

## Options of Treatment of Post Acne Scar: Review Article

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### ABSTRACT

**Background:** Despite improvements in acne treatment, post-acne scarring is still a widespread issue. Scarring is difficult to treat and difficult to avoid. Inflammatory mediators and enzymatic breakdown of collagen fibres and subcutaneous fat are likely involved in the aetiology of atrophic acne scarring.

**Objective:** Review of the literature on options of treatment of post acne scar.

**Methods:** PubMed, Google Scholar, and Science Direct were some of the places we explored for information about post-acne scarring and its treatment. Between January 2000 and May 2021, however, only the latest or most comprehensive study was considered. The authors also assessed the usefulness of references taken from similar books. We haven't paid attention to non-English documents because we don't have the time or money to translate them. Unpublished articles, oral presentations, conference abstracts, and doctoral dissertations were all widely acknowledged to not constitute valid scientific research.

**Conclusion:** Facial resurfacing procedures like dermabrasion and microdermabrasion mechanically ablate damaged skin and stimulate re-epithelialization. When performed properly, dermabrasion can remove the epidermis and reach the reticular or papillary dermis underneath. Both invasive and noninvasive treatments have been tried with varied degrees of success to cure atrophic scars, but it is still difficult to reach the aim of complete improvement, even with the most expensive approaches. Consequently, there is a growing need for therapeutic approaches that are both highly successful and very inexpensive in the treatment of acne scars.

**Keywords:** Post acne scars, Matrix metalloproteinases (MMPs).

### INTRODUCTION

Up to 95% of acne sufferers have some degree of acne scarring, with 30% reporting severe acne scarring<sup>(1)</sup>. Scarring from acne is common when medical care is delayed or is not sufficient, although it can also occur even when treatment is adequate. Acne inflammation causes collagen and other tissues to break down, resulting in long-term changes in skin texture and fibrosis. Common wound healing stages include inflammation, granulation, and remodeling, which all contribute to the formation of a scar. Scarring from acne is difficult to treat, and many methods may only be partially successful, which can lead to dissatisfaction and frustration among patients<sup>(2)</sup>. Acne scarring's consequences are not restricted to its visual manifestations. Acne scarring, on the other hand, has been linked to mental health issues including depression and suicide ideation as well as emotional and social impairments like shame and low self-esteem<sup>(3)</sup>.

About 90% of acne scars are related with collagen loss (atrophic scars), whereas the remaining 10- 20% show collagen gain (keloidal or hypertrophic scars). Resulting from the contraction of fibrous tissue, atrophic scars appear as depressions. We can divide atrophic acne scars into three distinct types: boxcar, icepick, and rolling<sup>(4)</sup>.

### Pathogenesis of atrophic acne scar:

Atrophic acne scars have a complex aetiology that likely involves inflammatory mediators, as well as the enzymatic breakdown of collagen fibres and subcutaneous fat. It may seem like there's a direct proportion between how bad your acne is and how bad your scars will be, but that's not always the case. Acne

scars are a potential outcome at any stage of the disease. Existing acne scars are frequently irreversible, but can be avoided if inflammatory and nodulocystic acne are treated early<sup>(5)</sup>.

Scarring from acne can occur regardless of whether or not the condition is properly treated with medication. Acne inflammation causes collagen and other tissues to break down, resulting in long-term changes in skin texture and fibrosis. Common wound healing stages include inflammation, granulation, and remodeling, which all contribute to the formation of a scar<sup>(6)</sup>.

The intricate process of wound healing involves many different types of cells. Parenchymal resident cells such as infiltrating blood cells like lymphocytes, monocytes, and neutrophils are all examples of these (collectively referred to as immunoinflammatory cells)<sup>(7)</sup>. Inflammation, granulation tissue development, and matrix remodeling are the three phases of the wound-healing process<sup>(8)</sup>.

The coagulation cascade, which causes inflammation, is triggered shortly after an injury. When a wound is made, platelets are the first cells to appear<sup>(9)</sup>. Furthermore, melanogenesis may be prompted. Post-acne erythema and hyperpigmentation are greatly aided by this process. Scarred cases showed a more severe and longer-lasting inflammatory reaction at the pilosebaceous gland<sup>(10)</sup>. The high correlation between inflammation severity and duration and scar formation shown by **Holland et al.**<sup>(11)</sup> suggests that reducing inflammation in acne lesions early may be the most effective way to avoid scarring. More scar tissue forms when inflammation levels are high throughout the healing process. Acne scarring is accompanied by an

immune response dominated by CD45+memory T cells that is first weak and ineffective but grows and becomes active as the lesions clear up. During the early lesion stage of acne scars, resolution occurs when the cellular infiltrate, which was initially large and active but included just a small number of memory T cells, begins to decline <sup>(12)</sup>.

