

Comparing of the effectiveness and patients satisfaction in employing two approaches of Subcision and microneedling with Subcision and laser CO₂ fractional in the treatment of acne scar

Mina Mamizadeh¹, Masoumeh Jowzi², Samaneh Tahmasebi Ghorabi^{3,4}, Seyed Hossein Hosseini⁵, Ali Khorshidi⁶, Arian Karimi Rouzbahani^{4,7}

¹ Department of Dermatology, School of Medicine, Emam Khomeini Hospital, Ilam University of Medical Sciences, Ilam, Iran.

² General Practitioner, Ilam University of Medical Sciences, Ilam, Iran.

³ Master of Health Education, Research Expert, Clinical Research Development Unit, Emam Khomeini Hospital, Ilam University of Medical Sciences, Ilam, Iran.

⁴ USERN Office, Lorestan University of Medical Sciences, Khorramabad, Iran.

⁵ Department of Pediatrics, School of Medicine, Ilam University of Medical Sciences, Ilam, Iran.

⁶ Department of Epidemiology, School of Health, Ilam University of Medical Sciences, Ilam, Iran.

⁷ Student Research Committee, Lorestan University of Medical Sciences, Khorramabad, Iran.

Abstract

Background Various treatments have been proposed to improve acne scars, with combination therapy sometimes required to achieve satisfactory results. This split-face, single-blind, controlled clinical trial compared subcision plus microneedling with subcision plus fractional CO₂ laser in treating acne scars.

Methods Thirty patients with bilateral grade 3-4 acne scars were enrolled in this study between 2019 and 2020. All scars were treated with subcision treatment. Then, microneedling was done on the right side, and CO₂ fractional laser was applied to the left. Patients were visited one month after the end of treatment. A dermatologist who was unaware of the treatment groups graded the acne scars on photographs taken before and after the intervention. The level of patient satisfaction was evaluated based on a researcher-made questionnaire. Statistical analyses were made using SPSS v.25 to compare improvements in acne scars and patient satisfaction with the different treatments.

Results According to Goodman and Baron's scar grading scale, the overall improvement of scars was 76.66% in microneedling plus subcision (right side), 20% in fractional CO₂ laser plus subcision (left side), and 3.33% on both sides (P=0.021). Patients' satisfaction was 66.7% with microneedling plus subcision and 23.3% with CO₂ fractional laser plus subcision (P<0.001).

Conclusion Microneedling plus subcision provides promising and satisfactory outcomes after one month for patients with grade 3-4 acne scars, performing much better than CO₂ fractional laser plus subcision. Further studies are required to assess long-term outcomes and side effects across repeated therapy sessions.

Key words

Microneedling; Subcision; Fractional CO₂ laser; Acne scars; Patient satisfaction.

Introduction

Acne is a common disease in adolescence that can manifest as papules, pustules, and cysts on

the face, chest, and back, sometimes persisting during adulthood.¹ Acne mainly involves adolescents and young adults, affecting their self-esteem and social activities to various

degrees.^{2,3} The condition affects approximately 85% of young people between 12 and 24 years old.³ The prevalence of acne is higher in women (54; 82.1%) than men (17.9; 40%).⁴ Although the disease is primarily self-limited, scars may develop and persist on the skin for many years and even a lifetime. Such lesions may impair young individuals' self-confidence and social interactions.^{1,5} Acne is caused by blockage of the sebaceous gland ducts of the skin by adipocytes, dead skin cells, and bacteria. This blockage leads to swelling and disruption of the follicular walls. In most deep instances, the scarring process commences in an attempt to repair the skin.⁶ Genetic factors, disease severity, and delay in treatment are the most important factors affecting scar formation.^{7,8} Most scars first heal within 2-3 years at a young age. However, over time, as the skin's firmness decreases and its fat stores are absorbed, these scars become more pronounced.⁹ The prevalence and severity of acne scars in the population are largely unknown.¹⁰ A British study of 2,133 volunteers between 18 and 70 years old found that 1% of people reported having acne scars, 14% of whom thought their scars were ugly.¹¹ Different classifications have been proposed for scars. Koranda referred to craters or pits, ice picks, keloidal, and hypertrophic scars.¹² In another classification, acne scars can be divided into three main categories depending on whether or not there is a loss or increase in pure collagen: atrophic, hypertrophic, and keloid. Scar classification is essential because it can help guide treatment options. Scar severity is another crucial factor in scar management—it is valuable in identifying a suitable treatment method and evaluating the results.¹³

