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Case Series

Regenerative touch: enhancing post-burn scar quality through autologous free fat grafting

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ABSTRACT

Post-burn scars lead to functional and cosmetic deformities. Conventional treatments have limited outcomes. Autologous fat grafting has emerged as a regenerative modality. A hospital-based prospective study was conducted on 17 patients with post-burn scars (>6 months). Fat grafting was performed using a modified Coleman technique. Scar assessment was done using POSAS scale at baseline, 1 month, and 3 months. Statistical analysis was done using repeated measures ANOVA. There was a statistically significant improvement in both subjective and objective POSAS scores ($p<0.001$). Maximum improvement was noted in itching, thickness and pliability. Histological analysis showed collagen remodelling, increased vascularity, and reduced fibrosis. Complications were minimal, mainly transient edema. Autologous fat grafting is a safe, effective, and minimally invasive technique for improving post-burn scar quality with significant clinical and histological benefits.

Keywords: Lipofilling, Burns, Cicatrix, Contracture, Fat grafting, Burn scars, POSAS, ADSC, Scar remodelling

INTRODUCTION

Burn injuries continue to represent a major global public health problem. According to the World Health Organization (WHO), burns account for approximately 180,000 deaths annually, with the majority occurring in low- and middle-income countries.[1] India contributes significantly to this burden, with an estimated 6-7 million new burn cases each year.[2] Advances in acute burn care and critical care management have improved survival, but a large number of patients are left with long-term sequelae, the most distressing of which are post-burn scars. Post-burn scars are characterized by contracture, hypertrophy, altered pigmentation, surface irregularity, and textural deformities. These not only cause functional impairment such as restricted joint mobility but also result in severe cosmetic disfigurement.[3] Survivors often experience stigmatization, social withdrawal, unemployment, and psychiatric morbidity including depression and post-traumatic stress disorder.[4,5] The psychosocial consequences underscore the WHO's definition of health as "a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity".[6] The disfigurement and loss of self-image associated with burn scars violate this principle of holistic health.

CASE SERIES

A hospital-based prospective interventional case series was conducted in the Department of Plastic Surgery at Government General Hospital (GGH), Guntur, from February 2023 to September 2025. The study evaluated the clinical and histopathological effects of autologous free fat grafting in patients with post-burn scars. A total of 17 patients fulfilling the inclusion criteria were

enrolled and followed up for a period of 3 months after intervention.

Table 1: Age wise distribution of the study population (n=17).

Age (years)	Frequency (N)	Percentage (%)
18-20	6	35.3
21-30	7	41.2
31-40	3	17.6
41- 50	1	5.9
51-60	0	0
61-65	0	0

Table 2: Gender wise distribution among study participants (n=17).

Gender	Frequency (N)	Percentage (%)
Male	3	18
Female	14	82

Table 3: Recipient site distribution among the study participants (n=17).

Recipient site	Frequency (N)	Percentage (%)
Face and neck	6	35.3
Face alone	7	41.2
Neck alone	1	5.9
Neck and forearm	1	5.9
Hand	1	5.9
Chest	2	11.8

Table 4: Distribution of amount of fat injected in fat grafting among study participants (n=17).

Average fat injected (ml)	Frequency (N)	Percentage (%)
30-50	6	35
50-70	7	41
70-90	3	18
90-100	1	6

All patients underwent autologous fat grafting using a modified Coleman technique. Fat was harvested under strict aseptic precautions, commonly from the abdomen or lateral thigh, processed by centrifugation, and injected into the scar tissue using microdroplet multilayered deposition. The procedure was performed under local or general anesthesia depending on the size and location of the scar. Patients were assessed preoperatively and at 1 month and 3 months postoperatively. Clinical assessment was carried out using the Patient and Observer Scar Assessment Scale (POSAS), which included both subjective and objective parameters. Serial clinical photographs were documented during each follow-up visit. Histopathological examination of scar tissue was also performed in selected cases to evaluate tissue remodeling following fat grafting. The study primarily aimed to evaluate improvements in scar quality, including vascularity, pigmentation, thickness, pliability, relief, surface irregularity, itching, and stiffness. Secondary objectives included assessing complications associated with the procedure and correlating histological changes with clinical outcomes.

