

# An Evaluation of the Semiadjustable Suture Strabismus Surgical Procedure

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**Background:** Muscle slippage is an adverse outcome of strabismus surgery. Its incidence is increased if adjustable sutures are used or if surgery is performed on the inferior or medial rectus muscles. Although there are no firm numbers for this complication, studies have suggested incidence rates between 7% and 41% when adjustable suture surgery is performed on the inferior rectus muscle. In theory, the semiadjustable suture procedure should decrease this adverse outcome. This procedure involves suturing the corners of the muscle firmly to the sclera and placing the center of the muscle on an adjustable suture. This study evaluates semiadjustable suture surgery with respect to muscle slippage. **Methods:** The primary treatment group consisted of 57 patients who underwent semiadjustable suture surgery on a total of 61 muscles that either had never previously undergone surgery or had undergone surgery and had not previously slipped postoperatively. Fifty-five were inferior rectus muscles and 6 were medial rectus muscles. An additional 7 patients had semiadjustable suture surgery on muscles that had slipped after prior surgery and were analyzed separately. The outcome evaluation was at least 6 months after surgery. **Results:** None of the 57 patients in the primary treatment group demonstrated muscle slippage after semiadjustable suture surgery. One of the 7 patients who had history of prior muscle slippage also had slippage after semiadjustable suture surgery. **Conclusion:** The semiadjustable suture procedure appears to decrease the incidence of muscle slippage. (J AAPOS 2004;8:481-487)

Slippage of an extraocular muscle is a recognized and potentially serious adverse outcome of strabismus surgery.<sup>1-13</sup> It occurs if the muscle that had undergone surgery fails to form a firm bond with the sclera and either retracts in its capsule or migrates posteriorly during the healing process.<sup>2-4,12,13</sup> It is characterized by a progressive overcorrection (if the affected muscle had been recessed) with a progressively increasing degree of underaction of the muscle; if the affected muscle had been resected, there would be a progressive undercorrection after surgery. Risk factors include surgery on the inferior rectus muscle and, to a lesser degree, the medial rectus muscle.<sup>5-8</sup> Also, the use of a suspension technique (hang-back), as is used with adjustable suture surgery, or surgery on tight fibrotic muscles as occurs in Graves orbitopathy are associated with an increased risk of postoperative slippage.<sup>5-8</sup> It occurs less commonly when surgery is performed on the lateral rectus or superior rectus muscles.

Possible reasons for the increased occurrence of postoperative slippage with surgery on the inferior rectus muscle include the attachment of that muscle to the inferior oblique muscle via Lockwood's ligament, which can have a destabilizing effect on bond formation with the sclera.<sup>5,7,8</sup> It has been postulated that the increased amount of connective tissue that is present under the inferior rectus muscle may interfere with adhesion of the muscle to the sclera when a suspension technique is used (A. Scott, unpublished personal communication, July 6, 2004). In addition, the Bell's phenomenon, particularly as it occurs during sleep, may theoretically interfere with bonding of the inferior rectus muscle to the sclera. Also, Jampolsky has theorized that the relatively short arc of contact of the inferior rectus muscle and, to a lesser degree the medial rectus muscle, may be the cause of the increased tendency of these muscles to slip after surgery using a suspension technique. If the eye moves into the field of action of the respective muscle during the healing period prior to the formation of a firm scleral bond, the muscle may lose apposition with the globe.<sup>11,14</sup> This theory has been supported by Chatzistefanou and co-workers using dynamic magnetic resonance imaging.<sup>13</sup>

In 1993 Spielmann described the "semiadjustable" suture technique, which, in theory, should decrease the incidence of postoperative muscle slippage yet retain many of the advantages of adjustable suture surgery.<sup>15</sup> She credited Campos as being a codeveloper of this procedure. The semiadjustable suture procedure involves fixating the corners of the muscle firmly to the sclera at the desired

