

ORIGINAL ARTICLE

Subcision-suction method: a new successful combination therapy in treatment of atrophic acne scars and other depressed scars

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Abstract

Background Among therapeutic modalities of acne scars, subcision is a simple, safe procedure with a different and basic mechanism for correcting atrophic and depressed scars. Subcision releases scar surfaces from underlying attachments and induces connective tissue formation beneath the scar directly, without injury to the skin surface. Therefore, subcision is a valuable method, but due to high recurrence rate, its efficacy is mild to moderate.

Objectives To increase the efficacy of subcision, a new complementary treatment of repeated suction sessions was added at the recurrence period of subcised scars.

Methods In this before and after trial, 58 patients with mild to severe acne scars of various types (rolling, superficial and deep boxcar, pitted), chicken pox, traumatic and surgical depressed scars were treated by superficial dermal undermining, with mainly 23-gauge needles. The protocol for suctioning was: start of suction on third day after subcision for flat and depressing subcised scars and its continuation at least every other day for 2 weeks.

Results Forty-six patients followed the protocol completely, had 60–90% improvement in depth and size of scars (significant improvement) with mean: 71.73%. 28.2% of them had '80% improvement or more' (excellent improvement). Twelve patients started suction late and/or had long interval suction-sessions, had 30–60% improvement (moderate improvement) with mean: 43.75%.

Conclusion Frequent suctioning at the recurrence period of subcision increases subcision efficacy remarkably and causes significant and persistent improvement in short time, without considerable complication, in depressed scars of the face. Therefore, subcision-suction method is introduced as a new effective treatment.

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Keywords

acne scar, depressed scar, scar, subcision, subcision-suction method

Conflict of interest

None declared.

Introduction

Acne scars are one of the most common causes of facial scarring.¹ For reasons of high incidence and importance of this cosmetic problem, causing disfiguration and considerable psychological impacts on patients,^{2,3} a wide range of therapeutic modalities have been used to improve acne scars over years.⁴

Considering the fact that successful treatment of acne scars is challenging and difficult,^{4–7} new techniques have been added and older ones have been modified to improve risk-benefit profiles.^{6,8} Moreover, multiple modalities are often required in combination to provide optimal correction.²

Subcision (subcutaneous incisionless surgery) is a surgical intervention used to treat a variety of skin depressions including atrophic acne scars, depressed scars and wrinkles for years.^{9,10} In subcision, the mechanisms of scar improvement are: releasing fibrotic strands underlying scars, organization of blood in the induced dermal pocket and connective tissue formation in the area.^{9,10} Although subcision is safe, valuable and practical, depression recurrence is a very common side-effect and overall improvement is mild-to-moderate.^{11–14}

We also observed such common re-depression in our patients in the first 2–3 weeks after subcision as follows: start of re-depression

from 2–5 days after subcision, rapid progress of re-depression up to about the 10th day of subcision and gradual progression for about 1 week more. This is concurrent with absorption of oedema and haemorrhage in dermal pocket and completion of healing process of dermal wound. Therefore, considering the possibility of doing suction by microdermabrasion device, we hypothesized that repeated suctioning (or vacuum) of the subcised scars at the recurrence period might prevent re-depression by induction of repeated haemorrhage in dermal pocket, delay in healing and more new connective tissue formation at the scar area.

Therefore, we decided to use repeated suctioning on the subcised scars at the recurrence period as a complementary treatment to subcision and to evaluate the efficacy of this combination therapy in treatment of acne and other depressed scars.

Patients and method

In this before and after trial, we studied 58 patients suffering from mild-to-severe acne scars, chicken pox, traumatic and surgical depressed scars from May 2007 to August 2008.

Patients with active cystic acne, isotretinoin therapy in the previous 12 months, susceptibility to keloid formation, bleeding diathesis, taking drugs that prolong bleeding such as Aspirin and vitamin E and 'those who were not able to follow-up our suctioning protocol' were excluded.

Patients were enrolled in the study after being briefed about different acne scar treatments, informed by verbal and written explanations about our treatment method, and filling out a consent form.

Photographs were taken in standard fashion before subcision, immediately and 5 days after subcision, at the end of treatment course, 2 and 6 months after subcision.

Subcision-suction method

Step 1: Subcision

Subcisions were performed under constant conditions, in the same facilities and by the same surgeon, using identical technique.

