The Surgical Anatomy of the Fat in the Upper Eyelid Medial Compartment

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The surgical anatomy of the upper eyelid fat in the medial compartment was investigated in 388 patients and in 12 cadavers. We found two individual fat pads comprising this compartment. The difference among the investigated cases was found to be the extent of their separation. In 16.7 percent of the cadavers' eyelids the fat pads were entirely separated, in 45.8 percent they were separated to about half their length, while in 37.5 percent only the tips were separated. Among the patients in whom only the protruded fat was inspected, 59.8 percent of the fat pads were separated, and in the rest, only the tips were isolated. On histologic examination we could always identify two well-circumscribed fat pads, each surrounded by a fibrocollagenous tissue. At the level of their interconnection, a loose fibroareolar tissue was found. In practice, during blepharoplasty, both fat pads should be addressed in order to achieve the expected results. (*Plast. Reconstr. Surg.* 99: 658, 1997.)

From the pioneering description of Bourguet[1] and Castanares,[2] we have learned that the upper eyelid contains two fat compartments, while the lower eyelid contains three. There is less consensus regarding the number of the fat pads, especially in the upper eyelid. In 1991, Niechajev and Ljungqvist[3] described the "central (third)" fat pad of the upper eyelid. The incentive for their study was three requests for secondary upper blepharoplasties. They emphasized that the primary procedures were performed by three different well-known plastic surgeons. The medial fat compartment of the upper eyelid was found to be left behind in those three cases. In a clinical study on 55 consecutive patients, they found two fat pads in 56 percent of the upper eyelids, while three different fat pads were depicted in 44 percent. They concluded that the third fat pad is anatomically and histologically an accessory medial extension of the lateral fat pad. They called this extension the central (third) fat pad. Independently, we faced the same problem when a few patients, some our own and some who were operated on by other expert surgeons, came to our clinic with residual fullness in the medial part of their upper eyelids. Reexploration of their medial compartments revealed residual fat, although we knew that this compartment had been addressed already. It was our motivation to investigate more meticulously the content of the medial compartment in our patients as well as in cadavers.

Materials and Methods

Between March of 1989 and July of 1995, 388 consecutive patients undergoing primary aesthetic upper eyelid blepharoplasties, including removal of protruding periorbital fat, were investigated comprehensively for the composition of their medial fat compartments. Their ages ranged from 39 to 75 years, with a mean of 56 years. A total of 198 patients underwent rhytidectomy, and 224 patients had lower blepharoplasty concomitantly with their upper eyelid surgery. The eyelid surgeries were performed under local and dissociative anesthesia. The local anesthesia was achieved by infiltration of lidocaine HCl 2% with epinephrine 1:100,000. The standard surgical technique for upper blepharoplasty described by Rees[4] was performed, with careful attention paid to the medial fat compartment of the upper eyelid. In addition, 8 preserved and 16 fresh upper eyelids of 12 cadavers were investigated for the content of their medial compartments. Their ages ranged

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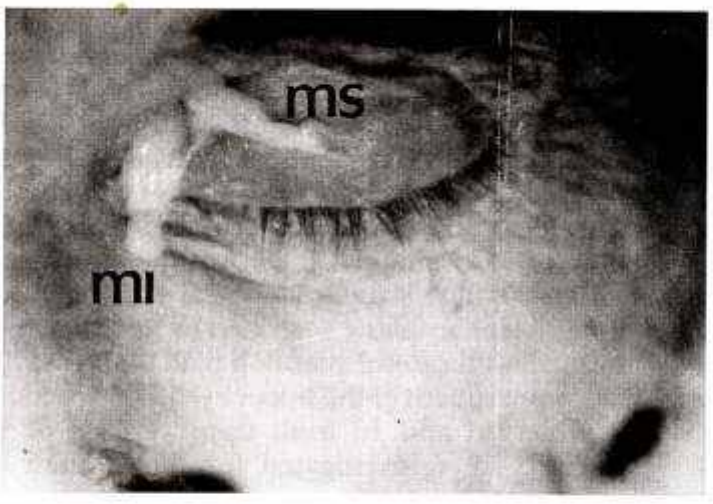
from 18 to 81 years, with a mean of 71 years. Histologic examination of the fat taken out from 5 cadavers and 5 patients was performed.

