Complications of Strabismus Surgery

Essay

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of the MS.C degree in ophthalmology

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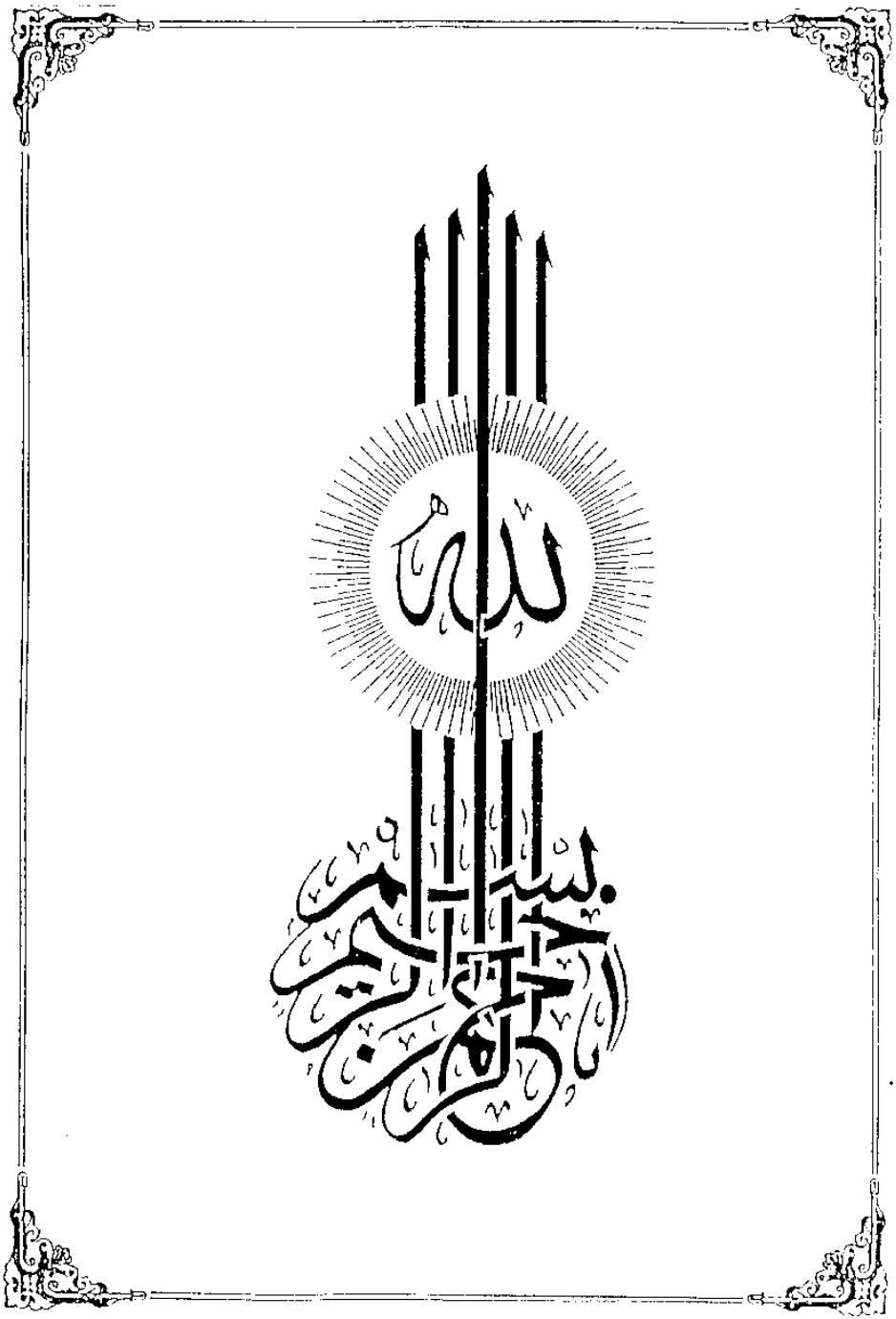

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THE CANDIDATE.

