

Liposculpture of the Face

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ABSTRACT

Background: The increase in patients undergoing fat removal lipoplasty has resulted in an increase in the use of that fat for injection as natural filler. This study aims to standardize the fat injection technique making it simple with more predictable results for facial liposculpture in facial rejuvenation and enhancement.

Material and Methods: Between 1998 and 2003, data of 132 cases were collected. All cases were operated on once except one patient that lost 26kg and needed a second procedure. The average amount of fat injected was between 26cc and 106cc. The population was divided into three groups according to their age and the procedure done. Group A: Up to third decade who were candidates for lipoinjection only, Group B: Fourth to fifth decade who were candidates for liposculpture and Group C: Fifth decade and older who were candidates for liposculpture and face lift procedures (41 cases). Follow-up was 1-4 years. The results were assessed by patients' satisfaction and comparing between pre-injection and at least 6 months post-injection photographs.

Results: The patients noticed that the use of fat grafting not only provides enhancement to the face but also improves the quality of skin. They feel their skin is thicker, firmer and their need for facial moisturizers has decreased. The volume of fat decreases at 1 to 1.5 months then starts to increase gradually to stabilize within 3 to 4 months. The main complication was the bruising that lasted from 1 to 4 weeks and swelling which lasted up to 6 weeks. No case was overcorrected but 7 cases were under corrected but refused to do a second procedure.

Conclusion: The cosmetic treatment of the face and neck has evolved into a delicate balance of facial volume restoration and soft-tissue lifting. The surgeons seeking optimal results with high patient satisfaction will incorporate both fat removal and fat transfer into their treatment.

INTRODUCTION

The increase in patients undergoing fat removal lipoplasty has resulted in an increase in the use of that fat for injection as natural filler. Grafted fat exhibits many of the qualities of an ideal filler [1]. It is autologous and completely biocompatible, naturally integrated into the host tissues, removable if necessary and potentially permanent. Because of these characteristics, in the last decade fat

grafting has become increasingly popular in aesthetic and reconstructive surgery as a primary procedure and as an adjunct to other procedures [1-4].

Facial sites are among the most popular for fat transfer [2,5,6]. There remains considerable controversy as to the optimal techniques for harvesting and injecting fat. Surgeons recommend a myriad of techniques for harvesting, processing and re-injecting the fat. It is generally believed that atraumatic handling improves long-term results. The results from fat transfer are quite variable, however and often dependent on the operator [2-4,6-8].

The use of fat to fill facial defects has been in practice since 1893, when Neuber used pieces of fat to reconstruct facial scars due to tuberculosis [1]. In 1926, Miller [9] 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. Illouz [7,10,11] 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 [11]. 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 [12] first began extracting fat via a syringe and needle and confirmed the integrity of the fat harvested by syringe aspiration. In the 1990s, Coleman [1,2,13-16] 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 revascularization and therefore, longevity of results. In 2001, Coleman coined the

concept of 'Structural Fat Grafting' which is an autologous tissue transfer in which the fat is removed and then infiltrated at the same procedure [1].

In 1999, Amar [17] described fat autograft muscle injection (FAMI), in which fat is harvested via syringe aspiration, refined via centrifugation and injected into the muscles of facial expression with specific anatomically curved cannulae. This technique aimed to improve viability of the grafted fat.

Butterwick [20] recently provided an in-depth review of autologous fat transfer. The authors compared the longevity and aesthetic results of centrifuged versus non-centrifuged fat transfer and the current controversies. These authors advocate using the fat autograft muscle injection (FAMI) to obtain longer-lasting results. However, many authors [1,3,7,8,11,13,18,19] described the main factor thought to impact fat survival is the means of harvest and transfer. The ideal harvesting and processing methods for fat transfer are hotly debated, with studies often giving conflicting results.

Fat transfer has also been incorporated into more traditional cosmetic facial surgery. Recently, Trepsat [21] presented his results in volume enhancement with midface lifting. These authors compared midface lift with or without fat transfer. Using a photograph rating system of selected facial zones, judges found superior results in the tear trough and nasolabial region in patients having the fat treatments but did not appreciate any difference in the malar and submalar regions. The author felt that the addition of the fat transfer to midface lifting was advantageous and anticipated improved results with refinement of their techniques.

