The Evolution of Midface Rejuvenation

Combining the Midface-lift and Fat Transfer

Allison T. Pontius, MD; Edwin F. Williams III, MD

Objective: To evaluate the aesthetic results in our initial group of patients treated with a combination of a midface-lift and fat transfer compared with a randomly selected group of patients who underwent a midface-lift without concurrent fat transfer by one of us.

Methods: The setting was a private, ambulatory, surgical center. The design was a comparative study between patients who did or did not receive fat transfer in addition to a midface-lift to determine if the addition of fat transfer to the midface-lift resulted in an improved aesthetic outcome. A total of 40 patients with complete photographic and medical records and a minimum of 6 months of follow-up were included in the study. Group 1 consisted of 30 patients randomly selected (from >650 potential patients) who underwent a midface-lift without fat transfer to serve as a control group. Group 2 consisted of our initial 10 patients who underwent fat transfer in addition to a midface-lift at the same setting. The degree of aesthetic improvement in 4 facial zones was assessed by 3 independent blinded evaluators. Zone 1 represents the tear trough/infraorbital rim; zone 2, the malar eminence; zone 3, the submalar region; and zone 4, the nasolabial crease. Each zone was given a rating from 0 to 2 (0 for no improvement; 1, mild improvement; and 2, marked improvement). The 2 groups were compared with 4 $\chi^2$ tests of independence.

Results: Four $\chi^2$ tests of independence were conducted to compare the findings between group 1 and group 2. One hundred twenty ratings were conducted; group 1 consisted of 90 total ratings on 30 patients and group 2 consisted of 30 total ratings on 10 patients. The first $\chi^2$ (tear trough/infraorbital rim) test revealed a significant difference on tear trough ratings by group ($\chi^2=73.59, P<.01$). The second $\chi^2$ test (malar eminence) did not reveal a significant difference on malar eminence ratings by group ($\chi^2=3.10, P=.21$). The third $\chi^2$ test (submalar region) failed to reveal a significant difference on submalar region by group ($\chi^2=4.01, P=.13$). The final $\chi^2$ test (nasolabial crease) revealed a significant difference on nasolabial ratings by group ($\chi^2=14.28, P<.01$).

Conclusions: Our findings revealed a statistically significant difference between group 1 (no fat transfer) and group 2 (fat transfer) in the tear trough region ($P<.01$) and the nasolabial crease ($P<.01$). The fat transfer technique in combination with a midface-lift is a safe and effective means to provide more complete facial rejuvenation, especially in the regions of the tear trough and nasolabial crease.

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THE AGED FACE IS THE CONSEQUENCE OF SEVERAL CONCURRENT FACTORS, INCLUDING SKIN LAXITY, SOFT TISSUE PTOSIS, AND VOLUME LOSS. IMPROVING THE CONDITION OF THE SKIN IS MOST COMMONLY OBTAINED WITH RESURFACING PROCEDURES, LASER AND LIGHT THERAPY, DAILY SKIN CARE, AND UV PROTECTION. CORRECTION OF SOFT TISSUE PTOSIS IS USUALLY SURGICALLY TREATED WITH A BROW-LIFT, MIDFACE-LIFT, AND LOWER FACE RHYTIDECTOMY. CORRECTION OF VOLUME LOSS CAN BE OBTAINED WITH INJECTABLE FILLERS, MOST NOTABLY BY AUTOGENOUS FAT TRANSFER PROCEDURES. IDEALLY, ALL OF THESE ELEMENTS SHOULD BE TREATED TO PROVIDE COMPLETE FACIAL REJUVENATION.