Address for correspondence

Arian Karimi Rouzbahani,
Student Research Committee,
Lorestan University of Medical Sciences,
Khorramabad, Iran.
Ph: 989306757977
Email: ariankarimi1998@gmail.com

Treatment options for acne scars can be broadly divided into energy-based and non-energy-based modalities. Common energy-based technologies include ablative and non-ablative lasers, fractional radiofrequency, intense pulsed light, and plasma skin regeneration. Non-energy-based options include subcision, microdermabrasion, microneedling, dermal fillers, and chemical peels.⁸ Alternative medical treatments include dressings, topical medications such as tretinoin, hydroquinone, alpha hydroxy acid, vitamin C, silicone and non-silicone gels and sheets, intralesional corticosteroids, and cryotherapy.¹⁴ Since acne scars vary in shape and depth, we typically need a combination of these methods to achieve satisfactory results.⁹

Subcision is a safe and straightforward surgical procedure to treat acne scars. In this method, the scar surfaces are released from the underlying joints, reducing the formation of connective tissue under the scar without damaging the skin surface. Cannulas are inserted subcutaneously to neutralize the fibrous fibers inside the scar, creating continuous movements and stimulating the formation of new connective tissue that will help raise the recessed surface of the scar. Local anesthetics are often used to reduce the pain of the procedure. The drawback of this method is that its effectiveness is mild to moderate due to a high recurrence rate.^{9,15} Side effects include swelling, bruising, and transient pain, but the bulge may remain stable at the site of treatment.¹⁶

Fractional CO₂ lasers have been proven to effectively treat a wide range of skin conditions, including the treatment of acne scars. The Fraxel fractional CO₂ lasers are a new generation of skin rejuvenation lasers that use advanced technology to split a laser beam into thousands of microscopic beams. In this technique, 1550-nm erbium laser fibers target water-containing tissues, creating narrow heat columns in the

skin. This method effectively treats skin lesions caused by light, atrophic acne scars, hypopigmented scars, and dyspigmented scars.^{9,17} It has no significant side effects and gives reasonable satisfaction.¹⁸ Fraxel laser affects the surface and middle layer of the skin simultaneously, so it has a significant impact on skin rejuvenation. The advantage of the Fraxel laser over previous lasers is that it damages the skin less since it only affects the thermal columns. For this reason, repair and recovery are faster, with fewer early (erythema and edema) and late (redness, skin blemishes, and scarring) complications than its predecessors.⁹

Microneedling is an emerging and efficient modality in the field of microchanneling, maintaining a low risk of complications.¹⁹ In 1997, it was recognized as a potential method in cosmetics, in which an ink-free tattoo gun is used to heal surgical scars.²⁰ Then, in 2006, a German inventor and a plastic surgeon proposed a needle-shaped impact device.²¹ Microneedling is a physical and invasive method that, by stimulating microscopic wounds with small Dermapen® needles in the skin, stimulates platelet growth factors to increase collagen and elastin production while facilitating the penetration of the floor of the acne scars by fresh blood vessels and collagen fibers. In this way, stem cells are stimulated, and the skin regenerates itself naturally and safely.^{22,23}

