



Efficacy micro-needling fractional radiofrequency in acne scars

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ABSTRACT

Background: Acne scars appear most often in people struggling with severe forms of acne vulgaris. **Objectives:** To determine the efficacy of using microneedles to deliver bipolar radiofrequency energy for treating acne scars. **Materials and method:** We performed a retrospective review of medical records of Patients diagnosed with acne scars in our clinics in Aden, during the period January 2020 to December 2021. Treatment sessions 4 to 6 and treatment interval one month. Statistical analysis of data was done by estimating rates, means and standard deviations, Fisher test was used and p-value < 0.05 was considered as statistically significant. The statistical software package SPSS version 17 was used. **Results:** The female patients were (83.3%) and the mean age was 27.8 ± 7.1 years. The difference between age means showed statistically significant ($p = 0.000$). Boxcar of acne scar were predominant (53.8%). There was a highly statistical significance between values of acne scar types related to sex ($p=0.000$). Improvement types were marked in (53.8%) patients and distributed as (51.2%) in females and (2.6%) in males, ($p=0.001$). The most common grade of acne scars were grade IV found in (61.5%) patients, followed by grade III in (30.8%). Marked type improvement found in (53.8%) patients, mild improvements were (12.8%) and moderate types were (33.3%), ($p = 0.002$). Marked improvement found after 4 sessions in (21.8%) patients. Moderate improvement was in (15.4%) patients after 4 sessions and after 5 sessions was in (11.5%) patients while mild improvement found in (9.0%) patients after 4 sessions, ($p > 0.05$). Erythema as side effects were in (3.9%) patients, hyperpigmentation found in (6.4%) patients and edema found also in (2.6%) patients. **Conclusion:** Fractional radiofrequency is well-tolerated procedure, which can be used for the effective treatment of scarring and it considered as an effective modality of treatment for moderate to severe acne scars.

فعالية الترددات الراديوية الجزئية بالابر الدقيقة في ندبات حب الشباب

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الكلمات المفتاحية:

الفعالية
الوخز الدقيق
التردد الراديوي الجزئي
ندبات حب الشباب

الملخص

الخلفية: تظهر ندبات حب الشباب في أغلب الأحيان عند الأشخاص الذين يعانون من أشكال حادة من حب الشباب الشائع. لأهداف: تحديد مدى فاعلية استخدام الإبر الدقيقة لتوصيل طاقة الترددات الراديوية ثنائية القطب لعلاج ندبات حب. المنهجية: أجرينا مراجعة بأثر رجعي للسجلات الطبية للمرضى الذين تم تشخيص ندبات حب الشباب لديهم في عياداتنا في عدن ، خلال الفترة من يناير 2020 إلى ديسمبر 2021. جلسات العلاج من 4 إلى 6 وفترة العلاج شهر واحد. تم إجراء التحليل الإحصائي للبيانات عن طريق تقدير المعدلات والوسائل والانحرافات المعيارية. تم استخدام اختبار فيشر واعتبرت قيمة $p < 0.05$ ذات دلالة إحصائية. تم استخدام حزمة البرامج الإحصائية SPSS الإصدار 17. النتائج: كانت نسبة الإناث (83.3%) ومتوسط العمر 27.8

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± 7.1 سنة. أظهر الفرق بين متوسط العمر دلالة إحصائية (ع = 0.000). كانت Boxcar من ندبات حب الشباب هي السائدة (53.8%). كانت هناك دلالة إحصائية عالية بين قيم أنواع ندبات حب الشباب المتعلقة بالجنس (ع = 0.000). تم تمييز أنواع التحسن لدى (53.8%) من المرضى وتوزيعها على (51.2%) للإناث و (2.6%) عند الذكور (p = 0.001) وكانت الدرجة الأكثر شيوعاً لندبات حب الشباب هي الدرجة الرابعة في (61.5%) من المرضى، تليها الدرجة الثالثة في (30.8%). تم العثور على تحسن ملحوظ في النوع في (53.8%) من المرضى، وكانت التحسينات الطفيفة (12.8%) والأنواع المعتدلة (33.3%)، (p = 0.002). لوحظ تحسن ملحوظ بعد 4 جلسات لدى (21.8%) من المرضى. كان التحسن المعتدل لدى (15.4%) من المرضى بعد 4 جلسات وبعد 5 جلسات كان لدى (11.5%) مرضى بينما لوحظ تحسن طفيف في (9.0%) بعد 4 جلسات. (p > 0.05) الحمامي كأثر جانبي كانت في (3.9%) مرضى، فرط تصبغ وجد في (6.4%) مرضى وذمة أيضاً في (2.6%) مرضى. الإستنتاج: إن الترددات الراديوية الكسرية هي إجراء جيد التحمل، ويمكن استخدامه لعلاج الندبات بشكل فعال ويعتبر طريقة فعالة لعلاج ندبات حب الشباب المتوسطة إلى الشديدة.

