The O'Connor cinch revisited

A. THOMAS WILLIAMS, HENRY S. METZ, AND ARTHUR JAMPOLSKY

From the Smith-Kettlewell Institute of Visual Sciences, San Francisco, California

SUMMARY The modified O'Connor cinch operation is a useful, but little used, adjustable resection operation. For increased understanding of its shortening and adjustment characteristics, a standard cinch was performed in animals and patients with strabismus. Animal studies showed that, as each strand of the cinch was removed, a small, relatively equal release of the cinch effect occurred. Measurement of the shortening obtained in patients with strabismus showed a consistent resection effect of about 4 mm.

Review of 17 cases in which the cinch was used as part of the surgical treatment showed the technique to be adjustable by reducing the overcorrection in 6 cases. Ten to 20 prism dioptres of reduction in the deviation was obtained with adjustment of the cinch on the first postoperative day. All 17 cases had satisfactory adjustment. The largest residual deviation was 12 prism dioptres.

O'Connor (1916) described a new operation for shortening a muscle with an effect analogous to that of a resection. The technique involved splitting the tendon into 2 lateral strips and a central tongue, and then shortening the lateral strips with loops of catgut before securing the central tendon to the sclera anterior to the insertion. McCool (1930) reviewed the procedure and quantified the shortening effect of the cinch in 32 operative cases and 6 pathological specimens. He concluded that the shortening was predictable and the effect was dependent on the width of the tendon strips, the number of strips, and the calibre of the suture strands. Durr (1937) pointed out the popularity of the cinch operation in San Francisco but its limited use elsewhere in the country. He suggested the reason for the limited use of the cinch was related to a poor understanding of the fine points of technique upon which the success of the operation depends.

Today the cinch operation has all but fallen into oblivion. It has recently been revived by Jampolsky (1975) in a modified form, as a method of adjustable resection. The indications, methods, effect, and understanding of how the cinch works are not generally known, so this useful strabismus operation suffers the same obscurity now as 35 years ago.

Adjustable suture techniques have proved a very useful tool of the strabismus surgeon (Rosenbaum *et al.*, 1977). The O'Connor cinch is a safe and effective adjustable resection technique and can be used in both adults and children.

The purpose of this paper is (1) to quantitate the amount of muscle shortening achieved with a standard cinch; (2) to examine the way in which the muscle lengthens as the cinch is released; and (3) to review the results in a series of patients in which the cinch was used.

Methods

TECHNIQUE OF MODIFIED CINCH

The cinch technique used in the study was performed in the following way.

(1) The muscle and its tendon were exposed through a conjunctival incision over the muscle insertion. The tendon was identified, freed of intramuscular membrane, and lifted on a muscle hook. A curved tendon-splitter (small, sharpened muscle hook—Fig. 1) was used to split the muscle in half, extending 5 to 6 mm back from the insertion. Each half of the muscle was then split again, producing 4 equal slips of muscle and tendon.

(2) A cinch cable was made from 4 strands of 3-0 nylon threaded through a large, curved, blunted needle (Fig. 2). The ends of the suture were tied in a knot or melted together with a cautery to make an 8-strand cable.

(3) After the end of the cable was clipped to the drape near the eye it was looped round the first muscle slip. As the cable was threaded under the muscle slip it was directed toward the cornea. The cable was then looped round each of the remaining slips, being directed away from the cornea on the second loop, towards the cornea on the third loop, and away from the cornea on the fourth loop (Fig. 3a).

Fig. 1 Instruments needed for the cinch procedure. From left to right there is a small, rounded muscle hook, a small, sharp-tipped muscle hook (useful for muscle splitting), side view of a forceps to fixate the cinch cable when tightening the cable, a top view of the same forceps, and 2 cinch cables attached to blunt-tipped needles

Fig. 2 Close-up view of the blunt-tipped needle with the attached strands of nylon cable for performing the cinch operation

Alternating the direction of the loops produces a more effective cinch on the muscle, and the long end of the cable that exits through the conjunctiva will be directed away from the cornea. The cinch was then pulled tight (Figs. 3*b, c, d*), forceps (Fig. 1) being used to hold the suture cable at one edge of the muscle. As the cinch was pulled taut, first on one margin of the muscle and then on the other, it effectively shortened the muscle (Fig. 3*d*). The nylon cable was then cut 1 or 2 mm from the superior margin of the muscle while the inferior end

was brought out through the conjunctiva to rest in the lower cul-de-sac. This end of the cable was left long enough to rest horizontally inside the lower lid. The conjunctiva was closed with interrupted sutures, with particular attention to form a tight closure about the nylon cable.

