Original Article

Sharp Vs Blunt needle injection technique for Autologous Fat Grafting in Burn Scars: A Comparative study

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ABSTRACT

Backgrounds: Autologous fat grafting is a promising modality for burn scar improvement due to its potential for tissue regeneration. However, the effectiveness of injection methods remains debated. This study compares sharp versus blunt needle techniques for adipose tissue transplantation into burn scars.

Methods: Nineteen patients with mature burn scars underwent split-scar fat grafting using both blunt and sharp needle injections. Fat was harvested, processed, and injected at 0.5 cc/cm^2 under anesthesia. Scars were clinically assessed using POSAS by both observers and patients at baseline and six months post-procedure. Statistical analyses compared changes in scar quality and complication rates between groups.

Results: Both injection methods produced significant improvements in scar pliability, pigmentation, and overall appearance according to patient and observer POSAS scores. No statistically significant differences in efficacy or complication rates were found between sharp and blunt needle injections.

Conclusions: This study confirmed that fat injection has been capable of improving the quality of burn scar, regardless of blunt Vs sharp needle technique with similar complication rates. However, sharp injection of fat in burn scar is technically easier and faster compared to blunt injection.

KEYWORDS
Fat graft; Blunt needle method; Sharp needle method; Burn scars

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INTRODUCTION

Advances in burn care have increased the number of survivors with significant scarring, impacting quality of life [1-5]. Scar formation is influenced by a number of factors, including wound healing, burn depth, age, skin type, presence of inflammation and infection, with varying effects [6-10].

Burn scars typically manifest with contracture, reduced pliability, and cosmetic deformity, leading to both physical and psychological sequelae [11-17].

Burn scar contracture through lack of skin extensibility, resulting in a loss of mobility or normal tissue arrangement in the joint or

anatomical structure [18-21]. There are some non-surgical approaches for preventing scar contractures [22-25] and many surgical techniques to correct fixed contractures[26-29]. Scar contractures can be treated using a variety of techniques, including Z-plasty, full-thickness and split-thickness skin grafts, transposition of regional flaps, and expanded flaps Surgical interventions for scar contractures offer variable functional and aesthetic outcomes, and color - texture mismatch remainsachallenge[30,31].
Autologous fat grafting is a well-known technique for soft tissue regeneration that is frequently utilized in cosmetic and reconstructive surgery [32-36] (**Figure 1**).

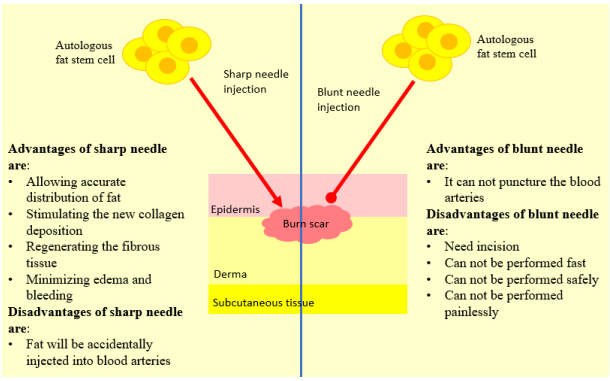

Figure 1. The two various methods for autologous fat injection in burn scars and their adventages and disadventages

Autologous fat grafting, rich in adipose-derived stem cells, has emerged as a minimally invasive option to improve scar texture, elasticity, and appearance[37-41]. However, injection technique—sharp versus blunt needle—may influence fat distribution and graft quality, especially in fibrotic tissues such as burn scars. Few studies have addressed the comparative effectiveness and safety of these methods [33-43].
In this study, the effect of sharp Vs blunt needle guided fat transfer to burn scar was compared.

METHODS

This interventional study enrolled 19 adults with mature burn scars. Institutional and patient consent were obtained. Patients underwent clinical assessment, and scars were divided into three equal regions: one treated with sharp needle fat injection, one with blunt needle injection, and one as a control. Fat was harvested from the abdomen or thigh using the Coleman technique, centrifuged, and injected at 0.5 cc/cm² per site under local anesthesia. Scar quality was measured at baseline and six months post-intervention using the POSAS by both observers and patients.
Data were analyzed for statistical significance using paired *t*-tests, Wilcoxon, and ANOVA as appropriate, with significance set at $P<0.05$.

