ORIGINAL ARTICLE

ANNALS OF PUNJAB MEDICAL COLLEGE

Nano Fat Graft Harvested from Abdomen in Comparison with Thigh in the Treatment of Hyperpigmentation of Face

Muhammad Amin Alam[1], Muhammad Nasrullah[2], Roomana Akhlaque[3], Samia Fatima[4], Sana Imdad[5], Hirra Rehman Alavi[6], Ajmal Farooq[7]

1 *Assistant Professor, Department of Plastic Surgery, PGMI / Ameer-ud-Din Medical College / LGH, Lahore Pakistan*
Principal investigator

2 *Assistant Professor, Department of Plastic Surgery, TBRSG / Ameer-ud-Din Medical College, Lahore Pakistan*
Manuscript writing

3 *Assistant Professor & HOD, Department of Plastic Surgery, PGMI / Ameer-ud-Din Medical College / LGH, Lahore Pakistan*
Discussion writing

4 *Assistant Professor, Department of Plastic Surgery, PGMI / Ameer-ud-Din Medical College / LGH, Lahore Pakistan*
Statistical analysis

5 *Women Medical Officer, Department of Plastic Surgery, PGMI / Ameer-ud-Din Medical College / LGH, Lahore Pakistan*
Data collection

6 *Senior Registrar, Department of Plastic Surgery, PGMI / Ameer-ud-Din Medical College / LGH, Lahore Pakistan*
Data collection

7 *Professor, Department of Plastic Surgery, PGMI / Ameer-ud-Din Medical College / LGH, Lahore Pakistan*
Supervised & Proof read

CORRESPONDING AUTHOR
Dr. Samia Fatima
Assistant Professor, Department of Plastic Surgery, PGMI / Ameer-ud-Din Medical College / LGH, Lahore Pakistan
Email: samia.87@live.co.uk

Submitted for Publication: 06-03-2024
Accepted for Publication 31-03-2024

How to Cite: Alam MA, Nasrullah M, Akhlaque R, Fatima S, Imdad S, Alavi HR. Nano Fat Graft Harvested from Abdomen in Comparison with Thigh in the Treatment of Hyperpigmentation of Face. APMC 2024;18(1):68-72. **DOI: 10.29054/APMC/2024.1577**

ABSTRACT

Objective: To evaluate the outcomes of nano fat graft harvested from abdomen in comparison with thigh in the treatment of hyperpigmentation of face. **Study Design:** Randomized control trial. **Settings:** Plastic and Reconstructive Surgery department, Lahore General Hospital, Lahore Pakistan. **Duration:** 2 years January 2021-December 2023. **Methods:** The tissue thickness was also assessed through ultrasonographical imaging in all patients. Cases enrolled were divided into two groups wherein Group I was those cases where Nano fat graft was generated from the medial thigh fat while Group II were those cases where the abdomen region fat was used for the formation of the fat graft. A 10-cc syringe (14G needle) in multiple layers was used for injecting fat graft under local anesthesia. Over corrections were performed up to 20-30% for due to absorption chance. Postoperative ultrasonography was performed and tissue thickness was observed after 3 months for comparing the fat survival and thickness rate. **Results:** The fat thickness in the application of medial thigh fat graft group I was observed slightly higher than the abdomen-based fat graft generated, although the variance was insignificant. It was observed that the rate of complications like bruising and pain was higher in the group I while seroma was lowed in group I than Group II. **Conclusion:** The Nano fat graft generated from the fat tissues of the medial thigh has higher efficacy and survival rate with lack of lethal complications than the nano graft generated form the abdomen fats.

Keywords: *Hyperpigmentation, Nanograft, Rejuvenation, Facial treatment.*

INTRODUCTION

Facial hyperpigmentation or melasma is a stressful condition which has been observed in all skin colors.[1] Facial hyperpigmentation related to refractory malfunctioning causes brown and grey pigmentation and is known as chloasma.[2] Melasma can be presented in both genders however its probability is higher in women than men especially in pregnant women.[3] There is another common facial hyper pigmentation disorder termed as post inflammatory hyperpigmentation which is presented as a result of post skin trauma or skin inflammation. This condition has an equal incidence to occur within both genders.[4] Several treatment plans are available for hyper pigmentation condition including topical treatments as well as photoprotection, surgical interventions and systematic medications.[5,6]

