

# Medial rectus muscle pulley posterior fixation sutures in accommodative and partially accommodative esotropia with convergence excess

Logan Mitchell, MBChB, FRANZCO,<sup>a</sup> and Lionel Kowal, MBBS, FRANZCO<sup>a,b,c</sup>

## BACKGROUND

The use of medial rectus pulley posterior fixation sutures to treat esotropia with convergence excess has limited support in the literature. We describe our results using this technique to treat patients with large near–distance disparities.

## METHODS

We retrospectively analyzed records of patients with accommodative or partially accommodative esotropia and convergence excess  $13^\Delta$  or greater treated with bilateral medial rectus muscle recessions augmented by pulley posterior fixation. Surgical doses of recessions were calculated for the mean of distance and near deviations. Primary outcome measures were ocular alignment at distance and near and near–distance disparity.

## RESULTS

A total of 26 patients were identified by the record review. Mean age at surgery was 5.4 years (range, 1.8–11.0 years) and mean follow-up time 12.7 months (range, 1.0–37.6 months). Mean preoperative distance esotropia was  $22.9^\Delta$  (range,  $0^\Delta$ – $53^\Delta$ ), with a mean near–distance disparity of  $26.4^\Delta$  (range,  $13^\Delta$ – $53^\Delta$ ). At 1 to 3 months postoperatively, mean distance deviation was  $0.5^\Delta$  exotropia (range,  $18^\Delta$  exotropia to  $12^\Delta$  esotropia), with a statistically significant decrease in mean near–distance disparity to  $4.5^\Delta$  (range,  $0^\Delta$ – $26^\Delta$ ;  $P < 0.001$ ). Three-quarters of patients (77%) achieved  $0^\Delta$  to  $9^\Delta$  esotropia at 1 to 3 months, with 4 overcorrections for distance and 2 undercorrections for distance and near. At final follow-up 2 patients had persistent exotropia less than  $10^\Delta$ .

## CONCLUSIONS

Augmentation of bilateral medial rectus recessions with pulley posterior fixation resulted in a significant decrease in near–distance disparity in this group of patients with accommodative and partially accommodative esotropia and convergence excess, with a low rate of persistent overcorrection for distance. (J AAPOS 2012;16:125–130)



The surgical dose for bilateral medial rectus muscle recession for accommodative and partially accommodative esotropia with convergence excess is often difficult to determine, and undercorrections are common in these patients.<sup>1</sup> Various means to augment the effects of bilateral medial rectus muscle recessions for the near angle have been reported.<sup>1–5</sup> Pulley posterior fixation lessens the effectiveness of the medial rectus muscle in its field of action by limiting movement of the muscle belly through its pulley. Clark and colleagues<sup>6,7</sup> demonstrated that scleral posterior fixation sutures may collide with the relatively immobile muscle pulley,

creating a mechanical restriction by preventing the muscle belly from telescoping through its pulley sleeve. This led them<sup>8,9</sup> to develop pulley posterior fixation by using a suture to fixate the muscle belly directly to the pulley to produce a comparable mechanical restriction. They found that this new technique was as effective as scleral posterior fixation sutures at decreasing near–distance disparity in partially accommodative esotropia<sup>8</sup> while also offering the safety advantage of avoiding possible scleral perforation.

Here, we describe our experience with medial rectus muscle pulley posterior fixation sutures, described herein as “pulley sutures.” The study describes the experience of a single surgeon (LK) in managing accommodative and partially accommodative esotropia with convergence excess in using this procedure.

## Methods

A retrospective review was undertaken of all surgeries encoded in our database as involving pulley sutures and performed by the senior author at his private practice and at the Royal Victorian Eye and Ear Hospital. Patients with accommodative/partially accommodative esotropia and a corrected near esotropia greater than  $13^\Delta$  larger than the corrected distance deviation at the

*Author affiliations:* <sup>a</sup>Ocular Motility Clinic, Royal Victorian Eye and Ear Hospital, East Melbourne, Victoria, Australia; <sup>b</sup>Private Eye Clinic, East Melbourne, Victoria, Australia; and <sup>c</sup>Centre for Eye Research Australia (CERA), University of Melbourne Department of Ophthalmology, Royal Victorian Eye and Ear Hospital, East Melbourne, Victoria, Australia.