Researchers have written extensively on the importance of addressing the midface in facial rejuvenation procedures; however, despite repositioning of the ptotic soft tissues of the midface, facial rejuvenation may remain incomplete because of the persistent loss of volume seen in these patients. Despite excellent surgical results obtained from the midface-lift, we found that our rejuvenation procedures needed to evolve to include the correction of facial volume loss. In 2004, we began introducing fat transfer to patients undergoing a midface-lift to improve our aesthetic results. We specifically used fat transfer in patients undergoing a midface-lift because the key areas of volume loss are centered around the midface: the tear trough/infraorbital rim, the malar eminence, the submalar region, and the nasolabial crease. We have found that these areas are where volume loss is most prominent. Additional areas where volume loss is present in some patients in-
were compared with 4
mild improvement; and 2, marked improvement). The 2 groups zone was given a rating from 0 to 2 (0 for no improvement; 1,
3, the submalar region; and zone 4, the nasolabial crease. Each
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assessed by 3 independent blinded evaluators. Zone 1 represents
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Group 1 consisted of 30 patients randomly selected (from
minimum of 6 months of follow-up were included in the study.
All patients underwent a midface-lift alone or in conjunction
performed by one of us (E.F.W.). Forty patients with complete photographic and medical records and a
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The degree of aesthetic improvement of the 4 zones was as-
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SURGICAL TECHNIQUE

Fat Retrieval

The patient is placed under monitored anesthesia care with in-
travenous sedation or general anesthesia. When fat transfer is
performed as the sole procedure, oral sedation is an option; how-
ever, because the patients in this study are undergoing a con-
comitant midface-lift, general anesthesia or monitored anes-
thesia care is necessary. Before any surgical manipulations or
filtration of local anesthesia, the areas of planned injection are
delineated with a surgical marking pen and the estimated
amount of fat needed is determined. Typically, for the 4 areas
examined in this study, a total of 40 mL of aspirated fat is suf-
ficient. Next, the fat harvest sites are delineated with the sur-
gical marking pen. We have found that the ideal place for fat
aspiration is the inner thighs; however, we commonly also ac-
access the outer thighs and the abdomen. In thin patients, we ac-
access any areas of fat accumulation, including the flanks and lat-
eral buttocks. Once the entry sites for aspiration are determined,
a single-stab incision is made with a No. 11 blade. A long li-
posuction aspiration cannula is attached to a 20-mL syringe filled
with the tumescent solution (1 mL of 1% lidocaine with
1:100 000 epinephrine, 4 mL of 1% plain lidocaine, and 15 mL
of isotonic sodium chloride solution). The long cannula is placed
through the stab incision and directed out from the injection
site in a fanlike pattern. A first pass is performed as a tunnel-
ing maneuver, and the second pass is when the tumescent so-
lution is infiltrated. This is repeated in the other fat aspiration
sites. Typically, a total of four 20-mL syringes are used to in-
filtrate the abdomen (2 per side, from periumbilical stab inci-
sions), and two 20-mL syringes of tumescent solution are used
per inner or outer thigh. The total amount of tumescent solu-
tion used in a case is dependent on the number of aspiration
sites; however, the total amount of lidocaine infiltrated is al-
ways carefully recorded. Ten minutes is allowed to elapse for the
maximal vasoconstrictive effect of the epinephrine. Next, the
same liposuction aspiration cannula is affixed onto a 10-mL
Luer-Lok syringe (B-D, Franklin Lakes, NJ). The nondomi-
nant hand is used to elevate the skin and superficial fat away
from the aspiration cannula, and the dominant hand is used to
perform manual aspiration of the fat (Figure 1). A vigorous
forward and backward movement of the cannula is used for op-
timal aspiration. When aspirating in the abdominal area, one
must be careful to stay in a relatively superficial plane to avoid
any trauma to the underlying rectus muscle or untoward peri-
toneal entry, especially in patients with a history of abdominal
surgery. The nondominant (or “smart” hand) can be used to
guide the aspiration cannula in the proper plane. Following as-
piration of the fat in multiple 10-mL syringes, the stab inci-
sions are closed with a single 5-0 fast-absorbing gut suture. If
the abdominal area was accessed, an abdominal binder is placed.
The inner and/or outer thighs are wrapped with a 15-cm stan-
dard compression (Ace) wrap.