This technique can be implemented using one of three tools, including a simple and relatively inexpensive device called the Dermaroller®, an advanced electrically calibrated automatic device called the Dermapen®, or a more expensive controlled microtunnel laser.²⁴ The instrument used in this study was the Dermapen® - an electromagnetic pen that strikes the skin with a vibratory motion, creating a series of microchannels.^{25,26} This pen has 9-12 needles, the depth of which can be adjusted by

up to 0.25 mm.²¹ Microneedling treats several skin conditions such as pigmentation disorders, wrinkles, surgical scars, burns, trauma, and varicella.²⁷ It is thought to have a lower risk of post-inflammatory hyperpigmentation than other modalities and can be performed with confidence on various skin types. Due to the pain caused by microneedling, local anesthetic creams are often needed.^{7,28} Through the use of combined methods for treating acne scars, maximum effectiveness can be attained.²⁹ Given that microneedling is an emerging modality and few studies have investigated its efficacy when combined with other methods, this study compared subcision plus microneedling with subcision plus fractional CO₂ laser in treating acne scars.

Methods

This split-face, single-blind, controlled clinical trial included 30 patients referring to a dermatology clinic affiliated with Ilam University of Medical Sciences between 2019 and 2020. The sample size was determined according to the costs and executive restrictions. This study was conducted per the Declaration of Helsinki and under the approval of the Ethics Committee of Ilam University of Medical Sciences, Ilam, Iran (Code: IR.MEDILAM.REC.1397.034). The inclusion criteria encompassed patients with grade 3 or 4 acne scars (based on the Goodman and Baron scale) who were willing to participate in the study. Excluded were those not interested in the study treatments or migrating to another city; pregnant and lactating women; patients at high risk of keloids; patients with herpes; patients taking isotretinoin; patients with active boils, or unreliable patients (such as patients with psychiatric problems). After explaining the method of conducting the study to eligible patients and assuring them of the confidentiality of their personal information, written consent was obtained.

Table 1 The Goodman & Baron acne scar grading system. [13]

Grade	Description
1 (Macular)	Macular erythematous, hyperpigmented, or hypopigmented flat marks.
2 (Mild)	Mild atrophic or hypertrophic scarring that may not be obvious at social distances of 50 cm or greater and easily covered by makeup or beard hair in men.
3 (Moderate)	Moderate atrophic or hypertrophic scarring that is obvious at social distances of 50 cm or greater and is not covered easily by makeup or beard hair in men, but is still able to be flattened by manual stretching of the skin.
4 (Severe)	Severe atrophic or hypertrophic scarring not flattened by manual stretching of the skin.

Data regarding the patients' demographic information such as age and sex were recorded, after which their scars were photographed with a 10-megapixel digital camera. Photos were reviewed before the intervention, and a dermatologist recorded the severity of the acne scars. Then, for both sides of the face, a subcision operation was performed. During this procedure, another dermatologist first anesthetized and helped relieve the adhesions in the affected areas on each side of the face by injecting 100 ml of Thomson solution (normal saline, epinephrine, lidocaine, and bicarbonate) under the scars and deep into the dermis. Then, the physician made a small incision and inserted the subcision cannulas (size A, B, C, and D; in order) into the skin through the incision before using forward and back movements to open the fibrosis in the dermis and subcutaneous surface of the deep dermis. The operation site was compressed with a needle to remove excess blood and prevent the formation of a large hematoma. In the next step, the Amia microneedling device of the Dermapen® type with six needles was used to create holes in the right side of the face via impact movements. The left side of the face was treated with a UNIXEL CO₂ fractional laser device. Only the dermatologist providing treatment to the patients was aware of the codes related to the treatment provided for each side of the face. After one month, the patients were re-visited, and photographs were taken from both sides of the face using the same digital camera. At this point, the participants answered a researcher-made questionnaire regarding their satisfaction with

treatment on each side of the face. Then, the same dermatologist who made the initial evaluations recorded the severity of the scars on the Goodman and Baron scale without knowing the treatment groups. All statistical analyses were made using SPSS20 (IBM Corp., Armonk, NY, USA). Fisher's exact test was used to compare the two groups in terms of the rate of improvement in acne scars and the satisfaction with the different treatments. P-values of below 0.05 were taken as statistically significant.