*Study conducted at The Private Eye Clinic, East Melbourne, Victoria, Australia.*  
*Data previously presented at the International Strabismological Association Meeting, Istanbul, Turkey, September 22–25, 2010.*

*Submitted March 4, 2011.*

*Revision accepted November 1, 2011.*

*Correspondence:* Logan Mitchell, MBChB, FRANZCO, c/- Private Eye Clinic, Level 3, 182 Victoria Parade, East Melbourne 3002, Australia (email: EYE3Y3@gmail.com).

*Copyright © 2012 by the American Association for Pediatric Ophthalmology and Strabismus.*

*1091–8531/\$36.00*

*doi:10.1016/j.jaapos.2011.11.013*

preoperative measurement were included (Pulley sutures were reserved for cases with near–distance disparity of at least  $13^{\Delta}$ ). Patients were excluded if postoperative follow-up did not exceed 1 month, they had undergone previous strabismus surgery, or reliable pre- or postoperative measurements could not be obtained. The study complied with all local laws and was in keeping with the principles of the Declaration of Helsinki. Institutional review board approval was not deemed necessary. Informed consent was obtained for all surgeries.

A preoperative assessment of patients included a complete ophthalmic examination, including alternating cover testing at 6 m and 33 cm, with and without full cycloplegic refractive correction. Alternate prism and cover testing was performed at 6 m and 33 cm with spectacle correction. Ductions and versions were documented. Cycloplegic refraction (using oxybuprocaine 0.4% then 1% cyclopentolate drops, repeated if pupils not fully dilated in 20 to 30 minutes, followed by refraction with manual retinoscopy using free lenses) and dilated fundus examination were performed.

Surgery consisted of bilateral medial rectus muscle recessions, with the surgical angle determined by the average of corrected distance and near deviations (using standard surgical tables; see e-Supplement 1, available at [jaapos.org](http://jaapos.org)), augmented by pulley sutures. The surgical technique (Figure 1 and Video 1, available at [jaapos.org](http://jaapos.org)) consisted of conjunctival fornix incisions, with medial rectus muscle recession in a standard manner using fixed 6-0 polyglactin 910 suture (Vicryl; Ethicon, Inc, Somerville, NJ). A retractor allowed exposure of the medial rectus muscle pulley, identified by its pale color. The pulley was brought forward with the use of a small muscle hook; its resistance to movement/displacement confirmed successful isolation. A 6-0 polyester suture (Mersilene; Ethicon Inc) was placed through the superior or inferior pulley margin (depending on ease of surgical access) then passed, full-thickness, through the corresponding edge of medial rectus muscle as far back as possible. The position of the pulley fixation suture was not measured. Successful pulley suture placement was confirmed by comparing range of adduction on forced duction testing before and after pulley fixation. In early cases this was a subjective estimate; later, the distance from temporal limbus to caruncle was measured on forced adduction, giving a quantitative measure of restriction produced. No vertical offsets were performed out of concern that they might affect pulley suture fixation. The conjunctiva was closed with 6-0 plain gut, and sub-Tenon's local anesthesia infiltrated.

Postoperative follow-up occurred on day 1 and at 1 to 2 weeks. Further follow-up occurred at clinically indicated intervals. Occasionally follow-up was performed by the patient's local optometrist. Ocular alignment with prescribed refractive correction was assessed at each follow-up visit, with reduction of hyperopic spectacle power occasionally required to control exotropia. Primary outcome measures were ocular alignment at distance and near and near–distance disparity. Target alignment was  $0^{\Delta}$  to  $9^{\Delta}$  of esotropia at distance, with any exodeviation regarded as an overcorrection.

Results were entered onto a computerized database and analyzed statistically (Excel; Microsoft, Redmond, WA), comparing means via use of the two-tailed paired *t* test and exam-

ining the strength of relationships using linear regression analysis.

