# The Versatility of Autologous Fat Grafting in Facial Volumetric Restoration

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**ABSTRACT**
Deformities in the craniofacial region are of great social and functional importance. Several surgical techniques have been used to treat such pathologies often with high morbidity and lacking the ability to address smaller contour defects. The minimally invasive technique of fat transplantation has evolved rapidly within the last few decades. The objective of this paper is to present the versatility and applicability of fat transplantation in a wide range of contour deformities in the craniofacial region. We share our experiences in treating 24 patients with autoimmune disorders, congenital malformations, and acquired defects.

**KEYWORDS:** Lipofilling; Autologous Fat Grafting; Facial Asymmetry.

## 1. INTRODUCTION
Gustav Neuber performed the first autologous fat transfer in 1893 for treatment of adhesive scars due to childhood tuberculous osteitis. He transferred fat parcels from the upper extremity to the infraorbital margin [1]. Since then refinements have improved the technique of fat transfer, primarily due to Coleman's systemization of fat transfer techniques in the 1990s, focusing on atraumatic fat transfer [2]. Initially autologous fat transplantation was considered an esthetic procedure. However, autologous fat transfer is now considered a valid option in reconstructive surgery as well as in correction of scars [3–7]. The purpose of this study is to describe our experiences and the versatility of autologous fat tissue transfer in patients with a wide variety of facial disfigurations caused by trauma, inflammatory, infectious, or congenital conditions.

## 2. METHOD(S)
This prospective study of 24 patients was conducted at Department of Plastic Surgery, Jawaharlal Nehru Medical College and Hospital, Aligarh Muslim University, Aligarh, Uttar Pradesh, India, from October 2018 to December 2020. An informed consent was taken for the same in each patient.

### 2.1. INFORMED CONSENT
A consent is signed by the patients stating that they are fully informed of the use of their clinical pictures in the paper entitled "The Versatility of Autologous Fat Grafting in Facial Volumetric Restoration." Preference for donor site was sought preoperatively from the patients. Expected postoperative results and occurrence of edema and bruising postoperatively was explained. Unpredictable uptake and volume loss of fat injected was explained with possible repeat fat grafting sittings. After thorough clinical examination and preoperative workup, patients were operated for autologous fat grafting.

### 2.2. ANESTHESIA
Tumescent anesthesia was used for fat harvest, and fat transfer was performed under local anesthesia. Tumescent fluid was made using the Klein's solution**.**

- 1000 ml Normal Saline
- 50 ml of 1% lignocaine
- 1 ml, 1:1000 adrenaline
- 12.5 ml, 8.4% sodium bicarbonate

One milliliter of fluid was injected for 1 ml of fat to be aspirated (1:1 ratio). One dose of IV antibiotic (Amoxycillin + Clavulanic Acid) was given before commencing the procedure. Sensitivity to the antibiotic and tumescent fluid was done. Donor site (usually the periumbilical region) was painted and draped. Tumescent fluid was infiltrated in a 1:1 ratio.

### 2.3. SURGICAL TECHNIQUE

We used the Coleman's technique (Figure 1) with centrifugation for harvesting and processing the fat graft, we found the technique to give good quality purified fat grafts. After waiting for vasoconstriction (10–15 minutes), a stab incision was made in the periumbilical region and a blunt 2 holed Coleman's cannula was places and attached to a 10 ml Leuer Lock syringe, with light manual negative suction. The fat was aspirated in to and flow manner with as minimal trauma as possible. After the syringes were filled, the plunger was removed and a Leuer Lock plug was placed on the syringe. The syringes were then centrifuged at 3000 rpm for 3 minutes. This separated the contents of the syringe into three layers:

Upper most by oils and broken-down fat, lower most by sedimented blood cells and tumescent fluid, and the middle layer contains the purified concentrated fat (Figure 2).

