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ORIGINAL ARTICLE

Functional and Aesthetic Outcome of Subdermal NanoFat Injection in Old Facial Scars; Prospective Case Series Study

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ABSTRACT

Background: One of the hardest problems in surgery is controlling face scarring, which is a challenging therapeutic issue for plastic surgeons to solve successfully. Nano fat injection under scar is expected to improve scar functionally and aesthetically. This study aimed to evaluate the effectiveness of Nanofat in improving the appearance of old facial scars using the Patient and Observer Scar Assessment Scale (POSAS) and clinical photographs.

Methods: This prospective case series study was conducted at the Plastic and Reconstructive Surgery Department, in Zagazig University Hospitals, included 20 patients with variable types of face and neck scars. Scar revision was done in (3 patients) either by linear revision, multiple small Z-plasty or W-plasty after excision of the original scar. In the remaining 17 patients, Nano-fat injection of the old scars was done without scar excision.

Results: In this study the most common site for harvested fat was (Abdomen in 15 patients), complication were minimal it was only in (25%) of total complication was occurred in scar site or donor site. We found that the POSAS scale for scar assessment, Evidently, there is marked improvement in the parameters of the score both individually ± in the final total score, P-values are found to be highly significant in all of them ($P<0.01$).

Conclusions: The findings suggest that Nanofat injection enhances neovascularization and extracellular matrix remodeling, can be an effective and safe treatment for reducing the appearance of old scars and enhancing their aesthetic quality.

Keywords: Nanofat Grafting ;POSAS ;Old Scars; Facial Scarring

INTRODUCTION

After wounds, injuries, and some diseases, scars a fibrous tissue replace normal tissue. Although scars are generally benign, they can result in serious issues with appearance, functionality, and social interaction **[1].**

Scars are mostly an inevitable result of human skin damage because of wound healing processes. Patients of all ages, genders, and skin types may have scarring. Scars can be classified as atrophic, hypertrophic, or keloid in nature and vary in color, texture, thickness, and surface area. Pruritus, discomfort, and functional difficulties are some of the side effects **[2].**

A way to efficiently evaluate a scar based on mostly objective (quantitative) elements was required in order to grade discrepancies and observe changes in scar forms. There are already around ten scar assessment scales available in the literature. In 1990, the

Vancouver Scar Scale (VSS), the first validated scar evaluation tool, was developed to evaluate burn scars. The absence of qualitative measures like pain, pruritus, and the psychological effects of scarring was one of the VSS's main drawbacks. Consequently, a modified VSS was created. Both the Hamilton Scale and the Manchester Scar Scale (MSS), which were created in 1998, have this flaw. When compared to the original VSS, the Patient and Observer Scar Assessment Scale (POSAS), which was created in 2004, was more trustworthy because it was the first scar scale to include both the patient and provider viewpoints **[2].**

Two distinct scales make up the POSAS, which was developed in 2004. Patients are given one to complete, while observers are given another. On a scale of 1 to 10, observers score scar vascularization, pigmentation, pliability, thickness, and alleviation, while patients rate scar color, stiffness, thickness, irregularity, pain, and itching. Furthermore, three alternatives are provided to further explain the pigmentation score: Hyperpigmentation, mixed pigmentation, or hypopigmentation **[2]**.

In the realm of plastic surgery, autologous fat grafting is becoming more and more common. It has become as one of the most popular treatments carried out by plastic surgeons since the 1980s. Applications for fat grafting can be found in many clinical settings, from facial volume loss to breast reconstruction. The advantages of fat grafting have recently been used to repair scars and promote wound healing **[3]**.

Van der Meulen described the first fat graft in 1889 to treat diaphragmatic hernias, and it has been used for more than a century. Because of the high volume of fat resorption in this instance, the attempt to insert fat between the liver and diaphragm was ineffective. Neuber reported the first successful fat graft to address facial scars **[4].**

Autologous fat grafting, or AFG, was initially described by Neuber and later identified by Coleman. AFG is thought to be a viable treatment option for scars in addition to its well-known filling effect because it contains adipose tissue derived stem cells (ADSCs), which have a high capacity for regeneration and can heal damaged tissues **[5]**.

