



ORIGINAL RESEARCH ARTICLE

Comparing the role of subcision suction method with and without the injection of platelet-rich plasma in the treatment of depressed scars

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Abstract: Among wound-healing modalities, platelet-rich plasma (PRP) has been used for wound healing, through the release of multiple growth factors. The platelets mediate wound healing by initiating the clotting pathway and the subsequent matrix remodelling. The aim of the work was to study the role of injection of platelet-rich plasma in the treatment of scars. This study was conducted on thirty patients who were divided into two groups (A and B). Each group included fifteen patients. The two groups were randomly distributed by using individual sealed envelopes. Group A was subjected to subcision of their acne scars using Nokor needle, followed by suction. Group B patients were subjected to the same treatment but followed by an injection of platelet-rich plasma once per month over three months. In Group A, 6 patients (40%) showed moderate improvement, 5 patients (33.3%) showed slight improvement and 4 patients (26.7%) showed significant improvement. In Group B, 7 patients (46.7%) showed moderate improvement, 5 patients (33.3%) showed marked improvement and 3 patients (20%) showed significant improvement. There was a statistically significant difference on the independent observer's after-treatment assessment between the groups ($P = 0.014$). In conclusion, subcision suction leads to a persistent improvement of acne scars in a short time, and the coupling with injection of PRP is the most effective in the treatment of depressed facial scars.

Keywords: Platelet-rich plasma; scars; subcision; suction

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Introduction

The process of wound healing is a complicated process whereby the skin repairs itself after injury^[1,2]. The wound healing stages are in the order of: (1) inflammation, (2) granulation tissue formation, and (3) matrix remodelling^[3].

Scarring leads to a difference in the normal structure and function of the skin, which manifests as a depressed

area and with an alteration of skin quality, colour, vascularity, nerve supply and chemical properties^[4].

Scars can be classified as listed^[5]:

1. Fine line scars
2. Stretched scars
3. Scar contractures
4. Raised skin scars
 - a) Hypertrophic scars

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- b) Keloidal scars
- 5. Atrophic scars
 - a) Ice-pick scars
 - b) Rolling scars
 - c) Box-car scars
- 6. Intermediate scars

Subcision is described by Orentreich and Orentreich in 1995^[6] to illustrate the surgical procedure of atrophic scars using a Nokor needle which is inserted in the scar. The mechanism of this surgery is to separate the fibrous tissues which hold the scar to the underlying tissue^[6]. Re-depression of scars must occur in the first two weeks after the procedure. Therefore, it was hypothesized that the suctioning of old scars prevent the re-depression by induction the hemorrhage in dermal pocket^[7,8].

Clinical trials have shown that the application of platelet-rich plasma (PRP) therapy to a wound can activate the healing process^[9,10]. PRP also reduces the percentage of sternal infection^[11]. Several recent reports have demonstrated the benefits of using topical application of PRP for improved post-operative outcomes following median sternotomy^[11,12], and so has PRP been used in the treatment of chronic wounds. Hence, an excellent management of chronic wounds is obtained toward improving natural healing^[13].

Materials and Methods

This interventional prospective randomized study was done on 30 patients who attended the dermatology outpatient clinic at Alexandria Main University Hospital. The patients were suffering from different types of depressed scars, and were enrolled in the study after obtaining informed written consent. The patients were divided into two groups (A and B) with 15 patients in each group:

1. Group A was subjected to subcision of their acne scars using Nokor needle, followed by suction starting on the third day after subcision and continued every other day using an electric-powered suction device for a period of two weeks.

2. Group B patients were subjected to subcision- suctioning similarly but followed by injection of platelet-rich plasma after their last session of suction with frequency of once per month for three months. Inclusion and exclusion criteria for patients were as follows:

Inclusion criteria:

1. Demonstrable post-acne, chicken-pox, traumatic and surgical depressed scars which were diagnosed on a clinical basis.
2. Patients who had given an informed consent to participate in the study.
3. Patients with reasonable and realistic outcome expectations about the procedure.

