

## Strengthening Procedures for Rectus Muscles

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### TYPES OF STRENGTHENING PROCEDURES

#### Resection

Involves tightening a muscle by excising part of the tendon and reattaching it at its original insertion site. More than the recommended resection for a muscle can result in removal of the contractile muscle fibers and will cause weakening of the muscle. Although, it often produces more reaction and congestion at the surgical site as compared to other strengthening procedures, it is still the most preferred muscle strengthening procedure. Inferior rectus resection may lead to narrowing of the palpebral aperture and superior rectus resection may lead to ptosis of the upper lid.

#### Advancement

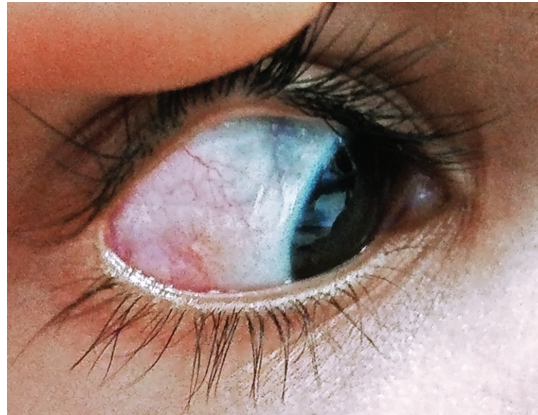
Here the muscle is re-inserted closer to the limbus thereby increasing the arc of contact of the muscle on the globe and increasing the torque. It is particularly useful in cases of consecutive strabismus where, a previously recessed muscle can be advanced to its original insertion. It has the disadvantage of becoming cosmetically unsightly if the muscle is advanced anterior to its original insertion.

#### Tuck

A tuck shortens the effective length of the muscle by folding and suturing on itself a measured length of the tendinous part of the muscle. In the present day, it is not frequently performed as muscle to muscle suturing does not hold well. Currently, the superior oblique is the only muscle on which the tuck is performed and this is done on the tendinous reflected part.

#### Plication

Here, the tendinous part of the muscle, posterior to the insertion, is secured to the sclera at the insertion, with the help of sutures effectively shortening the muscle. The rectus plication may help to preserve the anterior ciliary circulation while tightening



**Fig. 5.1:** Mild 'lumpy' appearance of the conjunctiva after lateral rectus plication

the rectus muscle. The muscle-to-sclera plication provides stable results as the muscle is anchored to the relatively less elastic scleral tissue. Earlier techniques using tendon-to-tendon plication have shown a reduction in the effect over the long-term, possibly due to loosening of the sutures. Early complication is a "lumpy" and congested appearance of the paralimbal area, which is more pronounced when the surgery is performed on the horizontal recti, as the site is visible in the palpebral aperture (Fig. 5.1). This can be avoided by folding the plicated part underneath the muscle so that the lump is not visible.

In strengthening procedures, the relationship of the vertical recti muscles to the lid structures must be taken into account. In terms of prism diopter correction per millimeter, a resection of a vertical rectus muscle is more effective than that of a horizontal rectus.

