# What Causes Eyelid Bags? Analysis of 114 Consecutive Patients

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**Background:** The purpose of this study was to identify the anatomical basis for perception of lower eyelid bags in patients seeking aesthetic surgery and to evaluate the cumulative contribution of different anatomic characteristics before surgery.

**Methods:** The histories and photographs of patients whose motivation for aesthetic consultation was lower eyelid bags were analyzed. Six categories of anatomic basis for the lower eyelid bags were identified. For each patient, a score from 0 to 4 was given in each category. The cumulative contribution score for each category was calculated as total points for that category for all patients, divided by the 456 total available points. The authors also developed a "uniqueness score" to reflect the percentage contribution of the worst identified anatomic problem compared with the other problems. This was calculated for each patient as the maximum score in one category, divided by total points for that patient.

**Results:** A total of 114 consecutive cases were evaluated (67 men and 47 women; mean age, 52 ± 11 years; age range, 23 to 76 years). The cumulative contribution score for each anatomic variable was as follows: cheek descent and hollow tear trough, 52 percent; prolapse of orbital fat, 48; skin laxity and sun damage, 35; eyelid fluid, 32; orbicularis hyperactivity, 20; and triangular cheek festoon, 13. Prolapsed orbital fat and tear trough deformity both received the higher score and were more common in men as compared with women. The average uniqueness score was 38 percent, with a range of 20 to 75 percent. No one category played a dominant role for most patients. Tear trough depression, skin laxity, and triangular malar mound were significantly more common in patients older than 50 years. Linear regression analysis showed that recommendation for surgery is based on the extent of fat prolapse, skin elasticity, and midface descent. Significant positive correlations were found in all six categories and in uniqueness scores calculated by different observers ($r$ values ranged from 0.31 to 0.73; $p < 0.001$, Pearson correlation), with the highest score in agreement with the contribution of eyelids fat ($r = 0.73$) and skin laxity ($r = 0.66$); the uniqueness score correlation was $r = 0.45$ ($p < 0.001$).

**Conclusions:** Eyelid bags do not have a single anatomic basis. For different anatomic problems, different treatments are recommended. (*Plast. Reconstr. Surg.* 115: 1395, 2005.)

Patients frequently consult aesthetic surgeons because of lower eyelid concerns. Common complaints that we hear include eyelid bags, circles under the eye, wrinkles around the eye, or a tired look.

In the past, a simplified approach to eyelid surgery was popular. Patients who were unhappy with their lower eyelid underwent lower blepharoplasty. Certainly, this simplified approach streamlined the surgical decision-

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making and decreased the requirement for learning different types of surgery. It was effective only for the patients whose problem was amenable to removing skin and fat, which rendered it suboptimal much of the time. Most aesthetic surgeons have evolved a customized approach to eyelid surgery in which the specific anatomic problems are identified and individualized surgery is designed to address these problems.[1–14] We studied a consecutive series of patients who presented for consultation regarding lower eyelid bags to characterize the anatomic features that we determined to be responsible for the patients' aesthetic concerns.

## Patients and Methods

One hundred fourteen consecutive patients who sought consultation for eyelid concerns were evaluated; patients were excluded if they had previous eyelid surgery. The authors reviewed consultation notes and graded standardized photographs taken in upgaze, downgaze, smiling, and oblique views. We scored patients in six main categories of anatomic contributions to the eyelid bags (Table I). Each of the six anatomic problems was graded on a five-point scale with 0 = no involvement, 1 = mild, 2 = moderate, 3 = marked, and 4 = severe in each of the specific categories. Diagnostic criteria for the six categories are summarized below.