Exclusion criteria:

1. Pregnant or lactating females.
2. Patients who were on systemic isotretinoin therapy in the previous twelve months.
3. Patients with susceptibility to keloid formation.
4. Patients taking drugs that prolong bleeding such as Aspirin and vitamin E.
5. Patients with active cystic acne lesions.
6. Patients with platelets dysfunction syndromes, bleeding diathesis.
7. Skin cancers, warts, solar keratoses and any skin infection.
8. Patients with liver cirrhosis or nephritis.

Assessment of the results was achieved objectively and the patients were digitally photographed using the same camera, lighting settings and patient positioning, before treatment and post-treatment at one month interval for a duration of three months. At the end of the study, a grading system of improvement for the evaluation was standardized. The severity of acne scarring was graded according to Goodman's qualitative global scarring grading system^[14] before and after treatment.

Subcision:

Anaesthesia: Topical anaesthesia (EMLA cream)

Patients' position: Semi-sitting position

Type of needle: Nokor needles (16–18 gauge)

Technique: Nokor needle was inserted into the scar with the bevel upwards parallel to the skin surface, and was moved back and forth in a fan-like motion under the scar. A snapping sound would be heard as the fibrous tissues separated. PRP was prepared by collecting the patient's own blood of about 20 cc aliquots, placed sterilely into four tubes (each tube containing 50 mL sodium citrate anticoagulant). After centrifugation, the platelets and other vital growth proteins would be ready at the top of supernatant. The PRP was then drawn off, and the addition of calcium gluconate activated the PRP and resulted in the prompt release of 70% of growth factors from the α -granules within 10 minutes (and nearly all the contents within an hour). We used a quartile grading scale^[15] to evaluate the effectiveness of the therapies, as stated below:

Slight improvement 0–25%

Moderate improvement 25%–49%

Significant improvement 50%–74%

Marked improvement \geq 75%

Ethics statement

This study was approved by Ethical Committee of Faculty of Medicine, Alexandria University.

Results

In Group A, the patients' ages ranged from 23–34 years with a mean value of 29.33 ± 3.18 years and the median value was 30; while in Group B, the ages ranged from 21–36 years with a mean age of 29.0 ± 4.83 years and the median age was 31 years. Out of 15 patients in Group A, 4 patients were males (26.7%) and 11 patients were females (73.3%). Group B consisted of 1 male (6.7%) and 14 females (93.3%). The groups were matched by age, gender and skin type. With regard to the distribution of scar based on etiology, the majority of patients in Group A (11 patients; 73.3%) had acne scars, 2 patients (13.3%) with chicken pox scars, 1 patient (6.7%) with traumatic scars and another patient (6.7%) had surgical scars. Group B included 13 patients (86.7%) with acne scars, 1 patient (6.7%) with chicken pox scars and 1 patient (6.7%) with traumatic scars.

In Group A, 6 patients (40%) showed moderate improvement, 5 patients (33.3%) showed slight improvement and 4 patients (26.7%) showed significant improvement. In Group B, 7 patients (46.7%) showed moderate improvement, 5 patients (33.3%) showed marked improvement, 3 patients (20%) showed significant improvement. There was a statistically significant difference ($P = 0.014$) in an independent observer's after-treatment assessment between the groups according to a quartile grading scale^[15], which was used to evaluate the effectiveness of the therapies, as shown in **Table 1** and **Figure 1**.

