

Autologous Fat Transfer National Consensus Survey: Trends in Techniques and Results for Harvest, Preparation, and Application

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59.1 Introduction

There has been interest in autologous fat transfer since the inception of whole-fat grafts in the 1890s (1) and injectable fat grafts in the 1920s (2). The earliest recorded human free fat transfer was performed by Neuber in 1893. He demonstrated viability of autologous fat transferred into scar tissue based upon clinical evaluation. Neuber emphasized the importance of small grafts for more predictable results, a concept believed integral in current methods. Early optimism was tempered by Peer (3), a pioneer in the science of autologous tissue transfer, who histologically determined that fat grafts lost about 45% of their weight and mass 1 year or more following transplantation. Interest in autologous fat transfer waned until the re-emergence of the procedure in the late 1980s, which correlated with the widespread application of suction lipectomy for body contouring.

In the last 20 years, the literature has seen numerous clinical reports highlighting the benefits of autologous fat transfer for facial recontouring (4–7). A greater understanding of how to maintain viable fat has led to modifications in technique, which is believed to improve clinical results. These modifications are intended to preserve the delicate structure of adipocytes and provide a robust blood supply upon which fat cells are extremely dependent (8). Unfortunately, the clinical optimism expressed by the proponents of the procedure has not been corroborated by objective scientific assessments. There are

many conflicting studies and physician experiences that exist regarding the durability and integrity of autologous fat grafts (9). It has been suggested that the variability in donor site and tissue preparation make a difference in graft take and survival (10). Ultimately, it may be that physician and patient satisfaction are the true indicators of the utility of the procedure. In order to assess this, we distributed a 30-question survey to a subset of plastic surgeons to examine the beliefs, practices, and satisfaction of both physician and patient.

59.2 Methods

A questionnaire was mailed to 650 plastic surgeons randomly selected from the American Society for Aesthetic Plastic Surgery master file in February 2005. The completion of the questionnaire was strictly voluntary and without compensation. The questionnaire was designed to delineate the experience, practices, and beliefs among plastic surgeons with regard to the use of autologous fat for contour restoration. The questionnaire contained 30 multiple-choice questions with ordinal variables as well as an open-ended question used to obtain data for further focus group research (Table 59.1).

Surgeon experience was assessed on the basis of the number of fat transfers performed per year either independently or in conjunction with other facial rejuvenation procedures. Surgeon practices and methods for autologous fat transfer were evaluated on the basis of surgeons' preferences for (a) harvest and transfer sites, (b) local anesthetic used at both sites, (c) technique used for fat harvest (e.g., cannula, microcannula, excision) and transfer (e.g. cannula, needle, and ratchet gun),

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Table 59.1 The 30-question autologous fat transfer survey sent to 650 randomly selected members of the American Society for Aesthetic Plastic Surgery. 508 surgeons responded