RESULTS

Observation completed the burn information at the beginning and end of the study using POSAS scale. The results of this information were statistically analyzed in several parts.

Overall scar examination

At the beginning of the study, the observer used the POSAS scale to determine the overall score for each patient's scar. The average score was 5.895 with a minimum of 3 and a maximum of 10. After six months, the re-score for each group was determined by the observer using the POSAS scale. The mean score in the sharp needle injection was 4.474 with a minimum of 1 and a maximum of 8 and in the fat blunt needle injection was 4.526 with a minimum of 1 and a maximum of 8. In statistical comparison, despite the improvement of the overall scar score, we did not see a significant difference after injection with either the sharp needle (P= 0.0613) or the blunt needle (P= 0.0602) methods. There was no significant difference between the two types of sharp and blunt needle injections (P> 0.999) (**Figure 2**).

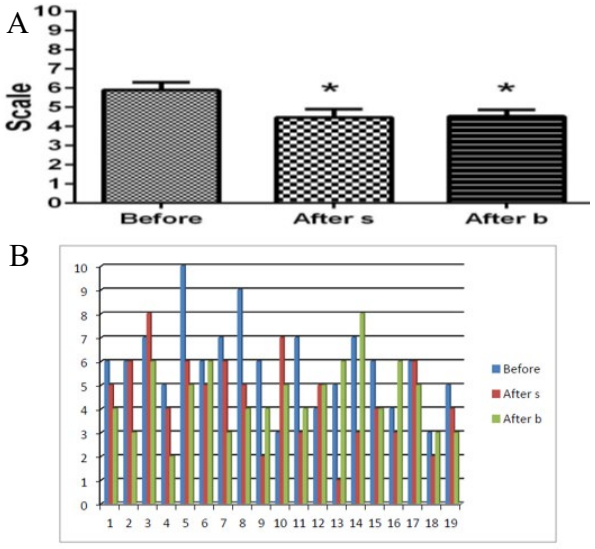

Figure 2. (A & B). Overall scar examination by observer

Scar color (pigmentation) examination

In the observation of pigmentation score by the observer with POSAS scale, the mean scar score before injection was 5.21 with minimum of 3 and maximum of 7 which was changed to mean 4.316 and minimum of 3 and maximum of 7 after sharp needle fat injection and 4.421 and minimum of 3 and maximum of 7 after blunt needle injection. Despite the improvement of scar color after 6 months in the patients, there was no statistically significant difference in the scar pigmentation score of patients before and after fat injection (P= 0.0524). Also, this comparison did not show a significant difference in blunt needle injection (p=0.975). There was no significant difference between the two types of sharp and blunt needle injections (**Figure 3**).

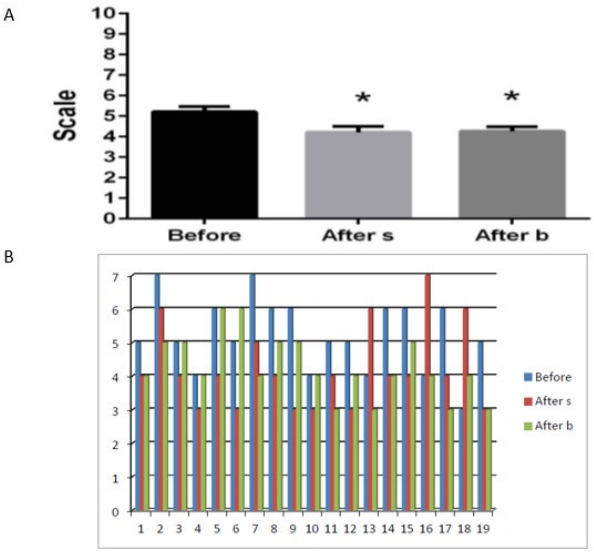

Figure 3. (A&B). Comparison of scar pigmentation by observer

Scar pliability examination

In the POSAS scale observer, the mean scar score before injection was 5.21 with a minimum of 1 and a maximum of 4, which after a sharp needle fat injection averaged 4.21 and a minimum of 1 and a maximum of 1, and after a blunt needle injection averaged 4.263 and a minimum of 4.263 and a minimum of 26. There was a statistically significant difference in the pliability scores of patients before and after fat injection (P= 0.0411). This comparison also showed a significant difference in the case of blunt needle injection (P= 0.0214). But there was no significant difference between the two types of sharp and blunt needle injections (P= 0.961) (**Figure 4**).