RESULTS

The medial compartment contents of 24 upper eyelids of 12 cadavers and 776 upper eyelids of 388 patients were investigated. There was a consistent finding that the medial compartment always contained two well-circumscribed fat pads. The difference between the studied eyelids was the extent of separation of the two fat pads. In the cadavers we could meticulously analyze the morphology of the fat pads. In 4 eyelids (16.7 percent), the medial compartment included two entirely separated fat pads (Fig. 1, *left*). By following the course of the fat pads deep into the orbita, we could observe that the medial pad was oriented toward the lower part of medial orbital wall; we termed it the *medial inferior pad*. The lateral fat pad was oriented toward the medial corner of the upper orbital wall; thus it was termed the *medial superior pad* (Fig. 1, *left*). In 11 (45.8 percent) of the eyelids, the fat pads were found to be separated to only about half their length; their lower half was confined within a delicate fibroareolar tissue, making what we called the *pantalon* (trousers) *sign* (Fig. 2, *left*). They could be separated easily by grasping them apart with forceps (Fig. 2, *right*). In the remaining 9 (37.5 percent) eyelids, only the tips of the two fat pads were separated, while the rest of their length was surrounded by the thin fibroareolar tissue. Grossly, there was no difference between the two fat pads, not in their dimensions nor in their color and consistency. In 10 (42 percent) of the cadaver eyelids, the tip of the lateral fat pad seemed to partially overlap the tip of the medial fat pad when the septum orbitale was opened.

In our 388 patients undergoing upper blepharoplasties, we were restricted from dissecting the fat pads entirely into the orbital depth and thus were able only to investigate the protruded part. Consequently, only two groups were defined. In 464 (59.8 percent), two separate fat pads were clearly identified in the medial compartment (Fig. 3). Occasionally, in their lower part, the two fat pads seemed to be interconnected, making the pantalon sign. In the other 312 (40.2 percent) eyelids observed, only the tips of the fat pads seemed to be separated. After realizing the existence of two fat pads, we were very careful to address both of them, and no recurrences were observed from that time on. There was no correlation between the amount of the fat excised from the eyelids and the body habitus. There were quantitative differences in the amount of the resected fat from the right and the left eye among 90 (23 percent) of the patients. We could see that the extent of separation of the fat pads was not always the same in the right and the left eyelids of the same patient.

Fat from the eyelids of five cadavers and five patients resected from different levels was taken for histologic examination. The samples



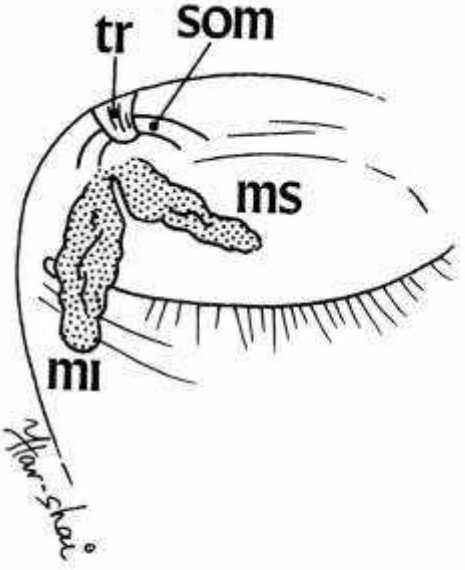


FIG. 1. (*Left*) The medial inferior (*mi*) and the medial superior (*ms*) fat pads in the medial compartment of the left upper eye lid are demonstrated in a 63-year-old cadaver. (*Right*) Schematic representation. The relationship of the medial fat pads to the trochlea (*tr*) and the superior oblique muscle (*som*) is shown.

