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" Efficacy of Modified Jessner's Solution with Microneedling by Dermapen in Treating Atrophic Post Acne Scarring: a comparative randomized clinical trial"

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Abstract

Background: Acne vulgaris is one of the most common skin disorders accounting for more than the 85% worldwide. Although it usually occurs in adolescents from 15 to 24 years old, it is not uncommon to develop in adults either.

Aim and objectives: to assess the outcome and the efficacy of microneedling (dermapen) and Modified Jessner's solution application among patients with atrophic post acne scars.

Subjects and methods: This comparative randomized trial was conducted in dermatology outpatient under supervision of the staff of dermatology department at faculty of medicine Port Said University. This study was conducted on 30 patients with atrophic post acne facial scars according to Goodman and Baron scarring global quantitative grading system. The patients allocated randomly into two groups: group1 included 15 patients treated with microneedling only and group 2 included 15 patients treated with microneedling plus Modified Jessner's solution.

Result; There was statistically significant difference between the two studied groups regarding Goodmann and Baron Scale after third session. There were 73.3% in grade 1 among group 2 while there was only 1 patient classified as grade 1 among group 1. There was statistically significant difference between the two studied groups regarding satisfaction after third session. There were 86.7% satisfied among group 2 while there were 40% satisfied among group 1. Conclusion: both studied techniques were effective, safe, and had tolerable side effects for treating atrophic acne scars. The combined technique (dermapen and Jessner’s solution peeling) showed the best clinical improvement with the least number of sessions.

Keywords

scars; dermapen; microneedling; peeling; Jessner's

Introduction

More than 90% of adolescents have acne, and about 12–14% of those cases persist into adulthood with psychosocial consequences (Ghodsi et al., 2009). The extreme inflammatory reaction causes lifelong scarring in some people. Both superficial and deep dermis tissue alterations might be seen in scars (Fabbrocini et al., 2009). To evaluate the severity of acne scars on objective lines, Goodman and Baron (2006) established an easy-to-use, globally applicable classification system for acne scars.

There are various treatment options for acne scars including surgical techniques (punch graft, punch excision, punch lift, and subsection), regenerative techniques (dermabrasion, needle therapy, ablative laser therapy, chemical peels), non-ablative laser therapy, fat injection, and injection of fillers. The efficiency and safety of combining various techniques and tools have been also comprehensively studied. It has been noted that using multiple approaches provides greater outcomes than depending only on one type of treatment (Gozali et al., 2015).

Dermabrasion needles are an add-on for post-acne scarring control. The procedure is performed in an office setting and results in thousands of minute incisions across the epidermis and into the papillary dermis (Majid, 2009). This treatment is a potent stimulator to begin the natural healing process of wounds, as it causes the release of several growth factors that encourage fibroblast migration and proliferation and promote collagen deposition (Sarkar and Ballantyne, 2000), in addition to the small channels which are created by the dermal needle to increase the absorption of topical treatments (Bencini et al., 2012). The commercially available microneedling devices are dermaroller,

dermapen and derma stamp. Dermapen is specifically designed to combat these varieties while controlling penetration deep into the skin with micro-needles. It uses an electrically operated pen to deliver a vibrating-like motion onto the skin, creating a series of tiny channels in the skin (McCrudden et al., 2015).

Chemical peels can be an effective scar treatment. There are three categories of chemical peeling agents: superficial, middle depth, and deep peels (Coleman and Brody, 1997). Exfoliation results in controlled chemical exfoliation and partial thickness of the epidermis and dermis, which speeds up the skin's repairing process (Ali et al., 2019).

Classic Jessner's solution is a mixture of 100 mg of 95% ethanol, 14 g of resorcinol, 14 g of salicylic acid, and 14 ml of lactic acid, has been proven to be extremely efficient and secure for treating superficial scarring (Khunger and IADVL Task Force, 2008). Resorcinol, a significant component of Jessner's peels, was used in concentrations of 10–50% in the early 20th century, but these high concentrations were linked to side reactions, such allergic contact dermatitis, irritating contact dermatitis, and skin discolouration. Allergic reactions to resorcinol are reported to be rare, but lymph node assay tests have identified resorcinol as a skin sensitizer (Al-Talib et al., 2017).