The other method which have been reported as valuable and effect in treatment of facial hyperpigmentation as a contour therapy includes Nano fat graft, fat transfer or the application of silicon / hydroxyapatite implants. The fat graft application is based on facial fillers.[7] However, there are various studies reporting the resorption of lipo-fillers with time[8,9] which relies on the volume of fat cells transplanted.[10]

Nanofat is a relatively novel technique in fat grafting. The fat grafts are either applied individually or in combination with the rejuvenating procedures having a benefit of less invasive with least complication rates.[10] The fat harvesting can be performed either from the thigh region or the abdomen.[11] Literature supports that the site from where the fat graft has been generated is really important and is related with the survival rate, complications severity.[12]

The current study was focused on comparing the thigh Nano fat graft with the abdomen based Nano fat graft in treating the facial hyper pigmentation cases. The results of this study have been able to identify the most suitable region for the graft as well as highlight the efficacy of both of the fat grafts in treating facial hyperpigmentation which results from facial trauma.

METHODS

It was a randomized control trial which was conducted in the Plastic Surgery department, Lahore General Hospital, Lahore within a period of 2 years from January 2021-December 2023. Ethical approval was taken for the study with Reference 112 IRB Number 112-2020. A total of 65 cases having facial contour deformity in relation to facial hyperpigmentation were included in this study. The age of inclusion was between 12-60 years. Hyperpigmentation was either congenital or result of a traumatic event. However, cases where facial hyperpigmentation was a result of comorbidities or any serious illness, bleeding disorders were excluded from the study. Each patient was clinically assessed before enrollment in the study. A well-structured questionnaire was sued for entering all relevant clinical data add formation as well as previous patients' clinical history. All the enrolled cases were requested to give a written informed consent of participation prior their enrollment. The tissue thickness was also assessed through ultrasonographical imaging in all patients. Preoperative protocols including photographs with anti-posterior as well as oblique and 45-degree angle views were completed for comparison purposes. Cases enrolled were divided into two groups wherein Group I was those cases where Nano fat graft was generated from the medial thigh fat while Group II were those cases where the abdomen region fat was used for the formation of the fat graft. The Nano fat graft construction involved fat extraction from patient. Separation of fat graft layer by centrifugation at 3000 rpm and transformation of it into Nanofat which comprised of small fat particles with a <0.1mm diameter and high concertation if the stem cells as well as of growth factors. A 10-cc syringe (14G needle) in multiple layers was used for injecting fat graft under local anesthesia. In context of risk of absorption extra absorption were conducted for 20% to 30%. A standardized mechanism for fat harvesting was applied by using 900 ml salt of 0.9% value with 0.25ml adrenaline in a constitution of 1mg per ml. This was followed by twenty ml lidocaine in a constitution of 20mg per ml. The harvesting of microfat was performed through 2.4mm measured harvester (tonaard) with a cannula which was 20cm, 1cm in diameter. Patient's choice was preferred for the selection of donor sires and also was assessed on the basis of fat depositions. Isotonic-salts ion was used for washing the fat and the nano fat was then fixed. Emulsification of micro fat was conducted by back-and-forth movement up to thirty times t within two interconnected 10 cc syringe. This continued until the fat had liquefied with a whitish development. Nylon cloth was placed for passing the emulsified fat. This nylon cloth had a opening/pore size of 0.5 mm. Various gauges (24, 25, or 27) were used for injecting liquid in the scar-tissue and or the derma. Post-operative ultrasonography was performed and tissue thickness was observed after 3 months for comparing the fat survival and thickness rate. In cases where the thickness dm was ≥6mm was considered as excellent, while 5 to 6mm was good and <5mm was considered as fair as observed at the final time of fat survival. All the complications post facial treatment were noted within groups and compared. Th treatment outcomes were noted at baseline, then at 1 week followed by 12 weeks. The data entered and analyzed by SPSS-26. ANOVA was used for statistically comparing the groups, p value <0.001 was taken as significant.