## Results

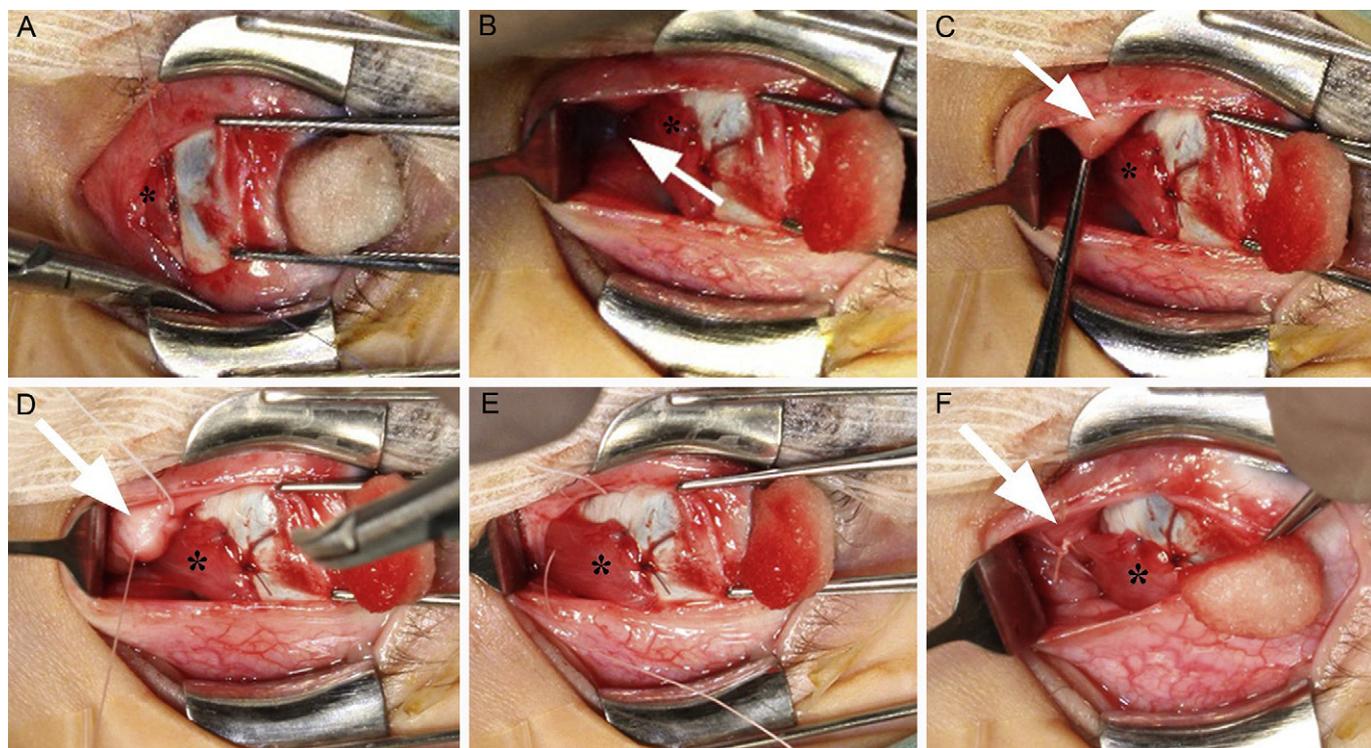
A total of 45 patients treated with pulley sutures between July 2006 and August 2010 were identified. Of these, there were 31 cases of accommodative or partially accommodative esotropia with convergence excess  $>13^{\Delta}$ , of whom 26 (14 females) had the minimum required follow-up and were included in the study.

Preoperative characteristics of the study cohort are given in Table 1. Mean corrected distance esodeviation was  $22.9^{\Delta}$  (range,  $0^{\Delta}$ - $53^{\Delta}$ ), with a mean near–distance disparity (convergence excess) of  $26.4^{\Delta}$  (range,  $13^{\Delta}$ - $53^{\Delta}$ ). Five children were aligned for distance at their preoperative visit: 4 were bifocal nonresponders (3 still misaligned for near with bifocals, 1 intolerant of their use), and 1 had an intermittent distance esotropia (reported and observed). The mean cycloplegic refraction (averaged between eyes) was  $+2.9$  D (range,  $+0.25$  to  $+8.50$  D), and 10 children (38.5%) were wearing bifocal spectacles preoperatively. Eleven patients (42.3%) had a documented history of amblyopia (visual acuity interocular difference of  $\geq 2$  Snellen lines), the same number having oblique muscle dysfunction.

The mean medial rectus muscle recession amount was 4.9 mm. In 5 patients the recession varied by greater than 0.5 mm from standard surgical doses, 2 with larger and 3 with smaller recessions. One of the larger recessions was a case of intermittent distance esotropia with dose incorporating that distance angle. The smaller recessions included an 11-year-old child with a large positive angle kappa, operated on for reconstructive indications, for whom surgery was on the distance angle only. No patients required lateral rectus resection, whereas 6 (23.1%) had inferior oblique muscle weakening.

There were no intraoperative complications. In one patient, a pulley suture was successfully placed unilaterally; although the pulley was identified in the fellow eye, the suture placed did not produce intraoperative restriction to adduction, and a scleral posterior fixation suture was placed on this eye instead.

