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Clinical and Radiological Assessment of Fat Transplantation Using Centrifuge Technique

YOUSSEF SALEH, M.D.* and HESHAM MOSTAFA, M.D.**

The Departments of Plastic Reconstructive Surgery, and Radio-Diagnosis**, Faculty of Medicine, Assiut University.*

ABSTRACT

Filling of soft tissue defects continues to be one of the major challenges for the plastic surgeon.

There are various techniques used for this reason as local and free flaps, free autologous fat, dermal fat graft, collagen injections and synthetic material.

Most of these procedures were abandoned because of limited aesthetic results after flaps, high resorption rates and fibrosis as in free grafts or higher complication rates (infection or immune disorders) with synthetic material.

Despite these obstacles the free fat transplantation remain the procedures of choice because it is easily performed, no scarring, ease of adding supplement, repeatability, no immune phenomena, reasonable cost, no secondary defects and quick recovery.

INTRODUCTION

Neuber 1831 used fat injection for correction of posttraumatic nasal defect. As early as 1893 and 1909 several attempts of using free fat graft from the abdomen to fill the defect in malar area. Throughout the 20th century attempts were made to correct other conditions as hemi-facial atrophy and breast defects. Modern fat grafting did not develop until the early 1980 with popularity of liposuction when illouse reported transfer of liposuction aspirate in 1984.

Various techniques have been suggested for improving the long term takes of these grafts as cleansing the aspirate, use of centrifuge for removal of the debris or addition of certain as insulin or growth factor to the aspirate **[3]**.

Aim of Work:

The aim of this study is to evaluate the result of transplanted fat using centrifuge technique clinically documented by pre and post-operative photography.

Also we calculate the amount of transplanted fat and the rate of resorption through pre and post-operative M.R.I. computer program.

PATIENTS AND METHODS

This study was carried upon 15 female patients, their ages ranged from 16ys to 40ys. With mean age 22.5yrs.

They are asking for facial augmentation due to various etiologies.

All patients underwent full medical history, examination and routine surgical fitness investigations.

Preoperative digital photography and preoperative M.R.I. picture (Coronal, Sagittal and Basal view) was done for every patient.

Technique of Fat Transplantation:

All cases were done under general anesthesia.

A- *Harvesting Fat (Fig. 1):*

Manual aspiration; by employing Tommy aspiration system which consists of a 4mm bore cannula attached to 60mm wide bore syringe creating 0.2 atmospheric pressure.

Donor Site: The buttock.

B- *Aspirate Preparation for Injection (Fig. 2):*

The aspirated fat was transferred from the syringe to the multiple tubes for centrifuge apparatus.

The low speed centrifuge 1000 rpm for 3 minutes does not cause damage to lipocytes.

The Aspirate after Centrifuge form Three Layers:

1- The upper oily layer of fatty acids.

2- The intermediate layer consists of lipocytes cell mass.

3- The lower one was dark red mass of packed red blood cell.

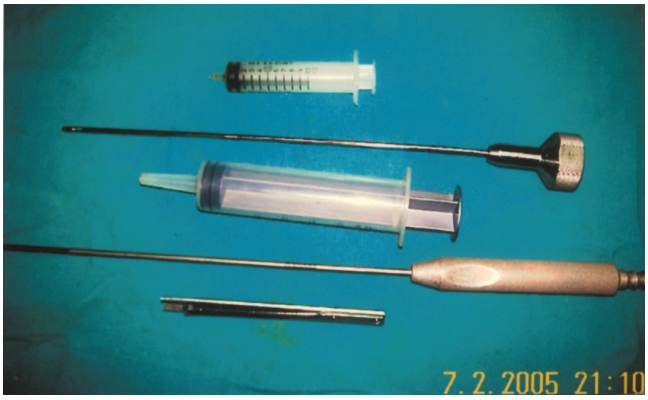
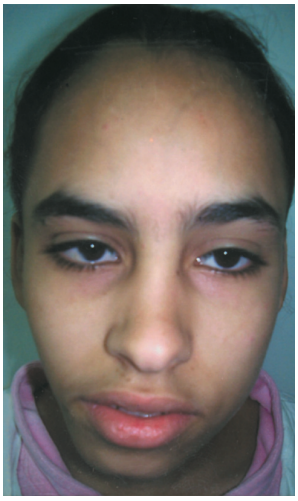


Fig. (1): Toomys manual aspiration system used for fat harvesting.

Fig. (2): Fat aspirate after centrifugation.

Fig. (3): Placement of fat through small bore cannula.

Fig. (4): Case 1:



(A): Pre-op. right hemi-facial microstomia P.A.

(B): Post-op. P.A. 1 year.

(C): Pre-op. lateral view of hemi facial microsto-mia.

(D): Post-op. lateral view 1 year follow up.

Fig. (5): Case 2:

(A): Preop. idiopathic fat atrophy lat. view.

(B): Post-op. 2 year after fat transplantation lat. view.

(C): Preop. idiopathic fat atrophy P.A. view.

(D): Postop. 2 year P.A.

Fig. (6): Case 3:

(A): Preop. right hemi-facial microstomia P.A. view.

(B): Postop. 8 months P.A. view.

(C): Preop. lateral view.

(D): Postop. lateral view, 8 months follow up.