Introduction

Acne vulgaris is a chronic skin disease that, depending on its course, is characterized by the occurrence of skin eruptions such as open and closed comedones, pustules, papules, and cysts (Chilicka et al., 2020, Leccia et al., 2015). It occurs in more than 80% of adolescents, 50–60% of women aged 20–25 years, and 12% of women over 25 years old. Factors that cause the disease include abnormal keratinization of the pilosebaceous canal, increased sebum production, bacterial colonization, as well as inflammatory and hormonal disorders of the skin (Chilicka et al., 2021, Contassot et al., 2014).

During the course of the disease, patients with acne experience itching and burning of the skin. Acne scars appear most often in people struggling with severe forms of acne, leading to a reduction in their quality of life. Patients often feel ashamed, embarrassed, anxious,

and socially isolated, which can lead to depression and even suicidal thoughts (Fabbrocini et al., 2018, Gupta et al., 2013).

It has been observed that 95% of acne patients develop some degree of facial scarring, which has a psychosocial impact on its sufferers (Layton et al., 1994).

All types of acne have been associated with scars, but nodulocystic acne more commonly develops acne scars (Layton et al., 1994). In a clinical survey, 49% of the total patients with acne had acne scars (Poli et al., 2001).

Face was the most common site for acne scars (95%), followed by trunk (Layton et al., 1994). Risk factors for acne scarring include severe inflammatory acne, time elapsed before treatment for acne scars starts, manipulation of lesions, family history of acne scarring, and involvement of trunk and frequent relapses (Tan et al., 2017).

Many therapeutic approaches, both invasive and non-invasive are used to treat acne scars but are marginally ineffective or causing considerable morbidity. These modalities can be energy-based devices such as ablative and non-ablative lasers, fractional radiofrequency, intense pulsed light, and plasma skin regeneration and non-energy-based devices include subcision, microneedling, dermal fillers, and chemical peels. Microneedling, also called collagen induction therapy, percutaneous collagen induction, needle dermabrasion, and intradermabrasion, involves repetitive puncturing of the skin using sterilized microneedles causing percutaneous collagen induction (Fernandes. 2002, Camirand et al., 1997).

Objectives: To determine the efficacy of using microneedles to deliver bipolar radiofrequency energy for treating acne scars.

Materials and method: We performed a retrospective review of medical records of all patients presenting to the Dermatology Private Clinics in Khormaksar and Almansoor, Aden, over a 2-year period from January 2020 to December 2021.

Seventy-eight patients (13 males and 65 females) were diagnosed with acne scars. Mean age of the patients 27.8 years and the ages

ranging from 17–45 years) were diagnosed with acne scars and treated with bipolar non-insulated microneedle radiofrequency treatment for mild to severe acne scarring. Patients were treated with four to six sessions of bipolar non-insulated microneedle radiofrequency treatment at one-month intervals.

The collected data were sex, age, clinical presentation, acne scar types, sessions of treatment, improvement types and the treatment outcome. The collected data were tabulated and statistical analysis was done by estimating rates, means and standard deviations, Fisher test was used and p-value < 0.05 was considered as statistically significant. The statistical software package SPSS version 17 was used.

Results:

Table 1 & Figure 1 revealed the distribution of the study patients related to sex, related to mean ages and related to age groups. The female patients were 65 (83.3%) while the male patients were 13 (16.7%) and the ratio females to males was 5:1.