Aim of the work:

In this study the author collected the data of the previous studies in combination with the experience gained aiming to standardize the technique and make it simple with more predictable results for facial liposculpture in facial rejuvenation and enhancement. This procedure was also combined with liposuction from the face and face lift procedures.

MATERIAL AND METHODS

The study was conducted on one hundred and thirty two cases between the years 1998 and 2003. All cases were operated on once except one patient that lost 26kg and needed a second procedure. One hundred and twenty one cases where females and 11 males. There were no difference in injection techniques between males and females. The average amount of fat injected was between 26cc and 106cc.

The population was divided into three groups according to their age and the procedure which done:

Group A: Up to third decade (<30 years) who were candidates for lipoinjection only (22 cases).

Group B: Fourth fifth decade (30 to 50 years) who were candidates for liposuction and lipoinjection (69 cases).

Group C: Fifth decade and older (>50 years) who were candidates for lipoinjection, liposuction and face lift procedures (41 cases).

Forty one cases had face lift procedure done at the same setting (Group C). In the face lift patients the fat was always injected deep directly over periostium first. This was proceeded by dissection of the flaps and lastly the superficial layers of fat are then injected under vision before closure of the wounds. This ensured proper placement of the fat transferred and prevents injection in the dissection sites under the flaps and resulting in fat transferred into pockets. In the younger age group (Group A, 22 cases) no liposuction from the jowls or neck was needed. In Group B (69 cases), liposuction from the jowls and neck was combined with the fat transfer.

Standardized technique:

1- Fat harvesting:

The fat was harvested using a 3 to 4mm Toomey's catheter after injecting 1/500000 epinephrine saline solution. No superwet techniques were used as it can create mechanical damage to fat parcels. The sites are chosen according to several rules; it should be an area where no previous liposuction has been done before with an adequate amount of fat. It is also better to harvest the fat from areas that are resistant to dieting and exercise. In the females the abdomen, trochanters, medial and anterior thighs, suprapubic area and medial aspect of the knees are some of the best sites. In males the abdomen and love handles are the usual sites where we find fat. The opening of the harvesting cannula must harvest intact parcels of fat which can easily pass through the lumen of the luerlok syringe. Parcels that will pass through the aperture of the syringe will pass through a 17 gauge lumen. During extraction we try to minimize mechanical trauma by gently pulling the plunger for only 1-2cc marks. The donor area is then treated like a normal liposuction area with post operative compression garments.

2- Refining the fat, purification and transfer:

The fat is then left to settle for 5 minutes. The fluid that settles is then drained and the fat is centrifuged for 2 to 3 minutes at 3000rpm. This will separate the denser components from the less dense ones. We will end up with three layers. The least dense layer which is the upper oily layer resulting from the ruptured fat cells is decanted, the middle level which is the potentially viable fat cell layer which is used for the grafts and the lowest fluid layer which is the most dense layer consisting of blood, saline and epinephrine which is also discarded (Fig. 1). To discard the oily layer we need to first decant it then placing a piece of gauze at the top of the fat. This will allow the oil to gradually wick. The gauze is changed at least twice. The viable centrifuged fat is then transferred to 1cc leurluk syringes. The syringes are filled in an upward direction to avoid air bubbles from entering. The fat parcels are now ready to be injected in the face.

3- Placement of fat, injection technique:

Sterile technique in the operating theater with draping and gowning was used on every patient. Any bacterial contamination will destroy the fat cells and can cause irregularities. The incisions are done by a scalpel no. 15. The sites of incisions are shown in Fig. (4). The injection is done by several passes in the same area. The intact, viable parcels of fatty tissue pass with ease through the lumen of the cannula into the host tissue. Placement of fat parcels is the basis of creating structural and textural changes. The fat is transferred as tissue and not as individual cells. The strategy of placement is to maximize surface contact areas with the recipient tissues. We always start deep just over the periosteum then gradually go superficial to make 3-4 levels depending on the thickness of the tissues (Fig. 2). The passes start directly over the periosteum then in the muscle, subcutaneous fat and finally in the dermal layer.