Table 1. Comparison between the two groups regarding independent observer's assessment at the end of the treatment

	Group A(n=15)		Group B(n=15)		χ^2	MC _p
	No.	%	No.	%		
Independent observer's assessment at the end of the treatment:						
Slight	5	33.3	0	0.0	10.030*	0.014*
Moderate	6	40.0	7	46.7		
Significant	4	26.7	3	20.0		
Marked	0	0.0	5	33.3		

χ^2 : Chi-square test

MC: Monte Carlo for chi-square test for comparing between groups A and B

*: Statistically significant at $P \leq 0.05$

Group A = without PRP

Group B = with PRP

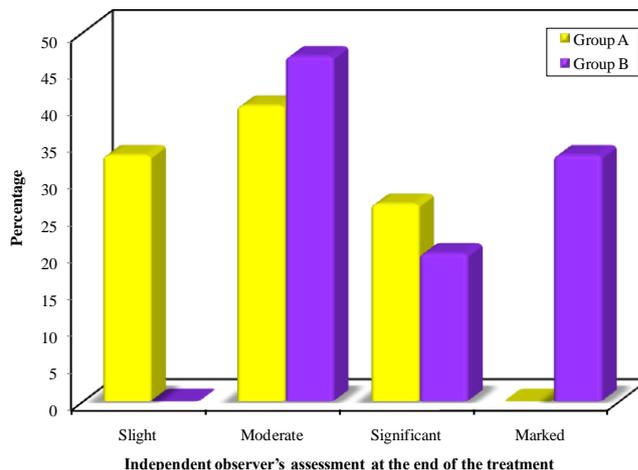


Figure 1. Comparison of improvement between the two groups regarding independent observer's assessment at the end of the treatment

Besides that, in Group A, 6 patients (40%) perceived their improvement as slight, followed by 5 patients (33.3%) who evaluated their improvement as moderate, 3 patients (20%) as significant, and only 1 patient (6.7%) as marked improvement.

In Group B, 7 patients (46.7%) ranked their improvement as marked, 5 patients (33.3%) as moderate improvement and 2 patients (13.3%) as significant and only 1 patient (6.7%) as slight improvement. There was a statistically significant difference ($P = 0.038$) in the patients' assessment score at the end of the treatment between the groups, as shown in **Table 2** and **Figure 2**.

Table 2. Comparison between patients' assessment score at the end of the treatment between the two groups

	Group A(n=15)		Group B(n=15)		χ^2	MC _p
	No.	%	No.	%		
Patient assessment score at the end of the treatment:						
Slight	6	40.0	1	6.7	8.114*	0.038*
Moderate	5	33.3	5	33.3		
Significant	3	20.0	2	13.3		
Marked	1	6.7	7	46.7		

χ^2 : Chi-square test

MC: Monte Carlo for chi-square test for comparing between groups A and B

*: Statistically significant at $P \leq 0.05$

Group A = without PRP

Group B = with PRP

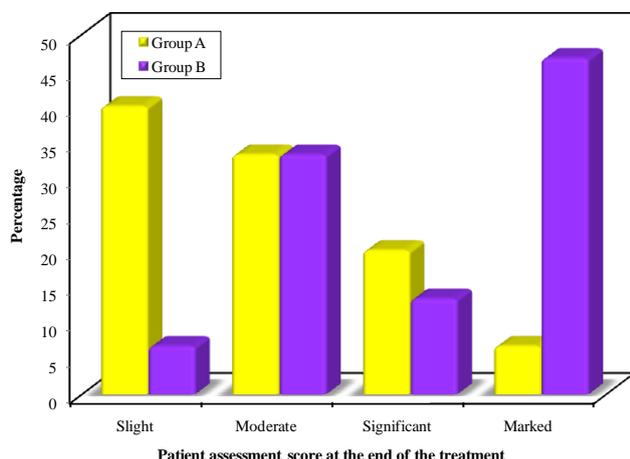


Figure 2. Comparison between patients’ assessment scores at the end of the treatment between the two groups

According to pre-treatment grade of scars in Group A, the majority of patients (8 patients; 53.3%) had moderate scars, followed by 4 patients (26.7%) with mild scars and 3 patients (20%) had severe scars. In the post-treatment grading of scars, 9 patients (60%) had moderate scars, followed by 6 patients (40%) with mild scars. There was a statistically significant difference ($P = 0.025$) regarding the grade of scars (pre-treatment and post-treatment) in Group A, as illustrated in **Table 3** and **Figure 3**.