### *Orbital Fat Prolapse*

Orbital fat prolapse can be recognized by the characteristic shape of the orbital fat compartments. The central fat pad often has a cigar shape (Fig. 1). The orbital fat seems more prominent with advancing age. It may be that the septum weakens, causing the orbital fat to protrude. Alternatively, loss of volume of the cheek and subcutaneous periorbital skin may lead to unveiling of the orbital fat. The orbital fat is defined above by its junction with the orbicularis muscle, a contour that becomes more apparent with loss of the subcutaneous eyelid fat. The orbital fat is defined below by the junction of the septum at the orbital rim. The orbital fat has individual compartments that can often be visualized through the skin. The lateral and central fat pockets are separated by the arcuate expansion of the inferior oblique; the central and medial pockets are separated by the oblique muscle itself. Often the separate medial, cigar shaped central, and lateral fat pockets can be individually observed, especially in upgaze.

TABLE I
Anatomic Contributions to Eyelid Bags in 114 Consecutive Patients

| Category | Cumulative Contribution Score |
|---|---|
| Tear trough depression | 238 (52%) |
| Orbital fat prolapse | 218 (48%) |
| Loss of skin elasticity | 159 (35%) |
| Eyelid fluid | 148 (32%) |
| Orbicularis prominence | 89 (20%) |
| Triangular malar mound | 61 (13%) |

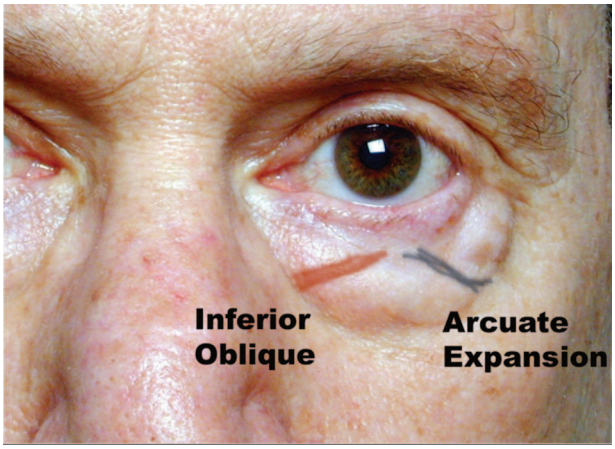


FIG. 1. A 55-year-old man with orbital fat grade 3 and tear trough grade 3. The central fat pad often has a cigar shape. The orbital fat has individual compartments that can often be visualized through the skin. (Copyright 2003, Regents of the University of California.)

### *Eyelid Fluid*

Eyelid fluid has specific diagnostic features. It is worse after a salty meal or in the morning. Eyelid fluid can be limited inferiorly by the orbital rim because of the cutaneous ligaments, but it does not show the orbital compartmentalization of orbital fat. Eyelid fluid often has a purplish color (Fig. 2). It does not increase in prominence in upgaze. Eyelid fluid is a manifestation of fluid accumulation in generalized fashion. The eyelid seems to have a fluid sponge that accumulates fluid preferentially in systemic edema or local edema such as facial allergy. It may not always be possible to distinguish the contour of a fluid bulge in the lower eyelid compared with a fat bulge. Some diagnostic features that suggest fluid include a history of variability; for example, increasing after a salty meal, purplish color, and failure to follow the contours of the demarcated fat complements. Orbital fat is separated by the arcu-

FIG. 2. Eyelid fluid is somewhat purplish, and does not have any delineation into medial, central, and lateral pockets. It does not change much in upgaze and is present in downgaze. If we press on the orbital rim with our finger, we can see the fluid gather below the orbital rim. Eyelid fluid, grade 4, demonstrating the purplish color and tendency toward festoon formation. (Copyright 2003, Regents of the University of California.)

ate expanse of the inferior oblique laterally and the valley of the inferior oblique medially, whereas eyelid fluid has an even contour that does not respect the orbital compartments in its distribution. Compared with orbital fat, eyelid fluid does not change much in upgaze and downgaze.

*Tear Trough Depression*

The tear trough depression is an important feature of eyelid and midface aging. It is characterized by loss of subcutaneous fat with thinning of the skin over the orbital rim ligaments combined with cheek descent (Fig. 3). It is often related to the underlying bony structure and is more common in patients with either congenital or age-related maxillary hypoplasia. The tear trough depression may blend into the triangular malar mound.