Patients were examined within 24 hours of surgery to determine the adequacy of alignment and the need for adjustment of the cinch. If a cover test in the sitting position showed a significant over-correction, adjustment was performed. To make the

Fig. 3 Diagram of the cinch procedure. (a) The muscle has been split into 4 strands. The cinch cable has been woven around each of the strands. Y marks the muscle insertion, X marks a point on the muscle posterior to the area of muscle that has been split. (b) The cable is being tightened, causing the muscle to begin shortening. (c) Further tightening of the cable. (d) The cable is fully tightened, cinching and thus shortening the muscle (shorter distance between a fixed point on the muscle posteriorly (X) and the insertion (Y))

Fig. 4 Removal of a strand of the cinch cable. The lids are held apart. After a drop of topical anaesthetic has been instilled, a forceps is used to grasp 1 of the strands, and the strand is removed by sliding it out horizontally. The cinch cable can be seen as several black strands adjacent to the caruncle

adjustment, the lower lid was everted and the cable exposed. With forceps a single strand of the cable was removed by gently sliding it out in a horizontal direction (Fig. 4). The patient was then asked to make horizontal saccades for a minute or two and the cover test was repeated. Additional strands of cable were removed, one at a time, until the alignment was satisfactory or all the strands were removed.

If no adjustment was required, the cable was not

removed until 14 days postoperatively. At that time the entire cable was removed 1 strand at a time.

QUANTITATIVE STUDIES

To study the shortening and unwinding characteristics of the cinch, separate clinical and laboratory studies were done.

Animal experiments. Nine dogs were anaesthetised and an 8-strand, 3-0 nylon cinch looped once around 4 strips of each lateral rectus muscle. The amount

of shortening was measured utilising a marking suture placed in the body of the muscle and measuring its change in position relative to the muscle insertion following the cinch procedure. One day later the conjunctiva was re-opened and the cinch undone 1 strand at a time. The change in length of the muscle per strand removed was measured in the same way.

Clinical measurements. Five patients undergoing strabismus surgery had a cinch of 1 muscle performed in a standard manner using 8 strands of 3-0 nylon looped once around 4 muscle strips. The shortening obtained was measured by the change in position of a silk suture placed in the body of the muscle relative to the insertion.

CLINICAL SERIES

Since 1974 17 patients with strabismus had a cinch procedure as part of their surgical treatment. These cases were evaluated with particular attention to the following criteria: (1) length of follow-up, (2) amount of correction obtained with adjustment, (3) stability in the postoperative period, and (4) final postoperative result. The patients ranged in age from 2½ to 57 years. All the cinches were performed on a horizontal rectus muscle, and the antagonist muscle was weakened with a recession or a 'Z' tenotomy. With the exception of 2 minimally scarred muscles all the cinches were performed on previously unoperated muscles.

Results

QUANTITATIVE STUDIES

Animal experiments. The amount of shortening of the lateral rectus muscle obtained with a standard cinch in 9 dogs of different breeds varied from 2 to 7 mm. The shortening for each lateral rectus pair was similar. Removal of the cable, 1 strand at a time, resulted in muscle lengthening in small, relatively equal increments. The muscle lengthening was approximately linear, ranging between 0.25 and 0.5 mm increase in muscle length per strand removed.

Operative measurements. Five patients had measurements of the amount of shortening obtained with our standard cinch. The cinch procedure shortened the muscle an average of 4 mm, with a range of 3 to 5 mm.

CLINICAL SERIES

In 17 patients a cinch was used as part of the surgical procedure. Follow-up ranged from 1 to 6 months with an average of 3.5 months. Eighteen cinches were used in these 17 patients. Of these, 6 were adjusted.

The preoperative deviations averaged 28 prism dioptres (range 80 prism dioptres of exotropia to 40 prism dioptres of esotropia).

