ORIGINAL ARTICLE

ROLE OF AUTOLOGOUS NANOFAT GRAFTING IN THE TREATMENT OF POST ACNE AND POST BURN SCARRING OF THE FACE

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Background: Post acne and post burn facial scarring are more common in young generation leading to disfigurement and unpleasing result. These scars have major aesthetic, functional, and social effects on the affected person. Aim of the study was to establish the role of Autologous Nanofat grafting in treating post acne & post burn facial scarring in terms of pleasing aesthetic appearance of face & patient satisfaction. **Methods:** A total no. of 24 patients with mean age of 23 years was enrolled in the study. Thirteen patients were of post acne face scarring and 11 patients were suffering from post-burn face scarring. There were 10 male and 14 female patients. All patients were treated with Nanofat grafting with an average of 3 sessions at an interval of 4–6 weeks. The results were assessed after 6 months from the last session by comparison of pre procedure & post procedure pictures and patient satisfaction. **Results:** Scars started improving after first session of Nanofat grafting and significant improvement in the scars was noted after 3rd session in terms of pigmentation, scar thickness and softness. Overall appearances of the scar were aesthetically improved a lot with a higher patient satisfaction rate. **Conclusion:** Autologous Nanofat grafting is a potential effective treatment modality for post-acne and post burn facial scarring with a good aesthetic outcome and higher patient satisfaction rate.

Keywords: Nano fat; Fat grafting; Scars; Stem cell

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INTRODUCTION

Scar formation is a natural process that occurs following any injury to the skin. Post acne and post burn facial scarring are more common in young generation leading to disfigurement and unpleasing result. These scars have major aesthetic, functional, and social effects on the affected person.[1] Multiple treatment options are there in treating these troublesome facial scarring. These different modalities include intralesional injections of corticosteroids, silicone sheets, laser & radiotherapy and surgical excision. However, these procedures vary in efficiency and have certain limitations such as high recurrence rates, color changes, cutaneous atrophy, and pain.[2] Finding a suitable scar treatment with good aesthetic outcome and patient satisfaction remains a challenge for most of the time.[3]

Autologous fat grafting is a new modality in managing post acne and post burn face scarring. This method was initially exercised by Neuber in 1893 and refined later by Coleman[4, 5]. Fat contains adipose tissue- derived stem cells (ADSCs) that has got tissue regeneration capacity as well as tissue filling effect.[6,7] There are many reports of improvement in the quality of scars in terms of texture, contour & color after use of fat grafts.[6] In 2013, Tonnard was the first person who described the technique of obtaining nano fat by emulsification and filtration of fat.[8]

Aim of the study was to establish the role of Autologous Nanofat grafting in treating post acne & post burn facial scarring in terms of pleasing aesthetic appearance of face & patient satisfaction. It was a prospective case series conducted from March 2022 to Feb 2023 at the Department of Plastic Surgery & Burns, Ayub Teaching Hospital, Abbottabad where all patients with post acne and post burn face scarring were presented. Informed written consents were taken from all the participants after explaining the nature of the study to them.

All patients with post-burn face & post acne face scars age ranging from 18–50 years both males & females were included. Age <18 or >50 years, recent scar injuries (<6 months), recent treatment of scars within the last 4–6 months, any bleeding disorders, scars hypertrophy & Keloid scars were excluded from study.

We followed Coleman's original technique of harvesting the autologous fat. Tumescent anaesthesia was used by using the Klein's solution. Then the fat (mostly from the abdomen) was harvested by using a 6-hole blunt tipped liposuction 1.5mm bore cannula via negative suction method attached to 10 ml syringe. The harvested fat was then centrifuged in

centrifuge machine at 3000 rpm for 3 minutes to separate it from remnants of tumescent anaesthesia and blood. The fat was then emulsified mechanically by passing it 30 times using 1 mm connector mounted between two 3 ml syringes. In the last, the Nanofat was obtained by passing the emulsified fat through 400 µm filter barrier. Then using strict aseptic conditions, intradermal Nanofat injections were performed using 25G injecting cannula. Follow up was done one week after the procedure and then after 6 months. All patients were treated with Nano fat grafting with an average of 3 sessions at an interval of 4–6 weeks. The results were assessed after 6 months from the last session by comparison of pre procedure & post procedure pictures and patient satisfaction using patient satisfaction rate *proforma.*

Quality of the scar was recorded and photograph taken at every follow up visit. Patient satisfaction rate was performed by the primary surgeon and the patient itself using satisfaction proforma on their last follow up visit. Each patient was asked if he or she was satisfied with the result or not. Patients answer was recorded as either a yes or no on the proforma. The pre procedure and post procedure photographs were evaluated by the primary physicians to know the improvement of skin appearance. In order to evaluate the results, a visual three-grade scale was used. Score 1: good result; Score 2: satisfactory result; Score 3: no change.