The amount of fat injected was then calculated. We know that the fat is not pure, so all cases were overcorrected by 20%. The overall amount of fat injected is from 26cc to 106cc.

Techniques in special areas: (Figs. 3,4)

Glabella: We inject the crease starting deep over the periosteum, the next pass is injected in the muscle and lastly in the subcutaneous fat. The final pass is in the dermis just under the crease. When the frown lines are injected the whole glabellar area appears puffed up.

Nasolabial crease: We start deep in the crease then move gradually superficially and the last pass

is in the dermis. Then we start to go medially towards the upper lip.

Eyelids: The eyelids are injected with a 1mm cannula. We first start on the infraorbital rim medially then we move laterally. This technique will obliterate the tear trough and palpebral malar groove. A small triangle just under this groove in the cheek area is then filled. Next the eyelid is injected superficially just under the skin in minute amounts with many passes to lighten the dark skin colour. In the upper eye lid especially in the skeletonized eye, injection is also done deep on the superior orbital rim. The medial part is usually hollow casting deep shadows and giving an aged look. When this area is filled a younger expression is obtained. The skin over the tarsus was never injected. The lateral part of the eye lid just under the eyebrow is injected to make it convex. This adds to the beauty of the face as it catches the light. This area is feathered with the lateral brow and temporal area.

Lip: The author starts deep in the buccal sulcus then move gradually down in the upper lip and up in the lower lip till the vermilion border is reached. The muscle (Orbicularis Oris) is not injected but only in the submucosal and subcutaneous layers. The exposed part of the vermilion is not injected superficially otherwise the red colour of the lips will be obscured by the fat resulting in a yellowish discoloration of the lips. The white line on the upper and lower lips is then injected with a 1mm cannula. The philtral ridges are injected in two passes one in subcutaneous tissues and the other is in the dermis with a maximum amount of 0.5cc in each ridge.

The lower border of the mandible: This area is usually a combination of liposuction and fat injection. If the mandible is weak or aging building up this area with fat produces a smooth more defined mandibular outline. The jowls and neck are addressed directly by liposuction first especially in the menton (double chin) area. Next the marionette areas are injected in the usual manner from deep to superficial. The lower border of the lateral part of the mandible is then filled up to 1cm superiorly to give a more defined mandibular border. This is done up to the angle of the mandible. The chin is also injected from superficial to deep.

Forehead: This area when injected caused lumps and resorbed completely so we stopped injecting it after the first 3 cases.

Temporal area: It is very important to inject the temporal area especially in the older individuals

as temporalis atrophy is a sign of aging. The temporal area is injected mainly inside the temporalis muscle itself with very little subcutaneous injection as this area becomes bumpy. This area is blended with the eyebrow, upper eyelid and zygomatic cheek.

The cheek: The author divided this area into the zygomatic cheek and the buccal cheek. The main area to be injected is the zygomatic cheek. The malar jugal groove is a depression that divides the zygomatic cheek into two areas. This area has to be injected first to fill it up. The level of injection is superficial (subcutaneous) in this area until this groove is obliterated. Then the zygomatic cheek is addressed as a whole and injected in the usual manner from deep to superficial. This cheek has to be carefully blended with the eyelids and nasolabial area. The buccal cheek is filled minimally just to blend all areas together otherwise it gives a bulldog appearance when it is over corrected which is very ugly. Sometimes when the face is atrophic we increase the amount of injected fat in the buccal area.

Preauricular area: The importance of this area is to blend the mandible with the cheek but it also does a slight lifting effect in the face.

Post operative care consists of ice packs for 3 days. Taping is done only to minimize edema and not to stabilize the fat. This is done for 2 days. All patients were given intra and post operative antibiotics.

RESULTS

This study was conducted over a period of four years. The follow-up was from 6 months to 4 years. The results were assessed by patients' satisfaction and comparing between pre-injection, 3 weeks post-injection and more than 6 months post-injection photographs. In the older age group these were also compared with their photographs before the age of thirty.