In pre-treatment grading of scars, the majority of patients in Group B (9 patients; 60%) had moderate scars, followed by 3 patients (20%) with mild scars and 3 patients (20%) with severe scars. In post-treatment grading of scars, 5 patients (33.3%) had moderate scars, followed by 9 patients (60%) with mild scars and 1 patient (6.7%) with severe scars. There was a statistically significant difference ($P = 0.005$) regarding the grade of scars (pre-treatment and post-treatment) in Group B, as shown in **Table 3** and **Figure 3**.

The improvements are depicted in clinical images shown in **Figures 4–10**.

Discussion

The possible mechanism of PRP in the reconstruction of a depressed scar is by promoting the recovery of damaged skin through the numerous growth factors released, especially the platelet-derived growth factor. This growth factor may help to stimulate the production of other growth factors important in tissue remodelling, which promote connective tissue healing by up-regulating collagen and protein synthesis^[16]. It has been suggested that autologous platelet-derived growth factors could be used in the treatment of depressed facial scars, which has been shown to accelerate tissue repair^[16].

Alam *et al.* evaluated the efficacy of subcision for the treatment of rolling acne scars in 40 patients. He demonstrated an approximately 50% improvement of depressed

Table 3. Comparison between the studied groups according to grade of scars

Grade of scars	Pre-treatment		Post-treatment		MH _{P1}
	No.	%	No.	%	
Group A (n =15)					
Mild	4	26.7	6	40.0	0.025*
Moderate	8	53.3	9	60.0	
Sever	3	20.0	0	0.0	
Group B (n =15)					
Mild	3	20.0	9	60.0	0.005*
Moderate	9	60.0	5	33.3	
Sever	3	20.0	1	6.7	
χ^2	0.347		2.630		
MC _P	1.000		0.275		

χ^2 : Chi-square test

MC: Monte Carlo for chi-square test for comparing between groups A and B

MH_{P1}: P values for marginal homogeneity test for comparing between pre- and post-treatment

*: Statistically significant at $P \leq 0.05$

Group A = without PRP

Group B = with PRP

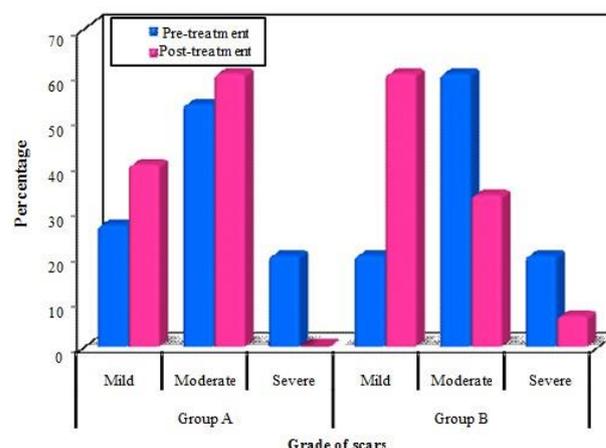


Figure 3. Comparison between the studied groups according to grade of scars (Qualitative scarring grading system)^[14]

Mild: Mild atrophy or hypertrophic scars that may not be obvious at social distances of 50 cm or greater and may be covered adequately by makeup or the normal shadow of shaved beard hair in men or normal body hair if extrafacial.

Moderate: Moderate atrophic or hypertrophic scarring that may not be obvious at social distances of 50 cm or greater and is not covered easily by makeup or the normal shadow of shaved beard hair in men or body hair if extrafacial, but is still able to be flattened by manual stretching of the skin (if atrophic).

Severe: Severe atrophic or hypertrophic scarring that is evident at social distances of 50 cm or greater and is not covered easily by makeup or the normal shadow of shaved beard hair in men or body hair if extrafacial and is not able to be flattened by manual stretching of the skin.



