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Subcision by different modalities for treatment of acne scars: A review

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Abstract

Background: Scarring from acne is a typical frustrating consequence of acne that may negatively impact patients' psychology and quality of life. Although Various latest developments and therapies for managing scarring caused by acne have emerged, its proper management is still a challenge.

Keywords: Subcision, carboxytherapy, blunt blade cannula subcision, acne scars

Introduction

According to the severity of the disorder, comedones, pustules, papules, & cysts, both open and closed are some of the skin eruptions that can occur with acne vulgaris. The pilosebaceous canal's aberrant keratinization, a rise in sebum production, growth of bacteria, and hormonal and inflammatory dermatological conditions all contribute to the disease ^[1].

People who suffer from severe kinds of acne are more likely to get acne scars, which lowers their quality of life. Patients frequently experience social isolation, anxiety, and feelings of embarrassment, which can cause despair and even suicidal thoughts ^[2].

During the healing process, improper collagen production and breakdown can result in the formation of different kinds of scars. Both atrophic and hypertrophic scars are possible. The icepick, rolling, and boxcar varieties of atrophic scarring are the three categorizations ^[3].

Today's aesthetic medicine and cosmetology offer a number of successful strategies to lessen acne scars. Depending on the kind of scar, its location, and the depth of the lesions, a dermatologist, in conjunction with a cosmetologist, may propose a series of treatments that will substantially flatten unattractive skin flaws while boosting the patient's quality of life ^[4].

A needle is introduced beneath the scar within a subcision to eliminate the fibrous tissue and affix the scar. This technique works well on rolling scars and other tethered scars because it elevates the scar and releases fibrous tissue. Because of its unique design, the blunt cannula has been proposed as a potentially suitable substitute for Nokor needles with a lower probability of neurological and vascular injury. It has a stainless-steel blunt blade with progressively narrower edges that combine to create two smooth surfaces whereas remained blunt with a mild tip that is sufficiently long to reach every area of concern ^[5].

The term "carboxytherapy" implies the medically beneficial use of carbon dioxide gas through the skin and subcutaneously. Since carboxytherapy can enhance vascularization, the production of collagen, and flow of blood, it has an effect comparable to needle subcision ^[6].

Acne Scars

Up to 80% of adolescents struggle with acne vulgaris, a prevalent ailment ^[7]. It may end with permanent scarring which has significant psychological distress on the patients ^[8]. Hypertrophic, keloid, or atrophic scars are the types of acne scarring. Atrophic scars are more common than keloid and hypertrophic scars ^[9].

The 3 principal forms of atrophic scarring from acne are rolling scars, boxcar scars, and icepick scars (Figure 1) ^[10]. The particular type of acne scars are mainly determined by depth, breadth, and 3D architecture ^[11]