**Figure 1: Intra op-fat harvesting from abdominal region.**

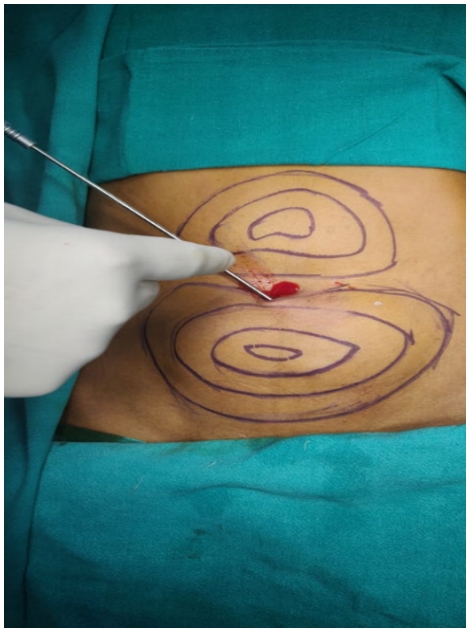
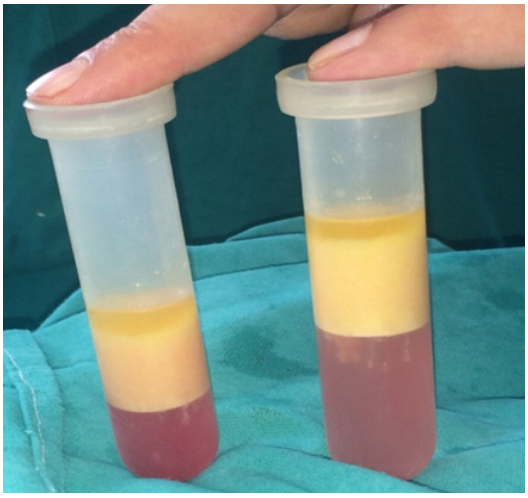


**Figure 2: Fat graft after centrifugation divided into three layers.**



The lowest layer sedimented is drained and the top oil layer is decanted by filter gauze. The pure fat is aspirated and transferred to 1 or 3 ml syringes to be used for infiltration of the recipient site. The donor site stab wound is closed with nylon, and compression dressings done to prevent seroma.

### 2.4. FAT TRANSFER/LIPOFILLING

- The scarred area is infiltrated with the local anesthesia/local nerve blocks were given.
- The scar was subscised with a beveled cannula and adequate pocket was made in different tissue planes.
- The fat was injected in small amounts in different layers from the periosteum to the dermis.
- Site of entry of cannula was suture with nylon.
- After the procedure, simple dressing is done and the patient is advised effective head end elevation.

Patients were treated on day care basis. We found the technique to give good quality purified fat grafts. Serial photographs were taken before and after the procedure and patients were followed up at 0, 3, and 6 months' intervals Figures 3, 4, 5.

## 3. OBSERVATIONS

A total of 24 patients (Table 1) with contour defects, unesthetic, thick, and retractile scars due to various etiologies were admitted. The mean age of presentation was 23.08 years, with 75% patients presenting within age groups of 21 to 30 years. In this study Table 1, 16 females and 8 males were admitted. The female to male ratio was 2:1. This implied the trend that young age females were more concerned with their cosmetic appearances, hence sought plastic surgery intervention more than males. Trauma was the major cause of the scars in 62.5% of patients followed by congenital cause (16.6%), postsurgical (12.5%). All the scars in our study were located in the head, face, and neck region, with most of the scars being in the cheek and forehead region (41.6% each), followed by lips (8.3%). The periumbilical region was the most common location of fat graft harvest in 91.6% patients followed by lateral thigh in 8.4%. The mean volume of fat injected was 9.87 ml. The mean follow-up period was 9.83 months. Eight patients (33.33%) reported mild-to-moderate bruising post procedure. None of the patients presented with any major complication. We observed no complications in 22 of 24 patients with minor bruising in remaining 2 patients. We observed progressive loss of volume postgrafting till it stabilized at 2 to 3 months, amounting to about loss of 10% to 15% grafted volume.

**Figure 3: (a) Before fat grafting. (b) Three months after fat grafting.**

**Figure 4: (a) Before fat grafting. (b) Three months after fat grafting.**

**Figure 5: (a) Before fat grafting. (b) Three months after fat grafting.**

## 4. STATISTICAL ANALYSIS

### 4.1. DATA COLLECTION

Results were tabulated according to the Patient and Observer Scar Assessment Scale (POSAS). Serial photographs were taken and patient was followed up at 0, 3, and 6 months' intervals. Complications were recorded and treated accordingly. A second sitting of fat grafting was done depending on the graft uptake and patient satisfaction. The observer POSAS score was modified by us to include one more variable (contour abnormality) as this was not provided in the scoring system and we thought it was necessary to quantify the overall effect of the filler fat graft.