Fat Processing

The plungers on the 10-mL syringes filled with aspirated fat are
removed, and a metal stopper is placed on the ends of the sy-
ringes. The syringes are then passed off the table to the circulat-
ing nurse, who places them into the centrifuge. The centrifuge
must always be “counterbalanced” (ie, an even number of sy-
rings should be placed in the centrifuge directly across from each
other). The fat is centrifuged for 3 to 5 minutes at 3500 rpm. At
the conclusion of the centrifugation, the fat has separated into 3
distinct layers: the top layer consists of oil from ruptured adipocytes, the central area is the usable fat, and the bottom layer con-
tains lidocaine, isotonic sodium chloride solution, and blood (se-
rous fluid) (Figure 2). The stoppers are then removed from the
syringes to allow drainage of the serous fluid. The oil layer is then
Fat Transfer Procedure

The details of our surgical approach to the midface are described extensively elsewhere. Once the midface-lift portion of the procedure is concluding, the surgical technician transfers the fat from the 10-mL syringes into individual 1-mL syringes using a Luer-Lok transfer device. Either a straight or a slightly curved 16-gauge blunt cannula is placed on the 1-mL syringes, depending on the anatomical site being injected. Attention is then turned to the previously marked-out areas on the face: the tear trough, the malar eminence, the submalar region, and the nasolabial crease. An 18-gauge NoKor needle (B-D) is used to create small stab incisions at the sites of entry. Beginning with the tear trough, the stab incision is made just inferior to the infraorbital rim and lateral to the infraorbital nerve. The 16-gauge blunt cannula is used to inject fat along the tear trough using multiple passes and laying down a minimal amount of fat (ideally about 0.03 mL per pass). The fat is injected at many different angles; however, at this location, the fat is injected only in the deep plane just superior to the periosteum. Next, attention is turned to the malar eminence. Injection at this site is focused on injecting into and along the zygomaticus major, zygomaticus minor, and levator labii superioris muscles and into the malar fat pad (Figure 3). The entry incision is made with the NoKor needle at the inferior region of the muscles. A similar technique of inserting the blunt cannula and injecting a small amount of fat on withdrawal is performed. Multiple passes with the cannula and injection into multiple tissue levels are performed. The submalar region is addressed next, with injections targeting the buccinator and risorius muscles. Finally, the nasolabial creases are addressed by making the entry stab incision at the inferrior most point of the nasolabial crease. The same technique is used herein, except that the injection is performed solely into the subcutaneous tissue layer and not into a specific muscle. After the conclusion of fat injections, the face is cleansed with isotonic sodium chloride solution, a small amount of antibiotic ointment is placed on each of the stab incisions, and a typical face-lift/brow-lift pressure dressing is placed (soley for the midface-lift). The injected areas are aggressively iced for the first 48 hours to decrease edema and ecchymoses.

COMPLICATIONS

The most common complication, or sequela, from the fat transfer was prolonged postoperative edema. The edema is thought to be due to the multiple tunneling performed with the fat transfer and the concurrent midface-lift. The second most common complication was ecchymoses from the stab incisions used to pass the injection cannula through the skin and from the multiple tunnels created to lay down the fat. Other reported complications of fat transfer include undercorrection, overcorrection, tissue irregularities and asymmetries, migration of the placement of the fat, and hematoma.

RESULTS

Four \( \chi^2 \) tests of independence were conducted to compare the findings between group 1 and group 2. A total of 120 ratings were conducted; group 1 consisted of 90 total ratings and group 2 consisted of 30 total ratings. Each of the 3 evaluators provided 1 rating per site; therefore, the total number of ratings for group 1 is 90 (30 patients \( \times \) 3 ratings per site) and the total number of ratings for group 2 is 30 (10 patients \( \times \) 3 ratings per site). The \( \chi^2 \) test of independence assumes that the obtained frequencies of all the cells are normally distributed around the expected frequencies after repeated sampling. Thus, all cells must have a minimum expected value of 5 in order to meet this assumption. This assumption was violated on the malar eminence and submalar region analyses.