RESULTS

Total no. of 24 patients was enrolled in the study. Post acne face scarring were 13 cases (54.1%) and post burn face scarring were 11 cases (45.8%). There were 10 male (41.6%) and 14 female (58.3%) patients. The age ranged between 19–35 years (mean±SD = 23=22.05±6.41). The duration of scars ranged from 1 to 8 years (4.43±2.45). In 13 cases of post acne scars, 9 patients (69.2%) were affected in the cheeks, 3 patients (23.07%) were affected in temple and forehead areas and in 1 patient (7.6%), chin and neck areas were affected along with the cheeks. Similarly, out of 11 cases with post burn face scarring, 4 patients (36.3%) were affected in the forehead, 3 patients (27%) were affected in the cheeks, 3 patients (27%) were affected in the temple region and 1 patient (9.09%) was affected in the nose. The donor site of fat harvesting was abdomen in 20 patients (83.3%) followed by thighs in 4 patients (16.6%). Complications encountered during and after the procedure was mild pain in 8 patients (33.3%), bruise in 5 patients (20.8%) and oozing from the wound in 2 patients (8.3%) while 9 patients (37.5%) experienced no complications.

Results of all 24 patients were clinically evaluated in the clinic after 3 months and then at 6 months follow up period. Assessment of quality of scars was done clinically by reduction in scar hardness/ thickness, hyperpigmentation and softness of scar. In 13 cases of post acne face scarring, scars were softer and less visible in 8 patients (61.5%). In 5 cases (38.4%), there was reduction of hyperpigmentation in temporal and forehead area scars. Similarly, in 11 cases of post burn cases, there were 6 cases (54.5%) of softer scars and 4 cases (36.3%) of reduction in hyperpigmentation. An improvement of skin quality was observed at more than 3 months after the procedure. The results in the majority of scars were good (74%). The results in 20% of the treated scars were rated as satisfactory and only 6% of all treated scars were rated as unchanged. Post procedure results in discolorations and reduction of hyperpigmentation were rated as good (65%) and as satisfactory (35%) by the primary surgeon. Eighteen of our 24 patients (75%) were highly satisfied with their results while 6 patients (25%) were not satisfied. Our results are shown below in the following figures.

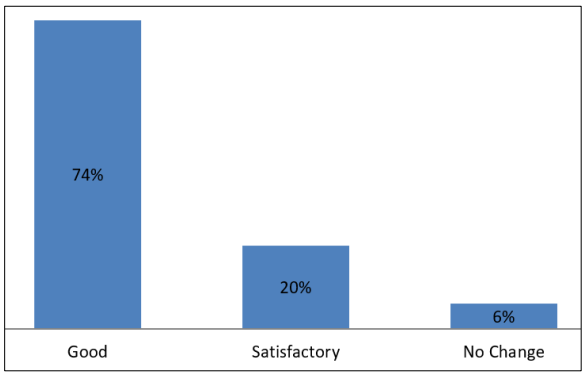

Figure-1: Evaluation of the surgical results (percentage).

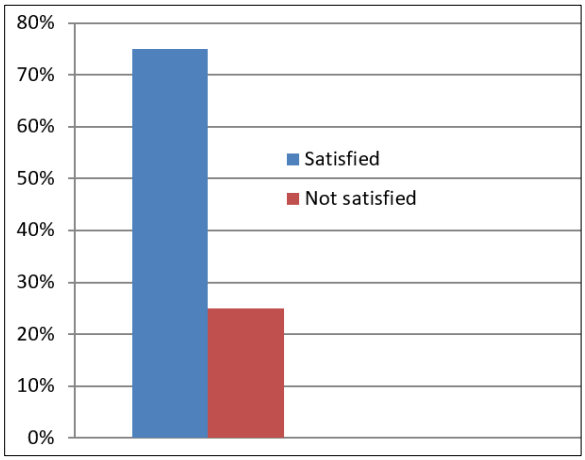

Figure-2: Patient satisfaction rate in percentages.

Figure-3: Post acne scarring more on the right cheek treated with 3 sessions of nano fat grafting.

Figure-4: Post burn hyper pigmented scarring in a young girl treatment result after 3 sessions with nano fat grafting.

Figure-5: Post acid homicidal right face in 30 years old treated with 3 sessions of nano fat grafting.