Release of chemo-attractive factors and vasoactive mediators triggers the formation of granulation tissue, which in turn triggers the migration of inflammatory cells like neutrophils. Excessive tissue loss in the wound region is caused by neutrophil-produced matrix metalloproteinases (MMPs) and collagenases, creating a matrix-free area that the remodeling phase will replace with scar tissue <sup>(9)</sup>. New blood vessels are generated and existing ones are mended as tissue damage is corrected. After neutrophils are cleared out, monocytes differentiate into macrophages and secrete growth factors that promote fibroblast migration and proliferation. Concurrently, keratinocytes migrate in from the wound's margin to create a new epithelial covering. Early extracellular matrix (ECM) deposition is followed by collagen framework remodeling via cell death and maturation to achieve scar ultimate strength. Up to 2 years after the initial injury, this process may still be ongoing <sup>(12)</sup>.

Matrix metalloproteinases and matrix metalloproteinase inhibitors. Matrix metalloproteinases (MMPs) are a family of enzymes that work together to break down and repair the ECM <sup>(13)</sup>. Scar tissue can become atrophic or hypertrophic depending on the balance of matrix metalloproteinases (MMPs) and tissue inhibitors of MMPs (TIMPs). Atrophic scars result from inadequate reactions, which in turn result from inadequate collagen deposition <sup>(14)</sup>.

#### **Pathogenesis of Hypertrophic acne scar:**

Both keloid and hypertrophic scars are considered abnormal forms of wound healing. After around 6-8 weeks, a wound's anabolic and catabolic processes will have balanced out. In this early phase, the wound's strength is only about 30-40% that of healthy skin. Scar tensile strength increases with scar age as collagen fibres become more strongly cross-linked. After several months, the hyperemic, thicker scar should fade into a flatter, whiter, more malleable and perhaps stretched mature scar. If the balance between collagen synthesis and breakdown during wound healing is off, the scar will grow in all directions. The scar is still hyperemic and protrudes above the skin. A keloid or hypertrophic scar is the result of an abnormal accumulation of fibrous tissue (Figure 1) <sup>(15)</sup>.



**Figure (1):** Acne scars types <sup>(15)</sup>.

### **Treatment Acne scar treatments for atrophy:**

Atrophic acne scars can be treated with a wide variety of modalities, and sometimes a combination of treatments is used for the best possible outcome. Acne scars can be effectively treated, but only if the doctor is familiar with the many types of scars and the best methods for treating them. In addition, dermatologists need to know the benefits, drawbacks, and overall effectiveness of each treatment option in order to properly advise and care for their patients <sup>(10)</sup>.

### **Dermabrasion / Microdermabrasion:**

Facial resurfacing procedures like dermabrasion and microdermabrasion mechanically ablate damaged skin and stimulate re-epithelialization. In dermabrasion, the epidermis is scraped off and the procedure continues down into the papillary or reticular dermis <sup>(7)</sup>. Microdermabrasion, a gentler kind of dermabrasion, scrapes away the epidermis's outermost layer to stimulate the skin's natural exfoliation process. Both approaches are quite effective at reducing the appearance of scars, leading to noticeable changes in the skin's look after treatment. Microdermabrasion has fewer and milder side effects than other skin treatments, can be performed on a regular basis without the need for anesthesia, and has a shorter recovery time <sup>(16)</sup>.

### **Punch Techniques:**

Icepick scars are best treated by punch or ellipse excision to the subcutaneous layer <sup>(17)</sup>, and also deep boxcar scars. Using a straight-walled, single-use or hair-transplantation punch, a pitted scar can be surgically excised. The goal is to replace a thick, conspicuous scar with a narrow, linear closure that, with any luck, will fade away with time <sup>(18)</sup>.

### **Subcision:**

Subcision involves passing a needle under the skin in a number of different planes. It works best on smooth, rounded acne scars with healthy skin at the scar's base. Boxcar and ice pick scars are more difficult to treat <sup>(19)</sup>. Scars can be improved by a number of different methods, including the dissolution of underlying fibrotic bands, the regulation of blood flow, and the development of new connective tissue <sup>(20)</sup>.

### **Chemical Peels:**

To hasten the skin's natural exfoliation process, a chemical peel involves deliberately destroying its outer layers through the application of chemicals <sup>(21)</sup>. Since different agents have varying penetration depths, there are four types of chemical peels dependent on the amount of necrosis they cause <sup>(18)</sup>.

