

Our Experience of Rejuvenation of Atrophied Web Spaces in Leprosy Patients with Fat Grafting

Somashekar Gejje^{1,*}, Arun K. Singh², P.K. Srivastava³ and Amrita Anadakumar Hongal⁴

¹Department of Plastic Surgery, The Bangalore Hospital, Bengaluru, India; ²Department of Plastic Surgery, King George's Medical University, Lucknow, India; ³Department of Radiotherapy, King George's Medical University, Lucknow, India and ⁴Department of Dermatology, The Bangalore Hospital, Bengaluru, India

Abstract: Atrophied web spaces are a common finding in the hands of leprosy affected hands and decreases the aesthetic appearance of the hands. Autologous fat transfer is an option for restoring the contour of the atrophied web spaces as it based on the principle "replace like with like". Free fat graft harvested from abdomen/thigh/buttock. Derma fat harvested from the groin crease was also used to correct web space atrophy. Study included the reabsorption quantification using high-resolution ultrasound and patient/surgeon satisfaction scale.

Keywords: Web spaces, Fat Grafting, Atrophy, HRUS.

1. INTRODUCTION

The principle "replace like with like" underlies much of the rationale behind the clinical use of autologous fat transplantation. Autologous fat transplantation is frequently used for a variety of cosmetic and reconstructive indications not limited to post traumatic defects of the face and body, involutinal disorders such as hemi facial atrophy, sequelae of radiation therapy and many aesthetic uses such as lip and facial augmentation and wrinkle therapy. In our study, we intend to correct the contour defects in the atrophied web spaces of the hands of leprosy pts.

2. PATIENTS AND METHODS

In this prospective study a total of 15 leprosy patients underwent fat grafting procedure at atrophied first web space from May 2012 till November 2013 at Department of Plastic surgery, KGMU. Out of these 11 patients underwent free fat grafting and 4 patients underwent Derma fat grafting. Pre operative photographs were taken and serial post-operative photographs were taken in the follow up at 1 month, 6 months and one year. HRUS was used in the volume estimation of the grafted fat at six and twelve months. Results were tabulated noting the patient, surgeons and laymen satisfaction.

2.1. Procedure

Abdomen was prepared and draped. Under local anaesthesia through tiny incision in the umbilicus for abdominal fat, posterior hip iliac crest region for buttock

fat, infiltrating solution was infiltrated in the intended subcutaneous areas of fat harvest. Fat was harvested using liposuction cannulas connected to 10 cc luer lock syringes by applying vacuum mechanical way. Fat was stored in a sterile 10 cc syringes and were centrifuged at 3000 rpm for 3 min. Donor site dressing was done and abdomen was strapped by dynaplast which stayed till two weeks' time to prevent seroma.

Derma fat was harvested using no 15 blade in the groin crease and elliptical chunk of derma fat harvested. Epithelium was removed using no 15 blade. Wound closed in two layers using 4-0 vicryl and 4-0 nylon and strapped with dynaplast.

The middle layer in the centrifuged sample was used for fat grafting and injected into the fat deficient areas in tiny aliquots by withdrawing the Coleman's infiltration cannulas through tiny incisions.

2. RESULTS

A total no of 15 patients underwent fat grafting in the first web space from May 2013 to November 2014. There were 13 male patients and 2 female patients. The mean age in our series was 33.6 years. 11 patients underwent free fat grafting and 4 patients underwent derma fat grafting. The mean amount of fat residue, serum residue and oil supernatant after centrifugation was 10.45 cc, 4.72, 3.63 respectively. The mean amount of free fat injected was 9.18 cc. The mean amount of free fat wasted was 1.27cc. The mean amount of free fat injected in order to achieve excess correction was 2.54 cc. The mean time duration was 46 minutes. The mean amount of free fat estimated by high-resolution ultrasound at six months and twelve months after the surgery was 6.85cc and 5.37cc

*Address correspondence to this author at Department of Plastic Surgery, The Bangalore Hospital, Bengaluru, India;
E-mail: gejje.somashekar@gmail.com

respectively. Donor site complication included seroma at the groin site in two patients who underwent derma fat grafting. Recipient site complication included fat atrophy to a variable extent in all the patients. Patient, surgeon and laymen satisfaction score was 6.61, 5.7 and 6.62 respectively.