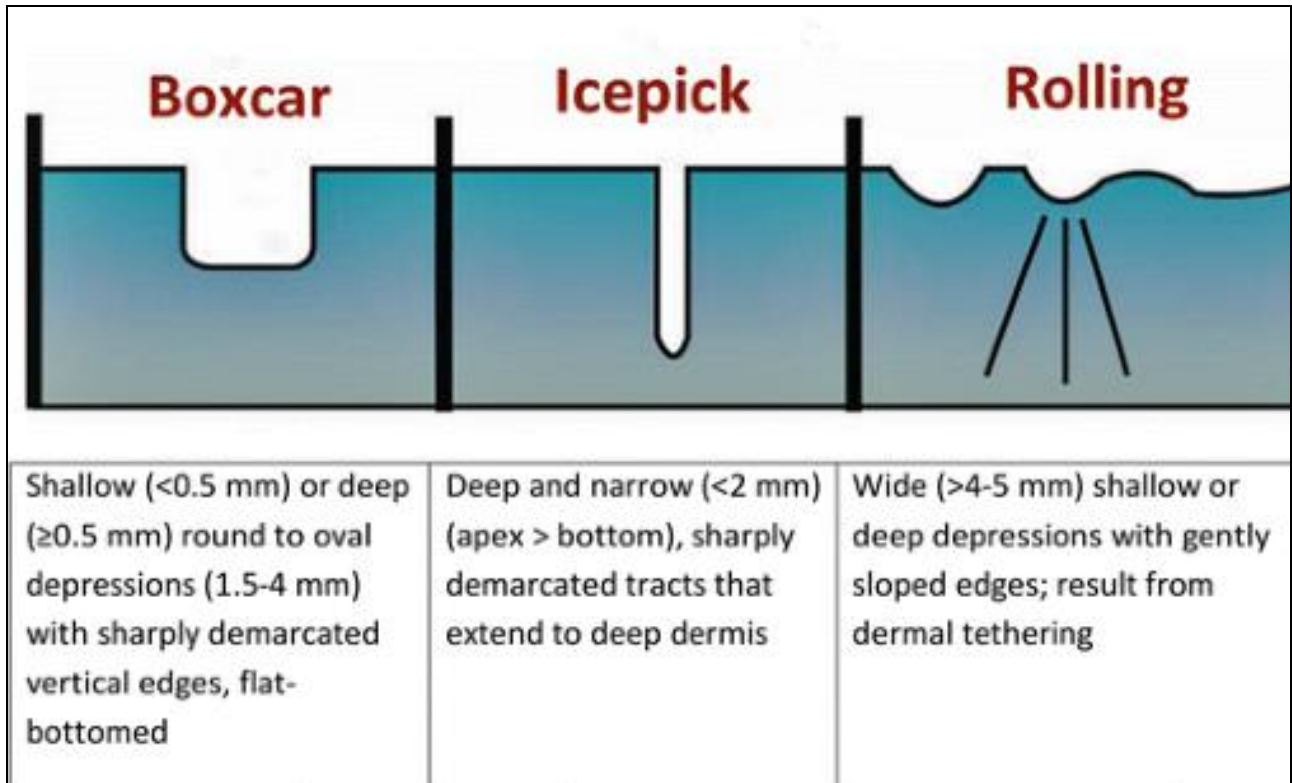


Fig 1: Types of atrophic acne scars. ⁽¹¹⁾

Rolling Acne Scars

From the dermis to the subcutaneous tissue, the rolling acne scars on the skin mimic strips. Typically, they are 4 to 5 mm broad. The healthy skin surface is shaded as a consequence

of the subcutaneous layer's anchoring of the dermal layer's aberrant fibrous layer (Figure 2) ⁽¹²⁾. It is effective at repairing this sort of scar when the subcutaneous layer has been repaired and cured ⁽¹³⁾.



Fig 2: Scars which proceed along the cheek ⁽¹³⁾.

Boxcar Scars

Boxcar scars mimic varicella scars in that they are circular to rectangular depressions with firmly marked vertical borders. In contrast to icepick scars, these scars are larger on the surface. At the deep stratum, they do not taper to a point ⁽¹¹⁾. These scars generally vary in width from 1.5 to 4 mm and can be shallow (0.1 to 0.5 mm) or deep (more than 0.5 mm) (Figure 3). If these scars are deeper than 3 mm in diameter (deeper boxcar scars), they might need to be cleaned. If these scars are not genuine, nonetheless, fractionated laser therapy is an effective way to remove them ⁽¹⁴⁾.



Fig 3: Boxcar scars on the cheek ⁽¹⁴⁾.

Icepick Scars

Icepick scars are deep, thin, cylindrical depressions that are smaller than 2 mm in diameter and extend vertically to the deep dermis layer or subcutaneous layer at the infundibulum of the hair follicle [12]. Although not always current, these kinds of scars may typically be recognized via a bigger surface opening than the deep layer (Figure 4). They don't reach the exact same depth as conventional skin-resurfacing alternatives [15].



Fig 4: Icepick scars on the cheeks [15].



Fig 5: The distinction between the three primary scar varieties [10].

Treatment of acne scar

There are multiple methods to managing scars from acne [16-17].

