



Updated treatment of Atrophic Acne Scars

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Abstract

Background

Acne scars are more prevalent among adolescents, affect both genders equally and are associated with psychological distress. Acne scars can be divided into atrophic and hypertrophic. Atrophic type includes ice picks, boxcar, and rolling scar. Different treatment modalities have been utilized to improve acne scars including chemical peeling, laser resurfacing, subcision, and fillers, dermabrasion, micro needling, and punch excision. Subcision is a minor surgical intervention utilized to treat multiple skin depressions such as depressed scars. Hyaluronic acid filler (HA) can be used to treat acne scarring through injection into the scar to elevate and support them immediately and successfully used in rolling types of scars. **Monothreads** are smooth types without barbs have been used for rejuvenation and to induce skin tightening. These threads are placed under the scars in a mesh-like for improving the scars appearance. They improve the skin and induce collagen production over the course of about 8 months.

Objective

Acne scars is a challenging disease and different treatment can provide significant improvement.

Material and methods

This review article focuses on the pathogenesis, classification and future treatment of atrophic acne scars. A Medline search was carried out on the different types of treatment for acne scars. The article was approved by the research ethical committee of Faculty of Medicine, Zagazig University.

Results

A total of 40 articles were identified for the treatment of atrophic acne scars.

Conclusion

The management of acne scars should follow an algorithmic approach that targets each component of scarring.

Keywords: Atrophic acne scars, Cross linking Hyaluronic acid fillers, monofilament threads, Subcision

I-Pathogenesis

Permanent acne scarring is a complication of untreated acne vulgaris. Acne scars can be emotionally distressing disease associated by a risk for suicide. Acne scarring may affect about 40% of patients with acne vulgaris. It was found that

scarring can affect 95% of patients while other revealed that it affects 30% of patients [1-5]. The mechanism of scarring formation may be resulted from interplay of complex factors such as disorganization between the production and deposition of collagen around inflamed follicles, resulting in visibly depressed scars. abnormal

wound healing following the damage that may occur in the sebaceous follicle during active acne. Abnormal cell mediated immune response (CMI) also has been found to be involved with recruitment of lymphocytes, macrophages, and endothelial cells that are confirmed by skin biopsies of the inflamed lesions [6-7]. There is a chronic delayed type hypersensitivity reaction provoked by a persistent antigen to which these patients are unable to eliminate it. An initial inflammation and granulation tissue formation and ultimately, atrophy occurs which affecting both dermis and subcutis. Abnormality of tissue remodelling, angiogenesis and vascular adhesion molecule expression have been reported. It was reported that the macrophages with persistent T cell activation, lymphocytes and macrophage secrete a varieties of cytokines and growth factors that to modulate dermal fibroblast recruitment, proliferation. Aberrant degradation and production of collagen may contribute to scar formation[7-8].

II-Classification of acne scars

In general there are two main types of scars; atrophic and hypertrophic type. Most of patients with acne scars have the atrophic type.

Types of atrophic acne scars

Depth and extent of the inflammation can determine numbers, type and depth of scarring. Superficial macular type results when the epidermis and superficial dermis are affected[9]. They appear as macules which may be erythematous or pigmented; pigmentation more common in patients with dark skin type. They fade within 3–18 months. Atrophic acne scarring has been subclassified into: ice pick (60%–70%), boxcar (20%–30%), and rolling type

(15%–25%) (Figure 1 and 2). Ice pick type is narrow (< 2 mm), deep and sharply margined that extend vertically to the deep dermis or even to subcutaneous fat. Moreover, its opening is usually wider than the deepest part. Rolling type is characterized by tethering the dermis to the subcutis; its opening is usually wider than 4 -5 mm. These scars give a rolling appearance to the skin. Boxcar type; it is round or oval in shape with well defined vertical edges, wide base. There are multiple grades have been used for post acne scarring; the qualitative global scarring grading system that classify acne scars into four main grades. While quantitative scale depends on the type as well as the scars number. This system assigns fewer points to macular and mild atrophic scars than to moderate and severe atrophic scars, (Table 1 and 2)[10].