**Table 1: Demographics and treatment of patients.**

| Sr No. | Age | Sex | Etiology of Defect | Location of Defect | Donor Site | Amount of Fat injected |
|---|---|---|---|---|---|---|
| 1 | 14 | m | Trauma | Forehead | Abdomen | 12 ml |
| 2 | 19 | m | Congenital | Right lower eyelid | Abdomen | 2 ml |
| 3 | 15 | f | Congenital | Upper lip | Abdomen | 6 ml |
| 4 | 24 | f | Trauma | Dorsum nose | Abdomen | 4 ml |
| 5 | 27 | f | Trauma | Forehead | Abdomen | 5 ml |
| 6 | 26 | f | Congenital | Bilateral cheek | Abdomen | 22 ml |
| 7 | 17 | f | Acne | Forehead | Abdomen | 8 ml |
| 8 | 26 | f | Trauma | Forehead | Abdomen | 5 ml |
| 9 | 27 | m | Trauma | Right cheek | Abdomen | 14 ml |
| 10 | 25 | f | Trauma | Forehead | Left thigh | 7 ml |
| 11 | 24 | f | Post op | Forehead | Abdomen | 8 ml |
| 12 | 23 | f | Trauma | Right cheek | Abdomen | 6 ml |
| 13 | 25 | m | Trauma | Right cheek | Abdomen | 19 ml |
| 14 | 27 | f | Trauma | Left cheek | Abdomen | 15 ml |
| 15 | 18 | f | Trauma | Forehead | Abdomen | 9 ml |
| 16 | 26 | f | Trauma | Lower lip | Abdomen | 8 ml |
| 17 | 29 | m | Postburn | Right cheek | Abdomen | 8 ml |
| 18 | 23 | f | Trauma | Forehead | Abdomen | 14 ml |
| 19 | 22 | f | Postoperative | Left cheek | Abdomen | 8 ml |
| 20 | 24 | f | Trauma | Forehead | Abdomen | 8 ml |
| 21 | 27 | m | Postoperative | Left cheek | Abdomen | 13 ml |
| 22 | 25 | m | Trauma | Right cheek | Left thigh | 8 ml |
| 23 | 21 | f | Trauma | Left cheek | Abdomen | 20 ml |
| 24 | 20 | m | Congenital | Forehead | Abdomen | 8 ml |

### 4.2. ANALYSIS

Results were tabulated according to the POSAS at 0, 3, and 6 months. Data were collected on Microsoft Excel spread sheet (master chart) and was subjected to statistical analysis using statistical software tool (IBM Corp. Released 2019. IBM-SPSS Statistics for Windows 10, version 26.0. Amos, NY: IBM Corp.). One-way repeated measure analysis of variance was used for intravariable comparison of results. p value of $< 0.05$ was considered as statistically significant change.

## 5. RESULTS

In the POSAS observer scale, there was a significant change $p < 0.05$ in the POSAS variables (Thickness, Rigidity, Pliability, Surface Area, Contour Abnormality, Overall, and the Total Score), while the variables of Vascularity and Pigmentation didn't show a significant change, $p > 0.05$. The POSAS patients scale showed a significant change $p < 0.05$ in the variables (Itching, Stiffness, Thickness, Irregular, Overall, and Total), while the variables (Pain and Color) did not show significant change, $p > 0.05$.

## 6. DISCUSSION

Autologous fat grafting is a promising and upcoming technique in treating depressed defects; it has resulted in the cosmetic and functional improvement in a variety of diseases. Fat being a natural source of adipose-derived stem cells is thought to improve the scar biology and texture and is also believed to be beneficial in wound healing [8]. Although there have been many attempts at attaining viable fat cells [9], it was mainly after Sydney Coleman popularized his technique [10] of fat harvest and placement that the use autologous fat grafting was popularized in modern plastic surgery from a simple filler to a potential source of stem cells. Today the Coleman's technique is accepted by most authors as a reliable, safe, and minimally traumatizing technique to attain high-quality fat grafts [11,12].

The patients expressed their satisfaction. Also, facial asymmetry after surgery for abscess, lumps was treated with the same technique. In these clinical cases, the soft tissue deficit was limited and able to receive the harvested fat, improving the facial contour.