Atrophic scars

Atrophic acne scars may currently be remedied with chemical peels, laser therapy, radiofrequency (RF), subcision, and microneedling, all of which have some efficacy. Depending on the sort of scarring and the chosen therapy, various results may be attained. (Figure 6) [18].

Figure 5 illustrates the way the three primary scar forms differ from one another.

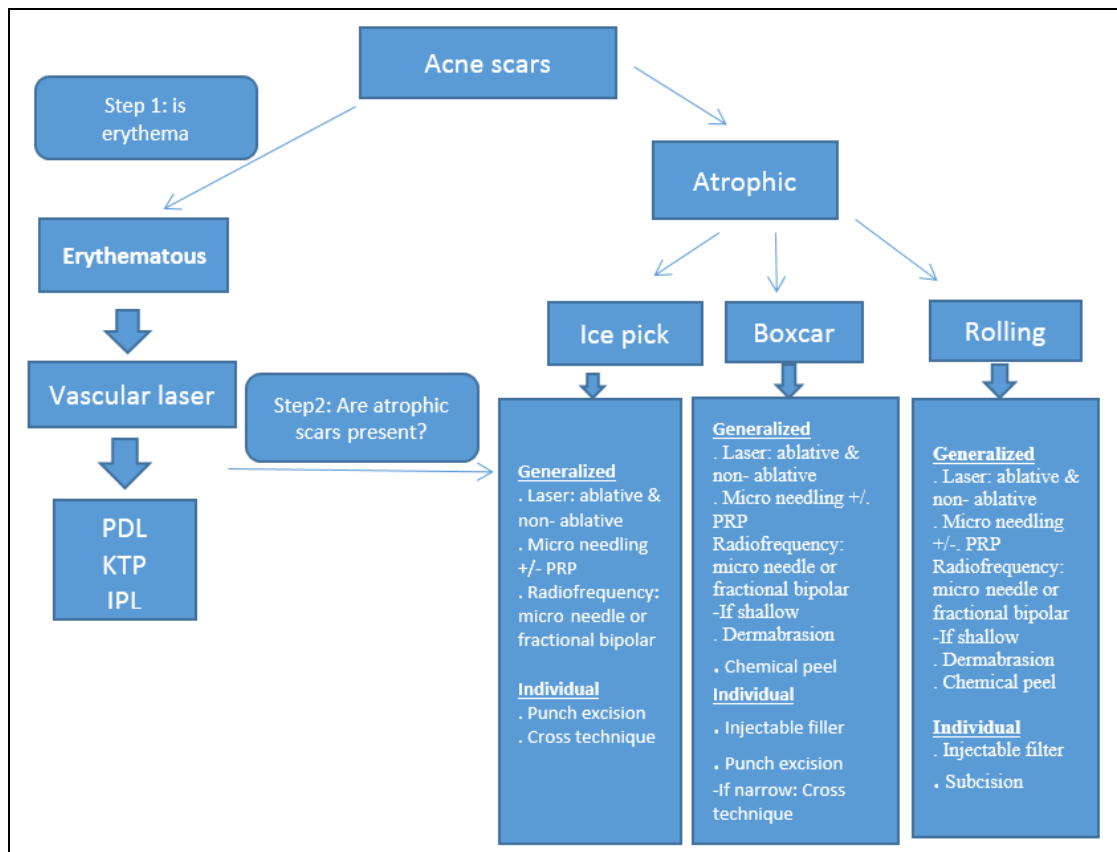


Fig 6: Acne scar treatment algorithm [19].

Resurfacing agents

Chemical peeling

Chemical peeling is a procedure in which chemicals are applied to the skin to eliminate the outer, damaged layers and hasten the exfoliation process. Chemical peels are used

to cure small, depressed scars but not icepick or deep boxcar scars. Chemical peels may be grouped into four categories based on the extent of necrosis that they trigger on a histological scale since various agents have variable penetration depths [20].

Classification of peeling agents ^[21]

Very superficial: degradation of the stratum corneum below the stratum granulosum without creating a wound ^[22].