Mean follow-up was 12.7 months (range, 1.0-37.6 months). All patients were seen between 1 and 3 months, whereas 12 (46.2%) were seen at 3 to 6 months, and 10 (38.5%) after 12 months. Twelve patients had final follow-up findings provided by their optometrist. Mean motor alignment results are given in Table 2. At 1 to 3 months, 20 patients (76.9%) achieved target distance (corrected) alignment between  $0^{\Delta}$  and  $9^{\Delta}$  esotropia, and 16 (61.5%) were aligned between  $0^{\Delta}$  and  $9^{\Delta}$  at near and distance. There were 4 (15.4%) overcorrected patients, 2 of whom required reduction of the hyperopic spectacle power—this was successful (orthotropic near and distance) to 19 months' follow-up in 1 patient and unsuccessful (distance exotropia) to 10 months' follow-up in the other. Among those with follow-up at 3 to 6 months and  $\geq 12$



**FIG 1.** Intraoperative photographs of medial rectus muscle recession augmented by pulley posterior fixation. A, Medial rectus recession completed (medial rectus muscle indicated by asterisk). B-C, Medial rectus pulley (arrow) identified then hooked with squint hook. D, Pulley secured with polyester suture. E, Suture passed through muscle belly as far posterior as possible; F, Completed, tied suture fixing pulley to muscle belly.

Table 1. Preoperative characteristics

| Variable                          | Mean | Range          |
|-----------------------------------|------|----------------|
| Age at surgery, yrs               | 5.4  | 1.8-11.0       |
| Visual acuity: better eye, LogMAR | 0.07 | -0.10 to +0.18 |
| Visual acuity: worse eye, LogMAR  | 0.23 | 0.00 to +0.60  |
| Distance esodeviation, PD         | 22.9 | 0-53           |
| Near esodeviation, PD             | 48.8 | 30-87          |
| Distance-near disparity, PD       | 26.4 | 13-53          |
| Refraction, D                     | 2.9  | +0.25 to +8.50 |

D, diopters; PD, prism diopters.

months follow-up, 9 of 12 (75%) and 9 of 10 (90%) achieved target alignment at distance. Two patients (7.7%) had an overcorrection (both  $<10^\Delta$ ) at their final follow-up.

There were no overcorrections for near at any follow-up examination. Most patients had near motor alignment of  $0^\Delta$  to  $9^\Delta$  esotropia at all follow-up intervals: 69.2% at 1 to 3 months' follow-up, 83.3% at 3 to 6 months, and 60.0% at  $\geq 12$  months. Table 3 shows the various success rates at achieving target distance and/or near alignment. Figure 2 shows pre- and postoperative alignments and near-distance disparities. Of the 8 patients undercorrected for near at 1 to 3 months' follow-up in Figure 2B, 4 had near-distance disparities of  $<10^\Delta$ , indicating an associated undercorrection for distance. Preoperative features of the remaining 4 patients (with a "true" undercorrection for near) were not unique, except for a history of amblyopia in all 4. Of these 4 true undercor-

rections for near, 2 resolved spontaneously (without altering glasses).

Near-distance disparity decreased by an average  $21.8^\Delta$  (79.9%; range,  $-3^\Delta$  to  $53^\Delta$ ) to a mean of  $4.5^\Delta$  (range,  $0^\Delta$ - $26^\Delta$ ) at 1 to 3 months' follow-up, a statistically significant decrease ( $P < 0.001$ ). The only preoperative feature common in the 5 patients who had  $10^\Delta$  or greater near-distance disparity at 1-3 months was a history of amblyopia in 4 (80%; Figure 2C). Of these 5 patients, 3 (60%) had an overcorrection in the distance at that time. Figure 3 demonstrates the good correlation (Pearson's correlation coefficient  $[R] = -0.81$ ) between preoperative near-distance disparity and its early postoperative reduction.

Quantitative measurement of intraoperative restriction to adduction produced by pulley suture fixation was only performed for 12 patients. There was poor correlation between degree of restriction produced and decrease in near-distance disparity ( $R = 0.02$ ).

Of the 10 children wearing bifocals preoperatively, 7 (70%) were able to discontinue their use by the time of their last follow-up visit, whereas 1 of 16 (6.3%) children not requiring bifocals preoperatively needed them at final follow-up. There were no postoperative complications, and no patients have required further surgery.