Table 5: Distribution of complications in fat grafting among study participants (n=17).

Complications	Frequency (N)	Percentage (%)
Bruising	1	5.9
Sagginess	1	5.9
Clumping	0	0
Edema	10	58.8
Facial nerve weakness	0	0
None	5	29.4

Aims and objectives

To study the clinical and histo-pathological effects of autologous fat grafting in post burn scars before and after therapy.

Sample size

Sample size was calculated for a paired continuous outcome (change in POSAS score) with $\alpha=0.05$ and power=80%. A minimum clinically important difference of 1.0 point and a standard deviation of paired differences of 1.2 gave a required sample of 12 patients, which increased to 14-15 after allowing 15% attrition. To enhance reliability and compensate for unforeseen variability, we recruited 17 patients.

Data collection

All relevant details of patients, along with their photographs (preoperative, intraoperative, postoperative, and follow-up), were recorded and analyzed. Patients were assessed at preoperative baseline, as well as at 1 month and 3 months after treatment. Scar evaluation was performed using the POSAS scale (7-10), which includes five parameters: vascularization, thickness, relief, pliability, and pigmentation. Each item is scored from 1 ("like normal skin") to 10 ("worst scar imaginable"), with a total score ranging from 5 to 50. Photographs were taken at each follow-up visit to maintain proper documentation and for comparative analysis.

Subject selection

Inclusion criteria

Patients included in the study had post-burn scars older than 6 months and were between 18 and 65 years of age.

Exclusion criteria

Patients were excluded from the study if they were unwilling to participate, had an infection at the scar site, or were suffering from active psychiatric illness. Additional exclusion criteria included patients with unrealistic expectations, a history of the cancer diagnosis within the past 5 years, and those with bleeding diathesis and/or an INR greater than 2.2. Patients receiving differential site treatments such as steroid injections, pressure garments, or silicone sheeting were also excluded. Furthermore, individuals with a positive pregnancy test, as well as active smokers and alcoholics, were not included in the study.

Table 6: Subjective POSAS scores among study participants (n=17).

POSAS score	Pre op	1 month	3 months
Pain	0	0	0
Itching	9.41±1.27	6.41±1.17	4.23±1.25
Colour	9.47±1.32	6.23±1.34	3.76±1.20
Stiffness	9.64±0.99	6.94±2.70	3.76±1.09
Thickness	9.41±1.22	6.47±1.17	3.94±1.08
Irregularity	9.58±1.00	6.41±1.12	4.00±1.27

Table 7: Repeated measures ANOVA results for subjective POSAS score among study participants (n=17).

POSAS score	F (DF)	P value	Partial η^2
Pain	0	0	0
Itching	216.43(2.32)	<0.001	0.931
Colour	169.52 (2.32)	<0.001	0.914
Stiffness	476.64 (2.32)	<0.001	0.967
Thickness	213.08 (2.32)	<0.001	0.930
Irregularity	181.32 (2.32)	<0.001	0.919

Table 8: Objective POSAS scores among study participants (n=17).

POSAS score	Pre op	1 month	3 months
Vascularity	9.77±0.24	6.71±0.34	4.47±0.32
Thickness	9.65±0.24	6.47±0.24	4.35±0.26
Relief	9.59±0.31	6.29±0.25	4.06±0.33
Pliability	9.71±0.24	6.18±0.26	4.18±0.23
Pigmentation	9.65±0.30	6.47±0.27	4.00±0.19
Surface area	9.77±0.24	6.18±0.21	3.82±0.29

Table 9: Repeated measures ANOVA results for objective POSAS score among study participants (n=17).