III-Treatment of acne scars

Prevention of scars formation is the main aim. Treatment of acne scars is challenging because there are many factors should be considered when approaching them. One of them is the different types of scars; ice pick, box car and rolling are the most common, degree of scarring is another important item. In addition to severity of lesion, patient expectations, side effects, cost of the treatment as well as psychological effects to the patient. Combination therapy can provide successful and satisfying outcome. Early management of active acne still remain the successful methods to decrease acne-related scarring[3-6].

Many therapeutic procedures are available (Figure 3).

1- Chemical Peels

Chemical peeling is an application of chemicals to the skin to destroy the upper damaged layers and accelerate the healing process.

a) Glycolic acid

Glycolic acid (GA) 70% is an alpha-hydroxy acid, derived from fruit and milk sugars. It works by decreasing the thickness of the stratum corneum (st.corn) and promoting epidermolysis and dispersing basal layer melanin. It increases collagen gene expression by increasing IL 6 secretion. The best outcome can be achieved by sequential sessions of GA, 2 weeks apart [11].

b) Jessner's Solution

It is a combination of salicylic acid, resorcinol, and lactic acid in 95% ethanol. It is suitable for superficial peeling. It acts by disrupting the hydrogen bonds of keratin and also increase penetration of other agents. Lactic acid is an alpha hydroxy acid induces corneocyte detachment with desquamation of the st. corn [12].

d) Salicylic acid

It is one of the excellent peeling agents in acne scars therapy. It is a beta hydroxy acid that dissolves the intercellular lipids. It can be used at 30% concentration, 3–5 times, 3 weeks apart in treatment of acne scars [12].

c) Pyruvic acid

It is an alpha-ketoacid peeling agent. It has keratolytic and antimicrobial effects. It stimulates new collagen formation. 40%–70% pyruvic acid has been used for the therapy of mild to moderate type of acne scars [13].

e) Trichloroacetic Acid (TCA)

TCA induces keratocoagulation which is protein denaturation that leads to formation of white frost. The degree of its penetration depends on multiple factors such as the concentration of TCA, site and the skin type. Selection of the suitable concentration is very important; using TCA higher than 35% should be avoided in dark skin type as it may lead to post inflammatory hyperpigmentation. Cross technique; using higher concentration (50 or 100%) was found to be effective in icepick scars [14-15].

2- Lasers

a) Laser resurfacing

In recent years, using lasers in the treatment of acne scars have gained popularity. Resurfacing remains the mainstay treatment for acne scars. It falls under two categories; ablative and non-ablative.

-Ablative laser:

It means removal of the damaged top layer of the scar tissue through vaporization; carbon dioxide laser (CO₂) and Erbium YAG laser are the most common and important tools used for treating the acne scars. Despite ablative lasers can provide the highest efficacy among other lasers, is associated with more pain and downtime with an increased risk for pigmentary alteration. Ablative laser is associated with long downtime and more complication. The risk of hyperpigmentation can be affected by laser parameters, skin type and degree of sun exposure [16-17].

-Non ablative laser:

This type does not remove the tissue, it induces heating the underlying tissues and stimulates new

collagen formation causing rejuvenation and lifting of the scars. In addition, it improves the facial rhytides and acne scars as it has fewer side effects compared to the ablative lasers. Non-ablative can provide more safety profile at the same time it does not offer excellent cosmetic results. The most commonly used are the NdYAG and Diode lasers. Although the outcomes obtained were not impressive as CO2 laser, they were associated with minimal complication. After the laser session, the area may appear erythematous and swollen for 5 days. An important point in treatment is to identify the depth of the scars; rolling and boxcar scars and also the penetration depth of the lasers. As the icepick scars very deep extend to the deep dermis or even to subcutaneous fat which can't be reached with the conventional types of lasers[17-18].