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recession point but also placing an adjustable suture through the center of the muscle. This technique is described in detail in the Subjects and Methods section. In theory, the use of a semiadjustable suture should prevent loss of apposition of the muscle with the globe during the healing process yet still allow some degree of postoperative suture adjustment. In 2000, it became my standard technique for recessing the inferior rectus muscle in those patients in whom I wished to use an adjustable suture and also for adjustable suture surgery on the medial rectus muscle if the surgical plan necessitated placing the muscle more than 12 mm from the limbus. The purpose of this report is to present my experience with the semiadjustable suture procedure, with particular attention to the incidence of postoperative muscle slippage. To my knowledge, no data have been published as to the efficacy of the semiadjustable suture procedure in this regard.

## SUBJECTS AND METHODS

This prospective study was approved by the University of Wisconsin Institutional Review Board; it consisted of all consecutive patients, subject to certain exclusion criteria, on whom I performed the semiadjustable suture procedure on 1 or more muscles between January 2000 and August 2003. All patients were followed at least 6 months after surgery. If patients were no longer under my care but if the referring doctor was a pediatric ophthalmologist and could provide 6-month follow-up information, they were included. I did include patients in whom semiadjustable suture surgery was performed on a previously operated muscle; however, I excluded from primary data analysis those patients in whom I found the previously operated muscle had either slipped in its capsule or formed an elongated scar at the time of my surgery because muscles that slip once have an increased incidence of repeated slippage.<sup>2-4,12</sup> However, these patients were analyzed and reported separately.

The primary outcome event was the occurrence of muscle slippage within 6 months after surgery. There are, however, multiple factors other than slippage that can cause a progressive overcorrection postoperatively. These include the postoperative unmasking of a bilateral masked superior oblique palsy,<sup>16</sup> contracture of the antagonist of a recessed muscle as often occurs in Graves orbitopathy,<sup>6,17</sup> or simply an unexplained progressive postoperative drift. Consequently, the mere occurrence of a progressive overcorrection does not confirm the diagnosis of muscle slippage. Similarly, one cannot make this diagnosis based solely on an arbitrary degree of muscle underaction after surgery because many forms of complex strabismus may in fact be characterized by underaction of a recessed muscle after surgery, despite good healing of the muscle and good alignment in the primary position (eg, Graves orbitopathy, restricted muscles secondary to orbital fracture, etc).<sup>18</sup> In fact, one cannot definitively make the diagnosis of muscle slippage in some circumstances unless the patient undergoes re-operation. Consequently, the following