In recent years, autologous fat transplantation has grown in popularity. It is a commonly used treatment technique for soft tissue augmentation and volume restoration in both reconstructive and cosmetic plastic surgery because of its availability and biocompatible qualities. The literature has detailed a number of protocols and therapeutic uses, with significant differences in the methods used for injection, processing, and harvesting **[6].**

In addition to the filling action of fat, which raises the height of the treated scars, ADSCs in nanofat aid in promoting the deposition of collagen and elastic tissue, improving scar pliability**[7].**

METHODS

The Plastic and Reconstructive Surgery Department of Zagazig University Hospitals conducted this prospective study between December 2023 and December 2024. Twenty patients (16 males and 4 women) who were bothered by ancient face scars were seen at this time. The inclusion criteria were age between 18-60 years, old scar in the face (>6 months after wound healing) (post burn – post traumatic) and no chronic diseases that could preclude the producer. The exclusion criteria were elderly patients with comorbid diseases, patients > 60 years old, patients who refused the technique, patients who had keloid scars or hypertrophic scars and cases presented to the outpatient clinic with scar less than 6 months. Approval was taken from the Research Ethical Committee and the Institutional Review Board (IRB#11361) of Zagazig University's Faculty of Medicine. Every patient gave their consent to take part in the trial. The work was conducted in compliance with the World Medical Association's Code of Ethics (Declaration of Helsinki, 1964) and its subsequent unifications for human subjects research.

Every patient underwent a thorough medical history and a clinical examination, either locally to check for scar criteria (length, width,

thickness, type of healing, atypical pigmentations, and trial of past revision) or generally to check for any related injuries. Routine laboratory investigations including complete blood count (CBC), coagulation profile, liver and kidney function. Preoperative single dose of prophylactic antibiotic (ceftriaxone 1gm IV) was given after skin sensitivity test.

This study included 20 patients with variable types of face and neck scars. All cases were operated upon under General anesthesia except for (6 patients) who were managed under local anesthesia + sedation. Scar revision was done in (3 patients) either by linear revision , multiple small z-plasty or w-plasty after excision of the original scar. In the remaining 17 patients , Nano-fat injection of the old scars was done without scar excision .

Surgical technique

Nano-Fat Preparation

Potential donor locations were found to be the thighs and lower abdomen. A 2mm incision performed with a number 11 blade in the donor area allows the infiltration of tumescent anesthesia (500 ml of 0.9% saline solution, 1/2 ampoule of adrenaline 1 mg/ml, and 10-15 ml of lidocaine hydrochloride 2%, 10mEq/L NAHCO3). From subcutaneous fat, we manually extracted 120 cc of mixed fat with tumescent solution using a 20 mL Luer Lock syringe and a 2.5 mm-15 cm harvesting cannula.

To allow the layers to separate, the harvest syringe is decanted vertically for three to five minutes. Based on their density, the yellow adipose grafts in the syringe rapidly separate from the underlying infranatant fluid, causing the grafts to float in the center with the lipid layer on top. For every 5 mL of aspirate, we can anticipate a yield of 1.5 mL of fat graft, and for every 100 cc of aspirated macro-fat, we obtain roughly 30–40 cc of micro-fat (Figure 1A).

A sterile dressing with compression was applied to the donor area to lessen post-operative bruises. The liquid's outermost layer is eliminated. Oil cysts may result from the oil coating that covers the collected fat. Red blood cells and any leftover local anesthetic solution should be removed with just one wash using Ringer's solution.

To liquefy the fat and give it a whitish appearance, the cleaned microfat is loaded into 20 cc syringes and mechanically emulsified by moving the contents back and forth between two 20 cc syringes connected by a 2.4mm connector 30 times, then 30 times with a 1.4mm connector, and finally 30 times with a 1.2mm connector.

Nanofat process

The nano transfer block, which has a 400 µm and 600 µm single-use cartridge net double filter, was used once to filter the emulsified fat before it was transferred into a 20 cc syringe. For injection, this nanofat was put into 1 cc Luer Lock syringes.

Nanofat injection

When nano-fat gets ready, it was injected intradermally either directly under the scar (in these cases managed without scar revision (17 cases)) or at the edges of the revised wounds (3 cases), Nano-fat injection was done at a rate of 0.05ml – 0.1 ml in a injection point. The endpoint of the injection was reached with the appearance of a yellowish discoloration over the injection site (Figure 1B). After completion of the injection process, Light skin massage was done for this area, Light compression + Light dressings were applied with occlusive Adhesive tape. We didn’t dispose any of the prepared Nano-fat. After completion of injection, the remaining component of nano-fat was mixed with a water-base Gramycin cream in syringe mixed by 3 ways tool. (Figure 1C). This was given to the patient for the early post operative wound care period + the patient was advised to preserve it in the fridge 4-8^{o} C (Fridge door).