*Loss of Skin Elasticity*

Loss of skin elasticity is a critical feature of eyelid aging, leading to rhytides, color and texture changes, and festoon formation. The thin skin unveils underlying irregularities including orbicularis, orbital fat, and the tear trough. Traditional blepharoplasty is not effective in restoring elasticity and is not the best treatment for skin problems.

*Orbicularis Prominence*

Orbicularis prominence contributes to cosmetic eyelid concerns. Although orbicularis prominence can be a feature of the youthful

FIG. 3. Tear trough depression, grade 4. In the oblique view we can appreciate the hollowness of the midface in the area of the orbital rim. (Copyright 2003, Regents of the University of California.)

eyelid, it combines with loss of skin elasticity to contribute to dynamic and static rhytides. Many patients notice horizontal or oblique lines that are accentuated with smiling. These may be more common in Asian patients.

*Triangular Malar Mound*

The triangular malar mound or festoon is a contour that occurs within a fluid sponge, bound by retaining ligaments along the orbital rim and cheek (Fig. 4). Prominent triangular malar mounds often run in families and can be variable with an allergic component. When the skin loses elasticity, the malar mound can become an actual festoon. The triangular malar mound is a fluid sponge bound above by the orbital rim ligament and below by the orbitozygomatic ligament.

All photographs were reviewed and scored by two masked observers (Goldberg and Simon), each unaware of the score given by the other observer. Correlations in grading of each observer in all categories and uniqueness score were calculated. An average score was calculated between the two observers. The cumulative contribution score was calculated for each of the six anatomic variables as a percentage of all possible points. A uniqueness score was cal-

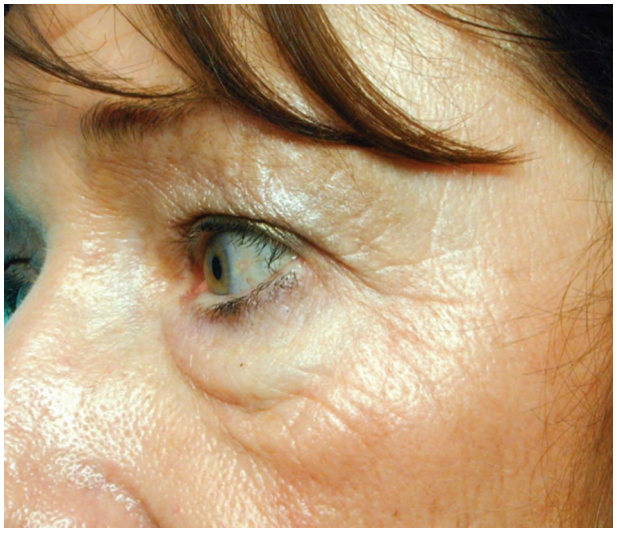

FIG. 4. This woman with chronic swelling demonstrates a significant triangular malar mound, grade 4. (Copyright 2003, Regents of the University of California.)

culated for each patient to reflect the percentage contribution of the worst identified anatomic problem compared with the other anatomic problems. The uniqueness score, calculated as the maximum score in one category divided by the sum of all six scores for each individual patient, is a measure of how important any one variable was. For example, if a patient receives a high score of 4 in one category and a low score of 1 in another category (and 0 in the others), he will have a high uniqueness score of $4/(4 + 1) = 0.8$, which implies that one variable is the most important contributor for the eyelid bag in that patient. Conversely, if a patient receives a score of 2 in three different categories (and 0 in the others), he will have a low uniqueness score of $2/(2 + 2 + 2) = 0.333$, suggesting that no single anatomic change is responsible for the eyelid bag in that patient. Photographs were evaluated and graded by two masked observers. Correlations in grading of each observer in all categories and uniqueness score were calculated. The study complied with the policies of the local institute review board.