2) Pulsed dye laser (PDL)

PDL is the gold standard for treating post inflammatory erythema (PIE). It induces selective photothermolysis to destruct the vascular components of the dermis resulting in improvement of PIE. The chromophore is oxyhemoglobin within cutaneous vessels, which selectively absorbs laser light in yellow and green range (418, 542, and 577nm). The laser heat energy leads to an increase in transforming growth factor beta (TGF- β), which induces fibroblasts activation with an improvement in the atrophic scars. PDL has shown to be comparable with 1,064nm Nd:YAG in improvement of acne scars erythema[19].

3) Fractional radiofrequency (FR)

FR is a new technology, using bipolar radiofrequency in both a few ablative and nonablative manner simultaneously. It causes more damage to the dermis than the epidermis. FR has a disposable tip provided with multiple pin electrodes on contact with the surface of the skin. The electric current flows between the pins and on the tip side. It was reported to be effective in the treatment of acne scars. It has the advantages of absence of epidermal damage, decrease the downtime, pain, risk of hyperpigmentation and well tolerated. It showed 70% improvement of acne scars[20].

4) Microneedling (MN)

MN is one of the collagen induction therapy. It is an electronic pin supplied a disposable head studied with 36 pins used for treatment of acne scars, stretch marks, rejuvenation of the skin and as drugs delivery system. The needles can be adjusted according to the depth of the treated areas. It induces multiple microinjuries in the dermis that initiate a cascade of growth factors that ultimately results in collagen induction. MN can be used alone in acne scars or combined with platelet rich plasma, or peeling[21,22].

5) Platelet-rich plasma (PRP)

PRP has a special interest in acne scars therapy. PRP is an autologous blood with a higher platelet concentration above its baseline. Multiple clinical studies have reported its significant effects in treatment of acne scars either alone or combined MN, lasers to improve the outcome. PRP are used for improvement of wound healing, scar revision and skin rejuvenating. PRP offers improvements in

acne scars and associated with higher patient satisfaction. PRP induces tissue augmentation, stimulation of fibroblasts, new collagen and blood vessels formation with improvement of acne, burn and surgical scars. PRP can improve the skin quality [23-25]

6)Punch Techniques

It was reported that Punch replacement techniques has a successful and significant effects in acne scars. It is suitable for improving the deep scars; there are two types of punch techniques: elevation and excision [26].

- Punch elevation is ideal for treatment of circular shallow or deep box scars without underlying fibrosis. It is a tool used to incise the scarred tissue to allow it to float upward. The scarred tissue is incised up to the subcutaneous level, then lifting of the tissue is performed. Sterile dressing was placed at the site to avoid its movement. The punch excision is best for the deep icepick or deep boxcar scars. It can be performed by using a disposable punch instrument of suitable size. The scar and its walls are excised down to the subcutaneous fat layer and sutured. [27].

7) Subcision

Subcision is a minor office procedure used to treat rolling acne scars mainly, with less effect for boxcar type and no effect in icepick type. It can be performed by inserting nokor needle under the scarred areas to separate the fibrous bands that fix the scar into the dermis. The mechanism of action of subcision based on creating a wound and hematoma which leads to release of cytokine with stimulation of fibroblast and endothelial cells[28-29]. It was reported that combination of subcision

with HA, laser, microneedling, threads can improve the outcome. Needle size is ranged from 18- 20-gauge tri-beveled hypodermic needle with triangular tip that helps smooth separation of the fibrous bands. Adverse events are mild as swelling, bruising, and infection [30-34].

8)Hyaluronic Acid (HA)

There are many new and older autologous, nonautologous biologic, and nonbiologic tissue augmentation agents that have been used in the past for atrophic scars, such as autologous Fat transplantation, collagen, bovine collagen, isolagen, alloderm, hyaluronic acid, fibrel, artecoll, and silicon, but nowadays, because of the high incidence of side effects, the recommended material to use is hyaluronic acid[35]. Hyaluronic Acid (HA) is composed of glycosaminoglycan disaccharide that characterized by its strong hydrophilic effect, thus contributes to the elasticity of the skin. HA is the main component of the extracellular matrix. The turnover of HA based on its location and the half-life in the skin is 24 hours[35]. With time HA fragments by hyaluronidases which dissolve the disaccharides at hexosaminidic linkages. HA can augment soft tissue, especially for both rolling and boxcar scars. HA augment collagen formation; not only volumizing but also rejuvenate the skin. Modes of injection in acne scars is tower technique; injection at deep part and superficial part of the scar[36-40]. The adverse effects are mild and transients such as erythema, swelling and lumps.