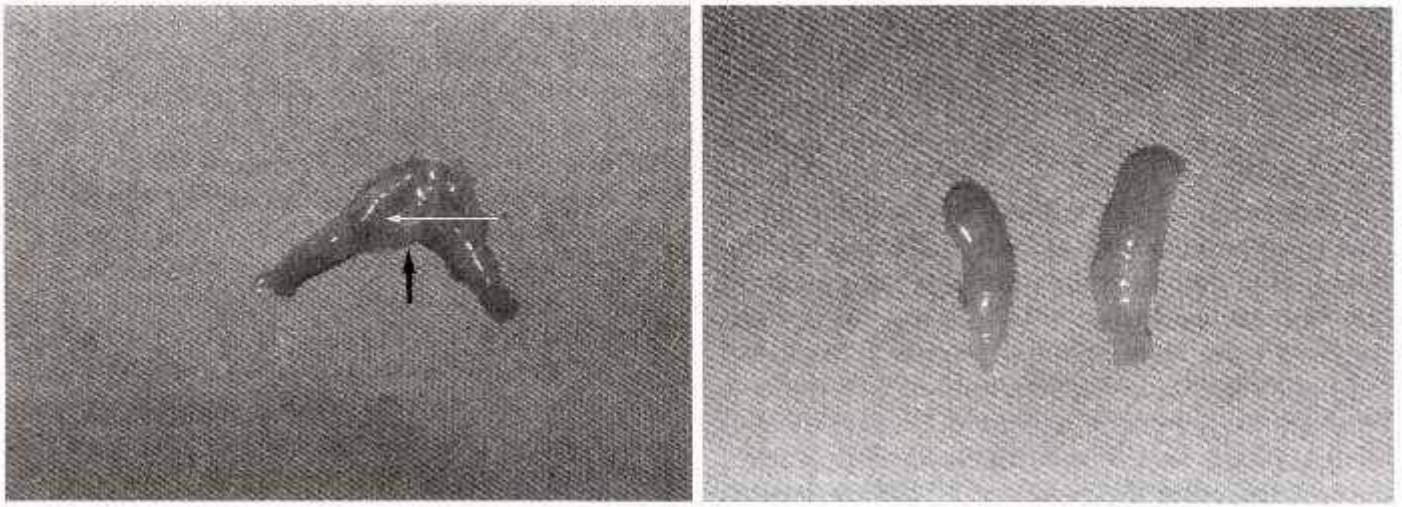


FIG. 2. (*Left*) Fat pads dissected out from the medial compartment of a 28-year-old female cadaver. The two fat pads are interconnected by a loose fibroareolar tissue (*black arrow*) to about half of their length. The picture is turned upside down to demonstrate the pantalon sign. (*Right*) After separation of the fat pads.

were stained with hematoxylin and eosin. The histologic sections showed two separate fatty structures, regardless of the level of resection, each of them composed of adipose tissue separated by small strands of paucicellular fibrous tissue containing small blood vessels (Fig. 4). A small number of elastic fibers were demonstrated by Weigert elastic stain as well as a few nerve fascicles stained by S100 stain in the fibrous tissue septa. Each specimen was exclusively surrounded by delicate fibers of collagenous fibrous tissue, shown by the Masson trichrome stain. The individuality of each fat pad could be demonstrated even in multiple sections performed at the lower level, in which the fat pads seemed macroscopically to be one mass (see Fig. 3). Each of the fat pads was well circumscribed by the fibrous tissue described above, and they were connected by a tiny, delicate, loose fibroareolar tissue.

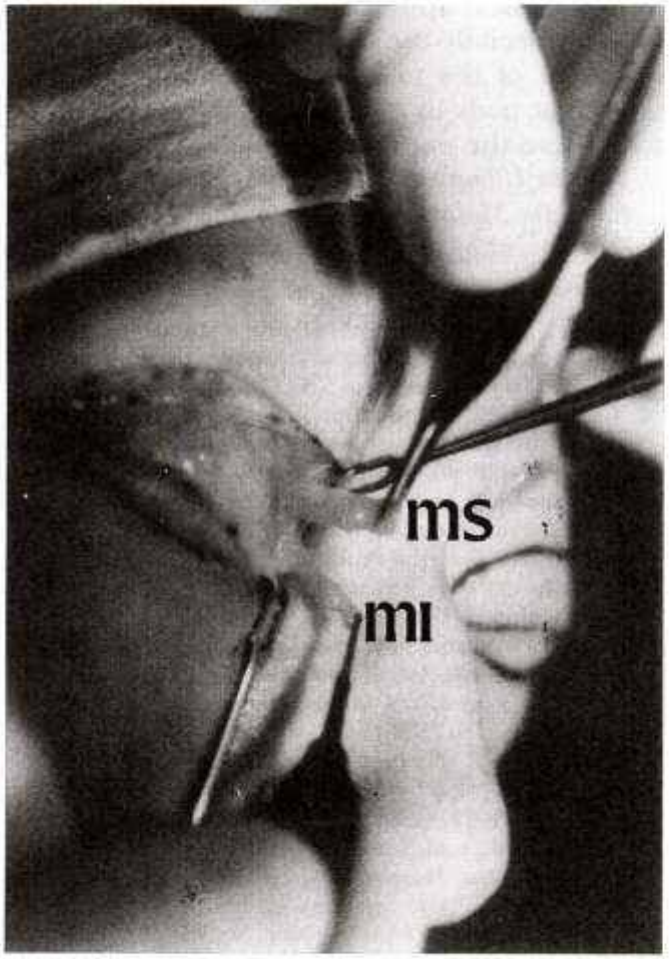


FIG. 3. Intraoperative demonstration of the two well-defined fat pads (*mi* and *ms*) composing the medial compartment in a 58-year-old woman.