Results

The mean age of participants was 32.43±6.01 years. Out of 30 patients, 6 (20%) were male, and 24 (80%) were female. At baseline, 18 (60%) patients had grade 3 scars, and 12 (40%) had grade 4 scars. **Figures 1 and 2** depict photographs of two of the patients under study before and after the interventions. According to the results, subcision combined with microneedling resulted in significant healing of the acne scars present on the right side of the face (**Table 2**).

Ten patients improved from grade 3 to grade 1, seven improved from grade 3 to grade 2, four

Table 2 Frequency of patients with scars of each grade on the right side of the face before and after treatment with subcision and microneedling.

Grade	Pre-intervention	Post-intervention	P-value
1	-	10	<0.001
2	-	11	
3	18	7	
4	12	2	

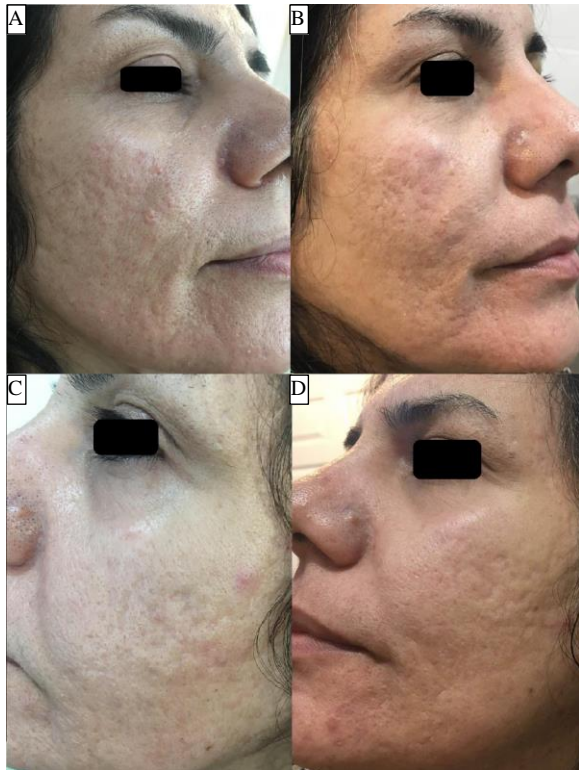


Figure 1 Acne scars of a one of the patients under study. Grade 4 acne scars are seen before (A) and after (B) treatment of the right side of the face with subcision and microneedling. On the left side of the face, treatment with subcision and fractional CO₂ laser resulted in an improvement from grade 4 (C) to grade 3 (D).