Autologous fat transfer survey	
1) How many fat transfer procedures do you perform per year?	(d) Other
(a) <10	(e) n/a
(b) 10–30	9) After harvest how do you treat the fat?
(c) 30–50	(a) Nothing
(d) >50	(b) Washing
2) What percentage of fat transfers are performed in conjunction with other facial rejuvenation procedures?	(c) Centrifugation
(a) <25%	(d) Adding insulin
(b) 25–50%	(e) Other
(c) 50–75%	10) Do you ever freeze excess fat for later application?
(d) 75–100%	(a) Yes
3) What is/are the preferred harvest location/donor site(s) for injectable fat? (mark all that apply).	(b) No
(a) Gluteal	11) If you perform direct excision, what does the graft consist of?
(b) Thigh	(a) Fat alone
(c) Flank	(b) Dermis and fat
(d) Abdomen	(c) Fascia and fat
(e) Knee	(d) Dermis, fascia, and fat
(f) Other	(e) Other
(g) I do not perform fat injection	(f) I do not perform direct excision
4) What is/are the preferred harvest location/donor site(s) for excised fat? (Mark all that apply).	12) What local anesthesia is used at the injection site?
(a) Gluteal	(a) 0.5% xylocaine with epinephrine
(b) Thigh	(b) 1% xylocaine with epinephrine
(c) Flank	(c) Wetting solution (50 mL 1% xylocaine + 1 mL epinephrine 1:1,000 + 1 L NS).
(d) Abdomen	(d) Epinephrine alone
(e) Knee	(e) Other
(f) Other	13) What anatomical locations do you place fat grafts? (mark all that apply).
(g) I do not perform fat excision	(a) Forehead
5) What local anesthesia is used for the donor site?	(b) Upper eyelids
(a) 0.5% xylocaine with epinephrine	(c) Lower eyelids
(b) 1% xylocaine with epinephrine	(d) Nasojugal region
(c) Wetting solution (50 mL 1% xylocaine + 1 mL epinephrine 1:1,000 + 1 L NS).	(e) Malar region
(d) Epinephrine alone	(f) Nasolabial fold
(e) Other	(g) Lips
6) What harvest technique is used?	(h) Chin
(a) Liposuction cannula	14) What do you use to inject the fat?
(b) Microcannula	(a) Cannula
(c) Syringe + large bore needle	(b) Needle
(d) Direct excision	(c) Ratchet gun
(e) Other	(d) Other
7) If a liposuction cannula is used, what size?	15) Do you overcorrect the defect?
(a) 1 mm	(a) Yes
(b) 2 mm	(b) No
(c) 3 mm	16) If so, by what percentage?
(d) 4 mm	(a) 10%
(e) Other	(b) 20%
(f) n/a	(c) 30%
8) If a syringe and needle are used, what size?	(d) 40%
(a) 14 gauge	(e) 50% or greater
(b) 16 gauge	17) Into what layer do you place the graft?
(c) 18 gauge	(a) Dermal
	(b) Subcutaneous
	(c) Intramuscular
	(d) Other

(continued)

Table 59.1 (continued)

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| <p>18) How do you assess the long-term results of fat injection? (mark all that apply)</p> <p>(a) Photography - 35 mm camera</p> <p>(b) Digital photography</p> <p>(c) Examination: palpation</p> <p>(d) Volumetric imaging: Radiographic imaging, Laser scanner or 3D photography</p> <p>19) Do you believe all fat that is injected survives?</p> <p>(a) Yes</p> <p>(b) No</p> <p>20) If not, what % do you think survives?</p> <p>(a) >75</p> <p>(b) 50–75</p> <p>(c) 25–50</p> <p>(d) <25</p> <p>21) Do you think that augmentation from fat persists 6 months after injection?</p> <p>(a) Yes</p> <p>(b) No</p> <p>22) If not, what % of original augmentation persists 6 months after injection?</p> <p>(a) >75</p> <p>(b) 50–75</p> <p>(c) 25–50</p> <p>(d) <25</p> <p>23) Do you think the maintenance of volume at 6 months is a result of fat survival, replacement with scar, or a combination?</p> <p>(a) Fat survival</p> <p>(b) Replacement with scar</p> <p>(c) A combination</p> <p>24) Do you think there is a difference in survival based upon injection site?</p> <p>(a) Yes</p> <p>(b) No</p> <p>25) If so, what site(s) do you think are best with regard to fat survival? (mark all that apply).</p> <p>(a) Forehead</p> <p>(b) Upper eyelids</p> | <p>(c) Lower eyelids</p> <p>(d) Nasojugal region</p> <p>(e) Malar region</p> <p>(f) Nasolabial fold</p> <p>(g) Lips</p> <p>(h) Chin</p> <p>26) What is the longest graft survival you have achieved?</p> <p>(a) 6 months or less</p> <p>(b) 6 months to 1 year</p> <p>(c) 1–2 years</p> <p>(d) >2 years</p> <p>27) What % of patients require repeat injections?</p> <p>(a) <10</p> <p>(b) 10–30</p> <p>(c) 30–50</p> <p>(d) <50</p> <p>28) In your estimation, what is the short-term (<6 months) patient satisfaction with the procedure?</p> <p>(a) Excellent</p> <p>(b) Good</p> <p>(c) Fair</p> <p>(d) Poor</p> <p>29) In your estimation, what is the long-term (>6 months) patient satisfaction with the procedure?</p> <p>(a) Excellent</p> <p>(b) Good</p> <p>(c) Fair</p> <p>(d) Poor</p> <p>30) In your estimation, what is the overall patient satisfaction with the procedure?</p> <p>(a) Excellent</p> <p>(b) Good</p> <p>(c) Fair</p> <p>(d) Poor</p> |
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Please feel free to comment on your personal experience and/or technique with autologous fat transfer (i.e., What do you do to achieve better, longer lasting results?)