Dr. Max Jessner then developed modified Jessner's solution to improve its overall effects as a keratolytic agent (Ladenheim and Marmur, 2021). Modified Jessner’s Solution is a medium depth chemical exfoliant which made up of 17% lactic acid, 17% salicylic acid, and 8% citric acid. The peeling strength is determined by the number of layers of the solution applied. Modified Jessner’s solution has been extremely well tolerated with minimal side effects as prolonged redness and hyperpigmentation (Lee et al. 2019).

The aim of the study:

This study is designed to assess the outcome and the efficacy of microneedling (dermapen) and Modified Jessner's solution application among patients with atrophic post acne scars.

Patients and Methods

A comparative randomized trial was carried out at the dermatology outpatient at Port said city under supervision of the staff of dermatology department at Port Said University. All patients presented with atrophic post acne facial scars according to Goodman and Baron scarring global quantitative grading system (2006), diagnosed by a trained dermatologist. Patients filled a written consent after receiving full information about setup and purpose of the study.

Exclusion criteria:

1. Patients on oral isotretinoin therapy.
2. Keloid scarring or patients with keloidal tendency.
3. Bleeding disorders (patients on anti-coagulant therapy should stop it 2 days before the session)
4. Patients on systemic steroids.
5. Active recent skin infections as viruses like warts and herpes also bacterial infections.
6. Pregnant and lactating patients.
7. Presence of skin cancers or solar keratosis.
8. Patients with collagen vascular disease and neuromuscular disease.
9. patients on systemic steroids
10. active recent skin infections
11. pregnant and lactating patients
12. presence of skin cancers or solar keratosis a
13. patients with collagen vascular disease and neuromuscular disease.

The calculated sample size was 15 participants per group. Given the fact that we have two groups, the total sample size was **30**.

Methods and evaluation:

- The qualitative scarring grading system developed by Goodman and Baron (2006) was used to examine the patients and grade the acne scars. Qualitative scarring grading system:

Score	Description
(1)	Macular: These scars can have hyperpigmentation, hypopigmentation, or erythematous flat markings. Contrasting with other types of scarring, this issue is one of colour rather than contouring.
(2)	Mild atrophic or hypertrophic scars: They can be well concealed with makeup, which is the natural colour of trimmed beard hair in men and may not be noticeable at social distances of 50 cm or more.
(3)	Moderate atrophic or hypertrophic scars: It can be flattened by manual skin pulling but only at social distances of 50 cm or more and cannot be easily concealed by body hair, makeup, or men's natural beard colour (if atrophic).
(4)	Severe atrophic or hypertrophic scarring: that can't be easily concealed by make-up, the natural colour of a man's shaved beard, or the body, and that can't be flattened by manual skin pulling when it shows at social distances of more than 50 cm.

- They were explained about the microneedling with dermapen and Modified Jessner's solution application and its components of 17% lactic acid, 17% salicylic acid, and 8% citric acid (MJS/1, Co- Delasco's founder, Approximate pH is 1.7).

The used dermapen device is electric pen, ULTIMA-A6; Advanced Microneedling System, Dr.pen electronic technology Co., China that consists of a hand piece, recharging battery, and needle tips (12 needles) with adjustable needle length of 1.5 mm.

- Patients had a discussion regarding the treatment's advantages, duration, potential adverse effects, and prognosis. The consent was gained with knowledge.

- Prior to and following therapy, digital pictures of every patient were obtained for grading and evaluation by Nikon digital camera D5100 (KCC-REI-NKR-D5100 CO., Thailand).

- Microneedling sessions were three sittings with six weeks apart and follow up during interviews was conducted after 6 weeks from the last session. They were evaluated every session for efficacy of the procedure.

The patients were prepared before the session by applying tretinoin 0.025% topical cream on the skin once daily for two weeks and discontinue it two days before the procedure.

- Prior to the procedure, a thick layer of topical anaesthetic cream (Emla5%) (25 mg of lidocaine and 25 mg of prilocaine) was used to anaesthetize the area of concern. The cream was then slowly removed.

The patients were randomly assigned to one of two groups:

Group 1:

-The skin was cleansed by ethyl alcohol and we used Vaseline to protect sensitive areas, as nose corners and lips.

-Then microneedling was performed using dermapen on a dry skin.