- 30% to 50% glycolic acid administered for one to two minutes.
- Jessner solution coated in one to three layers.
- One coat of 10% trichloacetic acid (TCA).

Superficial: An area of the epidermis, comprising all or part of it, has been harmed anywhere from the stratum granulosum to the basal cell layer ^[23].

- 50% to 70% glycolic acid given for 2 to 20 minutes, dependent on the amount.
- Jessner solution four to ten times.
- 10% to 30% trichloacetic acid (TCA).

Medium depth: The papillary dermis and some or all of the epidermis are eliminated ^[24].

- A 70% glycolic acid application was made for a range of times (3 to 30 minutes).
- TCA thirty-five percent to fifty percent.
- TCA that has been enhanced (Solid CO₂ plus 35% TCA, Jessner solution plus 35% TCA, or glycolic acid 70% plus 35% TCA).

Deep: Destruction proceeds into the reticular dermis and the papillary dermis ^[25].

- 88 percent phenol.
- Formula for Barker-Gordon phenol.

It may be difficult to maintain adequate control over the peeling depth. In dark skin, deeper peels, and sun exposure, Long-lasting erythema, infection, PIH, and scars are more prevalent issues ^[26].

Scars caused by icepicks and narrow boxcars should be managed using the cross technique. The scar's base is treated with a high-strength TCA peel (65-100%) to eliminate the epithelial wall and stimulate dermal remodeling ^[27].

Dermabrasion/Microdermabrasion

Cosmetic rejuvenation procedures such as dermabrasion and microdermabrasion eliminate damaged skin while promoting reepithelialization by mechanical ablation. Dermabrasion and microdermabrasion use different machines and have different technical implementations, despite the fact that both procedures include physical abrasion of the skin ^[28]. Dermabrasion induces structural protein changes in the skin by entirely eliminating the epidermis and penetrating to the papillary or reticular dermis. Dermabrasion methods such microdermabrasion, which merely remove the epidermis' surface layer, hasten the skin's natural exfoliation. Both therapies give rise to clinically substantial skin improvements and are especially effective for treating scars ^[29]. Both local and general anesthesia are acceptable for dermabrasion procedures. A wire brush or a diamond fraise is rotated by a motorized handpiece. Hand parts consisting of sodium bicarbonate or aluminum oxide crystals have been substituted with diamond tips, which were employed decades ago to improve precision and reduce irritation. The raw wound may bleed in small pinpoints, But with proper wound care, this will go away. Patients with darker complexion might experience blotchiness or ongoing skin discoloration ^[30].

A number of microdermabraders are available to accomplish microdermabrasion. With a hand piece and Hoover, a pump in every microdermabrader creates a spray of aluminum oxide or salt crystals that exfoliate the skin. In contrast to dermabrasion, microdermabrasion may be performed repeatedly with little downtime, is painless, doesn't require anesthesia, and has less serious and unexpected adverse reactions. However, the impacts are lesser, and it cannot remove deep scars ^[31].

Laser resurfacing

Acne scar therapy can benefit greatly from several laser types, such as non-ablative (traditional & fractional) & ablative (traditional & fractional) lasers ^[32].

- The 2,940 nm pulsed Er: YAG laser and 10,600 nm carbon dioxide (CO₂) laser are two common ablative lasers used to treat acne scars.
- **Fractional ablative** as fractional CO₂ laser.
- **Conventional non-ablative lasers** such the Q-switched, short- and long-pulsed Nd: YAG.
- **Fractional non ablative** such as 1440nm Nd: YAG, 1550 nm Erbium laser ^[33].

The ablative laser abrades the skin's surface while simultaneously tightening the collagen strands underneath. While non-ablative lasers do not eliminate tissue, they do encourage new collagen creation and tighten the skin, which causes the scar to be raised to the surface ^[34].

Fractional technology may yield superior results with little disruption and adverse effects. Fractional lasers create columns of microthermal therapy zones surrounded by healthy, unaffected tissue, which hastens recovery and minimizes the chance of adverse effects ^[5].