The first \( \chi^2 \) test revealed a significant difference on tear trough ratings by group (\( \chi^2=73.59, P<.01 \)). In group 1 (no fat transfer), 26% (n=23) received a no improvement rating, 74% (n=67) received a mild improvement rating, and 0% (n=0) received a marked improvement rating. In group 2 (fat transfer), 0% (n=0) received a no improvement rating, 33% (n=10) received a mild improvement rating, and 67% (n=20) received a marked improvement rating. Therefore, 67% of ratings for the patients who underwent fat transfer demonstrated a marked improvement vs 0% for the group who did not receive fat transfer.

The second \( \chi^2 \) test did not reveal a significant difference on malar eminence ratings by group (\( \chi^2=3.10, P=.21 \)). In group 1 (no fat transfer), 8% (n=7) received a no improvement rating, 57% (n=51) received a mild improvement rating, and 36% (n=32) received a marked improvement rating. In group 2 (fat transfer), 0% (n=0) received a no improvement rating, 53% (n=16) received a mild improvement rating, and 47% (n=14) received a marked improvement rating. These differences did not reach statistical significance.

The third \( \chi^2 \) test failed to reveal a significant difference on submalar region by group (\( \chi^2=4.01, P=.13 \)). In group 1 (no fat transfer), 7% (n=6) received a no improvement rating, 71% (n=64) received a mild improvement rating, and 22% (n=20) received a marked improvement rating. In group 2 (fat transfer), 0% (n=0) received a no improvement rating, 63% (n=19) received a mild improvement rating, and 37% (n=11) received a marked improvement rating. These differences did not reach statistical significance.

The final \( \chi^2 \) test revealed a significant difference on nasolabial ratings by group (\( \chi^2=14.28, P<.01 \)). In group 1
Miller described the infiltration of fat via a cannula. Although can survive in various areas of the body. In 1926, multiple reports have verified that fat can be transplanted and can survive in various areas of the body. By 1926, Miller described the infiltration of fat via a cannula. Although he described good results, the technique did not obtain much notoriety at the time. The breakthrough in fat transplantation occurred with the development of liposuction in the 1970s and its widespread use in the 1980s. Illo2 was a pioneer of liposuction, and he also studied the effects of fat transplantation to the face. In 1988, he studied the long-term results of facial fat injection in 167 patients. Despite finding somewhat disappointing results in the long-term correction of facial wrinkles, he remained optimistic in the possibility of fat cell survival and encouraged further research in this area. In 1985, Fournier first began extracting fat via a syringe and needle and confirmed the integrity of the fat harvested by syringe aspiration. In the 1990s, Coleman contributed significantly to our current techniques and understanding of fat transfer by emphasizing the need for gentle removal and handling of fat and the injection of small volumes of fat per pass combined with multiple passes to improve fat vascularization and, therefore, aesthetic outcome and longevity of results. In 1999, Amar described fat autograft muscle injection, in which fat is harvested via syringe aspiration, refined via centrifugation, and injected into the muscles of facial expression with specific anatomically curved cannulae.

In this study, we attempted to determine the aesthetic benefit of combining our extended minimal incision midface-lift with fat transfer by having 3 independent evaluators rate the aesthetic improvement on a 3-point scale. We compared the results of the study group with those of a control group of 30 randomly selected patients who had previously undergone a midface-lift alone. We only studied patients with a minimum of 6 months of medical record documentation and photographic follow-up. We concentrated on 4 areas of the face in which we saw shortcomings with the midface-lift alone: the tear trough/infraorbital rim, the malar eminence, the submalar region, and the nasolabial crease. The 10 patients presented in group 2 represent the initial group of patients in whom we combined a midface-lift with fat transfer. Obviously, while beginning to incorporate the fat transfer procedure into our operation for the midface-lift, we remained conservative with this initial group of patients. Fat volumes injected in these patients were somewhat modest (average, 21.5 mL per patient), and all patients underwent only 1 fat transfer procedure during their midface-lift.