### Discussion

Our study finds that the use of pulley sutures to augment bilateral medial muscle recession surgery decreased the

Table 2. Postoperative alignment by follow-up duration (negative values represent exodeviations)

| Postoperative outcome                                     | 1-3 months             | 3-6 months            | 12+ months            |
|---|------------------------|-----------------------|-----------------------|
| Number  | 26                     | 12                    | 10                    |
| Distance esodeviation (PD): mean (range)                  | -0.5 (-18 to 12)       | 0.8 (-8 to 14)        | 1.5 (0 to 10)         |
| Near esodeviation (PD): mean (range)                      | 4.1 (0 to 16)          | 3.2 (0 to 20)         | 6.9 (0 to 30)         |
| Near-distance disparity (PD): mean (range)                | 4.5 (0 to 26)          | 2.4 (0 to 10)         | 5.4 (0 to 30)         |
| Decrease in near-distance disparity (PD): mean (range), % | 21.8 (-3 to 53), 79.9% | 23.5 (4 to 53), 88.0% | 18.4 (0 to 47), 76.8% |

PD, prism diopters.

Table 3. Proportion achieving outstanding alignment results (0-9 PD esotropia at near and distance), undercorrections at near and/or distance, and overcorrections (which were all for distance) at different follow-up intervals

|   | 1-3 months | 3-6 months | 12+ months |
|---|------------|------------|------------|
| Number achieving 0-9 PD for near AND distance (%)       | 16 (61.5)  | 8 (66.7)   | 6 (60.0)   |
| Number undercorrected (>9 PD) for near alone (%)        | 6 (23.1)   | 1 (8.3)    | 3 (30)     |
| Number undercorrected (>9 PD) for near and distance (%) | 2 (7.7)    | 1 (8.3)    | 3 (30)     |
| Number overcorrected (any exotropia) for distance (%)   | 4 (15.4)   | 2 (16.6)   | 1 (10)     |

PD, prism diopters.

near-distance disparity in this group of children with accommodative or partially accommodative esotropia with convergence excess. This decrease was statistically significant, reducing the mean convergence excess to a clinically insignificant degree. Although 15.4% of patients had an early overcorrection, it persisted to final follow-up in only 7.7% (<10<sup>Δ</sup> in both instances). Pulley sutures were not associated with any complications in this series, except 1 case of unilateral pulley suture placement in the patient whose second eye did not produce adequate intraoperative restriction to adduction.

Pulley sutures therefore provide another useful surgical solution for convergence excess cases. Many different approaches have been described, all of which attempt to improve on the frequent surgical undercorrections for near that occur with "simple" bilateral medial rectus recessions while avoiding distance exotropia. It is known that medial rectus recessions reduce near-distance disparity in accommodative/partially accommodative esotropia with convergence excess by around 2/3.<sup>10-12</sup> Vivian and colleagues<sup>13</sup> summarize the controversies of this scenario, describing the problematic disparities in target outcomes, follow-up periods, and lack of high-quality evidence in the current literature.

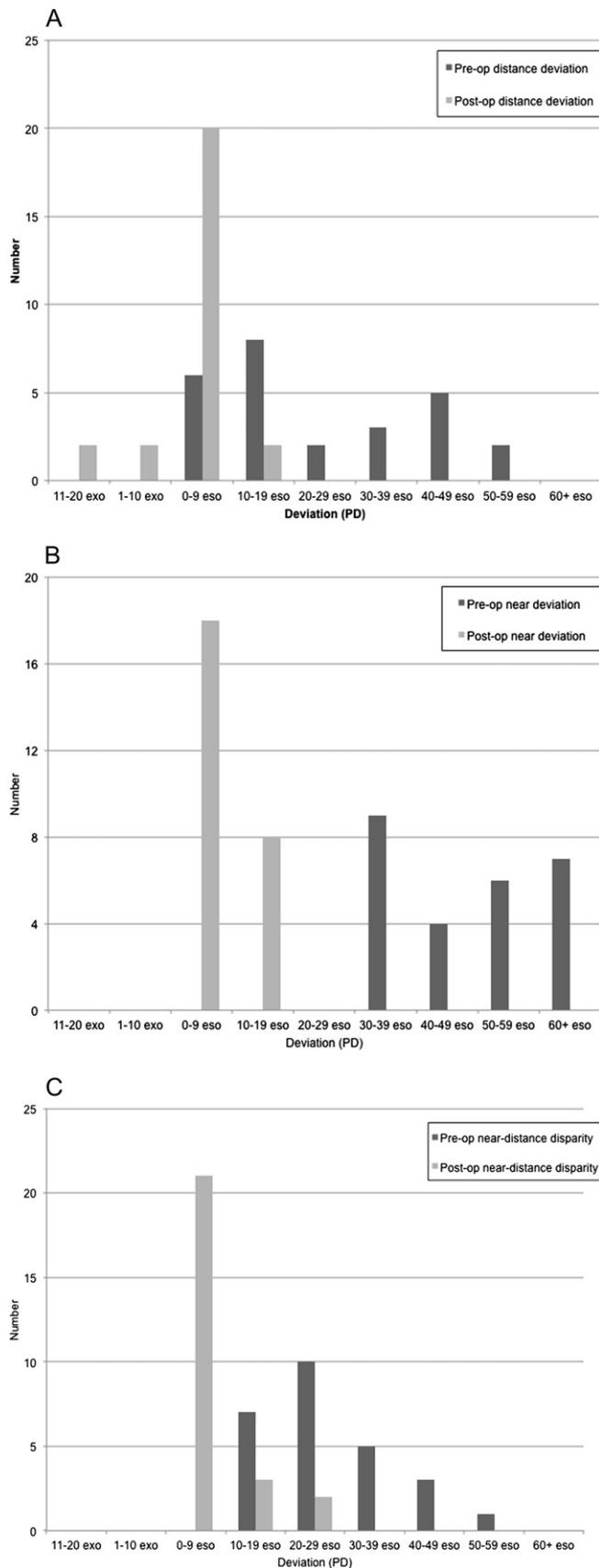
In 1993 Wright and Bruce-Lyle<sup>2</sup> used the average of corrected and uncorrected near deviations to augment bilateral medial rectus muscle recessions in 40 patients, 98% of whom achieved motor alignment of orthotropia  $\pm 10^{\Delta}$ , once spectacle strength was adjusted, with no undercorrections and one overcorrection.

