

Fractional CO2 Laser Resurfacing With Topical Insulin Application Versus Fractional CO2 Laser Resurfacing In Treatment Of Post-acne Scars

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Abstract

Objectives: Assess the safety and effectiveness of treating acne scars using fractional CO2 laser resurfacing and then applying topical insulin. Background: When used together, fractional CO2 laser and topical insulin may significantly enhance the appearance of post-acne scars, on par with other well-established therapy methods. Sources of Information: For the purpose of treating acne scars after the fact, we searched and reviewed the Medline databases (Pub Med and Medscape) for research that compared the efficacy of employing fractional CO2 alone with that of fractional CO2 combined with topical insulin up to the year 2023. Study Selection: Each study was carefully reviewed by experts in the field to ensure its inclusion. Inclusion was contingent upon them meeting the following requirements: This work is written and published in English. Featured in journals that undergo a rigorous peer review process. 3. Give an explanation of the difference between utilising fractional CO2 alone and using it in conjunction with topical insulin for the treatment of acne scars. When extracting data, studies were discarded if they did not meet the inclusion criteria. Ethical permission, established eligibility criteria, sufficient information, and well-defined evaluation metrics were all variables in determining the study's quality. For our concerned research outcomes, data were independently extracted from all qualifying studies utilising a data collecting form. Results show that fractional CO2 laser and topical insulin significantly enhance the treatment of acne scars.

Keywords: Topical insulin, fractional CO2, and scars left behind by acne are important

Introduction

Acne More than 80% of teenagers and young adults suffer with acne vulgaris, an inflammatory pilosebaceous illness. Inflammatory nodules, pustules, and papules define acne lesions, which most often manifest on the back, chest, and face (1).

The imbalance between matrix breakdown and collagen production, which results in post-acne scarring, is thought to be caused by an altered wound healing response that is triggered by cutaneous inflammation. Acne scars may be hypertrophic/keloid or atrophic, depending on whether there is an excess of collagen deposition or a reduction in it. Atrophic scars account for 80 to 90% of acne scars, with keloid or hypertrophic scars making up the minority. Boxcar, ice-pick, and rolling scars are subtypes of atrophying scars (2).

Scars may be effectively treated using fractional CO2 laser (FCL) monotherapy. Extensive research has shown that FCL therapy effectively reduces the appearance of acne scars (3).

Applying insulin topically to skin lesions activates the PI3K-AktRac1 pathway, which in turn increases the fibroblastic response, keratinocyte migration, and re-epithelialization. Coverage rate, granulation tissue thickness, and wound healing rate are all improved by fractional CO2 lasers (4).

The tools and techniques

Sources of Information: A search of the Medline databases was conducted to source the literature on the drop in post-acne scar therapy using fractional

CO2 combined with topical insulin, as opposed to using fractional CO2 alone, up to the year 2023. (Pub Med and Medscape).

A thorough, objective, and open screening method was used to choose the studies. Inclusion was contingent upon them meeting the following requirements:

First published in an English-language book. 2. Featured in journals that use a rigorous peer-review procedure. 3. Give an explanation of the difference between utilising fractional CO2 alone and using it in conjunction with topical insulin for the treatment of acne scars.

Data Extraction: Studies were omitted from consideration if they failed to fulfil the requirements for inclusion. The study's quality was determined by its adherence to ethical approval, eligibility criteria, information, and well stated assessment methods. We used a data collecting form to independently extract information pertinent to our research findings from each qualified qualifying study.

Literature review:

Common Acne

Inflammation of the sebaceous glands causes acne vulgaris (AV). Adolescents, influenced by normal circulating dehydroepiandrosterone (DHEA), are the ones that trigger it with the help of the bacteria *Candida acnes* (5). Reduced shedding and skin turnover, an increase in sebum production (a waxy, oily material secreted by glands to lubricate the skin), and certain skin bacteria might all be to blame.

Cosmetics and skin care products, hormones, mechanical stimulation (such as friction, rubbing, plucking, or squeezing), and certain medications (like corticosteroids) are additional variables (6).