Anaesthesia. To anaesthetize the treatment area, topical anaesthesia (EMLA cream) was used under occlusion 1–2 h pre-operatively. In patients with large number of scars on cheek(s), infraorbital nerve block was also performed. If Lidocaine injection was necessary, the scar margins were marked – to prevent the scar fading after injection – and Lidocaine was injected subcutaneously without Epinephrine.

Disinfection. The operation area was prepared using Povidone Iodine.

Patients' position. During the operation, the patients had sitting or semi-sitting position in which the scars, especially rolling ones, were more obvious compared with supine position.

Type of needle. We mainly used 23-gauge needles, by which undermining is easy. The 27-gauge needles (Insulin) could also be used for small and superficial scars. Nokor needles were used in few very fibrotic scars (Fig. 1a).

Subcision. We applied subcision for various types of acne scars including rolling, 'superficial and deep boxcars', and pitted scars (except ice-pick scars) as well as other types of depressed scars, no matter the number of scars on the face.

To facilitate the release of fibrotic tissue, the scar area was pinched or stretched to flatten the whole scar surfaces and the skin became tight and stable. The needle was inserted 1–2 mm from the target scar with the bevel upward and nearly parallel to the skin surface into the superficial dermis. First lancing motion (linear inserting-withdrawing needle motion) was performed sufficiently to release scar sub-surfaces including walls, base, borders or shoulders and 1 mm of the margin *IN SUPERFICIAL DERMIS* and finally fanning motion (side-to-side needle motion) was used to complete cutting of fibrous tissue in one plane (*SUPERFICIAL DERMAL UNDERMINING*). Sweeping the needle side-to-side under the scar without resistance and visible lifting up the scar surface was the end-point of the procedure (Fig. 1b–e). In some scars, especially large ones, 2–3 entry sites were needed to complete undermining of scars.

Homeostasis was achieved by just putting a piece of gauze *WITHOUT* pressure.

To improve the overall appearance of skin in patients with large number of scars, we subcised as many scars as possible, even small and superficial ones – mainly in the first session and the remaining, 5–6 days later.

A simple thin dressing was placed on the area and removed within 24 h. Oral antibiotic was also prescribed.

Step 2: Suctioning period

Considering the recurrence period of subcised scars, our protocol for suctioning was: starting suction sessions on the 3rd day after subcision and continuing at least every other day for 2 weeks.

We explained to the patients about maximum scar re-depression from the 3rd to 10th day after subcision and the potential effect of having more frequent suctioning within this period on the outcome. Therefore, based on their possibility to come to the clinic, the patients could have different suctioning sessions in the first week of suction period: at least every other day or even daily. In the 2nd week, all patients had every other day suctioning.

Suction procedure. Suctioning was performed with a hand-piece of microdermabrasion device-Clair Derm Australia- (*WITHOUT* crystal abrasion, with a 5 mm disposable nozzle) by a trained nurse, on the subcised scars, which had the same level as the skin or depressing. Suctioning was performed by both vertical and horizontal hand-piece motions non-traumatizingly.