The age of the patients ranged between 17 – 45 years and the mean age was 27.8 ± 7.1 years. The mean age of males was 28.0 ± 3.2 years, while the mean age of females was 27.7 ± 7.7 years. The difference between age means of gender showed statistically significant (p = 0.000). The patients were divided in two age groups and the age groups were ≤ 30 years and > 30 years. The majority 54 (69.2%) patients were aged ≤ 30 years and the age group > 30 years with 24 (30.8%).

Table 1: Distribution of demographic characteristics of the study patients (n = 78)

Variable	No	%	Mean & p-value
Sex:			
Females	65	83.3	
Males	13	16.7	
Female to male ratio	5:1		
Age range (years):	17–45		
Mean age ± SD* (years):			
All patients			27.8 ± 7.1
Male patients			28.0 ± 3.2
Female patients			27.7 ± 7.7
p-value			0.000
Age groups (years):			
≤ 30	54	69.2	
> 30	24	30.8	

SD*: Standard deviation

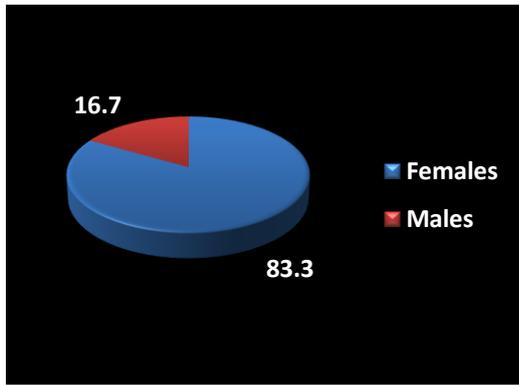


Figure 1: Distribution of patients related to sex

Table 2 illustrates the distribution of acne scar types and improvement types,

Boxcar of acne scar were predominant 42 (53.8%) among all study patients and distributed as 40 (51.2%) in females and 2 (2.6%) in males.

The type of icepick found in female patients 13 (16.7%) and in male patients 11 (14.1%). The mixed scar types found in female patients with 12 (15.4%) and none in male patients.

There was a highly statistical significance between values of acne scar types related to sex (p=0.000) as shown in Table 2. Also, in Table 2 improvement types were marked in 42 (53.8%) patients and distributed as 40 (51.2%) in females and 2 (2.6%) in males.

Mild types were 10 (12.8%) in all study patients; 5 (6.4%) in females and 5 (6.4%) in males.

The type moderate were 26 (33.3%) distributed as 20 (25.6%) in females and 6 (7.7%) in males. There was a highly statistical significance between values of acne scar types related to sex (p=0.001).

Table 2: Distribution of the study patient variables (n = 78)

Variables	Sex				Total		p-value
	Females		Males		No	%	
	No	(%)	No	(%)			
Type of acne scar:							
Boxcar	40	(51.2)	2	(2.6)	42	(53.8)	P = 0.000
Icepick	13	(16.7)	11	(14.1)	24	(30.8)	
Mix	12	(15.4)	0	(0.0)	12	(15.4)	
Improvement type:							
Marked	40	(51.2)	2	(2.6)	42	(53.8)	P = 0.001
Mild	5	(6.4)	5	(6.4)	10	(12.8)	
Moderate	20	(25.6)	6	(7.7)	26	(33.3)	

Table 3 shows the improvement types related to Goodman and Baron acne scar grades. The most common grade of acne scars in our study were grade IV found in 48 (61.5%) patients, followed by grade III in 24 (30.8%) and grade II in 6 (7.7%) patients.

Marked type improvement found in 42 patients (53.8%), and distributed as follows: 29 (37.1%) in grade IV, followed by Grade III with 7 (9.0%) and grade II with 6 (7.7%). Mild improvements were

10 (12.8%) and distributed 8 (10.3%) in grade IV and 2 (2.6%) in grade III. Moderate types were 26 (33.3%) and they were 15 (19.2%) in grade III and 11 (14.1%) in grade IV. Comparison between the types of improvement related to Goodman and Baron acne scar grades showed statistically significant (p = 0.002), as shown in Table 3.