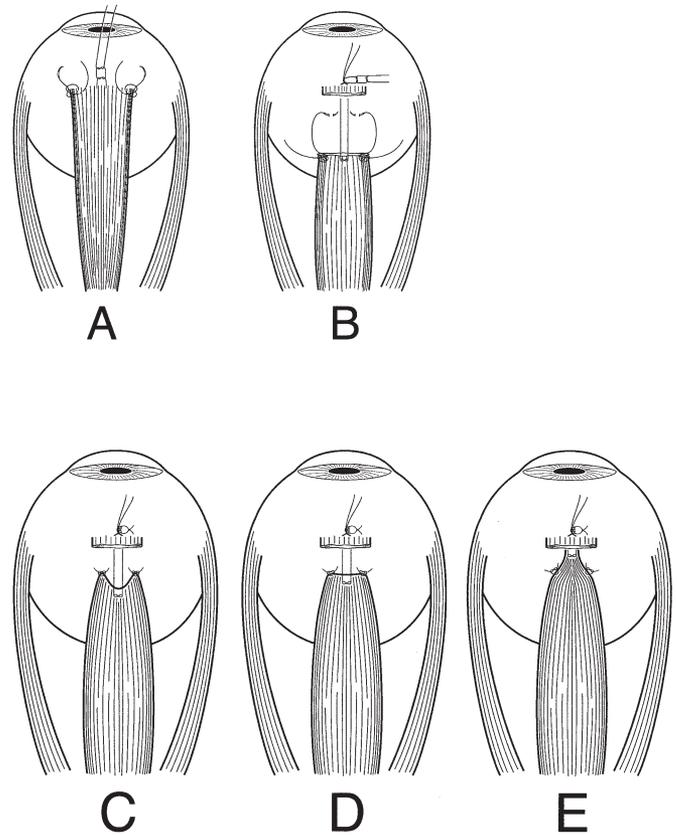
criteria for categorizing a patient as having muscle slippage were used for this study. Patients were considered to be "suspect" of having muscle slippage if their angle of misalignment changed by more than 4 prism diopters in the direction away from the field of action of the muscle (eg, hypertropia for the inferior rectus muscle and exotropia for the medial rectus muscle) between the measurement taken immediately after postoperative suture adjustment and the outcome examination at least 6 months after surgery. In addition, if versions showed more than 1 unit of change in the direction of increasing underaction (5 point scale 0 to -4 for muscle underaction) from the assessment 1 week after surgery to the 6-month outcome determination date, they also were considered suspect for muscle slippage. The 1-week postoperative version assessment was chosen as the baseline for version testing because often patients are splinting on the day after surgery and version testing in the extreme fields of gaze may be uncomfortable and difficult for them to perform. If a patient was suspected of muscle slippage for either of these 2 aforementioned reasons and underwent further surgery, the previously operated muscle was always surgically explored. If it was found at the time of reoperation to in fact have not slipped and the overcorrection could be attributed to other factors, the patient was no longer considered to have muscle slippage for the purpose of data analysis in this study. However if a patient was suspected of having muscle slippage and did not undergo further surgery, the patient was counted as having a slipped muscle for data analysis. This category included patients who may have declined further surgery that had been recommended, those who were successfully managed postoperatively with prism, or patients who underwent further surgery elsewhere.

The outcome determination date was the first examination that was more than 6 months after surgery. However, if at any later date they were found to have met the criteria for muscle slippage, they were counted as such for data analysis even though they had not met those criteria by the 6-month outcome date. These liberal criteria for diagnosing muscle slippage were intentionally chosen to err on the side of overestimating the incidence of this adverse outcome.

Eleven of the patients in this study underwent semiadjustable suture surgery on previously operated muscles. For the purpose of data analysis, the amount of recession for these muscles was calculated based on where the muscle was placed at the time of reoperation and the average normal location for the respective muscle's insertion. This was assumed to be 6 mm from the limbus for the inferior rectus muscle and 5 mm for the medial rectus muscle. For example, if an inferior rectus muscle was found 10 mm from the limbus and was recessed to 12 mm from the limbus, the recession was considered to be 6 mm. If an inferior rectus muscle was found 14 mm from the limbus and advanced to 12 mm from the limbus, the recession would also be considered 6 mm. This approach was chosen because the further distance a muscle is placed from the

limbus, the greater the likelihood that slippage will occur if the arc of contact theory is the cause of muscle slippage.<sup>13</sup> However, the information as to how much these muscles were actually advanced or recessed from the point at which I found them was noted and analyzed separately.