POSAS score	F (DF)	P value	Partial η^2
Vascularity	253.19 (2.32)	<0.001	0.941
Thickness	171.00(2.32)	<0.001	0.914
Relief	145.43 (2.32)	<0.001	0.901
Pliability	243.80 (2.32)	<0.001	0.938
Pigmentation	248.70 (2.32)	<0.001	0.940
Surface area	256.56 (2.32)	<0.001	0.941

The majority of patients were young adults, with 6 patients (35.3%) between 18-20 years, 7 patients (41.2%) between 21-30 years, 3 patients (17.6%) between 31–40 years, and only 1 patient (5.9%) above 40 years. No patients were recorded in the higher age groups (51–65 years). With regard to gender distribution, the study showed a female predominance, with 14 females (82.4%) and 3 males (17.6%). This indicates that post-burn atrophic scars requiring aesthetic improvement are most commonly encountered in young females. The recipient sites were predominantly located in the face and neck regions, which accounted for the majority of cases, followed by chest, hand, and forearm.

This emphasizes the preference for fat grafting in cosmetically exposed and functionally important areas where scar correction has a major impact on appearance and quality of life. Now the Face category (including cheek and chin) has 7 patients (41.2%). The Face and Neck category remains with 6 patients (35.3%). Chest (2

patients, 11.8%), Neck (1 patient, 5.9%), Neck and Forearm (1 patient, 5.9%), and Hand (1 patient, 5.9%) were less frequent.

Among the total of 17 cases, 6 patients (35.3%) received an average fat injection between 30–50 ml, while 7 patients (41.2%) received between 50–70 ml, making this the most common range observed. A smaller proportion of cases, 3 patients (17.6%), had an average fat injection of 70–90 ml, and only 1 patient (5.9%) required a higher volume of 90–100 ml. Thus, the majority of patients (76.5%) were injected with an average fat volume of less than 70 ml, indicating that moderate volumes were most frequently utilized in this study.

In our study, the complications following fat grafting were minimal. Bruising was observed in 1% of cases, usually in the immediate postoperative period, which subsided with conservative measures. Sagging was noted in 1% of patients, mainly presenting as dynamic laxity at the edges of the grafted area. Clumping was not observed in any of the cases (0%), indicating uniform distribution of fat in most patients. The most common complication encountered was edema, seen in 10% of cases, which presented as swelling in the immediate postoperative period and resolved spontaneously over time. Importantly, there were no cases of facial nerve weakness (0%), highlighting the safety of the procedure with respect to nerve function.

The table demonstrates the trend of subjective Patient and Observer Scar Assessment Scale (POSAS) scores at Pre Op, 1 month, and 3 months of follow-up. Across all domains except pain (itching, colour, stiffness, thickness, and irregularity)—there was a progressive reduction in scores over time, indicating gradual improvement in scar quality as perceived by the patients.

Pain

The Preoperative and postoperative mean score of pain was found to be zero.

Itching

At baseline, itching was reported with a mean score of 9.41±1.27, reflecting considerable discomfort. The mean value reduced to 6.41±1.17 at 1 month and further to 4.23±1.25 at 3 months. This gradual reduction highlights a steady improvement in scar-related irritation and discomfort over the follow-up period.

Colour

The mean score for colour was 9.47±1.32 at baseline, denoting noticeable discolouration of the scar. A substantial improvement was seen at 1 month (6.23±1.34) and further at 3 months (3.76±1.20). This indicates progressive normalization of scar colour with time, signifying improved cosmetic acceptability.

Stiffness

The baseline stiffness score was 9.64±0.99, reflecting significant rigidity of the scar tissue. At 1 month, the mean score remained relatively high at 6.94±2.70, but improved considerably by 3 months (3.76±1.09). This suggests that scar pliability improved gradually, with major changes seen at later follow-up.

Thickness

The thickness score at baseline was 9.41±1.22, which decreased to 6.47±1.17 at 1 month and further to 3.94±1.08 at 3 months. The reduction demonstrates a consistent trend of scar flattening and better integration with surrounding tissue during the healing period.

Irregularity

At baseline, the mean irregularity score was 9.58±1.00, indicating poor surface regularity of scars. By 1 month, the score had decreased to 6.41±1.12, and by 3 months it further improved to 4.00±1.27. This reflects progressive improvement in contour and smoothness of the scar, enhancing its aesthetic outcome.