(d) postharvest pretransfer fat preparation, (e) need for overcorrection, and (f) method for long-term evaluation of results. Finally, the questionnaire elucidated surgeons' attitudes and beliefs regarding autologous fat transfer by asking their experience regarding (a) the percentage of fat that persists at 6 months; (b) whether what persists is fat, scar, or a combination; (c) the percentage of patients who require repeat transfers; and (d) short- (<6 months) and long-term (>6 months) patient satisfaction.

Surveys were returned to the investigators via mail or facsimile. In order to increase the response rate, "no response" was followed up with one phone call asking the physician to take time for the survey, or by resending the questionnaire. The completed questionnaires were entered into a database (MS Access) by one investigator, and the quality of data entry was checked by a separate investigator. Calculation of crude percentages and correlations were conducted by our group of statisticians.

59.3 Results

Of the 650 questionnaires mailed, 508 (78%) were returned completed in their entirety and used for analysis. Three hundred and six physicians responded after a first request, and 202 responded after a second request. The 508 who responded represented surgeons from all 50 states. Ten questionnaires were returned blank, either because of bad addresses or with notes indicating valid reasons for non-response (e.g., intended recipient deceased or not in practice). Sixteen questionnaires were returned incomplete, and no response was received from 116 physicians surveyed.

59.4 Experience

Of the 508 surgeons surveyed regarding general fat transfer (injectable fat, dermal fat graft or other transfers), 41% perform less than 10 fat transfers annually, 35% perform between 10 and 30, and 24% perform more than 30. Forty-four percent of physicians perform fat transfers concurrent with other facial rejuvenation procedures in a majority of cases, whereas the remaining 56% tend to perform them as isolated procedures.

59.5 Technique

The most common solutions used for local anesthesia at the harvest site are wetting solution (50 mL 1% xylocaine + 1 mL epinephrine 1:1,000 + 1 L normal saline) (40%), 0.5% xylocaine epinephrine mixture (30%), or 1% xylocaine epinephrine mixture (22%), whereas 8% of respondents use either epinephrine alone or some other solution. Eighty percent of physicians report using either 0.5 or 1% xylocaine epinephrine mixture at the recipient site, whereas the remaining 20% use either wetting solution or some other solution.

The most preferred site for fat harvest is the abdomen (89%), followed successively by the thigh (34%), flank (25%), gluteal region (12%), and knee (9%) (Fig. 59.1). Another 2% of physicians report harvesting fat from alternative sites including the sacrum or temporal region. The Coleman microcannula technique is the most common method of fat harvest (54%), followed by standard liposuction cannula (25%),



Fig. 59.1 Percent of surgeons choosing these harvest locations/donor sites. The surgeons could choose more than one site

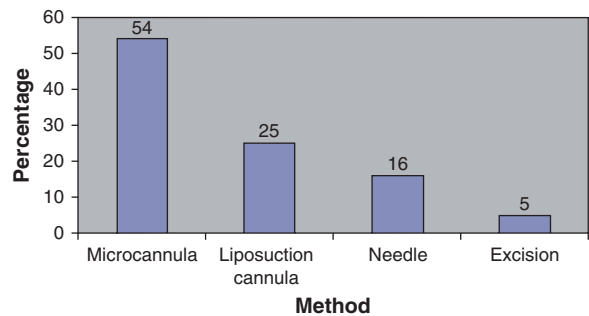


Fig. 59.2 Percent of surgeons using these harvest techniques primarily

syringe and large bore needle (16%), and direct excision (5%) (Fig. 59.2). The percentages reflect that individual physicians will utilize multiple sites of harvest and more than one harvest technique in their practice.