3. DISCUSSION

In a historical review, Billings and May [1] found that the first use of fat in human auto transplantation was described by van der Meulen in 1889. The search for the ideal facial filler began more than 100 years ago, when Neuber first described the free autologous fat graft for soft-tissue augmentation. In 1912, Holländer reported natural appearing changes after fat infiltration in patients with facial lipoatrophy 14 years later, Miller published his experience with fat infiltration through cannulas. One of the main indications for fat grafts has been for soft tissue augmentation including the cosmetic treatment of first web space atrophy [2,3].

In our study we performed fat grafting in a total of 15 patients who had web space atrophy post median and ulnar nerve palsy affected by leprosy. Free fat grafting in 11 patients and derma fat grafting in 4 patients. The age range of patients in this study was between 8 – 46 years, the mean age being 26.81 yrs. Most of the patients were in the young age group 20 – 40 yrs. The donor site for free fat was abdomen in 6 patients, thigh in 3 patients and buttock in 2 patients. The donor site for derma fat was groin in 4 patients. In our study series the main driving reason for opting fat grafting was aesthetic correction. This procedure was not done in conjunction with tendon transfer but was done after the tendon transfer surgery for ulnar and median nerve palsy.

The abdomen was the first choice in most of the patients especially in female patients as it is easy to harvest, hidden scar in the umbilicus and usually sufficient amount of fat present in the lower abdomen and periumbilical area. Free fat was harvested from buttock only in thin patients who did have sufficient fat in the abdominal wall. Free fat was harvested from thigh region in few cases only for comparison of the fate of fat harvested from different donor sites. Derma fat was harvested from groin in 4 cases to compare it with free fat. Ease of harvest was maximum in patients in whom the free fat was harvested from abdomen as it had sufficient amount of free fat, patients had to be in supine position, easy to drape and easy to infiltrate wetting solution and harvest. It was difficult to harvest

free fat from thigh and from buttock as they don't have a flat area and fat is coarse and dense as compared to abdomen. Also the patients found it difficult to lie prone for the harvest of fat from buttocks. Yield of free fat was maximum in the abdomen site and least in the buttock region. Also derma fat could be harvested to a limited extent from groin site. The mean duration of the surgery was 46 min. Mean duration was least (43 minutes) in cases where derma fat was used since two teams (surgeon and assistant) simultaneously carried out the harvest, pocket creation in the recipient site and insertion of the derma fat graft and closure of the donor site. Time duration was maximum (54 min) in cases where free fat was harvested from buttock region because of the extra time required in changing the position of the patient. The mean duration of surgery was 52 min in cases where free fat was harvested from abdomen. The duration of surgery was more in cases where free fat was used than compared to derma fat since lipoaspiration and fat injection was done by single surgeon.

The minimum amount of fat residue after centrifugation was 7 cc and the maximum amount of fat residue was 11 cc. The minimum amount of serum residue was 3 cc and maximum was 4.5 cc. In case of oil supernatant minimum amount was 2 cc and maximum amount was 3 cc.

Syringe aspiration is currently the most popular fat harvesting method. At our centre, we used blunt 2-hole cannulas attached to 10cc, 20cc and 50cc. Luer-Lok syringes. The cannula is pushed through 3-mm incisions and a gentle negative pressure is created by digital retraction of the syringe plunger. Together with this slight negative pressure, the curetting action of the cannula through the harvest site tissues lets small fat parcels progress through the cannula and into the syringe.

The procedure was done under local anaesthesia in all cases. 57.4% of free fat was retained and 42.6% of free fat got reabsorbed (41 cc) at the end of 12 months. Free fat reabsorption was at the rate of 3.41 cc per month HRUS was done with 10, 12 MHz short focus high frequency linear transducers through direct contact scanning technique on Toshiba Neimo 30 ultrasound machine. Probe was put gently on site of fat graft with inert ultrasound gel. Scanning was done in transverse, longitudinal, antero-posterior planes. Volume estimation was done. Grafted fat was found to be more echogenic than normal fat because of densely packed fat cells and it looks bright echogenic tissue with

homogenous consistency, can be easily differentiated from normal fat in body.

High-resolution ultra sound is a modality with a high sensitivity and specificity and has inter observer variations just like normal ultrasound. It is not the fault of the modality but the fault of the operator, which results in varied results. The inter observer variation was not there in our study as it was done by a single radiologist. The intra observer variation was also eliminated by keeping the ultrasound probe gently over the grafted fat which did not allow the fat to get displaced and result in the alteration of the dimensions (in three planes) of the measured fat.

