

## Adjustable sutures in children

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### SUMMARY

Although adjustable sutures are considered a standard technique in adult strabismus surgery, most surgeons are hesitant to attempt the technique in children, who are believed to be unlikely to cooperate for postoperative assessment and adjustment. Interest in using adjustable sutures in pediatric patients has increased with the development of surgical techniques specific to infants and children. This workshop briefly reviews the literature supporting the use of adjustable sutures in children and presents the approaches currently used by three experienced strabismus surgeons. (J AAPOS 2014;18:278-284)



Although adjustable sutures are frequently used in adults, few strabismus surgeons use them routinely in children. The rationale for not using adjustable sutures is understandable—children are difficult to evaluate in the hours after surgery, and the procedure adds time and stress to strabismus surgery while increasing the logistical complexity of postoperative management. Add to that a more fundamental skepticism of adjustable suture surgery held by many (especially those who lack experience using the technique), and the result is that only a handful of strabismus surgeons currently use adjustable sutures in children. While no randomized, controlled trials compare adjustable sutures with fixed sutures,<sup>1</sup> we lack such evidence for most of our surgical approaches, including whether or not to perform strabismus surgery at all, and there is strong retrospective evidence (see below) that adjustable sutures can improve the outcomes of strabismus surgery.

The purpose of this AAPOS workshop is to share our decades of experience performing adjustable sutures in children to assist surgeons who are considering adopting the technique. The workshop first provides a brief overview of the current published results of success using adjustable sutures in children. It then provides varied perspectives on

the technical aspects of the approach used by each of the authors in his own words, as transcribed during their AAPOS workshop.

### Results of the Adjustable Suture Approach in Children

A number of recent reports and review articles have addressed the topic of adjustable sutures, including a review by Nihalani and Hunter<sup>2</sup> and by Engel.<sup>3</sup> Only one published study—based on Dr. Guyton's experience—has compared a single surgeon's results using adjustable sutures with a control group of children operated on without adjustable sutures.<sup>4</sup> That study was a retrospective review of horizontal muscle surgery in patients  $\leq 10$  years of age. A group of 298 patients treated with adjustable sutures was compared with 98 historic controls operated on before Dr. Guyton switched to adjustable suture surgery in children in 1994. Satisfactory alignment was defined as  $\leq 8^\Delta$  of strabismus at 3 months' follow-up. In that study, 79% in the adjustable group achieved satisfactory alignment versus 64.5% in the nonadjustable control group ( $P < 0.01$ .) Other studies have also shown a high success rate. Engel and Rousta<sup>5</sup> reported an 88% success rate with a median follow-up of 19 weeks (range, 6-54 weeks). Nihalani and colleagues<sup>6</sup> described similar success rates. In fact, most published studies of adult and pediatric strabismus surgery where adjustable sutures were compared with a fixed-suture control group showed improvements of 14% to 33% in success rates or reoperation rates<sup>2</sup> in the adjustable suture groups (Table 1).

### Three Adjustable Suture Techniques Used in Children

#### Dr. Guyton

Since 1981 I have performed adjustable suture surgery on adults, and I have routinely used the approach in children since 1994. In the early days of adjustable sutures we anticipated that it would be an unpleasant experience for the patient; however, with practice, our approach became

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Table 1. Published clinical trials comparing outcomes of adjustable with nonadjustable sutures in children

Author	N	Reoperation rate		Success rate	
		Adjustable	Nonadjustable	Adjustable	Nonadjustable
Kraus and Bullock (1993) <sup>7</sup>	36	11%	29%	77%	46%
Tripathi et al (2003) <sup>8</sup>	443	9%	27%	96%	63%
Awadein et al(2008) <sup>4</sup>	396	-	-	79%	65%
Budning et al (2010) <sup>9</sup>	304	9%	27%	-	-



**FIG 1.** Q-tip test. A cotton-tipped applicator or similar material is applied to the unanesthetized lateral conjunctiva while the patient looks away.

more sophisticated, and we became comfortable carrying this over to select older children who seemed most likely to cooperate for postoperative adjustment. We could tell who was most likely to be able to cooperate by performing some quick tests. For example, if we touched the bare sclera with a corner of a fragment of facial tissue and the child did not flinch, he or she would do fine (Figure 1). If you simply examine how children react to the eyedrops, you can predict what their behavioral response will be after the surgery. Now with better anesthetics, including propofol, we are able to use adjustable sutures in children as young as 6 months regardless of how cooperative they are for the actual adjustment. Only rarely will they not cooperate for the postoperative assessment by refusing to open their eyes (less than 1% of cases).

Which muscles do I adjust? All of them, except when weakening the inferior oblique muscle, because it just appears floppy and does not respond to the adjustment. For example, an adjustable superior oblique suture spacer is shown in Figure 2. Note, however, that unlike most muscles, which require the patient's looking away from the muscle during the adjustment, in the case of the superior oblique muscle, the patient must look *up* in order to loosen the tendon enough to gain access to the sliding noose knot (Figure 2C).

Which procedures do we adjust? You may adjust any of them, including recessions, resections, tucks, Harada-Ito procedures, transpositions, and lower lid suspensions.<sup>10-13</sup> The only procedure where I do not adjust is the posterior fixation suture. Although I am aware that there have been adjustable procedures developed for this, I am not entirely sure how well they work.

For the procedure itself, when I first began operating, I used local anesthesia for adults, and while this worked well for two decades, the trouble is that we had to wait 5-6 hours for the anesthetic to wear off. Now I prefer general anesthesia for both adults and children, not only because you can perform the suture adjustment just an hour after surgery but also because you can judge the position of the eyes better at the beginning of surgery, and forced ductions are more reliable. I do not have much experience with using topical anesthesia for adjustable suture surgery.

The technique I like best for adjustable sutures is the cul-de-sac approach. I learned early on that it is more efficient because it is faster and the knot is buried. Also it is the best for postoperative comfort and for less scarring, but it requires a good assistant. The Guyton small incision muscle hook (Katena, Denville, NJ), has made my life easier because I can do these procedures with a small incision, without tearing the conjunctiva (Figure 3). It is similar to a Jameson muscle hook but includes an extra bend (Figure 3A). This hook facilitates strabismus surgery through a small cul-de-sac incision, so that the suture ends are better covered with more comfort. The conjunctiva never needs to stretch more than the distance between the ball and the second bend in the hook. When you bring the ball out, you do not have to stretch the tissue very far (Figure 3B), and this keeps the incision small and helps it heal faster.

The muscles are then isolated and secured. I use the S-28 needle to secure the muscle; I like the 18" length to have more suture to use for the adjustable portions. I always hang these muscles back from the original insertion, even for a resection, where I will resect an extra 2 mm and then hang the muscle back 2 mm to allow for adjustment in either direction. Then I put a sliding noose on the suture. I also add a scleral traction suture.

My other panel members have found ways to bury their sutures, but I have not had that need. I do not like that extra suture left behind, so we developed a removable sliding noose to take away all of that extra knot and noose material after the suture adjustment. The sliding noose is a 6-0 polyglactin 910 clove hitch with three slip knots. After adjustment, the noose is pulled sideways and pops off. When deciding where to leave the noose, I anticipate that removing it will yield 1.5<sup>A</sup> of loosening. I have described this removable noose in detail elsewhere,<sup>14</sup> along with an online video illustrating how it is tied, adjusted, and removed.

I always go back to either adjust or tie off, and with young children that means placing them back under

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