Figure 4. Clinical image depicting 'Marked' response to PRP therapy



Figure 5. A clinical image of acne scars showing 'Moderate' response following PRP treatment



Figure 6. Images showing 'Moderate' response of chicken-pox scar to PRP therapy

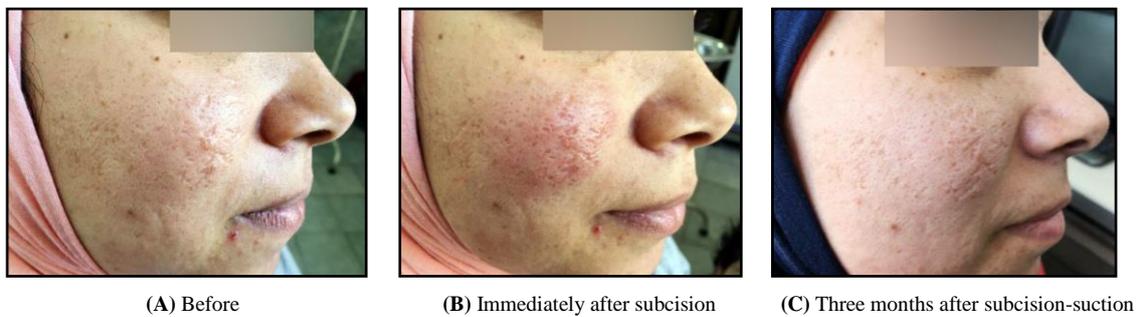


Figure 7. Clinical photograph depicting 'Slight' improvement after subcision-suction



Figure 8. Clinical photographs of acne scars showing ‘Marked’ improvement after PRP injection



Figure 9. A photograph of post-traumatic scar presenting ‘Slight’ improvement after subcision-suction



Figure 10. Clinical images of acne scars, rolling and ice pick, showing ‘Marked’ improvement after PRP injection

scars, as observed in the present study. His evaluation was based on investigator’s rating and patient’s satisfaction, but the study lacked an objective scoring system and statistical analysis, in contrast to the current study^[17]. Balighi *et al.* also used subcision for the treatment of depressed acne scars in 22 patients in absence of an objective scoring system^[18].

Goodman reported two cases with facial scars improved by subcision using a 19-gauge needle^[19]. Fulchiero *et al.* reported a case with acne scars improved by subcision, followed by further improvement after non-ablative resurfacing with 1320 nm Nd:YAG laser^[20]. These studies lacked patient quantity compared to our study. Photographic assessment in the current study fur-

ther promoted that subcision is an effective treatment for acne scars.

Kang and colleagues have also reported significant improvement of atrophic acne scars after the use of triple combination therapy (CROSS technique, subcision and fractional laser), suggesting that combination therapy could be associated with better response than isolated modalities. This further substantiates the coupling of subcision and suctioning in the present study^[21].

In the adaptation of subcision, Goodman^[22] discussed the use of 19-gauge needles, while Hexsel and Mazzuco^[23] reported preferring 18-gauge Nokor needle. Later, it was found that better results could be achieved by using an 18-gauge (1.5 inch) Nokor admix needle (Becton Dick-

inson and Co., Franklin Lakes, NJ)^[24] due to its triangular tip and the back-and-forth motion which allows for smooth and thorough separation of the fibrous cords. This explains the choice of Nokor needles in the current study.

Subjective and objective scorings were done by an independent dermatologist in order to minimize individual bias. Almost all patients treated with PRP stated that there was more reduction in the visibility of scars in comparison with the other group in the study. They also emphasized that the roughness of skin after treatment was higher in Group A than Group B.

