

The Orbicularis Retaining Ligament of the Medial Orbit: Closing the Circle

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Background: There exists some ambiguity regarding the exact anatomical limits of the orbicularis retaining ligament, particularly its medial boundary in both the superior and inferior orbits. Precise understanding of this anatomy is necessary during periorbital rejuvenation.

Methods: Sixteen fresh hemifacial cadaver dissections were performed in the anatomy laboratory to evaluate the anatomy of the orbicularis retaining ligament. Dissection was assisted by magnification with loupes and the operating microscope.

Results: A ligamentous system was found that arises from the inferior and superior orbital rim that is truly periorbital. This ligament spans the entire circumference of the orbit from the medial to the lateral canthus. There exists a fusion line between the orbital septum and the orbicularis retaining ligament in the superior orbit, indistinguishable from the arcus marginalis of the inferior orbital rim. Laterally, the orbicularis retaining ligament contributes to the lateral canthal ligament, consistent with previous studies. No contribution to the medial canthus was identified in this study.

Conclusions: The orbicularis retaining ligament is a true, circumferential “peri-orbital” structure. This ligament may serve two purposes: (1) to act as a fixation point for the orbicularis muscle of the upper and lower eyelids and (2) to protect the ocular globe. With techniques of periorbital injection with fillers and botulinum toxin becoming ever more popular, understanding the orbicularis retaining ligament’s function as a partitioning membrane is mandatory for avoiding ocular complications. As a support structure, examples are shown of how manipulation of this ligament may benefit canthopexy, septal reset, and brow-lift procedures as described by Hoxworth. (*Plast. Reconstr. Surg.* 121: 994, 2008.)

There exist several possibilities for manipulation of the orbicularis retaining ligament for periorbital rejuvenation. Despite its potential significance, there is some controversy in the literature as to the actual dimensions of this structure, specifically, as to its medial limit in both the superior and inferior orbits.

The description of the orbicularis retaining ligament is an interesting story, with suggestions of its existence being present in the literature several decades ago. To be historically accurate, Hargiss¹ offered the first description of fascia from the inferior rim traveling to cheek skin in 1963, later referred to as suborbicularis fascia by Putterman in 1973.² It was Raul Loeb who was the first to

anatomically document a “septum that separates the orbital area from the nasal and cheek areas” during his technique of orbital fat transposition published in 1981.³ Without referring to it as such, Loeb was very likely releasing the orbicularis retaining ligament to transpose fat beneath the orbit cheek crease.

Loeb ascribed a protective role to this membrane; he felt it prevented spread of nasal infection to the face and eyes. Pessa performed dye injection studies that supported this concept of a protective role.⁴ Kikkawa et al. looked at this area from the perspective of possible superficial musculoaponeurotic system attachments to the orbit, and labeled this membrane the orbitomalar ligament in 1996.⁵

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Received for publication June 2, 2006; accepted August 16, 2006.

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DOI: 10.1097/01.prs.0000299941.62645.4e

Disclosure: *The authors have no financial interest in any company or licensing agreement that relates to this research.*

Muzaffar et al. are credited with applying the currently accepted nomenclature “orbicularis retaining ligament” to this structure in 2002, in keeping with its origin from bone and insertion to muscle.⁶ Their study, combined with the previous anatomical treatise by Moss et al.,⁷ added an enormous amount of information to the understanding of this anatomy. These studies were the first to show a membrane in the *superior orbit*, to define its contribution to the lateral canthus as a lateral orbital thickening, and to identify its exact architecture as a bilaminar structure, the last observation having eluded all previous investigators.

Despite these studies, some anatomical questions remain. One question is whether the orbicularis retaining ligament spans the entire circumference of the orbit as suggested by lower lid studies,^{4,5} or whether it only partially encircles the orbit as shown by other authors.^{6,7} The exact origin of the orbicularis retaining ligament along the orbital rim has not been mentioned, nor has its relationship to the orbital septum and arcus marginalis been clarified. The following fresh cadaver study was performed to address these questions.

MATERIALS AND METHODS

Sixteen fresh hemifacial cadaver dissections were performed in the anatomy laboratory. None of these specimens had sustained soft-tissue trauma or had previous facial surgery, with the exception of lens implants. A preliminary dye injection test was performed to confirm the position of the orbicularis retaining ligament in the superior orbit, dye diffusion having been used in the inferior orbit in previous work.⁴ There were five male and three female cadavers in this study, with an age range from 19 to 91 years. Orbital dissection was performed by leaving a rim of pretarsal skin in the upper and lower eyelids to maintain the integrity of the lid margin.