- Patients were given instructions on how to properly moisturize after the session and how to use a topical antibiotic three times a day for five days following treatment to prevent subsequent bacterial infection. They were also told not to forget to use a suitable sunscreen.

Group 2:

- Identical to group 1, except after every session, we put one layer of the peeling. Modified Jessner's solution was applied with a cotton-tipped applicator to the affected areas.

-This kind of peel had to be left undisturbed (without application of water or oil) on the skin for 15 minutes post-treatment then rinsed with water.

-Modified Jessner's acid peel is self-neutralizing but there are some cases cannot tolerate the peel till the point of self-neutralization so acid neutralizer Sodium Bicarbonate 10% solution was necessary to be used if frosting observed to neutralize the reaction between the acid and skin.

-Patients were instructed with the same after session instructions as group 1.

Statistical analysis

The 26th version of the SPSS program (Statistical Package for Social Science) was used to computerize and statistically analyze the acquired data. Every statistical comparison used a two-tailed significance test. P-values less than

0.05 denote non-significant variations, whereas P-values more than 0.05 denote significant difference exists.

Results

According to age among the two studied groups, the mean age was 29.1± 5.4 among group 1 and 26.5± 4.9 among group 2. There was no statistically significant difference between the two studied groups.

According to Gender distribution among the two studied groups, there were 13.3% males and 86.7% females among group 1. There were 20% males and 80% females among group 2. There was no statistically significant difference between the two studied groups.

After the first session and after the second session there was no statistically significant difference between the two study groups in terms of the Goodmann and Baron scale (Tables 1 and 2) and in terms of satisfaction **(Figures 1 and 2).**

Table 1. Goodmann and Baron scale after first session among the two studied groups.

Variables	Group 1	Group 2	P value
Grade 2 n (%)	2 (13.3)	4 (26.7)	0.379
Grade 3 n (%)	8 (53.4)	9 (60.0)	
Grade 4 n (%)	5 (33.3)	2 (13.3)	

Fisher Exact test: *p is significant at <0.05

Table 2: Goodmann and Baron scale after second session among the two studied groups

Variables	Group 1	Group 2	P value
Grade 1 n (%)	0 (0)	2 (13.3)	0.526
Grade 2 n (%)	4 (26.7)	5 (33.3)	
Grade 3 n (%)	10 (66.7)	8 (53.4)	
Grade 4 n (%)	1 (6.7)	0 (0)	