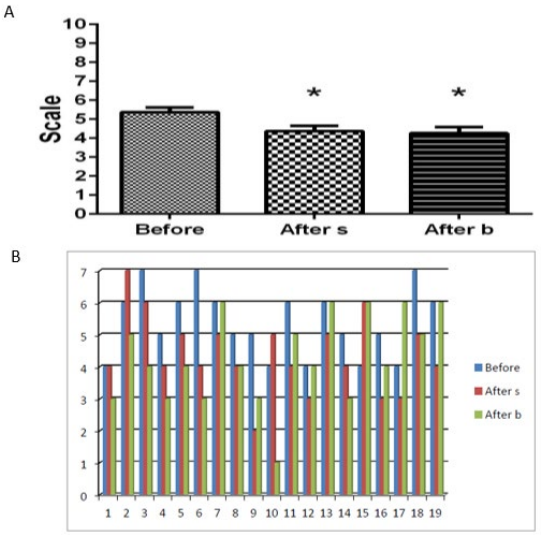

Figure 4. (A&B). Comparison of scar pliability by observer

Scar relief examination

In the observation of the scar relief score by the observer with POSAS scale, the average scar score before the injection was 3.841 with a minimum of 1 and a maximum of 8, were changed after the fat sharp needle injection with a mean of 3.789 and a minimum of 1 and a maximum of 3 and after a blunt needle injection with a mean of 3.684 and a minimum of 1 and maximum of 6. There was no significant difference in the statistical comparison of scar scores of patients before and after sharp needle fat injection (P= 0.994). Also, this comparison did not show a significant difference in the case of blunt needle fat injection (P= 0.948) (**Figure 5**).

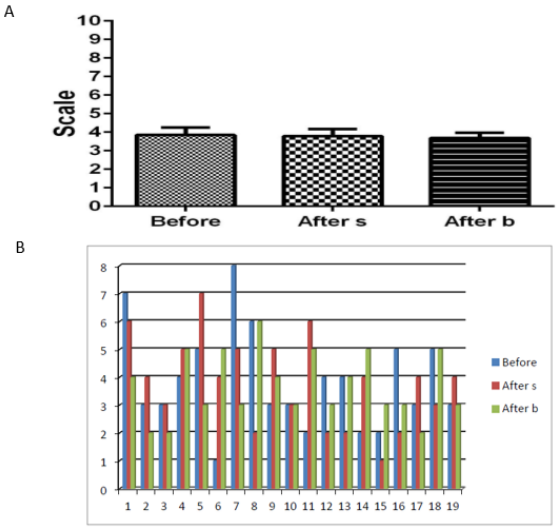

Figure 5. (A&B). Comparison of scar releif by observer

Scar vascularity rate examination

In the POSAS scale observer, the mean score of scars before the injection was 3.105 with a minimum of 1 and a maximum of 5, which were changed to mean of 3.211 and a minimum of 1 and a maximum of 5 after sharp needle fat injection and a mean of 3.053 and a minimum of 1 and a maximum of 5 after a blunt needle injection. There was no significant difference in statistical comparison of patients with scar vascularity score before and after fat sharp needle injection (*P*= 0949). Also, this comparison did not show a significant difference in the case of blunt needle injection (*P*= 0.987) (**Figure 6**).