A)  B 

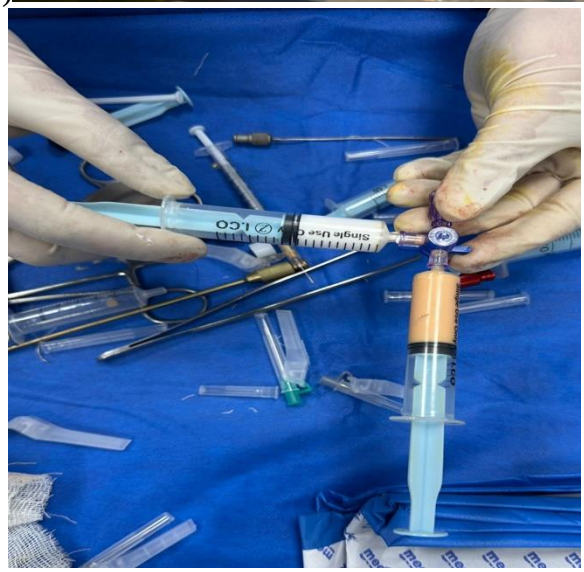
C 

Figure (1): A) Harvest syringe had macro-fat and other components. B) **Nano-fat injection in subdermal layer in the scar.** C) **Nano –fat cream preparation .**

Postoperative care

Starting from the 3rd postoperative day, patients were instructed to leave the wounds/scars exposed to apply this (nano-fat/gramycin) cream twice daily with light massage. All patients received analgesics, anti-edematous medications, and antibiotics for 1 week post operative till sutures were removed + cream finished .

Follow up

Patients were followed up at 3-6 months. Assessment was done using POSAS (Patient Observer Scar Assessment Scale) and standard photos were taken to compare the preoperative with the postoperative outcome.

Statistical analysis

The statistical package for the social sciences (SPSS) version 27 (IBM Corp., Armonk, NY, USA) was used to code and enter the data. The Wilcoxon Rank test was used to compare two paired groups with respect to quantitative data and non-parametric distribution. The correlation between two quantitative factors in the same group was evaluated using Spearman correlation coefficients. A 95% confidence interval and a 5% acceptable margin of error were established. The p-value was deemed highly significant (HS) when it was less than 0.05 and less than 0.01.

RESULTS

Table 1; showed that most of cases in this study were males (16 (80%)). The most common only affected age was the young age group (18-40 years) with overall age Mean ± SD (24.8 ± 5.44). The Clinical data related to scars of patients of the study, most common cause of scars in this study was post traumatic (17 cases (85%)), The most common duration was more than 12 months. The most common site was in forehead, the most common length was (≤5), The most common type of scar was (Atrophic) and the most color of scar was (Hypopigmentation).

Table 2; showed that the Pre-operative Observer Assessment Score among the studied patients, the Range of pre operative total observer score was (22-28). Pre-operative Patient Assessment Score among the studied patients, the Range of pre operative total score was (27-37).

Table 3; showed that surgery related data of the studied patients , the most common in type of anesthesia was (General anesthesia, 14 (70%)), the most common type of surgery was (Nanofat alone , 17(85%)) and the most time of surgery was (30-60 min, 17(85%)). Patient had nanofat alone taken time (30-60min) only. That Nanofat harvesting and processing data of the studied patients, the most common site of harvested fat was (Abdomen, 15 (75%)), the most common amount of harvested fat was (>100 CC , 8(40%)) and the most amount of nanofat obtained was (≤ 5 ml , 14 (70%)).

Table 4; showed that postoperative complications , the most common scar site complication was (Seroma , 3(15%)) and the most donor site complication was (Seroma, 5(25%)). Patients who had seroma, had aspiration done under local anesthesia . Patients who had hematoma, ice packing and anti edematous treatment help to improve. Patients who had wound infection, antibiotics and daily dressing help to improve. Patients who had skin sloughing, creams (soothing cream) like (Panthenol) help to improve .