Following fat harvest, 47% of respondents perform centrifugation of fat, 29% perform fat washings, and 12% site-unspecified “other” treatment techniques, whereas 12% do not use any preparation methods, and none of the respondents add insulin to the harvested fat.

Each respondent was asked to select locations that could benefit from fat injections. The nasolabial folds (83%) and lips (74%) are the most popular sites for injection, followed by the nasojugal region (59%), malar eminence (43%), chin (35%), forehead (30%), lower eyelids (20%), and upper eyelids (12%) (Fig. 59.3). A majority of physicians use a cannula (60%) or needle (38%) for fat application, whereas 2% use a ratchet gun. Six percent of physicians froze excess fat for later application.

Fifty-five percent of physicians use direct surgical excision as one of their harvest techniques. Of the

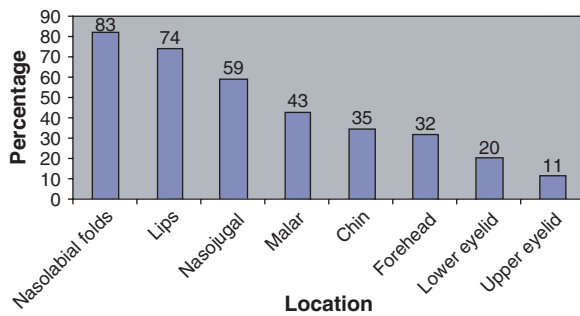


Fig. 59.3 Percent of surgeons placing fat grafts at these anatomical locations. Surgeons were asked to mark all locations where they apply fat grafts

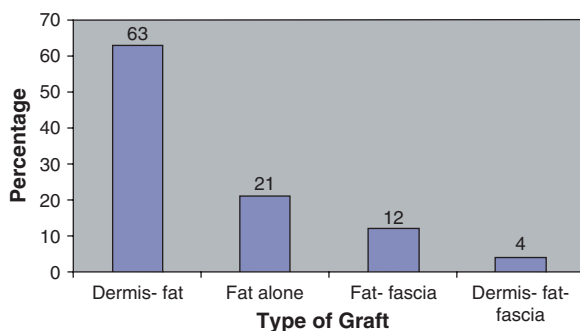


Fig. 59.4 Percent of surgeons choosing these graft consistencies when performing direct excision

surgeons that excise fat grafts, most often the grafts consist of dermis-fat (63%) or fat alone (21%), and less frequently fat-fascia (12%) or dermis-fat-fascia (4%) (Fig. 59.4). The preferred harvest sites for those who perform direct surgical excision of grafts include abdomen (50%), gluteal region (9%), thigh (4%), flank (3%), and knee (2%). Nine percent of respondents use an alternate site such as the sacrum or temporal region, and the rest do not perform direct fat excisions (23%).

Eighty-seven percent of physicians believe that it is important to overcorrect autologous fat grafts. Nineteen percent of those polled believe a 10% overcorrection is required, whereas 60% recommend overcorrecting by 20–30%, and 21% overcorrect by 40–50%.

59.6 Outcomes

The manner in which most practitioners assess the results of autologous fat transfer are by examination with palpation (55%) and/or photos (48%) (digital

photography 39%; photography with 35 mm camera 9%), and less often by other methods (13%) such as imaging studies for facial volume measurements with radiography, laser scanners, or 3D photography.

The percentage of physicians who believe that there is at least some resorption of fat at 6 months is 92%. Of these, 52% believe the resorption rate is 50% or greater, while the remaining 48% believe it to be less than 50%. A majority (63%) of respondents are of the opinion that the remaining volume consists of a combination of fat and scar tissue, whereas 34% believe the volume is all viable fat and 3% that it is all scar tissue. Sixty-nine percent of physicians believe they have observed fat grafts persisting for more than 2 years, whereas the remaining 20% have only witnessed survival for either 1–2 years (19%), 6 months to 1 year (9%), or less than 6 months (2%) (Fig. 59.5).

When physicians who perform a few fat transfers (<10 annually) were compared to physicians who performed many fat transfers (>30 annually), there were differences in perceived “take.” With regard to percentage of fat that survives injection, 76% of the few fat transfer group recorded that less than 25% survived. In contrast, 72% of the many fat-transfer groups recorded that more than 50% of fat survived. In addition, 89% of the many fat-transfer groups compared to only 16% of the few fat-transfer groups had observed fat grafts persist for more than 2 years.

