



Properly Diluted Fat (P.D.F.): A Safer Approach to Periocular Fat Grafting

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Key Message

- Diluting the fat to improve results in periocular fat grafting

51.1 Introduction

Fat depletion represents a factor of utmost importance in facial senescence. The work by Lambros [1] powerfully remarks how much volume depletion can do in terms of improving facial aging consequences. Many consequences of aging, such as tear-trough deformities, sunken orbits, and nasojugal depressions, can be treated effectively with fat grafting to the deflated areas, thereby obviating complex fat flaps or procedures that require transposition of skin, muscle, and fat (e.g., midface lift). In the past decade, fat grafting to the face has become a routine procedure in the operating room and may be performed independently or in conjunction with techniques such as facelift or blepharoplasty.

In many patients, the empty-appearing upper eyelid emphasizes the roundness of the globe.

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Lipofilling of the upper orbit can apparently lower the supratarsal fold and transform round, hollow eyes into pleasant, almond-shaped eyes. Volume deflation in the lower eyelid area yields a skeletal appearance with more visible fat pads, an accentuated tear-trough deformity, an elongated lower lid, a deeper lid-cheek junction, loss of malar prominence, and more noticeable projection of the lower globe (Fig. 51.1a, b).

Primary indications for periocular fat grafting are (Table 51.1) round and hollow eyes, age-related deflation, sunken eyelids, and iatrogenic deformities, such as in blepharoplasty with overzealous fat removal. Nonsymptomatic eye prominence and a negative vector (i.e., a condition in which the anterior surface of the cornea lies anterior to the malar prominence) also are indications for periocular fat grafting, and we frequently encounter these features in our practice in Italy. Fat transfer to the periorbital region in these patients can increase the projection of the upper and lower orbit, thereby creating the appearance of globe retrusion to an aesthetically appealing plane.

Consensus is lacking on the details of periorbital fat grafting, including choice of donor sites, fat harvesting, fat preparation (e.g., washing, filtering, and centrifuging), and fat injection tools [2–11]. Investigators generally agree on the following: (1) some amount of volume loss after fat grafting is the rule, and (2) multiple lipofilling sessions often are necessary to achieve a stable result [12, 13].

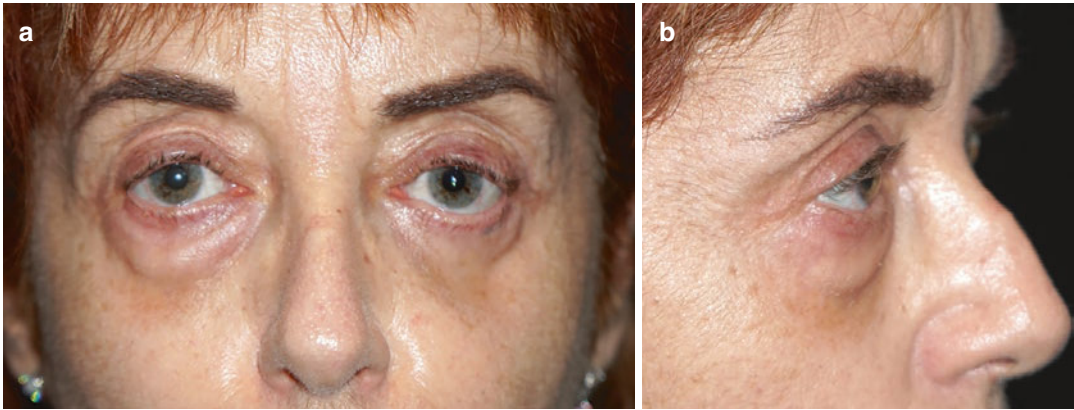


Fig. 51.1 (a, b) This 62-year-old woman shows the typical age-related changes due to volume deflation in the upper and lower eyelid area, i.e., visible fat pads, accentu-

ated tear-trough deformity, elongated lower lid, a deeper lid-cheek junction and loss of malar prominence with negative vector

Table 51.1 Indications for periocular fat grafting

Indications	Percentage of patients
Age-related deflation	60–70
Round and hollow eyes	40–50
Prominent eyes	15–20
Scleral show	5–10
Iatrogenic depression	3–5

Data are approximate due to overlapping indications

Fat grafting is performed less frequently in the periocular region than in other facial zones. The risk of blindness with periocular fat transfer represents an fearful occurrence but many surgeons also have expressed concerns that this procedure can yield contour irregularities, including nodules and masses, that are a source of patient dissatisfaction [3, 9]. Unfavorable contour results can occur relatively frequently, especially in the lower eyelid, which has thin teguments. Uneven accumulation of grafted periocular fat is difficult to conceal—especially in patients who are older and have excess skin—because of an insufficient native fat pad and the subtle orbicularis. After periocular fat transplantation, noticeable adipose masses or nodules in the eyelids can be cause for great concern in patients.

When contour irregularities occur after this procedure, the only effective treatment is surgical removal of the grafted fat. In our hands, steroid injections yield little or no improvement. The aim of this chapter is to describe our technique

of periocular fat grafting, with which we have obtained consistently satisfactory results and few contour irregularities. We injected preparations of “properly diluted fat (PDF),” [14] in which centrifuged fat was recombined with fluid rich in stromal vascular factors and diluted with saline such that the following was approximately true: (mL of centrifuged fat) ÷ (mL of PDF) = 0.7.

51.2 Surgical Technique

The donor site was determined for each patient based on the presence of fat, patient preference, and operating position. The inner knee was the most common donor site, followed by the upper abdomen, external thighs, the lower abdomen, and the flanks.

Donor areas were infiltrated with a solution containing 10 mL of 10% bupivacaine, 90 mL of normal saline, and 0.5 mg of epinephrine. The infiltration volume differed among patients and was based on the amount of fat harvested.