Dissection proceeded from lateral to medial in both the upper and lower orbits. This sequence of dissection was used because it is easiest technically to identify the orbicularis retaining ligament at the lateral orbital rim. The orbicularis retaining ligament was identified in its suborbicularis location using the vertical spread technique. The ligament was traced medially along the orbital rims and identified at its insertion near the medial canthus. The relationship of the orbicularis retaining ligament to the orbital septum, arcus marginalis, corrugator muscles, and orbital rim was noted.

Gross anatomical dissection was performed with loupe magnification. Magnification of 3.5× to 5× was used for identification of the ligament.

The Zeiss operating microscope (Carl Zeiss, Oberkochen, Germany) was used for high-power dissection of the orbicularis retaining ligament along the orbital rim and to closely confirm its relationship to the orbital septum. Photographic documentation was achieved with the Canon digital 20D system (Canon, Tokyo, Japan) and a 50-mm macro lens; images were scanned into Photoshop CS2 (Adobe Systems, Inc., San Jose, Calif.).

RESULTS

Sixteen facial halves were dissected assisted by loupe and microscopic magnification. The circumferential nature of the orbicularis retaining ligament was consistent in every specimen. The orbicularis retaining ligament was noted to be continuous from the medial orbit to the lateral orbit in both upper and lower eyelids (Fig. 1, *above, left and below*). The orbital septum can be seen to insert onto the inferiormost part of the orbital rim; the orbicularis retaining ligament inserts 2 to 3 mm above this point (Fig. 1, *above, right*).

The orbicularis retaining ligament was always noted to be distinct from the orbital septum (Fig. 2, *left*); the two merge onto the orbital rim at the thickening called the arcus marginalis. In the superior orbit, two membranes were occasionally noted, in accordance with the previously described bilaminar nature of the orbicularis retaining ligament.⁶

Dissections of the lateral half of the upper and lower orbits confirmed the previously noted insertion of the orbicularis retaining ligament into the lateral canthus. The lateral orbital thickening was noted to arise from the orbicularis retaining ligament and to be confluent with the superficial lateral canthal ligament, in accordance with findings described by Moss et al.⁷ Observations from our dissections indicated that the orbicularis retaining ligament was more lax and greater in length laterally (Fig. 2, *right*), whereas medially it was a more taut, shorter structure (Fig. 2, *left*). Therefore, medially it may function as a supportive “hammock” for the brow depressor muscles. Ancillary dye studies confirmed previous work that confirmed that the orbicularis retaining ligament displays relative impermeability.⁴

DISCUSSION

This study clarifies three points regarding the orbicularis retaining ligament: (1) the orbicularis retaining ligament is a circumferential, periorbital structure; (2) the orbicularis retaining ligament of the superior orbit has similar impermeability characteristics as has been shown in