### *Statistical Analysis*

Statistical analysis was performed using the independent samples $t$ test to evaluate mean score in each category among different age groups of patients and to evaluate the difference between men and women. Pearson bivariate correlation was used to examine the similarity of scoring between two masked observers in each category and in uniqueness score. Linear regression analysis was used to identify the contribution of each anatomic problem on the surgical decision. We realize that we use an arbitrary 0 to 4 scale, but we assume the change in each point in the scale is equivalent (i.e., change from 1 to 2 is equal to change from 2 to 3 or 3 to 4). If these assumptions are not met, then the probability values are approximate. Statistical analysis was carried out with Microsoft Excel XP and SPSS programs.

## RESULTS

One hundred fourteen consecutive cases were evaluated (67 men and 47 women; mean age, 52 ± 11 years; age range, 23 to 76 years). The cumulative contribution score for each anatomic variable was as follows: cheek descent and hollow tear trough, 52 percent; prolapse of orbital fat, 48 percent; skin laxity and sun damage, 35 percent; eyelid fluid, 32 percent; orbicularis hyperactivity, 20 percent; and triangular cheek festoon, 13 percent (Table I); the sum of all total points equals 456 possible points.

The average uniqueness score was 38 percent (±11 percent), with a range of 20 percent to 75 percent; this reflects the percentage contribution of the worst identified anatomic problem compared with the other anatomic problems (Fig. 5). There was no one category that played a dominant role for most patients; rather, multiple anatomic categories were identified as playing a role in producing the eyelid bags.

The orbital fat and tear trough were the two anatomic problems to receive the highest cumulative contribution score, indicating that they were thought to be most important in causing the aesthetic problem. They also had the highest percentage of grades 3 and 4 as compared with all other anatomic problems (31 percent and 28 percent grade 3, and eight percent grade 4, respectively). Both anatomical problems were slightly more common in males as compared with females (average score of 2.3 versus 1.7 for fat prolapse and 2.4 versus 1.9 for tear trough deformity; $p = 0.01$ and $p = 0.02$, respectively).

If we compare patients under 50 years of age and over 50 years of age, we note that tear trough depression and skin laxity were the two factors that seemed to increase the most with increasing age (mean score of 1.7 versus 2.4 for tear trough and 0.98 versus 1.7 for skin laxity; $p < 0.001$, independent samples $t$ test); this find-

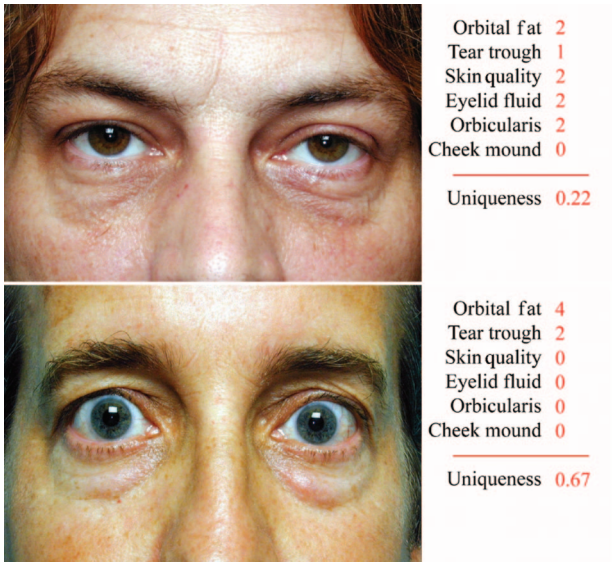


FIG. 5. Uniqueness score calculation (maximum score/sum of all six scores). (*Above*) This patient had moderate scores in many of the variables so that no one feature was dominant, leading to a low uniqueness score of 0.22. (*Below*) This patient was scored to have particularly prominent orbital fat and moderate tear trough with minimal contribution of other features, so that his uniqueness score of 0.67 reflected the more concentrated participation of these two variables. (Copyright 2003, Regents of the University of California.)

ing is consistent with our understanding of facial aging (Fig. 6). Triangular malar mound (festoon) was significantly more common in patients older than 50 years of age (0.77 versus 0.36; $p = 0.01$). The average uniqueness score was similar in the two age groups.