The fatty infiltration in the surrounding areas of the fat grafted site such as in the atrophied muscles near the web spaces of hand, glands (parotid, submandibular etc.) in the craniofacial region will be heterogeneous, fat will be hyper echoic, patchy density will be seen as fat found is mixed with adjacent muscle/parenchyma. The injected fat will be well defined, uniformly homogenous with peripheral slight halo echo pattern with no intervening muscle/parenchymal echo pattern. HRUS easily differentiates injected fat from infiltrated fat.

The mean percentage of retained free fat in the fat grafted area when the donor was abdomen was 57.9% at the end of 12 months as estimated on HRUS. The mean percentage of retained free fat in the fat grafted area when the donor was thigh was 50.9% at the end of 12 months as estimated on HRUS. The mean percentage of retained free fat in the fat grafted area when the donor was buttock was 66.7% at the end of 12 months as estimated by HRUS.

The mean percentage of retained derma fat was 80.9% of the estimated volume at 6 months at the end of 12 months. The mean percentage of the retained free fat was 70% of the estimated volume at 6 months at the end of the 12 months. The retained fat volume at the end of 12 months in case of derma fat was 75% compared to a similar case of free fat (similar volume) where the retained fat at the end of 12 months was 45%.

There was a significant difference in the fat atrophy between the cases where free fat was used for contour correction and the cases where derma fat was used for contour correction ($P = 0.01$). Fat reabsorption was less and volume of the fat retention was more in cases where derma fat graft was used compared to the cases where free fat graft was used. Volume estimation by HRUS at six months and one year proved that fat

atrophy was least in the cases where derma fat was used and much more in the cases where free fat was used. But there was no significant difference between the cases where free fat was harvested from different donor sites (buttock, thigh and abdomen) on analyzing the results of volume estimation by HRUS.

Guibert *et al.* [4] also reported volume estimation although by different method (3D photography) in a similar manner of follow up as done in our study. The mean survival of fat grafted was 40 % in their series comparable to our study. Fontdevila *et al.* [5] reported in their article a method of volume estimation using computed tomography in their series of fat grafting done in the facial region.

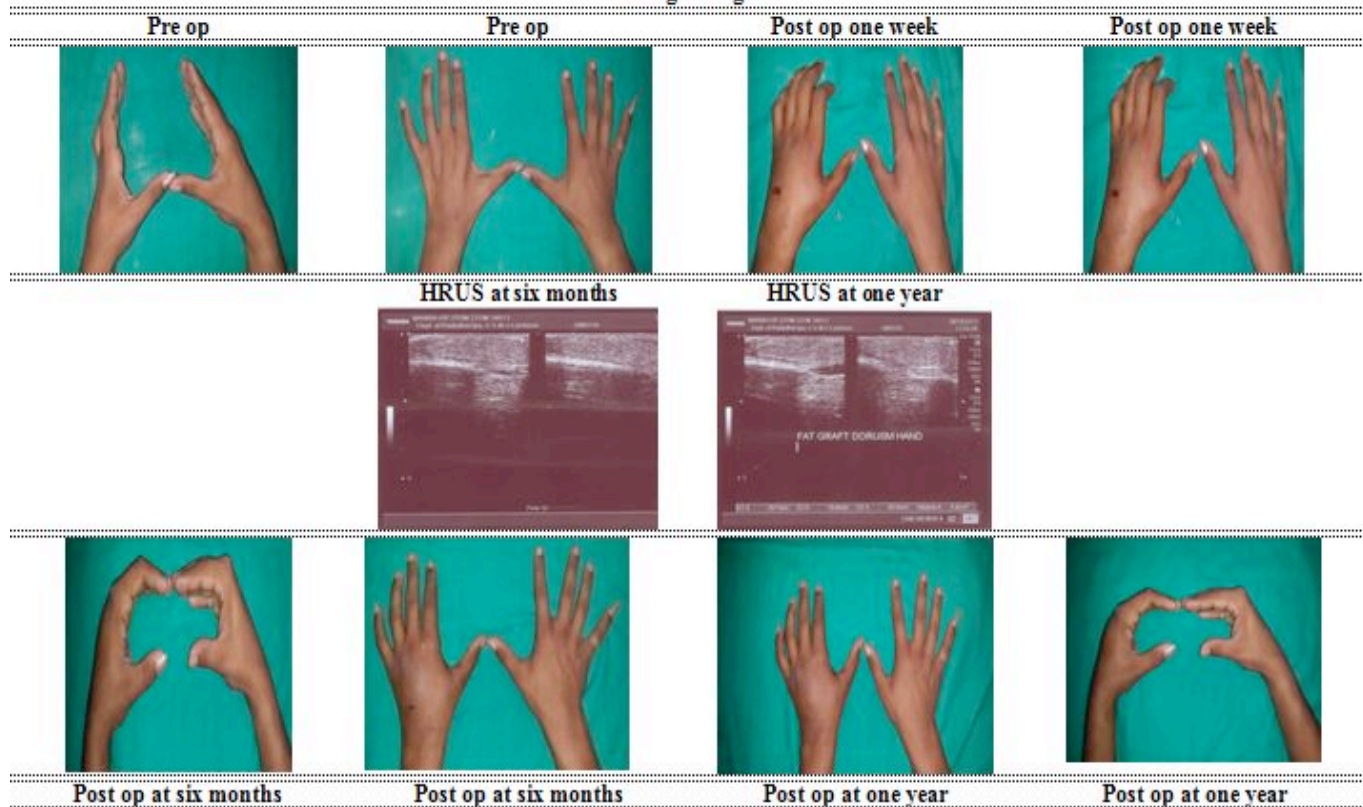
The surgeon's satisfaction scale was an objective one taking into consideration the volume of the fat retained. The scale rating was 1 for < 10% of fat retained and 10 for 90-100% of the fat retained at the end of twelve months. The patient satisfaction was a subjective one based on their personal appreciation of the end result (at the end of twelve months) of the appearance of the fat grafted area. The patients were asked to give points from 1-10 based on their satisfaction of the end result. The layperson scale was also a subjective one on a scale of 1-10, 10 being the best correction and 1 being the poorest correction. The laypersons (other patients and their attenders who attended the outpatient clinic along with the study group patients) rated the end result of the procedure by seeing the site of fat grafting region in the patient.

