The Aging Eye: Pathophysiology and Management

ANDRÉ CAMIRAND, M.D., C.S.P.Q.
JOCELYNE DOUCET, R.N., HEAD NURSE
MONTREAL, QUEBEC, CANADA

JUNE HARRIS, B.SC., B.P.ED., M.D., ASSOCIATE PROFESSOR OF ANATOMY
FACULTY OF MEDICINE
MEMORIAL UNIVERSITY OF NEWFOUNDLAND
ST. JOHN'S, NEWFOUNDLAND, CANADA

As humans go through the normal process of aging, there is drooping of many of the deep structures of the eyes. For generations, and continuing today, aesthetic plastic surgeons are removing superficial structures (i.e., skin and fat) as the primary management of drooping upper and lower eyelids. However, the dissatisfaction of patients with the results of these conventional approaches (Fig. 1) has led to further research and the development of innovative techniques that give a more youthful and harmonious appearance to the face.

PATHOPHYSIOLOGY

During youth, the eyebrow lies at 1 cm above the supraorbital rim in females and at the level of the rim in males. The distance between the eyebrow and eyelashes should be approximately 2.7 cm; this can be viewed as a universal aesthetic standard. As a result of aging, the brow gravitates downward causing a pseudodermachalasis of the upper eyelids, a reduced distance between the eyebrows and eyelashes, a widened forehead, and static crow's feet. Because one is continually working to raise the eyebrows to their normal position, the procerus, corrugator, and frontalis muscles become hypertrophied and create forehead wrinkles.

The lateral canthus of the eye lies 2 to 3 mm above the medial canthus; this imparts a beautiful almond shape to the eyes and a mongoloid fissure of youth. In addition, the lower eyelid covers 1 to 2 mm of the lower limbus. Lockwood's suspensory ligament is attached to the lateral canthus and maintains the eyeball in an upward and forward position (Fig. 2). With aging, the lateral canthus gravitates downward causing a decrease in the mongoloid

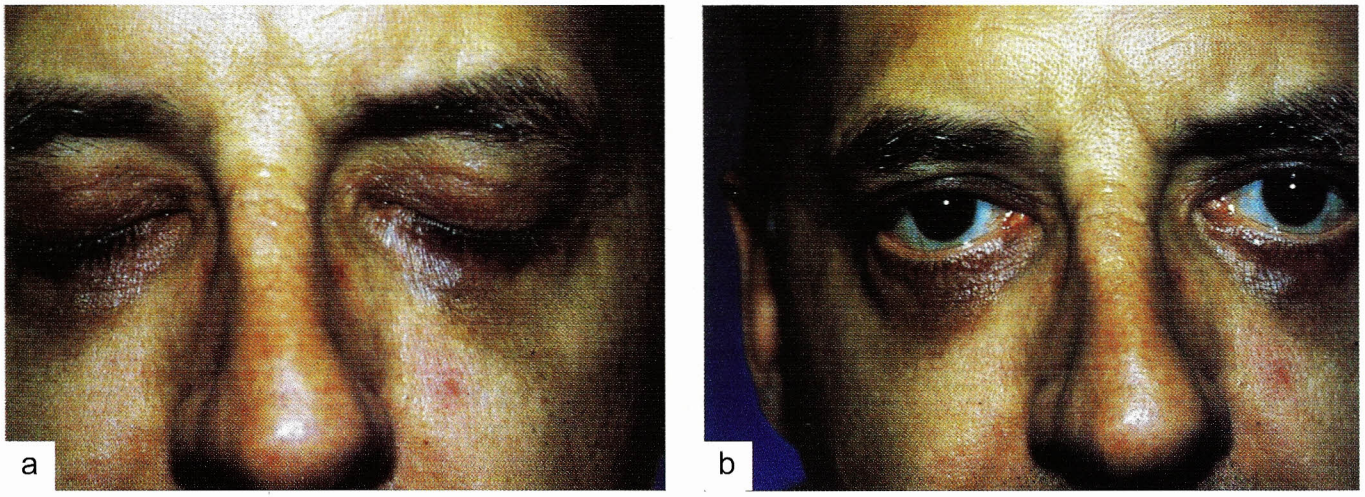

Figure 1. An unhappy patient after a conventional upper and lower blepharoplasty, showing (a) an antimongoloid slant and a striking contrast between the pretarsal skin and the skin inferior to the eyebrow, plus (b) scleral show and a decreased distance between the eyebrows and eyelashes.