It is well accepted that survival of fat grafts depends on the fat drops having a maximum radius of 2 mm, so the transplant can survive by plasmatic imbibition until revascularization establishes a recipient capillary network. In addition, it is theorized that an increase in volume to a recipient site decreases the compliance of the tissue. This decrease in compliance results in an increase in interstitial fluid pressure which in turn decreases capillary circulation and subsequently graft survival [13]. It is consequently imperative that one considers every transplantation unique as a delicate balance between graft volume and recipient site. Although there is no consensus on the amount of fat reabsorbed, some studies report a loss of 20% to 90% injected fat [14]. The mechanisms responsible for resorption are not completely clear. The most accepted theory is the "cells survival theory" postulated by Peer which states that the number of viable adipocytes at the time of transplantation correlates with the ultimate fat graft survival volume [15]. There is no consensus as to the exact method to measure the amount of fat retained in the body following grafting, Fontdevila *et al.* found a statistically significant ($p < 0.01$) amount of fat retained with the mean baseline fat before the procedure and the mean volume 12 months later [16].

Several authors promoted fat as an ideal filler, as it is autologous, bio-compatible, stable, available in sufficient quantities, naturally integrated, and easily removable if necessary [17]. Some authors add that it is potentially permanent too [18,19] but others claim results are inconsistent and uncertain [20].

Osama *et al*. and Guyuron *et al.* used an amount ranging from 1 to 5 cc as most of their patients presented with small subcutaneous scars, and for facial augmentation respectively [21], Cervelli and Gentile stated that they injected about 120 cc fat mixed with platelet-rich plasma, this could be explained as they were treating progressive hemifacial atrophy [22], while Fontdevila *et al*. injected 6.53 to 11.46 cc fat in cases of facial atrophy due to ART therapy and other causes [23]. Guerrissi *et al.* reported the largest volume injection of 80 mL in a 21-year-old man with circumferential burns of the right leg [24]. The volume injected was proportional to the extent of scarring and surface area affected. Klinger *et al.* suggest that 1 ml fat graft for each 3.5 $cm^2$ should be used [25] and Piccolo *et al.* suggested 1.6 to 2.0 ml per 10 $cm^2$ [26]. No other studies reported a volume: scar size method for calculating injected autologous fat grafting volume. The degree of scar retraction more commonly guided volume of fat injected.

## 7. CONCLUSION

The present report has highlighted the multiple utilities of fat transplantation in patients with various deformities of the craniofacial region. In our experience, autologous fat grafting is a safe procedure for volumetric restoration in face, head and neck. When deemed necessary, it is a safe procedure. Improvement of contours and softening of the skin were achieved. Fat transplantation has a wide range of application in contour deficits, scar adherence, and disfiguration caused by trauma, inflammatory, infectious, or congenital conditions and after tumor removals. The procedure is minimally invasive and hospitalization is short. We also found that local anesthesia can be sufficient when transferring fat into the head and neck area.

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**AUTHOR CONTRIBUTIONS**
All authors have contributed equally in this work.

**CONFLICT OF INTEREST**
The authors declare that there is no conflict of interest regarding the publication of this paper.