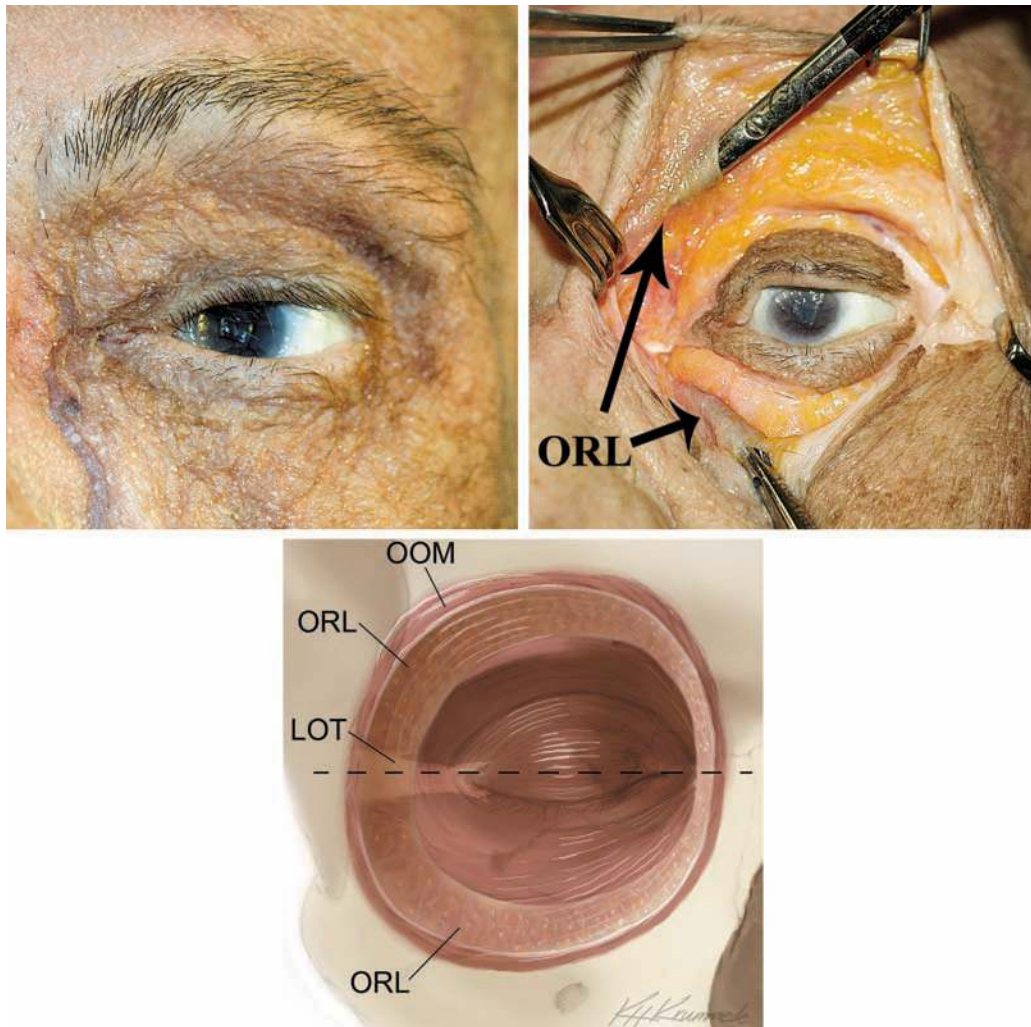


Fig. 1. (Above, left) Predissection photograph of an 88-year-old man. The dissection technique to approach the orbicularis retaining ligament is similar to what is used clinically in the operating room. The orbicularis retaining ligament is most easy to identify laterally using the vertical spread technique, after which it can be traced medially along the orbital rims. (Below) Schematic depicting the orbicularis retaining ligament (ORL) as a “circumferential” structure of the orbit that follows the orbicularis oculi muscle (OOM) fibers, and is associated with the lateral orbital thickening (LOT). (Above, right) The orbicularis retaining ligament of the medial orbit is seen clearly in both the superior and inferior orbits. The orbicularis retaining ligament is separate from the orbital septum. The orbicularis retaining ligament spans the entire circumference of the orbits from the medial to lateral canthus.

the inferior orbit; and (3) the orbicularis retaining ligament of the superior orbit arises 2 to 3 mm above the orbital rim in the mid orbit. These seemingly minor points have important ramifications for clinicians.

It may seem of academic interest only whether or not the orbicularis retaining ligament acts as a partitioning membrane. However, if botulinum toxin is injected directly at the lower edge of the infraorbital rim, the patient may develop elevator paralysis and eyelid ptosis (Fig. 3, left). If, in con-

trast, botulinum toxin is injected several millimeters above the inferior edge of the rim (above the origin of the orbicularis retaining ligament), levator dysfunction is much less likely (Fig. 3, right). In this scenario, the function of the orbicularis retaining ligament as a partitioning membrane becomes important to the practicing clinician, as does knowledge of the precise origin of this ligament in reference to the edge of the supraorbital rim. Figures 4 and 5 shows this anatomy in a schematic fashion.