Fisher Exact test: *p is significant at <0.05

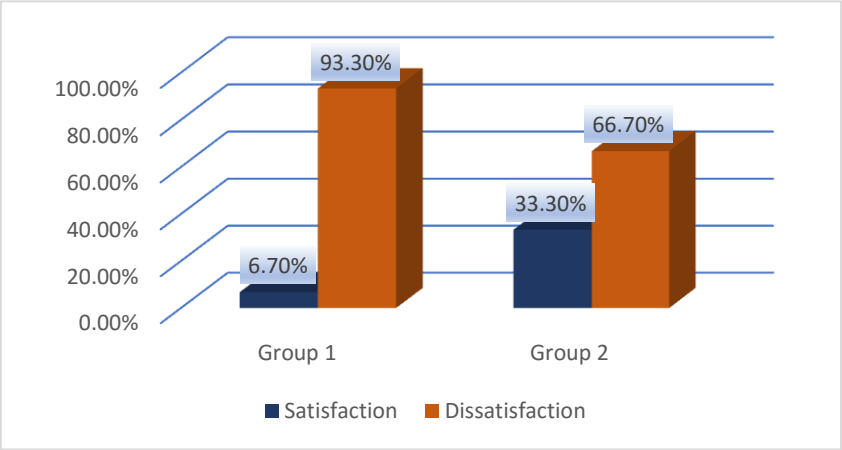


Figure 1: Satisfaction after first session among the two studied groups

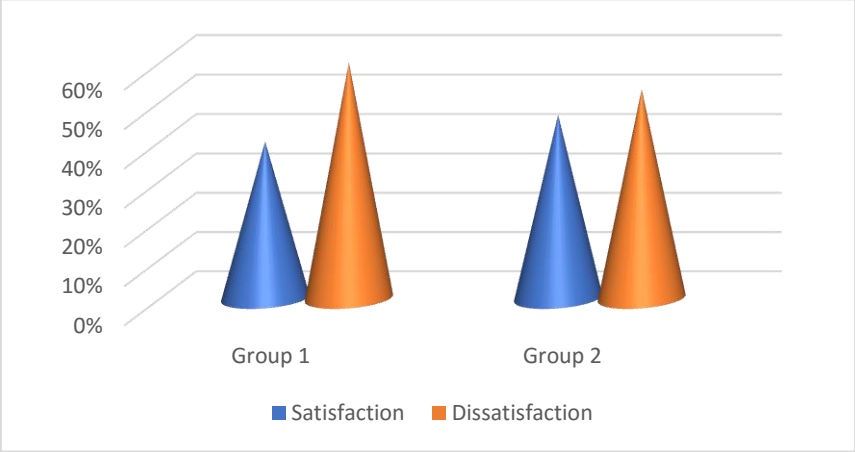


Figure 2: Satisfaction after second session among the two studied groups

After the third session, there was a statistically significant difference in the Goodmann and Baron Scale scores (Table 3) as well as patients' satisfaction (Figure 3) between the two study groups. There were 73.3% in grade 1 among group 2 while there was only 1 patient classified as grade 1 among group 1, and there were 86.7% satisfied among group 2 while there were 40% satisfied among group 1, denoting more favourable results among group 2. There were no side effects have been noticed in any patient during this trial.

Table 3: Goodmann and Baron scale after third session among the two studied groups

Variables	Group 1	Group 2	P value
Grade 1 n (%)	1 (6.7)	11 (73.3)	**0.001***
Grade 2 n (%)	9 (60)	3 (20)	
Grade 3 n (%)	5 (33.3)	1 (6.7)	

Fisher Exact test; *p is significant at <0.05

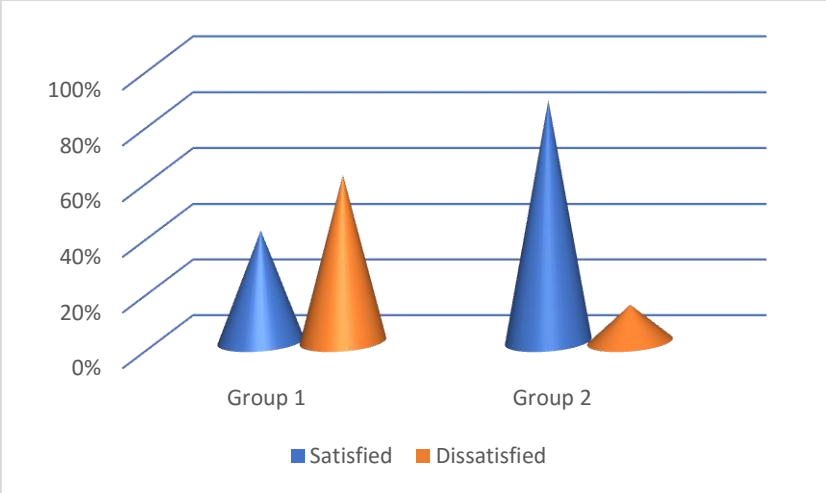


Figure 3: Satisfaction after third session among the two studied groups.

Comparing the scar scale as well as patients' satisfaction before and after therapy in all patients, both statistically significantly improved (Tables 4 and 5).

Despite improvement, comparing baseline scar scale and after treatment showed no statistically significant difference in group I. However, there was weak statistically significant difference in group II (Tables 6 and 7).

Table 4: Comparison between the baseline scar scale and after treatment

Variables	*Pre-treatment*	*After treatment*	*P value*
Scar scale Mean± SD	***3.3± 0.8***	***1.8± 0.8***	***<0.001****

Paired t test: *p is significant at <0.05

Table 5: Comparing satisfaction before and after treatment

Variables	*Pre-treatment*	*After treatment*	*P value*
Satisfaction scale Mean± SD	*0.2± 0.4*	*0.6± 0.5*	*0.001**

Paired t test: *p is significant at <0.05

Table 6: Comparing baseline scar scale and after third session scale in Group I:

Grade	*Baseline scale*	*After third session scale*	*p-value*
Grade 1	*0*	*1*	*0.638*
Grade 2	*1*	*9*	
Grade 3	*6*	*5*	
Grade 4	*8*	*0*	