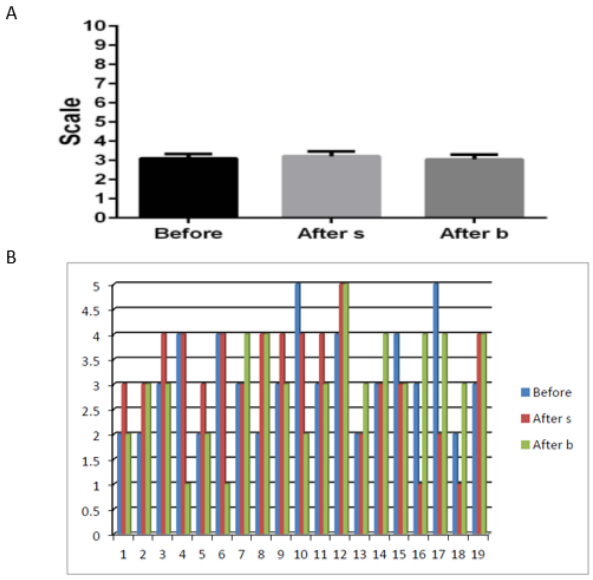

Figure 6. (A&B). Comparison of the vascularity of the scar by observer

Scar surface area examination

In the observation of the scar surface score by the observer with POSAS scale, the average scar score before injection was 4.584 with a minimum of 2 and a maximum of 8, which were changed to a mean of 4.211 and a minimum of 2 and a maximum of 7 after sharp needle fat injection and a mean of 4.368 and a minimum of 2 and a maximum of 6 after blunt needle injection. There was no significant difference in the statistical comparison of patients' scar surface scores before and after sharp needle fat injection (*P*= 0.546). Also, this comparison did not show a significant difference in the case of blunt needle injection (*P*= 0.763) (**Figure 7**).

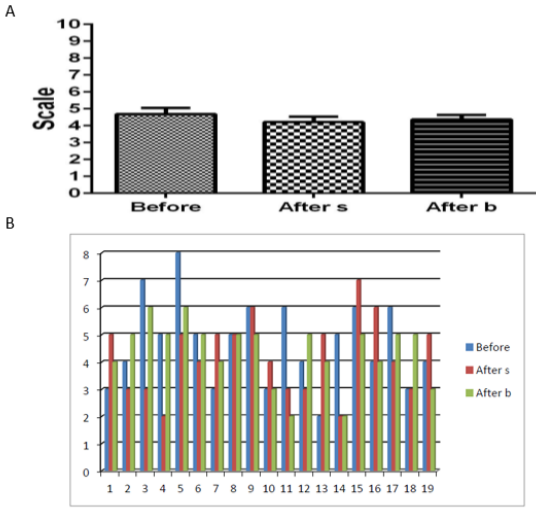

Figure 7. (A&B). Examination of surface area of scar by observer

Scar thickness examination

In the score of scar thickness by the observer using POSAS, the average score of scars before injection was 4.632 with a minimum of 3 and a maximum of 7, which were altered to a mean of 4.211 and a minimum of 3 and a maximum of 6 after sharp needle fat injection and a mean of 4.368 a minimum of 3 and a maximum of 6 after blunt needle fat injection. There was no significant difference in the statistical comparison of patients' scar scores before and after sharp needle fat injection (*P*= 0.389). Also, this comparison did not show a significant difference in the case of blunt needle injection (*P*= 0.688) (**Figure 8**).

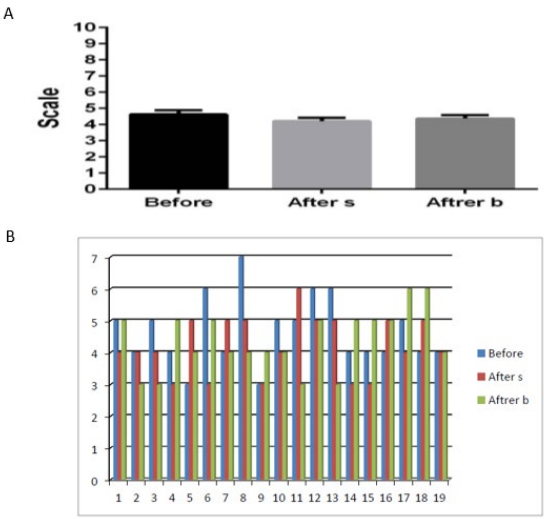

Figure 8. (A&B). Examination of the thickness of the scar by observer

Scar examination by the patient using the POSAS scale

Patients completed their burn information at the beginning and end of the study. The results of this information were statistically analyzed in several parts, which are mentioned below:

Overall scar examination

At the beginning of the study, patients used a questionnaire to determine the overall score for scar. The average score was 5.421 with a minimum of 3 and a maximum of 9. After six months, this score was determined by the patients. The mean score in the sharp fat injection group was 4.316 with a minimum of 2 and a maximum of 7 and in the blunt needle fat injection group was 4.211 with a minimum of 2 and a maximum of 6. There was a significant difference in the statistical comparison of patients' scar scores before and after fat injection (*P*= 0.0376). This comparison also showed a significant difference in the case of blunt injection (0.0206). But there was no significant difference between the two types of sharp and blunt injection methods (0.9685) (**Figure 9**).