Table 5;showed postoperative Observer Assessment Score, the Range of postoperative observer score was (16-21). Postoperative Patient Assessment Score, the Range of total score postoperative patient was (19-26).

Table 6; showed that the Comparison between overall preoperative and postoperative POSAS scores. Evidently, there is marked improvement in the parameters of the score both individually. P-value are found to be highly significant in all of them (P<0.01).

Table (1): Demographic data of studied cases.

Item	**No.**	**%**	**Mean**	**SD**
Age				
(18 – 40)	**20**	**100.0%**	24.8	5.44
(40 – 60)	0	0.0%		
Sex				
Male	**16**	**80.0%**	–	–
Female	4	20.0%		
Clinical data	**Item**		**No. (%)**	
Cause of scar	**Post traumatic**		**17 (85%)**	
	Surgical		3 (15%)	
	Post burn		0 (0%)	
Duration	6-12 month		3 (15%)	
	More than 12 month		**17 (85%)**	
Site	**Forehead**		**8 (40%)**	
	Cheek		5 (25%)	
	Neck		2 (10%)	
	Combined		5 (25%)	
Length groups	**≤ 5 cm**		**13 (65%)**	
	5 - 10 cm		6 (30%)	

Item	No.	%	Mean	SD
	> 10 cm		1 (5%)	
Type of scar	**Atrophic**		**9 (45%)**	
	Broad		4 (20%)	
	Regular		3 (15%)	
	Irregular		4 (20%)	
Color of scar	Normal		7 (35%)	
	Hypopigmentation		**10 (50%)**	
	Hyperpigmentation		3 (15%)	

Table (2): Pre-operative Observer Assessment Score among the studied patients

Item		Total no. = 20
Total score was (22-28)		
Vascularity pre (Observer)	Mean ± SD	5.7 ± 0.57
	Median (IQR)	6 (5.5 – 6)
	Range	4 – 6
Pigmentation pre	Mean ± SD	5.2 ± 0.7
	Median (IQR)	5 (5 – 6)
	Range	4 – 6
Thickness pre score	Mean ± SD	5.9 ± 0.85
	Median (IQR)	6 (5 – 6)
	Range	5 – 8
Relief pre	Mean ± SD	1.65 ± 0.59
	Median (IQR)	2 (1 – 2)
	Range	1 – 3
Pliability pre	Mean ± SD	5.75 ± 0.79
	Median (IQR)	6 (5 – 6)
	Range	5 – 7
Total observer score pre	Mean ± SD	24.2 ± 1.4
	Median (IQR)	24 (23 – 25)
	Range	**22 – 28**
Total score was (27-37)		
Pain pre score (patient)	Mean ± SD	4.4 ± 1.1
	Median (IQR)	4 (3.5 – 5)
	Range	3 – 6
Itching pre	Mean ± SD	5.65 ± 0.81
	Median (IQR)	6 (5 – 6)
	Range	4 – 7
Color pre score	Mean ± SD	5.5 ± 1.05
	Median (IQR)	5.5 (5 – 6)
	Range	4 – 7
Thickness pre	Mean ± SD	5.7 ± 0.98
	Median (IQR)	6 (5 – 6.5)
	Range	4 – 7
Stiffness pre	Mean ± SD	5.85 ± 0.81
	Median (IQR)	6 (5 – 6.5)
	Range	5 – 7
Irregularities pre	Mean ± SD	6 ± 0.86
	Median (IQR)	6 (5 – 7)
	Range	5 – 7
Total score pre	Mean ± SD	33.1 ± 2.43
	Median (IQR)	33.5 (31.5 – 35)
	Range	**27 – 37**

Table (3): Surgery related, Nanofat harvesting and processing data of the studied patients

		Total no.= 20
Surgery related		
Type of anesthesia	**General**	**14 (70%)**
	local + sedation	6 (30%)
Type of surgery	**Nanofat alone**	**17 (85%)**
	Linear scar revision	1 (5%)
	w – plasty	1 (5%)
	z-plasty	1 (5%)
Time of surgery groups (min)	**30 - 60 min**	**17 (85%)**
	60 - 90 min	1 (5%)
	90 - 120 min	2 (10%)
Nanofat harvesting and processing data		
Site of harvested fat	**Abdomen**	**15 (75%)**
	Inner thigh	4 (20%)
	Buttocks	1 (5%)
Amount of harvested fat (cc)	≤ 60 CC	5 (25%)
	60 - 100 CC	7 (35%)
	>100 CC	**8 (40%)**
Amount of nanofat obtained	**≤ 5 ml**	**14 (70%)**
	5 - 10 ml	5 (25%)
	> 10 ml	1 (5%)