The average uniqueness score was 0.38 ($\pm$ 0.12), with a minimum of 0.20 and maximum of 0.75. This suggests that for most patients, more than one feature was important. We suggest that the implication of this finding is that the surgeon must be prepared to address more than one variable to maximally achieve the patient's aesthetic goals.

Linear regression analysis to evaluate the contribution of each of the different categories on the decision for surgery showed that recommendation on lower lid blepharoplasty is influenced by the extent of fat prolapse ($\beta = 0.35$, $p = 0.001$) and by the amount of skin laxity ($\beta = 0.23$, $p = 0.04$). Recommendation on any other surgery, such as fat transposition, midface lift/implant or lower blepharoplasty, is also influenced by the extent of tear trough deformity.

Positive correlations were found in all six categories and in uniqueness scores calculated by different observers (r values ranged from 0.31 to 0.73; $p < 0.001$, Pearson correlation) with the highest score in agreement to the contribution of eyelid fat ($r = 0.73$) and skin laxity ($r = 0.66$); uniqueness score correlation

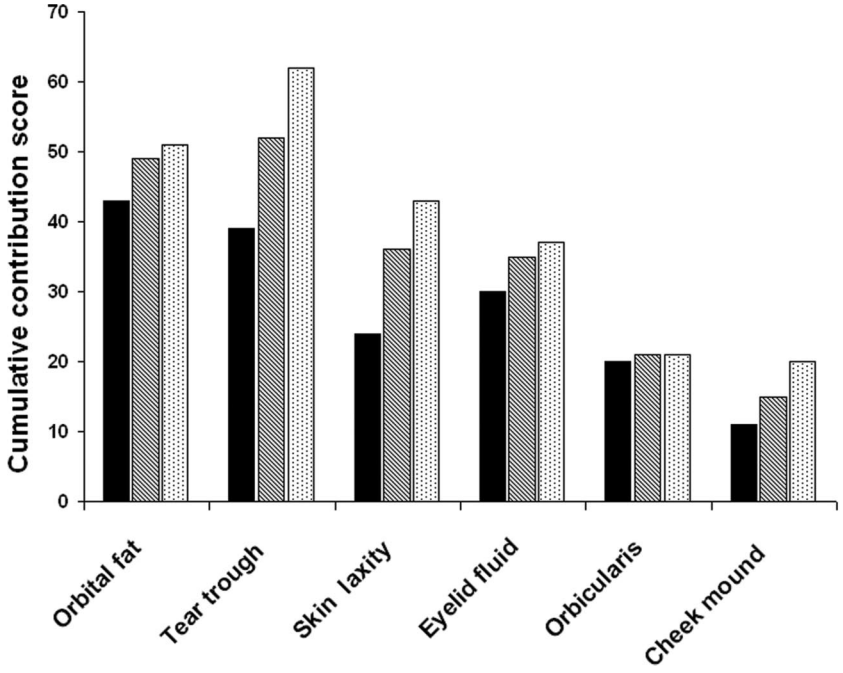


FIG. 6. Cumulative contribution score for each category. Average value (*lined bars*) is shown along with values for the subpopulations under 50 years of age (*solid bars*) and over 50 years of age (*speckled bars*). (Copyright 2003, Regents of the University of California.)

was $r = 0.45$ ($p < 0.001$). Interobserver correlations greater than 0.70 are desired; this was achieved only in the eyelid fat category.

## Discussion

We have found that lower eyelid bags are a complex problem; often several anatomic changes may contribute to patients' perception. The most common anatomic problems that contribute are orbital fat prolapse, lower lid skin elasticity, and tear trough deformity; these may be more prevalent with increasing age.