In the recipient area, a small volume of a solution containing 10 mL of 10% bupivacaine, 30 mL of normal saline, and 0.4 mg of epinephrine was infiltrated into the supraorbital and infra-orbital foramen. The remaining recipient areas were infiltrated with a solution of saline and epinephrine (1:100,000) to induce vasoconstriction. There is some debate among researchers regard-

ing the effects of anesthetic drugs on harvested fat [15], but our preference was to avoid unnecessary risks of damaging the fat.

Fat was harvested by means of a 0.5-mm, multiple-hole cannula attached to a 10-mL syringe under light aspiration pressure. Lipoaspirates were centrifuged at 2000 rpm for 2 min. The bottommost 1 mL of reddish fluid in the syringe was extracted and retained. This infranatant fluid comprises blood and infiltrate and is thought to contain a high density of stromal vascular factors as advised by Dr Rigotti, through personal communication. In a recently published paper by Gontijode-Amorim et al. [16] in which Dr. Rigotti was a coauthor, washed fat that had been enriched with the pellet of centrifuged lipoaspirate (i.e., the solids immediately beneath the reddish fluid layer) was better retained in the face at 1 year, compared with unenriched fat. Any remaining reddish liquid and the uppermost oily layer (i.e., the layers flanking the centrifuged fat fraction) then were discarded.

A series of 10-mL syringes then were prepared for fat transfer by adding 7 mL of centrifuged fat, 1 mL of the reddish fluid (presumably enriched in stromal vascular factors), and 2 mL of normal saline, so that centrifuged fat constituted 70% of the PDF, and 30% of the PDF comprised the diluent (i.e., saline plus the reddish infranatant) (Video 5.1). The recipient site was prepared for fat transfer by making a network of crisscrossing tunnels with an empty 1.2-mm cannula (Video 5.2). We confirmed that there was no bleeding, which indicated that no large vessel had been damaged. Immediately before fat injection, we blended the contents of the 10-mL syringe with gentle shaking. The contents then were transferred to 1-mL Luer-lock syringes, and PDF was injected into the recipient site by means of a 1.2-mm cannula with a single 1-mm hole positioned laterally at its end. PDF transfer was carried out immediately after transfer to each 1-mL syringe to avoid separation of the centrifuged fat and diluent.

For treatment of the upper eyelid, injections were made at the midpoint of the eyebrow and at the upper-lateral canthal area. Treatment of the lower eyelid involved an injection in the cheek

area—1 cm medial to the lateral canthus and 2 cm lower than the upper border of the malar bone—and an injection 1 cm lateral and caudal to the lateral canthus. These two entry points enabled passage of the cannula in a crisscrossing, fan-like pattern, which yielded even distribution of fat.

Injection of the PDF was carried out slowly and in small quantities as the cannula was withdrawn. Because the lipoaspirate had been collected at the donor site through 0.5-mm holes and then was diluted, it had a fluid-like consistency on injection. Thus, it readily flowed through the 1.2-mm cannula without clogging. Due to the fluidity of the fat and the presence of the tunnels the fat distributed smoothly into the areas avoiding the need for numerous passes. The syringe was passed 5–7 times to infiltrate 1 mL of fat (Video 5.3). The procedure was completed within 15–20 min for the four eyelids.

All patients received PDF injection in the submuscular plane and in the suprapariosteal or suprasedal area. No patient underwent injection in the subdermal plane. When treating deep tear-trough deformities some fat was injected into the medial portion of the orbicularis muscle, that, in this area, is firmly attached to the bone. In patients who were older, extreme care was exercised to avoid perforating the thin orbicularis. The injection entry points were not sutured but were covered with Steri-Strips (3M, St. Paul, MN). In our experience, it is very difficult to calculate the precise amount of fat needed to correct a specific area of depression or deflation. We recommend gaining experience in this procedure and exercising good clinical judgment. Given the expectation of postoperative volume loss owing to resorption, we generally overcorrect by 20% to 30%; however, it should be emphasized that this is an approximation.

51.2.1 Postoperative Care

To avoid placing pressure on the lipofilled sites, no ice or dressings were applied postoperatively. Antibiotic therapy (amoxicillin [1000 mg] and clavulanic acid [125 mg]) was given for 4 days.

Patients were advised to sleep in the supine position for 3 days, to avoid sun exposure until the ecchymoses had resolved, and to refrain from physical exercise for 2 weeks.

All patients received follow-up on the first postoperative day. Because much of the injected liquid volume and edema usually dissipates by 24 h, we evaluated patients on the first postoperative day and carried out revisional aspiration of any localized fat accumulation with the same cannula used for infiltration.

51.2.2 Two Special Situations: Prominent Eyes and Scleral Show

51.2.2.1 Special Cases: Prominent Eyes and Scleral Show

In the authors' clinical practice, 35% of patients present with prominent eyes (defined as >20 mm projection, as measured with a Hertel exophthalmometer). Ascertainment of eye prominence or protrusion is complicated and can be imprecise. Because the eye globe is surrounded by the upper and lower orbit (i.e., the malar area), its prominence is assessed relative to either or both of these structures. In our assessment of eye prominence, we distinguish orbital protrusion from malar protrusion, i.e., negative vector by utilizing the superolateral orbit or the most anterior point of the malar area, respectively, as reference points [17].

A large orbital prominence (i.e., exophthalmos) may coexist with a large or small malar prominence. Both orbital protrusion and malar retrusion are common in our patient practice because of the dolichocephalic anatomy typical of patients living in southern European countries. We perform fat grafting routinely in these individuals to improve insufficient protrusion at the orbital and malar levels.

By increasing the projection of the eyebrow and the upper eyelid, the orbital prominence is made less obvious. Lipotransfer to the lower lid and the lid-cheek junction fills out the palpebrojugal depression transforming it into a flat surface. Less skin then is needed to cover the lower globe.