Table (4): Postoperative complications of the studied intervention

		Total no.= 20
Scar site complications	No complication	11 (55%)
	Hematoma	**5 (25%)**
	Seroma	3 (15%)
	Wound infection	1 (5%)
	Wound adhesion	0 (0%)
	Oil cyst form	0 (0%)
Fat donor site complications	No complication	12 (60%)
	Seroma	**5 (25%)**
	Skin sloughing	2 (10%)
	Hematoma	1 (5%)
	Skin irregularity	0 (0%)
	Wound infection	0 (0%)

Table (5): Postoperative Observer and Patient assessment Score among the studied patients

Observer Assessment Score		**Total no.= 20**
Vascularity post (Observer)	Mean ± SD	4.5 ± 0.61
	Median (IQR)	5 (4 - 5)
	Range	3 – 5
Pigmentation post	Mean ± SD	3.75 ± 0.44
	Median (IQR)	4 (3.5 - 4)
	Range	3 – 4
Thickness post	Mean ± SD	4.5 ± 1.1
	Median (IQR)	4 (4 - 5)
	Range	3 – 7
Relief post	Mean ± SD	1.3 ± 0.47
	Median (IQR)	1 (1 - 2)
	Range	1 – 2
Pliability post	Mean ± SD	4.3 ± 0.86
	Median (IQR)	4 (4 - 5)
	Range	3 – 6
Total score post	Mean ± SD	18.35 ± 1.31
	Median (IQR)	18.5 (17.5 - 19)
	Range	**16 – 21**
Patient Assessment Score		
Pain Post (patient)	Mean ± SD	2.75 ± 0.72
	Median (IQR)	3 (2 - 3)
	Range	1 – 4
Itching post (p)	Mean ± SD	4.15 ± 0.88
	Median (IQR)	4 (3 - 5)
	Range	3 – 5
Color post	Mean ± SD	4.2 ± 0.89
	Median (IQR)	4 (4 - 5)
	Range	3 – 6
Thickness post (p)	Mean ± SD	3.8 ± 0.95
	Median (IQR)	3.5 (3 - 4.5)
	Range	3 – 6
Stiffness post (p)	Mean ± SD	3.2 ± 0.62
	Median (IQR)	3 (3 - 4)
	Range	2 – 4
Irregularities post (p)	Mean ± SD	4.45 ± 0.69
	Median (IQR)	4 (4 - 5)
	Range	3 – 6
Total score post	Mean ± SD	22.55 ± 2.11
	Median (IQR)	23 (20.5 - 24)
	Range	**19 – 26**

Table (6): Comparison between overall preoperative and postoperative POSAS scores

Item		Pre	Post	Test value	P-value	Sig.
POSAS	Mean ± SD	57.3 ± 2.79	40.9 ± 2.79	-3.933≠	<0.01	HS
	Median (IQR)	57 (56 - 59)	41.5 (38 - 43)			
	Range	53 - 64	36 – 46			

P-value > 0.05: Non-significant; P-value < 0.05: Significant; P-value < 0.01: Highly significant
≠: Wilcoxon Signed Ranks test

DISCUSSION

Eighty percent of the patients in this study were men, and their average age ranged from eighteen to forty years. In our investigation, every treated scar was mature (more than 12 months). Studies such as **Tonnard et al., [8]** included mixed-gender populations, often with a higher proportion of females due to cosmetic concerns. However, younger patients, regardless of gender, have shown better outcomes due to enhanced tissue regeneration, aligning with the observed results.

Adly et al. examined the effectiveness of treating depressed scars in 40 individuals who had subcutaneous abnormalities brought on by depressed scars; the forehead was the injection site. For 40% of patients, the injection location was the face. In half of the instances, the age ranged from 12 to 31 years, with a mean age of 21.8±5.1 years. In the investigation of **Adly et al. [9]** showed study sample consisted of 12 (30.0%) males and 28 (70.0%) females.