RESULTS

The mean age in Group I was 26.5 ± 7.5 years while in Group II was 28.1 ± 6.9 years. Within the various age groups the maximum age was reported age 58 years while minimum was 12 years. The majority of the cases were presented within the age group of 12-34 yeas within both groups. There was a higher frequency of females than males with 56.25% in Group I and 57.57% in group II respectively. Table 1

Table 1: Demographic distribution within groups

Demography		Group I (n=32)		Group II (n=33)	
		Frequency	Percentage	Frequency	Percentage
Age Groups	12-34	20	62.5	21	63.63
	35-54	8	25	7	21.21
	>55	4	12.5	5	15.15
Gender	Males	14	43.75	15	45.45
	Females	18	56.25	19	57.57

The fat thickness in the application of medial thigh fat graft group I was observed slightly higher than the abdomen-based fat graft generated, although the variance was insignificant. However, the difference in fat

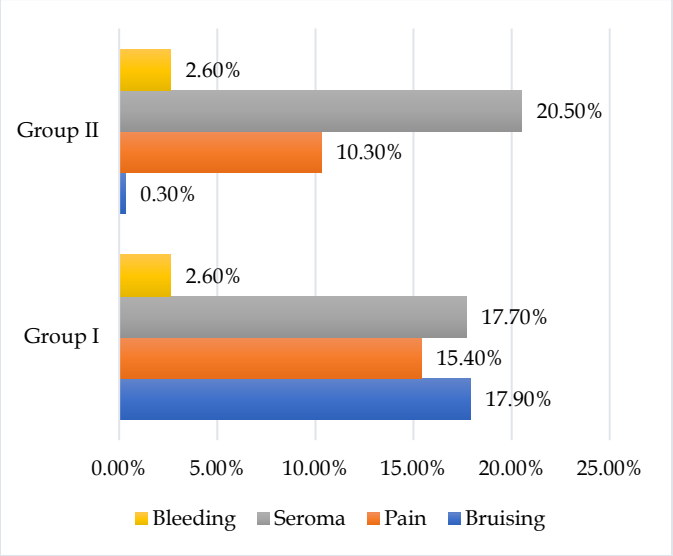
thickness significantly improved with higher fat thickness reported on 1 week followed by 12 weeks in medial thigh based Nano fat graft than the abdomen based Nano fat grafts. Table 2

Table 2: comparison of fat thickness between group & group II

Fat thickness	Group I (n=32)	Group II (n=33)	P value
	Mean ± SD	Mean ± SD	
preoperative (mm)	1.61±0.076	1.60±0.071	0.641
1 week	6.6±0.11	5.7±0.071	<0.001
12 weeks (final fat thickness)	6.03±0.095	4.9±0.094	<0.001

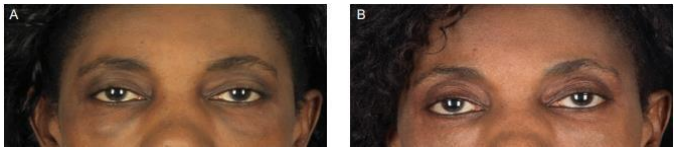
The complications post treatment of facial hyperpigmentation was also evaluated within both groups and it was observed that the rate of complications like bruising and pain was higher in the group I while seroma was lowed in group I than Group II. The bleeding was almost equal within both groups. Fig 1

Figure 1: Complications comparison within group I & group II



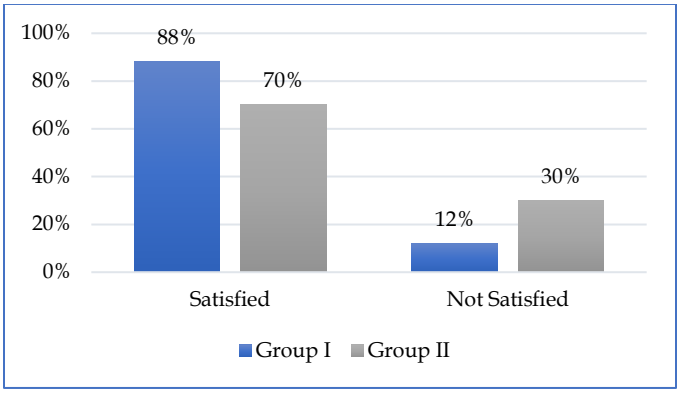
Chi square 0.498

Most of the patients were satisfied with Nano graft from medial thigh as reported by 88% of the cases, and illustrated as below.



(A) A 50 year-old female Pre periorbital hyperpigmentation treatment in Group I. (B) One month posttreatment in Group I

Figure 2: Comparison of satisfaction level between two groups



A) Nano fat grafting in Group II. B) Results after 6 months.

A 42 year old male with improvement in pigmentation. The post operative picture is showing results 1 year after nano grafting in Group I.

