

ORIGINAL RESEARCH

Nano Fat Injection for Rejuvenation of Scars: A Prospective Observational Study

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ABSTRACT

Background: Scar revision continues to be a challenge to any practicing cosmetic surgeon. Rejuvenation of existing scar without revision surgery reduces the psychological stress of the patient as well as the clinician. Nano fat grafting for scar rejuvenation has gained increasing popularity because of its relative safety and has become an increasingly popular alternative to dermal fillers due to its biocompatibility. The aim of this study is to determine the aesthetic outcome of nanofat injections in scars using a standardized and validated Patients Observer scar Assessment Scale (POSAS) and photographs.

Material & Methods: This was a prospective observational study done on 50 patients who came in general surgery outpatient department with scars demanding scar revision in J.L.N. Medical College & Hospital, Ajmer, a tertiary care centre in Rajasthan, India during a period of two year from January 2020 to December 2021. Pre-operative POSAS observer scale scoring was done by the principal investigator and the patient scale scoring was done by patient under investigator's supervision. Photographic documentation was also done for all cases.

Results: Our study showed that the mean age of all the patients which was calculated to be 43.88 ± 9.55 years. Most of the patients, i.e., 76% it had hypertrophic scar where is 14 % had flat type of scar and 10% of all the patients had atrophic type of scar. In this study it was found that 68% of patients at the scar for less than 5 years and 32% of patients had the scar for more than 5 years. Preoperatively, mean score in all the questions ranged between 5.24 and 6.02 with the mean total score being 39.56 ± 3.45 , whereas, mean score in all the questions postoperatively ranged between 3.5 and 4.74.

Conclusion: After undergoing the extensive research, collecting the data for the study purpose, analyzing the data, we could safely conclude that the nanofat injection was useful for the scar treatment.

Keywords: Nanofat injection, Scar revision, POSAS, Rejuvenation.

INTRODUCTION

Nano fat injection has gained popularity in the field of treatment of scars in order to retain its cosmetic appeal following tissue reconstruction and augmentation. Its regenerative properties and beneficial effects with respect to skin texture have been observed in several studies.^{1,2}

Nano fat grafting, or microfat grafting, is a fat transfer procedure that uses a very thin injection cannula to smooth out wrinkles and improve skin quality. Scarring is an appalling and irksome result following injuries due to various causes.³ Scar is a fibrous tissue that appears at the place of normal tissue following wounds, injuries, and some diseases. Hyperpigmentation, skin texture, and scar quality may equally play an important role in determining a suitable treatment and resulting outcome.⁴

Currently, the traditional scar correctional procedure has been surgical excision, which often results in the enlargement of the scar length and residual or recurring hypertrophy or redness. So there has been a constant quest for alternate procedures for the management of scarring preserving as much cosmetic appearance as possible. It can be understood that, disfiguring scars in the exposed parts of the body create a psychological trauma and social embarrassment to the sufferer. Though, they are benign in nature, they are able to cause major aesthetic, functional, and social problems.⁵ Scar revision continues to be a challenge to any practicing cosmetic surgeon. Rejuvenation of existing scar without revision surgery reduces the psychological stress of the patient as well as the clinician. Nano fat grafting for scar rejuvenation has gained increasing popularity because of its relative safety and has become an increasingly popular alternative to dermal fillers due to its biocompatibility.

Nano fat grafting has many benefits over the conventional dermal fillers which are being widely employed as it adds volume to the cheeks and midface, helps skin look and feel firmer & tighter, lessens the appearance of scars to name a few and many others. In fact, nano fat grafting can often provide better results than fillers, with patients reporting additional benefits including improved overall skin quality and lightening of skin discolorations. Moreover, a wide spectrum of patients are eligible for this procedure as its post-operative complications to this are extremely rare. The pre-requisites one can list are good health of a patient and the patient being a non-smoker, or willing to give up.