Thirty-one percent of physicians reported that more than half of their patients require reinjection, whereas the remaining 69% felt this value was less than half. Short-term (<6 month) patient satisfaction was believed to be excellent for 36%, good for 52%, fair for 8%, and poor for 4% by the physicians surveyed. Long-term (>6 month) patient satisfaction was believed to be

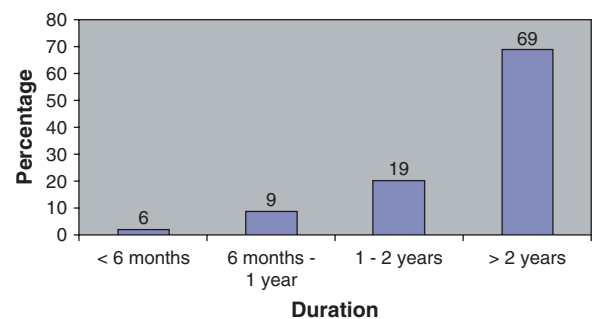


Fig. 59.5 Percent of surgeons achieving these longest graft survival durations

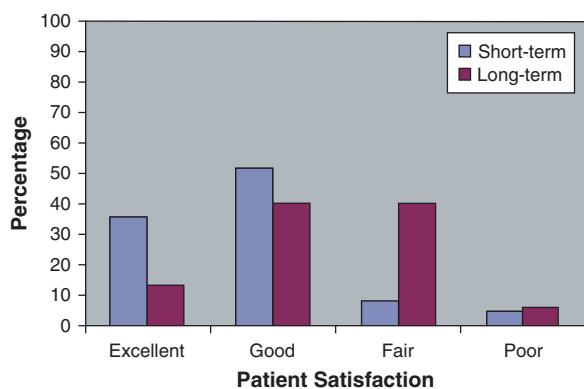


Fig. 59.6 Percent of surgeons rating patient satisfaction as Excellent, Good, Fair, or Poor in the short and long term

excellent for 13%, good for 40%, fair for 41%, and poor for 6% (Fig. 59.6).

59.7 Discussion

Facial recontouring is one of the more sought after plastic surgery procedures for correction of congenital defects, traumatic injuries, or the aging face. Numerous surgical approaches and methods have been investigated using either alloplastic materials or autologous tissue (11–38). Facial alloplasts include injectable forms (e.g., collagen, silicone, polyacrylamide gel) and solid implants (e.g., expanded polytetrafluoroethylene (ePTFE; brand name, Gore-Tex), allogeneic dermis (AlloDerm). Autologous grafts include fat alone, dermis-fat, dermis-fat-fascia, fascia alone, and free tendon grafts (36–38).

Some of the problems associated with alloplastic materials are foreign body reactions and fatigue or warping of the material. Although injectable silicone was widely advocated in the past, its use was associated with significant morbidity including abscess formation, inflammatory tissue reaction, and granulomas (11–15). The American College of Plastic Surgeons has subsequently deemed it unacceptable to perform silicone injections for facial recontouring. Instead, collagen and hyaluronic acid injections have gained popularity because of both a high rate of patient satisfaction and because these injectables are generally regarded as safe (17–21). Nonetheless, since these substances are biologic materials, they are subject to degradation by

the body and the effects often are limited to 6 months before reinjection is required (22, 23).

The ideal augmentation material necessitates certain qualities, including consistent and reproducible results, biocompatibility, lack of toxicity, ease of use, and economically prudent. In addition, the material should have a natural feel, be customizable to each individual patient, and be easily removable in the event of complication or patient dissatisfaction. While various options exist for facial recontouring, to date there is still no ideal filler, mainly because of complications that have been associated with each method. Autologous fat represents a contour material that meets many qualities of an ideal augmentation material. The greatest technical challenge of autologous fat transfer is maintaining longevity, and the current literature is controversial regarding the durability of fat grafts. The purpose of this study was to survey a subset of plastic surgeons in order to analyze the beliefs, practices, and perceived outcomes of short- and long-term viability.