9) Threads

Thread lifts are recently emerged to offer a facelift for patients who need less downtime and fewer side effects compared to surgical face lift. Threads are made from the materials used in surgery for wounds closure. Threads are inserted under the skin to tighten and lift the saggy skin[43]. There are 3 types of threads: Mono, Screw/Tornado and Cog. Mono types are smooth threads without barbs. These types are used for improving and inducing collagen formation around them but not suitable for lift. They

can be utilized in parallel lines both vertical and horizontal manner to improve the acne scars[44]. Screw or tornado types are single or double threads intertwined with each other around needle. They can give a volumizing effect for the depressed area of skin. Therefore, they can offer a significant improvement of acne scars. Cog threads are threads with barbs act as a hook to the underneath skin. These barbs require anchoring points and are used for lifting[45-46].

Table (1): Qualitative global scarring grading system (*Goodman and Baron, 2006*)

Grade	Level of the disease	Clinical features
1	Macular	These scars can be erythematous,hyper- or hypopigmented flat marks. They do not represent a problem of contour but of color.
2	Mild	Mild atrophy or hypertrophy scars that may not be obvious at social distances of 50 cm or greater and may be covered adequately by makeup or the normal shadow of shaved beard hair in men.
3	Moderate	Moderate atrophic or hypertrophic scarring that is obvious at distances of 50 cm or greater and is not covered easily by makeup but is still able to be flattened by manual stretching of the skin if atrophic.
4	Severe	Severe atrophic or hypertrophic scarring that is evident at social distances greater than 50 cm and is not covered easily by makeup or the normal shadow of shaved beard hair in men and is not able to be flattened by manual stretching of the skin.

Table (3):Acne scar procedures grouped by procedure type (Fife, 2010).

RESURFACING PROCEDURES
Chemical Peels <ul style="list-style-type: none">• Full Face• CROSS Technique Dermabrasion <ul style="list-style-type: none">• Laser Resurfacing• Ablative/non ablative

<ul style="list-style-type: none"> Fractional
LIFTING PROCEDURES
Subcision
Filler
<ul style="list-style-type: none"> Directly under scars Volumizing Autologous fat transfer
Punch elevation
EXCISIONAL TECHNIQUES
Punch excision
Elliptical excision
Punch grafting
OTHER
Skin needling Facelift Combination technique