The newly created excess skin together with the improved support provided by the injected volume raises the lid rim and reduces the amount of scleral show (Fig. 51.2a–f) Furthermore, increasing the projection of the malar area and of the lower eyelid corrects the negative malar prominence to a positive one, making the lower globe appear less protrusive (Fig. 51.3a–f).

51.3 An Overview of our Last 200 Patients

A retrospective study was conducted on 200 consecutive patients who underwent injection of PDF in the periocular area (i.e., the upper and lower eyelids, and in some patients, the brows) from January 2011 to January 2017. This study was conducted in accordance with guiding principles set forth in the Declaration of Helsinki. All patients provided written consent for the procedure.

Patients were included who had (1) hollow-appearing upper and/or lower eyelids owing to age or to genetic or iatrogenic factors (170 patients; 85%) and/or (2) prominent eyes (70 patients; 35%). Patients with unilateral eye deformities or posttraumatic cases were not purposely included in this study.

All procedures were performed in the operating room, either under local anesthesia with sedation (140 patients; 70%) or under general anesthesia (60 patients; 30%). A total of 152 patients (76%) received additional facial treatments in the same surgical session. We included patients who also received upper blepharoplasty only when tissue excision was limited to the skin and there was no undermining of the orbicularis; similarly, we included patients who also underwent lower blepharoplasty only when the preseptal portion of the orbicularis was avoided during the operation.

Follow-up visits were planned for days 1, 4, and 10 and for months 1, 3, 6, and 12. Photographs typically were obtained on postoperative day 10 and at subsequent follow-up visits. Results of periocular grafting with PDF were evaluated by meticulously comparing preoperative pho-



Fig. 51.2 (a, c, e) 52-year-old woman with prominent eyes (21 mm on right and 20 on left by Hertel exophthalmometry), visible deflation on lower lid and asymmetrical scleral show. (b, d, f) After fat grafting on upper and lower

lids. Eye prominence is less marked, supratarsal fold appears lower and scleral show has improved due to the straightening of the lower lid concavity by volume implementation

tographs with those obtained postoperatively at 6 months and 1 year. Patients who presented for follow-up at 1 year but not at 6 months were excluded from the study. Visual inspection of the photographs was carried out by three examiners: the operating surgeon, an independent plastic surgeon with no working relationship with the primary surgeon, and a secretary from the

administrative department of our hospital. Each examiner completed a chart to assess change in the facial aesthetic and contour irregularities 6 months and 1 year postoperatively. Because many patients in the series underwent additional aesthetic procedures, the examiners were asked to consider only results of the fat grafting procedure in their assessment.



Fig. 51.3 (a, c, e) This 54-year-old woman presented with bilateral eye protrusion (24 mm on left and 23 on right by Hertel exophthalmometry), negative malar prominence (3 mm negative vector), and 3 mm of scleral show on right and 2 mm on left. The globe protrusion was exacerbated by deflation of the lower eyelids. The patient received 6 mL of PDF (4.2 mL of centrifuged fat) in each brow, 4.5 mL of PDF (3.15 mL of centrifuged fat) in the upper part of each eyelid, and 5 mL of PDF in the lower part of each eyelid. She also received a facelift without

sub-SMAS undermining, but she did not undergo canthopexy or placement of a malar prosthesis. (b, d, f) Two years postoperatively, the globes are no longer prominent, and the eyes have a pleasing appearance. The rims of the lids are raised postoperatively because the lower eyelid has been straightened and is no longer concave. The SOOF was improved only by fat grafting. The apparent improvement in the nasal profile is due to hyaluronic acid and steroid injections in the supratip area

51.4 Results

Eighteen of the 200 patients were men (9%) and 182 were women (91%). The mean age of the patients was 52.3 years (median, 50.1 years; range, 26–73 years). The upper eyelids were treated in 171 patients, the lower eyelids in 138, and the eyebrows in 62.

Injection volumes varied from 1.5 mL of PDF (1.05 mL centrifuged fat) to treat a minimal localized depression to 36 mL of PDF (27.5 mL of centrifuged fat) to address the four eyelids and the eyebrows. Injection volumes of PDF were 3–6.5 mL for each eyebrow, mean being 4.5 mL, 1.5–5.2 mL for each upper eyelid mean being 3.7 mL and 1.5–4.2 for each lower lid mean being 2.7 mL. Aspiration of accumulated fat to revise the aesthetic result 1 day postoperatively was carried out in two patients.

A total of 164 patients (82%) presented for follow-up 6 months postsurgically and were photographed; 83 patients (41.5%) presented and were photographed 1 year after the operation. Of the 164 patients who returned for the 6-month visit, photographs of 4 patients were excluded because the images were of insufficient quality for analysis. Similarly, of the 83 patients who returned for the 1-year appointment, 4 patients were excluded from analysis owing to inadequate photographic resolution.

51.4.1 Complications

No complications were noted intraoperatively. All patients experienced swelling immediately postoperatively as a result of the dilution of injected fat and the intentional overcorrection. By 24 h after surgery, swelling generally was observed to decrease abruptly, with limited edema and some ecchymoses in most patients. The short duration of the edema was attributed, at least in part, to the small number of passes of the syringe (5–7 times for each mL of fat), which elicited only limited, local trauma. In three patients, yellow-

Table 51.2 Complications in the study population

Complication	No. (%) of Patients
Hematoma or seroma	0 (0)
Temporary upper eyelid ptosis	4 (2)
Chemosis	2 (1)
Visible masses	2 (1)
Volume excess in treated area after body weight increase	2 (1)

ish skin discoloration was noted 7–10 days after surgery; this resolved spontaneously by 1 month postoperatively.