The technique for the semiadjustable suture procedure is as follows: the muscle is isolated in the usual manner. For this study, the medial rectus muscle was isolated through a limbal incision and the inferior rectus muscle through an incision parallel to and just anterior to the muscle's insertion. Two single-armed 6-O polyglactin sutures were placed through the corners of the muscle at the insertion and securely locked. A double-armed 6-O polyglactin suture was placed through the central 1-2 mm of the muscle at the insertion (a through and through bite) and secured with a square knot. After the muscle was disinserted, the 2 corner sutures were sewn through the sclera at the desired recession distance approximately 5 mm apart. This intentionally bunched the muscle somewhat at the new insertion and permitted the center of the muscle to sag 1-2 mm. It is helpful to have the 2 needle tracks in the sclera directed toward one another, as opposed to being directed toward the insertion. Because these were single-armed sutures and there was only 1 scleral tunnel made for each suture, the muscle would tend to creep anteriorly toward the scleral exit point of the suture when it was tied, if the suture pass was directed toward the insertion. Next, the double-armed suture securing the center of the muscle was brought out through the insertion and secured with a 6-O polyglactin cinch in the usual manner for adjustable suture surgery.<sup>19</sup> The cinch was then tightened so as to eliminate the sag in the center of the muscle, positioning the center of the muscle level with the 2 corners (Figure 1). At the time of surgery, one can easily see that despite a recession of as much as 6 or 7 mm, maximum adjustment of the semiadjustable suture would permit advancement of the center of the muscle all the way anteriorly to the original insertion (Figure 2). Although in theory, postoperative adjustment would allow an increase in the amount of recession, by permitting the central sag in the muscle to reappear, in reality this technique is very limited in its ability to allow an increase in the initial amount of recession. For that reason, my surgical formula typically had me err on the side of doing a slightly greater recession than I would normally perform for a given deviation (1/2 to 1 mm), thus minimizing the likelihood that the recession would need to be increased at the time of adjustment. As previously described, a reference knot was placed in the adjustable suture to permit accurate quantification of the amount of postoperative adjustment that was actually performed.<sup>20</sup> In brief, this technique involves placing a knot in the adjustable suture at any arbitrary distance (usually 30-50 mm) anterior to the cinch. The distance between the cinch and the knot is measured at the time of surgery. After adjustment, the distance between the cinch and the knot is again measured,



**FIG 1.** In A, The inferior rectus muscle is isolated in the usual manner. Two double-armed 6-O polyglactin sutures are placed through the nasal and temporal corner of the muscle and secured with lock bites. A double-armed 6-O polyglactin suture is placed through the central 1-2 mm of the muscle at the insertion and secured with a square knot. In B, The muscle has been disinserted. The sutures in the nasal and temporal corner of the muscle are sewn through the sclera at the desired distance posterior to the insertion and spaced approximately 5 mm apart horizontally. The double-armed 6-O polyglactin securing the center of the muscles is brought out through the insertion and secured with a 6-O polyglactin cinch to permit adjustment to the center of the muscle. In C, The corner sutures are tied thus fixing the corners of the muscle firmly to the sclera. The center of the muscle can sag about 1-2 mm. In D, The double-armed 6-O polyglactin securing the center of the muscle is advanced and the cinch slid down to position the center of the muscle level with the 2 corners of the muscle. In E, Intraoperatively one can advance the center of the muscle the entire distance to the insertion without disturbing the adherence of the 2 corner sutures. This simulates what would happen with maximum adjustment after surgery.

the difference representing the amount of muscle adjustment. In patients in whom the inferior rectus muscle was recessed 5 mm or more, the capsulopalpebral head was advanced in the previously described manner to minimize post-operative lower eyelid retraction.<sup>21</sup>

For all patients in this study, postoperative adjustment was performed on the morning after surgery. Although the endpoint for suture adjustment varied somewhat depending on the nature of the strabismus being treated, some consistent principles were applied. For patients with

**TABLE 1.** Study Group Characteristics (N = 57 Patients)

Gender (male/female)	30/27
Age, years $\pm$ SD (range)	48.5 $\pm$ 17.4 (17–82)
Outcome evaluation: months postop, mean $\pm$ SD (range)	7.2 $\pm$ 0.9 (6–9.5)
Follow-up: Months postop, mean $\pm$ SD (range)	13.6 $\pm$ 5.9 (6–28)

Graves orbitopathy or superior oblique palsy, the targeted endpoint was between 2 PD of undercorrection to orthophoria in both the primary position and near downgaze reading position. However, if attaining that alignment in the near downgaze position was at the expense of producing an overcorrection in the primary position, the default was to leave a larger undercorrection for near. For all patients, an attempt was made to avoid an overcorrection in the primary position.