Taken together, these findings demonstrate that all six parameters of the patient-reported POSAS scale showed a statistically and clinically significant improvement over the 3-month follow-up period. itching showed the fastest reduction, whereas improvements in thickness, colour, and irregularity were more gradual but steady. This highlights the positive impact of the intervention on both subjective symptoms and cosmetic outcomes, thereby contributing to enhanced overall patient satisfaction.

A repeated measures ANOVA was conducted to evaluate changes in scar characteristics (pain, itching, color, stiffness, thickness, and irregularity) at three time points: baseline (pre-fat grafting), 1 month, and 3 months post-fat grafting.

Pain

There was no effect of Fat grafting on pain scores.

Itching

Significant main effect of time was found for itching, $F(2,32)=216.43$, $p<0.001$, partial $\eta^2 \approx 0.931$. The linear trend was highly significant ($F(1,16)=297.85$, $p<0.001$), while the quadratic trend reached significance ($F(1,16)=6.48$, $p=0.022$), suggesting a slight curvature in the improvement pattern. Pair wise comparisons confirmed significant differences between all three time points (all $p<0.001$). Itching improved significantly over time, with the greatest reduction observed by 3 months.

Color

The effect of time on color was statistically significant, $F(2,32)=169.53$, $p<0.001$, partial $\eta^2\approx 0.914$.A strong linear trend was detected ($F(1,16)=264.11$, $p<0.001$), while the quadratic trend was not significant ($p=0.114$).Pairwise comparisons showed significant differences between baseline, 1 month, and 3 months (all $p<0.001$).Color irregularities decreased consistently over the follow-up period.

Stiffness

Stiffness showed a significant main effect of time, $F(2,32)=529.80$, $p<0.001$, partial $\eta^2\approx 0.971$.The linear trend was significant $F(1,16)=529.80$, $p<0.001$), while the quadratic trend was not ($p=0.104$).

Estimated marginal means indicated reductions from baseline (M=9.65) to 1 month (M=6.35) and further at 3 months (M=3.77). Stiffness decreased significantly in a linear fashion, with the largest improvements by 3 months.

Thickness

Time had a significant effect on thickness, $F(2,32)=213.08$, $p<0.001$, partial $\eta^2\approx 0.930$.A strong linear trend was present ($F(1,16)=310.28$, $p<0.001$), while the quadratic trend was non-significant ($p=0.275$). Pairwise comparisons confirmed significant reductions between all-time points ($p<0.001$). Thickness progressively decreased, with significant improvement by 3 months.

Summary of findings

Across all six measured domains (itching, color, stiffness, thickness, and irregularity) except pain, repeated measures ANOVA demonstrated statistically significant improvements over time. The predominant pattern was a strong linear trend, indicating consistent reductions from baseline through 3 months post fat grafting. These findings suggest that fat grafting led to progressive and sustained improvements in scar-related symptoms and appearance.

The above table depicts the objective Patient and Observer Scar Assessment Scale (POSAS) scores assessed at baseline (0 month), 1 month, and 3 months of follow-up. The objective POSAS evaluates scar characteristics including vascularity, thickness, relief, pliability, pigmentation, and surface area. A progressive decline in scores was observed across all parameters, indicating gradual and sustained improvement in scar quality with time.

Vascularity: At baseline, the mean vascularity score was 9.77±0.24, reflecting pronounced vascular changes in the scar tissue. At 1 month, it decreased to 6.71±0.34, and further to 4.47±0.32 at 3 months, suggesting marked reduction in redness and vascular prominence.

Thickness: The mean thickness score was 9.65±0.24 at baseline, which reduced to 6.47±0.24 at 1 month and 4.35±0.26 at 3 months. This consistent reduction indicates progressive thinning of the scar, making it more comparable to surrounding skin.