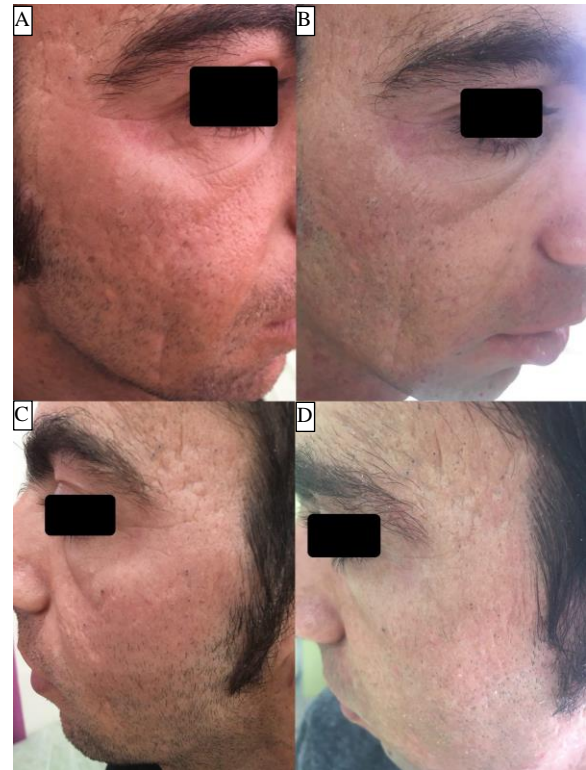


Figure 2 Acne scars of a study participant. On the right side of the face, treatment with subcision and microneedling resulted in an improvement from grade 4 (A) to grade 2 (B). On the left side of the face, treatment with subcision and fractional CO₂ laser resulted in an improvement from grade 4 (C) to grade 3 (D).

Table 3 Frequency of patients with scars of each grade on the left side of the face before and after treatment with subcision and fractional CO₂ laser.

Grade	Pre-intervention	Post-intervention	P-value
1	-	1	0.004
2	-	14	
3	18	11	
4	12	4	

improved from grade 4 to grade 2, and six improved from grade 4 to grade 3. However, the scars of one patient in grade 3 and two patients in grade 4 remained unchanged.

Our results showed that subcision plus CO₂ fractional laser also provided a significant healing effect for acne scars on the left side of the face (**Table 3**). One person improved from grade 3 to grade 1, twelve from grade 3 to grade

2, two from grade 4 to grade 2, six improved from grade 4 to grade 3. However, the scars of five patients in grade 3 and four patients in grade 4 remained unchanged.

According to the Goodman and Baron acne scar grading scale, the overall recovery rate was 23/30 on the right side (subcision plus microneedling), 6/30 on the left side (subcision plus fractional CO₂ laser), and 1/30 on both sides. The recovery rate was significantly higher with the subcision plus microneedling method than the subcision plus fractional CO₂ laser treatment (P=0.021).

Discussion

The present split-face clinical study compared

microneedling, as an emerging therapeutic modality, with CO₂ fractional laser following subcision therapy in patients with grade 3 and 4 acne scars. Our findings indicate that both treatments resulted in significant healing of acne scars, though the improvement rate was significantly higher in the subcision plus microneedling method than subcision plus CO₂ fractional laser.

Our results are indicative of the therapeutic advantages of the microneedling method in treating acne scars. These findings are in line with those of Dogra *et al.*, who stated that microneedling is a simple and inexpensive method of treating acne scars with satisfactory results in a short period and few side effects in the Asian skin type.³⁰ El-Domayti *et al.* also concluded that microneedling effectively treats atrophic acne scars in the office with a low risk of complications and a short recovery time.¹⁹ The present study revealed that subcision plus microneedling was more effective in healing acne scars than subcision plus fractional CO₂ laser. This is parallel with the de Oliveira Góes *et al.* study,³¹ which concluded that subcision and microneedling are superior to other methods for treating acne scars in terms of recovery time, cost, and side effects. Furthermore, Garg and Baveja concluded that the combination of 15% TCA and microneedling and subcision provided significant results in improving different degrees of acne scars.³²

Due to the fact that scars have different shapes and degrees, and in order to achieve satisfactory results in the treatment of scars, we need a combination of methods, and combined methods respond better to treatment. Because individual methods may each work better on a particular type of scar. Zayed *et al.*³³ in a study conducted in 2019 on the improvement of burn scars, showed that fractional CO₂ laser is more effective than microneedling in the treatment of

atrophic scars caused by burns, which is not consistent with the present study. One of the possible reasons for the better treatment of CO₂ laser against microneedling could be that the scars were atrophic and caused by burns rather than acne, with subcision also not being used. Patients' satisfaction with the combined microneedling and subcision method was significantly higher than fractional CO₂ laser with subcision, in parallel with the objective results according to acne grades. These findings are consistent with those of Ibrahim *et al.*³⁴ and Nilforoushzadeh *et al.*⁹ Overall, it seems that combined methods result in more favorable subjective and objective outcomes in improving acne scars. The present study faced several limitations. Firstly, long-term follow-up and multiple treatment sessions were not feasible. Secondly, adverse effects were not evaluated. Finally, the patients could not be blinded due to the different nature of each treatment.