Postoperative complications are summarized in Table 51.2. No patient experienced obvious hematoma or seroma. Temporary upper lid ptosis of limited degree occurred in four patients; this effect subsided spontaneously in 4–8 weeks. Transient ptosis is known to occur occasionally after fat transfer to the upper eyelid [1] and may result from trauma to the elevator muscle caused by the cannula as well as the extra weight of the fat injected into the upper eyelid. A case of upper eyelid ptosis is depicted in (Fig. 51.4a–c); in this woman, the upper eyelid rose by approximately 2 mm after injected fat was partially removed from her lower lid.

Two patients (both of whom had undergone upper and lower eyelid skin excision through a “pinch maneuver”) experienced limited unilateral chemosis. This condition was treated with steroid ointment and drops and resolved within 1 week. In two patients, visible masses became visible in 1 of the lower eyelids by 2–3 months postoperatively. Both patients requested treatment by surgical removal of the mass. For 1 patient, this was conducted by a direct approach through lower lid skin (Video 5.4) for the other patient, removal of the mass was achieved by means of a lower lid blepharoplasty incision. In two patients, the aesthetic results were deemed very good at 6 months and 1 year postoperatively, but a volume excess (upper eyelid for 1 patient; lower eyelid for the other) occurred subsequently. For both cases of excess fullness, the cause was attributed to gain

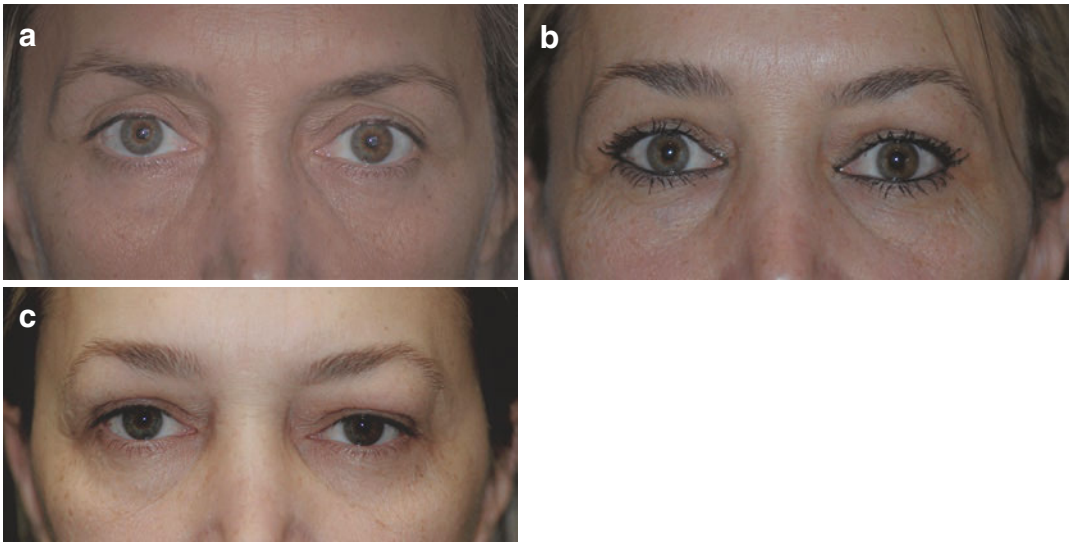


Fig. 51.4 (a) This 48-year-old woman presented with concerns of round, hollow-appearing eyes bilaterally. She underwent injection of 3.5 mL of PDF (2.45 mL of centrifuged fat) on the right upper eyelid and 2.5 mL of PDF (1.75 mL of centrifuged fat) on the left upper eyelid. (b)

Six months postoperatively, the result is aesthetically pleasing. (c) Two years postoperatively: left eyelid ptosis with aesthetical blemish is present due to increased fat volume consequent to 7 kg weight gain

in body weight (5–7 kg) [19]. Of these patients, 1 returned to her former body weight and the eyelid fullness subsided without treatment; the other similarly lost the excess weight, but still required removal of some grafted fat from the left upper eyelid. We noted that the rim of the left upper lid was lifted as a result of removal of excess fat.

51.4.2 Photographic Evaluation

Examiner findings regarding aesthetic improvement and contour irregularities are presented in Tables 51.3 and 51.4, respectively. Results of our evaluation of 6-month-postoperative photographs indicated that 154 of 160 patients (96.2%) had an excellent to moderate improvement in the periocular aesthetic, based on the averaged findings of three evaluators; 6 patients (3.7%) were regarded as having little or no improvement.

In assessments of photographs taken 1 year postoperatively, the averaged findings of the three examiners were that 74.3 of 79 patients (94%) had excellent to moderate periocular improvement and 4.6 patients (5.8%) had little or

no improvement. All 79 patients evaluated 1 year postsurgically also had been evaluated 6 months after surgery.

On average, the three examiners noted contour irregularities in the 6-month-postoperative photos of 5.3 of 160 patients (3.3%) and in the 1-year-postoperative photographs of 2.6 of 79 patients (3.2%). The two patients in whom excess transferred fat was removed in a secondary procedure were omitted from the photographic evaluations.

The findings of the three evaluators were similar; this might be explained by the good clarity of the photographs, which enabled easy scoring of aesthetic results. The 79 patients who were photographed at follow-up visits 6 months and 1 year postoperatively were closely examined by the operating surgeon. Sixty of these patients had no detectable change in volume from the 6-month to the 1-year visits, whereas 12 had some degree of volume depletion during this time (Fig. 51.5a–c). A similar likelihood of volume retention was found in patients evaluated at 1-year and 2-year-postoperative visits. Hence, we agree with other researchers who maintain that stable results of fat grafting cannot be assessed until 2 years postoperatively.