DISCUSSION

Currently, the conventional method for correcting scars involves surgical excision, a process that frequently leads to the elongation of the scar and the persistence of hypertrophy or redness. Notably, fat grafting has demonstrated positive effects on contracted scars initially treated for volume loss. The inaugural application of autologous fat transfer for facial volume loss dates back to 1893, utilizing fatten bloc to fill subcutaneous defects.

In 1912, fat injections were employed to correct retracted scars after mastectomy. However, recent refinements in the technique of fat harvesting and injection have significantly improved outcomes.[13-15]

Due to its biocompatibility and lack of immunogenicity, adipose tissue emerges as an ideal transplant material for patients. Additionally, it is easily harvestable and associated with minimal donor site morbidity. Clinical observations have indicated the regenerative effects of adipose tissue on dermal and subcutaneous tissues. Although the precise mechanisms enhancing tissue quality remain unclear, studies suggest potential reasons, including the formation of new blood vessels, tissue remodeling, and inflammatory responses, contributing to scars regaining characteristics of normal skin. There is consensus that adipose tissue-derived stem cells (ADSCs) are multi- and pluripotent and are abundant in the stromal vascular fraction (SVF) of adipose tissue. Experimental studies injecting ADSCs intralesionally into rabbit ears have demonstrated a reduction in hypertrophic scarring, suggesting potential therapeutic benefits.[16,17]

The term "nanofat," introduced in 2013, describes a novel method for preparing autologous fat to predominantly leverage its regenerative properties. Comparisons with lipoaspirates obtained by standard fat harvesting techniques have shown that while viable adipocytes are eliminated after the emulsification process, the number of ADSCs remains comparable. Despite adipocytes comprising only 25% of the total cell count in fat tissue, the prepared tissue can still be termed as a form of fat since SVF and ADSCs are not removed from the solution before injection.[18,19]

The noanfat technique was originally developed for the regeneration as well as for remodeling of the tissue, however it has been applied for the tissue deformity filling at various surgical settings. The formation of nanofat is cumbersome involving the repetitive shuffling of the lipo-aspirate. Although this procedure does not lead to alteration in tissue viability, nor it leads into any SVF related impact. The clinical presentation of nanofat has shown significant improvement in the quality of the skin with reduction in skin discoloration in 67 patients. Softer and more flexible skin were also observed in cases of nanofat treatment. The process also does not lead to the formation of new scars with a regenerative ability.

Through nanfoat technique the chance of malfunctioned healing are reduced as no novel surgical interventions are conducted and a very rare chance of and special post-surgical treatment is present. In many cases only a single session has been observed to be sufficient as well as beneficial. Research has proven enhanced effects of nanofat treatment when combined with the conservative fat grafting technique specifically in context of high quality of skin as well as preventing/improving crucial retractile scarring, in cases of breast implant. Studies have recommended that nanofat prompts tissue regeneration as well as upgrades skin quality and dermal and deep wrinkles elasticity. While improvements are typically noticeable up to 100 days post-treatment, long-term studies are warranted to comprehensively document the longevity of these effects.[20-22]

CONCLUSION

The Nano fat graft generated from the fat tissues of the medial thigh has higher efficacy and survival rate with lack of lethal complications than the Nanograft generated from the abdomen fats. The complication of bleeding was almost similar in both groups while the fat thickness was significantly improved in the medial thigh group than abdomen group reflecting better survival rate as well.

LIMITATIONS

The limitation of this study is the limited number of cases and short study period.

SUGGESTIONS / RECOMMENDATIONS

Larger stage studies involving multiple centers are required to make the results generalized.

CONFLICT OF INTEREST / DISCLOSURE

There is no conflict of interest and no funding sources.

ACKNOWLEDGEMENTS

We want to acknowledge our co-workers and patients, for there help support and consent for the study