Conclusion

Microneedling plus subcision provides promising and satisfactory subjective and objective outcomes after one month for patients with grade 3-4 acne scars, performing much better than CO₂ fractional laser plus subcision. Further studies are required to assess long-term outcomes and side effects across repeated therapy sessions.

References

1. Baghestani SH, Mosallanejad Z, Zare SH, M S. Acne vulgaris and quality of life in medical student-Bandar Abbas, Iran, 2008. *Med J Hormozan Uni.* 2008;**4(2)**:91-7.
2. Yazdanfar A, Khezrian L, Pirdehghan A, Bahadori M. The Relationship between Acne Severity and Body Mass Index in Females. *Avicenna J Clin Med.* 2017;**24(1)**:26-31.
3. Collier CN, Harper JC, Cantrell WC, Wang W, Foster KW, Elewski BE. The prevalence

- of acne in adults 20 years and older. *J Am Acad Dermatol*. 2008;**58**(1):56-9.
4. Fisk WA, Lev-Tov HA, Sivamani RKJCDR. Epidemiology and management of acne in adult women. *Curr Dermatol Rep*. 2014;**3**(1):29-39.
 5. Jones-Caballero M, Chren MM, Soler B, Pedrosa E, Penas PF. Quality of life in mild to moderate acne: relationship to clinical severity and factors influencing change with treatment. *J Eur Acad Dermatol Venereol: JEADV*. 2007;**21**(2):219-26.
 6. Kang WH, Kim YJ, Pyo WS, Park SJ, Kim JH. Atrophic acne scar treatment using triple combination therapy: dot peeling, subcision and fractional laser. *J Cos Laser Ther*. 2009;**11**(4):212-5.
 7. Fabbrocini G, Annunziata MC, D'Arco V, De Vita V, Lodi G, Mauriello MC, et al. Acne scars: pathogenesis, classification and treatment. *Dermatol Res Pract*. 2010;**2010**:893080.
 8. Kravvas G, Al-Niaimi F. A systematic review of treatments for acne scarring. Part 1: Non-energy-based techniques. *Scars Burn Heal*. 2017;**3**:2059513117695312.
 9. Nilforoushzadeh MA, Faghihi G, Jaffary F, Haftbaradaran E, Hoseini SM, Mazaheri N. Fractional Carbon Dioxide Laser and its Combination with Subcision in Improving Atrophic Acne Scars. *Adv Biomed Res*. 2017;**6**:20.
 10. Gozali MV, B Z. Effective treatments of atrophic acne scars. *J Clin Aesthet Dermatol*. 2015;**8**(5):33-40.
 11. Cunliffe W, Gould D. Prevalence of facial acne vulgaris in late adolescence and in adults. *Br Med J*. 1979;**1**(6171):1109-10.
 12. Koranda F. Treatment and modalities in facial acne scars. Facial Scars St Louis: CV Mosby. 1989:278-89.
 13. Goodman GJ, Baron JA. Postacne scarring: a qualitative global scarring grading system. *Dermatologic Surgery*: official publication for American Society for Dermatologic Surgery. 2006;**32**(12):1458-66.
 14. Khunger N. Standard guidelines of care for acne surgery. *Indian J Dermatol venereol Leprol*. 2008;**74**:S28-36.
 15. Aalami Harandi S, Balighi K, Lajevardi V, Akbari E. Subcision-suction method: a new successful combination therapy in treatment of atrophic acne scars and other depressed scars. *J Eur Acad Dermatol Venereol: JEADV*. 2011;**25**(1):92-9.
 16. Chandrashekar B, Nandini A. Acne scar subcision. *J Cut Aesthet Surg*. 2010;**3**(2):125-6.