All patients noticed that the use of fat grafting not only provides an improvement in their looks but they feel their skin is thicker, firmer and furthermore the need for facial moisturizers has decreased. In Groups B and C the patients were pleased to find that they look the same as their photographs taken at the age of 30 or less. Their features were maintained without any distortion.

The volume of fat seems to decrease by 1 to 1.5 months then starts to increase gradually to stabilize at 3 to 4 months, but there may be a subtle

decrease in volume for even up to 1 year after the procedure.

In Group A the fat survived by more than 80%. Their faces were enhanced and they were highly satisfied. In Group B the fat survived by 60-80%. The results of the face lift group (Group C), gave better results than face lifting without fat graft as the fat filled the resistant areas to pulling as the tear trough, nasolabial, temple, marionette lines and chin.

In all patients, the transplanted fatty tissues did not feel like isolated collections of fat. This was assessed by palpation and patients' observation. There is a remarkable integration or blending of the newly grafted fat into the recipient sites.

In a few cases, after a year or two, some returned complaining that the grafted fat must have been resorbed because they could not feel it anymore. However, comparing pre-injection to recent photographs there loss of fat was observed. This was attributed to the fact that the results were so natural with good integration that the patients forget what they have looked like.

All cases were satisfied with the results except 6 cases. The first patient had fibromyalgia and the fat resorbed completely. She refused to do any other procedure. Three patients were over 70 years old and 80% of their fat was resorbed, they were treated by re-injecting them with permanent synthetic fillers. The last two patients were middle aged, healthy individuals but they were very thin with no adequate fat in their body and one of them had had previous liposuction from the donor areas. About 80% of their fat was resorbed. They were treated with non permanent synthetic fillers.

The main complication was the bruising that lasted from 1 to 4 weeks and swelling which lasted up to six weeks. Three cases had discoloration under the lower eyelid which lasted 1 year. They were treated with vitamin K ointment and concealers. No case developed infection as all the procedures were done in the operating theater under strict sterile conditions. Ten cases had mild numbness of the upper lip which resolved within three weeks. There was no case of nerve injury.

No case was overcorrected but 7 cases were under corrected but refused undergo a second procedure. They were supplemented with absorbable synthetic fillers. The nasolabial areas started to resolve in several cases after 1-2 years. They were also supplemented with absorbable synthetic fillers. The other areas do not seem to resolve even after 4 years.

- **Upper level:** _____
 - Least dense layer
 - Oil from ruptured fat cells
- **Middle level:** _____
 - Viable parcels of fat
- **Lower level:** _____
 - Most dense layer
 - Fluid (blood & saline).

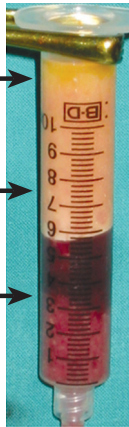


Fig. (1): Liposuction contents after centrifuge separated into 3 layers. The upper oily layer of disrupted fat cells, is decanted, the central viable fat cell, is used for grafting and the lower fluid layer is also discarded.

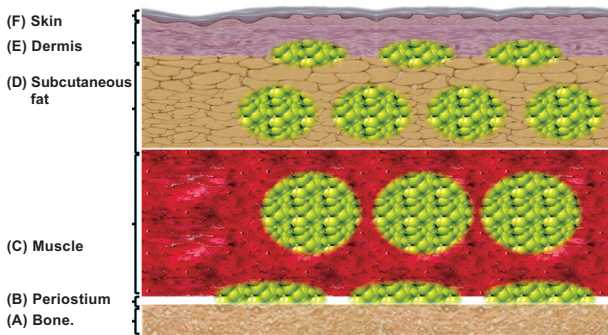


Fig. (2): The fat is transferred in minute globules in layers. The bone (A), periosteum (B), muscle (C), subcutaneous fat (D), dermis (E) and finally skin (F).

