

Central (Third) Fat Pad of the Upper Eyelid

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Abstract. A clinical study on the surgical anatomy of the upper-eyelid fat pads was performed on 55 consecutive patients who underwent a blepharoplasty. It was confirmed that the periorbital fat is encapsulated in compartments and that the number of fat pads varies. In 56% of the cases there were two fat pads and in the 44% three fat pads in the upper eyelid. The third fat pad is anatomically and histologically an accessory medial extension of the lateral fat pad. However, for the sake of clarity, the term central fat pad of the upper eyelid is proposed as a denominator of this structure. The purpose of this article is to make the less experienced surgeons aware of variations in the configuration of the periorbital fat and to remind them that after two fat pads are removed from the upper eyelid there might still be a third.

Key words: Periorbital fat, anatomy of—Blepharoplasty—Aesthetic surgery

Understanding the surgical anatomy of periorbital fat is based on the classical pioneering descriptions of Bourguet [3] in 1929 and Castanares [4] in 1951. Because of them every resident in plastic surgery awakened in the middle of the night is expected to be able to repeat by heart: There are two fat compartments in the upper eyelid and three in the lower.

The periorbital fat of the upper eyelid is best exposed after opening wide the periorbital septum. The

lateral fat pad readily protrudes downward into the operative field after a gentle push on the orbit. It is butter-yellow in color and encapsulated within a thin membranous sac whose wall contains the tiny blood vessels and a few terminal branches of the supra-orbital nerve, the first division of the trigeminal nerve. This fat-containing sac rests on the aponeurosis of the levator palpebrae muscle.

The medial fat pocket is clinically found in a more medial location, toward the root of the nose, than where it is anticipated to be (Fig. 1A). After the roof of the medial sac is opened, the pale-yellow or white medial fat can be gently pulled into the operative field. The medial fat accumulation has a considerable connective tissue component, is well innervated by the branches of the supratrochlear nerve, and contains a variable amount of blood vessels, which are the terminal branches of the superior ophthalmic artery and vein.

Over the past few years our clinical experience showed that there are frequent variations in the structural configurations and the quantity of the periorbital fat. Less frequently, such differences were also noticed between the left and right eyes of the same patient. Sometimes the lateral fat pad was divided in two parts by a more or less complete septum.

The incentive for this study was three requests for secondary upper blepharoplasties. The primary procedures were carried out by three different renowned academic plastic surgeons; in one case there were two subsequent revisions. The medial fat compartment of the upper eyelid was found to be left behind in all three cases. Because of the high degree of concern for their periorbital appearance, the patients were advised to have a coronal browlift with simultaneous exploration and resection of the medial fat pad through a stab wound incision. The drooping

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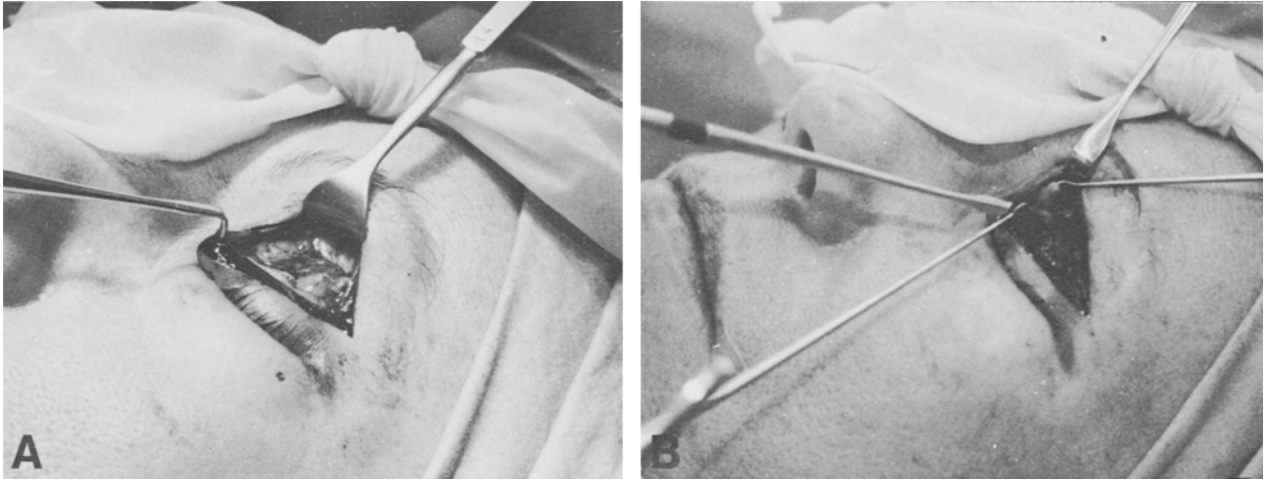