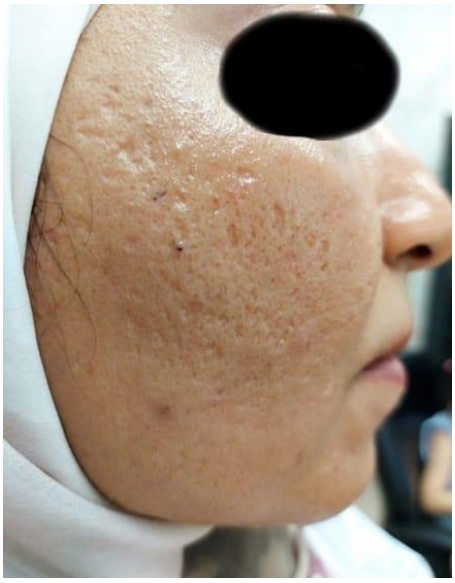
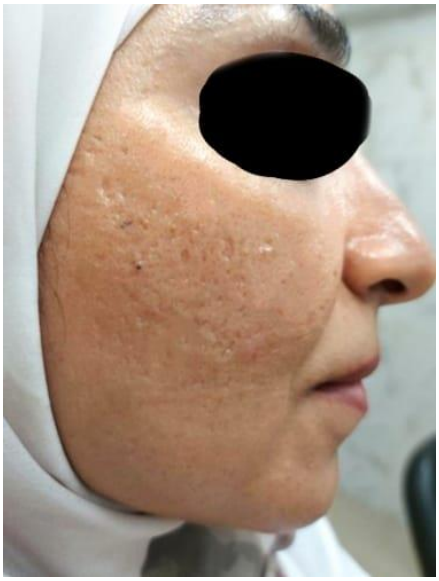
Paired t test: *p is significant at <0.05

Table 7: Comparing baseline scar scale and after third session in Group II:

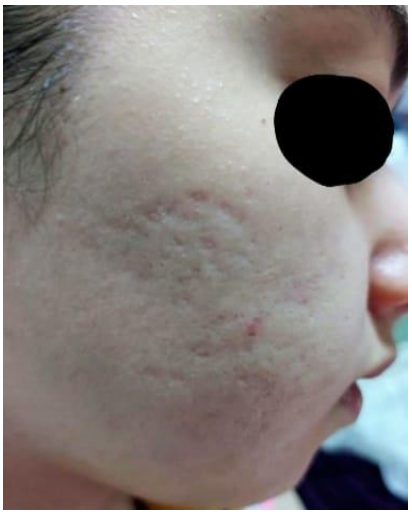
Grade	*Baseline scale*	*After third session scale*	*p-value*
Grade 1	*0*	*11*	*0.064*
Grade 2	*4*	*3*	
Grade 3	*4*	*1*	
Grade 4	*7*	*0*	

Paired t test: *p is significant at <0.05

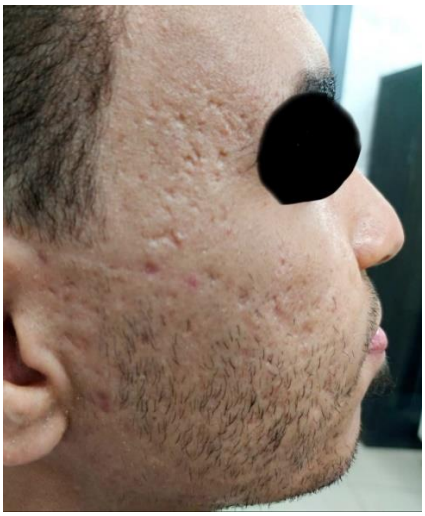
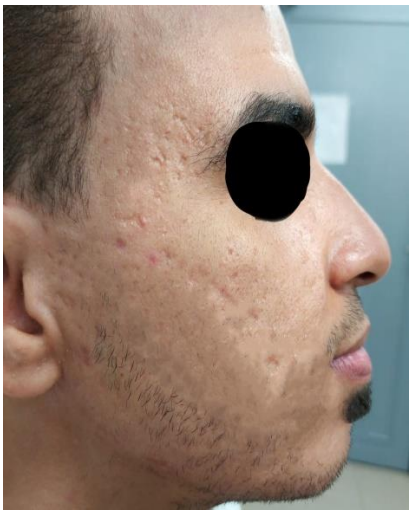
Clinical photos for some of the study patients are shown in Figures 4-10).