Table 51.3 Assessments of aesthetic improvement from patient photographs

Evaluator	Total no. of patients evaluated	No. (%) of patients with excellent improvement	No. (%) of patients with moderate improvement	No. (%) of patients with little or no improvement
<i>6 months postoperatively</i>				
Surgeon ^a	160	104 (65)	51 (31.8)	5 (3.1)
Doctor ^b	160	110 (68.7)	45 (28.1)	5 (3.1)
Administrative assistant	160	106 (66.2)	46 (28.7)	8 (5)
<i>1 year postoperatively</i>				
Surgeon ^a	79	50 (63.2)	25 (31.6)	4 (5)
Doctor ^b	79	53 (67)	22 (27.8)	4 (5)
Administrative assistant	79	51 (64.5)	22 (27.8)	6 (7.5)

^aPerformed the operation^bNo professional relationship with the operating surgeon**Table 51.4** Evaluations of contour irregularities from patient photographs

Evaluator	Total no. of patients evaluated	No. (%) of patients without contour irregularity	No. (%) of patients with visible contour irregularity
<i>6 months postoperatively</i>			
Surgeon ^a	160	155 (96.8)	5 (3.1)
Doctor ^b	160	156 (97.5)	4 (2.5)
Administrative assistant	160	153 (95.6)	7 (4.3)
<i>1 year postoperatively</i>			
Surgeon ^a	79	76 (96.2)	3 (3.7)
Doctor ^b	79	76 (96.2)	3 (3.7)
Administrative assistant	79	77 (97.4)	2 (2.5)

^aPerformed the operation^bNo professional relationship with the operating surgeon

We did not assess patient satisfaction directly in this study. The results of our retrospective review of medical records suggested that most patients were satisfied because out of the 200 patient's records only three contained a notation about a patient's complaint for partial or unsatisfactory result.

51.5 Discussion

For the past 2 decades, autologous fat has been utilized widely as a soft-tissue filler [1, 2, 5, 6, 10, 13, 20]. Fat grafting in the periorbital area is particularly challenging because of thin skin and a scarcity of subcutaneous tissue in this region. Even in expert hands, complications of periorbital fat grafting are common [14, 19], espe-

cially those involving subcutaneous nodules that may require challenging surgical maneuvers for removal.

When we began performing periocular fat grafting in our clinical practice, we adhered carefully to techniques described in the literature, including utilization of larger hole cannulas for harvesting and smaller hole cannulas for injecting, extensive centrifugation of the lipoaspirate, and delivery of concentrated fat. We found that contour irregularities were common (about 15%) with these conventional methods and were a primary cause of patient concern. We sought to achieve better aesthetic results of periocular fat grafting. Toward this aim, we incorporated dilution of centrifuged fat into our technique. In our hands, transfer of PDF is crucial to avoid the accumulation of fat clusters that result in unfavorable

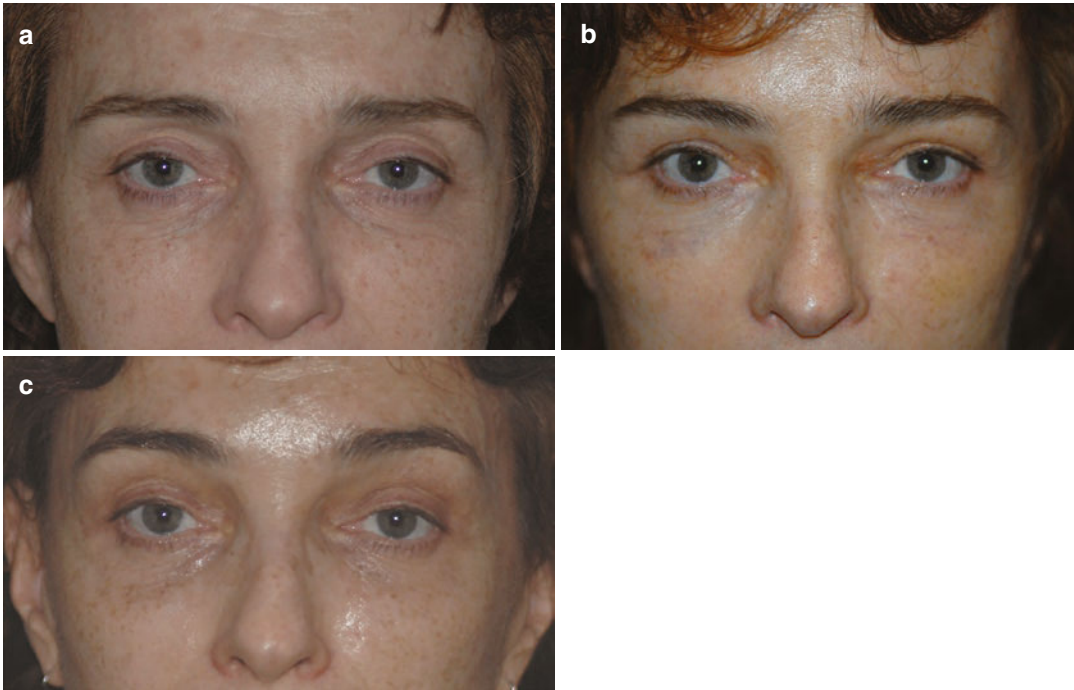


Fig. 51.5 (a) This 62-year-old woman presented with deflation of the upper and lower eyelids. She received 3 mL of PDF (2.1 mL of centrifuged fat) in each upper and lower lid. (b) Two months postoperatively, the aesthetic

result is satisfactory; however, by (c) 1 year postoperatively, most of the injected fat had been reabsorbed, and the volume again is inadequate

contour postoperatively. Moreover, PDF transfer appears to elicit less edema and ecchymosis because fewer passes of the syringe are made. Currently, our periorbital fat grafting technique requires attention given to (1) the proper plane, (2) the fat fluidity, (3) tunnelization, and (4) dilution of fat.

51.5.1 The Proper Plane

Some surgeons suggest that, in addition to submuscular injection, fat should be injected into the muscle or under the skin. We avoid these maneuvers because these planes are likely to yield contour irregularities, in our experience. We consider the submuscular plane to be the safest for injection of fat.

