The large esotropic drift in the esotropia group was partly because of a large shift in four patients.

Our adjustment rates (22.2%) were less than other published studies (Awadein – 64%, Engel – 24.6%, Chan – 27%, Dawson – 67%).[1,3,4,7] It has been reported that the alignment changes when the deviations are measured sometime after removing the patch and this may have worked in our favor. Robbins *et al.* reported that the adjustment rates may be less if the adjustment is delayed.[6,7] Our study numbers were too small to permit a comparison between patients who needed an adjustment and those who did not. We used intravenous ketamine with midazolam for postoperative adjustments. Ketamine is a dual action drug and provides excellent analgesia in addition to anesthesia. It has a rapid onset of action with fast recovery and protects against the parasympathetic activation induced by oculocardiac reflex. We did not encounter any complications with the use of ketamine in our study population. The use of midazolam along with ketamine mitigates the unpleasant side effects of the latter.[10,11]

A major disadvantage of suture adjustment in children is the need for general anesthesia for adjustments. The adjustment procedure requires only 8–14 min with intravenous ketamine and should not be difficult to schedule. No inflammation or prominent scarring due to additional suture material under the conjunctiva was noted in any of our patients who did not undergo adjustment. This is in agreement with other studies.[3]

To summarize, the data presented show that a delayed adjustable technique for strabismus surgery with a bow-tie knot is feasible in children and can yield good initial results. All children who underwent adjustment had a better immediate postoperative result than what they would have achieved without adjustment. There were no complications such as slipped muscles, postoperative infections, or excess inflammatory response with the use of a bow-tie technique and additional scleral passes. Further studies with larger number of patients are needed to determine the long-term success rates.

Conclusion

To conclude, delaying the evaluation and adjustment in children after adjustable strabismus surgery may facilitate patient cooperation and result in better short-term outcomes and lower adjustment rates. This needs further evaluation in a larger series of patients.

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Nil.

Conflicts of interest

There are no conflicts of interest.

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Supplementary Table 1: Exotropia

Age	Diagnosis	Preoperative deviation distance	Preoperative deviation near	Procedure	First-day post-op distance	First-day post-op near	Third-day postop deviation distance	Third-day post op deviation near	Adjustment (if any)	Deviation after adjustment distance	Deviation after adjustment near	Deviation at 1 month distance	Deviation at 1 month near
9	**IXT**	45 BI	35 BI	OD LR Rc 7 mm (adj.) with MR Rs 5 mm, left eye : LR Rc 7 mm (adj.) OU IO Rc	Poor cooperation	10 BO (poor cooperation)	9 BO	18 BO	OD LR advanced by 2.5 mm	6 BO	10 BO	4 BI	8 BO
3	**EIX**	60 BI	60 BI	OD LR Rc (8.0 mm) MR Rs (5.0 mm), OS LR Rc 8.0 mm (adj.)	0	6 L/R	0	0	Nil			3 PD L/R	0
7	**IXT**	46 BI	46 BI	OD LR Rc 8.0 mm MR Rs 6.0 mm OS LR Rc 6.0 mm (adj.)	10 BO	6 BO	10 BO	8 BO	Nil			0	0
6	**IXT**	42 BI	42 BI	OS LR Rc 7 mm, MR Rs 5 mm. OD LR Rc 5 mm (adj.) OU PTSO	10 BO (poor cooperation)	10 BO (poor cooperation)	25 BO	25 BO	OD advancement of LR to insertion	8 BO	10 BO	7 BO	7 BO
8	**IXT**	25 BI	30 BI	OD LR Rc 6.0 mm (adj.) with MR Rs 5.0 mm	Poor cooperation	0	0	0	Nil			0	3 BI
11	**IXT**	54 BI	48 BI	OD LR RC 7.0 mm with MR Rs 5.0 mm OS LR Rc 5.0 mm (adj.)	7 BO	2 BO	7 BO	2 BO	Nil			0	0
3	**EIX**	60 BI	65 BI	OU LR Rc 6.0 mm (adj.) with MR Rs 5 mm WITH bilateral PTSO	Poor cooperation	Poor cooperation	6 BO	4 BO	Nil			0	4 BO

Contd...

Supplementary Table 1: Contd...

Age	Diagnosis	Preoperative deviation distance	Preoperative deviation near	Procedure	First-day post-op distance	First-day post-op near	Third-day postop deviation distance	Third-day post op deviation near	Adjustment (if any)	Deviation after adjustment distance	Deviation after adjustment near	Deviation at 1 month distance	Deviation at 1 month near
4	**IXT**	45 BI	45 BI	OS LR Rc 6.0 mm MR Rs 6.0 mm OD LR Rc 6.0 mm (adj.) OU IO Rc	Poor cooperation	3 L/R	12 BO	3 L/R	Nil			0	0
5	**IXT**	35 BI	35 BI	OD LR Rc 7.0 mm (adj.) with MR Rs 5.0 mm with bilateral IO Rc	6 BO	9 BO	10 BO	3 BO	Nil			0	5 BI
9	**EIX**	52 BI	57 BI	OU LR Rc 7.0 mm (adj.) with MR Rs 5.0 mm with OU PTSO	10 BO	6 BO	10 BO	6 BO	Nil			0	0
5	**IXT**	50 BI	50 BI	OU LR Rc 6.0 mm (OU adj.) with left MR Rs 5.0 mm with bilateral IO Rc	Ortho	2 BI	0	2 BI	Nil			7 BI	2 BI