## RESULTS

During the course of this study, a total of 72 muscles in 68 patients underwent semiadjustable suture surgery (4 patients underwent simultaneous semiadjustable suture surgery on more than 1 extraocular muscle). Of the 68 muscles, 7 were found at the time of my surgery to have slipped as result of prior surgical intervention. These 7 were excluded from the primary data analysis but were studied separately. Four patients were lost to follow-up, leaving a study group of 61 muscles in 57 patients. Of the 4 patients who were lost to follow-up, none showed signs of muscle slippage as of their last examination (range 1.75 to 4 months after surgery). Of the 57 patients in the study group, I performed the outcome examination on 51 patients. In the remaining 6, data were provided by the referring ophthalmologists who were fellowship-trained pediatric ophthalmologists in all cases. Table 1 describes the makeup of the study group with respect to gender, age, and follow-up.

The distribution of muscles on which I performed semiadjustable suture surgery and the etiology of the strabismus in this series are outlined in Table 2. Note that Table 2 only describes the muscle undergoing the semiadjustable suture procedure. Many patients underwent simultaneous surgery on other extraocular muscles using a nonadjustable suture technique. This frequently included nonadjustable suture surgery on horizontal rectus muscles combined with semiadjustable suture surgery on an inferior rectus muscle, or other vertical rectus muscles combined with the semi-adjustable procedure on the inferior rectus muscle.

Table 3 presents the data on the result of adjustment with respect to amount of advancement and the change in alignment it produced. There were 17 patients in whom adjustment in the form of advancement of a muscle was attempted; 14 involved the inferior rectus muscle and 3 the medial rectus muscle. In all patients in whom advancement was desired, the muscle could be successfully adjusted to produce the desired amount of alignment change. In 4

**TABLE 2.** Distribution of Muscles Operated (N = 61)

	N
Eye (R/L)	33/26*
Etiology	
Idiopathic strabismus	18
Graves orbitopathy	14
Fourth Nerve Palsy, contralateral inferior rectus	8
Orbital fracture	6
Paralytic strabismus (not fourth nerve)	4
Myotoxicity after retrobulbar anesthesia	6
Orbital myositis	1

R/L, right/left.

\*Total equals more than 57 patients because 2 patients had simultaneous semiadjustable surgery in both eyes. The total is less than 61 muscles because 2 patients had 2 semiadjustable procedures in the same eye.

patients, the center of the muscle was advanced all the way to the original insertion, thus negating most of the effect of the muscle recession. In all patients in whom this was attempted, advancement could easily be performed. In 3 patients an attempt was made to increase the recession. All involved the inferior rectus muscle. It was difficult to obtain more than 1 mm of additional recession with the semi-adjustable suture technique. There was only 1 patient of 57 in whom more recession was desired than was obtainable with adjustment. This was a myopic patient with Graves orbitopathy who had a 6-mm semiadjustable suture recession of the right inferior rectus muscle. After adjustment, he had 10 prism diopters of right hypotropia in the primary position but was orthophoric at near in downgaze. He was comfortable wearing prism in single vision distance spectacles to obtain comfortable binocular vision and removing his spectacles for reading. He therefore did not require a re-operation.

Of the 57 patients in this study group, there were 4 that met the criteria of possible muscle slippage at the time of the outcome evaluation who subsequently underwent surgical exploration. In all 4 patients the muscle suspected of slippage was inspected and found to be in the desired position in all 4; none were found to have slipped. In all 4 cases the overcorrection could be attributed to other causes such as contracture of the antagonist muscle or simply a post-operative drift.

During the course of this study, 7 patients were found to have a previously slipped muscle at the time of my semiadjustable suture procedure. Table 4 describes these patients with respect to the muscle undergoing surgery, where the muscle was found, and where it was placed surgically. Of the 7 patients, only 1 developed repeated muscle slippage after the semiadjustable suture procedure. He was a 51-year-old man who had sustained left orbital floor fracture with inferior rectus entrapment, for which he had undergone 3 prior adjustable suture surgical procedures involving the left inferior rectus muscle. At the time of his fourth strabismus surgical procedure, I found his left inferior rectus muscle inserting 12 mm from the limbus, indicating it had slipped. It was advanced 3 mm on