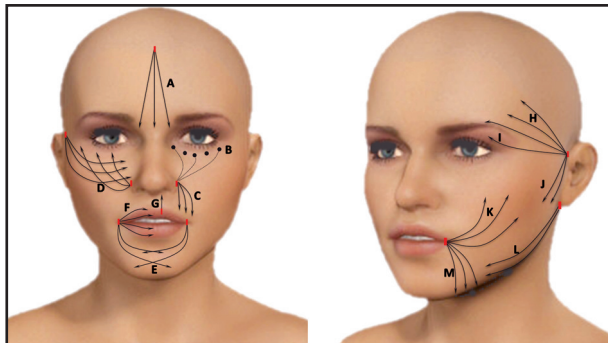


Fig. (3): The incisions (red dash) and directions of the passes that is done in each area: Glabella (A), Lower eyelid (B), Nasolabial sulcus (C), Zygomatic cheek (D), Chin (E), Lips (F), Philtral ridge (G), Temple (H), Upper eyelid and brow (I), Preauricular area (J), Buccal cheek (K), Mandibular border (L) and Marionette line (M).

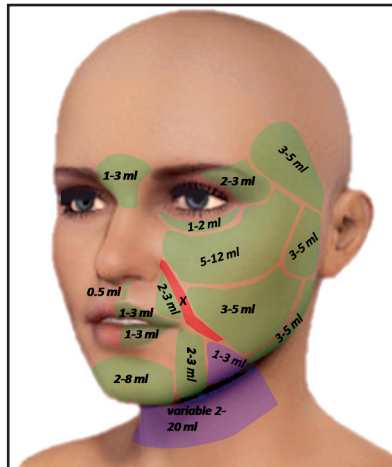


Fig. (4): The average amounts of fat that is injected in each area. The nasolabial fold is not included in the injection sites (x).



Fig. (5): Before and after 1 year photos of a 26 year old patient with a thin bony face. The total amount injected was 106 cc (Left side: 53cc / Right side: 53cc).



Fig. (6): Before and after 2 years photos of a 49 years old patient. The total amount injected was 94 cc (Left side: 42cc/ Right side: 52cc).



Fig. (7): A 59 year old patient underwent face lift with fat transfer (pre- and 2 years postoperative photos). The total amount injected was 73 cc (Left side: 36cc / Right side: 37cc).

DISCUSSION

Lipoplasty, with its corollary procedures of liposculpting and autologous fat transfer, is part of a more comprehensive approach to aesthetics emphasizing both the reversal of the effects of gravity and the restoration of volume. Facial sites are among the most popular for fat transfer. There remains considerable controversy as to the optimal techniques for harvesting and injecting fat [1,3,7,8, 11,13,18].

Surgeons recommend a myriad of techniques for harvesting, processing and re-injecting the fat. It is generally believed that atraumatic handling improves long-term results [1]. The results from fat transfer are quite variable [1,8,11,16,17,18,26], however and often dependent on the operator.

One factor thought to impact fat survival is the means of harvest and transfer. The ideal harvesting and processing methods for fat transfer are hotly debated, with studies often giving conflicting results. Boschert et al. [27] and Von Heimburg et al. [28] studied the viability of fat transfers harvested and processed by various techniques. These authors showed no differences in overall graft survival. They did, however show improved cell viability in specimens having minimal manipulation.

Coleman, who coined the term 'lipostructure', recently reviewed his experience with fat grafting [1]. He describes his experiences and the techniques that provide his best long-term results. Coleman presented remarkable results for large and small volume correction of a number of clinical conditions, including contour defects in irradiated fields [1,2,13-16]. The technique involves multiple micro-injections of very small volumes of unprocessed fat. Coleman maintains that the injected fat must be placed within a few millimeters of a vascular supply to survive and be maintained.

In this study we have collected the data of the previous studies in combination with our experience to standardize, simplify the technique so as to achieve more predictable results for facial liposculpture.

Our technique is applicable with a rapid learning curve and following the techniques in each area guarantees more satisfactory predictable results. In addition, by putting parameters and guidelines for fat injection, we have minimized fat resorption.

The fat donor areas should be areas that are resistant to diet and especially if no previous liposuction was done in these areas. By discarding

the oil and fluid after centrifugation, we can be sure that equal amounts are added in reciprocal areas of the face. We always started deep then go more superficially to allow more fat to be put in each compartment. In addition, using the FAMI technique by injecting the fat in the muscle mass, allows adding more layers of fat.

