

Combination Treatment of Skin Needling, Platelet-Rich Plasma and Glycolic Acid 70% Chemical Peeling for Atrophic Acne Scars in Fitzpatrick's Skin Type IV–VI

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Abstract

Background: Acne scar is disfiguring, both physically as well as psychologically. Combination of various treatment give excellent results in the treatment of atrophy acne scar in Fitzpatrick skin type IV - VI.

Objectives: To evaluate the efficacy and safety of combination of skin needling, platelet-rich plasma and glycolic acid 70% chemical peeling for atrophic acne scars in Fitzpatrick's skin type IV-VI

Patients and methods: Seventeen patients (7 males and 10 females) with atrophic acne scars were enrolled in this study. Combination of skin needling, platelet-rich plasma and glycolic acid 70% chemical peeling were done for all patients. Patients were followed up every 3 weeks. Subjects were photographed and analyzed using the Facial Skin Image Analysis (FSIA) before and after treatment.

Result: Seventeen patients completed the study and follow up period. The mean FSIA score at the baseline and at the end of the study were 22.10 and 20.16 respectively, with $p < 0.05$.

Conclusion: Based on Facial Skin Image Analysis results, also considering the efficacy and safety profile, combination of skin needling, platelet-rich plasma and glycolic acid 70% chemical peeling can be the treatment of choice for atrophic acne scars among people with Fitzpatrick Skin Type IV-VI.

Keywords: Atrophic acne scar; Skin needling; PRP; GA 70% chemical peeling

Introduction

Acne is a common inflammatory disease of the pilosebaceous follicle, and despite advances in the treatment of acne, scar are the most complications from acne. Unfortunately, scarring occurs early, because of inappropriate or delayed treatment [1]. Scar is defined as "the fibrous tissue that replaces normal tissue destroyed by injury or disease". Causes of acne scar formation can be broadly categorized as either the result of increased tissue formation or, more commonly, loss or damage of local tissue [2].

One classification system frequently used in clinical practice for acne scars is based on both clinical and histological features. Atrophic acne scars are classified into three basic types depending on width, depth, and 3-dimensional architecture which are icepick scars, boxcar scars, and rolling scars. Icepick scars: narrow (diameter < 2 mm), deep, sharply marginated and depressed tracks that extend vertically to the deep dermis or subcutaneous tissue. Boxcar scars: round to oval depressions with sharply demarcated vertical edges. They are wider at the surface than icepick scars and do not taper to a point at the base. These scars may be shallow (0.1-0.5 mm) or deep (≥ 0.5 mm) and the diameter may vary from 1.5 to 4.0 mm. Rolling scars: occur from dermal tethering of otherwise relatively normal-appearing skin and are

usually wider than 4 to 5 mm in diameter. An abnormal fibrous anchoring of the dermis of the sub cutis leads to superficial shadowing and to a rolling or undulating appearance of the overlying skin [2].

There are different techniques in treating various types of acne scars. There is no single technique that effective for the various types of acne scars, and the treatment has to be combination between several modalities or several techniques. Subcision, mid infrared laser, fractional laser, dermabrasion/microdermabrasion, punch techniques, dermal grafting, chemical peeling using trichloroacetic acid and glycolic acid have been used in combination for acne scar with good results.

Skin needling; also known as micro needles (MN), Percutaneous Collagen Induction (PCI), Collagen Induction Therapy (CIT); is a procedure that involves using a sterile roller comprised of a series of fine, sharp needles to puncture the skin [3]. Skin needling are micron-sized, minimally invasive devices that breach the outermost layer of the skin, the stratum corneum (SC), creating transient, aqueous pores in the skin and facilitating the transport of therapeutic molecules into the epidermis. To overcome the issues of varying pressure application by physicians/users and the subsequent skin needling depth penetration achieved, an advanced skin needling device named the Dermapen® has been designed. It is described by manufacturers as a spring-loaded, fractional skin needling device, with an adjustment ring allowing for alteration of the heights of the skin needling, which carries out the function of 'fractional mechanical resurfacing'. It utilises an electrically

powered pen to deliver a vibrating stamp-like motion to the skin, creating a series of micro-channels in it [4]. Skin needling is a relatively new technique in the armamentarium of acne scar management.