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INTRODUCTION

ANATOMY OF THE EXTRA-OCULAR MUSCLES

The eye is a specialized sensory organ that develops as an outpouching of the forebrain and is endowed with an active motility system that provides it with precise movement in different directions of gaze of all the body's sense organs, the eye is unique in its capacity for independent movement.

This feature affords three obvious advantages : (a) a large field of vision. (b) foveal vision for a large portion of the visual field, and (c) binocular vision in all directions of the gaze and in all distances of observation.

In a manner befitting a jewel, the eye is encased within the orbital bones, cushioned with a layer of fat, and covered with tow vertical curtains, i.e. the sliding lids, each containing a protective shield of cartilage like tissue, i.e. the tarsus.

Fundamental to the motility of the eye is its articulation in the orbit. the manner in which the muscles link the eye to the orbit and the relationship of its surrounding fascia determines the mechanical features that both produce and limit the motility of the globe.

The eye is suspended within the orbit by a balance of forces. The four rectus muscles exert a significant backward pull to keep the eye against the retrobulbar fat pad, which is moulded as an intraorbital cushion, while the two oblique muscles exert force to displace the eye forwards. Each muscle is encased in its own capsule. The muscles and the fascial expansion between them (inter muscular septa) form a muscle cone; its apex is at the annulus of Zinn and its base is occupied by the posterior half of the eye. Encased within the muscle cone posterior to the eye is a cushion of fat moulded to the posterior surface of the eye.

Coursing through the fat within the muscle cone are the optic nerve, the ophthalmic arterys and vein, branches of the oculomotor nerve, and the ciliary ganglion. ***(Parks, M. M.,1983).***

The four rectus muscles arise from the common tendinous ring (annulus of Zinn) at the orbital apex. This common tendinous ring is composed of two bands. The lower band arises from the inferior root of the lesser wing of the sphenoid bone, and the upper band arises from the body of sphenoid (Fig. 1).

The Medial Rectus Muscle is 40.8 mm long from its at the common tendinous ring to its insertion 5.5 mm posterior to the limbus. Its tendinous portion at the insertion is approximately 4 mm long and 10.3 mm wide.

The Lateral Rectus Muscle is 40.5 mm long and arises both from the upper and lower parts of the common tendon and bridge the superior orbital fissure. Its tendinous termination is about 9 mm long and is inserted 7 mm posterior the limbus by a width of 9.2 mm.

The Superior Rectus Muscle originates at the tendinous ring just below the origin of levator palpebrae superioris. The muscle is 42 mm long and is inserted in the sclera 7.7 mm posterior to limbus. Its tendon is about 5.8 mm long 10.8 mm wide.

The Inferior Rectus Muscle is 40 mm long and is inserted 6.5 mm posterior to the limbus from its origin at the common tendon. Its tendon is about 5.5 mm long and 9.8 wide.

The Superior Oblique Muscle is the longest muscle and originates from the orbital apex just medial to the optic foramen .One centimeter before reaching the trochlea, the muscle become a rounded tendon that passes through the pulley and angles posteriorly, inferiorly and laterally. It then passes under the superior rectus muscle and is inserted in the posterosuperior quadrant of the globe, lateral to the midvertical plane.

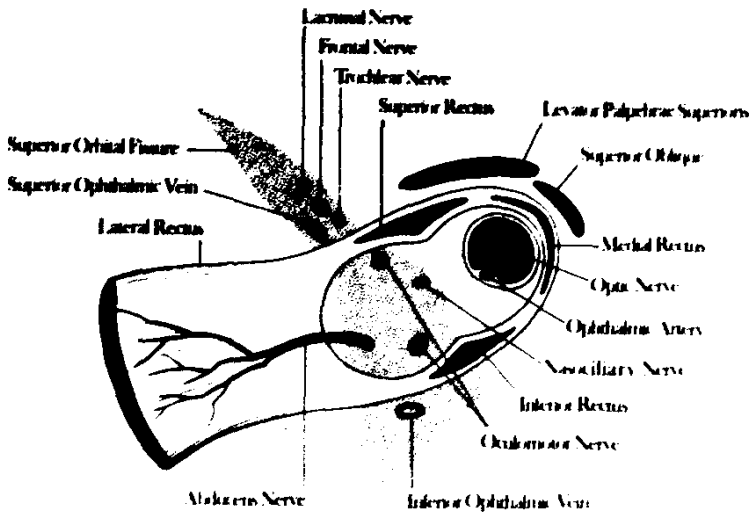

Fig. 1 Diagram showing topographic relationship of muscle orgins in the annulus of Zinn ***(Hamming and Apple, 1980).***