Table 3: Improvement types related to Goodman and Baron acne scar grades

Variables	Goodman and Baron acne scar grade						Total		p-value
	Grade II		Grade III		Grade IV		No	%	
	No	(%)	No	(%)	No	(%)			
Type of improvement:									
Marked	6	(7.7)	7	(9.0)	29	(37.1)	42	(53.8)	P = 0.002
Mild	0	(0.0)	2	(2.6)	8	(10.3)	10	(12.8)	
Moderate	0	(0.0)	15	(19.2)	11	(14.1)	26	(33.3)	
Total	6	(7.7)	24	(30.8)	48	(61.5)	78	(100)	

Table 4 reveals the relation between improvement types and number of sessions. Marked improvement found after 4 sessions in 17 (21.8%) patients. Moderate improvement was in 12 (15.4%) patients after 4 sessions and after 5 sessions was in 9 (11.5%) patients while

mild improvement found in 7 (9.0%) patients after 4 sessions, (p > 0.05).

Table 4: Relation between improvement types and number of sessions

Variables	Sessions						Total		p-value
	4 sessions		5 sessions		6 sessions		No	%	
	No	(%)	No	(%)	No	(%)			
Type of improvement:									
Marked	17	(21.8)	9	(11.5)	16	(20.5)	42	(53.8)	P > 0.05
Moderate	12	(15.4)	9	(11.5)	5	(6.4)	26	(33.3)	
Mild	7	(9.0)	1	(1.3)	2	(2.6)	10	(12.9)	
Total	36	(46.2)	19	(24.3)	23	(29.5)	78	(100)	

Erythema as side effects were 3 (3.9%) among the patients and hyperpigmentation found in 5 (6.4%) patients and edema found also in 2 (2.6%) patients, as shown in Table 5 and Figure 2.

Table 5: Distribution of the patients with side effects and none side effects (n = 78)

Variables	No	%
Side effect:		
Erythema	3	3.9
Hyperpigmentation	5	6.4
Edema	2	2.6
None	68	87.1
Total	78	100

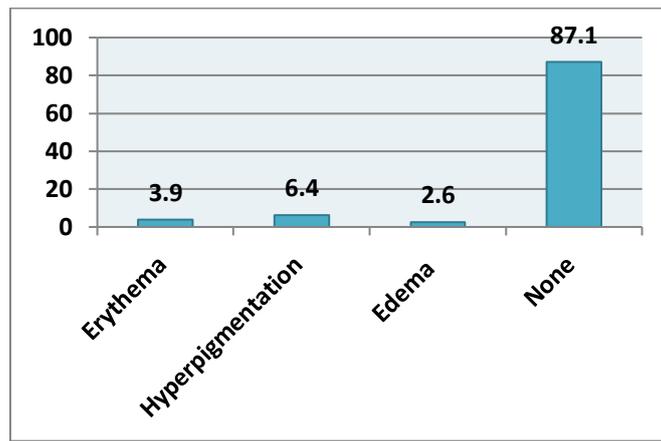


Figure 2: Percentage of side effects and none side effects among the study patients



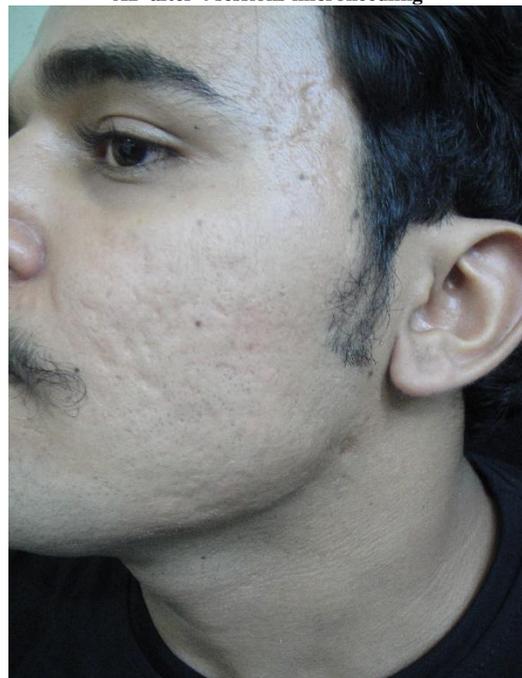
A1 befor microneedling laser



A2 after 4 sessions microneedling



B1 befor microneedling laser



B2 after 4 sessions microneedling

Discussion:

Acne scarring occurs subsequent to visible resolution of deep inflammation. Scarring may occur regardless of the severity of acne. Although acne scarring is likely to be associated more often with nodulocystic acne, it may occur in cases with only superficial forms of acne as well, especially when effective treatment is delayed (Rivera, 2008).