The improvement rate in the current study following subcision-suction was clearly higher than that reported by Alam *et al.*^[17] and Balighi *et al.*^[18], who performed subcision as a solitary therapy for acne scars. They described an efficacy of 50% with subcision alone. The enhanced efficacy by suction in the present study was maybe due to subcision alone, which releases the fibrotic tissue and thereby separating the underlying attachment and formation of blood dermal pocket beneath the scar. Blood not only acts as a short-term spacer to keep the tissue from early attachment, but also the subsequent organization of blood is thought to induce connective tissue formation and correction of the defect. The added benefit of repeated suction as a complementary treatment is most probably mediated by the suction causing repeated haemorrhage, delay in early attachment of dermal wound and more new connective tissue formation during the healing process of the subcised scar.

Subcision appears to be a simple, safe and well-tolerated surgical tool to improve acne scars. It is useful mainly for rolling depressed scars. It can be part of multiple types of treatments used for patients with acne scars. It can also lead to overall improvement in those unwilling to undergo other types of sophisticated treatments such as laser, dermabrasion or dermal fillers.

Redaelli *et al.* noticed improvement of acne scarring by PRP intradermal injection while using PRP for skin rejuvenation^[25]. This led to the first recommendation for further trials to examine the benefit of PRP in acne scars. Lee *et al.* postulated that using PRP injection immediately after carbon dioxide laser resurfacing enhances the recovery of laser-damaged skin and synergistically improves the clinical appearance of acne scars^[26].

Therefore, PRP seems to be a promising new nonsurgical aesthetic modality. However, larger and well-controlled studies with prolonged follow-up periods should be performed to investigate its efficacy as a biostimulator and certify its long-term effects. The only trial that used the dermaroller combined with topical application of PRP was that of Fabbrocini *et al.*^[27]. They compared in

a split-face study the effectiveness of skin needling alone and the combined use of skin needling plus topical PRP. Their results showed that the scar severity grade was greatly reduced on both sides of the face, but the improvement was more prominent on the side treated with both skin needling and PRP despite the inter-individual variation—a comparable finding which can be appreciated in present study.

In the present study, according to pre-treatment grade of scars in Group A, the majority of patients (53.3%) had moderate scars, followed by 26.7% with mild scars and 20% had severe scars. In regards to post-treatment grade of scars, 60% had moderate scars, followed by 40% with mild scars. In Group B, the majority of patients (60%) had moderate scars, followed by 20% with mild scars and 20% with severe scars in pre-treatment grade of scars. In regards to post-treatment grade of scars, 33.3% of patients had moderate scars followed by 60% with mild scars and 6.7% with severe scars.

Also in the current study, according to the independent observer's rating improvement, the majority of patients (40%) in Group A showed moderate improvement, 33.3% showed slight improvement, and 26.7% showed significant improvement. In Group B, 46.7% of patients showed moderate improvement, 33.3% showed marked improvement, and (20%) showed significant improvement. This was in accordance with Hanradi *et al.* where 28.6% of their patients showed improvement $\geq 80\%$ ^[28]. This may be attributable to the inclusion of other types of scars as chicken pox scars, surgical and traumatic scars in the study. According to patients' assessment score at the end of the treatment between the two groups, the greater number of patients (40%) in Group A perceived their improvement as slight, followed by 33.3% who evaluated their improvement as moderate, 20% as significant, and 6.7% as marked improvement. In Group B, 46.7% of patients ranked their improvement as marked, 33.3% as moderate improvement, 13.3% as significant, and 6.7% as slight improvement.

Nofal *et al.* treated 45 patients with atrophic acne scars with either PRP, 100% TCA CROSS, or skin needling with PRP^[29]. An excellent-to-very-good rating was found in 46.7% of the PRP group, 26.7% of the TCA CROSS group, and 60% of the PRP with microneedling group. Similarly, Chawala completed microneedling upon 30 patients with facial acne and compared a split-face study of PRP and topical vitamin C^[30]. The combination of microneedling with PRP had an excellent result in 18.5% of patients and was best with treating boxcar and rolling acne scars. Microneedling with topical vitamin C had a 7% excellent improvement rate and showed more of an improvement in firmness and decreased post-inflammatory hyperpigmentation.