The advantage of nanofat for scar treatment is that it introduces regenerative properties and does not create new scars. Furthermore, the risk of abnormal healing is low as no new surgical intervention is applied to the skin. Another advantage is that it can be easily combined with traditional fat grafting. In this way, quality of skin improvement can prevent or improve cases where severe retractile scarring is prevalent, for example in breast implantation. It can also make cicatricial tissues suitable to accept prosthesis and expanders. It is also seen that reddened and slightly elevated scars and discolorations benefit the most from nanofat. As nanofat causes tissue regeneration and improves skin quality it can also increase dermal elasticity, and therefore the elasticity of deep wrinkles. His study had shown remarkable effects in skin rejuvenation after nanofat injection. Clinical study of the use of nanofat in scar rejuvenation and its objective assessment for improvement using standard validated tool has not been reported in the literature.

MATERIAL & METHODS

This was a prospective observational study done on 50 patients who came in general surgery outpatient department with scars demanding scar revision in J.L.N. Medical College & Hospital, Ajmer, a tertiary care centre in Rajasthan, India during a period of two year from January 2020 to December 2021. Informed written consent was obtained from all the patients.

INCLUSION CRITERIA

All patients with scars of varied aetiology like post traumatic, post burn, post inflammatory and types like hypertrophic, flat, atrophic between 14-65 years of age, if they did not fall in exclusion criteria.

EXCLUSION CRITERIA

- Unstable scars
- Malignancies
- Contractures

METHODS

Pre-operative POSAS observer scale⁶ scoring was done by the principal investigator and the patient scale scoring was done by patient under investigator's supervision. Photographic documentation was also done for all cases.

The observer Scale of POSAS has six scar parameters –

1. Vascularity,
2. Pigmentation,
3. Thickness,
4. Relief,
5. Pliability
6. Surface area.

Each parameter was scored from 1 to 10. Score 1 was given when the scar matches that of normal skin. Score 10 was given for worst scar imaginable. The total minimum score on observer scale was 6, and maximum score was 60.

The POSAS is a comprehensive scale that was designed for the evaluation of all types of scars, and it has the advantage that it evaluates the scar in the patient and observers perspective.⁷

The patient scale gives the POSAS an important extra dimension because the patient's opinion is mandatory for a complete scar assessment. The internal consistency; of both the patient and observer scale; as shown by Cronbach's alpha is 0.86 and 0.90, respectively.⁷ The observer scale was scored by the principal investigator itself in all the cases.

The observer scar matches that of normal skin. Score 10 was given for the worst scar imaginable. The total minimum score on observer scale was 6, and the maximum score was 60.

The patient scale on POSAS also has six parameters –

1. Pain
2. Itching
3. Colour
4. Thickness
5. Stiffness
6. Irregularity

Each parameter was scored from 1 to 10. Score 1 was given if there were no symptoms and matches the normal skin and score 10 for worst symptoms. The patient scale will be filled by the patient under the supervision of the principal investigator. The total minimum score of the patient scale was 6, and the maximum score was 60.

The aesthetic outcome will be evaluated based on the total patient score and total observer score on the POSAS scale.

The total score of 6–24 was categorized as a good outcome, while a score of 25–60 was taken as a bad outcome. Duration of the scar will be categorized as; long duration (>5 years) and short duration (<5 years).

SURGICAL TECHNIQUE

The procedure was done under tumescent anesthesia with aseptic precautions. The fat was aspirated from the lower abdominal wall in all cases using 3 mm mirrored triport Colemans cannula and 10cc Leur Lock syringe by syringe liposuction technique [Figure 1a]. The

aspirated fat was kept undisturbed for 10–15 min in the vertical position in a 200 ml sterile steel tumbler after capping it with hypodermic needle to avoid leakage [Figure 1b]. The tumescent fluid separating from the aspirate was discarded. The supernatant fat was emulsified to a milky white emulsion by multiple passes (30–35 passes) using two 10cc Leur Lock syringes connected with a 3-way connector [Figure 1c]. The emulsion was further sieved using a two-layered moist saline surgical gauze to remove all solid elements and to ensure free flow through a 1 inch, 27G needle. This was injected intralesionally into the scar using insulin syringe and 1 inch, 27G needles [Figure 1d]. Yellowish blanching of the scar marked the end point of injection [Figure 1e]. Post-operatively, the scar was reassessed at 3 months using the POSAS Scale and photographs.