Platelet-rich plasma (PRP) is an autologous solution of plasma containing 4-7 times the baseline concentration of human platelets. It is prepared from centrifuging the patient's own blood. Platelet-rich plasma has been used for various dermatological conditions including wound healing, anti-inflammatory, and cosmetic uses. Platelet-rich plasma contains various growth factors (GF) contained in alpha granules and dense granules. Alpha granules contain seven fundamental GF: the platelet derived growth factors (PDGF α , PDGF β , PDGF γ), transforming growth factor beta (TGF β 1 and 2), epithelial growth factor (EGF) and vascular endothelial growth factor (VEGF). These growth factors modulate cell proliferation, differentiation, angiogenesis, and chemotaxis [5].

Superficial chemical peeling is utilized to induce a damage limited to the epidermis and papillary dermis, which results in epidermal regeneration and postinflammatory collagen neof ormation. Because their potency is mild, repeated treatments are required to obtain the desired effects [6].

To evaluate and analyze the result of the acne scar treatment, this study used Face Skin Image Analysis (FSIA). It is a valid and reliable computer program in evaluating skin surface contour based on digital image. Images of acne scar and healthy skin will be taken from as far as 1.5 meters in distance, 30 degrees of angle, with a lamp set on 1.5 meters height. Face skin contour will also be analyzed from 1 x 1 cm cropped part of the image which determined by the anatomical point, such as the edge of the nose for cropping the cheek.

Material and Methods

Subject

This present study was conducted on 17 patients (seven males and ten females) with Fitzpatrick skin type IV to VI with different types of atrophic acne scars. The study was approved by the research committee of Saiful Anwar Regional Hospital, Malang, Indonesia. The informed-consent has been obtained from all the patients participating in this study. For the purpose of showing the result, the author took the patients' photo before and after the treatment, from the front and the side.

Treatment protocol

Patients were subjected to three months of treatment (6 sessions at 3-week intervals). Erythema, edema, hypo- or hyperpigmentation were monitored during each visit.

Their face was thoroughly cleaned with saline. The procedure of skin needling was performed under topical anaesthesia in the form of a eutectic mixture of lidocaine and prilocaine. The cream was applied to the treatment area as a thick coating and left for 30 minutes under occlusion before it was gently removed.

To create PRP, twenty cc of venous blood was collected from the antecubital vein under complete aseptic conditions into tubes containing sodium citrate (10:1) as an anticoagulant. The citrated whole blood was subjected to two centrifugation steps; the initial centrifugation at 1419 g for 7 minutes to separate the plasma and platelets from red and white blood cells. The resulting plasma supernatant, which contains the suspended platelets, was harvested to

a second centrifugation step at 2522 g for 5 minutes, leading to separation of the plasma into two portions: PPP and PRP. The lower 2 cc of the plasma was yielded as PRP concentrate after centrifugation. Then PRP was activated by adding calcium chloride immediately before the injection [7] (Figure 1).

Dermapen[®] is an electric hand piece with a disposable needle tip containing 12 microscopic needles. The internal motor of Dermapen[®] causes the needles in the tip to deliver a vibrating stamp-like motion to the skin. The Dermapen[®] penetrates through the epidermis, which is only punctured and heals rapidly. Both the stratum corneum and the epidermis remain intact except for the minute holes. The endpoint for any treatment session was the presence of uniform bleeding points over the scarred area. The serous ooze was wiped away with sterile saline solution, and then the PRP was placed on the face immediately after skin needling procedure. After several minutes, a thin layer of topical antibiotic "fusidic acid" cream was applied to the treated areas, and then moisturizing cream until the erythema resolved. Patients were advised to avoid the use of scrubs, loofahs and to avoid sun exposure by using sunscreens with a sun protection factor (SPF) value of 30 during the day.

Three weeks after skin needling, GA 70% chemical peeling was performed on the full face. Each patient underwent 3 sessions of skin needling and 3 sessions of GA peels. All patients were assessed and photographed at the end of each treatment (Figure 2).

Statistical analysis

The data were coded and entered using SPSS version 17, and were summarized using means standard deviations for quantitative variables. The mean FSIA score of acne scar was computed, at the time of presentation and after the completed treatment. The statistical significance of the difference in FSIA score was estimated using two-tailed paired t-test at 5% significance level.

Results

After successfully completing the treatments, the authors have analyzed the efficacy of skin needling, PRP and glycolic acid 70% chemical peeling on different types of acne scars. All patients have completed their participation. The patients, ranging in age from 18 to 52 years, with the mean age 29.71 years, were recruited from the dermatology outpatient clinic of Saiful Anwar Regional Hospital, Malang, Indonesia. All patients have showed clinical improvement of their acne scars appearance and also got reduction for FSIA score.

At the baseline, mean FSIA score of 17 patients was 22.10 (range 23.12-20.12). The acne scars on the patients were in various types (ice-pick scar, boxcar scar, and rolling scar type). After completing the study, mean FSIA score was 20.16 (range 21.98-19.27), and the difference from the baseline was statistically significant ($p < 0.05$) (Table 1).