DISCUSSION

Fat grafting has got major role in the treatment of scars and is an effective new addition to the reconstructive ladder of scar treatment. The concept of nano fat as a new modality for scar treatment was first described by Tonnard *et al*. in 2013.[8] Nano fat is obtained after mechanical process of fat emulsification and filtration through small diameter cannula and filtration barrier. The Nano fat obtained so far by this method has got a rich source of adipose derived stem cells (ADSCs) and stromal vascular fraction (SVF).[8,9] These ADSCs are a major source of growth factors and induce formation of new blood vessels that causes reduction of inflammatory phase and fibrosis leading to accelerated healing of wound and improvement of skin quality.[8,9] ADSCs are just like seeds which have got the capacity to induce new growth and tissue regeneration.[9]

Most of the scars treated in our study were having a duration ranged from 1 to 8 years. It means that all these scars have reached to maturation after passing all steps of physiologic healing of wounds thus eliminating any possibility of physiological regeneration as an improvement of scars quality. Facial scarring after acne and burns are troublesome and causes social embarrassment especially in young and females forcing these patients to consult their physician for scar treatment. Fat have got the filling effect that help improve the depressed scars as well as helping in collagen and elastic tissue deposition through the abundant supply of ADSCs.[10]

Our study is similar to the study performed by Lee *et al*. who have found improved scar quality on scar assessment scale after using fat injection therapy in treating surgical scars.[11] In 2017, Jaspers *et al*. conducted a similar study of fat grafting role in scars and they have observed good improvement of scar quality after a 3-months follow up period by using Patient Observer Scar Assessment Scale (POSAS).[12] Pallua and Kim in 2020 performed a study on the outcome of autologous fat grafting for facial scarring.[13] They also used the POSAS and showed that scars were significantly improved in terms of pigmentation, color, pliability etc. Our results are also comparable to the study conducted by Bollero *et al*. in 2014 that used AFG for post traumatic, burn & surgical scars in their patients.[14] There were increased height of depressed scars and good improvement of texture of scar. In 2017, Riyat *et al*. did a systemic review on 1158 patients to assess efficacy of AFG in scar[15]. Scars were assessed in terms of pigmentation, height & thickness and functional restoration after fat grafting. All these parameters showed good outcome. These findings are also similar to our study. Similar studies on nano fat were done by Jan *et al*. and Gu *et al*. and both these studies have found marked reduction in hyperpigmentation of post burn and atrophic scarring of the face.[16,17] This effect of reducing the hyperpigmentation in scars is attributed to the inhibition of enzyme tyrosinase and melanin synthesis by nano fat as described by Kim *et al*.[18] There are multiple studies done in the past regarding role of fat grafting in treating scars and all of them have observed and documented that fat grafting have induced remodelling of collagen, formation of new blood vessels and rebuilding of new dermis. These findings are

comparable to our study.[19–21] Our study is contrary to the findings observed by Brown *et al*. in 2013 that did a comparative study between fat grafting and saline injection in treating scars.[22] Their study showed no statistical differences in terms of neogenesis, inflammation, and thickening of epidermis. Gal *et al*. conducted a similar study and they were of the opinion that a single session with AFG did not improve burn scars in paediatric population in comparison to normal saline injection.[9] Their results might be affected by the possibility that they have injected abnormal volume of fat injection. Their study has showed that multiple factors like aetiology of scar, location & duration of scar, age, and the heterogeneity of the scars can affect the results of AFG. It has been hypothesized that nano fat contains large quantity of ADSCs having the capability of inducing proliferation of epithelium and formation of new blood vessel.[7] These effects are mostly attributed to the release of multiple growth factors by ADSCs like vascular endothelial growth factor (VEGF), platelet-derived growth factor (PDGF), transforming growth factor beta (TGF-β) etc. These factors help in remodelling and modification of scar tissue via activating proliferation of endothelial cells, mesenchymal cells and fibroblasts.[23]

CONCLUSION

Autologous Nanofat grafting is a potential effective treatment modality for post-acne and post burn facial scarring with a good aesthetic outcome and higher patient satisfaction rate. Follow-up of patients on long term is needed to demonstrate effectively the long lasting effect of nano fat. With the above discussion, we believe that our study provides sufficient information on the role of autologous nano fat in post acne and post burn face scarring. As of now, there only limited data on the clinical results are available. In addition, further studies need to be done to characterize the underlying molecular mechanisms of scar improvement.

AUTHORS' CONTRIBUTION

FK: Concept, proofreading. MK, MS: Data collection, analysis, interpretation.

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