Adjustment was done within 24 hours in 4 patients and 6 days postoperatively in 2 patients. Pre-adjustment deviations, as determined by cover test, ranged from 12 to 25 prism dioptres. Of those patients adjusted on the first postoperative day there was an immediate reduction in the deviation of 10 to 20 prism dioptres; those adjusted on the sixth day had a reduction of 3 to 10 prism dioptres. Three of the 4 cases adjusted on the first postoperative day had an additional 8 to 15 prism dioptre spontaneous reduction of the deviation in the following 2 to 4 weeks. The average change was 12 prism dioptres. The fourth case and the 2 patients adjusted on the sixth postoperative day showed no drift after adjustment. Of the 6 cinches adjusted 4 had no residual deviation, 1 had 8 prism dioptres of esotropia, and the other had 10 dioptres of exotropia.

The final residual deviation in this series of 17 patients varied from 10 dioptres of exotropia to 12 dioptres of esophoria. Eight patients had less than 2 dioptres of residual deviation, 5 had between 2 and 5 dioptres of esotropia, 1 had 12 dioptres of esophoria, and 3 had between 2 and 10 dioptres of exotropia. The average residual deviation was approximately 2 prism dioptres. None of these patients required additional surgery.

Discussion

Data from our studies illustrate several important characteristics of the cinch procedure. With a standard procedure a predictable muscle shortening occurs in man. This averaged 4 mm of resection. This amount of resection is frequently the maximum effect desired in vertical rectus surgery and can be sufficient when operating on tight horizontal rectus muscles or when 3 or 4 horizontal rectus muscles are operated upon at the same time.

It also gives consistent shortening in lateral rectus muscle pairs in animals. The wide difference in effective muscle shortening by the cinch between animals is probably due to the varying width of the lateral rectus muscles among dogs of different size and breed. The release of the cinch occurs in a graded fashion in animal studies. As each cable is removed, there is a relatively equal, incremental release of the cinch effect.

Clinical data show that there is an additional 'stretching out' of the cinch effect for 2 to 4 weeks after adjustment. A 10 to 20 dioptre reduction in the deviation can be achieved with removal of some or all of the cinch strands on the first postoperative day. When the entire cinch is removed, the muscle

unwinds completely, thus minimising the effect of recession of the antagonist. The cinch can be adjusted only in one direction; it can be loosened or removed, not tightened.

The cinch can be used in children over the age of 3. If adjustment is required in a child, one instills a topical anaesthetic, pulls down the lower lid, picks up 1 strand of the cable with forceps, and gently slides it out horizontally. There is minimal discomfort to the patient, not unlike removing skin sutures.

Although the average follow-up is relatively short (3.5 months), the mechanical effect of any strabismus procedure is set approximately 8 weeks after surgery. Changes in the deviation after 3.5 months would not be the result of the type of surgery used, as no operative technique promises excellent results for an unlimited time.

We have encountered no complications resulting from this procedure. Patients may experience some minor discomfort from the cable resting in the cul-de-sac along with mild conjunctival hyperaemia. Occasionally the cable may pop out from beneath the lower lid, but it is easily replaced. There have been no postoperative infections as a result of the cinch.

The cinch procedure may be used in cases where the option for postoperative adjustment is desired. This might include patients with fusion capability, cases in which the surgical effect is somewhat

unpredictable, or patients too young to co-operate for the 'standard' adjustable technique (ages 3 to 14). It is not recommended for use on previously operated muscles, as the effect of the cinch may be difficult to predict because of scarring. It should be reserved for children over the age of 3, as some patient co-operation is required.

The advantages of the cinch operation are: (1) it is a safe operation, as no scleral sutures are required; (2) it is easily performed; (3) it is an adjustable resection technique; (4) it can be used in adults and children; (5) it is reversible by removing the cinch cable on the first postoperative day.

This study was supported in part by NIH Grants No. EY 01186 and EY 01585 and NIH 5SO1WR05566, and in part by the Smith-Kettlewell Eye Research Foundation.

References

- Durr, S. A. (1937). The O'Connor cinch-operation technique. *American Journal of Ophthalmology*, **20**, 178-180.
- Jampolsky, A. (1975). Strabismus reoperation techniques. *Transactions of the American Academy of Ophthalmology and Otolaryngology*, **79**, 704-717.
- McCool, J. L. (1930). Some original experiments with the O'Connor muscle-shortening operation. *American Journal of Ophthalmology*, **13**, 491-495.
- O'Connor, R. (1916). A new shortening technique with report of forty-two operations. *Journal of the American Medical Association*, **67**, 268-276.
- Rosenbaum, A. L., Metz, H. S., Carlson, S., and Jampolsky, A. (1977). Adjustable rectus muscle recession surgery. *Archives of Ophthalmology*, **95**, 817-823.