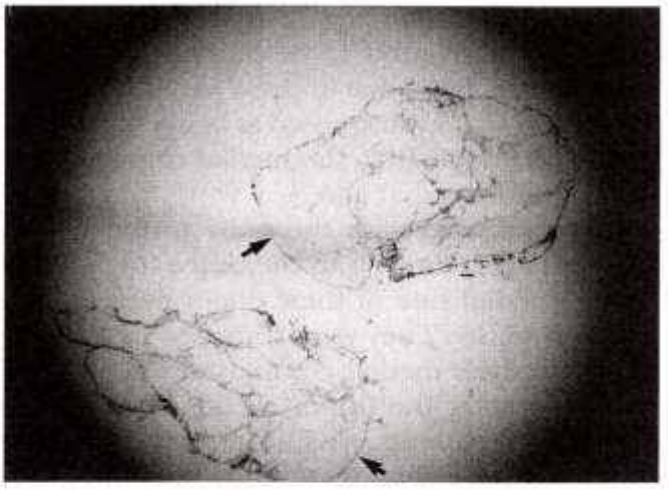


FIG. 4. Histologic cross section through the lower third of the medial fat pad at the level demonstrated by the white arrow in Figure 2 (*left*). Two individual fat pads, each of them well circumscribed by its own fibrous envelope (*arrows*), are clearly demonstrated. The adipose tissue within the fat pad is separated by fibrous septa. The interconnecting areolar tissue was destroyed during the processing of this slide (H&E stain; ×4).

Discussion

It is well accepted that the periorbital fat is confined within compartments.[4-6] Two exist in the upper eyelid and three in the lower eyelid. The compartments are separated by a thin fibrous septum and by the inferior oblique muscle in the lower eyelid. In both eyelids the fat in the medial compartment is more pale, granular, fibrous, and vascular in comparison with the fat in the other compartments.[4] The concept of "compartmentalization" of the periorbital fat is generally accepted and clinically useful. Hugo and Stone[7] challenged this concept by injecting the orbits of 27 cadavers with Evans blue dye. Dissections revealed generalized diffusion of the dye throughout the orbit, leading them to believe that there is no true compartmentalization. Barker[8] injected the dye into each compartment and found that only the fat in the injected compartment was stained. Other authors challenging the two classic compartments of the upper eyelid wrote about three segments of intraorbital fat in the upper eyelid (medial, central, and lateral), but on the accompanying drawing, only the medial and the lateral compartments were displayed.[9] Gradinger[10] also has mentioned three fat pockets in the upper eyelid. Niechajev and Ljungqvist[3] tried to solve these controversies by describing three fat pads in 44 percent of their investigated patients and referred to the third fat pad as an accessory medial extension of the lateral fat pad. It also was stated that in three patients who had returned for revision, the fat in their medial compartments was found to be left behind. These authors speculated that in these patients the central fat pad was misdiagnosed as being the medial fat pad; consequently, the medial compartment was not addressed at all.

We were faced with the same problem in a few patients returning to the office for fullness on the medial side of their upper eyelids after blepharoplasty. They were found to have residual fat in their medial compartments.

By dissecting the upper eyelids of 12 cadavers and 388 patients, we found that the medial compartment contains two individual fat pads. We termed them *medial superior* and *medial inferior,* according to their orientation. The differences between the cases were limited to the extent of separation of the fat pads. In the cadaver eyelids a complete dissection of the fat pads could be performed, and three groups could be identified. In 16.7 percent of the eyelids the medial fat pads were found to be entirely separated, in 45.8 percent they were separated to about half their length, while in 37.5 percent only the tips were separated. Among the patients, 59.8 percent of the medial fat pads were found to be separated, and in the rest, only the tips were isolated. The histologic examinations confirmed the clinical impression that the fat in the medial compartment is built of two individual fat pads, each surrounded entirely by a delicate collagenous fibrous tissue. Even the macroscopically unseparated parts were microscopically composed of two well-circumscribed fat pads. For practical purposes, we can postulate some clarification to the controversies regarding the fat distribution in the upper eyelids to be as follows: The fat of the upper eyelid is distributed between two compartments (in that we agree with most of the authors). The lateral compartment contains two fat pads in about 44 percent of the cases, and the medial compartment contains two fat pads, separated to different degrees, according to our observations.

The clinical application is obvious: The surgeon, especially the inexperienced one, has to be aware of the possible existence of two different fat pads in each compartment in order to achieve the expected results.

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