Lasers could be used mainly to Cure rolling scars or shallow or deep boxcar scars. Ablative lasers displayed an elevated likelihood of issues and adverse effects than non-ablative such as persistent erythema, hyperpigmentation, scarring ^[35].

Radiofrequency

An approach to healing scarring from acne that is still fairly recent is radiofrequency therapy ^[2]. An alternative energy source to lasers is radiofrequency. Instead of possessing a chromophore-dependent mechanism of action, RF has an impact that is based on the impedance-specific properties of each tissue ^[36]. On the contact tip of a bipolar fractional RF, arrays of negative and positive electrodes are arranged in a structured manner to generate numerous radiofrequency waves ^[37]. Microneedles or multi-electrode pins are employed to produce a lot of heat when electromagnetic radiation interacts with high impedance tissue. This triggers extensive dermal remodeling, comprising neocollagenesis and elastogenesis, but only very minor disturbance to the epidermis. Skin renewal is results-oriented and there is little downtime and danger of problems ^[38].

The higher the energy of FRF, the deeper the ablation and the deeper the dermal coagulation depth. For the purpose of curing scars from acne, usual energy for bipolar FRF has been 60 to 100mJ/pin.

Non-ablative radiofrequency therapies can be performed alone or in conjunction with fractional laser therapies ^[39].

The best therapies for acne scars, particularly icepick and boxcar scars, are microneedle bipolar RF and fractional bipolar RF ^[40].

Plasma exeresis

A recent non-surgical cosmetic medical method named plasma exeresis sublimes the treated region with no harm to the surrounding tissue. Gases in the gap (the area between the tip of the instrument and the tissue to be treated) are ionized to form plasma. (1) Continuous mode for the elimination of skin lesions like solar lentigos or seborrheic keratosis. (2) The sublimation of punctiform regions with no overlaps and spots lasting no more than two seconds can be applied to eliminate skin laxities. It became known that plasma exeresis, a remedy for acne scars, is both reliable and secure [41].

Microneedling:

The application of microneedling (MN), additionally referred to as collagen induction therapy, as a non-pharmacological therapeutic method for acne sufferers has grown during the past ten years. It is a straightforward, affordable, and well-tolerated therapy based on repeated physical stress to the skin brought on by the entry of sterile microneedles, leading to in dermal regeneration [42].

The papillar layer of the dermis generates collagen and elastin as a consequence of the physical damage to the epidermis, which triggers an inflammatory response involving the recruitment of platelets and neutrophils that release growth factors like TGF-alpha, TGF-beta, and platelet-derived growth factor (PDGF) [43].

The method entails repeatedly puncturing the skin with needles, a tattoo gun, roller 0.25-3mm in length or dermapen. Erythema, edema, hypo- or hyperpigmentation are possible side effects that may occur [44].

Volume related maneuvers for removing scars from acne

Plasma rich with platelets: High platelet concentrations exist in autologous platelet-rich plasma (PRP), which originates from autologous blood. several growth factors and cytokines that are present in abundance in platelets serve crucial functions in tissue healing and can trigger the creation of various other growth factors that have the effect of stimulating tissue regeneration. PRP has been demonstrated to facilitate epithelial development and minimize inflammation in rabbits after damage [45].

Because skin needling establishes a pathway for PRP absorption, topical PRP works in combination with skin needling to repair acne scars. After fractional ablative CO₂ laser, PRP as an intradermal or topical treatment improves how laser-damaged skin heals and how scars from acne appear clinical [46].

Transplanting fat: Due to its inexpensiveness, accessibility, and immunity to anaphylactic or other tissue responses, fat is nearly the ideal augmentation element. The procedure is divided into two stages: graft procurement and graft placement. During the injection phase, which employs tiny chunks of fat positioned in several tubes, the fat transplant has maximal access to its accessible blood supply. Majority of acne-scarred individuals notice the best improvement three months after the surgery. Infection may occur as a side effect for fat injection [47].