**TABLE 3.** Recession and Adjustment Data

Muscle (Total N)	Recession mm ± SD (range)	N*	Advanced at Time of Adjustment		
			Mean advancement, mm ± SD (range)	Mean PD change at adjustment, ± SD (range)	Mean PD/mm change with adjustment ± SD (range)
Inferior rectus (55)	4.2 ± 1.0 (2.5–7)	14	2.2 ± 1.5 (1–6)	7.4 ± 4.5 (3–16)	3.5 ± 0.8 (2–5)
Medial rectus (6)	6.6 ± 0.8 (5.5–8)	3	1.5 ± 0.7 (1–2)	6.0 ± 1.4 (6–7)	4.2 ± 1.1 (3.5–5)

\*N denotes number of muscles that did undergo advancement at time of adjustment.

**TABLE 4.** Data on Previously Operated Muscles

Procedure and Muscle	Etiology	Millimeters Posterior to Limbus Found at Surgery*	Millimeters Posterior to Limbus Placed at Surgery*
Rerecession			
Medial rectus	Graves orbitopathy	10.0	12.0
Inferior rectus	Contralateral fourth nerve palsy	10.0	12.0
Inferior rectus	Idiopathic strabismus	10.0	12.0
Advancement			
Inferior rectus	Contralateral fourth nerve palsy	14.0	13.0
Inferior rectus	Contralateral fourth nerve palsy	12.0	9.0
Inferior rectus	Graves orbitopathy	11.0	10.5
Inferior rectus	Graves orbitopathy	12.0	10.0
Inferior rectus	Graves orbitopathy	12.0	10.0
Inferior rectus	Graves orbitopathy	11.0	10.5
Inferior rectus	Orbital fracture	14.0	10.0
Inferior rectus	Idiopathic strabismus	13.0	10.0

\*Refers to location of the muscle at the time of surgery and not after postoperative adjustment.

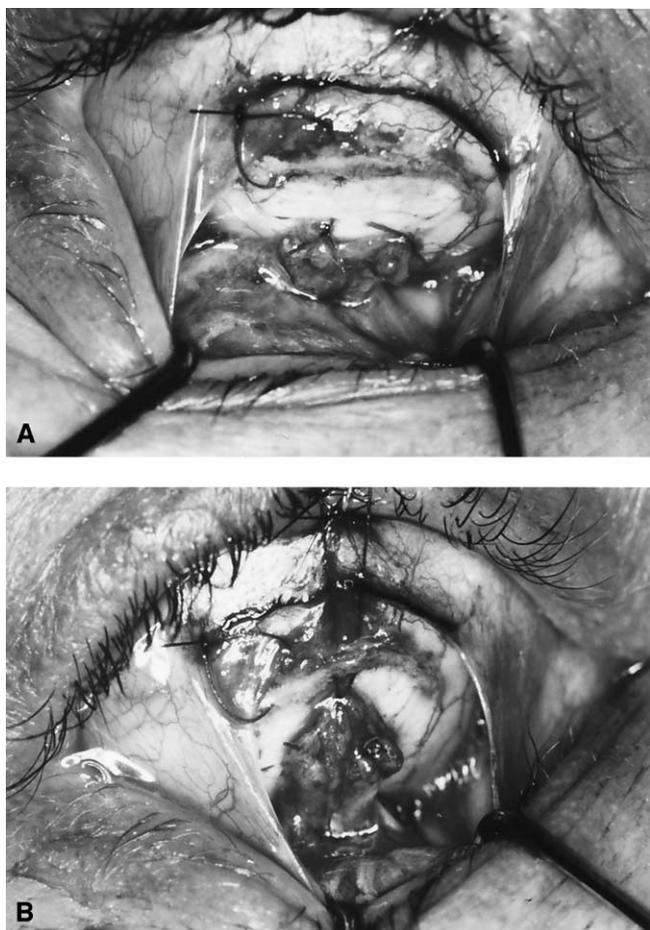
a semiadjustable suture combined with surgery on other extraocular muscles. He subsequently developed a progressively increasing left hypertropia, which resulted in a another operation 3 months later by his referring pediatric ophthalmologist. At surgery the left inferior rectus muscle was found 13.5 mm from the limbus. It was advanced using non-absorbable sutures and a non-adjustable technique. His motility has been satisfactory and stable for the subsequent 11 months.