	
Before	After

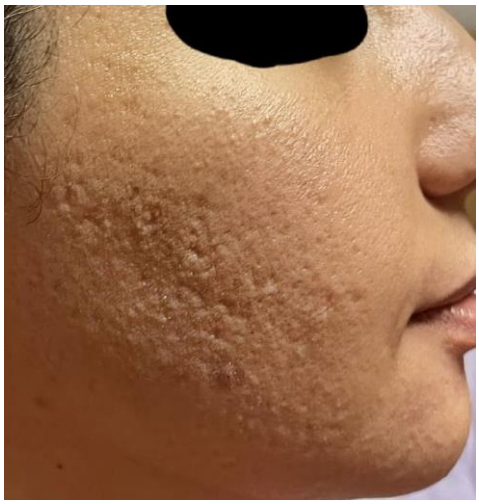
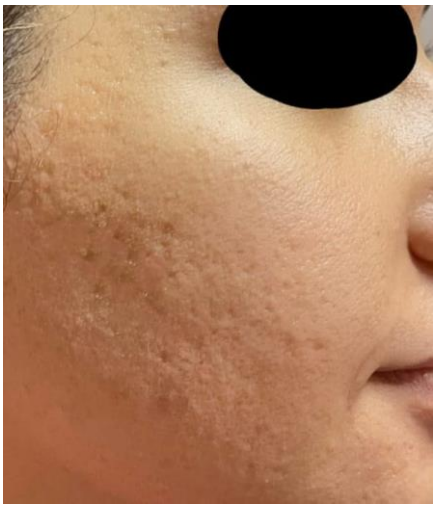
(Figure 4) Group II case: A case of a 39-year-old female with atrophic acne scars. After three sessions of combined dermapen and modified Jessner's solution therapy, the grade (using the Goodman and Baron qualitative grading system) dropped from 4 to 3, showing significant improvement.

	
Before	After

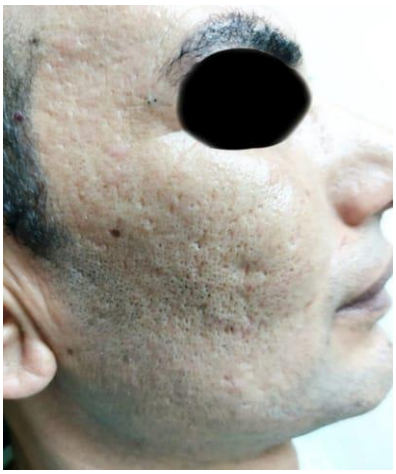
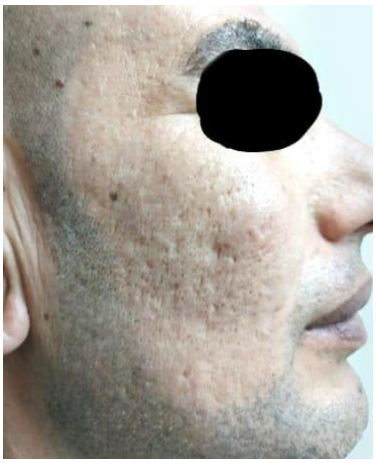
(Figure 5) Group II case: A case of a female patient, age 20, with atrophic acne scars. The grade was 4 prior to treatment (according to the Goodman and Baron qualitative grading system), and after three sessions of dermapen and modified Jessner's solution, the grade was 2, showing a highly significant improvement.