Because The fat particles are still too big, and the depression occasionally has a little scar and is only superficial. The introduction of nanofat, which may facilitate injection into the subdermal or intradermal plane, offered a solution to this issue. Nanofat, which is produced by mechanically digesting

and filtering fat, has graft and tissue particle sizes of 400-600 m or even smaller. Furthermore, nano fat can be employed alone or in conjunction with PRP to treat acne scars [48].

Fillers: While less effective for deep icepick scars, injectable fillers can be utilized to enhance soft tissue, particularly in soft atrophic rolling and boxcar scars. Hyaluronic acid (HA), poly-L-lactic acid (PLLA), and calcium hydroxyapatite are examples of semi-permanent fillers. Some instances of permanent fillers include polymethylmethacrylate (PMMA), silicone, polyacrylamide, and polyalkylimide. Temporary fillers have impacts that last up to 18 months. Semi-permanent fillers have the impacts that last up to 2 years [49].

Different techniques, such as droplet injection, linear threading, fanning, or three-dimensional volumization, are employed to inject fillers. Infection, discomfort, erythema, lumps, swelling, and abscess development are a few typical adverse reactions [50].

Surgery related

Subcision

The processes for scar enhancement during subcision comprise the release of fibrotic strands beneath scars (Figure 7), the organisation of blood in the ensuing dermal pocket, and the creation of connective tissues in the area.

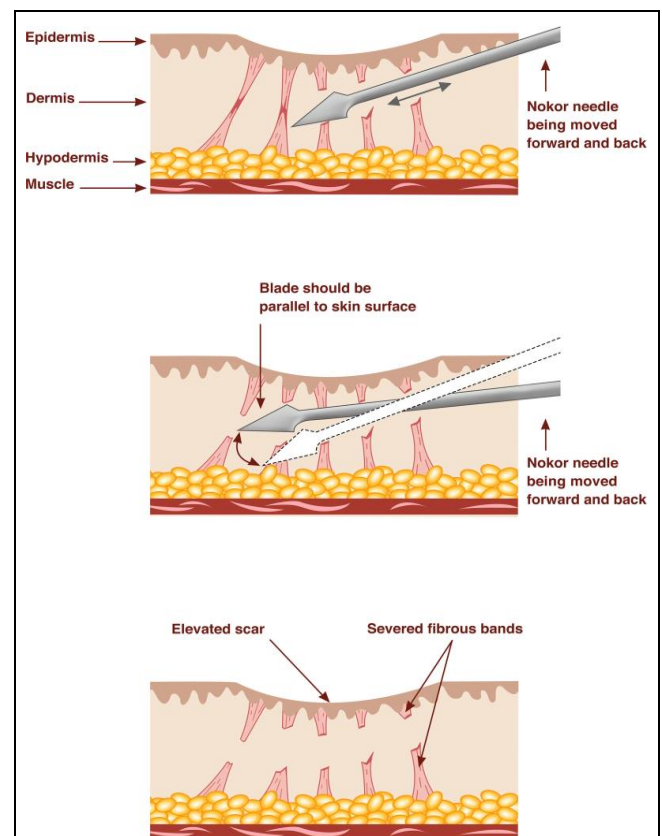


Fig 7: Principle of subcision [51].

Over the past few years, subcision techniques have been improved, and various scientific studies have established that it may be applied to disorders other than cellulite and acne-related scarring [52-54].

Iranian dermatologist Dr. Barikbin, who pioneered the blunt blade subcision technique, implemented a blade with a thin

wall and a blunt tip (Figure 8). He reasoned that employing a BB would minimize the danger of the surgeon suffering needle stick injuries, neurological and vascular damage, and depressed scars. It has a distinctive shape with a blunt blade made of stainless steel that progressively narrows into two smooth surfaces. Yet, the blade stays blunt with a mild tip that is long enough to reach all the afflicted areas [55].



Fig 8: Blunt blade cannula.