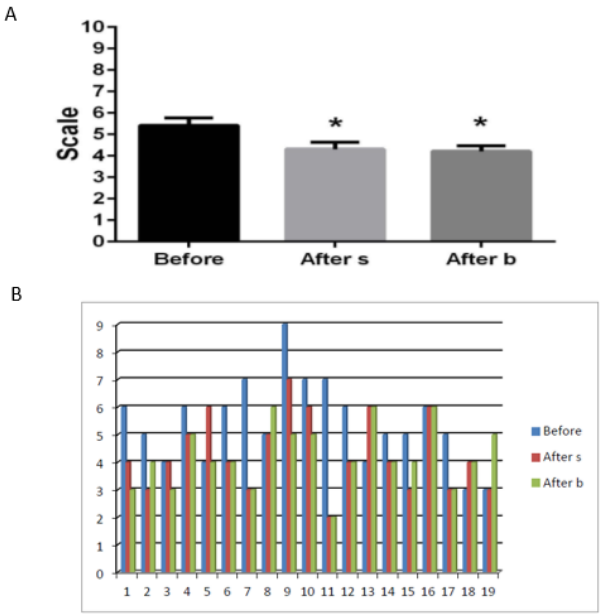

Figure 9. (A&B). Overall scar examination by patients

Scar color (pigmentation) examination

In the study of pigmentation score by patients with a questionnaire, the mean score of scar pigmentation before injection was 5.579 with a minimum of 4 and a maximum of 7. These scores were changed after sharp fat injection with an average of 4.526 and a minimum of 3 and a maximum of 8 and after blunt needle fat injection with a mean of 4.421 and a minimum of 2 and a maximum of 6. There was a significant difference in statistically comparing the scar pigmentation score of patients before and after sharp fat injection (*P*= 0.0226). This comparison also showed a significant difference in the case of blunt needle injection (*P*= 0.0109). But no significant difference was observed between the two types of sharp and blunt injections (*P*= 0.9596) (**Figure 10**).

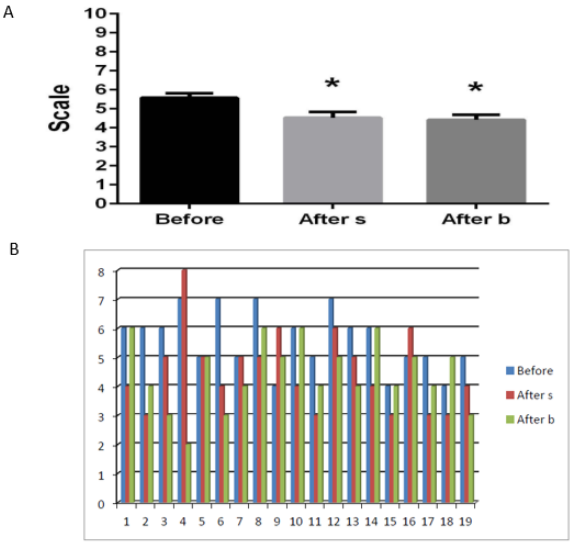

Figure 10. (A&B). Comparison of scar pigmentation by patients

Scar pliability examination

In assessing the degree of pliability of scars by patients, the average score of scar stiffness before injection was 6.35 with a minimum of 4 and a maximum of 9, which were changed after sharp fat injection with a mean of 5.35 and a minimum of 4 and a maximum of 7 and after blunt injection with a mean of 5.25 and a minimum of 4 and a maximum of 8. There was a significant difference in statistical comparison of patients' scar pliability scores before and after sharp needle fat injection (*P*= 0.0301). This comparison also showed a significant difference in blunt needle injection (*P*= 0.0153), but no significant difference was observed in comparison between sharp and blunt injections (*P*= 0.962) (**Figure 11**).