Fig. 1. Case BK: **(A)** The orbital septum is opened and two sacs containing butter-yellow lateral fat emerge in the operative field. **(B)** After removal of both lateral fat pads, dissection proceeded in the nasal direction where the medial fat pad is located

of the lateral part of the brow seen in these patients was not due to excess eyelid skin but to the age-related ptosis of the forehead and brow.

We reflected upon the possible reasons for these mistakes. The lack of time because of patient load and the laws and regulations limiting cosmetic surgery are the frequent causes of inadequate practical training in aesthetic surgery at many university departments of plastic surgery. Many of us must pick up the practical surgical guidelines from medical books. The illustrations of the surgical steps are usually made by artists and not by surgeons and often do not correspond to the realities of dissection in surgery. The discrepancy between the actual location of the medial fat pocket compared with the illustration and the occurrence of the aberrant partitioned lateral fat were probable causes of the unsatisfactory results in the aforementioned patients. We started to gather systematic records on the configuration of fat pads of the upper eyelids and the quantity of the periorbital fat.

Material and Methods

Fifty five consecutive patients (49 females and 6 males), operated on for blepharochalasis and protrusion of the periorbital fat by upper aesthetic blepharoplasty, including lipectomy, were reviewed between December 1988 and March 1990. All patients were of northern or central European origin. Their age ranged from 25 to 72 years, with a mean age of 46 years. None of them had previous eyelid surgery. All operations were done under local and dissociative anesthesia, using intravenous sedation of diazepam–ketamin followed by the local infiltration with 2% prilocaine with 5 μ g epinephrine/mL. The same

standard surgical technique for the upper blepharoplasty as described by Baker and Gordon [1] was followed each time. In 49 patients lower-lid blepharoplasty was performed during the same session. Only the fat from the upper eyelids was investigated. In two cases Barker's experiment [2] of injecting the methylene blue dye into the lateral fat pads was repeated. The specimens from the other four patients were sent for histologic examination. Van Gieson and hematoxyline–eosin were used as staining media.

Results

The amount of periorbital fat varies from individual to individual and has no correlation to the total amount of body fat. In 11 patients (20%) there were apparent quantitative differences in the amount of the resected fat from the right and left eyes. In one patient the medial fat pad could not be found, perhaps because of the local atrophy of the fatty tissue.

Two standard fat pockets, one medial and one lateral, corresponding to the textbook description [1, 5], were encountered in 31 patients (56%). The rest (24 patients [44%]) each had the lateral fat pad divided into two parts, i.e., they actually had three separate fat pockets in their upper eyelids (Fig. 1). The mean age of the patients with three fat pads was 42 years and for those with the classical two fat pads, 49 years.

Among the patients with three fat pads, 23 had an identical bilateral configuration of periorbital fat, and one had three fat pads in the one eyelid and only two pads in the other. The centrally located fat pad was, as a rule, either somewhat smaller than or equal in size to the lateral fat and could be seen partially