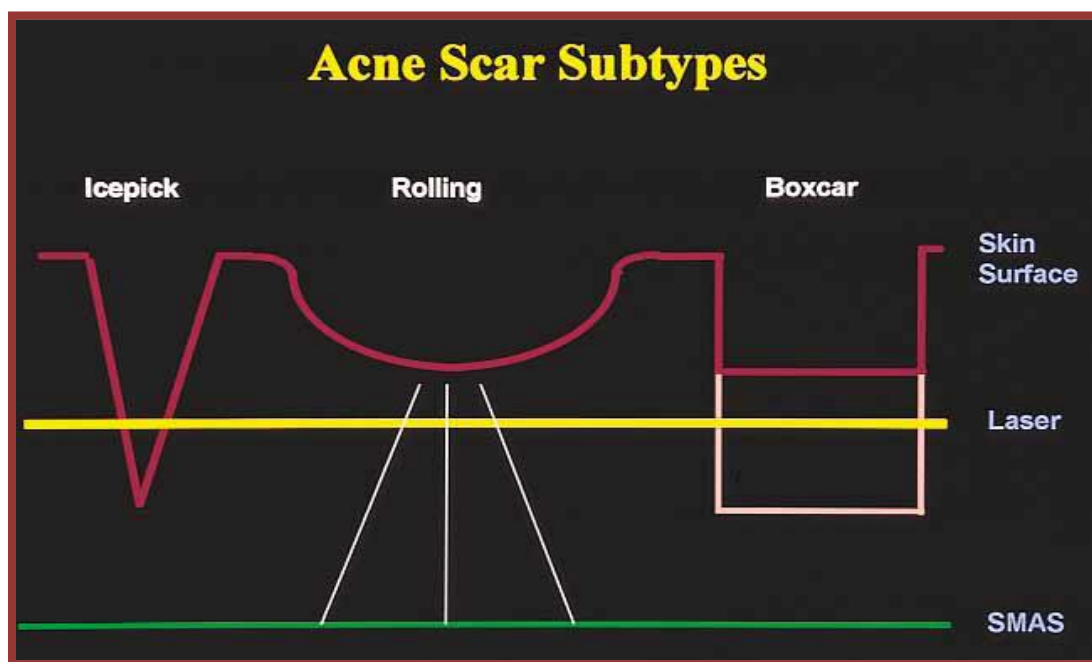


Figure (1): Atrophic acne scars subtypes; icepick, rolling, and boxcar (superficial and deep). *Green line* represents superficial musculo-aponeurotic system to which fibrous bands adhere, creating rolling scars (*Jacob et al., 2001*).



Figure (a) : Boxcar scar (*Fabbrocini et al., 2010*) **Figure (b):** Rolling scar (*Bettoli et al., 2006*)



Figure (c): Icepick scar (*Bettoli et al., 2006*)

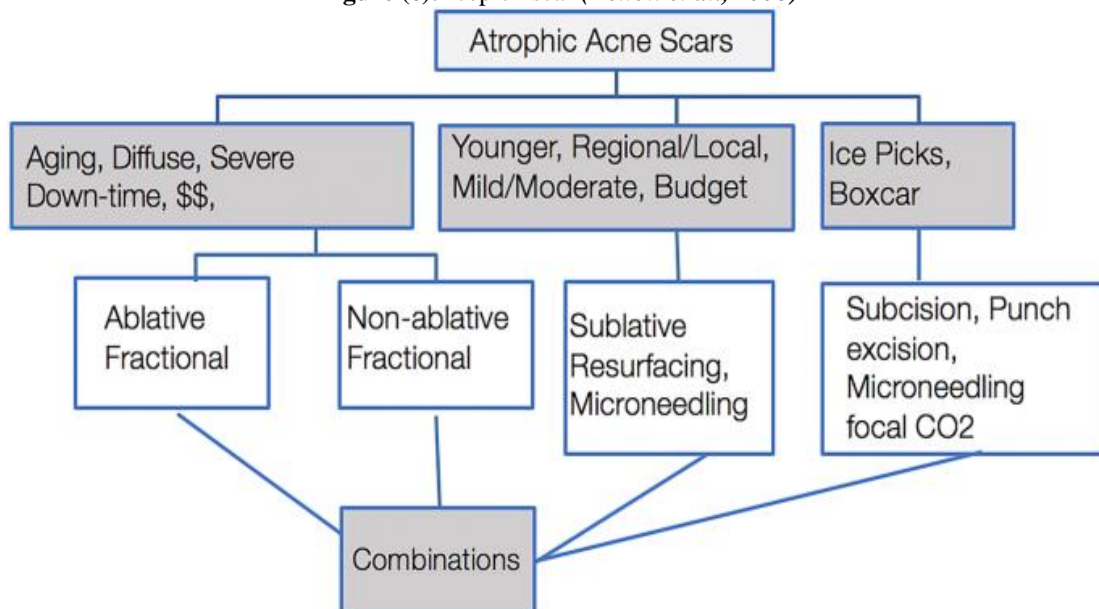


Figure (3): Treatment Decision Tree. Courtesy of Amy Forman Taub, MD (2019).

Conclusion

Acne scarring is a common problem that has a significant impact on the patients' quality of life. The management of acne scars should follow an algorithmic approach that targets each component of scarring. The first approach in acne scars therapy is addressing the residual erythema, if found. Then, examining the patients for the predominant type of scars and finally, choosing the most suitable method for the individual scar. Types of acne scars as well as patient expectation will yield the highest patient satisfaction.

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