REFERENCES

1. Alexis AF, Sergay AB, Taylor SC. Common dermatologic disorders in skin of color: a comparative practice survey. Cutis. 2007 Nov 1;80(5):387-94.
2. Sarma N, Chakraborty S, Poojary SA, Rathi S, Kumaran S, Nirmal B, et al. Evidence-based review, grade of recommendation, and suggested treatment recommendations for melasma. Indian Dermatology Online Journal. 2017 Nov 1;8(6):406-42.
3. Taylor SC. Epidemiology of skin diseases in ethnic populations. Dermatologic clinics. 2003 Oct 1;21(4):601-7.
4. Kaufman BP, Aman T, Alexis AF. Postinflammatory hyperpigmentation: epidemiology, clinical presentation, pathogenesis and treatment. American journal of clinical dermatology. 2018 Aug;19(4):489-503.
5. Taraz M, Niknam S, Ehsani AH. Tranexamic acid in treatment of melasma: A comprehensive review of clinical studies. Dermatologic therapy. 2017 May;30(3):e12465.
6. Moolla S, Miller-Monthrope Y. Dermatology: how to manage facial hyperpigmentation in skin of colour. Drugs Context. 2022 May 31;11:2021-11-2.
7. Bellini E, Grieco MP, Raposio E. The science behind autologous fat grafting. Annals of medicine and surgery. 2017 Dec 1;24:65-73.
8. Del Vecchio D, Rohrich RJ. A classification of clinical fat grafting: different problems, different solutions. Plastic and reconstructive surgery. 2012 Sep 1;130(3):511-22.

9. Dolen U, Cohen JB, Overschmidt B, Tenenbaum MM, Myckatyn TM. Fat grafting with tissue liquefaction technology as an adjunct to breast reconstruction. Aesthetic Plastic Surgery. 2016 Dec;40:854-62.
10. Li K, Gao J, Zhang Z, Li J, Cha P, Liao Y, et al. Selection of donor site for fat grafting and cell isolation. Aesthetic plastic surgery. 2013 Feb;37:153-8.
11. Yu NZ, Huang JZ, Zhang H, Wang Y, Wang XJ, Zhao R, et al. A systemic review of autologous fat grafting survival rate and related severe complications. Chinese Medical Journal. 2015 May 5;128(09):1245-51.
12. Ahmadi S, Mujahid AM, Khan H, Khalid FA, Saleem M, Mehrose MY. Comparison of graft survival between fat harvested from abdomen and medial thigh for facial contour deformity: a randomised control trial. J Coll Physicians Surg Pak. 2019 May 1;29(5):440-3.
13. Guisantes E, Fontdevila J, Rodríguez G. Autologous fat grafting for correction of unaesthetic scars. Annals of plastic surgery. 2012 Nov 1;69(5):550-4.
14. Riyat H, Touil LL, Briggs M, Shokrollahi K. Autologous fat grafting for scars, healing and pain: a review. Scars, burns & healing. 2017 Sep 14;3:2059513117728200.
15. Xu X, Lai L, Zhang X, Chen J, Chen J, Wang F, et al. Autologous chyle fat grafting for the treatment of hypertrophic scars and scar-related conditions. Stem cell research & therapy. 2018 Dec;9:1-8.
16. Salthouse D, Novakovic K, Hilkens CM, Ferreira AM. Interplay between biomaterials and the immune system: Challenges and opportunities in regenerative medicine. Acta Biomaterialia. 2023 Jan 1;155:1-8.
17. Tran TT, Kahn CR. Transplantation of adipose tissue and stem cells: role in metabolism and disease. Nature Reviews Endocrinology. 2010 Apr;6(4):195-213.
18. Verpaele A, Tonnard P, Jeganathan C, Ramaut L. Nanofat needling: a novel method for uniform delivery of adipose-derived stromal vascular fraction into the skin. Plastic and reconstructive surgery. 2019 Apr 1;143(4):1062-5.
19. Tonnard P, Verpaele A, Carvas M. Fat grafting for facial rejuvenation with nanofat grafts. Clinics in plastic surgery. 2020 Jan 1;47(1):53-62.
20. Jeyaraman M, Muthu S, Sharma S, Ganta C, Ranjan R, Jha SK. Nanofat: a therapeutic paradigm in regenerative medicine. World Journal of Stem Cells. 2021 Nov 11;13(11):1733.
21. Ding P, Lu E, Li G, Sun Y, Yang W, Zhao Z. Research progress on preparation, mechanism, and clinical application of nanofat. Journal of Burn Care & Research. 2022 Sep 1;43(5):1140-4.
22. Grünherz L, Sanchez-Macedo N, Frueh FS, McLuckie M, Lindenblatt N. Nanofat applications: from clinical esthetics to regenerative research: Potential applications of nanofat in tissue regeneration with a focus on wound healing and vascularization. Current Opinion in Biomedical Engineering. 2019 Jun 1;10:174-80.