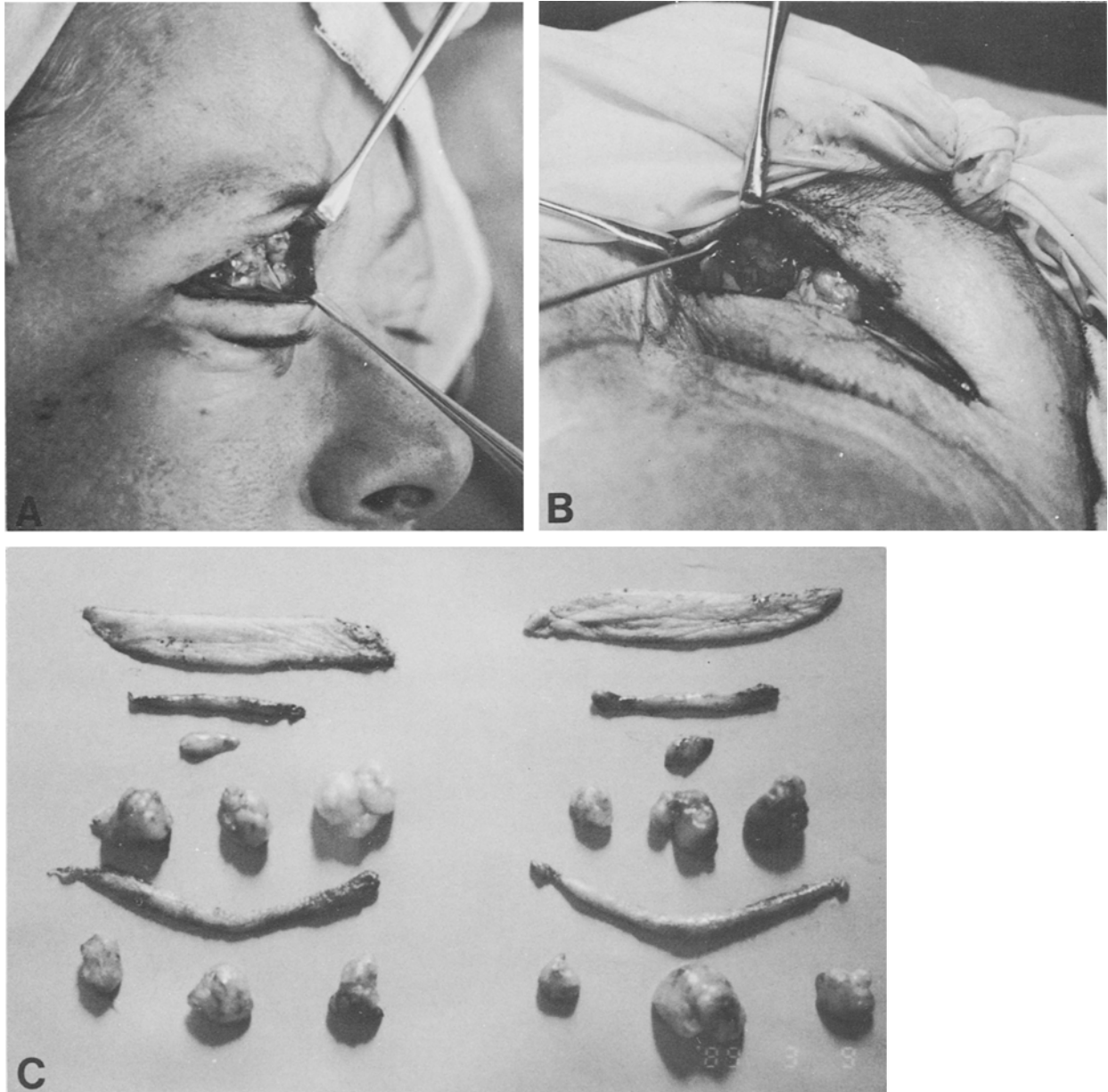


Fig. 2(A) Case LA: A clearly defined septum divides the lateral fat pad into two parts. **(B)** Case AS: Three fat pads were found in 44% of dissected upper eyelids. **(C)** Case LA: The tissues resected at blepharoplasty. From top to bottom: skin of the upper eyelid, orbicularis oculi muscle strip, orbital septum, fat pads of the upper eyelid, skin of the lower eyelid, fat pads of the lower eyelid

or even completely encased in its own individual sac (Fig. 2). Finally, in four cases the lateral fat pad consisted of two components. Besides the regular lateral fat body, there was a cauda protruding laterally into the outer third of the orbit and just inferior to the palpebral part of the lacrimal gland (Fig. 3). Such extension of the lateral fat was also described by Zide and Jelks [14].