To treat the upper eyelid, we inject PDF under the orbicularis and above the periosteum in the upper area; we also inject PDF above the septum in the lower area of the upper lid. In patients who

receive treatment of the brow and upper lid in the same session, we also wrap fat around the supraorbital rim. This transfer pattern positions fat on the anterior surface of the supraorbital rim and yields an even cleavage plane. We never intentionally inject fat under the septum. To address the lower eyelid, we transfer fat under the orbicularis and over the septum; in the lower orbital area, fat is delivered above the periosteum.

When additional procedures, such as canthopexy or facelift, are planned for the same surgical session as the periorbital fat grafting, we avoid undermining the supraperiosteal plane to preserve its integrity to receive the fat graft. Removal of transconjunctival retroseptal fat can be performed in conjunction with fat grafting to the palpebromalar groove if the integrity of the septum is preserved (Fig. 51.6a–g).

The upper and lower eyelids should be regarded as parts of an aesthetic unit that also comprises the brow and malar areas. Therefore, when volume is delivered to a circumscribed

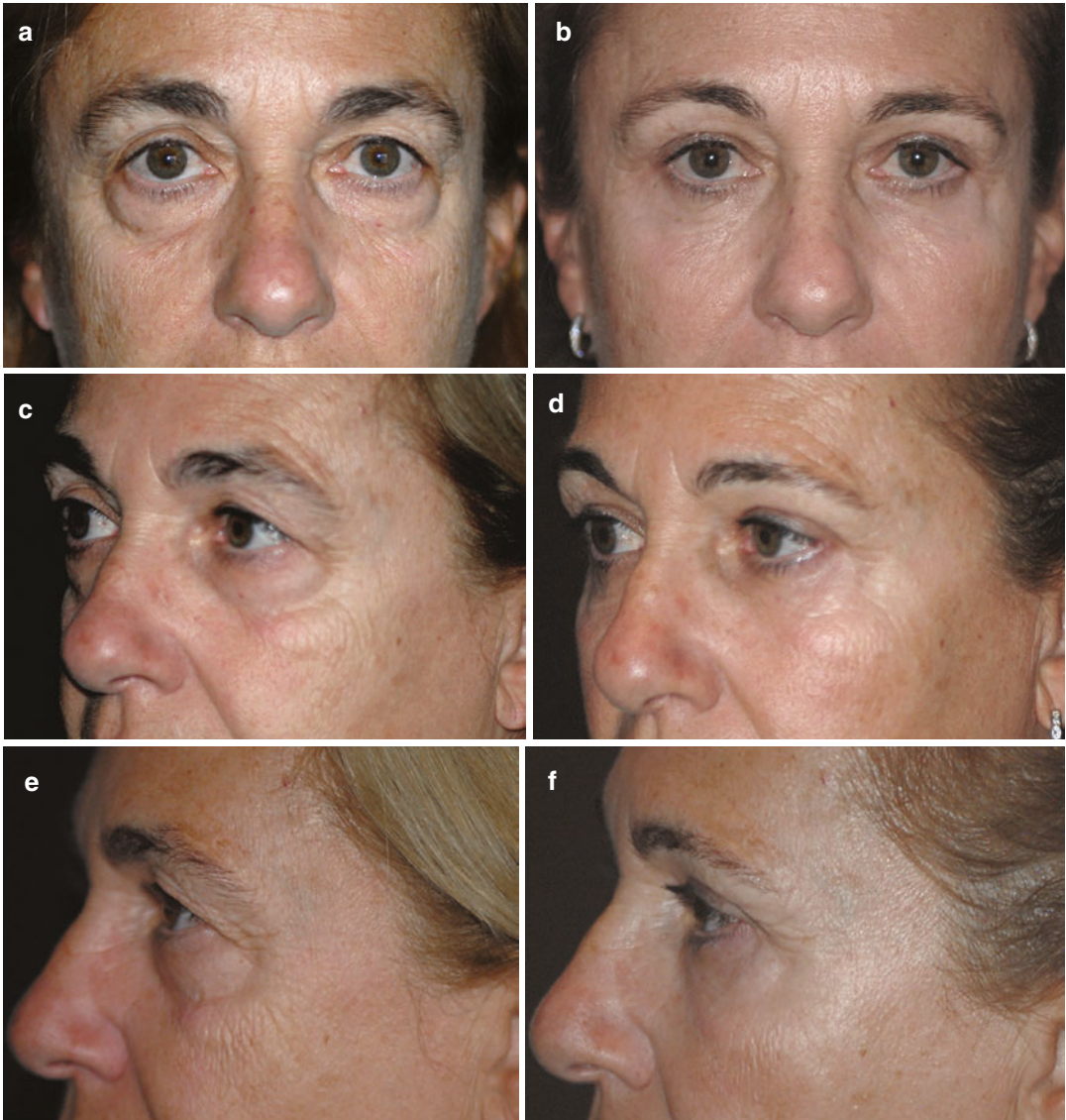


Fig. 51.6 (a, c, e) This 54-year-old woman presented with excess skin of the upper lid; the right upper lid appears more hollow than the left. Fat hernias were evident on the lower lids, with deep depressions below this area. Negative prominence of the malar region also was noted (6 mm negative vector). It was predicted that fat removal from the lower lids alone would create an obvious concavity, accentuating the negative vector. The patient underwent removal of excess skin from the upper lids and delivery of 1.5 mL of PDF (1.05 mL of centri-

fused fat) into the upper lid on the right side. A moderate amount of fat was excised transconjunctivally through a retroseptal approach, and 3 mL of PDF (2.1 mL of centrifuged fat) was injected into the preseptal plane at the level of each lid-cheek junction. Some fat also was injected into the malar areas. Canthopexy was associated. (b, d, f) One year postoperatively, the result is satisfactory, and the negative malar prominence has been corrected to neutral. (g) Preoperative markings of the lid-cheek junction, where fat delivery was planned



Fig. 51.6 (continued)

area, such as the lower eyelid, the fat must be “feathered out” toward the malar region, thereby creating a smooth transition.