All patients reported facial edema and slight pain but it resolved 72 hours after the procedure. By the fourth and fifth day, there was only mild erythema which resolved completely 1 to 2 days after procedure. Two patients developed postinflammatory hyperpigmentation after the first treatment of skin needling, but it resolved after the completion of the study. There were no infection-related complications shown by any of the patients (Figure 3).

| | Mean | Standard deviation | Standard error | p |
|------------------|---------|--------------------|----------------|-------|
| Before treatment | 22.1029 | .79394 | .19256 | 0.001 |
| After treatment | 20.1641 | .81535 | .19775 | |

Table 1: Mean FSIA Score.

Discussion

Acne scar is the most common cause of facial scarring. The psychological impact of acne and its scars can be devastating and is considered to be an important risk factor for suicide. The decision to do skin needling, PRP and glycolic acid 70% chemical peeling as the combination treatment was made scar anatomy differs even in the same patient [1].

Skin needling has been proved to be one of the treatments that effectively work to clear up the acne scars. Skin needling is a simple procedure for the treatment of acne scar and percutaneous drug delivery.

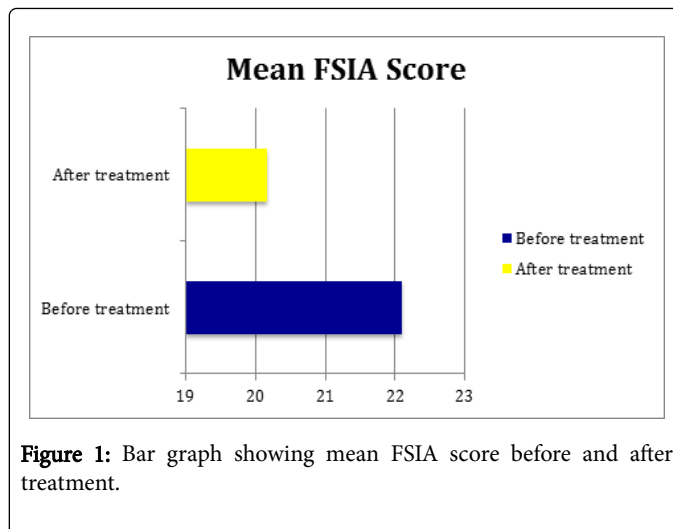


Figure 1: Bar graph showing mean FSIA score before and after treatment.

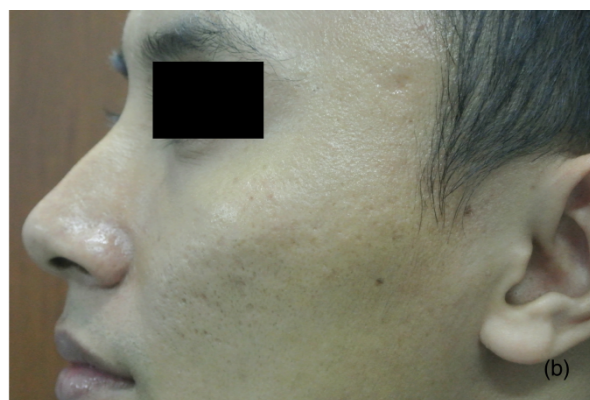
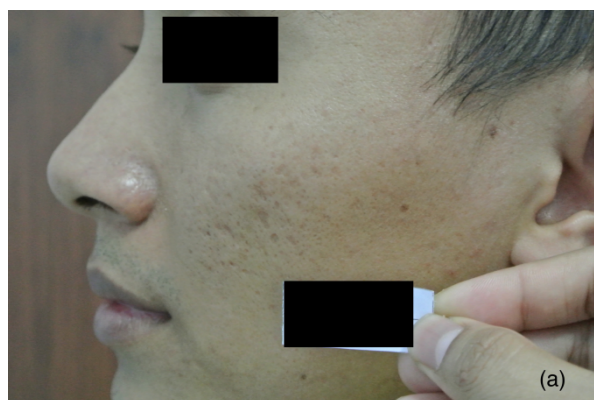


Figure 2: A patient with acne scars before (a) and after (b) treatment.