Perioperative injection of the methylene blue into the lateral fat compartments confirmed the findings of Barker [2]. The dye stained only the fat in that

compartment (Fig. 4). The histologic examination performed on the fat pads (Fig. 5) showed that the medial fat pad had a considerable connective tissue component in the form of bands surrounding agglomerations of rather small fat cells. It contained filaments of sensory nerves and small blood vessels.

The central and the lateral fat accumulations were composed mainly of mature fat cells—adipocytes identical with the fat cells seen in the other parts of the body. These two fat pads had their own vascular net. The blood vessels were seen in the periphery of



Fig. 3. Case IG: The rare case of the presence of the cauda of fat extending from the lateral fat pad laterally inferior to the lacrimal gland.

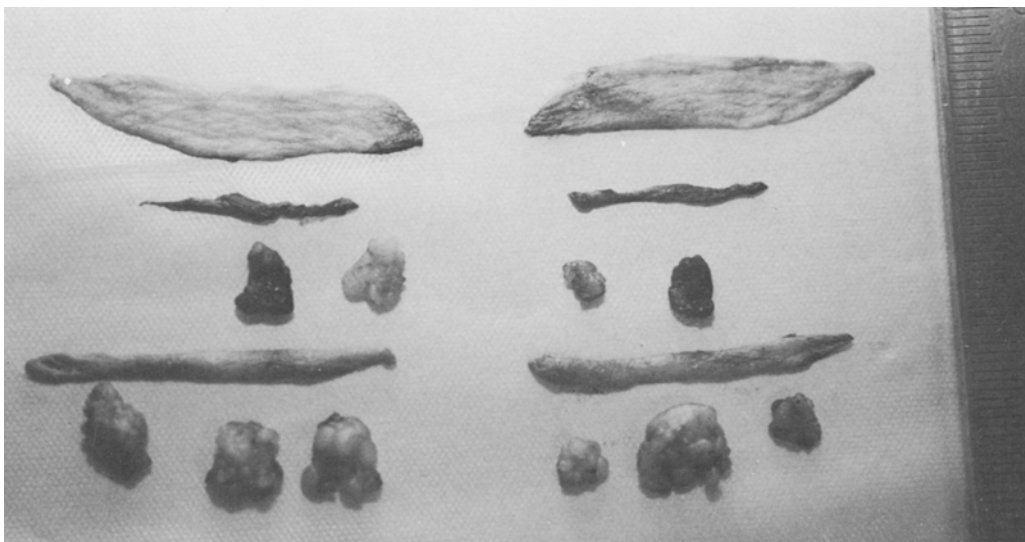


Fig. 4. Case IC: After perioperative injection of methylene blue into the lateral fat compartments, the dye did not spread to the medial compartments

the lobules of fat. The filaments of the sensory nerves here were much sparser compared with the density of filaments in the medial fat and could be visualized only by using special histochemical stain for the nerve tissue S-100.

Discussion

The literature on the periorbital anatomy was reviewed. At present, the conception that the perior-

bital fat in the upper eyelid is divided into two parts and confined in two compartments is generally accepted [1, 5]. However, others have sometimes also observed the presence of a third fat compartment in the upper eyelid. Smith [11] writes about two compartments but in an illustration clearly depicts three. Courtiss [6] describes the medial, central, and lateral segments of "intraorbital" fat of the upper eyelid, but on the adjacent drawing he displays only the medial and central fat. Finally, Gradinger [8] mentions the medial, central, and lateral fat pockets,