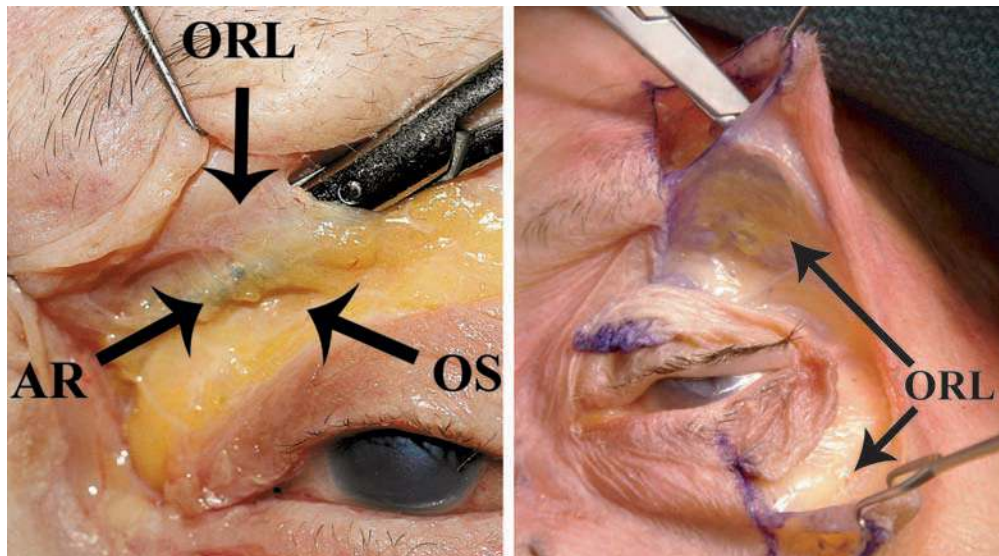


Fig. 2. (Left) The orbicularis retaining ligament in a 91-year-old man illustrates how this structure is separate from the orbital septum (OS). The orbital septum has an origin on the inferior edge of the orbital rim. The orbicularis retaining ligament has a higher origin 2 to 3 mm superior to the inferior rim edge. The fusion point of the orbicularis retaining ligament (ORL) and the orbital septum is referred to simply as the arcus marginalis (AR), which is nothing more than the common fusion line of these structures and periosteum from the bones that form the orbital aperture. The medial orbicularis retaining ligament is short and taut. (Right) The orbicularis retaining ligament is long and lax laterally, which may partially explain the phenomenon of “lateral hooding.”

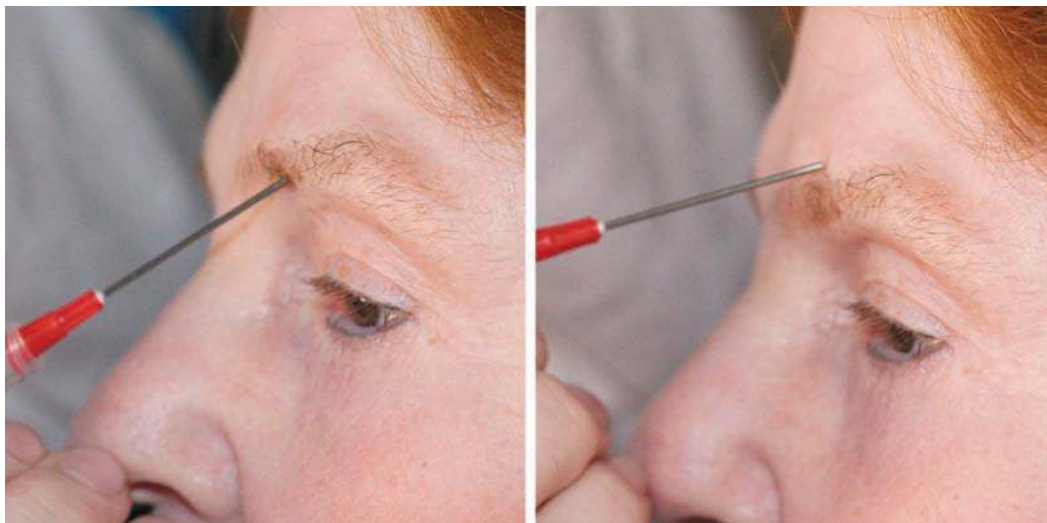


Fig. 3. (Left) If one only palpates the inferior edge of the supraorbital rim and injects neuroparalytic agent, this may lead to levator paralysis. This needle entrance point is below the origin of the orbicularis retaining ligament at the mid orbit. (Right) Proper needle placement, above the origin of the orbicularis retaining ligament, ensures that injected fluid is partitioned away from the levator mechanism. Understanding of this anatomy is important when one considers any periorbital injection, whether it be neuroparalytic agents or fillers.