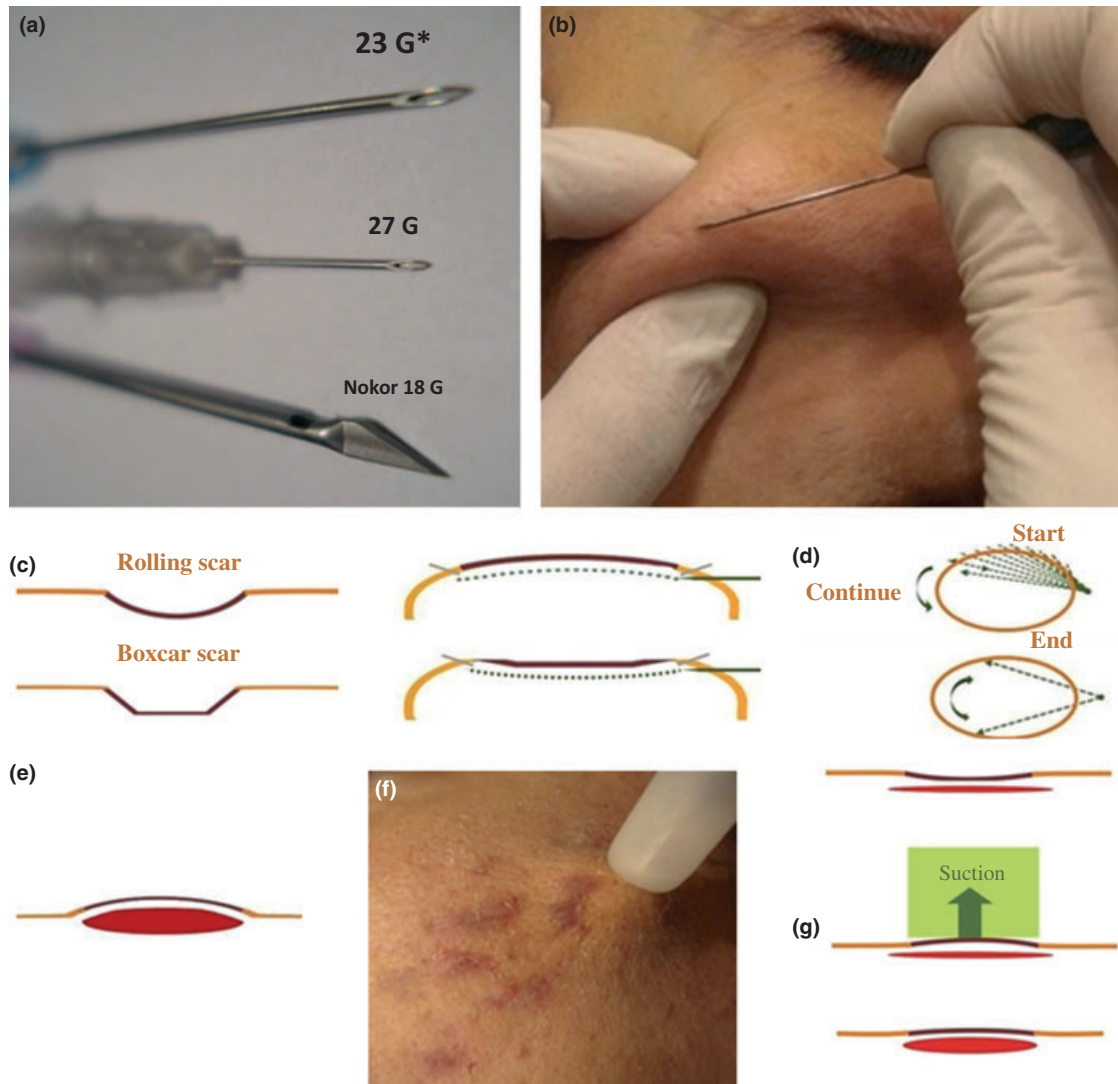


Figure 1 Subcision-suction method: (a) type of needles, (b and c) Pinching and/or stretching the skin make scar surfaces flat & enable us to perform subcision superficially in dermis: correct and complete releasing of whole scar surfaces especially walls, shoulders and only 1 mm of margins is very important in the outcome, (d) Lancing and fanning motions, (e) Schematic view: immediately after subcision (superficial dermal undermining), (f) Suctioning of the subcised scars, (g) Schematic view: effective suctioning of a depressing scar must lead to scar elevation above the skin surface.

In the beginning of suction period, elevated lesions were not suctioned until they became flat. On the first days, we used less negative pressure; but in the subsequent sessions, depending on the condition of scars, we could increase negative pressure (even to maximum: -70 mmHg), length of time (not more than 4 s in each pass) and the number of suctioning passes (even 8–12 passes) per session. ‘Effective suctioning caused oedema and haemorrhages in the subcised scars and led to *ELEVATION OF DEPRESSING SCARS ABOVE THE SKIN SURFACE*’ (Fig. 1f,g).

Assessment and grouping. Two investigators and the patients rated improvement of scars using percentage after

completion of treatment in two stages: 2 and 6 months. To assess the improvement, close visualization including comparison with preoperative photographs and clinical data were used. Scar elevation, decrease in size and smoother appearance of scars were attention points. Finally, the minimum rate on which both investigators agreed was considered as investigators’ view in the study.

At the end, to evaluate the role of suctioning frequency on the final results, patients were divided into group A, those who followed the treatment as per the protocol, and group B, those who did not follow it. Based on the suction sessions frequency on the first week of suctioning period, Group A was also divided into

two groups: almost daily (group A1) and every other day (group A2).

The results were also graded as mild (<30%), moderate (30%–60%), significant (60%<) and excellent (80%≤) improvement in comparison with the pre-operative conditions based on a semi-quantitative scale.