Causes of acne

The development of acne may be explained by four main factors: increased sebum production (seborrhea), changes in follicular growth and differentiation (follicular hyperkeratosis), the colonisation of pilosebaceous units by *Propionibacterium acnes*, and inflammation (7).

Symptoms of Acne

Areas with a high concentration of sebaceous glands, such the face and, to a lesser degree, the trunk, are more prone to the development of acne vulgaris.

On occasion, it may also manifest in the proximal upper extremities and the neck (8). The condition starts with the pathognomonic comedo, which is a blocked follicle that may be open or closed (9).

There are several clinical forms. Grouped and polyporous comedones, nodulocystic lesions, burrowing, interconnecting deep-seated abscesses, and draining sinus tracts with purulent, foul-smelling discharge characterise Acne conglobata, generally known as conglobate acne, a severe, destructive, and extremely inflammatory kind of acne that mostly affects young men (10).

Common Acne Severity

Acne that is not severe, characterised by little to no pustules and comedones. Multiple papules, pustules, and a small number of nodules characterise moderate acne. Severe acne is characterised by a large number of nodules and either a large number of papules-pustules or both. Acne fulminans, acne conglobata, and the follicular occlusion triad are the most severe and damaging types of the illness (11).

For each of the six areas (face/forehead, left and right cheeks, nose, chin, and chest and upper back), the severity and distribution of pilosebaceous units are rated from 0 (no lesions), 1 (one comedone), 2 (one papule), 3 (one pustule), and 4 (one nodule), with each rating multiplied by a factor specific to that area. After adding together all the local scores, you get the global score. On a scale from 0 to 39, acne is rated as mild, moderate, severe, or extremely severe (12).

Pimple Marks

Scarring from acne occurs because the body's reaction to inflammation in the skin is different from normal. While healing, lesions including comedones, papules, pustules, nodules, and cysts may leave behind scars (13).

The Reasons Behind Acne Scars

Open and closed comedones, papules, pustules, nodules, and cysts are the hallmarks of acne vulgaris, a prevalent chronic inflammatory disease of the pilosebaceous unit (14). Its pathophysiology is

characterised by an upregulation of sebum production, aberrant follicular keratinization, and pilosebaceous unit bacterial growth (15). Early lesions in people who are not scar-prone elicit a strong, nonspecific immune response, which fades as the lesions heal. On the other hand, skin-homing CD4+ T-cells are less numerous in early lesions in scarring patients compared to non-scarring individuals; this response is more active when the lesions are clearing (16).

Scars Caused by Acne

There are three primary types of depressed acne scars: boxcar, ice pick, and rolling atrophic. Boxcar scars are characterised by being wider than deep and having defined borders. Ice pick scars are deeper than broad. Stretching these scars might make them disappear (17).

Wounds from Using an Ice Pick: It seems as if they carve a tiny, narrow, and profound crater into the flesh. Some of them could resemble a big open pore (18). These V-shaped tracts extend into the deep dermis or even subcutaneous layer; they are finely delineated and less than two mm in width (19).

Damage from Boxcars: These U-shaped tracts are 0.1-0.5 mm broad and have sharp, vertical edges; their width ranges from one to four mm (19).

Dermal anchoring to the subcutis is a hallmark of rolling scars. Irregular in shape and often measuring 4 mm or more in diameter, they may be seen to be rolling or undulating (19).

Scaling the Severity of Acne Scars Worldwide

Evaluation of individual scar morphology has been the basis for acne scarring. This method provides valuable information for managing specific scars, but it does not provide a comprehensive picture of the patient's illness status. By using global scoring, researchers and clinicians are able to compare and contrast the effectiveness of different treatments in an unbiased manner. Due to its ease of use and potential for long-term comparisons amongst physicians, this method seeks to provide a basic index of severity. According to this approach, the severity of acne scars may be categorised into four grades: macular, mild, moderate, and severe (20).

Treatment of Acne Scars

The Dermabrasion, chemical peels, dermal fillers, punch grafting, microneedling (with or without radiofrequency), and lasers are some of the methods used to treat acne scars (21).