### **Glycolic Acid:**

The most popular alpha hydroxyl acid used as a peeling agent is glycolic acid. Concentrations as low as 5% to 15% are effective as everyday skin care. For chemical

peels, concentrations between 30 and 70% are typically utilized <sup>(22)</sup>.

### **Trichloroacetic acid (TCA):**

Different amounts of trichloroacetic acid (TCA) are used for different types of skin peels, with 10% to 20% TCA used for light peels and 35% TCA used for medium peels. Results are less predictable and scarring is more likely at concentrations above 35%, so they are not advised <sup>(7)</sup>. Depending on the dosage of TCA, epidermal cells and collagen in the papillary and upper reticular dermal layers are killed <sup>(23)</sup>.

### **Jessner's solution:**

When applied alone or as a prelude to a TCA peel, Jessner's solution provides a mild exfoliation. Salicylic acid, resorcinol, lactic acid, and ethanol are the active ingredients in this concoction. It was discovered that Jessner's solution was able to tear down epidermal cells, hence weakening the epidermal barrier. Jessner's approach has the benefit of a superficial peel that is both safe and rarely penetrates deeper than expected. Redness and uneven colouring are two drawbacks <sup>(22)</sup>.

### **Pyruvic acid:**

This alpha ketoacid, pyruvic acid, can be used as a peeling agent. It has the ability to induce new collagen creation and the formation of elastic fibres, in addition to keratolytic, antibacterial, and sebostatic capabilities. It has been suggested that a solution containing 40–70% pyruvic acid could be used to reduce the appearance of mild to moderate acne scars <sup>(7)</sup>.

All skin types can benefit from pyruvic acid because of its ability to penetrate deeply while causing only minor erythema and desquamation. Upper respiratory mucosa irritation, burning sensation, and neutralising requirements are all drawbacks <sup>(24)</sup>.

### **Salicylic acid:**

When it comes to removing acne scars, salicylic acid is a highly effective peeling agent. As a beta hydroxyl acid agent, it breaks down fatty membranes between cells. A 30% concentration applied in many sessions (three to five times every three to four weeks) has shown to be the most effective for reducing the appearance of acne scars. Redness and dryness are two such side effects. Salicylic acid has a well-documented safety profile and can be used on any skin type. Salicylic acid's major drawback is the pain it causes <sup>(24)</sup>.

### **CROSS technique/dot peeling:**

Chemical reconstruction of scarred skin (CROSS) with a strong TCA peel. Those with ice pick or miniature boxcar scars are the greatest candidates. The CROSS method involves stretching the skin and applying 65–100% TCA using a fine wooden toothpick to the base of the ice pick scar to cause epithelial tract breakdown. No anaesthetic is necessary for the brief but bearable burning that occurs upon application. In some cases, the

process may need to be performed twice or thrice, at 2- to 4-week intervals. The adnexal structures and normal tissue surrounding the tumour are protected during the CROSS procedure, which results in faster recovery and fewer complications <sup>(21)</sup>.

#### **Deep peels (Phenol):**

Due to the lengthy recovery time, potential difficulties, and adverse events, deep peels are rarely done <sup>(25)</sup>.

#### **Radiofrequency (RF):**

Radiation at a frequency between 3 and 300 GHz is known as radiofrequency and is not harmful to living things. To deliver RF energy through the skin, fractional bipolar RF devices use parallel arrays of electrode pins. Inducing a wound healing response and stimulating collagen remodeling in the dermis, fractional deep dermal heating is produced in the electrode matrix area. Fractional bipolar RF was developed to increase RF's efficacy and lessen its side effects; it results in mild epidermal disruption and significant dermal remodeling. The fractional bipolar RF device also had a significant impact on acne scars <sup>(26)</sup>.

#### **Tissue Augmentation:**

Acne scars can benefit from soft tissue augmentation because it restores lost volume and encourages the body's own fibroblasts to produce collagen. Collagen fillers have lost popularity over the years to alternatives including hyaluronic acid, calcium hydroxyapatite, poly-L-lactic acid, autologous fat transfer, and polymethylmethacrylate, all of which pose less of a risk of allergic reaction. Because of the size of the molecules used in dermal fillers, these treatments are often reserved for more severe cases of rolling scars <sup>(27)</sup>.

#### **Fat Transfer (FT):**

Since it is not susceptible to rejection or allergic or other unfavourable tissue reactions, fat is nearly ideal as an augmentation material. By injecting the fat in little pieces through several tubes, the fat graft can receive the most blood possible. The majority of individuals with acne scars have their best results three months after the surgery. Although FT has shown promise in reducing acne scarring, the benefits are not permanent, and the process is very dependent on the skill of the practitioner <sup>(18)</sup>.