Relief: At 0 month, the relief score was 9.59±0.31, indicating considerable elevation or depression relative to normal skin. The score improved to 6.29±0.25 at 1 month and 4.06±0.33 at 3 months, showing steady improvement in surface contour and smoothness.

Pliability: Baseline pliability was 9.71±0.24, denoting significant stiffness of scar tissue. By 1 month, it improved to 6.18±0.26, and by 3 months to 4.18±0.23, indicating better softness and elasticity of the scar over time.

Pigmentation: The pigmentation score at baseline was 9.65±0.30, showing marked discoloration compared with adjacent skin. This reduced to 6.47±0.27 at 1 month and 4.00±0.19 at 3 months, reflecting progressive normalization of colour.

Surface area: At baseline, the mean surface area score was 9.77±0.24, suggestive of large visible scar coverage. This reduced to 6.18±0.21 at 1 month and further to 3.82±0.29 at 3 months, indicating contraction and reduction of the scar size with healing.

Repeated-measures ANOVA revealed a significant main effect of time for all scar outcome domains. Vascularity ($F(2,32)=253.19$, $p<0.001$, partial $\eta^2\approx 0.941$), thickness ($F(2,32)=171.00$, $p<0.001$, partial $\eta^2\approx 0.914$), relief ($F(2,32)=145.43$, $p<0.001$, partial $\eta^2\approx 0.901$), pliability ($F(2,32)=243.80$, $p<0.001$, partial $\eta^2\approx 0.938$), pigmentation ($F(2,32)=248.70$, $p<0.001$, partial $\eta^2\approx 0.940$), and surface area ($F(2,32)256.56$, $p<0.001$, partial $\eta^2\approx 0.941$) all showed significant changes over time. Linear trends were highly significant for all parameters (all $p<0.001$), indicating a consistent pattern of improvement, while quadratic trends were significant for thickness ($p=0.015$), relief ($p=0.005$), pliability ($p=0.002$), pigmentation ($p=0.041$), and surface area ($p<0.001$), but non-significant for irregularity ($p=0.114$) and vascularity ($p=0.059$), suggesting that in addition to steady linear improvements, some domains also exhibited curvilinear patterns of change.

Pairwise comparisons confirmed significant differences between all three time points for every outcome measure (all $p<0.001$). Overall, all scar parameters improved significantly and progressively over the follow-up period, with most showing both linear and curvilinear improvements.

This denotes that the intervention was consistently effective in reducing scar severity across all measured domains, reflecting sustained and multidimensional i Histological Features of Fat Grafting (Preoperative vs Postoperative). Histological analysis revealed distinct differences in tissue characteristics before and after fat grafting.

Epidermis: Preoperatively, the epidermis showed a thin, atrophic basal layer. Postoperatively, there was a thickened basal layer with better-formed rete ridges, indicating improved epidermal regeneration and restoration of normal skin architecture.

Dermis: The dermis preoperatively was characterized by dense and disorganized collagen deposition. After fat grafting, there was evidence of collagen remodeling with more elastic fibres and signs of dermal regeneration, suggesting structural reorganization and functional improvement.

Vascularity: Preoperatively, the tissue demonstrated poor vascularity. Following grafting, there was revascularization with increased capillary loops, confirming improved perfusion and angiogenesis within the treated tissue.

Inflammatory Cells: Chronic inflammatory infiltrates with few macrophages were observed preoperatively. Postoperatively, there was a reduction in inflammatory cell infiltrates reflecting a transient healing response and tissue remodeling.

Fibrosis: Preoperatively, the tissue exhibited marked fibrosis with thick collagen bundles. After grafting, there was a reduction in fibrosis, with collagen bundles becoming more spaced and organized, indicating a shift towards healthier connective tissue.

Adnexal Structures: Preoperatively, adnexal structures were largely absent or atrophic. Postoperatively, there was evidence of partial regeneration of adnexal structures, along with increased dermal vascularity, highlighting restoration of supportive skin elements. Overall, the histological findings confirm that fat grafting leads to epidermal thickening, collagen remodeling, improved vascularization, reduced fibrosis, partial adnexal regeneration, and integration of adipose tissue. These changes collectively suggest enhanced tissue regeneration, scar remodeling, and restoration of normal skin architecture following fat grafting.