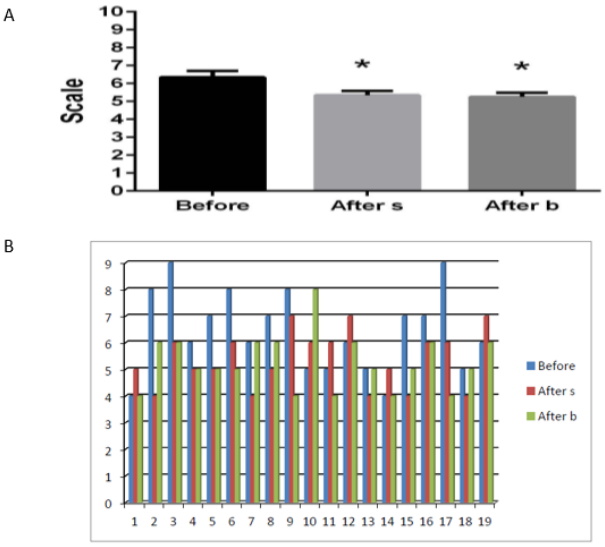

Figure 11. (A&B). Comparison of scar pliability by patients

Scar surface area examination

In the evaluation of scar surface score by patients, the average scar score before injection was 5 with a minimum of 1 and a maximum of 8, which were changed after sharp needle fat injection into an average of 4.368 with a minimum of 2 and a maximum of 7 and after blunt needle injection with an average of 4.421 and a minimum of 2 and a maximum of 7 were changed. There was no significant difference in the statistical comparison of patients' scar level scores before and after sharp needle fat injection (P= 0.4351). Also, this comparison did not show a significant difference in the case of blunt needle injection (P= 0.4959) (**Figure 12**).

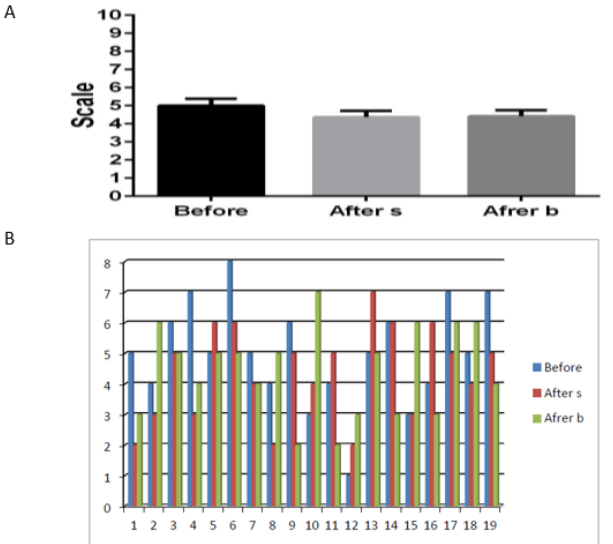

Figure 12. (A&B). Comparison of surface area of scar by patients

Scar thickness examination

In the evaluation of scar thickness score by patients, the average scar score before injection was 4.236 with a minimum of 3 and a maximum of 7, and after Sharp needle injection with an average of 4.211 and a minimum of 3 and a maximum of 6, this score after blunt needle injection was with an average of 4,368 and a minimum of 3 and a maximum of 6. There was no significant difference in the statistical comparison of the scar surface of patients before and after sharp needle fat injection (P= 0.389). Also, this comparison did not show a significant difference in the case of blunt needle injection (P= 0.688) (**Figure 13**).

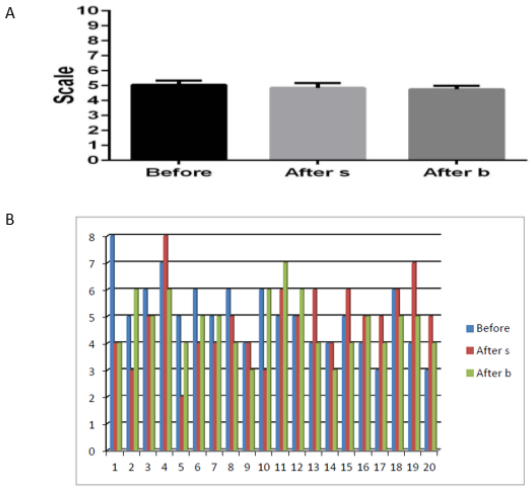

Figure 13. (A&B). Comparison of scar thickness by patients

Comparison of sharp and blunt needle injections complications

The only possible complication of sharp needle injection compared to blunt needle injection was the amount of ecchymosis after injection (**Figure 14**). In this study, it was found that in the blunt method, 4 patients developed ecchymosis after injection, which increased to 5 patients in the sharp needle injection. There was no statistically significant difference in the amount of postoperative ecchymosis between blunt and sharp needle injection methods (P= 0.7101) (**Figure 15**).