slant, pseudodermachalasis of the lower eyelids, and scleral show. This lowering also contributes to herniated fat pads and enophthalmia mainly as a result of the lowering of Lockwood's suspensory ligament. The eyeball is not maintained in its normal position and moves backward and downward, thus decreasing the space between the globe and the floor of the orbit. Intraorbital fat projects anteriorly, stretching the orbital septum, orbicularis oculi muscle, and overlying skin.

A weakened orbital septum should not be implicated as the cause of herniated fat pads. The authors base this conclusion on experience and observation. When lacerations of the lower eyelid are deep enough to involve the orbital septum and surgical intervention does not involve closure of this septum, the patients do not develop herniated fat pads. In addition, fractures of the orbital floor may cause tearing of the orbital septum, but if the septum is left open, these patients do not later develop herniated fat pads.

Indications for removal of herniated fat pads are rarely, if ever, present. We have never been able to demonstrate an excess of intraorbital fat (i.e., *exo*phthalmia) in any of our patients, but we do know that enophthalmia results when herniated fat pads are excised. Combining excision with the normal resorption of this fat over time would further exaggerate the inevitable enophthalmia of aging and would thus prematurely age these patients.

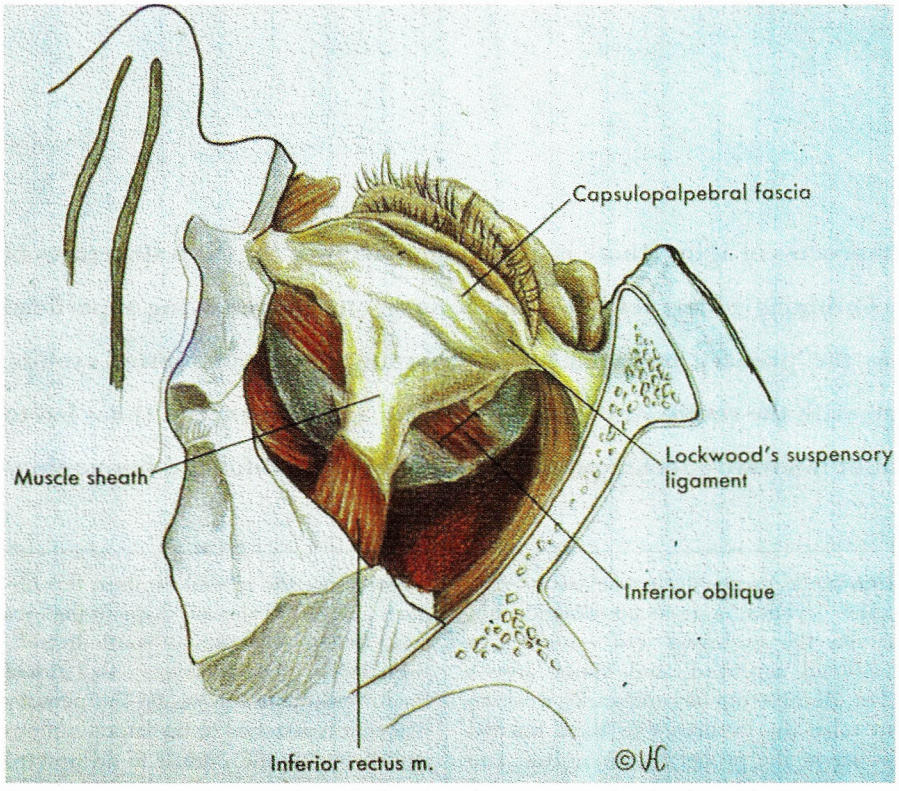

Figure 2. View from underneath the eyeball to show the capsulopalpebral fascia and Lockwood's ligament attached to the lateral canthus. The ligament maintains the eyeball in its normal position. (Reprinted with permission.[12])