As a retaining ligament, enough information exists to begin using the orbicularis retaining ligament in surgical techniques. Muzaffar et al. suggested release of the orbicularis retaining ligament and lateral orbital thickening for proper

redraping of the orbicularis muscle during mid-face lift.⁶ This idea, the concept that orbicularis muscle can be repositioned more effectively after release of the orbicularis retaining ligament, enables the technique of orbicularis retaining liga-

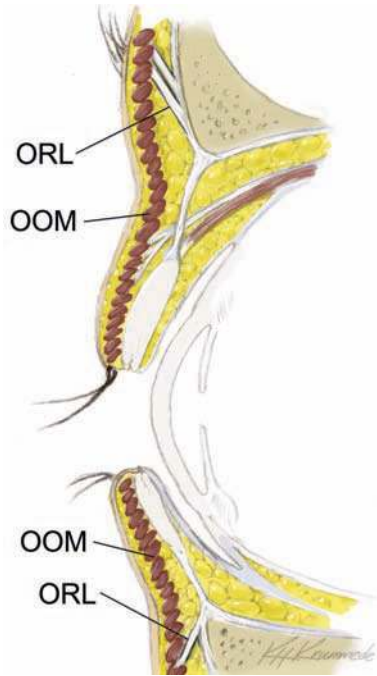


Fig. 4. Schematic drawing of the relationship of the orbital septum and the orbicularis retaining ligament. The orbicularis retaining ligament arises from orbital rim several centimeters above the inferior edge. The arcus marginalis is really nothing more than a fused area of the orbital septum, orbicularis ligament, and periosteum, and lies between these two structures. *OOM*, orbicularis oculi muscle; *ORL*, orbicularis retaining ligaments.

ment release to be applied creatively in many other ways.

Canthopexy by release and resuspension of the orbicularis retaining ligament has been used by Hoxworth.⁸ This obviates the need to disrupt the lateral canthal tendon (Fig. 6). Once the orbicularis retaining ligament has been released from the inferior orbital rim, the overlying orbicularis muscle is essentially free: it can be placed under any amount of tension desired. In situations where canthal position is unaffected, such as ectropion or lamellar scarring, Hoxworth's technique of orbicularis retaining ligament release and fixation without canthal disruption may provide an alternative method of securing the lower lid.⁸

The above technique can be performed simultaneously with fat transposition of the lower eyelid. The orbicularis retaining ligament can be simply transected to allow for intraorbital fat to fill the suborbital hollow (Fig. 7). Almost by definition, once the orbicularis retaining ligament is transected, the position of the orbital septum has to be reset, because the orbicularis retaining ligament is the inferior (caudal) anatomical boundary of lower eyelid fat (Fig. 7, left). Hamra described his approach using release of the arcus marginalis, which is a fusion plane along the orbital rim.⁹ Recently, Barton et al. have critically evaluated this technique, its indications, and its long-term results.¹⁰ Knowledge of orbicularis retaining liga-

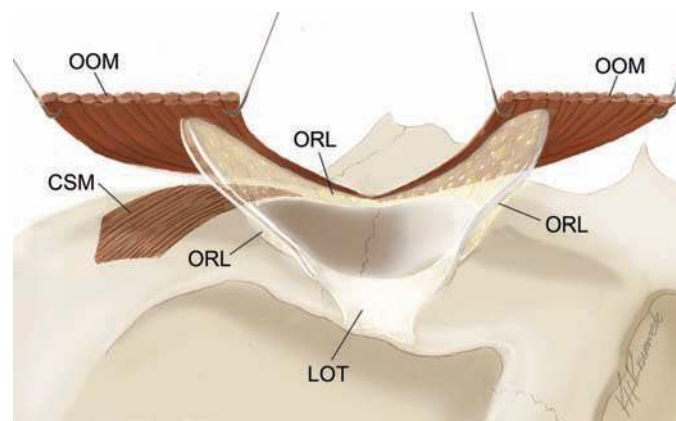


Fig. 5. A schematic as viewed from the lateral orbital rim toward the nasal bones with the orbicularis oculi muscle (*OOM*) suspended by hooks to demonstrate the length and size differential between the lateral and medial orbicularis retaining ligaments (*ORL*). The lateral orbicularis retaining ligament is longer than the medial in both the superior and inferior orbits. Note the relationship between the orbicularis retaining ligament, the corrugator supercilii muscle (*CSM*), and the lateral orbital thickening (*LOT*).

