

PROSTHETIC CORRECTIONS OF EYELID PTOSIS
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PTOSIS

Ptosis or blepharoptosis presents itself as an intriguing and challenging lid anomaly for the ocularist. It is my belief that successfully dealing with this anomaly is one of the cornerstones of the foundation to becoming a competent ocularist. Learning to deal with this and other lid anomalies ultimately focuses your attention on both the anatomy of the orbit and the relational configuration of the prosthesis.

To truly understand this complex anomaly it is imperative to review and understand the anatomy. Having a firm grasp of the anatomy will help you understand the differences within the classification of ptosis. I strongly believe that as ocularists we perceive and deal with ptosis altogether differently than the oculoplastic surgeon. It is these differences that I believe you must fully understand before you can proceed to a greater understanding of ptosis within the anophthalmic socket.

My intention is to first do an overview of anatomy. I will then review ptosis from the oculoplastic point of view, followed by the view of the ocularist. Finally, I propose to cover some practical solutions of the dynamics of fitting ptosis.

EYELID ANATOMY

- **Upper Eyelid Skin** - Due to the constant movement of the eyelids with each blink, the resulting laxity that occurs with age is quite common. The upper eyelid crease approximates the level of the superior border of the tarsus created by attachments from the levator aponeurosis to the pretarsal obicularis bundles.

- **Protractors** - Obicularis oculi muscle, contraction of this muscle is innervated by the seventh cranial nerve. It closes the palpebral fissure, and is referred to as a protractor of the eyelids.
- **Retractors** - The retractors of the upper lid are the levator muscle, the levator aponeurosis and the sympathetically innervated superior tarsal muscle (mullers muscle). The retractors of the lower lid are the capsulopalpebral fascia and the inferior tarsal muscle.
- Levator muscle/aponeurosis complex attaches to the lower 1/3 of tarsus and lid crease. This complex supplies the major lifting force. The levator muscle is innervated by the III cranial nerve.
- The origin of the levator muscle/aponeurosis complex is from the annulus of zinn as muscle.
- Levator palpebrae superioris inserts into obicularis muscle and upper lid skin as well as the anterior tarsal surface.
- Mueller's muscle originates 10-12 mm above tarsus from the levator aponeurosis and attaches to the top of the tarsus. This complex supplies only about 2mm of the total lid elevation.
- Whitnall's ligament seems to provide a fulcrum for the levator complex. Most surgeons recommend that it not be cut during ptosis surgery.
- **Tarsus** - The tarsi (superior and inferior) are firm fibrous plates. These plates give the eyelid a more solid or rigid base. The upper eyelid tarsal plate measures approximately eight to twelve millimetres vertically in the centre of the eye lid. The inferior tarsal plate measures approximately 4mm in the central portion of the lower lid. The tarsi contain the Meibomian glands.

CLASSIFICATION

Classification of ptosis from the ophthalmologists point of view

must be fully understood. The classification process provides the surgeon with the ability to differentiate ptosis, thus determining the correct surgical approach.

There are three general classifications of ptosis: congenital, acquired and pseudoptosis.

CONGENITAL

Presence is usually detected within first year. An abnormal muscle is present from birth. Approximately 2/3's of all ptosis.

- 1) With normal superior rectus function --> due to a developmental dystrophy of the levator muscle.
Less ptosis on down gaze.
Often poor lid crease.
- 2) With superior rectus weakness - due to close embryologic association of S.R. and levator.
- 3) Blepharophimosis syndrome - ptosis, telecanthus epicanthus inversus, inferior lid ectropion.
- 4) Synkinetic
 Marcus Gunn jaw wink - chewing movements influence position of ptotic lid. This syndrome is caused by an aberrant connection of the oculomotor nerve fibers to the levator muscle and the trigeminal nerve fibers to the muscles of mastication.
- 5) Congenital fibrosis of the extraocular muscles - extraocular muscle fibrosis results in lack of movement of the globe.

ACQUIRED

Acquired ptosis is classified as aponeurotic, neurogenic, myogenic, mechanical and traumatic. This accounts for approximately 1/3 of all ptosis.

Aponeurotic - most common type of acquired ptosis. It is usually characterized by good lid function, high lid crease.

Disinsertion; dehiscence of aponeurosis from tarsus. Quite

common as a result of aging. Can occur also after trauma.