Overall, subcision is a safe, practical, and beneficial therapy, nevertheless there is a chance for negative effects. Depression, recurrence, and the necessity for repeated sessions are three of the most typical issues encountered while undergoing subcision operations on acne scars. Along with pain during the procedure, there is a chance of bruising, temporary dyspigmentation, keloid formation, edema, lumps, temporary paresthesia, hematoma, infection, and the emergence of hemorrhagic papules and pustules when managing acne scars. The majority of the adverse effects outlined are minor and go away within a few days [56].

The absolute contraindications involve being pregnant, having little cellulite, having cottage cheese- or orange-peel lesions, having coagulation problems, having noteworthy illnesses, being unable to follow postoperative instructions, and having unreasonable expectations in patients. Relative contraindications involve having a history of keloid or hypertrophic scars, having current local or systemic infections, applying coagulation-interfering medications, or applying local anesthetics [57].

Carboxytherapy

Carboxytherapy or carbon dioxide treatment means transcutaneous injection of CO₂ for therapeutic purposes. Carboxytherapy is used to help improve microcirculation. Carboxytherapy can help with any disease that requires increased vascular supply, local tropics, or analgesic effects. Therapy for ischemic and vasculopathy conditions such Raynaud's syndrome, Morbus Buerger syndrome, chronic venous insufficiency, and chronic venous-lymphatic insufficiency has historically had beneficial effects. Another new indication is the therapy of erectile dysfunction brought on by microangiopathy [58].

While temporary local vasodilation is present during CO₂ administration, Repeated operations have a propensity to return to normal vascular circulation, thereby ironically, telangiectatic rosacea and psoriasis can occasionally be enhanced through CO₂ face rejuvenation. As a consequence of this, during CO₂ face rejuvenation, we frequently see little veins in the eyelids or on the cheeks contracting. Some

doctors have had success treating nail diseases, vitiligo, and erysipelas, but these results are highly dependent on the particular patient's condition and are not necessarily repeatable [59].

It has become obvious that carboxytherapy has a wide range of applications in aesthetic medicine, such as the management of cellulite (fibrolipodystrophy), adhesions afterwards liposuction, and skin rejuvenation (face, neck, décolleté, dorsal hands, body skin). Therapy for hair loss and alopecias should be covered in this section since hair health is an aesthetic medicine subject [60].

extreme anemia, chronic liver disease with low plasmatic protein levels, gaseous gangrene, and people by utilizing carboanhydrase inhibitors (such as acetazolamide and diclophenamide) for these conditions. However, if a patient has additional issues such a leg ulcer or gangrene in the early stages and is in poor overall health, the physician must make a decision on an individual basis. Since carboxytherapy is not a pharmacological cure and the only other option is amputation in certain cases, it might be worthwhile to pursue it, though not as vigorously as in the case of a healthy patient. The most prevalent exclusions from aesthetic medicine are those linked to pregnancy and nursing (mainly because of legal reasons) [61].

At the injection site, patients can experience burning, discomfort, and tingling. The temperature of the treated area can rise for 10-20 minutes as a result of increased microcirculation. Patients may experience a subjective sensation of skin creaking and extreme tenderness in the treated area after the procedure. Following CO₂ injections, petechiae and hematomas are feasible, though they will disappear after a few days [62].

Threads injection

Absorbable threads have been used successfully in aesthetic medicine for many years to lift skin in mild to moderate facial laxity and to rejuvenate the face. One of these threads, PLLA threads, has been used in scar treatment because it is put beneath the scar and induces type I collagen ingrowths with long-term tissue filling effects, resulting in a better scar appearance [63].

No requirement for patient preparation before to operation, one session treatment, complete absorption with time, minimum or no adverse effects, and long lasting results are all advantages of PLLA threads over other treatment modalities. The danger of PLLA thread insertion is small and transient, such as a burning feeling, edema, and ecchymosis that diminish in a few days [64].

Subcision is successful and safe when paired with either saline solution injection or Therapy of atrophic scars from acne with PLLA threads [65].