51.5.2 Fat Fluidity

If the holes of the harvesting cannula are larger than those of the injecting cannula (e.g., 2 mm vs 1 mm), the fat cells may cluster, forming small, solid masses. During expulsion of fat, these masses can clog the holes of the injecting cannula, requiring the surgeon to increase pressure on the plunger and force the cluster into the recipient site. When fat is transferred to the eyelid in this manner, a mass can form that is not immediately evident, owing to edema in the intraoperative and early postoperative periods. By a few weeks postoperatively, a contour irregularity can become visible at this site, causing concern in the patient and precluding a favorable aesthetic result.

To avoid this complication, several years ago we designed a harvesting cannula with multiple 0.5-mm holes. Nowadays many manufacturers produce similar cannulas. On aspiration, this cannula reduces fat into very fine particles, resembling a liquid. Subsequent delivery of fat is carried out through a single 1-mm hole of the injecting cannula. Moreover, the fat harvested

through 0.5-mm holes is diluted prior to delivery, which enhances its fluidity. In our hands, this technique involves fast, smooth distribution of PDF in the periocular region with almost no risk of bolus formation.

51.5.3 Tunnelization

Before fat injection, we prepared the recipient site with a network of crisscrossing tunnels by inserting an empty cannula. We perform tunnelization for several reasons. First, if a vessel is perforated by the tunneling cannula, some bleeding is likely to occur, informing the surgeon of the increased risk of fat embolism. In addition, we have found empirically that injecting PDF [20] into a network of preformed channels facilitates its smooth and rapid distribution into the recipient site. We inject 1 mL of PDF into a site that has been prepared with 5 or 7 passes of the injecting cannula. This technique is less traumatic than tunnelizing with far more numerous passes per mL of fat, as suggested by other authors. Fewer passes also decreases the risk of penetrating a vessel with the cannula and is associated with less edema.

51.5.4 Dilution of Fat

Fibrin and other hematic components in lipoaspirate induce aggregation of fat particles, similar to the agglutination of red blood cells. It is a visible phenomenon that the likelihood and extent of aggregation increase proportionate with the concentration of fat cells. Removing all fluids from the aspirate—by filtration or centrifugation—concentrates the fat cells and yields a denser substance that may get trapped in the holes of the injecting cannula. We employ light centrifugation (2000 rpm for 2 min), which we have found to be adequate to separate fat from the oily supernatant and the infranatant blood and anesthetic fluid. We resuspend each 7-mL aliquot of centrifuged fat in a diluent of 1 mL of reddish infranatant liquid and 2 mL of saline [14]. This is an essential

part of our technique because it improves the fluidity of the fat such that light pressure on the syringe plunger is sufficient to distribute the fat uniformly (and without nodules) in the tunneled recipient matrix.

In the lower eyelid and malar area, fat grafting with this technique also yields the favorable result of decreased scleral show (Figs. 51.2a–f, 51.3a–f, and 51.7a–f). By flattening the surface of a sagittally concave lower eyelid, scleral show can be mitigated without the need for additional skin. Further support can be achieved by lipofilling the malar area. In our hands, periocular fat grafting alone usually is sufficient to correct a bowed lower lid and scleral show in many primary patients, especially when fibroligamentous structures and orbicularis muscle tone are adequate. Patients with a history of facial surgery generally have less favorable results of fat grafting alone, owing to the presence of fibrous and retracted tissues in the facial area and less fat take. In these patients, more complex procedures must be added to fat grafting.

We have observed that patients in our practice who undergo periocular grafting with PDF generally are satisfied, even if the volume improvement is only moderate. This finding was unexpected, and we attribute it, at least in part, to the patient being unable to predict the outcome and being willing to accept a less profound aesthetic outcome in exchange for a painless and scarless procedure.

At 1-year postoperatively, 79 of the 200 patients returned for follow-up. It is not unreasonable to interpret this finding as a lack of major complications in the 121 patients who did not present for follow-up. The presence of contour irregularities likely would have motivated these patients to express their dissatisfaction. Adipose tissue masses, especially in the lower lid, are noticeable and certainly unfavorable. However, we acknowledge that we cannot rule out complications in this patient subset. The unknown fate of this cohort constitutes a weakness of this study.

To avoid contour irregularities caused by fat nodules, we advocate only moderately overcorrecting facial concavities. We assert that the risk

of a moderately suboptimal result is preferable to the risk of a visible facial mass. The lower eyelid is most at risk of contour irregularities, followed by the upper lid. The eyebrow area is a more forgiving site for fat transfer because thicker tissues in this area help conceal irregularities.

The only disadvantage we have noted with our technique is that it is challenging to evaluate the aesthetic results of fat transfer intraoperatively when the fat being delivered is diluted. Nevertheless, intraoperative assessments of fat placement are unreliable with concentrated fat as well because of edema caused by local infiltration and the trauma of numerous passes of the cannula. We predetermine the amount of fat to be delivered; intraoperative findings are rarely cause for deviation from this plan.

Gradual loss of volume after fat grafting is not a complication but the rule. It is impossible to predict the extent of volume loss in the postoperative period. Therefore, the surgeon should exercise caution to avoid excessive overcorrection, especially in the lower eyelid where fat transfer can create the appearance of malar bags. Overcorrection can be especially problematic in patients who are younger; these individuals typically have better volume retention and are likely to experience body weight gain over time—which can exacerbate facial fullness after fat transfer. We strongly recommend that surgeons discuss the following with patients: (1) progressive fat resorption is common, and additional grafting may be needed to replace lost volume, and (2) an increase in body weight can dramatically alter the aesthetic result because the transplanted fat behaves as if it still is part of the donor site [18, 19].