Acne scars are common and have a high association with reduced quality of life and psychological detriment (Bhate et al., 2013).

Treatment can be challenging with variable inter-individual responses (Jacob et al., 2001). Acne scars can be classified as keloidal, hypertrophic or atrophic with the latter further being sub-classified into boxcar, ice-pick and rolling scars (Jacob et al., 2001, Cameli et al., 2014).

A scar (also named cicatrix) is a skin lesion that results from the healing of wounds due to chemical, mechanical, or thermal injuries. Scars can develop after skin inflammation, for example, as a complication of acne. Scar formation is part of the wound healing process, which is divided into three phases: inflammatory, healing, and remodeling (Chilicka et al., 2022).

Acne scars develop out of the evolution of acne from a non-inflammatory process to an inflammatory one that can lead to rupture of the follicular wall. Rupture of the follicular wall leads to release of irritating contents (hair, lipids, keratin, Propionibacterium acnes, etc.) into the dermis, leading to a dermal inflammatory reaction that activates the classic and alternative complement pathways (Goodman, 2000). There is evolution of perifollicular abscesses that usually heal, but if encapsulation is incomplete, this can lead to multichannel fistulous tracks and creation of scars (Goodman, 2000). In our present study, the female patients were 65 (83.3%) while the male patients were 13 (16.7%) and the ratio females to males was 5:1. The age of the patients ranged between 17 – 45 years and the mean age was 27.8 ± 7.1 years. The mean age of males was 28.0 ± 3.2 years, while the mean age of females was 27.7 ± 7.7 years. The difference between age means of gender showed statistically highly significant ($p = 0.000$).

1 These findings were similar to age distribution (27.4 years) seen in study done by Reddy et al (Reddy et al., 2021) and (28.2 years) seen in a study done by Petrov et al (Petrov et al., 2015).

We found in our study, the majority 54 (69.2%) patients were aged ≤ 30 years and the age group > 30 years with 24 (30.8%).

Gupta et al (Gupta et al., 2021) reported in their study that the majority of the patients (86%) were in the age group of 21–30 years. This percentage is similar to our finding.

A study done by Tirmizi et al (Tirmizi et al., 2021) from Pakistan reported similar findings to our results. They mentioned that the total study patients were 50 and out of them 36 (72%) were female and 14

(28%) were males with a mean age of 30.92 ± 6.19 years. Additionally, 26 (52%) were patients under the age of 31 years and 24 (48%) were 31 years old or more.

In our study the boxcar type of acne scar were predominant 42 (53.8%) among all study patients and distributed as 40 (51.2%) in females and 2 (2.6%) in males. The type of icepick found in female patients 13 (16.7%) and in male patients 11 (14.1%). The mixed scar type found in female patients with 12 (15.4%) and none in male patients. There was a highly statistical significance between values of acne scar types related to sex ($p=0.000$).

A comparable results were reported by Anum et al (Anum et al., 2020) from Pakistan; they found in their study (51.1%) patients had boxcar scars whereas (37.8%) patients had ice pick scars and only (11.1%) patients had mixed scarring. Saadawi et al (Saadawi et al., 2018) reported a similar frequency of box scars (52.4%) from Egypt.

Gupta et al (Gupta et al., 2021) from India reported similar to our finding in which they mentioned that 25 (69.4%) patients had all the three types of scars. They added that the most common type of scars in patients was boxcar scars (39%), followed by icepick (34%) and rolling scars (27%).

A previous study reported other finding than our, as the study by Chandrashekar et al

(Chandrashekar et al., 2014) found the most patients had mixed types of atrophic acne scars, including ice pick, boxcar and rolling scars. Atrophic acne scarring appears to be most common type associated with acne (Chandrashekar et al., 2014).