Our findings demonstrate that there was a statistically significant difference between group 1 (no fat transfer) and group 2 (fat transfer) in the tear trough region (P<0.01) and the nasolabial fold (P<0.01). The most impressive results were seen in the tear trough/infraorbital rim, where most patients in group 2 (67%) had a marked improvement rating. No patients in group 1 received a marked improvement rating in this area. The tear trough demonstrated excellent aesthetic improvement and long-term correction, as noted at 6 months. In the tear trough region, the injection is performed in a deeper plane, just superficial to the peristeum in an area of minimal mobility that may account for the more dramatic results seen in this area compared with the other studied areas. After seeing these initial impressive results in the tear trough, we are increasing the volume of fat transferred to this region. In this study, all patients received 1 mL of fat transfer to the tear trough/infraorbital rim (per side); however, we are now using 3 mL of fat per side with even more impressive results and no apparent increase in morbidity.

In the nasolabial fold, we also found a statistically significant difference between groups (P<0.01). Patients in group 2 showed more mild improvement ratings than those in group 1; however, no patient in either group received a marked improvement rating. The nasolabial crease continues to be a challenging area to correct long term. Most commonly, the initial correction observed with fat transfer is only a mild improvement by the 6-month follow-up. This may in part be due to the mobility of the region and the more superficial plane of injection.

In the malar and submalar regions, there were no statistically significant differences between groups; however, because the values in these groups were not normally distributed around the expected frequency, a type II error may have occurred. In other words, there may in fact be a clinical difference that is not statistically discernable. Regardless, possible reasons for the minimal improvements noted in the malar and submalar region may be related to the midface-lift itself. We perform a subperiosteal midface-lift that elevates the origin of the zygomaticus major muscle off of the underlying bone. This creates a potential space in the subperiosteal plane that is much easier to enter when injecting fat than is the belly of the zygomaticus muscles themselves. In addition, the midface structures are suture suspended to the temporalis fascia; therefore, extreme caution must be used not to break these sutures when injecting the midface. The edema and occasional bleeding incurred during the midface-lift may also be playing a role in fat resorption and obscuring tissue planes of injection.

Potential alterations in technique that may yield more significant results in the malar and submalar regions may include staggering the midface-lift and fat injection procedures to eliminate the effects of tissue edema seen immediately following the midface-lift and to provide more static planes of injection. In addition, a second fat transfer procedure may be indicated in certain patients at 3 to 6 months to restore complete correction.

In our practice, the evolution of the midface-lift includes the addition of fat transfer to the operation. Our study is in support of the use of fat transfer to correct the tear trough deformity and the nasolabial crease.
Figure 4. Preoperative (A, C, E, and G) and postoperative (B, D, F, and H) photographs of a patient who underwent a midface-lift with fat transfer. There was improvement in the tear trough region and nasolabial creases secondary to the fat transfer.
during the midface-lift. Many patients who undergo a midface-lift have a significant tear trough deformity and infraorbital skeletonization (either from previous blepharoplasty or aging) that can be emphasized with a midface-lift alone. By combining fat transfer to the tear trough/infraorbital rim with the midface-lift, we are able to create a youthful convex contour between the lower eyelid and the cheek, which provides superior aesthetic results and long-term correction (Figure 4). In addition, the nasolabial crease can be improved with fat transfer. In our initial group of patients, this resulted in modest long-term improvement; however, because our fat transfer technique is evolving, we are anticipating even more impressive results in the future.

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Correspondence: Allison T. Pontius, MD, Plastic Surgery Associates of New York, 59 E 79th St, Suite 1AB, New York, NY 10021 (allisonpontius@yahoo.com).

Author Contributions: Dr Pontius had full access to all of the data in the study and takes responsibility for the integrity of the data and the accuracy of the data analysis.

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