

*Research Article***Horizontal Strabismus Surgery****Mohamed F. Sayed Othman, Sahar T. Abdelrazik Abdelaziz,****Asmaa A. Mohamed Oribey and Ahmed A . Abdel Halim .**

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Introduction

Traditionally, the objective of treatment in strabismus has been to eliminate diplopia by realigning the visual axes, or to produce, maintain, or restore binocular vision. Furthermore, procedures to eliminate abnormal eye movements, improve the abnormal head posture, or restore the normal anatomical position of the eyes are well- acknowledged indications for surgery^[1]. Surgical techniques include muscle weakening procedures that decrease the pull of a muscle, muscle strengthening procedures that enhance the pull of a muscle and procedures that change the direction of the action of a muscle^[2].

Anatomy

Among seven extra ocular muscles. There are four recti muscles (medial rectus, inferior rectus, lateral rectus and superior rectus muscles) and two oblique muscles (superior oblique and inferior oblique) that control movements of the eye^[3]. The four rectus muscles originates from the annulus of zinn which is a fibrous ring at the orbital apex. The annulus of zinn is composed of two portions, the lower tendon (tendon of zinn) and the upper tendon (tendon of Lockwood). The lower tendon gives origin to the inferior rectus and the inferior portions of the medial and lateral rectus muscles while The upper tendon gives origin to the superior rectus and the superior portion of the medial and lateral rectus muscles^[4]. The extra ocular muscles inserted anteriorly at variable distances from limbus forming Spiral of Tillaux^[3]. There are many surgical importances for the spiral of Tillaux. It keeps the surgeon oriented during surgery, gives landmarks to help reinsertion of transposed or advanced muscles and gives insight about the type

and amount of previous strabismus surgery and^[5]. The lines of insertion of the rectus muscles are more or less curved rather than straight. The straightest lines are the insertion of the lateral and medial rectus muscles but these are slightly convex towards the limbus. The lines of insertion of the inferior and superior rectus muscles are markedly convex towards the limbus with their lateral ends further away than their medial ends from the limbus^[6].

Physiology of Extraocular Muscles

The power of contraction of the extraocular muscle depends on the number of motor units activated and the frequency of muscle fiber stimulation⁽⁷⁾. When the muscle contracts, it produces a force that rotates the globe in a particular direction (muscle action) with a certain rotational force which is directly proportional to the moment arm length and the muscle contraction force^[8]. The rectus muscles insert millimeters anterior to the equator so there is a long arc of muscle scleral contact that remains the same and also the length of the moment arm will remain constant throughout eye rotations^[7]. Strabismus surgery corrects misalignment of the eye by tightening the muscle (resection, tucks, and plications), slackening the muscle (recession) or by changing the site of the muscle insertion, thus changing the direction of pull (transposition)^[8].

Strabismus Surgery: Recession

Recessions are the most commonly performed weakening procedure. In this procedure the muscle is disinserted and moved some distance posteriorly to the insertion^[9]. Recession is a procedure that is easier, faster, with less postoperative conjunctival reaction and better response^[10].

Steps of recession procedure

1. The muscle is exposed by reflecting a flap of overlying conjunctiva and Tenn's capsule.
2. Two vicryl sutures are passed through the outer quarters of the muscle tendon near the insertion.
3. The muscle tendon is disinserted from the sclera with the help of tenotomy scissors.
4. The amount of recession is measured with the calipers and marked on the sclera.
5. The muscle tendon is sutured with the sclera at the marked site posterior to original insertion.
6. Conjunctival flap is sutured back.^[2]

The usual recessions of horizontal rectus muscles range from 3 to 7 mm for the medial rectus muscle and 4 to 8 mm for the lateral rectus muscle. In some cases as extremely large deviations or in myopic eyes, larger recessions may be performed^[9].

Greater caution is required while exceeding the limit (7 mm) with the medial rectus muscle than with the lateral rectus muscle (that can be recessed up to 12 mm) because the functional equator is placed more anteriorly on the medial side. So, if the medial rectus is recessed beyond the functional equator, limitation of adduction and convergence can occur^[9].

Resection

Resection is a procedure to strengthen the muscle by excision of a predetermined length of the muscle comprising primarily of the tendinous portion (starting from the insertion) and reattaching the shortened muscle to the original insertion, in effect tightening the muscle^[9].

Compared to recession procedure, a resection procedure produces greater post-operative discomfort and conjunctival injection^[5].

Steps of resection procedure

1. The muscle is exposed as for recession and the amount to be resected is measured with calipers and marked.

2. Two absorbable sutures are passed through the outer quarters of the muscles at the marked site.
3. The muscle tendon is disinserted from the sclera and the portion of the muscle anterior to sutures is excised.
4. The muscle stump is sutured with the sclera at the original insertion site.
5. Conjunctival flap is sutured back.^[2]

Regardless of the age of the patient, the minimum amount of resection of either medial rectus muscle or lateral rectus muscle is 5 mm. The maximum resection for a horizontal rectus muscle is 8 mm for infants under 1 year and ordinarily 10 mm for older children and adults^[11].

According to Wright, The minimum amount of resection of medial rectus is 3 mm and the minimum amount of resection of lateral rectus is 3.5 mm while the maximum amount of resection for medial rectus is 6.5 mm and the maximum amount of resection for the lateral rectus is 8 mm^[8].