The major clinical types of atrophic scars are ice pick, rolling or superficial and deep soft scars, and boxcar or depressed fibrotic scars (Rivera, 2008, Jacob et al., 2001).

Acne scars can be classified according to the cause and time of their formation and appearance. Atrophic scars are below the surface of the skin and are recessed. On the other hand, hypertrophic scars are raised above the skin surface (Connolly et al., 2017).

Atrophic scars can be divided into the following types: icepick, rolling, and boxcar. Icepick scars are deep, narrow, and can reach the border of the dermis with the subcutaneous tissue. The skin of a person with such scars looks like it has been pierced with a skewer or sharp instrument. Icepick scars account for 60% to 70% of atrophic scars. Boxcar scars are oval or round but quite wide and flat and resemble the letter U or a square. Boxcar scars have the cross-section of the letter M and account for 15 to 20% of atrophic scars. Rolling scars are the largest of all types and can reach a diameter of 5 mm. They comprise 15% to 25% of atrophic scars (Connolly et al., 2017). In our present study the improvement types related to Goodman and Baron acne scar grades were: marked improvement found in 42 patients (53.8%), and distributed as follows: 29 (37.1) in grade IV, followed by grade III with 7 (9.0%) and grade II with 6 (7.7%).

The second type of improvement was moderate improvement in which

26 (33.3%) and they were 15 (19.2%) in grade III and 11 (14.1%) in grade IV.

In published studies, boxcar and rolling scars demonstrated the greatest clinical improvement after microneedling or fractional radiofrequency microneedling, while icepick scars were often recalcitrant (Moftah et al., 2018, Osman et al., 2017, El-Domyati et al., 2015). Patients treated with microneedling or fractional radiofrequency microneedling for other types of scars also demonstrated clinical improvement (Margit et al., 2020).

The most common grade of acne scars in our study were grade IV found in 48 (61.5%) patients, followed by grade III in 24 (30.8%) and grade II in 6 (7.7%) patients.

A previous study results from Pakistan differ in low values from our finding. They reported that patients had predominantly, moderate (Grade-III) and severe acne scars (Grade-IV), i.e. (54.4%) patients had moderate (Grade-3) scars and (45.6%) patients had severe (Grade-4) scars (Anum et al., 2020).

In the present study, most of the patients showed (21%) marked improvement after four treatment sessions followed by moderate improvement (15.4%) after four sessions and mild improvement found in patients after four treatment sessions. After six sessions, we observed marked improvement in (20.5%) patients.

Chandrashekar et al (Chandrashekar et al., 2014) mentioned that patients had undergone four sessions of microneedling fractional radiofrequency treatment for their acne scars with an interval of 6 weeks between each session, since the time for collagen remodeling lasts around 4-6 weeks. Treatment regimen was individualized based on predominant scar type and scar depth.

In our study the erythema as side effects were 3 (3.9%) among the patients, hyperpigmentation found in 5 (6.4%) patients and edema found also, in 2 (2.6%) patients.

Previous study reports (Rahman et al., 2006, Carniol et al., 2015) determined the side effects as follows: Side effects include redness and swelling, skin dyschromia, scarring, skin infections, eczema etc. After ablative fractional lasers, these following are common side effects, especially over the neck.

- Excessive skin peeling, scaling and crusting.
- Swelling, for up to 7 days post treatment, which can be reduced with regular icing.
- Post inflammatory hyperpigmentation-High frequency in darker skin patients and those with previous episodes.
- Acneiform eruptions, herpes, bacterial, fungal infections and contact dermatitis.

Chandrashekar et al (Chandrashekar et al., 2014) reported in their published study that the treatment was generally well tolerated. All patients underwent treatment-related pain. All patients had reported

mild erythema for two days, two patients had edema for more than three days, five patients reported post inflammatory hyperpigmentation and two patients had track marks of the device probe.

Conclusion:

Acne scars are still an unpleasant complication for people who have suffered from acne vulgaris. They represent a real challenge for dermatologists. Scientific researches on improving acne scars is ongoing and shows multiple effective modalities to treat this type of scar. Fractional radiofrequency is well-tolerated procedure, which can be used for the effective treatment of scarring. It considered as an effective modality of treatment for moderate to severe acne scars.

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