	
Before	After

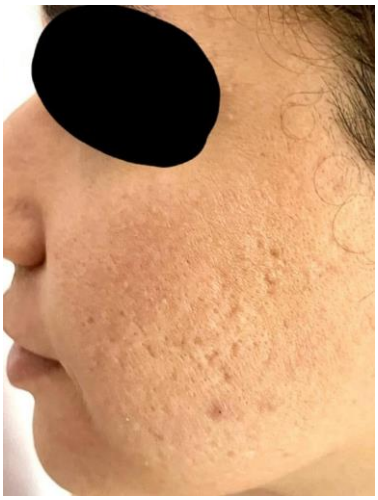
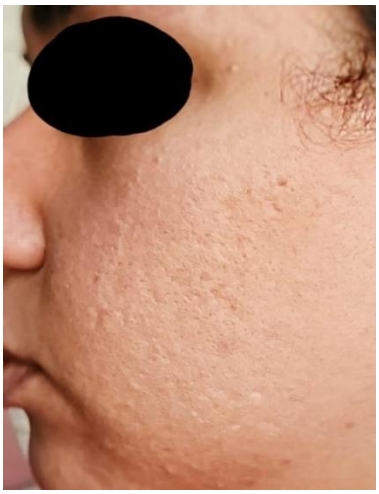
(Figure 6) Group II case: A male patient, age 25, who had atrophic acne scars. The grade was 4 prior to treatment (according to the Goodman and Baron qualitative grading system), but it improved to 3 following three sessions of dermapen and modified Jessner's solution.

	
Before	After

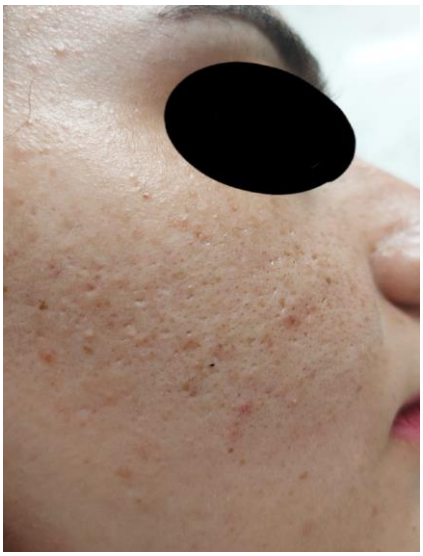
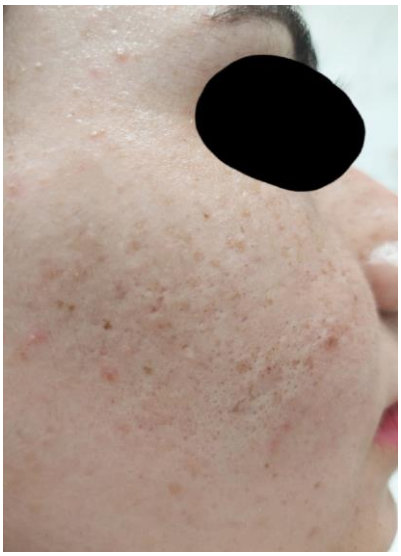
(Figure 7) Group II case: A case of a 31-year-old female with atrophic acne scars. After three sessions of combined dermapen and modified Jessner's solution therapy, the grade (using the Goodman and Baron qualitative grading system) dropped from 4 to 3, showing significant improvement.

	
Before	After

(Figure 8) Group I case: A 40-year-old male patient with atrophic acne scars. Grade 4 prior to treatment (according to the Goodman and Baron qualitative grading system), and grade 4 following three sessions of dermapen therapy alone.

	
Before	After

(Figure 9) Group I case: A 29-year-old female patient with atrophic acne scars. Grades 4 and 3 prior to treatment (according to the Goodman and Baron qualitative grading system), and grades 3 and 2 following three sessions of dermapen therapy alone.

	
Before	After

(Figure 10) Group I case: A 25-year-old female patient with atrophic acne scars. Grade 3 prior to treatment (according to the Goodman and Baron qualitative grading system), and grade 2 following three sessions of dermapen therapy alone.

Discussion

The use of microneedling, also known as "collagen induction therapy," as a non-pharmacological therapeutic method for acne patients has increased during the past ten years. It is a straightforward, affordable, and well-tolerated technique based on repeated physical damage to the skin brought on by sterile microneedle penetration and leading to dermis regeneration (Chandrashekar et al., 2014).