West and Repka<sup>3</sup> reported the results of surgery on the corrected near angle in 25 patients with a >10<sup>Δ</sup> near-distance disparity (mean, 21<sup>Δ</sup>). They achieved an 80% success rate in motor alignment (orthotropia  $\pm 10^{\Delta}$  distance and near), with 2 patients requiring reoperations. Kutsche and Keech<sup>4</sup> used prism adaptation for the near angle in 65 patients with greater than 9<sup>Δ</sup> near-distance disparity

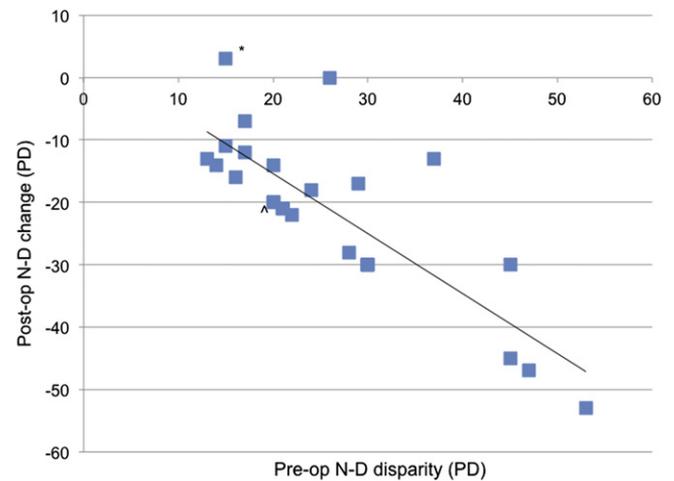
(mean, 13.1<sup>Δ</sup>). Almost 90% had motor or sensory fusion with prisms (prism-response), whereas 31% were prism-builders. They found the prism response to be more important than prism-building in achieving better motor and sensory outcomes—up to 86% of the prism responders achieving target outcomes versus up to 50% of the nonresponders. Wygnanski-Jaffe and colleagues<sup>1</sup> also used near-angle prism adaptation in 65 patients with convergence excess (mean, 15.1<sup>Δ</sup>) and found similar rates of prism-responders and prism-builders. Excellent postoperative results (orthotropia  $\pm 8^{\Delta}$  and Worth 4-dot near fusion) were more frequent for the prism-builders than in the nonresponders (100% vs 55%,  $P = 0.011$ ).

Scleral posterior fixation sutures also appear to reduce distance-near disparity.<sup>5,13</sup> Among children with a near-distance disparity greater than 10<sup>Δ</sup>, Kushner and colleagues<sup>5</sup> found a statistically significant difference between augmented surgery for the near angle and the use of posterior fixation sutures, with 100% of 25 patients treated with the dose for the near surgical angle and 80% of 21 patients treated with scleral posterior fixation having less than 10<sup>Δ</sup> esotropia at 6 months' follow-up. Kushner<sup>14</sup> later found that the excellent sensory and motor outcomes persisted in 86% of 22 patients treated with near angle surgery who had received 15 years of follow-up.