The patients were followed up till one year in our study. 14 patients visited regularly in the follow up till the end of one year. One pt was lost in the follow up after six months so HRUS could not be done in the Patients visited at one week, one month, six months and at one year period. Photographs in standard view was taken in pre operative period, immediately after the surgery, at one week, at one month, at six months and at one year.

Guijarro-Martínez *et al.* reported in their article an average postoperative follow up of 26.4 months with serial photography done every 3 months comparable to our study group. Guijarro-Martínez *et al.* [6] also reported the need of second sitting of autologous fat transfer in 2 of their 11 patients in view of significant fat reabsorption.

Xie *et al.* [7] reported in their case series that all patients were seen at the postoperative days 7, 30 and 90 days and standard photographs were taken during

A 24 yr old male pt with post leprosy ulnar and median nerve palsy with 1st web space and dorsum of lt hand atrophy underwent free fat grafting



each visit. Photographic documentation was obtained preoperatively and at 3,6,12, and 24 months post-operatively.

Seroma at the groin site was drained from the suture site at the third post-operative day and pressure bandage using dynaplast was applied. It resolved and the sutures were removed on the tenth day.

Recipient site complications included fat reabsorption (atrophy) to a certain extent in all cases. Slight bruising and swelling were not taken into account as complications as they were found in all cases and was not a worrying thing. Slight bruising and edema resolved in 10 to 14 day time.

Guijarro-Martínez, *et al.* [6] also reported in their article the complications regarding the donor and recipient sites comparable to our study.

4. CONCLUSIONS

1. Autologous fat grafting is a good option for volumetric restoration by autologous tissue and correction of the contour abnormalities in various sites of the body including atrophied web spaces. It improves the aesthetic appearance of the hands and self-confidence of the patients. Significant difference in

the fat atrophy was noted between the cases where free fat was used for contour correction and the cases where derma fat was used for contour correction.

2. Volume of the fat and contour correction was maintained for a longer time in cases where derma fat graft was used.
3. Volume estimation by HRUS at six months and one year proved that fat atrophy was least in the cases where derma fat was used and much more in the cases where free fat was used.
4. No significant difference between the cases where free fat was harvested from different donor sites (buttock, thigh, abdomen) on analyzing the results of volume estimation by HRUS.
5. The mean was 5.65 in the surgeon's satisfaction scale. The mean was 6.35 in the patient's satisfaction scale. The mean was 6.16 in the layperson's satisfaction scale.
6. HRUS is an excellent handy modality for serial volume estimation of the grafted fat, cost effective, non-invasive, multi planar modality, does not require

any preparation, and easily done outdoor procedure. Follow up is a practical proposition with HRUS.

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