## DISCUSSION

The semiadjustable suture procedure appears to decrease the incidence of muscle slippage with surgery on the inferior rectus muscle or medial rectus muscle as compared with standard adjustable suture surgery. In this series of 57 patients in whom the muscle undergoing surgery was either previously unoperated or had been previously operated but did not manifest slippage, none developed that complication with the semiadjustable procedure.

There are no meaningful incidence figures for the complication of muscle slippage. Its occurrence is a function of the magnitude of the recession performed, the nature of the strabismus being treated (eg, increase incidence with fibrotic muscles) and also the specific muscle undergoing surgery (eg, increase incidence with inferior rectus and medial rectus muscles). Sprunger and Helveston reported a 41% occurrence of late progressive overcorrection with

adjustable suture surgery on the inferior rectus muscle.<sup>7</sup> That series did not differentiate other causes of late progressive overcorrection (such as antagonist contracture, bilateral masked superior oblique palsy) from muscle slippage. Hudson and Feldon found that late progressive overcorrection that occurs weeks to months after adjustable suture surgery on the inferior rectus muscle in patients with Graves orbitopathy, correlated highly with the size of the antagonist superior rectus muscle as seen on orbital imaging.<sup>6</sup> This suggests that many cases of overcorrection may have less to do with muscle slippage than contracture of the antagonist. I reported 6 cases of confirmed muscle slippage in a series of 58 consecutive patients undergoing adjustable suture surgery on the inferior rectus muscle for an incidence of 10.3%.<sup>5</sup> Because there are no reliable incidence figures for muscle slippage, rigorous statistical analysis cannot be performed to compare muscle slippage with standard adjustable suture surgery to the semiadjustable suture technique. Nevertheless, the absence of muscle slippage in this series of 57 patients, when compared with these previously published reports, suggests that the semiadjustable suture procedure does appear to decrease the incidence of that adverse outcome. Despite this obvious benefit, there are some noteworthy tradeoffs with this procedure. Most importantly, it has limited efficacy for increasing the desired amount of recession at the time of adjustment. However, with proper surgical planning, the



**FIG 2.** In a, Intraoperative photograph of an inferior rectus muscle on a semiadjustable suture (as seen from below). The muscle has been recessed 6 mm. In b, With traction on the semiadjustable suture, the center of the muscle can be advanced the entire 6 mm to the insertion stump, without disturbing the fixed corner sutures.

use of the semiadjustable suture can decrease the reoperation rate when adjustable sutures are used if the surgeon targets an initial overcorrection. Nevertheless, this tradeoff represents a distinct downside with this procedure for surgeons who like to use adjustable sutures. However, when viewed in light of the apparent higher incidence of muscle slippage with standard adjustable suture surgery, the tradeoff may be worthwhile.

Jampolsky recommended taping the lower half of a patient's spectacles when adjustable suture surgery is performed on the inferior rectus muscle or the nasal aspect of the spectacle lens when performed on medial rectus muscle to avoid nonadherence after adjustable suture surgery.<sup>11,14</sup> This advice has some obvious limitations. It is not useful for patients who do not wear spectacles. Even for patients who do wear spectacles, there may be brief moments when they inadvertently move their eyes into the field of action of the operated muscle during the early postoperative healing (eg, first thing in the morning, before going to sleep). It is not known whether a brief eye