We recognize that the scoring system and methodology employed in this study are subjective and probably not highly reproducible; that is the nature of aesthetic surgery, which is as much art as science. We hope that the data that we obtained will not be viewed as a definitive quantitative analysis of aesthetic eyelid evaluation but rather as a starting place for a thoughtful approach to individualized analysis of aesthetic eyelid problems. Still, we have managed to show a good agreement between two masked observers in different categories and in the uniqueness score, suggesting that there are consistent and identifiable anatomic features in the differential diagnosis of eyelid bags. Eyelid fat was the only category with interobserver correlation greater than 0.70, suggesting that this is the anatomic change that can be easily identified. The other anatomic changes may be subtler, therefore receiving different scores by different observers.

In our practice we develop a customized surgical plan for each patient on the basis of the identified anatomic problems. In this group of 114 patients, surgeries were recommended as indicated (Table II). As expected, based on the range of identified anatomic components, many procedures, not just blepharoplasty, were recommended. The details of all of the different surgical options for eyelid rejuvenation are beyond the scope of this article. We will illustrate some of the more common options to demonstrate the relationship between identification of anatomic contribution and selection of an individualized surgical plan.

Traditional transconjunctival blepharoplasty with fat removal still plays a role for patients with prominent orbital fat[10] (Fig. 7). Fat repositioning through a transconjunctival approach is an appropriate option for patients with adequate orbital fat and a significant tear trough depression.[11–13] Radiofrequency eyelid sponge thermoplasty utilizes an insulated tungsten needle placed transcutaneously into the fluid sponge in the lower eyelid or cheek; radiofrequency energy is applied in closed fashion to desiccate and scar the fluid sponge[14] (Fig. 8). Rejuvenation of the skin is accomplished using a stepwise approach, including skin care programs, chemical peel, and laser resurfacing (Fig. 9). Skin rejuvenation cannot compensate for deep structural problems, however. If there is loss of skin elasticity and cutaneous redundancy to the point of festoon formation, skin pinch techniques are often useful. Botulinum toxin is useful to control orbicularis prominence; to reduce the risk of temporary paralytic ectropion, conservative graded dosing is used in the lower orbicularis (Fig. 10). When there is substantial deflation or descent of the

TABLE II
Surgical Options Recommended Based on Anatomic Problems

| Surgical Option | No. |
|---|---|
| Blepharoplasty | 23 |
| Fat repositioning | 26 |
| Radiofrequency eyelid sponge thermoplasty | 53 |
| Laser or peel | 51 |
| Botulinum toxin type A | 14 |
| Midface lift with or without implant | 8 |
| Fat injection | 10 |

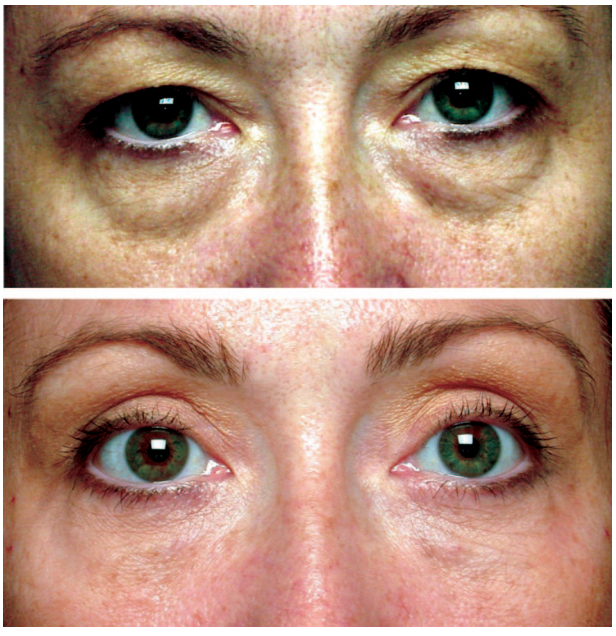

FIG. 7. A 45-year-old woman with grade 3 orbital fat prolapse before (*above*) and 14 months after (*below*) lower transconjunctival blepharoplasty. (Copyright 2003, Regents of the University of California.)