STATISTICAL ANALYSIS

Discrete data will be expressed in the outline of frequencies and percentages. Continuous data will be expressed in terms of 'Mean +/- Standard Deviation'. 'Chi Square Test' will be used to analysis the statistical significance of data for the discrete data. Whereas 'Student t-test' will be used to analyse the continuous data. Statistical significance is at the level of 0.05 for the practical purpose. SPSS version 21 will be used for the purpose of the statistical analysis.



Fig. 1a: Syringe liposuction technique



Fig. 1b: Tumbler after capping it with hypodermic needle



Fig 1C: Emulsification by two 10cc Leur Lock



Fig. 1d: Emulsified fat injected intralesionally syringes connected with a 3-way connector



Fig. 1e: Yellowish blanching marks the end point of intralesional injection

RESULTS

Our study showed that the mean age of all the patients which was calculated to be 43.88 ± 9.55 years. Highest number of patients, i.e., 48% belonged to the age group of 41 to 50 years, followed by the age group of 31 to 40 years with 20% of all the patients. 24% of the patients were male and 76% were female (table 1).

Table 1: Distribution of patients on the basis of their demographic profile

Demographic profile	Number of patients (n=50)	Percentage
Age group (yrs)		
<20 years	1	2%
21-30 years	5	10%
31-40 years	10	20%
41-50 years	24	48%
51-60 years	8	16%
>61 years	2	4%
Mean±SD	43.88 ± 9.55	
Gender		
Male	12	24%
Female	38	76%

It was found that 36% of all the patients had scar post elective surgeries while 26% of the patients developed the scar as a consequence of any trauma while 20% of the patients had the scar that was due to Caesarean section procedure. Most of the patients, i.e., 76% it had hypertrophic scar where is 14 % had flat type of scar and 10% of all the patients had atrophic type of scar. In this study it was found that 68% of patients at the scar for less than 5 years and 32% of patients had the scar for more than 5 years. The difference between the

proportion of patients in the two categories was found to be statistically significant (p value<0.05) (table 2).

Table 2: Distribution of patients according to scar characteristics

Scar characteristics	Number of patients	Percentage
ETIOLOGY OF SCAR		
Post caesarean	10	20%
Emergency surgical scar	13	26%
Elective surgical scar	18	36%
Others	9	18%
TYPE OF SCAR		
Hypertrophic	38	76%
Flat	7	14%
Atrophic	5	10%
DURATION OF SCAR		
<5 years	34	68%
>5 years	16	32%

Preoperatively, mean score in all the questions ranged between 5.24 and 6.02 with the mean total score being 39.56 ± 3.45 , whereas mean score in all the questions postoperatively ranged between 3.5 and 4.74. Moreover, the mean of total score was 22.18 ± 11.35 , which is statistically significantly lower than that calculated before surgery (table 3).

Table 3: Mean values in the questionnaire in POSAS Patients scale scores

Questions	Pre-operative	Post-operative	P value
Has the scar been painful the past few weeks	6 ± 1.00	4.74 ± 1.48	<0.001*
Has the scar been itching the past few weeks?	6.02 ± 0.04	3.42 ± 1.28	<0.001*
Is the scar colour different from the colour of your normal skin?	5.24 ± 0.98	3.5 ± 1.4	<0.001*
Is the stiffness of the scar different from your normal skin at present?	5.32 ± 1.06	3.5 ± 1.23	<0.001*
Is the thickness of the scar different from your normal skin at present?	5.36 ± 1.10	3.56 ± 1.46	<0.001*
Is the scar more irregular than your normal skin at present?	5.78 ± 1.18	3.74 ± 1.32	<0.001*
What is your overall opinion of the scar compared to normal skin?	5.62 ± 1.40	4.12 ± 1.55	<0.001*
Total	39.56 ± 3.45	22.18 ± 11.35	<0.001*

Table 4 represent the mean values of scores in all the fifty patients in the POSAS observer scale. Pre-operatively the mean score in all the scar parameters ranged between 5.36 and 6.04. Moreover, the mean of total score was 33.88 ± 2.58 . Whereas, post surgery, the mean POSAS score in all the scar parameters ranged between 3.4 and 4.14 and the mean of total score was 22.22 ± 3.45 .