Complications of Strabismus Surgery

The strabismus surgery has had improvement in both safety and effectiveness over the years. Although serious complications are rare, no surgery is without risk and so it is important for the surgeons to be aware of the incidence of complications and its risk factors^[12].

Haemorrhage

Hemorrhage can occur due to disruption of the muscle sheath, injury to vortex veins or injury to the muscle during dissection^[12].

Lost and Slipped Muscle

In lost muscle, the muscle with its sheath retracts posteriorly through the Tenon's capsule and no attachment between the muscle tendon or its sheath with the sclera. While in slipped muscle, the tendon retracts posteriorly within the muscle sheath and the muscle sheath remains attached to the sclera^[13].

Globe Perforation and retinal detachment

Scleral perforation occurs during suturing the muscle to the sclera and is considered one of the most devastating complications of strabismus surgery^[14].

Corneal Dellen

Corneal dellen typically develops within the first 2 weeks after surgery due to disturbance the regularity of the tear film by swelling of the conjunctiva ^[15].

Overaction or underaction

Unsatisfactory results is a common post-operative complication. Under-corrections are more common than overcorrections. It can occur from incorrect preoperative evaluation, intra-operative measurement errors, improper surgical technique and excessive scarring or inflammation ^[16].

Postoperative Diplopia

Postoperative diplopia is sometimes distressing and an unwelcome sign for the surgeon and the patient but may be a welcome sign in long-standing deviations with a potential for recovering the binocularity ^[12].

Anterior Segment Ischaemia

The most important risk factors for the development of anterior segment ischemia are older age, previous rectus muscle surgery, and surgeries involving more than two recti. Other causes include Atherosclerosis, hyperviscosity, carotid artery ligation and Graves's ophthalmopathy ^[17]. Clinical pictures are corneal oedema, severe ocular pain, anterior segment flare and hypotony. It is managed by intensive topical steroids and short course of systemic steroids ^[12].

Postoperative Infection

Postoperative infection range from suture abscess by contaminated suture or granuloma from foreign body reaction to suture, lash or cotton to much dangerous infections in the form of orbital cellulitis and endophthalmitis ^[12].

Aim and Conclusion

The aim of this study is to discuss two of the most common surgical technique. Recession and resection, used for correction of horizontal strabismus and their effectiveness and complication.

Correction of strabismus eliminate diplopia, reestablish the realignment of the visual axes and restore binocular single vision.

Recessions are the most commonly performed weakening procedure for correction of horizontal strabismus and its effectiveness depends on the integrity and force of its antagonist.

Resection is a procedure to strengthen the muscle but with greater postoperative discomfort and conjunctival injection compared to recession procedure.

References

1. Paysse E: Adult strabismus: goals of realignment surgery. *Binocular vision and strabismus quarterly* 2001, 16 (1):9-10.
2. Khurana A: Strabismus and nystagmus. In: *Comprehensive ophthalmology: New Age International (P) Ltd; 2007: 313-337.*
3. Bron A, Tripathi R, Tripathi B: The extraocular muscles and ocular movements. In: *Wolff's Anatomy of the Eye and Orbit. London: Chapman & Hall; 1997: 147-152.*
4. Helveston EM: Surgical anatomy. In: *Atlas of strabismus surgery. St. Louis: Mosby; 1993: 23-45.*
5. Coats DK, Olitsky SE: Surgically Important Anatomy. In: *Strabismus surgery and its complications. Berlin, Heidelberg: Springer; 2007: 3-19.*
6. Kestenbaum A: Anatomy. In: *Applied anatomy of the eye. New York: Grune & Stratton; 1963.*
7. Wright KW: Anatomy and physiology of eye movements. In: *Pediatric Ophthalmology and Strabismus: Springer; 2003: 125-143.*
8. Wright KW, Strube YNJ: Principles of Strabismus Surgery. In: *Color Atlas of Strabismus Surgery (strategies and techniques). Los Angeles, USA: Springer; 2015: 7-12.*
9. Agrawal S, Singh P, Srivastava RM: Horizontal Muscle Strabismus Surgery. In: *Strabismus: Springer; 2019: 131-146.*
10. Von Noorden GK, and Emilio C: Principles of surgical treatment. In: *Binocular vision and ocular motility: theory and management of strabismus. St Louis: Mosby; 2002: 566-631.*

11. Helveston EM: Resection technique of a rectus muscle. In: Atlas of strabismus surgery. St. Louis: Mosby; 1985: 141-161.
12. Phuljhele S, Saxena R, Sharma P, Saini M: Complications of Strabismus Surgery. In: Strabismus: Springer; 2019: 159-170.
13. Coats DK, Olitsky SE: Slipped and Lost Muscles. In: Strabismus surgery and its complications. Berlin, Heidelberg: Springer; 2007: 233-246.
14. Wright KW, Spiegel PH: Strabismus Surgery. In: Pediatric ophthalmology and strabismus. New York, Inc: Springer Science & Business Media; 2003: 278:292.
15. Helveston EM: Complications in strabismus surgery. In: Atlas of strabismus surgery. St. Louis: Mosby; 1985: 261:284.
16. Kim DB, Meyer DR, Simon JW: Retractor lysis as prophylaxis for lower lid retraction following inferior rectus recession. Journal of Pediatric Ophthalmology and Strabismus 2002, 39(4):198-202.
17. Olver JM, Lee JP: The effects of strabismus surgery on anterior segment circulation. Eye 1989, 3(3):318.