ALTERNATIVE TO UPPER BLEPHAROPLASTY

A brow lift[1] is the most logical treatment of brow ptosis (Figs. 3, 4). When the brow is raised to its normal position, one can correct all of the consequences of downward displacement of the brow. Most importantly, if a brow lift is done as the primary procedure, there is rarely any need to remove upper eyelid skin. Three months after the brow lift when the swelling has subsided, if there is still excess skin, one can then safely perform a conservative upper blepharoplasty. However, if a conventional upper blepharoplasty is done before a brow lift, lagophthalmia may prevent the patient from having a future brow lift.

The type of incision used is another important aspect that must be considered when performing a brow lift. Hairline incisions, unlike coronal incisions, will advance the hairline and narrow the forehead, and if they are done perpendicular rather than parallel to the hair follicles, they become inconspicuous when hair grows in front of the scar (Fig. 4).[2-6]

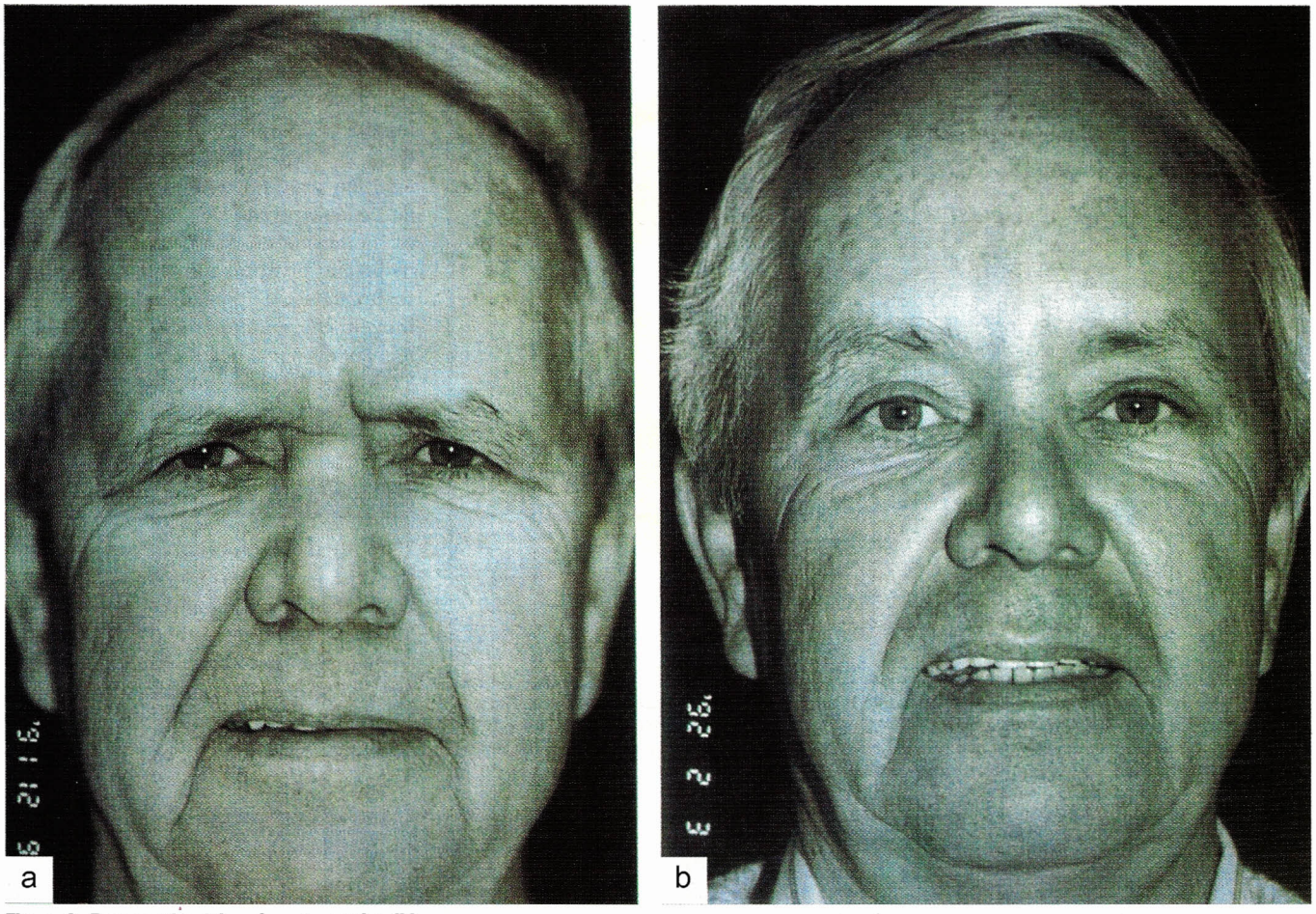

Figure 3. Preoperative (a) and postoperative (b) views of a patient managed by a brow lift and a lateral canthopexy.

ALTERNATIVES TO LOWER BLEPHAROPLASTY

A lateral canthopexy[7,8] is used to reduce herniated fat pads and reinstate the almond-shaped eye of youth. If this procedure is done properly (i.e., the lateral canthus must be thoroughly freed from all its attachments), it will give back the mongoloid slant, cover the lower limbus, redrape the pseudodermachalasis, and raise, via Lockwood's suspensory ligament, the globe from the orbital floor. Increasing the space between the globe and the orbital floor will inevitably reduce the herniated fat pads. Redraping of the skin plus manipulation of the lateral vertical fibers of the orbicularis oculi muscle[9] during this procedure also serve in the treatment of dynamic crow's feet (Figs. 3, 4). When these techniques are combined with a peeling or laser resurfacing of the lower eyelid, it becomes very difficult to justify the need for either skin or fat pad removal.

Reduction (*not* excision) of herniated

Figure 4. A patient with eyebrow ptosis and an antimongoloid eye slant (a) who requested upper and lower blepharoplasty. Instead, she was managed by a brow lift and lateral canthopexy, thus eliminating the eyebrow ptosis and dynamic crow's feet and producing an almond-shaped eye (b). The scar is virtually invisible (c).