FIG. 8. A 48-year-old woman with grade 3 fluid bags before (*above*) and 3 months after (*below*) radiofrequency eyelid sponge thermoplasty. (Copyright 2003, Regents of the University of California.)

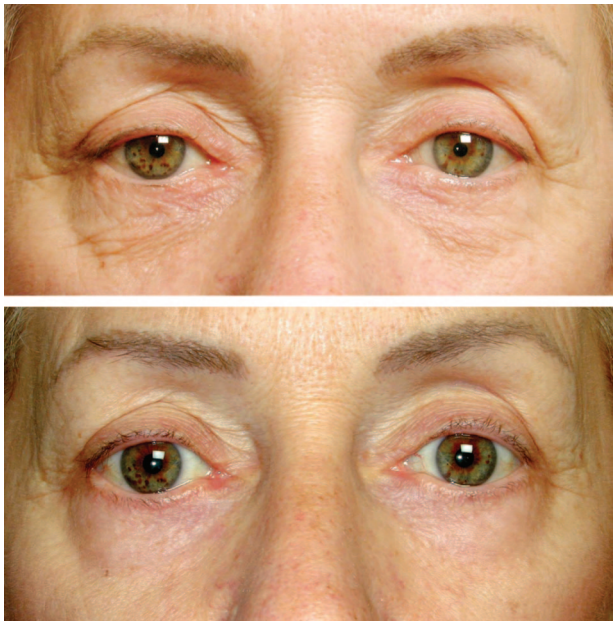

FIG. 9. This patient with loss of skin elasticity is seen before (*above*) and 3 months after (*below*) chemical peel. Some surgeons would have recommended a skin blepharoplasty, but we believe that excising skin does not improve skin quality and have had more success treating skin issues with chemical peel or resurfacing. (Copyright 2003, Regents of the University of California.)

malar and periorbital tissues, midface lift with or without cheek or periorbital implant is considered.[15–20] Fat injection is used for periorbital

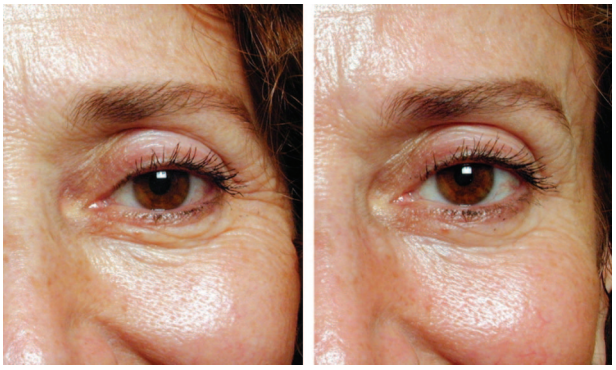

FIG. 10. This patient with prominent orbicularis lines (*left*) is improved with botulinum toxin to the lower eyelid orbicularis (*right*); often a small dose of 5 units spread across the lower orbicularis ring is adequate to soften these orbicularis rolls. (Copyright 2003, Regents of the University of California.)

volume augmentation, although the newer fillers such as cross-linked hyaluronic acid provide a smoother contour and avoid the need for tissue harvesting (Fig. 11).

## SUMMARY

The lower eyelid and midface is a focal point of the face, and patient concerns in this area often lead to consultation with aesthetic surgeons. A number of congenital and age-related

FIG. 11. A 34-year-old man with grade 3 tear trough deformity before (*above*) and 1 month after (*below*) Restylane (nonanimal stabilized hyaluronic acid, Medicis Aesthetics) injection. (Copyright 2003, Regents of the University of California.)

anatomic changes can contribute to aesthetic problems in this complex anatomic region. The better we can diagnose the contribution of these various anatomic components, the better we can design individualized surgery. Big surgeries have big risks, and we continue to pursue new options for minimally invasive aesthetic rejuvenation.

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