movement of this type may break the fragile adherence that is forming between a muscle and the sclera when an adjustable suture technique is used and result in nonadherence. The use of nonabsorbable sutures has been recommended for adjustable suture surgery on the inferior rectus muscle to minimize nonadherence.<sup>5</sup> This has the disadvantage of leaving a nonabsorbable knot just anterior to the muscle's insertion, which can erode and cause irritation. One author has given up using adjustable sutures on the inferior rectus muscles because of concern about late overcorrection.<sup>8</sup> The semiadjustable suture procedure appears to have advantages over all of these approaches. It still allows one to have some of the benefits of adjustable sutures without the increased risk of muscle slippage. In addition, it has been reported that some patients with Graves orbitopathy may have tight inferior rectus muscles, yet do not take up slack easily. When they are disinserted, they merely retract several millimeters and do not retract back further posteriorly on their own. If a large adjustable suture recession is desired, the muscle does not take up the slack in the suture and the desired amount of recession is not obtained.<sup>5</sup> The only methods described for overcoming this phenomenon to date have been to either forego the use of an adjustable suture and sew the muscle to the sclera at the desired recession point or to use postoperative pullover sutures to force the muscle to take up the desired slack.<sup>5</sup> This latter approach greatly increases postoperative discomfort. The semiadjustable suture procedure allows muscles who exhibit this phenomenon to be sewn to the sclera in the desired position, yet still be adjusted after surgery.

The only patient on whom I performed semiadjustable suture surgery, and who later developed muscle slippage, was one in whom the muscle had previously slipped. Possibly I erred by failing to identify a pseudotendon or elongated scar. If such was the case, repeat slippage would have occurred irrespective of whether I used any type of adjustable suture technique. The remaining 6 patients in whom I performed semiadjustable suture surgery on a previous slipped muscle, did not show repeat slippage. Perhaps it would be wise to use nonabsorbable sutures for the fixed corner sutures in patients in whom a previously slipped muscle is found, and use an absorbable suture for the adjustment of the center of the muscle. This approach still has advantages over using a nonabsorbable suture for the entire procedure, as it places the non-absorbable knots substantially posterior to the muscle insertion. In this position they are less likely to erode or be cosmetically objectionable. Although it is not possible to draw firm conclusions from this small pool of 7 patients with previously slipped muscles, this approach seems reasonable.

This study needs to be viewed in light of its obvious limitations. The diagnosis of muscle slippage is subjective in those patients in whom re-operation was not conducted. I feel my liberal criteria for diagnosing this adverse outcome minimizes the impact of this limitation. The study

was not randomized and lacks a control group. However, the incidence of muscle slippage in general is small enough, and the patients who are at high risk for it are uncommon enough that it is not practical to do a randomized study of this technique. Because the incidence of muscle slippage was so low in this study (no cases out of 57) and the incidence so much higher in historical control studies, it makes sense that this procedure decreases the incidence of postoperative muscle slippage when adjustable suture surgery is desired. A tradeoff with this procedure is that it provides limited capability to increase the amount of recession at the time of adjustment. However, with surgical planning that includes targeting an initial overcorrection, this represents a limited downside. It appears the semiadjustable suture procedure is a useful adjunct to our surgical armamentarium (Figure 2).

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## An Eye on the Arts – The Arts on the Eye

Through the sense of sight, not only emotions but also the mind develop

The eyes are not just important in the development of emotions. As a matter of fact, visual stimulation is important for the development of the brain. It can be said that for a baby, the sense of vision is the foundation of the development of the brain.

It is for this reason that when I go on rounds and see a baby with open eyes, I make a point of holding him and looking into his eyes. Each baby has a different focal point, so I try moving my eyes closer and further away. Interestingly enough, I see that the baby (even when slightly moving his eyes) maintains eye contact with me. In other words, already at this point the development of the brain has started. Earlier I mentioned that eye contact is important in conveying love for the child, but in addition it is also the first step in the education of the child.

According to my experience, the eyes of a child are a barometer of the baby's growth. Babies who look into my eyes when I hold them are all growing fully.

When the baby becomes two or three months old, he will hold eye contact with increasing duration. According to my experience, the longer the baby is able to hold eye contact, the healthier the baby is.

—Jushichiro Naito (from *Childcare: Nurturing the Heart*)