Fig. (7): Case 4:

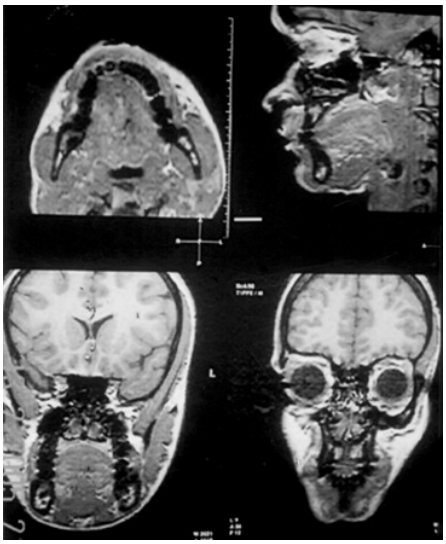
(A): Preop. fat atrophy P.A.

(B): Postop. 6 months after fat injection P.A.

(C): Preop. lateral view.

(D): Postop. lateral view 6 months follow up.

Fig. (8): M.R.I. Finding:



(A): Preop. all views (coronal, sagital and basal).

(B): Postop. all views showing the transplanted fat (coronal, sagital and basal).

C- *Placement of the Fat (Fig. 3):*

A 20ml syringe with blunt tipped cannula of 3mm bore attached to its nozzle. Through 1cm sub-mandibular incision, the cannula is used to create subcutaneous tunnels in a fan shaped manner into which the fat cells are deposited when the cannula withdrawn.

Over correction of about 25% was done.

D- *Post Operative Care:*

1- Broad spectrum antibiotic and anti-inflammatory drugs for one week.

2- The patient should be in semi sitting position in order to decrease the amount of edema.

3- Routine cold fomentation and light massage in order to enhance resorption of ecchymoses and postoperative edema.

4- Application of antibiotic cream over the incision site twice daily.

Follow-up:

Every case was subjected to post-op. photography every week for 3 months.

Also immediate postoperative and at the end of 3 months M.R.I. pictures were done to calculate the amount of transplanted fat and also the absorption rate.

The follow up period ranged from 3 months to 30 months.

RESULTS

Every Patient was Evaluated as Following:

Clinical Assessment:

Early: For infection, ecchymoses and edema.

Late: Aesthetic appearance of fat and rate absorption.

Radiological Assessment: M.R.I examination for determination of amount of transplanted fat and rate of absorption through computer program.

There were no cases develop postoperative infection.

There are two cases developed mild postoperative edema and mild ecchymoses in 1st 3 days which rapidly resolved in response to cold fomentation and strong anti-inflammatory drugs.

The rate of absorption varied from 20% to 50%.

Aesthetic results were classified according to patient satisfaction and rate of absorption:

A- Satisfactory result: Excellent clinical apperance and absorption rate from 0-20% (6 cases).

B- Good results: Absorption rate from 20% to 40% and acceptable clinical appearance (7 cases).

C- Poor result: Absorption rate more than 40% (2 cases) which need another sitting for injection.

M.R.I. Findings:

Calculation of Amount of Transplanted Fat:

A three dimensional volume of fat was determined before and after the autologous fat graft, by subs-traction of the former from the latter yielded the exact volume of fat injected. Also another picture at end of 12th weeks was done to measure the rate of absorption. It is usually correlated wilh the clinical finding in most of our cases.

DISCUSSION

Fat grafting has become a popular procedure for facial reconstruction and rejuvenation.

Various techniques have been suggested for improving the long term take of these grafts, including cleansing the aspirate, centrifugation for removal of undesired noncellular elements and addition of insulin, vitamins or growth factors **[4]**.

In this study, 15 female patients complaining of facial atrophy of various etiology. All of them under went facial augmentation by using centrifuge free fat graft. In this study we reported 2 cases only out of 15 developed mild ecchymosis and edema due to the use of blunt small bore cannula during injection.

There were no cases developed postoperative infection due to complete aseptic technique during harvesting or placement of fat and also application of broad-spectrum antibiotics.

The resorption rate in our study was up to 20% in 6 cases, and 20% to 40% in 7 cases and only 2 cases developed 50% resorption rate.

The finding is lower than **[5,6]**, both reported resorption rate from 20% to 90%, they did aspiration of the fat by the mechanical suction machine which produce higher atmospheric pressure than manual aspiration which lead to marked damage to fat cell and also they did not use centrifuge and immediately transfer the fat which may result in transfer of red cell mass with fat which increase inflammatory reaction and rapid resorption of the transplanted fat.

Our finding is consistent with Yaron et al., **[4]** who did free fat transplantation using manual aspiration technique and centrifugation with resorption rate from 20% to 70%.

This lower rate of resorption in our thesis may be attributed to multiple factors:

1- The use of manual aspiration producing lower pressure (0.2 atmospheric pressure) which significantly reducing the damage of lipocytes in comparison to the mechanical pressure which produce higher pressure (more than 1 atmospheric pressure) leading to significant damage to the lipocytes.

2- The use of centrifuge enable further concentration to the transferred fat cell, also remove the upper oily layer of fatty acid that has detergent effect on the lipocytes and lastly centrifuge enable the surgeon to remove all debris and packed red cell from the fat cell mass thus lowering postoperative infection and edema.

3- The use of M.R.I. provides a useful and accurate tool for determination of the amount of transplanted fat cell and also determines the amount of absorption.

4- The use of blunt small bore cannula and tunneling during injection markedly reducing postoperative edema and ecchymosis.

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