**REFERENCES**

1. Raaf ROCVANDEG. Orteweg STFSK. G a n (1850–1932) - 1893. 2010;1:7-11.
2. Coleman SR. Structural fat grafting: more than a permanent filler. Plast Reconstr Surg. 2006;118(3), supplement:108S-120S. http://www.ncbi.nlm.nih.gov/pubmed/16936550
3. Guibert M 1, Franchi G, Ansari E, Billotet B, Diner PA, Cassier S, *et al.* Fat graft transfer in children's facial malformations: a prospective three-dimensional evaluation. J Plas Reconstr Aesth Surg. 2013; 66(6):799-804.
4. Del Papa N, Caviggioli F, Sambataro D, Zaccara E, Vinci V, Di Luca G, *et al*. Autologous fat grafting in the treatment of fibrotic perioral changes in patients with systemic sclerosis. Cell Transplant. 2015;24(1):63-72. doi: 10.3727/096368914X674062.
5. Clauser LC, Tieghi R, Galie M, Carinci F. Structural fat grafting: facial volumetric restoration in complex reconstructive surgery. J Craniofac Surg. 2011;22(5):1695-1701.
6. Arcuri F, Brucoli M, Baragiotta N, Stellin L, Giarda M, Benech A. The role of fat grafting in the treatment of post traumatic maxillofacial deformities. Craniomaxillofac Trauma Reconstr. 2013;6(2):121-126.
7. Lim AA 1, Fan K, Allam KA, Wan D, Tabit C, Liao E, *et al.* Autologous fat transplantation in the craniofacial patient: the UCLA experience. J Craniofac Surg. 2012;23:1061-1066.
8. Rigotti G 1, Marchi A, Galiè M, Baroni G, Benati D, Krampera M, *et al.* Clinical treatment of radiotherapy tissue damage by lipoaspirate transplant: a healing process mediated by adipose-derived adult stem cells. Plast Reconstr Surg. 2007;119(5):1409-1424.
9. Chajchir A, Benzaquen I. Fat grafting injection for soft tissue augmentation. Plast Reconstr Surg. 1989;84(6):921-935.
10. Neuber F. Fet transplantation. Berichtüber die Verhandlungen der Deutschen Gesellschaftfür Chirurgie. Zbl Chir. 1893;22:66.
11. Pu LLQ 1, Coleman SR, Cui X, Ferguson REH Jr, Vasconez HC. Autologous fat grafts harvested and refined by the Coleman technique: a comparative study. Plast Reconstr Surg. 2008;122(3):932-937.
12. Pu LLQ 1, Cui X, Fink BF, Cibull ML, Gao D. Long-term preservation of adipose aspirates after conventional lipoplasty. Aesth Surg J. 2004;24(6):536-541.
13. Hasham S, Matteucci P, Stanley PRW, Hart NB. Necrotising fasciitis. Br Med J. 2005;330(7495):830-833.
14. Plakida D. Fat injections for facial rejuvenation: 17 years experience in 1720 patients. J Cosmetic Dermatol. 2004;2:119-125.
15. Peer LA. Cell survival theory versus replacement theory. Plast Reconstr Surg. 1955;16:161-168.
16. Fontdevila J 1, Serra-Renom JM, Raigosa M, Berenguer J, Guisantes E, Prades E, *et al.* Assessing the long-term viability of facial fat grafts: an objective measure using computed tomography. Aesth Surg J. 2008;28:380-386.
17. Coleman SR. Facial recontouring with lipostructure. Clin Plast Surg. 1997;24:347-367.
18. De la Fuente A, Tavora T. Fat injections for the correction of facial lipodistrophies: a preliminary report. Aesth Plast Surg. 1988;12:39-43.
19. Clauser LC 1, Tieghi R, Galiè M, Carinci F. Structural fat grafting: facial volumetric restoration in complex reconstructive surgery. J Craniofac Surg. 2011;22:1695-1701.
20. Ersek RA. Transplantation of purified autologous fat: a 3-year follow-up is disappointing. Plast Reconstr Surg. 1991;87(2):219-227.
21. Guyuron B, Majzoub RK. Facial augmentation with core fat graft: A preliminary report. Plast Reconstr Surg. 2007;120:295-302.
22. Cervelli V, Gentile P, Grimaldi M. Regenerative surgery: use of fat grafting combined with platelet-rich plasma for chronic lower-extremity ulcers. Aesth Plast Surg. 2009;33:340-345.
23. Fontdevila J 1, Serra-Renom JM, Raigosa M, Berenguer J, Guisantes E, Prades E, *et al.* Assessing the long-term viability of facial fat grafts: an objective measure using computed tomography. Aesth Surg J. 2008;28:380-386.
24. Pallua N, Baroncini A, Alharbi Z, Stromps JP. Improvement of facial scar appearance and microcirculation by autologous lipofilling. J Plast Reconstr Aesth Surg. 2014;67(8):1033-1037.
25. Klinger M 1, Caviggioli F, Klinger FM, Giannasi S, Bandi V, Banzatti B, *et al.* Autologous fat graft in scar treatment. J Craniofac Surg. 2013;24(5):1610-1615.
26. Piccolo N, Piccolo M, Piccolo M. Fat grafting for treatment of burns, burn scars, and other difficult wounds. Clin Plast Surg. 2015;42(2):263-283.