Each area is injected in isolation and then blended with the neighboring areas. The glabellar creases are always injected deep over the periosteum then tapered up to the dermis, the whole glabella area is puffed up.

In the nasolabial crease area, we always fan it medially towards the upper lip. The eyelids are always injected using a 1mm injection cannula and we start deep directly over the inferior and superior orbital rims. The lower lid is injected perpendicular to the tear trough deformity. We give the lids superficial passes to lighten the color of the skin in darker races.

In the lips we inject the fat in a submucosal plane starting at the buccal sulcus till we reach each border. We never inject superficially in the exposed vermillion or the red color will be obscured. By adding the fat to the white line at the dermal level, we can define the lips giving them a harmonious effect.

Not one area of the face is neglected, and even the lower border of the mandible receives its share. By injecting it directly over the bone, the resorption of the bone that occurs with aging is compensated for. Even in the young groups, weak mandibles could be enhanced.

Another area which is neglected, is the temple area where hollowing occurs with aging, giving the face a skeletonized look. Most of the fat is injected intramuscular with minimal subcutaneous amounts as much subcutaneous injection to this area cause lumps.

The chin is also addressed from deep to superficial to give it a smoother contour. By injecting the preauricular area, mild lift could be produced for sagging faces with or without midface lift.

The forehead and neck gave non impressive results with bumps and pits, therefore, these areas are discarded from fat transportation.

Combining the fat injection with liposuction in the jowls and neck enhanced the face with or without face lift in older age group.

Another important factor in fat graft survival is the method of placement. The early suggestions by Bircoll of placing fat in small aliquots [1] were met with disdain. Amar [17] described fat autograft muscle injection (FAMI) and Butterwick [20] advocated using the FAMI to obtain longer-lasting results. Coleman [1] stated the purposeful placement of a miniscule volume of fat with each pass. We conclude that multiple passes when layered [26], with miniscule volumes of fat placed in the dermis, subcutaneous fat, intramuscular and the subperiosteal area will give an ideal result.

The volume of fat decreases within one month then starts to increase gradually to stabilize at 3-4 months with a subtle decrease in volume up to 1 year. After that the volume of fat remains constant. In group A (<30 years) the fat survives by more than 80%. In group B and C (>30) the fat survives by 60-80%. However, No case was overcorrected [2,26].

In all patients, the transplanted fatty tissues did not feel like isolated collections of fat. There is a remarkable integration or blending of the newly grafted fat into the recipient sites. The fat placed next to bone seemed to feel like bone, the fat placed directly under skin felt like thicker skin and the fat placed into muscle felt like muscle. However, the patients notice that they feel their skin is thicker, firmer and the need for facial moisturizers has decreased. Because of this high level of integration of the grafted fat with the surrounding tissues, we realized that meticulous photography was essential for evaluation of results from fat grafting. Without accurate photography in many views to demonstrate three-dimensional correction, grafted fat is so natural feeling that many patients (and physicians) think that the correction from the fat is gone.

The results of the face lift group gave better results than face lifting without fat graft as the fat filled the resistant areas to pulling as the tear trough, nasolabial, temple, marionette lines and chin [21,29,30].

The main complication was the bruising that lasted from 1 to 4 weeks and swelling which lasted up to six weeks. No case developed infection as all the procedures were done in the operating theater under strict sterile conditions.

The nasolabial areas started to resolve in several cases after 1-2 years. The author attributes this to the excessive movement in this area during eating and talking. The other areas do not seem to resolve even after 4 years.

Recent developments in technology may provide more efficient removal of unwanted fat while scientific advances in adipocyte-derived stem cells offer promise for improving fat transfer especially in the older age group [23-25]. Incorporation of stem cells with fat transfer may increase their long term survival.

Conclusion:

The cosmetic treatment of the face and neck has evolved into a delicate balance of facial volume restoration and soft-tissue lifting. The surgeons seeking optimal results with high patient satisfaction will incorporate both fat removal and fat transfer into their treatment.

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