Nanofat's regenerative capacity, primarily through vascular endothelial growth factor (VEGF), enhances neovascularization and extracellular matrix remodeling**[10]**. which likely contributed to the improvements observed in this study. Similarly, **Del Papa et al. [11]** reported that post-traumatic and surgical scars respond well to nanofat treatment, largely due to the vascular and structural damage these scars often exhibit. In the current study, we revealed that the clinical data related to scars of patients of the study were most common cause of scars in this study was post traumatic (17 patients (85%)),2nd cause Surgical (3patients (15%)), this may be explained by high frequency of males exposure to trauma than females.

In this study, sites of scars was in the cheek, neck or combind and the most common site was the forehead (8 patients (40%)). Length of scars was 5-10cm ,more than 10cm and the most common was ≤5cm. Types of scars was broad scars, regular scars, irregular scars and most common type of scar was (Atrophic). Color of scars was normal scars, hyperpigmentation and most common color of scar was hypopigmentation (10 patients(50%)). In agreement with this study, **Maione et al. [12]** also found hypopigmentation to be the most common discoloration in post-traumatic scars, reflecting similar challenges in pigmentation restoration.

In the current study, the mean of pre operative observer assessment total score was (24.2±1.4) and the mean of pre operative patient assessment total score was (33.1±2.43). High preoperative scores in pigmentation (5.2 ± 0.7), thickness (5.9 ± 0.85), and stiffness (5.85 ± 0.81) indicate significant baseline severity. **Gentile et al. [13]** reported comparable baseline scores in their patient cohort, highlighting severe pigmentation(8.2) and thickness issues. Their study noted similar preoperative vascularity scores of around (5.8), aligning with this study's findings.

In the study made by **Yosra et al. [14],** the nanofat grafting group included 10 cases, they received two grafting sessions with 3-6 months interval. The Mean of pre operative observer assessment total score was(32.20±5.53) and the mean of pre operative patient assessment total

score was (43.10±8.99), **Yosra** study had low score because it was included 10 cases.

In the current study, the most common type of anesthesia was general anesthesia (14 patients (70%)), General anesthesia helped to taken time for harvesting fats and good preparation for nanofat and Local anesthesia with sedation in(6 patients(30%)) , Most common type of surgery was (Nanofat alone (17 patients (85%)) and the most time of surgery was (30-60min, 17patients (85%)). Patient had nanofat alone taken time (30-60min)). Linear scar revision was done in (1 patient (5%)) under general anesthesia. Also, W- Plasty and Z-Plasty was done in equally (1 patient (5%)) for both technique under general anesthesia , this mean why preferred general anesthesia in most common type of surgery.

In the study made by **Nabil et al. [15]** In their study, all 20 patients (100%) were female. Several anesthetic techniques were employed, including sedation (25%), local infiltration (30%), local creams and local infiltration combination (30%), and local creams just (15%). The only kind of surgery was an injection of nanofat.

The study of **Gentile et al. [13]** who highlighted the abdomen as an ideal donor site due to its high fat content and accessibility. The processing method yielded small volumes of nanofat (≤5 ml in 70% of cases), consistent with protocols reported in previous studies.

In this study, the inner thigh of 4 patients (20%), the abdomen of 15 patients (75%) and the buttocks 1 patient (5%) were the primary sites for fat harvesting. Most common amount of harvested fat was (>100 cc, 8 patients (40%)) and the most amount of nanofat obtained was (≤ 5 ml, 14 patients (70%)). This choice aligns with findings from **Amr et al. [16],** the lower abdomen and thighs were noted as potential donor areas as these sites are richer in SVF, and ADSCs. The most site of harvested fat was Lower abdomen (18 patients, (69.2%)) and inner thigh (8 patients, (30.8%)) and amount of fat injection range was (15-80cc).

Some complications can occur in the scar site or fat donor site in this producers like hematoma, seroma, wound infections or adhesion, oil cyst form, skin irregularity and skin sloughing**[17]**. In the study made by **Amr et al. [16]** complications include moderate infection (8%) and minor hematoma (3.8%); and persistent edema lasting longer than three weeks (11.54%). All complications were resolved by medical treatments only. Notably, in our work there were no severe complications such as infection or fat necrosis in this study, further validating the procedure's safety. Although, In this most common scar site complication was (Seroma, 3 patients (15%)) and most donor site complication was (Seroma, 5 patient (25%)). Patients who had seroma , Aspiration done under local anesthesia and this was enough to resolve it .