Clark and colleagues<sup>8</sup> first described the use of pulley fixation in 13 patients with accommodative or partially accommodative esotropia associated with a near-distance disparity greater than 10<sup>Δ</sup>. Mean distance deviation was 14.6<sup>Δ</sup> and near-distance disparity was 16.8<sup>Δ</sup>. Bilateral medial rectus recessions were performed either for their prism-adapted, corrected distance angle or their uncorrected distance angle (if refraction was <+2.0 D), whereas those with no esotropia at distance underwent pulley suture fixation alone, without medial rectus muscle recession. They compared 9 patients who had similar medial rectus



**FIG 2.** Preoperative and 1- to 3-month postoperative corrected alignment. A, Distance deviations. B, Near deviations. C, Near–distance disparity.



**FIG 3.** Preoperative near–distance disparity plotted against 1- to 3-month postoperative change in near–distance disparity. Note absence of any near exotropia. The straight line indicates a linear regression trend line ( $R = -0.81$ ); the asterisk, a case with preoperative distance esotropia of 20<sup>Δ</sup>, near ET 35<sup>Δ</sup>, and postoperative distance exotropia of 18, near XT 0—representing an increase in near–distance disparity from 15<sup>Δ</sup> to 18<sup>Δ</sup>; and the caret, the case in which the pulley fixation was placed unilaterally, with scleral posterior fixation used contralaterally. *PD*, prism diopters.

muscle recession doses but with scleral posterior fixation sutures. In this group, mean distance deviation was 30.6<sup>Δ</sup> and near–distance disparity was 16.2<sup>Δ</sup>.

The primary outcome measure of this study, unlike previous studies, was the reduction in near–distance disparity. The pulley fixation group had a mean esodeviation at distance of 1.7<sup>Δ</sup> (including 1 patient who was overcorrected), with a mean near–distance disparity of 2.5<sup>Δ</sup> (a reduction of 14.4<sup>Δ</sup> or 85.7%) at an average follow-up of 9.7 months. Of note, 12 of 13 pulley suture patients (92.3%) and 7 of 9 scleral posterior fixation suture patients (78%) had final distance alignment between 0<sup>Δ</sup> and 9<sup>Δ</sup> esotropia. There were no statistically significant differences in primary or secondary outcome measures between the two groups.

Our study is to our knowledge the second (and largest) report of the use of pulley fixation to augment bilateral medial rectus recession in the treatment of accommodative or partially accommodative esotropia with convergence excess. Successful motor outcomes were broadly comparable to those of previous case series using various techniques. Notable exceptions include the perfect or near-perfect alignment results obtained by Kushner and colleagues<sup>5</sup> using a near-angle target and by Clark and colleagues<sup>8</sup> using pulley sutures.

A key feature of our study is the analysis of the reduction in the near–distance disparity, which was 22<sup>Δ</sup>, or 80%. This is similar to results reported by Clark and colleagues,<sup>8</sup> although 3 key differences warrant highlighting. First, the mean distance esotropia and near–distance disparity were both larger in our group than in their pulley fixation group.

Second, bilateral medial rectus muscle recessions in our study were determined by the average of corrected distance and near deviations, whereas Clark and colleagues used either the uncorrected distance angle for those with  $<2.0$  D hypermetropia or prism-adapted distance angle for those with  $>10^{\Delta}$  distance esotropia and  $>2.0$  D hypermetropia. Finally, Clark and colleagues placed 2 pulley posterior fixation sutures on each muscle, while in our patients only one was placed if a restriction to adduction was produced. If the mechanism proposed by Clark and colleagues is correct, as long as this restriction is produced, the effect should be the same.

The 15% early overcorrection rate, with only 2 overcorrections (measuring  $5^{\Delta}$  and  $6^{\Delta}$ ) persisting to final follow-up compares favorably with the persisting  $\geq 5^{\Delta}$  overcorrection rate (11%-20%) seen in near angle surgery<sup>3,4</sup> and prism-adapted near angle surgery (7%-10%).<sup>1,4</sup> The increased prevalence of amblyopia in the patients undercorrected for near or with persisting  $\geq 10^{\Delta}$  near-distance disparity is interesting, perhaps indicating associated fusional abnormalities.