Data were analysed with SPSS (ver15) using Chi-square test. *P*-value less than 0.05 was considered statistically significant.

Results

A total of 58 patients (34 female and 24 male) were enrolled in our study. The patients' age ranged from 16 to 44 years (mean age: 28.68 ± 6.4). The skin type of patients was mostly type III (87.9%) and five of them (8.6%) had skin type IV. The number of subcised scars on patients ranged from 1 to 70 (mean 21.03 ± 16.35). Table 1 shows the scar distribution based on aetiology.

All the patients followed the treatment. Table 2 shows the results in different groups.

In group A, 46 patients, both investigators and patients observed 60–90% scar improvement (significant improvement). The mean improvement was about 70%. In many scars, the improvement was even 80–90% (excellent improvement). In other words, large scars changed into small or pitted ones (remarkable size reduction); and in boxcar and chicken pox scars, the base became nearly as level as the surrounding skin, although the borders did not disappear (remarkable scar elevation). This high grade of improvement was mostly in patients in group A1 who had almost daily suctioning in the first week of suctioning period (Fig. 2). 'The mean improvement' and '80% improvement or more' were signifi-

cant comparing groups A1 and A2 from the view points of investigators and patients. Table 3 shows the study findings.

All patients in group A (especially A1) were satisfied with considerable reduction in depth and size of scars and noticeable smoother appearance of their skin.

In group B, 12 patients who started suctioning late (5–7 days after subcision) and/or had long intervals (2–3 days) between sessions in the first week of suctioning period, the results were 30–60% (moderate improvement).

Based on this study, the following findings can be mentioned:

- Oedema of subcised areas diminished generally within 2–6 days.
- Bruising was observed in all cases. It was gradually absorbed within 7–12 days.
- Prominent features after suctioning were: increased haemorrhage (in the first week), oedema and 'elevation of scars which were depressed before suctioning'.
- Discoloration: In groups A1 and A2, some discoloration was for about 2 months and 1 month respectively. No hyperpigmentation was observed in any patients, even in those with skin type IV after about 2 months.
- Haemorrhagic papule and pustula: They were shiny purple haemorrhagic indurated raised lesions, containing blood and/or pus; determined on the 2nd to 5th day after subcision in some subcised scars (5.6%). The lesions were drained with a needle. For most lesions, it was necessary to repeat drainage in successive sessions and to prescribe topical antibiotic or steroid, as needed. Haemorrhagic papule and pustula could either be precursor for hypertrophic scars or induce long-term discoloration.
- Hypertrophic scars: These firm elevated scars mostly appeared quickly in course of haemorrhagic papule and pustule during 4th to 8th day after subcision. Totally, 1.7% of the subcised scars became hypertrophic (22 scars in six patients). In one patient without any detectable aetiology, six scars of eight subcised ones became hypertrophic with some days' delay. All the hypertrophic scars were managed from the early stages completely by Contractubex gel.

Table 1 Distribution of scars based on etiology

Scar origin	Number of patients	Percent (%)
Acne scar	45	77.6
Other depressed scars		
Chicken pox	6	10.3
Traumatic	6	10.3
Surgical	1	1.7
Total	58	100

Table 2 Classification of patients based on start of suctioning period and the number of suction sessions in the 1st week and improvement results after 6 months

Group	Number of patients	Mean improvement		'80% Improvement or more'	
		Investigators' view	Patients' view	Investigators' view	Patients' view
Group A*					
A1: Almost daily	24	74.37%	77.91%	41.66%	54.16%
A2: Every other day	22	68.86%	72.72%	13.66%	27.7%
Total group A	46	71.73%	75.43%	28.26%	41.5%
Group B†	12	43.75%	49.16%	–	–

*Patients who started suctioning from 3rd day after subcision and continued it at least every other day for 2 weeks. They were divided into group A1 & A2 based on the frequency of suction sessions in the first week of suction period.

†Patients who started suctioning late (5th–7th day after subcision) and/or had long intervals between sessions.



Figure 2 Results of subcision-suction method: (a) A schematic view: comparing depth, size and smoothness before and after subcision-suction method in group A1, (b) a patient in group A1 who had daily suctioning in the 1st week of suction period. The marked scars have not been subcised.