Although there is a perception that autologous fat transfer is a commonly performed procedure by plastic surgeons in the United States, the results of the survey may refute this notion. Many (41%) of respondents perform less than 10 procedures annually. Furthermore, it appears that there are relatively few practitioners performing large volumes of this procedure, as only 24% reported more than 30 procedures annually. It may be that the apparent interest in fat transfer is propagated by those few most active in performing the procedure. Alternatively, the results of this survey may not reflect the craniofacial and reconstructive surgeons performing the procedure for congenital or traumatic defects.

Techniques for harvest are, for the most part, uniform across the country. There is little variability with regard to local anesthesia solution or harvest site. Most practitioners use a mixture of xylocaine and epinephrine, with or without saline, and the abdomen is overwhelmingly the choice for harvesting fat. It is interesting to note that the techniques described by Coleman (6, 8) have had a large influence on the way physicians perform the procedure. More than half of the respondents (54%) perform the harvest with microcannulas and nearly half (47%) centrifuge the graft, as Coleman described.

The preferred sites of application tend to be within the lower third of the face (nasolabial folds and lips), whereas the least preferred sites are within the upper

third of the face (upper/lower eyelids and forehead). These trends likely reflect the increased likelihood of a poor aesthetic result when injecting around the eyes. The thin periorbital skin will reveal even the slightest irregularity, and it is not uncommon to have visible and palpable nodularity of fat grafts, especially when performed by less experienced physicians. Furthermore, the most morbid complications of fat grafting (blindness, cerebrovascular accident (CVA) have been reported from fat injections into the forehead and eyelids (39).

The results of the survey indicate that there is some interest in fat grafts harvested with other tissue types, especially dermis. One interpretation of this trend is that physicians are continuing to explore ways in which to overcome the limitations and unpredictable results of “fat only” grafts. Dermis and/or fascia may provide an additional conduit for neovascularization of the graft, thus preventing or reducing the high resorption rates associated with autologous fat transfer.

An overwhelming majority of respondents (87%) believe it is necessary to overcorrect the contour irregularity, presumably due to the tendency for fat loss or resorption. This belief, held by a majority of surgeons, is not shared by proponents of fat grafting. Coleman has suggested that micrografts of “seeded fat” get vascularized within muscle or subcutaneous tissue, and Guerrosantos stated that fat stem cells from fat grafting recruit other cells into the recipient site. However, a recent review of the literature that reported on long-term (6 months) fat loss rates in animal studies supports the belief of many clinicians surveyed that there is fat loss (40). Animal studies have documented fat resorption rates of 60–70%, many incorporating objective measures of assessment.

The reported rates of resorption in clinical studies vary widely (25–90%) and the outcome measures are often based upon subjective assessments. The results of our survey would indicate that most practitioners (92%) believe there is at least some resorption after 6 months. A majority of practitioners (52%) believe the loss is greater than 50% and of the volume that persists, and 66% believe it is partially a result of scar tissue. In contradistinction, 69% of respondents have observed fat graft survival beyond 2 years. Clearly, we have yet to determine all the factors responsible for graft survival beyond 2 years, as it seems that many fat grafts undergo significant resorption within 6 months.

It appears that most physicians are correctly estimating the amount of required overcorrection, as only 31%

reported that more than half of their patients require reinjection. This seems to correlate with patient satisfaction as reported by practitioners. A majority of physicians reported short-term patient satisfaction to be excellent to good, and long-term satisfaction to be good to fair. It may be argued that the true test of a procedure is patient satisfaction, and if so, are we willing to accept “good” or “fair” patient satisfaction over the long-term?

59.8 Conclusions

Autologous fat may be the best material we have for facial contouring; however, it seems that it is less than perfect. The rationale for performing the procedure in the face of varied and somewhat unpredictable results may be the low associated morbidity, good to excellent short-term patient satisfaction, readily available graft material for repeat injections, and lack of something better. Continued modifications in technique driven by objective outcome studies will likely lead to improved clinical results in the future. In the meantime, it appears that there is some uniformity of techniques across the country, which results in a rate of patient satisfaction that is acceptable to many physicians.

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