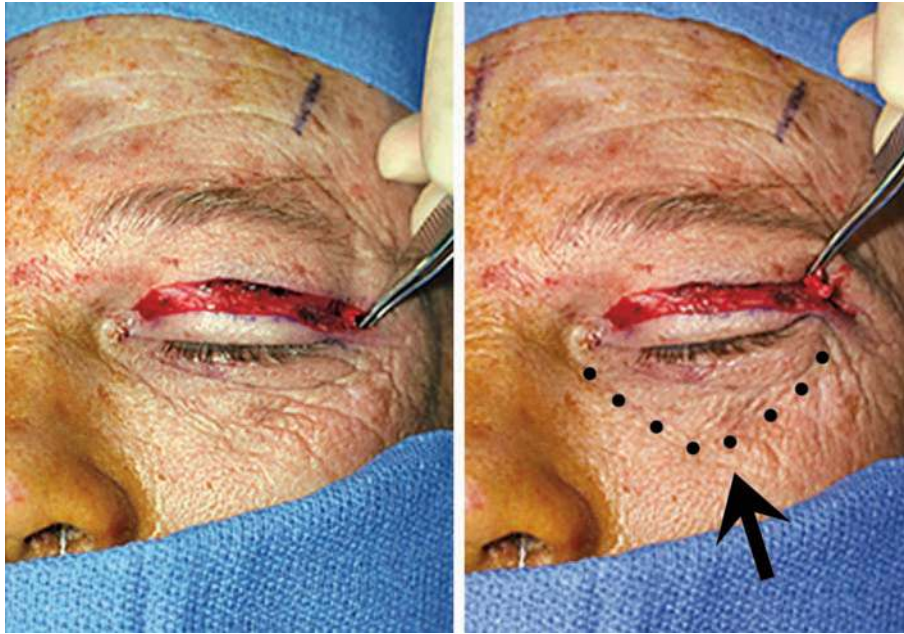


Fig. 6. (Left) The orbicularis retaining ligament can be released to resuspend undermined orbicularis muscle during blepharoplasty. Before orbicularis retaining ligament release, the lower lid is relatively immobile. (Right) Without disruption of either the lateral canthal tendon or the lateral orbital thickening, simple release of the orbicularis retaining ligament from the inferior orbital rim allows for lid repositioning under any degree of tension. The orbicularis retaining ligament is fairly dense tissue laterally, and can be incorporated into the suture for added support. (Photograph and technique courtesy of Ronald E. Hoxworth, M.D.)

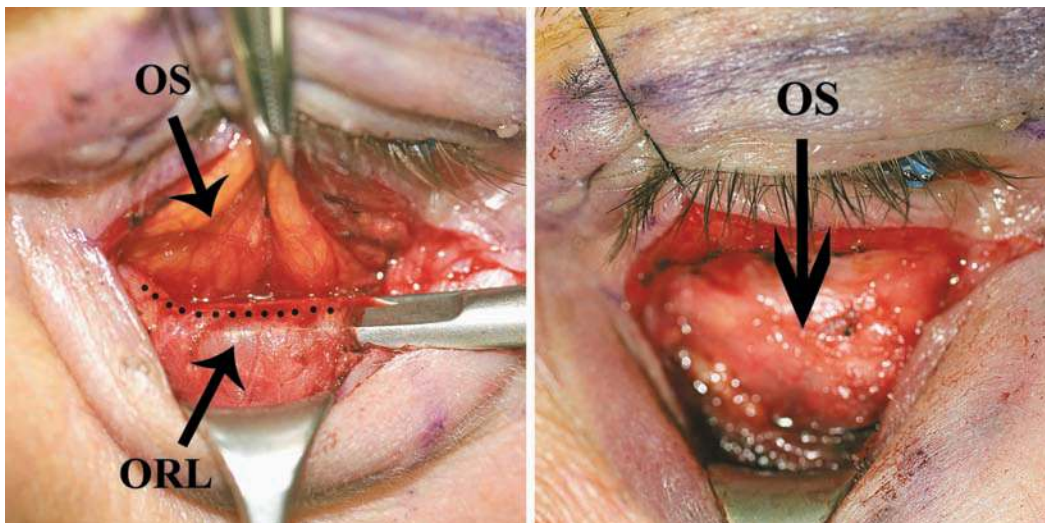


Fig. 7. (Left) Orbicularis retaining ligament (ORL) release and fat transposition is possible with orbicularis retaining ligament transection in the lower lid. The orbicularis retaining ligament is noted beneath the dissection scissors. The orbital septum has not been opened. Transection of the orbicularis retaining ligament was performed along the line shown. (Right) Completed orbicularis retaining ligament transection and fat repositioning is shown. This procedure is anatomically straightforward, because after identifying the orbital septum (OS), the next structure caudal has to be the orbicularis retaining ligament. A vertical spread technique is very useful for accurate dissection of this ligament from the orbital rim to the orbicularis muscle. (Photograph and technique courtesy of Ronald E. Hoxworth, M.D.)

ment anatomy makes release and fat repositioning a relatively straightforward technique. In addition, the anatomy of the orbicularis retaining ligament is reflected onto the overlying soft tissue and can be visualized with knowledge of its anatomical detail and its boundaries (Fig. 7, right).