This study had several limitations. The study design was retrospective and nonrandomized; therefore, patient selection bias may have influenced the results. In addition, the examiners were asked to address only the results of periocular fat grafting, even though many patients in this series underwent additional aesthetic facial treatments, including blepharoplasty and facelift. These additional procedures may have influenced the perceived results.



Fig. 51.7 (a, c, e) This 57-year-old woman presented with excessively round eyes and asymmetrically hollow upper orbits with excess skin. On profile view, exophthalmos (23 mm by Hertel exophthalmometry) and negative malar prominence (4 mm negative vector) were evident. She had scleral show bilaterally (3 mm on the right and 2 mm on the left). The patient received 5.2 mL of PDF (3.64 mL of centrifuged fat) in the left upper lid and 4 mL of PDF (2.8 mL of centrifuged fat) in the right upper lid. In addition, 4.5 mL of PDF (3.15 mL of centrifuged fat)

was injected in each lower lid. She also underwent upper and lower blepharoplasty without skin resection. Canthopexy was associated. (b, d, f) Two years postoperatively, the eyes appear less round and protuberant, scleral show is improved substantially, and the asymmetry has been corrected. No ptosis treatment was carried out. Fat grafting to the upper eyelid creates the illusion that the supratarsal fold has been lowered, thereby simulating the correction of the upper eyelid ptosis

51.6 Conclusions

Periocular fat grafting is considered to be difficult and risky, especially when the lower lid is treated. We demonstrate herein that recipient site tunnelization and injection of PDF is a simple and reliable technique that yields good contour in the periocular region (Figs. 51.8a–f and 51.9a–c) We do not suggest that PDF is inferior or superior to nondiluted fat with regard to

volume retention, but we do assert that delivery of PDF is unlikely to yield contour irregularities. Of 200 patients who underwent periocular fat grafting with this technique, only two presented to our office requiring surgical correction of poor contour. Injection of PDF is safe and effective for diverse patients, including those with prominent eyes, a negative vector, primary scleral show, small fat hernias, and palpebromalar grooves.



Fig. 51.8 (a) This 34-year-old man presented with concerns of round, hollow-appearing eyes and asymmetry. He received 3.5 mL of PDF (2.45 mL of centrifuged fat) on the right side and 2.5 mL of PDF (1.75 mL of centrifuged fat) on the left. Canthopexy was associated. The patient

did not undergo treatment to correct the ptosis of the right upper lid. (b) One year postoperatively, the eyes protrude less and have a pleasing appearance. The apparently lower supratarsal fold creates the illusion of ptosis correction

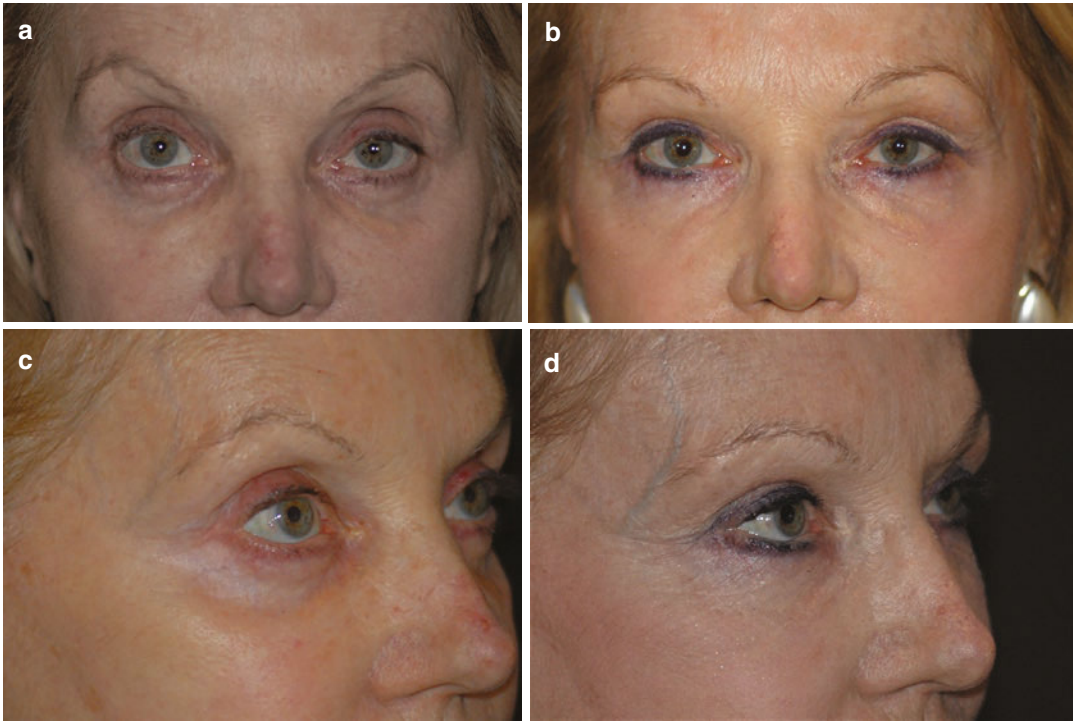


Fig. 51.9 (a, c) 72-year-old woman with hollow eyes and marked depressions over the eyelid-cheek junction. (b, d) After fat grafting on upper (5cc on each with 30% dilution) and lower lid (5 cc on each with 30% dilution).

Botulinum toxin was injected over her forehead wrinkles 1 month beforehand. Hollowness was marked improved, lower lid appear shorter and scleral show amended

Key Messages

- Fat deflation is a primary cause of periorcular aging
- Periorcular fat grafting can achieve excellent result
- Prominent eyes and scleral show can highly benefit of this procedure
- Dilute the fat to decrease the risk of contour irregularities
- Cautious overcorrection is indicated when dilution is carried out
- Use blunt cannulas to decrease the risk of perforating a vessel
- Create multiple subcutaneous tunnels before injecting the fat
- Smooth edges of the injected areas

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