Table 4: Mean values of Scar parameters on POSAS Observer Scale

Scar parameters	Pre-operative	Post-operative	P-value
Vascularity	5.54 ± 1.01	3.66 ± 1.04	<0.001*
Pigmentation	5.36 ± 0.80	3.4 ± 0.86	<0.001*
Thickness	6.04 ± 1.16	4.14 ± 1.24	<0.001*
Relief	5.8 ± 1.11	3.82 ± 1.14	<0.001*

Pliability	5.56±0.97	3.72±0.99	<0.001*
Surface area	5.58±0.88	3.48±0.93	<0.001*
Total score	33.88±2.58	22.22±3.45	<0.001*

DISCUSSION

Scar revision continues to be a challenge to any practicing cosmetic surgeon. Rejuvenation of existing scar without revision surgery reduces the psychological stress of the patient as well as the clinician. Nano fat grafting for scar rejuvenation has gained increasing popularity because of its relative safety and has become an increasingly popular alternative to dermal fillers due to its biocompatibility. The current study was compared with multiple published articles for the discussion purpose, such as Van der wal MB et al⁸ which published the results in a data set of 1,629 observer scores and 1,427 patient scores of burn scars, Chae JK et al⁹ diagnosed with facial cutaneous malignancy and transplanted skin after Mohs micrographic surgery in 23 patients, Rageh M et al³ with post-traumatic scars in 19 patients, Uyulmaz et al⁴ published their results in 52 patients.

The mean age in the current study was approximately 44 years. Similar to ours, in the study by Uyulmaz et al⁴, the age of the patients ranged from 15 to 64 years with a mean of 42 years. Whereas the age range was not congruent with that in the current study in the study done by Rageh Met al³ (19 -40 years, mean as 30.5 yrs) and Chae JK et al⁹ (33~86 years, median age as 71 yrs).

UyulmazS et al⁴ documented the average age of scars ranging from 15 months to 40 years with a mean of 5.8 years, whereas Rageh M et al³ documented the duration of scars ranging from 2 to 11 years with a mean of 4.53 years.

In the current study, the distribution of patients was also done based on the outcome of the surgery which was estimated according to the sum of POSAS score in all the 7 questions. In our study it was found that 78% of all the patients that had undergone the surgery had the POSAS score of 6 to 24 which indicated good outcome, whereas the rest 22% of patients had the POSAS score of 25 to 60 which indicated bad outcome and the difference between the proportion of patients in the two categories was statistically significant. Moreover, the mean score in all the questions ranged between 3.5 and 4.74. As well as the mean of total score was 22.18 ± 11.35 which was statistically significantly lower than that calculated before surgery (which was 39.56 ± 3.45). Similar to the results of the current study, Uyulmaz et al⁴ classified the results in the majority of scars post-treatment as good (74%). The results in 18% of the treated scars were rated as satisfactory and only 8% of all treated scars were rated as unchanged post-treatment.

Furthermore, discolorations post-treatment and wrinkles post-treatment were good in 60% and 34% of patients respectively. Our results were little different from that of Chae JK et al⁹ where the mean total score using the VSS for facial skin graft scar was 3.4 ± 1.8 . The mean total score using the observer component of POSAS for facial skin graft scar was 15.8 ± 7.0 and that using the patient component of POSAS was 18.4 ± 10.3 . The difference in the results could be attributed to the low sample size of only 23 in his study.

In the current study, the POSAS score on the Observer scale for the vascularity was between 4 and 6 for most of the patients, i.e., 56%, followed by the POSAS score of 1 to 3 with 44% of patients. None of the patients had the POSAS score of more than 6. Also, the current study shows that the POSAS score on the Observer scale for the pigmentation was between 1 and 3 for 52% of the patients while 48 % patients had the score between 4 and 6. None of the patients had the POSAS score of more than 6. In the study done by Chae JK et al⁹ on the other hand when measuring scar colour using spectrophotometer, there was no significant difference between the scar and normal skin.

CONCLUSION

After undergoing the extensive research, collecting the data for the study purpose, analyzing the data, we could safely conclude that the nanofat injection was useful for the scar treatment.

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