Scar treatment using fractional CO2 laser monotherapy has gained a lot of recognition. Fractional photo thermolysis is the theoretical foundation of this therapy. In order to achieve uniform thermal damage at a certain depth under the skin, it creates tiny thermal wounds (22). It uses laser technology to target specific areas of the skin, which

in turn stimulates the production of new collagen and improves the skin's texture (23). Due to its ability to induce collagen contraction, it is an excellent choice for the treatment of face ageing. It may also help with actinic keratoses and pigmented lesions. Laser fractionation enables treatment of non-face regions, including the arms, legs, chest, and neck. Warts, nevi, acrochordons, sebaceous hyperplasias, xanthelasma, syringomas, actinic cheilitis, angiofibromas, and keloids are among the treatment indications (24). Transdermal medication administration allows for the introduction of fractional CO₂ to the skin (25).

Drug distribution via the skin

A medication formulation is applied to healthy, undamaged skin in a painless manner, allowing for systemic drug delivery. The medicine enters the skin via the stratum corneum and then moves deeper into the dermis and epidermis, avoiding buildup in the dermal layer. Drugs may be absorbed into the bloodstream via the dermal microcirculation once they reach the dermal layer (26). Microneedles, thermal ablation, lasers, patches, microdermabrasion, electroporation, and cavitation ultrasound are all part of the third generation of delivery technologies that aim to reach the stratum corneum, the outermost layer of the skin (27).

The peptide growth factor insulin has several physiological functions. Insulin is essential for the proliferation of human keratinocytes. Insulin also has the ability to recruit healing-related cells and stimulate their proliferation (28). The IGF-1 receptor is the target of insulin-like growth factor -1 (Topo-1). Patients with diabetic foot complications who utilized topical insulin had a much higher risk of epithelization (29). When injected topically, insulin regulates the inflammatory response and decreases tissue levels of reactive oxygen species (ROS), both of which aid in wound healing (30). In addition, wounds treated with topical insulin were shown to have dead tissue removed by neutrophil recruitment, macrophage chemotaxis and phagocytosis, and overall wound healing (31).

Topical Insulin Delivery to the Skin

Microneedles, sonophoresis, patches, electroporation, iontophoresis, vesicular formulations, microemulsions, nanoparticles, and microdermabrasion are some of the many methods used for transdermal insulin administration (32).

Microneedle

The inherent issues with other invasive procedures are reduced by the microneedling approach. Different types of microneedles used to inject insulin via the skin (32).

Patches

An attractive dosing approach for the regular and predictable administration of insulin into the circulation is the use of transdermal patches (33).

Sonophoresis

Phonophoresis and sonophoresis relate to the use of ultrasound to improve transdermal medication delivery. Ultrasound waves with a low frequency of 20-100 kHz were shown to boost insulin delivery via the skin route. This increase may be caused by the disruption of stratum corneum layers (32).

Microemulsions

The designed insulin transdermal microemulsions had a maximum flow of 4.93 µg/cm²/h across goat skin and were composed of 10% oleic acid, 50% surfactant phase, and 2% DMSO. Microemulsions showed great promise for skin-based insulin administration (34).

Nanoformulation

Researchers looked at the possibility of using a supercritical antisolvent micronization method to create transdermal insulin nanoparticles. The results showed that insulin was not degraded by the supercritical antisolvent method. The insulin nanoparticles showed an excellent penetration rate and followed Fick's first diffusion law in an in vitro study (32). Poly lactic-co-glycolic acid was used to effectively create a stable insulin polymeric nanoformulation (PLGA). Various methods for evaluating insulin stability after encapsulation verified full release of insulin from nanoparticles while structural integrity was maintained. Preliminary safety and effectiveness evaluations in vitro and in vivo showed very encouraging results, particularly with regard to the reduction of skin burn healing time (35).

Security of Topical Insulin

Because it is not absorbed systemically, topical insulin promotes wound healing without altering blood glucose levels (36).

Conclusion:

By combining fractional CO₂ laser with topical insulin, a significant improvement may be achieved, on par with other well-established therapeutic methods. Acne scar therapy with this combination is warranted due to its high safety and efficacy profile, cheap cost, ease of accessibility, and non-invasive nature. Although more research is needed to determine the best administration method for insulin and which individuals are most likely to benefit from treatment, insulin shows promise as a new anti-scarring medication.

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