Punch excision: Punch or elliptical excision to the level of the subcutaneous tissue is the most successful therapy for ice pick scars and severe boxcar scars. Punch excision is the process of removing a pitted scar by employing a straight-walled disposable or hair transplant punch that is slightly larger than the scar to be eliminated. The goal is to replace a deeper, more noticeable scar with a more subtle, linear closure that should fade with time. Excisional procedures are an efficient one-time therapy, but one big drawback is that only the treated scars have a chance to become better. The surrounding textural irregularity or coloration that is typical of an acne scar field is unaffected by it [66].

Punch elevation: Punch elevation mixes punch excision and grafting approaches without running the danger of misaligned skin tone or texture. It is therefore restricted to healing shallow and deep boxcar scars. Once it has been detached from the surrounding skin, the scar rises enough to be somewhat raised against the surrounding tissue. The transplanted tissue retracts throughout the healing process, creating a homogeneous surface [67].

Punch replacement grafting: This is probably the most efficient of these techniques for deep ice pick wounds or scars with sharp walls. It necessitates a lot of time and frequently requires 20 or more replacement grafts in a single session, but it typically pays off since it gives the ideal outcome for challenging, strongly defined scars. The postauricular region, which is substantially bigger, is employed to replace the scar with a full-thickness skin graft. While some grafts will heal further up, others will restore at the same level as the skin surface [68].

Other modalities

Stem cell therapy

Stem cells' limited capacity for self-renewal and proliferation has an impact on how well wounds heal. Epidermal and seed cells of the dermal substitute—mostly fibroblasts—are instances of cutaneous stem cells. Fibroblasts are easy to get and multiply fast, but they serve a simple purpose and fail to promote the creation of skin appendages [69].

Traditional stem cell therapy involves isolating stem cells from patients, propagating and differentiating them in vitro, and then injecting autologous cells back into the patient. Local stimulation and recruitment of endogenous stem cells to the site of defect for new tissue regeneration is an alternative strategy that may be easier. Intravenous or subcutaneous injection are two methods for delivering stem cells to promote wound healing. Stem cell therapy is effective in treating all types of atrophic acne scars [70].

The vascular stroma of adipose tissues comprises self-renewing, multipotent adult cells termed adipose-derived mesenchymal stem cells (ASCs). They are crucial to growth after foetal development, tissue homeostasis, tissue repair, and regeneration. Their supposed three main mechanisms of action are their multi-differentiation potential, self-renewal abilities, and immunomodulatory capabilities [71].

A study revealed that all forms of atrophic facial acne scars may be healed effectively and safely using autologous bone marrow stem cells [72].

Epidermal growth factor

Epidermal growth factor (EGF) is one of the growth factors generated during the inflammatory reaction. The interaction of EGF and its receptor is important for epidermal hemostasis and has been demonstrated to enhance the proliferation of keratinocyte stem cells in vivo as well as speed up skin healing. When administered topically, epidermal growth factor's capacity to stimulate neo-collagenesis and dermal thickening results in a reduction in fine lines and wrinkles and an increase in firmness, as well as an improvement in acne scars [73].

Treatment options for hypertrophic post acne scars

Several treatment options can be applied for hypertrophic acne scars and keloids either medical as silicon gel,

intralesional injection of corticosteroids, bleomycin, 5-fluorouracil, imiquimod, interferon, cryotherapy, pulsed dye laser or surgical as scar excision. All these modalities help scars to flatten and shrink [74].

Conclusion

From our study it could be concluded that both carboxytherapy and blunt blade cannula subcision are Post-acne scarring therapies that are efficient and secure with no significant side effects.

Blunt cannula subcision has promising advantages including affordable price, less complications, and remarkable outcome after a single treatment session for acne scar treatment.

Atrophic post-acne scars can be also treated effectively, tolerably, safely, and non-invasively with carboxytherapy as it has combined mechanical and biological effects on the skin. Fibrotic tissue breakdown may arise from high-pressure CO₂ gas injection below scars., creating an effect that is comparable to subcision.

Conflict of Interest

Not available

Financial Support

Not available

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