#### **Laser treatment:**

Acne scars that have atrophied can be successfully treated with laser resurfacing. Acne scars, with the exception of deep icepick scars, can be effectively treated with both non-ablative and ablative lasers <sup>(28)</sup>.

#### **Ablative laser resurfacing:**

In ablative resurfacing, a carbon dioxide (CO<sub>2</sub>) or erbium YAG laser is used. It is the method of choice for treating acne scars. The ablative lasers can significantly reduce the appearance of scars by contracting and

rebuilding collagen and tightening the skin. Unlike with non-ablative lasers, considerable improvement is seen after just one treatment session. Significant discomfort or agony during the procedure, a higher risk of dyspigmentation, scarring, and infections, and a longer healing time as compared to non-ablative lasers are the costs associated with the noticeable clinical improvement <sup>(29)</sup>.

#### **Non-ablative laser resurfacing:**

Acne scars can be treated with infrared lasers like short- and long-pulsed Nd:YAG lasers, as well as Q-switched lasers. These lasers' thermal energy can promote collagen synthesis and new cell growth, ultimately repairing and replacing ageing, scarred tissue <sup>(30)</sup>.

#### **Fractionated laser treatment:**

The goal of fractional lasers (Fraxel) is to stimulate the tissue under your scar in order to destroy cells that are darkly pigmented beneath the top layer of skin. Sometimes this laser is effective in treating boxcar and icepick scars <sup>(31)</sup>.

#### **Stem Cell Therapy:**

Patients' own stem cells are extracted, multiplied and differentiated in a lab, and then re-injected as part of the standard protocol for stem cell treatment. Stem cell therapy is now being seen as a viable option for treating any and all illnesses. Stem cells can self-renew and develop into various other cell types <sup>(32)</sup>.

#### **Combined Therapy:**

Scars often necessitate volume restoration, improved tightness, and/or tissue movement, making combination therapies to be more advantageous than monotherapies <sup>(3)</sup>. *Zaleski et al.* <sup>(33)</sup> demonstrated the feasibility of combining treatment modalities without compromising patient safety, and highlighted the synergistic effects that resulted from combining them. Better and faster results can be achieved when techniques such as TCA, subcision, fillers, needling, and/or punch excision are combined with energy-based technology such as lasers or RF.

Historically, laser therapy has been the gold standard for treating scars. Despite being less effective than ablative lasers like CO<sub>2</sub> and Er:YAG, fractional radiofrequency technology can nonetheless deliver satisfactory results on darker and more delicate skin types with minimal risk. Cases who had moderate or severe rolling may benefit from combining these energy-based modalities with additional modalities for optimal and faster outcomes. The thermal effects are amplified by combining fractional CO<sub>2</sub> laser with RF, require less time and fewer sessions to get better results without raising the potential for unwanted side effects. A device combining bipolar RF with 915-nm diode laser had excellent results on both shallow and deep atrophic scars, and this was followed by sublative bipolar RI. If you have a rolling scar or any other type of bound-down

scar due to tethering, subcision should be the first technique you try. In order to effectively treat rolling scars, a combination of TCA 20% peel, subcision, and fractional CO<sub>2</sub> laser was used in a single treatment session. Results for all types of scars improve when subcision is performed before CO<sub>2</sub> laser. Subcision or punch elevation can be performed prior to fractional CO<sub>2</sub> laser for enhanced efficacy. Excellent results have been seen with subcision, followed by needling, and a 15% TCA peel, applied at alternating two-week intervals, for both rolling and boxcar scars<sup>(34)</sup>.

#### Treatment of hypertrophic/keloidal acne scars:

Following photodynamic therapy (PDL), the authors execute non ablative fractional laser (NAFL) and inject 0.1 mL TAC 10 mg/mL and 0.9 mL of 5-FU. Injecting more than 0.1 mL into a scar is unnecessary. It is acceptable to treat a recurrence of NAFL every three weeks with intralesional TAC or 5-FU. Most writers treat keloids using intralesional TAC and/or 5-FU due to the lack of long-term effectiveness data for laser treatment<sup>(35)</sup>.

#### CONCLUSION

An important goal of treatment for AN should be to diagnose and treat the underlying cause of the disorder. When it comes to obesity-related AN, hyperkeratotic lesions may clear up if the patient loses enough weight, and hyperinsulinemia can be alleviated with dietary and lifestyle changes. When treating AN, topical retinoids are often among the first choices considered, especially for unilateral nevoid AN. Some people who suffer from AN have found relief from using superficial chemical peels. Trichloroacetic acid (TCA) is a stable molecule, making it easy to judge the endpoint of its exfoliation. It is also non-toxic, inexpensive, and easy to manufacture.

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