Neurogenic - Oculomotor nerve palsy which is the III cranial nerve that innervates the levator muscle can become damaged due to a variety of reasons. Quite often time is allowed for the maximum improvement in the oculomotor nerve function and the status being stable prior to any surgical correction. Vascular (aneurysm), inflammatory (meningitis), neoplastic (parinauds) misdirected oculomotor nerve regeneration or trauma can account for this type of ptosis. Marcus Gunn jaw winking ptosis, multiple sclerosis, Horner's syndrome and ophthalmoplegic migraine are all neurogenic types of ptosis as well.

Horner's syndrome --> mild ptosis, associated with Mueller's muscle paralysis. Due to interruption of sympathetic innervation.

Myogenic

- (a) Progressive external ophthalmoplegia poor lid function and association. Extraocular muscles progressively involved. Onset of ptosis in adolescence.
- (b) Late acquired hereditary ptosis - onset 4th - 5th decade.
- (?) Oculopharyngeal Dystrophy - quite often arises in middle age and is associated with difficulty in swallowing. It is familial and the ptosis is bilateral and progressive.
- (d) Myasthenia gravis - history of difficulty swallowing, chewing, talking, breathing, raising arms, walking; especially toward evening. Element of fatigue present.
- (e) Hyperthyroidism
- (f) Corticosteroids
- (g) Mascara
- (h) Chronic conjunctivitis/uveitis

TRAUMATIC

- 1) Lid laceration
- 2) Myogenic or neurological --> best if repaired initially or by waiting several months.
- 3) Post-surgical --> eg. cataract removal
- 4) Foreign body in orbit superiorly or fracture

MECHANICAL

Ptosis due to mechanical factors - has a normal levator muscle.

- 1) Blepharochalasis - rare, often hereditary condition. Characterized by recurrent attacks of marked eyelid edema.
- 2) Lid tumour - Hemangioma, neurofibroma
- 3) Cicatricial - ocular pemphigoid, trauma
- 4) Treatment of this ptosis is usually directed at the cause of the mechanical restriction, rather than at the levator muscle.

PSEUDOPTOSIS

This accounts for a very small portion of ptosis for the ophthalmologist - not so for the ocularist.

- 1) Microphthalmia, Anophthalmia and Phthisis bulbi.
- 2) Hypotropia - globe is directed significantly inferiorly thus the eyelid will be lower than the opposite eyelid.
- 3) Dermatochalasis - drooping of excess upper eyelid tissue over eyelid margin.
- 4) Due to globe malposition - eyelids in normal position but globe may be elevated mechanically, eg. orbital floor or rim trauma, fibrous dysplasia of the orbit, orbital inflammatory disease, after treatment of inferior orbital tumour.

SURGICAL CORRECTION OF PTOSIS

The selection of the surgical approach can and will vary amongst surgeons. In some cases this reflects differences in training and experience. Included is a variety of conditions or syndromes and possible surgical corrections.

CONGENITAL PTOSIS

This usually relates to the simple levator maldevelopment group. As such it is broken into:

- 1) **mild ptosis ($\leq 2mm$)** - This is usually corrected with a fasanelle-servat type tarsal Muller's muscle resection or by aponeurotic repair or advancement.
- 2) **Moderate ptosis (2-4mm)** - Correction is dependent upon good, fair or poor levator muscle function. This is relational to the amount of the levator muscle resection.
- 3) **Severe ptosis ($\geq 4mm$)** - Correction can be a maximum levator muscle correction or more often is best treated with a brow suspension.
- 4) **Superior rectus weakness** - Usually requires an additional 3-4mm of levator muscle resection.
- 5) **Blepharophimosis syndrome** - Epicanthus inversus and telecanthus should be treated prior to ptosis repair. Ptosis repair is treated similarly to simple levator maldevelopment ptosis.
- 6) **Congenital fibrosis of the extraocular muscles** - Due to possible exposure keratitis minimal eyelid elevation is required to just clear pupils. This is done by full thickness - eyelid resection or by frontalis suspension.

ACQUIRED PTOSIS

- 1) **Aponeurotic ptosis** - surgical repair is done by repairing the aponeurosis.
- 2) **Neurogenic**
 - a) Oculomotor Nerve Palsy (III nerve) correction is usually a frontalis suspension or levator muscle resection - advancement.
 - b) Misdirected oculomotor nerve regeneration is usually corrected by excising the levator muscle then doing a frontalis suspension procedure.
 - c) Marcus-Gunn jaw winking ptosis - excising the aberrantly innervated muscle and utilizing the

frontalis muscle function for the eyelid. Levator resection or possible fasanelle-servat can also be considered, depending upon symptoms.