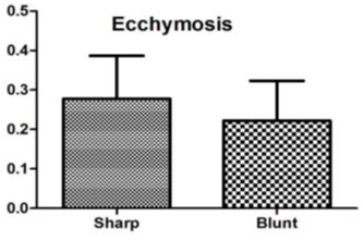

Figure 14. Comparison of sharp and blunt needle injection methods effects on ecchymosis

Figure 15. The photografs of the patient the patient at the beginning of the study and six months later

DISCUSSION

Autologous fat grafting with its tissue regeneration capability, is a well-established technique in cosmetic and reconstructive surgery [32-34, 42]. The findings demonstrate the beneficial effects of autologous fat grafting on burn scars, consistent with prior research supporting adipose-derived stem cells' role in tissue regeneration.[33,36,38,43,44].

Both sharp and blunt injection techniques are effective, though sharp needles facilitate easier passage through fibrotic scar tissue and potentially better distribution of graft material. This may reduce patient discomfort and procedural complexity.

Fat injection into burn scar improves quality of scar, as well as color, elasticity, thickness, and softness of skin [33, 38, 44]. Various studies have revealed that the injection technique can exert a varying degree of biologic effect on scarred skin [33,34,46].

Intracutaneous injection of autologous fat within burn scar with sharp needle was reported in literature.[32,34] In addition, technical ease in passing through dense fibrotic scar and regenerating effect on scar tissue remodeling have mentioned as main advantages of using sharp needle in comparison to blunt needle [32,34]. On the other hand, blunt needle injection may lead to more tissue edema due to more tedious passage through dense fibrotic burn scar [33,45].

In our study, sharp and blunt injection techniques; resulted in significant improvement of pliability, pigmentation and overall appearance of burn scar according to patients. From observers' point of view, there was noticeable improvement in pliability and overall scar quality. The 18-gauge sharp needle we used in sharp injection group, easily penetrated fibrotic burn scar without additional stab incision. In fact, sharp needle allows accurate distribution of fat, especially at the junction of the skin to the hypodermis, stimulation of new collagen deposition, and regeneration of fibrous tissue with minimal edema and bleeding at the graft site [34]. The adipose derived stem cells of harvested fat that seems to play a major role in changing the quality of burn scar, theoretically is more potentiated by sharp needle [32,45]. In a study, autologous fat transfer was used into immature scar for prevention of hypertrophic scar formation .[46] However, the patients included in our study were those with mature burn scar.

There are reports of vascular complications of fat

injection as embolic arterial blockade led to skin necrosis, stroke and even blindness[46]. In this study, the complication were minor and the rate was negligible in both sharp and blunt needle groups. We used atraumatic Coleman technique, with controlled and precise injection volume of fat under modest pressure in retrograde manner to minimize complications. The present study encountered limitations, including the lack of more samples and no histological examination or any other non-invasive objective evaluation to support our study. The effect of improving fat transplantation on burn scars is probably due to fat stem cells, which in addition to being able to transform into different cells, can secrete several growth factors with strong anti-inflammatory, immunomodulatory, antioxidant and anti-fibrotic effects. All the evidence shows the potential for fat tissue regeneration and offers new insights into regenerative effects. Undoubtedly, further cytologic and immunohistochemical approval of this theoretical findings are necessitated. Autologous fat transplantation and its study may provide more advanced strategies for the prevention or treatment of scars, so finding a more appropriate method of injection can be a great help in serving this method for burn patients.

Therefore, in this novel comparative study of two injection techniques of autologous fat transfer with sharp and blunt needle revealed similar scar remodeling potential and complication rate in both groups, but technical advantages and patients' comfort may favor sharp needles.

CONCLUSION

Autologous fat grafting significantly improves burn scar pliability and appearance, regardless of injection technique. The sharp-needle approach offers practical benefits without increasing risks, and may be preferred in challenging, fibrotic scars.

ACKNOWLEDGMENTS

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CONFLICT OF INTEREST

The authors declare that there is no conflict of interests.

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