Table 3 Comparison of the results of the study from the view of statistics and clinical findings

Items	Comparison
Mean improvement between groups A1 and A2 by investigators	<i>P</i> -value = 0.041
80% improvement or more between groups A1 and A2 by investigators	<i>P</i> -value = 0.037
Mean improvement between groups A1 and A2 by patients	<i>P</i> -value = 0.029
80% improvement or more between groups A1 and A2 by patients	<i>P</i> -value = 0.031
Efficacy between patients and investigators	<i>P</i> -value = 0.85*
Improvement of acne scars & other depressed scars	<i>P</i> -value = 0.977†
Duration of bruising and discoloration	Group B < A2 < A1
Scar recurrence	Group A1 < A2 < B
Haemorrhagic papule & pustule and hypertrophic scar:	No difference between the groups‡

*The patients' and investigators' assessment of efficacy showed no significant difference.

†Improvement rate in patients with acne scars and other depressed scars was not significant.

‡These are complications of subcision; 63.64% of the hypertrophic scars were caused by subepidermal like undermining, 4.54% were caused by vigorous undermining and 31.82% were caused by skin susceptibility.

- Scar recurrence: scar re-depression, in different amounts, occurred mainly in the first week of suction period and minimally in the following week. The results at the end of

2 weeks suction period were nearly the same as the final results.

Discussion

There are various methods for treatment of atrophic acne scars.^{1,2,4,6} Selection of proper treatment for a patient depends on these important factors: skin type, type of scars, treatment downtime, efficacy, side-effects, treatment course, improvement persistency and patient's expectations. For example, in ablative methods, considerable factors are patient's skin type, downtime and risks of side-effects like infection, prolonged erythema and discoloration;¹⁵ in use of hyaluronic acid fillers, improvement persistency;¹² and in non-ablative and fractional resurfacing lasers, treatment course and efficacy are the points of attention.^{1,12,16–18}

Subcision is a simple, well-tolerated surgical procedure with no remarkable side-effects and applicable in any area of the face in minutes,^{11,13} although scar recurrence is a common limiting factor. Efficacy of subcision is 15–80%.^{11–14} In two studies, efficacy is mentioned mild (<30%)^{12,14} and in two others, the improvement is about 50%.^{11,13} In our study, the improvement average in patients with limited suction sessions was 43.75%, which is near subcision alone.

In our study, combination therapy of subcision and repeated suctioning, the improvement was 60–90% (mean: 71.73%). Moreover, 28.26% of patients had '80% improvement or even more'. Such improvement in subcision-suction method compared with subcision alone is quite remarkable and shows that repeated suctioning at the recurrence period increases the efficacy of subcision

significantly. This high rate of improvement is also significant compared with other acne scars treatments.^{12,16–18} ‘We believe that such improvement is due to attention to dermal nature of acne scar, using subcision as an effective method, considering the period of scar recurrence and the mechanisms and techniques of subcision and repeated suctioning’.

Atrophy and fibrous tissue formation following improvement of acne is the aetiology of depression in acne scars.¹⁹ In subcision, due to release of fibrotic tissue, scar surfaces separate from underlying attachment and blood dermal pocket is formed beneath the scar. Blood not only acts as a short-term spacer to keep the tissue from early attachment,^{4,6} but also the subsequent organization of blood is thought to induce connective tissue formation and correction of the defect.^{6,9} We used these points as the main selection criteria for repeated suctioning as a complementary treatment, which causes repeated haemorrhage, delay in early attachment of dermal wound and more new connective tissue formation during the healing process of the subcised scar. In other words, this method is based on elimination of the aetiology of depression and bound-down appearance of scars and causes scar augmentation by patient’s own connective tissue.

The important and differentiating points of subcision-suction method, contributing also to have significant outcome, are:

1. Subcision technique

In the beginning, it is better to have a brief review on subcision and acne scar treatments. Subcision is mostly used for rolling acne scars and is the treatment choice for them.^{2,11,13,14} There are some other choices for other scar types: punch elevation and scar excision for deep boxcars, dermabrasion and ablative resurfacing laser for superficial boxcars and punch excision for ice-pick scars.^{1,2} Therefore, to treat a patient with various types of scars, it would be necessary to use different methods.^{1,2} In addition, Nokor needle is known as a typical instrument for subcision,^{5,13} although 16–30 gauge needles are also used by different physicians.^{9,10} Subcision is also performed in various levels of skin,¹⁰ but mostly, deep dermis and at dermo-subcutaneous junction.^{2,11,13}

There are several considerable and differentiating points in this study:

We mainly used 23-gauge needles which are accessible for all, do not traumatize the skin at the insertion site; and easily cut the fibrous tissue of scars; and 27-gauge needles. The needles, and ‘pinching or stretching the skin’, enabled us to subcise *various types of acne scars including rolling, deep and superficial boxcars, and pitted ones* (except ice-pick); and also chicken pox, traumatic and surgical depressed scars. Subcision was also performed *in superficial dermis (SUPERFICIAL DERMAL UNDERMINING)*.