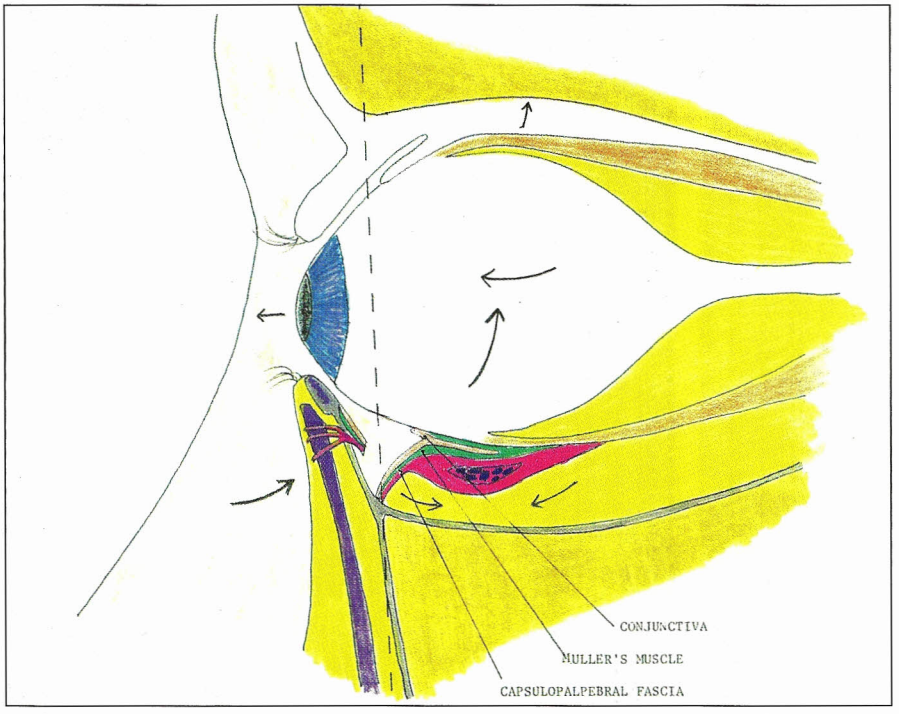

Figure 5. During surgery, the capsulopalpebral fascia is cut via a transconjunctival approach. The herniated fat pad is reduced and the reduction is maintained by suturing the capsulopalpebral fascia to the orbital rim. The eyeball moves upward and forward and the space between the globe and orbital floor is increased, thus treating and preventing enophthalmia.

fat pads can also be achieved through a transconjunctival approach by reducing the herniated fat pads and maintaining the reduction by suturing the capsulopalpebral fascia to the arcus marginalis (Fig. 5).[10] Using this technique, there is *never* any need for removal of intraorbital fat or lower eyelid skin. In fact, reduction of the herniated fat raises the eyeball to its proper position and treats the enophthalmia (Fig. 6). Because skin is not removed, there is no risk of scleral show. A concomitant chemical peeling with TCA may be done to improve the aesthetic appearance of the lower eyelid skin.

CONCLUSION

With these procedures, we eliminate the risks of ectropion, scleral show, lagophthalmia, retrobulbar hematoma and blindness. These innovative techniques are simpler and safer than conventional methods and give a better aesthetic and youthful result; plus there are no stigmas of surgery. STI