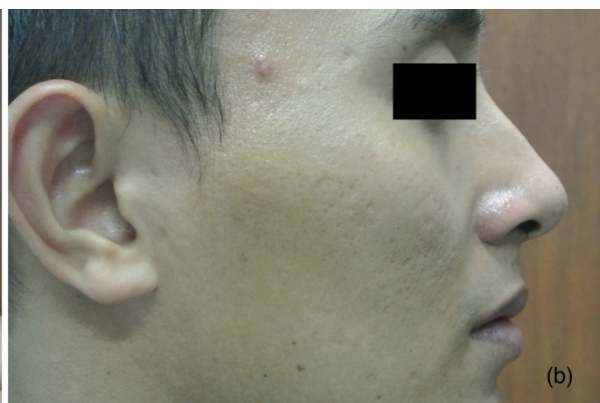
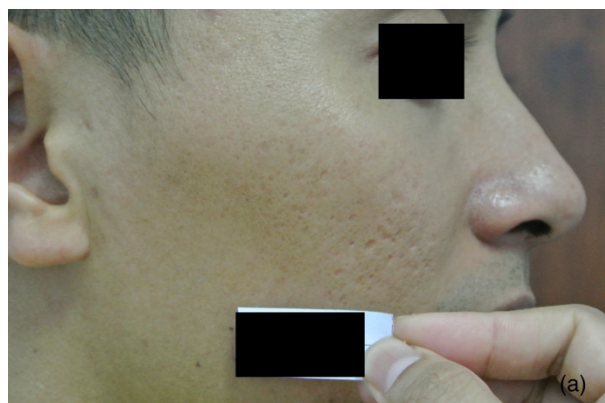


Figure 3: A patient with acne scars before (a) and after (b) treatment.

When a needle penetrates into the skin, it causes some localized damage and bleeding by rupturing fine blood vessels. A completely different picture emerges when thousands of fine pricks are placed

close to each other. The needles also break old collagen strands in the most superficial layer of the dermis that tether scars or wrinkles. This

process promotes removal of damaged collagen and induces more collagen immediately under the epidermis [3].

The other skin needling mechanism has been postulated that needles have their own electrical potential which triggers the proliferation of fibroblasts. The body reacts to any epithelial injury with electrical signals that controls cascade of wound-healing mechanisms. Under normal conditions, the interior of skin cells has a resting electrical potential of -70 mV. The extra cellular space as well as the skin's surface is charged positively. If an epithelial injury occurs, the skin cells release potassium and proteins that in return change the conductivity of the interstitium. At the same time, the inner cellular potential increases dramatically to -120 and more mV. This potential difference forces fibroblast to migrate to the point of injury and finally forces them to proliferate and transform into collagen fibrils. Revascularization and neocollagenesis fill up the atrophic scar tissue [8].

Aust et al. showed that skin needling does not cause any damage to the stratum corneum, other layers of the epidermis or the basal membrane and there is no dermabrasive reduction of epidermal thickness evident 24 hours after the procedure. The number of melanocytes neither increased nor decreased in any of the groups. This explains why skin needling can be repeated safely in dark skin [9].

The combination of skin needling and PRP in acne scar treatment was also used in Asif et al. study, which supported the effectiveness of the treatments in reducing the appearance of acne scars. It was explained that the injury to the dermis by skin needling acts in synergy with activated platelets, which modify the natural healing response from the beginning of inflammation to the initiation of collagen induction by releasing cytokines and growth factors. All these factors induce remodelling of acne scars. Thus the combination works well in treating the acne scars [10].

Superficial peeling with glycolic acid 70% can be performed for acne scar. It acts as an adjuvant to skin needling, to promote neocollagenesis leading to an improvement in the acne scars, and to improve existing post acne hyperpigmentation as well as any post inflammatory hyperpigmentation caused by skin needling itself. In this study, the purpose of glycolic acid 70% chemical peeling was for reduce the risk of post inflammatory hyperpigmentation due to skin needling treatment, because there were higher post inflammatory hyperpigmentation complication of skin needling in dark skin.

Conclusion

For more satisfying result in treating the acne scars, the combination of the treatment will be beneficial. This study has chosen the skin needling, PRP and glycolic acid 70% chemical peeling as the combination treatment for the acne scars of the selected patients. The

treatments chosen were for the convenience and safety for the patients' skin type.

After the three months treatment, all patients have shown great improvement of their acne scar appearance. There were facial edema and erythema reported, however it disappeared after two days.

Skin needling is an inexpensive and simple modality of treatment for the acne scar, has the advantages such as the epidermis remains intact and minimal downtime and also safe for skin types IV-VI. PRP gives synergy effects with skin needling for acne scar, and glycolic acid 70% peels causes reduction of postinflammatory hyperpigmentation risk. The combination of skin needling, platelet-rich plasma and glycolic acid 70% chemical peeling give additional improvement for acne scars compared to a single method alone.

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