Also, skin tightening to decrease the appearance of acne scars can be achieved through several methods. Garg and Baveja examined 50 patients with mild-to-severe acne scarring and found that the combination of subcision, microneedling and 15% TCA peel greatly improved both severe and mild acne scarring with a high level of patient satisfaction^[31].

Asif *et al.* treated 50 patients, all between 17–32 years of age with atrophic acne scars, with microneedling performed on both halves of the face. Intradermal injections as well as topical application of PRP were given on the right half of the face, while the left half of the face was treated with intradermal administration of distilled water with three treatment sessions given at intervals of one month^[32]. Goodman's quantitative scale and qualitative scale were utilised for the final evaluation of results. The results of the right and the left halves showed 62.20% and 45.84% improvement, respectively, based on Goodman's quantitative scale.

Gawdat *et al.* conducted a study using PRP and Fractional CO₂ Laser (FCL) and experienced that combined PRP and FCL-treated areas had a significantly better response ($P = 0.03$), fewer side effects and shorter downtime ($P = 0.02$) than FCL treated areas^[33].

Zhu *et al.* evaluated the efficacy of PRP and observed the overall degree of clinical improvement in the treatment of acne scars. Erbium FCL therapy was administered to patients with facial acne scars, and topical PRP gel was applied after laser therapy. In total, 68% and 91% of patients demonstrated a 50% improvement or greater of their scars on a quartile scale after the first and third treatment, respectively^[34]. This study was not a split-face study, making it more difficult to assess how much of the improvement could be attributed to the PRP or the erbium FCL.

Another study utilized a split-face design to examine the treatment of patients with PRP injections on one half and saline injections on the other half of the face, after ablative carbon dioxide FCL therapy for the treatment of acne scars^[26]. PRP treatment reduced the overall duration of erythema from 10.4 ± 2.7 to 8.6 ± 2.0 days. Furthermore, erythema was significantly less by day 4 as measured by a chromometer and the duration of edema was reduced by approximately one day on the PRP-treated side. The PRP-treated side showed notable improvements in the overall clinical appearance of acne scars compared to the control group as evaluated by independent dermatologists using a quartile grading system with a mean improvement of 2.7 ± 0.7 for the PRP group and 2.3 ± 0.5 for the control group^[26].

Both the topical and intradermal PRP treated groups had shorter recovery times and demonstrated significant improvements in the clinical appearance of acne

scars compared to the control group that received FCL therapy only. Optical coherence tomography measurements of acne scar depth revealed that the FCL-only treatment group showed less improvement compared to the topical and intradermal PRP treatment.

There were no differences between the topical and intradermal PRP treatment groups, but the intradermal is considered the most used^[33]. The present study documents the efficacy of combining subcision with suction in the treatment of atrophic acne scars. Subcision-suction has the potential to be used as the first step for acne and other depressed scars management. As multi-step treatment is necessary for an optimal correction of acne scars, it may be recommended to continue the treatment with other techniques or to repeat the subcision-suction method for several months. Combining subcision with injection of PRP can improve and/or eliminate depressed, broad-based acne scars. We propose that platelet-rich plasma is efficacious in the management of depressed facial scars. It can be combined with subcision to enhance the final clinical outcomes in comparison with subcision alone.

Conclusion

In conclusion, subcision is suitable for the different types of scars, especially rolling acne scars and depressed scars. However, for patients who want an overall improvement of acne scars, subcision can be an important component of a multistep treatment plan. Subcision-suction leads to a persistent improvement of acne scars in a short time, without considerable complication. Further studies evaluating the effectiveness of other surgical techniques in the management of depressed acne scars are recommended. Subcision followed by injection of PRP is most effective in the treatment of post-acne scars and all depressed facial scars. PRP injection is a new and promising modality for the treatment of scars without the risk of hyperpigmentation or scarring.

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