After a fat transplant, complications like infection, cysts, and skin calcification might occasionally arise. Following a fat transplant, the majority of these issues are brought on by the widespread necrosis of fat cells **Mineda et al. [18]**, By making improvements to the technology used to inject the recipient area, these difficulties can be substantially avoided. Perhaps as a result of the tiny injection volume and the fine injection of nanofat, none of these issues were seen in our investigation.

This study showed that there was a positive correlation between both patients and observers assessments .This appears in the non-significant values of P-value in all items of the score + in the total score. **Tonnard et al. [8]**, described a similar agreement in their study, attributing it to the visible and tangible improvements in scar pliability and thickness after nanofat application.

In this study, Mean value of total postoperative observer assessment score (POSAS) was (18.35±1.31). Evidently, there is marked improvement in the parameters of the score pre and post observer score (POSAS) individually + in the final total score. P-value are found to be highly significant in all of them (P<0.01). Mean value of total postoperative patient assessment score (POSAS) was (22.5±2.11), there is marked improvement in the parameters of the score pre and post patient score individually + in the final total score. P-value

are found to be highly significant in all of them (P<0.01). These results align with **Tonnard et al. [8]**, who reported similar enhancements in scar quality within six months of nanofat treatment. Improvements in pliability and pigmentation may be attributed to the regenerative effects of stromal vascular fraction (SVF), which promotes collagen remodeling and melanin regulation.

Yosra et al. [14], In reference to the POSAS observer scale, The average postoperative observer scale score for the nanofat grafting group was 17.20±6.87. The group's mean values for vascularization, pigmentation, thickness, alleviation, and pliability were statistically higher before than after therapy. Prior to and during management, the mean value of the nanofat grafting group's overall POSAS observer scale score was statistically higher (p=0.000), indicating improvement. Overall postoperative patient assessment scores for the nanofat grafting group had a mean of 20.30±6.01, and the group's mean score improvement was statistically significant in terms of pain, itching, color, stiffness, thickness, and irregularity scores before and after management. Our findings were in good agreement with the statistically significant improvement in the mean value of the whole POSAS patient scale score among the nanofat grafting group before and after care (p=0.000).

The preoperative POSAS score in this study had an overall mean value of 57.3±2.79. The lowest value was 54, the highest was 63. The mean value of the postoperative POSAS score was 40.9±2.79. The score's parameters have been improved, with the maximum value being 60 and the minimum being 45. All of them have highly significant P-values (P<0.01).

Similarly reported in study by **Moshira et al. [19]**, which included 46 patients with hypertrophic post burn scars, 2 groups, Group A : Hypertrophic scars managed with fat injection, Group B : Hypertrophic scars managed with silicon sheets. In Group A the preoperative POSAS score mean value was (68.13±5.30), Maximum value was 76 and minimum value was 55. The post-operative POSAS score mean value in Group A was(45.65 ±4.27). Maximum value was 78 and minimum value was 59. The mean difference in Group A was (22.48±4.26). There was statistically significant change (P value < 0.001). Although this study was done on hypertrophic scars, which difference from our work, its outcome goes will with our work.

The comparison between preoperative and postoperative scores highlights the efficacy of nanofat injections. The total POSAS scores improved significantly from 57.3 to 40.9, representing a marked enhancement in scar quality. **Li et al., [20]** reported comparable improvements, with sustained benefits observed up to 12 months postoperative. The significant reduction in stiffness and irregularities further underscores the effectiveness of nanofat in scar remodeling.

Conclusions

The clinical results demonstrated a significant improvement in skin texture and the overall appearance of the scars following treatment with this technique. The findings suggest that Nanofat injection, with its enhances neovascularization and extracellular matrix remodeling, can be an effective and safe treatment for reducing the appearance of old scars and enhancing their aesthetic quality.

Based on these results, it is recommended to consider Nanofat injections as an innovative and effective treatment option for old facial scars, minimal complications with consultation from specialized practitioners to determine the most appropriate approach for each individual case.

This technique appears to be a promising alternative to traditional methods for addressing old facial scars. Future research should focus on larger, long-term studies to evaluate the sustained effects and to refine the best usage protocols and integrated techniques for maximizing the benefits of this treatment**.**

Conflict of interest:

The authors declare no conflict of interest.

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