‘Superficial dermal undermining under the whole scar surfaces including base, walls, borders or shoulders and 1 mm of the margins was the key point of successful undermining for various types

of atrophic and depressed scars’ (Fig. 3b). Using this technique, most of acne scars of a patient in any type, number, shape and size could be treated in one session. Therefore, it was not necessary to use various methods to treat different scar types on a patient. Moreover, considerable change was achieved in overall appearance of scars and skin after one treatment course. These important points, as well as other advantages of subcision, differentiate ‘superficial dermal undermining’ from other acne scar treatments. ‘It must be noted that deeper undermining was not so effective in management of various types of scars’ (Fig. 3c).

There are some other modifications in subcision in this study:^{1,2,11,20} we did not mark the scars because of the types of anaesthesia and patient’s position during subcision; moreover, considering the role of blood in dermal pocket, we did not use Epinephrine, did not press the subcised area for haemostasis and did not use compressive dressing.

Finally, it is necessary to discuss about hypertrophic scars, which were the most important complication of subcision in our study, although they were just seen in 1.7% of total subcised scars. ‘Our etiologic investigation led to a considerable point: performing subcision too superficially (subepidermal like undermining), was the main aetiology for this complication in most scars’. The mechanism by which this technical error causes a hypertrophic scar is formation of a prominent subepidermal blood pocket, which consequently induces an elevated fibrous scar tissue immediately under the epidermis (Fig. 3a). Skin susceptibility was also another aetiology for hypertrophic scar in two patients (3.44% of patients). Therefore, in addition to taking a good history, having a few scar subcision tests 2 weeks before treatment may be practical.

2. Two-week suction period

Comparison of the results of our groups shows several important points:

The highest improvement was related to patients who had nearly daily suctioning in the first week of suction period: mean 74.37%, and ‘80% improvement and even more’ in 40% of patients (Fig. 3d). ‘This high improvement is also remarkable in current acne scar treatments’.^{12,16–18}

Moreover, the best time to start suctioning is the 3rd day after subcision; and the most important time for doing suction to prevent scar recurrence is the first week of suction period. Hence, we named this period the ‘Golden Time’. ‘Daily suctioning in this time increases the patient’s chance to have “80% improvement and more” significantly’. In addition, the second week of suction period has the maintenance role and stabilizes the results (Maintenance Time). Therefore, ‘to have the best outcome, daily effective suctioning on flat and depressing subcised scars in the golden time and its continuation every other day in the maintenance time are suggested’.

The advantages of this innovative method are: easy to apply, not too expensive tools, short down-time, applicable for various