Rc=Recession, Rs=Resection, IXT=Intermittent exotropia, EIX=Essential intermittent exotropia, adj. = adjustable, IO=Inferior oblique, PTSO=Posterior tenectomy of the superior oblique, BI=Base in (exo), BO=Base out (eso), RHT=Right hypertropia All adjustable sutures were placed on the recessed muscles

Supplementary Table 2: Esotropia

Age	Diagnosis	Preoperative deviation distance	Preoperative deviation near	Procedure	First-day post-op distance	First-day post-op near	Third-day postop deviation distance	Third-day post op deviation near	Adjustment (if any)	Deviation after adjustment distance	Deviation after adjustment near	Deviation at 1 month distance	Deviation at 1 month near
7	**IET**	18 BO	35 BO	BMR Rc 4.00 mm	0	0	2 BI	3 BO	Nil			1 BO	3 BO
6	**IET**	53 BO	66 BO	OS MR Rc 5.0 mm with LR Rs 8.5 mm with IO Rc OD MR Rc 4.0 mm (adj.) with IO Rc	Did not cooperate	6 BI	6 BI	10 BI	OD MR advanced by 3.0 mm	4 BO	2 BO	4 BO	2 BO
3	**IET**	Not cooperative for distance measurement	85 BO	BLR Rs 7.0 mm BMR Rc 4.5 mm	Did not open eyes	Did not open eyes	Not cooperative for distance measurement	2 BO	Nil			0	4 BO
8	**ACE**	64 BO	66 BO	BMR Rc 5 mm OD LR Rs 8 mm	5 R/L	1 R/L	4 R/L	4 R/L	Nil			1 BO, 2 R/L	6 R/L
3	**ACE**	25 BO	30 BO	BMR Rc 4.5 mm	Not cooperative	0	3 BI	0	Nil			8 BO	2 BO
3	**IET**	58 BO	NA	BMR Rc 4.0 mm WITH OS LR RS 7.0 mm	Not cooperative	0	NA	0	Nil			0	0
3	**ACE**	54 BO	45 BO	BMR Rc 4.0 mm with OS LR Rs 7.0 mm	9 BO	10 BO	0	6 BO	Nil			14 BO	12 BO
4	**ACE with V pattern**	30 BO	30 BO, 12 R/L	OD MR Rc 4.5 mm (adj.) with LR Rs 6.0 mm OU IO Rc	Not cooperative	10 BI 3 R/L	9 BO	10 BO	Nil			8 BO	8 BO
6	**ACE**	70 BO	64 BO	OD MR Rc 5.0 mm LR Rs 7.0 mm OS MR Rc 4.0 mm LR Rs 6.5 mm	6 BO (poor cooperation)	10 BO (poor cooperation)	Not cooperative for distance measurement	14 BI	LE MR advanced to insertion	0	0	0	9 BI

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Supplementary Table 2: Contd...

Age	Diagnosis	Preoperative deviation distance	Preoperative deviation near	Procedure	First-day post-op distance	First-day post-op near	Third-day postop deviation distance	Third-day post op deviation near	Adjustment (if any)	Deviation after adjustment distance	Deviation after adjustment near	Deviation at 1 month distance	Deviation at 1 month near
2	**IET**	60 BO	70 BO	OD MR Rc 5.0 mm with Rs 8.0 mm OS MR Rc 4.0 mm (adj.) with LR Rs 6.0 mm	8 BI (poor cooperation)	4 BI (poor cooperation)	6 BO	10 BO	Nil			10 BO	16 BO
10	**IET**	50 BO	50 BO	OD MR Rc 5 mm, OS MR Rc 4 mm (adj.). OD LR RS 6.0 mm	2 BO	2 BO	7 BI	7 BI	OD advance MR by 2.0 mm	0	0	0	6 BO
4	**V pattern ET**	25 BO	25 BO	B/L IO Rc OS MR Rc 4.0 mm (adj.) with LR Rs 7.0 mm	Poor cooperation	Poor cooperation	4 BO	10 BO	Nil			2 BO	0
1	**IET**	65 BO	65 BO	OS: MR Rc 5.0 mm LR Rs 7.0 mm OD: MR Rc 4.0 mm	Poor cooperation	0	2 BI	2 BI	Nil			0	0
6	**ACE**	60 BO	60 BO	BMR Rc 4.0 mm with OS LR Rs 7.0 mm	14 BO	14 BO	0	0	Nil			0	0
3	**IET with V pattern**	40 BO	49 BO	BMR Rc 4.0 mm (OU adj.) with OS downshift with OS LR Rs 5.0 mm with 5.0 mm upshift	Poor cooperation	6 BO	16 BO	20 BO	OU MR slipped by 2.0 mm	6 BO	12 BO	8 BO	4 BO
1	**ACE**	45 BO	40 BO	BMR Rc 4 mm OD LR Rs 6 mm	Did not open eyes	Did not open eyes	6 BO	6 BO	Nil			10 BO	7 BO

Rc=Recession, Rs=Rs, IET=Infantile esotropia, ACE=Acquired comitant esotropia, ET=Esotropia, BMR=Both eye medial rectus, BLR=Both eye lateral rectus, MR=Medial rectus, LR=Lateral rectus, adj.=Adjustable, IO=Inferior oblique, SO=Superior oblique, PTSO=Posterior tenectomy of the superior oblique, BI=Base in (exo), BO=Base out (eso) All adjustable sutures were placed on the recessed muscles