Table 10: Histological features of fat grafting (preoperative vs postoperative).

Feature	Pre op	Post op
Epidermis	Thin, atrophic basal layer	Thick, improved basal layer, better rete ridge
Dermis	Dense, disorganized collagen	Collagen remodeling with more elastic fibers, signs of dermal regeneration
Vascularity	Poor vascularity	Revascularization with increased capillary loops
Inflammatory cells	Chronic inflammatory infiltrate, few macrophages	Reduced inflammation, Macrophages initially increase, then resolve
Fibrosis	Marked fibrosis, thick collagen bundles	Reduction in fibrosis, morespacedmore spaced and organized collagen bundles
Adnexal structures	Absent or atrophic	Partial regeneration Increased dermal vascularity

DISCUSSION

Demographic profile

In the present study, the majority of patients belonged to the younger age group (18–30 years), accounting for 76.5% of the study population. Similar findings were reported by Patil and Deshpande, who observed that younger individuals are more likely to seek scar revision procedures due to greater psychosocial and cosmetic concerns. Suman and Spies also reported higher treatment-seeking behavior among younger burn survivors attending reconstructive clinics.[7,8]

Females constituted 82.4% of the study population, indicating a marked female predominance. This finding is comparable to studies by Patil et al, which highlighted that women tend to seek treatment more frequently for cosmetically disfiguring scars, particularly involving exposed body areas.[7]

Recipient site distribution

The lateral thigh and abdomen were the most common donor sites as described by Coleman and Kanchwala et al, who highlighted their accessibility, abundant fat volume, and good contour post-harvest.[9,10] The face and

neck were the most commonly treated recipient sites in the present study. Similar observations were made by Rohrich et al, who emphasized the importance of fat grafting in aesthetically sensitive areas such as the face and neck due to its dual volumizing and regenerative effects.[11]

Clinical outcomes (POSAS scores)

Both subjective and objective POSAS scores showed statistically and clinically significant improvements across all domains at 3 months post-grafting. Itching, and stiffness showed the most rapid and sustained improvements, while pigmentation and surface irregularities improved more gradually. These findings are consistent with the studies of Klinger et al and Brongo et al, who demonstrated progressive scar softening, color blending, and symptomatic relief after autologous fat grafting.[12,13]

The linear trends in ANOVA indicate steady improvements, whereas significant quadratic trends in pliability, pigmentation, and surface area suggest additional remodeling effects during later follow-up. Similar trends were reported by Pallua and Wolter, emphasizing fat grafting's long-term regenerative role.[14]

Itching

Itching scores decreased from 9.41±1.27 preoperatively to 4.23±1.25 at 3 months. Similar reductions in pruritus were reported by Klinger et al, who attributed symptomatic relief to improved tissue hydration, vascularity, and reduction in inflammatory mediators following fat grafting.[12]

Colour and pigmentation

Scar colour improved significantly over the follow-up period, with mean scores reducing from 9.47±1.32 to 3.76±1.20. Comparable findings were reported by Brongo et al, who observed progressive blending of scar pigmentation with surrounding skin after adipose tissue transplantation.[13] The improvement may be related to enhanced vascularization and dermal remodeling mediated by adipose-derived stem cells.

Stiffness and pliability

A marked reduction in stiffness and improvement in pliability was observed in the present study. Stiffness scores improved from 9.64±0.99 preoperatively to 3.76±1.09 at 3 months, while objective pliability scores improved from 9.71±0.24 to 4.18±0.23.

These findings are consistent with those of Pallua and Wolter, who reported significant softening and increased elasticity of scar tissue following fat grafting.[14] The observed improvement may be explained by collagen remodeling and replacement of dense fibrotic tissue with more organized extracellular matrix.

Thickness and relief

The present study showed significant improvement in scar thickness and surface relief. Thickness scores reduced from 9.41±1.22 to 3.94±1.08 subjectively and from 9.65±0.24 to 4.35±0.26 objectively.