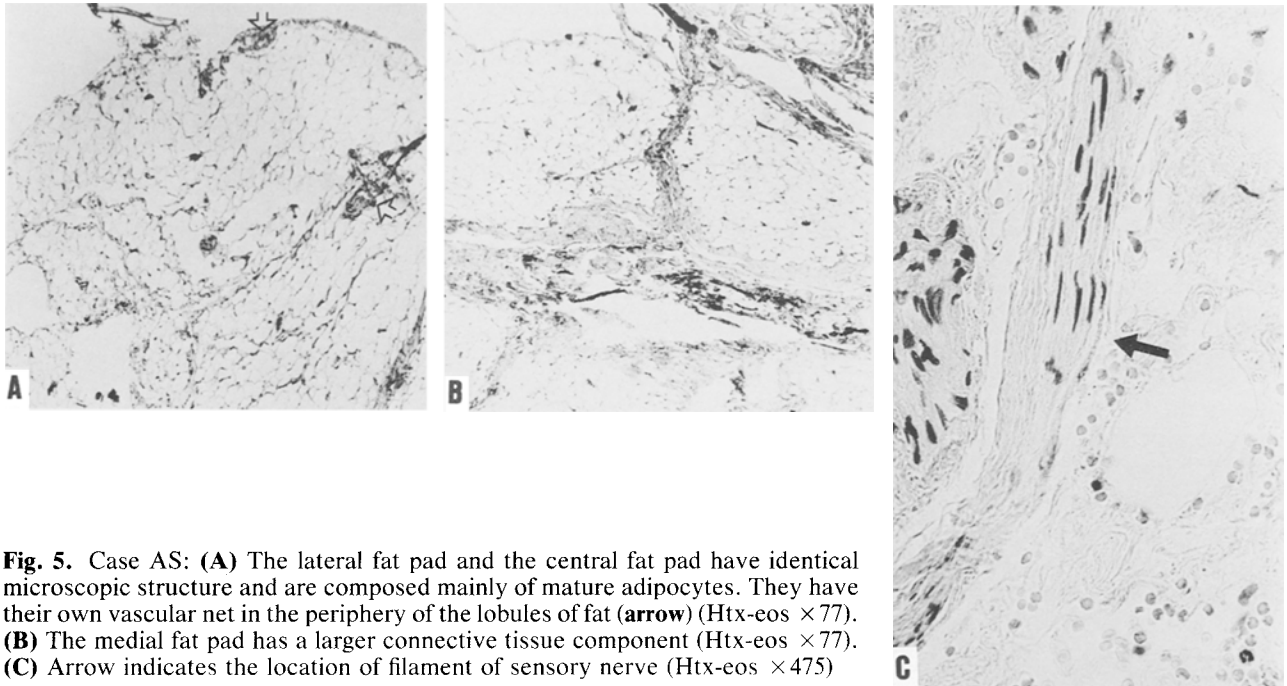


Fig. 5. Case AS: **(A)** The lateral fat pad and the central fat pad have identical microscopic structure and are composed mainly of mature adipocytes. They have their own vascular net in the periphery of the lobules of fat (arrow) (Htx-eos $\times 77$). **(B)** The medial fat pad has a larger connective tissue component (Htx-eos $\times 77$). **(C)** Arrow indicates the location of filament of sensory nerve (Htx-eos $\times 475$)

and his perioperative photographs indicate the presence of both two and three fat compartments variants, as described in the present study.

The terms lateral fat pad and central fat pad of the upper eyelid are used interchangeably in the literature. The term central fat pad is incorrect if only two fat pads are present, since "central" suggests the presence of two other fat pads. On the other hand, the region of the upper eyelid can be divided into the three segments. The medial segment contains the medial fat compartment, the central segment the other one or sometimes two fat pads, and the lateral segment the lacrimal gland.

Owsley [10] described a lateral fat pad in the upper eyelid located under the orbicularis muscle and, in contrast to the other fat compartments, external to the orbital septum. This fat positioned close to the lacrimal gland caused a lateral bulge on the upper eyelids. It was never encountered in the present series and thus the findings of Owsley cannot be confirmed here.

Following carried dye injections into the lateral fat compartment (Fig. 4), we are even more skeptical of the widely cited study of Hugo and Stone [9] who injected methylene blue into the individual "classic" compartments in cadavers and then dissected the periorbital fat. They concluded that the fat pads are interconnected and not encapsulated within separate compartments. That might have been true in the specimens from the morgue, but anyone who does blepharoplasty knows that the periorbital fat is compartmentalized. A possible explanation of the obser-

vation of the lack of compartmentalization [9] is the age-dependent progressing atrophy of the connective tissue. Patients older than about 50 generally have looser and thinner tissues in the orbital region. This tendency of decreased delineation of the compartments' septa was reflected in the mean age difference which was calculated to be 49 years for patients with two fat pads and 42 years for patients with three fat pads. Consequently, dissection and localization of fat pads were easier with older individuals.