- d) Horner's syndrome- usually a fasanelle-servat procedure.
- e) Ophthalmoplegic migraine - usually of short duration and does not require surgery.

3) ***Myogenic Ptosis***

- a) Oculopharyngeal Dystrophy, chronic progressive external ophthalmoplegia, and muscular dystrophy. These situations are best corrected by trying to elevate the eyelids but to leave the eyelids less than fully corrected. Quite often aponeurotic defects are present. Levator advancement or small resection can be done if aponeurotic defect not found. Full thickness eyelid resections or frontalis suspensions can be done also.
- b) Myasthenia gravis - patient who cannot tolerate medical therapy can be treated by aponeurotic repair or resection.

4) ***Traumatic Ptosis***

- a) Trauma to the levator muscle should be repaired promptly or the formation of scar tissue could complicate correction.
- b) Trauma that may involve neurological factors may be better to wait. Quite often they will improve in time.

5) ***Mechanical Ptosis***

- a) Correction of mechanical ptosis is usually directed at the specific cause of the eyelid distortion. Correction most often involves medical and/or surgical correction.

PSEUDOPTOSIS

- a) This situation also requires the direction of repair to be focused on the specific defect.
- b) Quite often surgery is required to correct resultant defect after possible correction, e.g. phthisis bulbi and scleral shell fitting still resulting in some degree of ptosis.
Ptosis surgery is based on defect with corrected prosthesis.

ANOPHTHALMIC PTOSIS

Anophthalmic ptosis represents a situation that truly requires its own classification. Not only is the anatomy varied in relation to the contents of the orbit, such as a wide range of implants, but also varying sizes of globes as well. However, having a phthisical globe present is a contradiction of terms in anophthalmic ptosis. As ocularists, any drooping lid that can be repaired by a change in the shape or volume of an ocular prosthesis or scleral lens, constitutes an anophthalmic socket syndrome ptosis repair in my opinion.

Surgeons deal with ptosis corrections entirely different than ocularists. Quite often the ocularist is looked at to repair these situations prosthetically. If this is not possible, then the surgical correction is undertaken. However, at this stage the degree of correction is minimized, usually resulting in a less aggressive surgical repair.

ANOPHTHALMIC PTOSIS CLASSIFICATIONS

- 1) ***Pseudoptosis*** - Usually a result of a lack of orbital volume. Quite often this can be a result of microphthalmos, enophthalmos, phthisis or a poorly fitted prosthesis. This can also become apparent with a rapid regression of edema or an atrophy of the posterior orbital tissues.
- 2) ***Persistent Ptosis*** - Quite commonly attributed to accidental or surgical trauma (aponeurotic sheath attached to the

levator muscle becomes disinserted). Neurological causes, congenital or a superiorly migrated sphere which causes the levator muscle and tarsus to be pushed forward and downward.

- 3) **Temporary Ptosis** - Most common after enucleation or evisceration during the first few weeks to several months. This is usually caused by edema of the orbital tissues pressing the upper edge of tarsus forward. This subsequently results in the superior lid moving anteriorly and inferiorly. Infection, inflammation and steroid myopathy also result in this type of ptosis.
- 4) **Intermittent Ptosis** - Quite often can be secondary to a medical problem such as transient Horner's syndrome, myasthenia gravis, or third nerve paralysis. Waking or morning ptosis can also represent intermittent ptosis. Pseudo intermittent types of ptosis can come from protein deposits on the surface of the prosthesis. Fatigue type ptosis results from the fatigue of the levator muscle and is also intermittent.
- 5) **Progressive Ptosis and Pseudoptosis** - Familial ptosis such as blepharophimosis or a tumour in the orbit. A tumour as it grows will manifest itself in a progressive nature. Atrophy of the posterior orbital fatty tissues, or rapid regression of edema may also manifest itself as progressive ptosis. However, it is truly a pseudoptosis.
- 6) **Prosthetic Correction of Ptosis** - There are relatively just a few good choices at prosthetic correction of ptosis such as Lee Allen's method as described in the literature, or a ptosis shelf or crutch. All of these forms have their merit. However, they all have their limitations. That is why it is imperative for you to know what you are up against before you launch yourself into a prosthetic correction.