Klinger et al similarly demonstrated flattening of hypertrophic scars after autologous fat transfer.[12] The reduction in scar thickness observed in our study may be attributed to the regenerative effects of adipose-derived stromal cells and improved collagen orientation.

Surface irregularity

Surface irregularity improved progressively over the follow-up period. Brongo et al also reported improved contour smoothness and enhanced aesthetic outcomes following fat grafting in burn scars.[13]

Objective POSAS parameters

Objective POSAS analysis demonstrated statistically significant improvement in vascularity, thickness, relief, pliability, pigmentation, and surface area.

Vascularity

Vascularity scores reduced significantly from 9.77±0.24 preoperatively to 4.47±0.32 at 3 months. Similar findings were observed by Rigotti et al, who demonstrated enhanced angiogenesis and microvascular regeneration following adipose tissue transplantation.[21]

Surface area

Reduction in scar surface area was observed progressively during follow-up. This finding may be due to tissue remodeling and scar contracture release following fat grafting. Pallua and Wolter also described long-term scar remodeling and improved tissue quality after lipotransfer.[14]

Histopathological correlation

Histological examination in the present study revealed epidermal thickening, improved rete ridges, collagen remodeling, increased vascularity, reduction in fibrosis, and partial regeneration of adnexal structures.

These findings are consistent with those of Kato et al, who demonstrated dynamic tissue remodeling after fat grafting, including neovascularization and collagen reorganization.[20] Matsumoto et al and Yoshimura et al reported that adipose-derived stem cells play a key role in tissue regeneration through paracrine signaling and extracellular matrix remodeling.17,19 Rehman et al further demonstrated that adipose stromal cells secrete angiogenic and antiapoptotic growth factors, which contribute to enhanced vascularity and tissue regeneration.[18] The histological changes observed in our study support these regenerative mechanisms.

Complications and safety profile

The procedure was associated with minimal complications. Edema was the most common

postoperative finding and resolved spontaneously. No cases of fat necrosis, infection, or facial nerve injury were observed. These findings are comparable with the observations of Guerrerosantos et al and Coleman and Saboeiro, who reported low complication rates and favorable safety profiles with autologous fat grafting procedures.[15,16]

Statistical interpretation

Repeated measures ANOVA demonstrated highly significant improvements across nearly all POSAS domains ($p<0.001$). The large partial eta squared values observed in the present study indicate strong treatment effects. The predominance of significant linear trends suggests progressive and sustained improvement over time, whereas significant quadratic trends in selected parameters indicate additional remodeling effects during later stages of healing.

Clinical significance

The present study highlights the dual role of autologous fat grafting in post-burn scar management. Beyond simple volume restoration, fat grafting demonstrated substantial regenerative effects, leading to improvement in scar texture, pigmentation, pliability, vascularity, and overall aesthetic appearance. The procedure also contributed to symptomatic relief, particularly reduction in itching and stiffness, thereby improving patient comfort and quality of life. These findings support the growing role of regenerative plastic surgery techniques in scar management.

Limitations

The study was limited by its relatively small sample size and short follow-up duration. Long-term outcomes beyond 3 months and comparison with other treatment modalities such as laser therapy or dermal substitutes would provide further insights. Our findings, supported by clinical and histological evidence, confirm that autologous fat grafting is a safe, minimally invasive, and effective modality for the management of post-burn atrophic scars. The observed improvements are consistent with existing literature and can be attributed to the regenerative potential of adipose tissue.

CONCLUSION

Autologous fat grafting proved to be a safe, effective, and minimally invasive procedure for the management of post-burn atrophic scars. It resulted in significant improvement in scar texture, pliability, pigmentation, and vascularity, with minimal complications and strong patient satisfaction. Both clinical outcomes and histological evidence highlight the regenerative potential of fat grafting, making it a valuable tool in reconstructive and aesthetic plastic surgery. So, we recommend this procedure for rejuvenation of post-burn atrophic scars.

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