It may be that significant advances in brow lifting may arise by manipulation of the orbicularis retaining ligament. It may be that some of the splaying of the medial brows noted with conventional techniques may be ameliorated by leaving the medial orbicularis retaining ligament intact in this region. We observed the orbicularis retaining ligament to be short and taut medially, increasing its “retaining” effect on the medial brow and the corresponding muscles (orbicularis oculi and corrugator supercilii muscles) (Fig. 5). Laterally, the orbicularis retaining ligament is long and appears to be redundant beyond the temporal crest line, where there is a paucity of muscular support to the brow (Figs. 2, right and 5). These interesting anatomical variations between the superomedial and superolateral orbicularis retaining ligament in the upper orbit may explain why lateral hooding occurs readily with aging and medial hooding does not. Again, with knowledge of the anatomy, it is clear that any approach to the corrugators through the upper eyelid has to transect the orbicularis retaining ligament (Fig. 8).

Release of the lateral orbicularis retaining ligament through an upper eyelid incision has been performed, and it can be effectively released and its position reset through a direct brow technique or with endoscopic brow techniques.⁸ Lateral orbicularis retaining ligament release may be important in brow lifting for two reasons: (1) it releases the attachment of the brow to the orbital rim and (2) it sets the stage for orbicularis retaining ligament fixation to accurately reposition the eyebrow. It may be that the longevity of endoscopic brow procedures can be improved by orbicularis retaining ligament release, as advocated by Hoxworth⁸ and as shown in ongoing clinical studies.

CONCLUSIONS

Several additional anatomical points are described relating to the orbicularis retaining ligament. These anatomical details become important when one considers surgical procedures in the periorbital region. As a functional barrier, knowledge of the precise anatomy is important when performing injection techniques. Understanding of the role this ligament plays as a retaining struc-

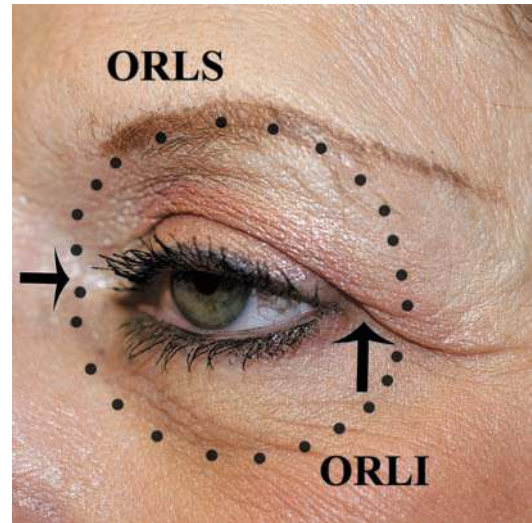


Fig. 8. The anatomical limits of the orbicularis retaining ligament of the upper (ORLS) and lower (ORLI) orbits are illustrated by the dotted line. This ligament spans the entire orbit. It is interesting to note that skin at the lateral canthus overhangs the lateral orbital thickening, where orbicularis is more densely attached to bone (lateral arrow). The orbicularis retaining ligament in the inferior orbit reflects its shape onto the skin as the orbit cheek crease, which is simply the submuscular fusion point of the orbicularis retaining ligament with orbicularis oculi muscle. Medially, a double indentation is occasionally seen that corresponds to the orbicularis retaining ligament of the medial orbit.

ture may lead to improved techniques in both eyelid and brow rejuvenating procedures.

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ACKNOWLEDGMENTS

This article would not have been possible without the efforts of Melinda Mora of the University of Texas Southwestern Medical Center Willed Body Program, whose dedication and hard work has facilitated all of this work. Kind thanks to Holly Smith for suggestions and recommendations for this article that have only served to help make it better, and to Kim Hoggatt-Krumwiede for elegant illustrations and attention to detail.

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