Finally, the fact that bifocals could be discontinued in 70% of our bifocal wearers speaks to the collapse of the convergence excess produced with this procedure. Indeed, correlation between preoperative near-distance disparity and its postoperative decrease, and the low rate of persisting overcorrections in this series suggest an effect of pulley sutures solely on the convergence excess, without inducing a near exotropia or significantly altering the effect of bilateral medial rectus recessions. Kushner<sup>5</sup> found greater variability in results with scleral posterior fixation, but in our subset of patients with pulley fixation this was less of a problem.

Limitations of this study primarily relate to its retrospective nature, in which we used real-world data available from a subspecialist strabismus practice. Some potentially relevant outcomes (eg, sensory fusion and stereopsis) were not measured frequently or reliably enough to allow inclusion here. The lack of good-quality long-term follow-up is another obvious limitation. However, the use of only one surgeon's records can also be seen as a strength of this study since it minimizes variations in pre- and postoperative measurements and in surgical technique.

In conclusion, we found that medial rectus muscle pulley fixation was a useful additional surgical step for addressing marked convergence excess associated with accommodative and partially accommodative esotropia, where surgery aimed at the near angle may cause concern (real or imagined) about overcorrections for the distance. Although technically more difficult to perform than a simple recession, the technique, once learned, avoids the additional surgical risks of scleral posterior fixation. More data will be

necessary to continue to assess the indications, contraindications, and appropriate surgical dose calculations for this procedure.

## Literature Search

PubMed was searched February 27, 2011, using the following terms: *pulley sutures* OR *pulley suture* OR *pulley posterior fixation* OR (*pulley* AND *strabismus*).

## Acknowledgments

*We thank Dr. Joseph Demer for his advice and Drs. Lloyd Bender, Avinash Mahindrakar, Elaine Wong, and Elina Landa for their previous analysis of this cohort and for preparing the surgical video.*

## References

1. Wagnanski-Jaffe T, Trotter J, Watts P, Kraft SP, Abdolell M. Preoperative prism adaptation in acquired esotropia with convergence excess. *J AAPOS* 2003;7:28-33.
2. Wright KW, Bruce-Lyle L. Augmented surgery for esotropia associated with high hypermetropia. *J Pediatr Ophthalmol Strabismus* 1993;30:167-70.
3. West CE, Repka MX. A comparison of surgical techniques for the treatment of acquired esotropia with increased accommodative convergence/accommodation ratio. *J Pediatr Ophthalmol Strabismus* 1994;31:232-7.
4. Kutsche PJ, Keech RV. Surgical outcome after prism adaptation for esotropia with a distance-near disparity. *J AAPOS* 2001;5:189-92.
5. Kushner BJ, Preslan MW, Morton GV. Treatment of partly accommodative esotropia with a high accommodative convergence/accommodation ratio. *Arch Ophthalmol* 1987;105:815-8.
6. Clark RA, Miller JM, Demer JL. Three-dimensional location of human rectus pulleys by path inflections in secondary gaze positions. *Invest Ophthalmol Vis Sci* 2000;41:3787-97.
7. Clark RA, Isenberg SJ, Rosenbaum AL, Demer JL. Posterior fixation sutures: A revised mechanical explanation for the fadenoperation based on rectus extraocular muscle pulleys. *Am J Ophthalmol* 1999;128:702-14.
8. Clark RA, Ariyasu R, Demer JL. Medial rectus pulley posterior fixation is as effective as scleral posterior fixation for acquired esotropia with a high AC/A ratio. *Am J Ophthalmol* 2004;137:1026-33.
9. Clark RA, Ariyasu R, Demer JL. Medial rectus pulley posterior fixation: A novel technique to augment recession. *J AAPOS* 2004;8:451-6.
10. Rosenbaum AL, Jampolsky A, Scott AB. Bimedial recession in high AC/A esotropia. A long-term follow-up. *Arch Ophthalmol* 1974;91:251-3.
11. Arnoldi KA, Tychsen L. Surgery for esotropia with a high accommodative convergence/accommodation ratio: Effects on accommodative vergence and binocularity. *Ophthalmic Surg Lasers* 1996;27:342-8.
12. Archer SM. The effect of medial versus lateral rectus muscle surgery on distance-near incomitance. *J AAPOS* 2009;13:20-6.
13. Vivian AJ, Lyons CJ, Burke J. Controversy in the management of convergence excess esotropia. *Br J Ophthalmol* 2002;86:923-9.
14. Kushner BJ. Fifteen-year outcome of surgery for the near angle in patients with accommodative esotropia and a high accommodative convergence to accommodation ratio. *Arch Ophthalmol* 2001;119:1150-53.