### Indications

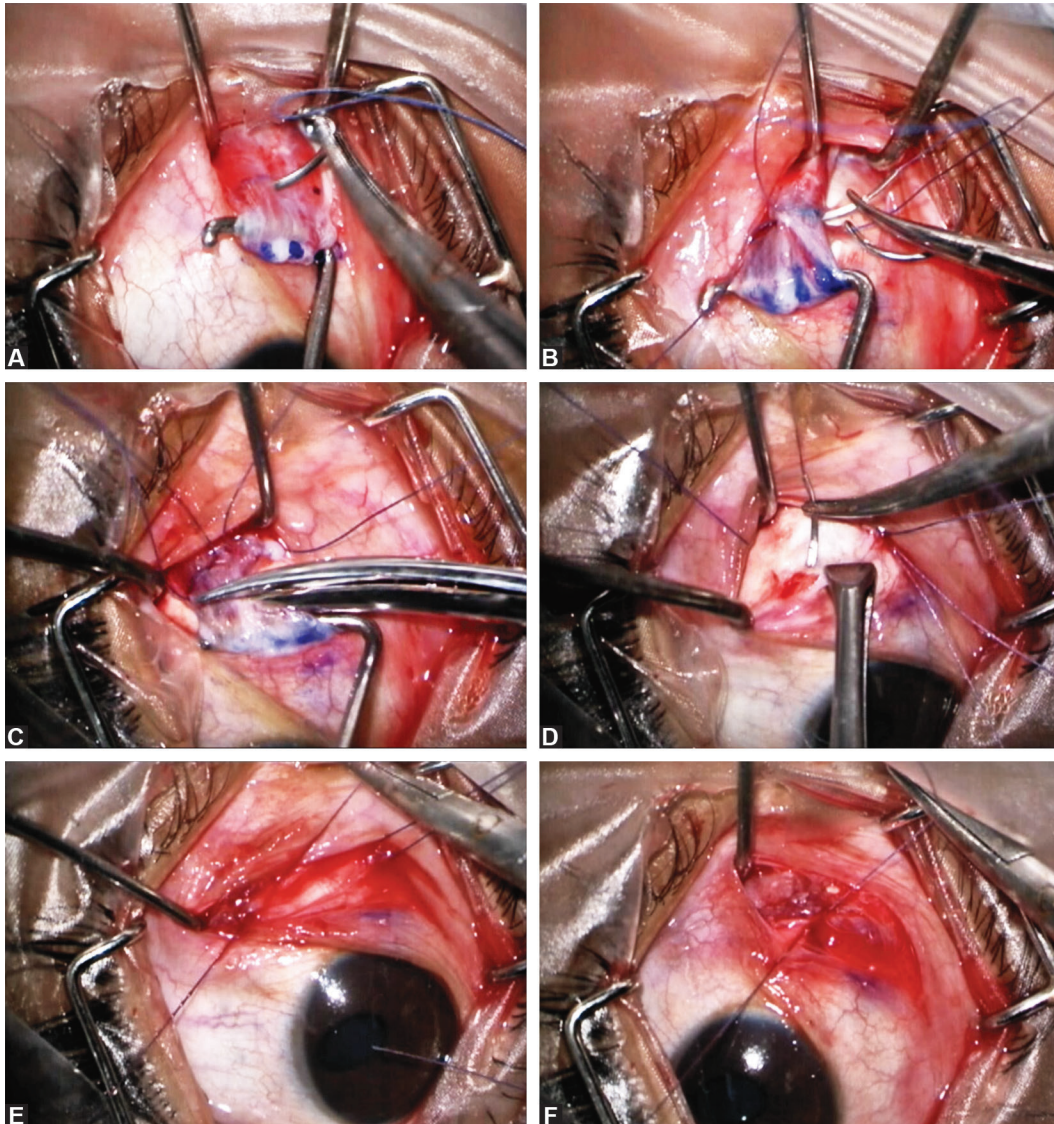
- Esotropia/exotropia—as a part of unilateral recession and resection procedure
- A or V pattern strabismus—slanting resection
- Dissociated vertical deviation without inferior oblique overaction—resection of the inferior rectus as a reserve option in cases which do not respond to recession or retroequatorial myopexy of superior rectus.
- Third nerve palsy—if the medial rectus still has some tone, medial rectus resection along with supramaximal recession of the lateral rectus may correct the horizontal deviation.
- Superior oblique palsy—tucking of the superior oblique tendon
- Nystagmus—as a part of the modified Kestenbaum surgery
- Consecutive strabismus—where recession has already been done, an advancement may be performed.

### Contraindications

- Duane's retraction syndrome—resection of the horizontal recti of the same eye should not be done as it can increase the retraction.
- Strabismus fixus
- Congenital fibrosis of extraocular muscles (CFEOM)

**RESECTION-SURGICAL TECHNIQUE** (Fig. 5.2; Video 5.1A)

- After the eye has been anesthetized, a self-retaining eye speculum is placed. A forced duction test is performed for the muscle to be operated on. Cotton/silk suture is passed at the limbus to fix the globe.
- Conjunctival peritomy is done and the muscle is hooked by Jameson's hook. To ensure that all the fibers of the muscle are hooked, the hook faces opposite to the muscle at the start of the process and the sclera is depressed with the hook as it is passed underneath the muscle.



**Fig. 5.2:** Steps of rectus resection. (A and B) Two double-armed 6-0 Vicryl sutures are passed at the marked site on the rectus muscle; (C) The muscle is cut anterior to the bridle sutures; (D to F) The resected muscle is re-inserted at the original insertion with two knots (one knot with each of the double-armed sutures)