The Inferior Oblique Muscle originates from the anterior medial angle of the floor of the orbit lateral to the lacrimal sac. It passes backwards below the inferior rectus and then underneath the lateral rectus to become inserted into the lateral part of the posteroinferior quadrant of the globe. It has a very short tendon (often none at all).

Extra ocular muscle actions : (Fig. 2) the medial rectus lying in the horizontal plane acts solely as an adductor. The lateral rectus for the same reason is solely an abductor. Elevation of the globe is produced by the inferior oblique and superior rectus muscles. The action of the inferior oblique as an elevator is most pronounced in adduction, and that of the superior rectus in abduction. Depression is produced by the superior oblique and the inferior rectus muscles. The superior oblique action is most pronounced in adduction and that of the inferior rectus is in abduction. Incycloduction is produced by the superior oblique and superior rectus muscles. Excycloduction is produced by the inferior oblique and the inferior rectus muscles. ***(Warwick, 1976; Snell and Lemp, 1989).***

Innervation of the Extra ocular Muscles : The extra ocular muscles have a rich nerve supply from the trunks of the third, fourth, and sixth cranial nerves, and rich connections with the central nervous system, there are also unmyelinated fibers from the autonomic nervous system.

The motor nervous supply of the medial, superior and rectus muscles and inferior oblique comes from the third (oculomotor) nerve, that of the superior oblique is from the fourth (trochlear) and that of the lateral rectus is from the sixth. (Abducent) nerve (Fig. 3).

The nucleus of the third nerve is composed of : (1) main motor nucleus, that is situated in the anterior part of the gray matter surrounding the cerebral aqueduct of the mid brain, at the level of the superior colliculus. (2) accessory parasympathetic nucleus (edinger westphal nucleus) situated posterior to the main nucleus. The trochlear nucleus is

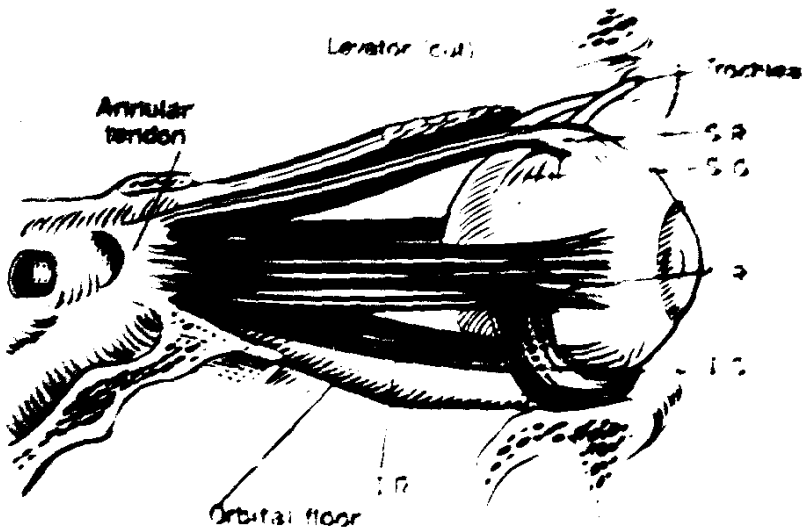

Fig. 2 The muscles of the Right oribit in lateral View, Showing their relationships of each other ***(Warwic, 1972).***

situated in the anterior part of the gray matter surrounding cerebral aqueduct of the mid brain, in line with the main oculomotor nucleus but at the level of the inferior colliculus. The abducent nucleus is small and situated beneath the floor of the upper part of the fourth ventricle. It lies close to the midline and beneath the colliculus facialis. ***(Snell and Lemp, 1989).***