Here are a few important factors to consider first. Is the ptosis permanent or temporary? Does the ptosis vary at all during the day, in the morning or night? Is there a volume deficiency? Is the ptosis progressive. If so, in what way? What is the etiology of this situation. All of these factors must be considered prior to making your correction. Failure to realize these factors will only limit your ability to fully correct the ptosis. Subsequently you can subject your patient to a tremendous amount of discomfort by being overly aggressive and also not understanding the circumstances surrounding the ptosis. You must fully grasp your limitations based on the classification. Quite often ptosis can be a team approach with yourself, the surgeon, and your patient.

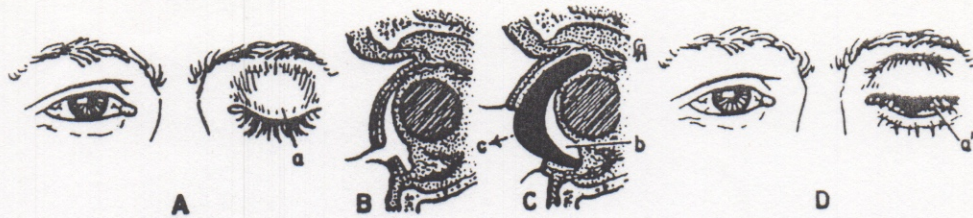


FIGURE 14. (A) Ptosis of upper left eyelid (a). (B) Cross section of same eye showing ball implant in Tenon's capsule. (C) Snellen Reform shaped prosthesis in socket, direction of gaze downward (c), unfilled space (b) behind prosthesis. (D) Front view of unsatisfactory cosmetic result (a') from prosthesis shown in (C). (From Allen and Webster [1].)

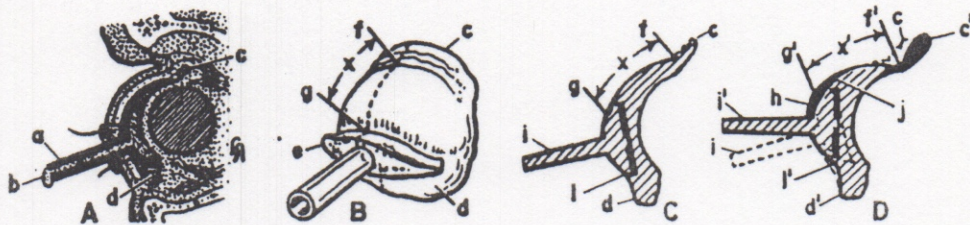


FIGURE 15. (A) Taking impression of socket with ptosis of upper eyelid. Stem of impression shell (a), impression material (b), tongue of impression into thin space in upper fornix (c), fullness of material from lower fornix (d). (B) Impression removed from socket. Material from lower fornix (d), record of palpebral fissure (e), record of upper margin of upper tarsus (f), record of lower margin of upper eyelid (g), width of upper tarsus (x). (C) Wax pattern copied from impression. Stem of iris-cornea piece pointing downward (i), other features identified as in (B). (D) Modified wax pattern with stem (i) realigned to straight ahead (i'), material added to lift upper eyelid margin (h) blends off in area of (j). Tongue at (c) moved to (c') and made larger. Material removed from lower limbal area (l'). Space for upper tarsus moved backward (l'-g') with width of space for upper tarsus (x) maintained as (x'). (From Allen and Webster [1].)

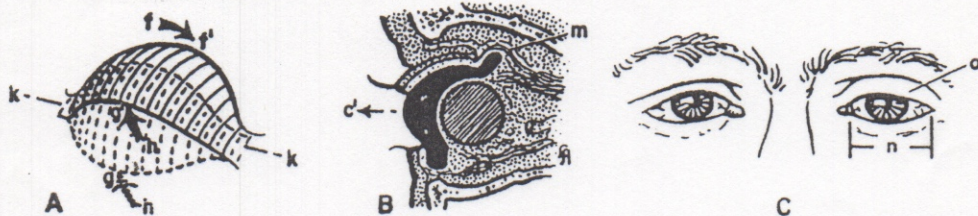


FIGURE 16. (A) Principle by which upper tarsus is rotated upward and backward around axis, palpebral ligaments (k-k). Prominence added to upper corneoscleral limbus of pattern applies lift (h) to elevate lower margin (g) to level (g'), upper margin (f) moves back to (f'). (B) Cross section showing artificial eye of modified impression in same socket as seen in Figures 9 and 10, upper eyelid being lifted, prosthesis pointing ahead (c'), Mueller's muscle buckled at (m). (C) Front view of cosmetic result, eyelid opening satisfactory, expanse of upper eyelid remains slightly greater than in companion eye (o). (From Allen and Webster [1].)