- This is followed by passing the Green's hook underneath the Jameson's hook. The guard on the Green's hook ensures that the muscle does not slip during manipulation.
- The rectus muscle is freed as far as the planned length of resection.
- A calliper is used to measure the amount of resection. It is important that the muscle should not be pulled excessively when making this measurement, as the length of resection is conventionally calculated for the unstretched muscle.
- A common error during the measurement occurs when the muscle hook pulls the eye excessively towards the surgeon. This leads to an unintentional, additional 2 to 3 mm of muscle resection as the folded part is not included in the calliper measurement.
- Two double armed 6-0 Vicryl sutures are passed in an interlocking manner, one needle of each suture being placed close to the center of the insertion and the other through the corresponding outer edge.
- Each pair of sutures is placed in a serrefine, which is removed only when the suture is being used again, to prevent confusion between the four suture ends.
- A muscle clamp is applied 2 mm distal to the sutures, following which, the muscle is severed. Wet field cautery is used to control bleeding of the muscle stump.
- The muscle is secured at the original insertion line with deep scleral bites. The suture bites should not be taken through the original muscle stump, as they might cut through while pulling the muscle up into position or later in the postoperative period.
- The muscle is advanced to the scleral insertion by pulling on the sutures. It is important not to pull up on the sutures but to pull parallel to the scleral tunnel to avoid tearing the sclera and pulling the suture out. The sutures are tied together with a double-throw overhand knot.
- The conjunctiva is re-apposed with interrupted sutures using 8-0 Vicryl sutures, ensuring that there is no prolapse of Tenon's tissue. A forced duction test must be carried out at the end of the surgery as there is a risk of excessive tightening of the muscle, which can result in a limitation of movement in the direction opposite to the resection.

### Disadvantages of Resection

Resection procedure results in a greater amount of inflammation, edema and congestion. Also, if the vessels are not cauterized, postoperative subconjunctival hemorrhage is possible. Other concerns are pain and discomfort and ocular surface disturbances.

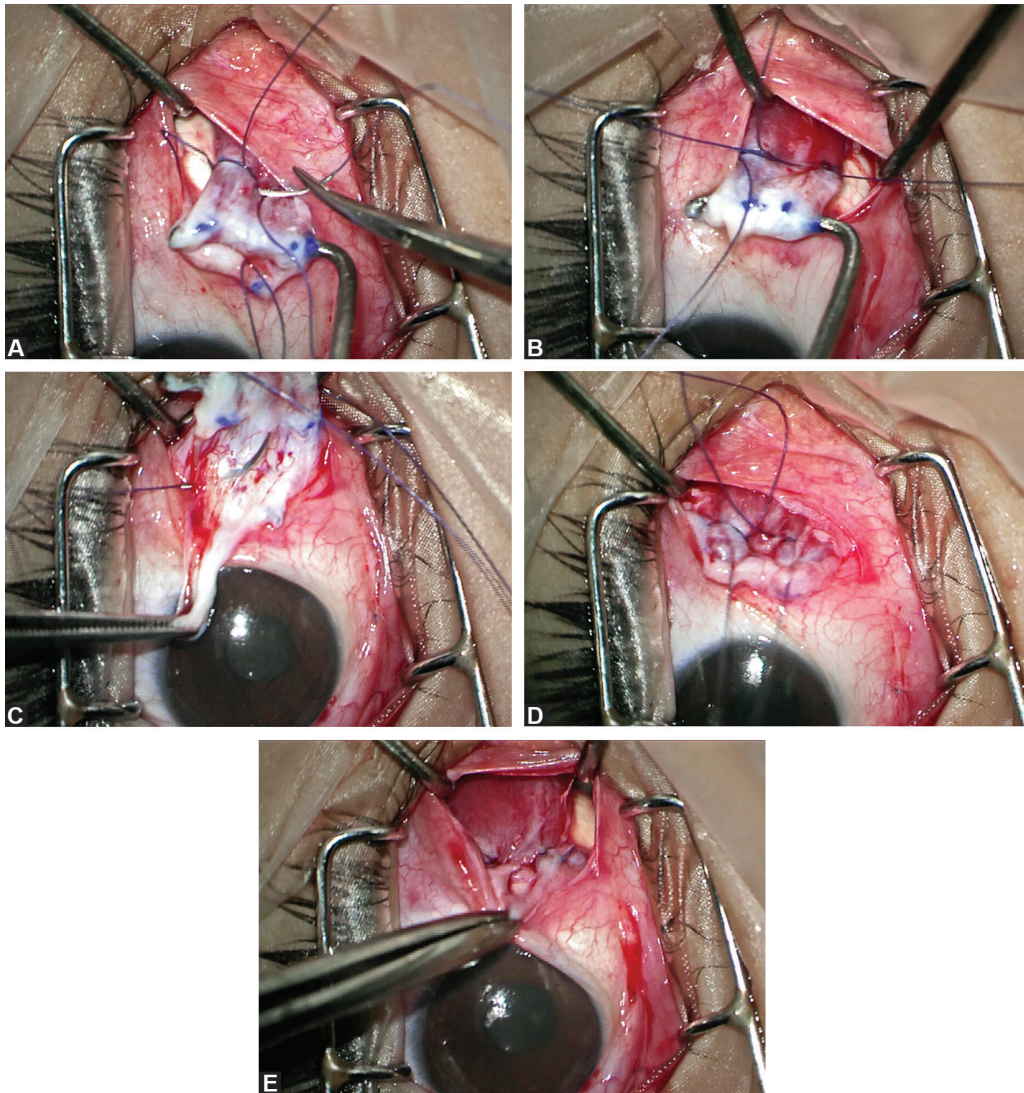
Another cosmetic concern is the mild to moderate anterior displacement of the plica semilunaris that occurs after large resections of the medial rectus muscle.