The terminal twigs of these nerves enter the bulbar aspect of the extrinsic muscles near the junction between their proximal and middle thirds, except the fourth nerve which enters the outer aspect of the posterior third of the superior oblique muscle as a series of 3 or 4 twigs. ***(Warwick, 1976).***

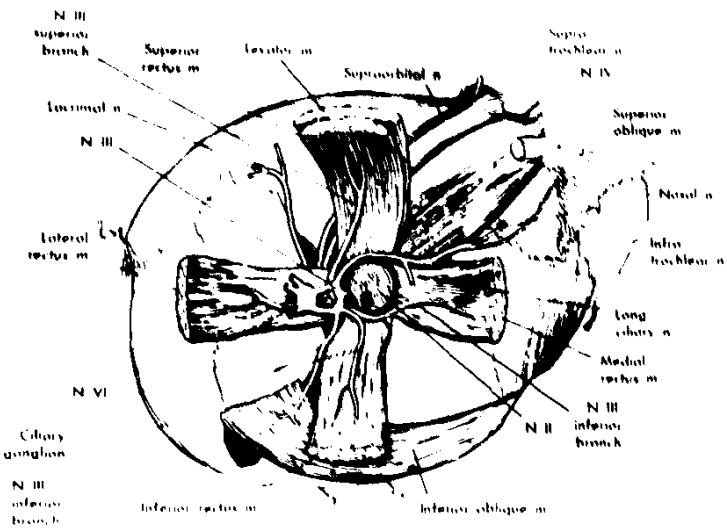

Fig. 3 Innervation of the extra-ocular muscle ***(Von Noorden, 1985).***

SURGERY OF THE EXTRA-OCULAR-MUSCLE

The aim of surgery on extra-ocular muscles is to correct the misalignment of the eye post and, if possible, also to restore binocular single vision.

The three main types of operation are :

A- Weakening procedures that decrease the pull of a muscle.

B- Strengthening procedures that enhance the pull of a muscle.

C- Procedures that change the direction of the action of a muscle.

A. Weakening procedures :

The three operations used to weaken the action of a muscle are: recession, marginal myotomy and tenotomy, recently botulinum A, toxin injection into individual extra-ocular muscle, was introduced as new method of weakening.

1- Recession procedure :

- In this procedure the insertion of a muscle is moved posteriorly towards its origin. (Recession can be performed on any of the six extra-ocular muscles).
- Recession is generally easier and faster than resection with less post-operative conjunctival reaction it gives better response, a recession is nearly always included in the initial strabismus surgery, either unilaterally, bilaterally, with or without a resection on another muscle.
- There are two recession techniques used :

a- Recession with one double armed sutures.

b- Recession with two single armed sutures.

The two recession techniques can be used with any conjunctival incision techniques. ***(Von Noorden G. K.,1968).***

2- Marginal Myotomy :

In this procedure, the length of the muscle is increased without altering its insertion, a myotomy may be applicable when the surgeon has performed what he (or) she considers, the maximum recession of a rectus muscle and the maximum resection of the antagonist muscle but still more weakening is necessary, the larger rectus muscle recessions performed in recent years have reduced the need for the marginal myotomy.

- The operation is performed by first clamping about three quarters of the width of the muscle from opposite sides in two places and then cutting the crushed areas with scissors. ***(Helvston E. M., 1970).***

- There are four indications for doing a marginal myotomy :

1- To further weaken a previously operated rectus that has already been recessed to the functional point of tagency with the globe.

2- When combined with a recession, to obtain double weakening effect while retaining a physiologic arc of contact.

3- To weaken a rectus that has at or near its insertion an implant, exoplant, or an encircling element used for retinal detachment repair.

4- To weaken a rectus in a patient with excessively thin sclera posterior to the insertion. ***(Helvston E.M. & Cofield D. P., 1970).***

3- Myectomy procedure :

In this procedure, the muscle is severed from its insertion and not reattached. Myectomy is most commonly used in weakening an overacting inferior oblique muscle. Very occasionally the procedure is performed on a severely contracted rectus muscle as might occur in thyroid myopathy. ***(Parks M. M., 1972).***

4- Tenotomy procedure :

The superior oblique is effectively weakened by tenotomy, this should be done with minimal disruption of the tendon sheath and