Courtiss stated [6] that the lateral fat pad of the upper eyelid is an avascular structure and thus could be excised simply without preceding coagulation. Our histologic observations proved the rationale of coagulation of the blood vessels in all of the fat pads of the upper eyelid. Leaving the operative field "dry" is crucial in all periorbital surgery because postoperative hemorrhage is a dreadful complication.

Another misconception perpetuated in the literature is the description of the superior oblique muscle or its tendon as a structure that divides the medial and the lateral fat pads in the upper eyelid [4, 6]. Subsequently, the surgeon is warned not to injure this muscle while removing the medial fat pad [13]. This misconception is an erroneously drawn parallel to the anatomic relationship of the inferior oblique muscle with the medial and the central fat pads in the lower eyelid. This muscle is a landmark that divides these fat pads and is clearly visible during a lower-lid blepharoplasty.

It is unlikely that the superior oblique muscle will be seen during the normal blepharoplasty dissection [7] unless one searches for it. To do this the fascia under the orbital rim has to be divided, and one can then reach the tendon of the superior oblique muscle at its trochlea. According to anatomy atlases, e.g., Sobotta and Becher [12], the tendon of the superior oblique muscle lies directly on the bulbus oculi and under the rectus superior muscle and the levator muscle aponeurosis. The periorbital fat lies above (the lateral fat pad) or medially (the medial fat pad) to the levator aponeurosis.

Our study showed that in nearly half of the cases we studied the periorbital fat of the upper eyelid was confined within three compartments, and in the remainder of the cases, within two compartments. Histologically and genetically this third fat pad belongs to the fat accumulation in front of the levator muscle aponeurosis and is normally located between the medial fat pad and the lateral fat pad proper. Therefore, it is an accessory lateral fat pad, but, for the sake of clarity, it seems appropriate to call it a central fat pad of the upper eyelid.

We wished to make the less experienced surgeons or those who perform blepharoplasty infrequently aware that the configuration of the upper eyelid fat can vary. The novice surgeon should keep in mind that after he has removed two fat pads in the upper eyelid, there may be a third left. The medial fat compartment of the upper eyelid is the most difficult one to find and the easiest one to miss. A thorough knowledge of the orbital anatomy will allow the surgeon to perform a technically excellent blepharoplasty and achieve consistently good results.

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References

1. Baker TJ, Gordon HL: Blepharoplasty. In: Surgical Rejuvenation of the Face. St. Louis: CV Mosby, 1986, pp 268–269
2. Barker DE: Dye injection studies of intraorbital fat compartments. *Plast Reconstr Surg* 59:82, 1978
3. Bourguet J: La chirurgie esthétique de l'oeil et des paupières. *Monde Med* 725–731, 1929
4. Castanares S: Blepharoplasty for herniated infra-orbital fat: Anatomic basis for new approach. *Plast Reconstr Surg* 8:46, 1951
5. Castanares S: Surgery of the eyelids. In: Grabb WC, Smith JW (eds): *Plastic Surgery*, 3rd ed. Boston: Little, Brown, 1979, pp 404–409
6. Courtiss EH: Alternatives in esthetic blepharoplasty. *Clin Plast Surg* 8:739, 1981
7. Gordon HL: Personal communication, 1989
8. Gradinger GP: Cosmetic upper blepharoplasty. *Clin Plast Surg* 15:289, 1988
9. Hugo NE, Stone E: Anatomy of blepharoplasty. *Plast Reconstr Surg* 53:381, 1974
10. Owsley JQ: Resection of prominent lateral fat pad during upper lid blepharoplasty. *Plast Reconstr Surg* 65:4, 1980
11. Smith JW: Cosmetic surgery of the ageing face. In: Grabb WC, Smith JW (eds): *Plastic Surgery*. Boston: Little, Brown, 1973, pp 562–567
12. Sobotta J, Becher H: Die Augenmuskeln. In: *Atlas der deskriptive Anatomie des Menschen*. München: Urban & Schwarzenberg, 1957, bd 3, pp 296–304
13. Zide BM: Anatomy of the eyelids. *Clin Plast Surg* 8:623, 1981
14. Zide BM, Jelks GW: The eyelids. In: *Surgical Anatomy of the Orbit*. New York: Raven Press, 1985 p 25