After the epidermis is physically damaged, platelets and neutrophils are drawn in, and they release growth factors including TGF-alpha, TGF-beta, and platelet-derived growth factor (PDGF), which cause the papillary layer of the dermis to produce collagen and elastin (Fernandes, 2005). Different studies reported that microneedling resulted in clinical improvement in acne scars by occurrence of selective dermal injury that leads to wound healing repair response by increasing the growth cytokines synthesis, collagen and elastin deposition and decreases inflammatory markers (Mujahid et al., 2020). Microneedling techniques show interesting benefits compared to ablative therapies, as

microneedling does not cause thermal damage. Epidermal lesions typically show a fast regeneration, less downtime, and fewer non-serious adverse events. It is also of low cost and is readily available to a wide patient population (Juhansz and Cohen, 2020).

Jessner's solution (JS): Salicylic acid (14%), resorcinol (14%), and lactic acid (14%), combined in 95% ethanol, perform as a superficial peeling agent. Each JS component has a unique impact on post-acne scarring. JS has also been shown to be effective in treating acne vulgaris, in particular because of its high level of safety, short recovery period, and little side effects (Grimes, 2012).

Combining microneedling with superficial or medium chemical peeling has been studied for acne scars in several previous studies and showed potentiation of microneedling effect with significant improvement (Ali et al., 2019; Rana et al., 2017; Garg & Baveja, 2014; Sharad, 2011). We chose to combine microneedling with modified Jessner’s solution (17% lactic acid, 17% salicylic acid, and 8% citric acid) due to its likely efficacy with minimal side effects, such as prolonged redness and exfoliation (Ali et al., 2019).

Our study showed significant improvement of scar score after combined microneedling and modified Jessner’s solution peeling with more favourable satisfaction.

In agreement with our study, Ali et al. (2019) used microneedling and Jessner’s solution on sixty patients with atrophic acne scars divided into three groups: group I was treated with dermapen only, group II was treated with Jessner’s solution peel only and group III was treated with miconeedling followed by Jessner’s solution. There was a significant clinical improvement of acne scars in group III than in group I and group II, and boxcar scars showed the best clinical improvement in all studied groups, denoting that combined technique (dermapen and Jessner's solution peeling) showed the best clinical improvement with the least number of sessions for atrophic acne scars treatment.

Additionally, the research by Rana et al. (2017) compared the effectiveness of microneedling alone with a combination of microneedling and serial 70% glycolic acid peel in the treatment of atrophic acne scars, concluding that combining microneedling with a sequential 70% glycolic acid peel improved scars and enhanced skin texture more than when microneedling is used alone.

Our findings are further supported by research by Garg & Baveja (2014) who used subcision and microneedling with 15% TCA peel. They found that this combined treatment was effective in treating Grades 2, 3 and 4 acne scars, with the best results achieved with Grade2 (all 11 (100%) patients with Grade 2 scars were left with no scars), with high degree of patient satisfaction.

Additionally, Sharad (2011), who used microneedling with glycolic acid peel, observed that superficial and moderately deep scars were significantly improved (grade 1–3), with decreased post-acne pigmentation and improvement in skin texture.

Despite improvement, our results regarding microneedling alone showed statistically insignificant difference in scar score after treatment, with less favourable patient satisfaction, compared with combined treatment group.

Dogra et al. (2014) studied the efficacy and safety of microneedling treatment alone for Asians with atrophic facial acne scars. Contrary to our results in group I, their results showed "good response" in 22 patients and "excellent response" in four patients, at the end of study. The procedure was well tolerated by most of the patients, and chief complications noted were postinflammatory hyperpigmentation in five patients and tram-trek scarring in two patients.

In contrast to our research, EL-Domyati et al. (2015) found that microneedling skin therapy significantly improved post-acne atrophic scars, skin texture, and patient satisfaction when compared to baseline. Moreover, Majid (2009) found that out of 36 patients received microneedle treatment by

dermaroller, 34 achieved a reduction in the severity of their scarring by one or two grades. More than 80% of patients assessed their treatment as ‘excellent’ on a 10-point scale.

The discrepancy between our results and the above-mentioned studies’ results could be due to different study populations, technique of microneedling, and number of sessions. Further studies on larger numbers with different microneedling techniques and for extended number of sessions are warranted.

Conclusion:

It can be said that combining procedures for treating atrophic acne scars was successful, secure, and had nearly no side effects.

Compared to microneedling alone, the combination (Dermapen and Modified Jessner solution peeling) showed greater outcomes with the fewest sessions in terms of clinical improvement. To support the present findings and evaluate treatment side effects, more research with a bigger sample size is required.

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