### RECTUS MUSCLE PLICATION (Fig. 5.3; Video 5.2)

In this procedure, instead of removing the anterior part of the muscle; the bridle sutures are passed through the sclera just anterior to the insertion thus, folding the muscle on itself.

### Steps of Surgery (Fig. 5.3)

The muscle is secured with two 6-0 Vicryl single-arm sutures with spatulated needles. The sutures are passed through the muscle at the same location as planned for a rectus muscle resection.

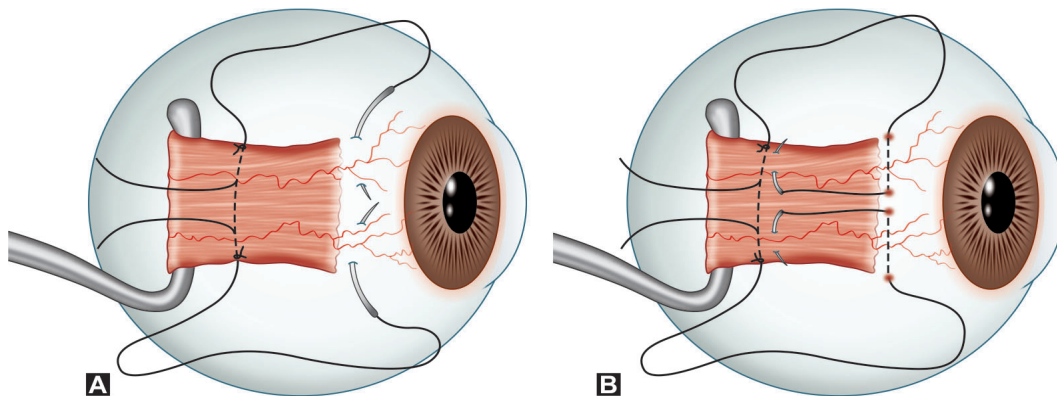


**Fig. 5.3:** Steps of rectus plication. (A and B) The muscle is secured with two single-armed 6-0 Vicryl sutures at marked site; (C) The needles are passed through the sclera just anterior to the muscle insertion, from out to in; and then again through the muscle at the marked site, just anterior to the bridge sutures; (D and E) The sutures are pulled and the folded part of the muscle is pushed underneath its advanced part; the needle-bearing end of each of the sutures is tied to its respective cut end to secure the plicated muscle in place

Full thickness bites are taken through the muscle, starting near the center of the muscle towards the edge of the muscle. Another locking bite is placed at the edge of the muscle. This is performed on both halves of the muscle.

The needles are then passed through the sclera just anterior to the muscle insertion. The suture is again passed through the muscle at the point of the planned plication providing a muscle-sclera-muscle attachment (Fig. 5.4).

The sutures are then pulled to bring the sutures closer together and during this process the folded part of the tendon is pushed back so that it is folded underneath the advanced muscle and does not present a significant cosmetic problem.



**Fig. 5.4A and B:** Illustrative representation showing steps of 'muscle-sclera-muscle' technique of rectus muscle plication

This process of double loops on both sides of the muscle ensures a stronger muscle to sclera union and reduces the risk of recurrence.

#### Advantages

Rectus muscle plication may preserve the anterior ciliary circulation and so reduces the risk of anterior segment ischemia in susceptible patients. The sutures can be passed sparing the vessels however some compromise to blood flow can occur when the sutures are tightened and tied. There is reduced inflammation in the postoperative period as muscle tissue is not cut during the procedure. The other advantage is reversibility in the early postoperative period, which can be done by simply cutting and removing the sutures and allowing the muscle to unfold back.

#### Disadvantages

A lump of tissue that is produced by the tuck may be visible under the conjunctiva postoperatively, thereby becoming a cosmetic concern.

#### Advancement

During advancement, the muscle is re-inserted closer to the limbus, thus making it tauter and increasing the arc of contact.

#### Indications

- Consecutive strabismus where a previously recessed muscle has to be strengthened.
- In paralytic strabismus, advancement may be combined with resection.

### SUGGESTED READING

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