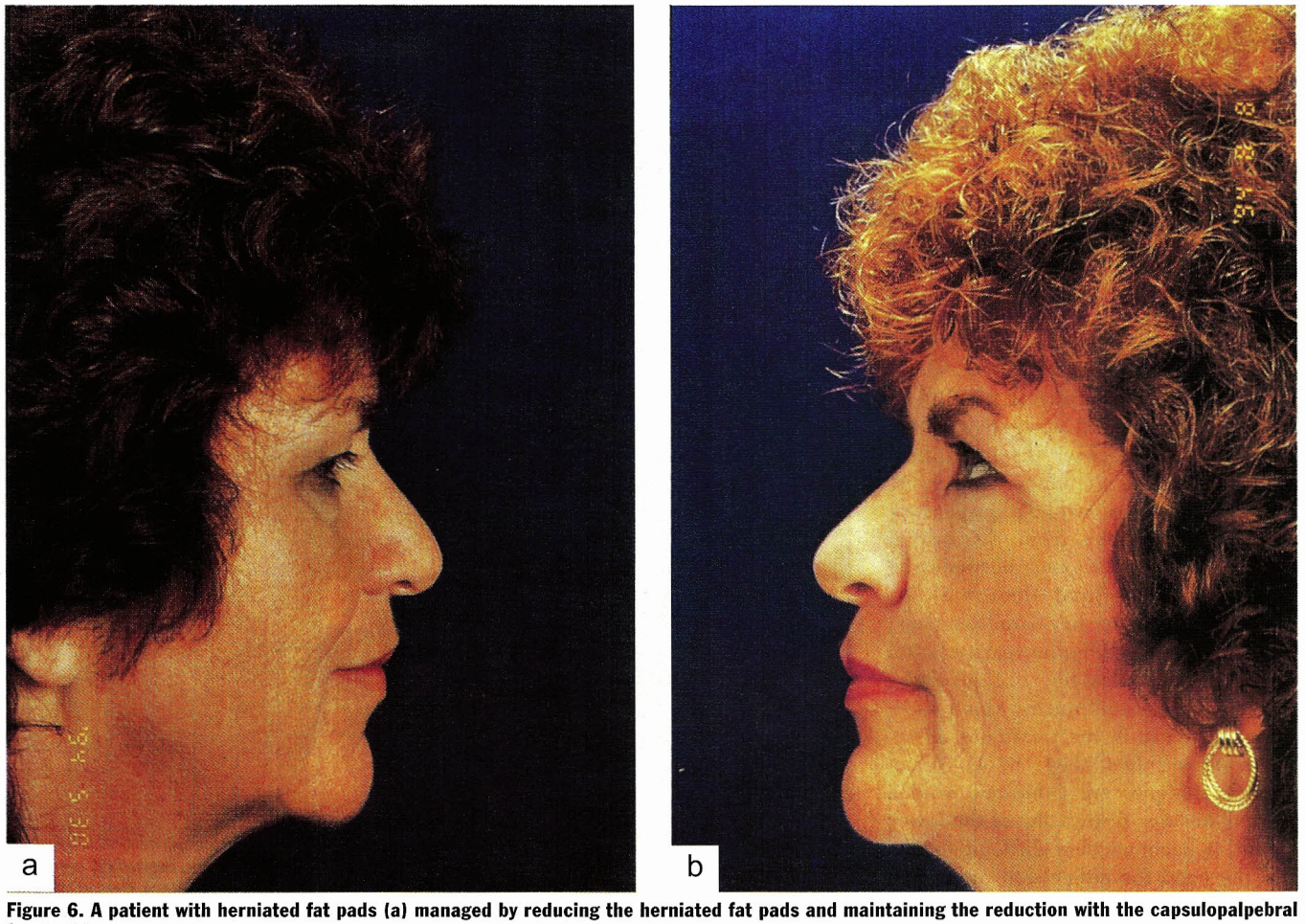

Figure 6. A patient with herniated fat pads (a) managed by reducing the herniated fat pads and maintaining the reduction with the capsulopalpebral fascia (b).

Table 1. Aging eye: causes and effects

Brow descends causing:

- Pseudodermachalasis of the upper eyelids
- Forehead (frontalis, corrugator, and procerus) wrinkles
- Static crow's feet
- A widened forehead
- A reduced distance between the eyebrows and the eyelashes

Lateral canthus descends causing:

- A decreased mongoloid slant
- Pseudodermachalasis of the lower eyelids
- Herniated fat pads
- Scleral show
- Enophthalmia

Table 2. Herniated fat pad and enophthalmia of the lower eyelid

Pathophysiology

Lowering of Lockwood's suspensory ligament (attached to the lateral canthus)

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Reduction of space between the globe and the floor

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Anterior projection of intraorbital fat

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Stretching of inferior orbital septum, orbicularis oculi muscle, and skin

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Development of enophthalmia and herniated fat pad

Table 3. Enophthalmia: causes

- Lowering of the globe (genetic or age-related)
- Herniated fat pads
- Surgical excision of herniated fat pads
- Surgical coagulation of orbital fat
- Resorption of orbital fat with aging

Table 4. Enophthalmia: management and prevention

- Use a proper canthopexy to raise the eyeball
- Use the capsulopalpebral fascia to reduce and maintain herniated fat pads

Table 5. Methods to improve crow's feet

Static crow's feet

- Brow ptosis — Rx: Brow lift
- Actinic or senile — Rx: Retin A, peelings, dermabrasion, laser resurfacing

Dynamic crow's feet

- Incise, excise, or cauterize the vertical fibers of the orbicularis oculi muscle
  Surgical approaches:
  - Canthopexy
  - Brow lift
  - Blepharoplasty (upper or lower)
  - Face lift
- Cover with the SMAS (Fogli)[11]

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