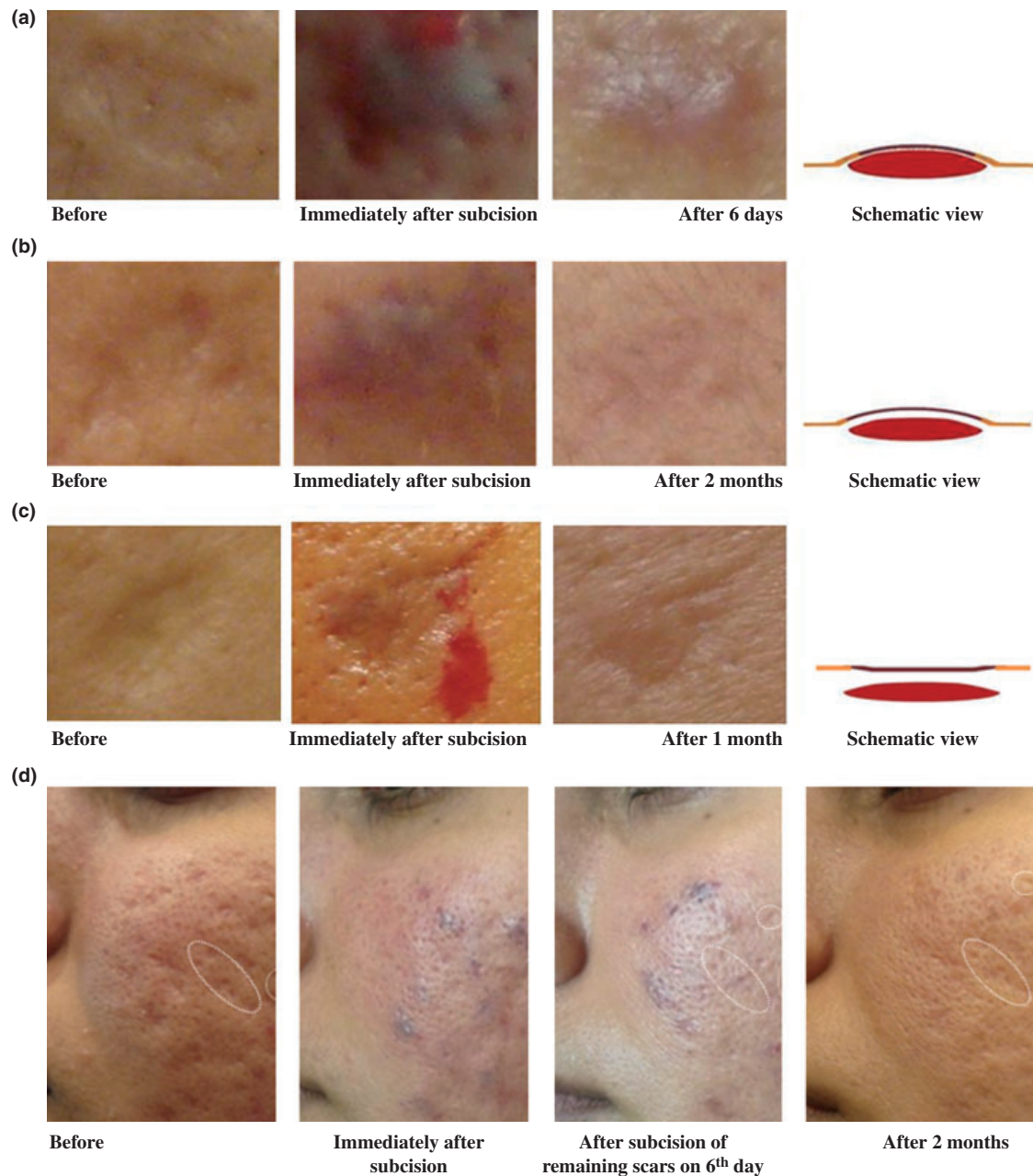


Figure 3 Performing subcision precisely is essential to have good outcome. (a–c) completely different results following subcision in different levels of dermis: (a) ‘Subepidermal like undermining’ by formation of subepidermal blood pocket causes hypertrophic scar. Undermining near epidermis is high risk for hemorrhagic papule and hypertrophic scar formation in subcision, (b) Superficial dermal undermining (undermining in superficial dermis or undermining superficially in dermis) is the correct subcision technique, (c) Deeper undermining is not effective in release of all scar surfaces especially walls, shoulders and margins, (d) a patient in group A1 who had daily suctioning in the 1st week of the suction period. The marked scars have not been subcised.

skin types (I–IV), applicable for different types of acne and other depressed scars, just working on the scars, no significant complications; and finally, remarkable and persistent improvement in short time without injury to the skin surface.

The disadvantages, mostly unremarkable, are: pain at the time of subcision in some cases, bruising, transient discoloration, haemorrhagic papule and pustule (because of nearly subepidermal undermining, comedone in the area and infection), hypertrophic

scar (because of subepidermal or vigorous undermining; infection, skin susceptibility or needle reaction), necessity of frequent suctioning sessions and somewhat recurrence.

Considering the points discussed, we introduce subcision-suction method as a highly effective method for treatment of various types of acne scars and other depressed scars of the face. It seems that this method has the potential to be used as the first step for acne and other depressed scars management. As multi-step treatment is necessary for optimal correction of acne scars,^{1,2,4,5} it is better to continue the treatment with other techniques or repeating subcision-suction method after several months. Undoubtedly, development of this method requires further trials by interested colleagues to solve such a prevalent cosmetic problem from which many people suffer.

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