 17. Tanzi EL, Wanitphakdeedecha R, Alster TS. Fraxel laser indications and long-term follow-up. *Aesthet Surg. J*. 2008;**28**(6):675-8.
 18. Hu S, Chen MC, Lee MC, Yang LC, Keoprasom N. Fractional resurfacing for the treatment of atrophic facial acne scars in asian skin. *Dermatol Surg*. 2009;**35**(5):826-32.
 19. El-Domyati M, Barakat M, Awad S, Medhat W, El-Fakahany H, Farag H. Multiple microneedling sessions for minimally invasive facial rejuvenation: an objective assessment. *Int J Dermatol*. 2015;**54**(12):1361-9.
 20. Orentreich DS, Orentreich N. Subcutaneous incisionless (subcision) surgery for the correction of depressed scars and wrinkles. *Dermatol Surg*. 1995;**21**(6):543-9.
 21. Singh A, Yadav S. Microneedling: Advances and widening horizons. *Indian Dermatol Online J*. 2016;**7**(4):244-54.
 22. Serrano G, Almudever P, Serrano JM, Cortijo J, Faus C, Reyes M, et al. Microneedling dilates the follicular infundibulum and increases transfollicular absorption of liposomal sepia melanin. *Clin Cosmet Invest Dermatol*. 2015;**8**:313-8.
 23. McCrudden MT, McAlister E, Courtenay AJ, Gonzalez-Vazquez P, Singh TR, Donnelly RF. Microneedle applications in improving skin appearance. *Exp Dermatol*. 2015;**24**(8):561-6.
 24. Elghblawi E. Medical micro-needling. *Trichol Cosmetol Open J*. 2017;**1**.
 25. Kim YC, Park JH, Prausnitz MR. Microneedles for drug and vaccine delivery. *Adv Drug Deliv Rev*. 2012;**64**(14):1547-68.
 26. Donnelly RF, Singh TRR, Morrow DI, Woolfson AD. Microneedle-mediated transdermal and intradermal drug delivery: John Wiley & Sons; 2012.
 27. Majid I. Microneedling therapy in atrophic facial scars: an objective assessment. *J Cut Aesthet Surg*. 2009;**2**(1):26.
 28. Asif M, Kanodia S, Singh K. Combined autologous platelet-rich plasma with microneedling verses microneedling with distilled water in the treatment of atrophic acne scars: a concurrent split-face study. *J Cosmet Dermatol*. 2016;**15**(4):434-43.
 29. Alam M, Omura N, Kaminer MS. Subcision for acne scarring: technique and outcomes in

- 40 patients. *Dermatol Surg*. 2005;**31**(3):310-7.
30. Dogra S, Yadav S, Sarangal R. Microneedling for acne scars in Asian skin type: an effective low cost treatment modality. *J Cosmet Dermatol*. 2014;**13**(3):180-7.
31. de Oliveira Góes HF, VirgensI AR, Neta AH, Cha CC, de Sica RCP, Meski APG. Subcision and microneedling therapy: report of two cases. *Surg Cosmet Dermatol*. 2016;**8**(4):381-4.
32. Garg S, Baveja S. Combination therapy in the management of atrophic acne scars. *J Cut Aesth Surg*. 2014;**7**(1):18-23.
33. Zayed AA, Mashaly HM, Raheem HMA, El-Nabarawy E, El-Hawary MS, Shaker OG, *et al*. Microneedling versus fractional CO₂ laser in the treatment of atrophic postburn scars. *Journal of the Egyptian Women's Dermatologic Society*. 2019;**16**(1):37.
34. Ibrahim MK, Ibrahim SM, Salem AM. Skin microneedling plus platelet-rich plasma versus skin microneedling alone in the treatment of atrophic post acne scars: a split face comparative study. *J Dermatol Treat*. 2018;**29**(3):281-6.