

Microneedling: A Short Review about Techniques, Efficacy, and Applications

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Abstract:

Microneedling, also known as collagen induction therapy, has gained significant attention in recent years as a minimally invasive procedure for various dermatological conditions. There some devices developed contain tiny needles usually termed as microneedles. The therapy is gaining popularity in rejuvenating the hair and skin with good results. This review article aims to provide a comprehensive overview of micro needling, including various of its techniques, efficacy, mechanisms of action, and applications in dermatology. We discuss the different types of available micro-needling devices, their needle configurations, and the procedure protocols used in clinical practice. Furthermore, we delve into the scientific evidence supporting the efficacy of micro-needling for skin rejuvenation, scar revision, hair regrowth, and the treatment of various dermatological conditions. Finally, we highlight the safety considerations, potential side effects, and future directions for research in the field of microneedling.

Keywords — Microneedles, Collagen, Skin rejuvenation

I. INTRODUCTION

Microneedling is very safe, minimal invasive therapeutic technique which involves injuring the skin upto defferent depths by using microneedles for skin and hair rejuvenation. Microneedling is gaining popularity as a cosmetic procedure rather than a therapeutic one. In this process tiny needles used to injures the skin minimally which ultimately stimulates the collagen tissue formation that’s why its another name is collagen induction therapy. microneedling has gained popularity in recent years due to its ability to address a variety of skin concerns and improve the overall appearance of the skin. The procedure stimulates the body's natural ability to heal and promote collagen and elastin production, which are essential proteins to maintain healthy and sound skin.

During a microneedling session, a trained professional uses a specialized device or a roller covered in fine needles to create micro-injuries on the surface of the skin. These micro-injuries are virtually invisible to the naked eye but are sufficient to trigger the skin's healing process. Eventually the skin produces new collagen and elastin fibers, ultimately rejuvenate the skin.

2. Background and Historical Perspective:

The concept of micro-needling originated in the mid-1990s. In 1995, Orentreich and Orentreich introduced the idea of dermal needling as a subcision technique for scar treatment. In 1905, Dr. Ernst Kromayer, a German dermatologist, used microneedles of different sizes for scarring,

hyperpigmentation, and other skin conditions. later in 1997, plastic surgeon Camirand independently utilized tattoo guns without ink to alleviate tension from postsurgical scars. In the development of microneedling techniques contributions of German scientist Liebl in 2000 and a plastic surgeon Fernandes in 2006 was a breakthrough as Liebl designed a drum-shaped device featuring multiple fine protruding needles, while Fernandes utilized this device for percutaneous collagen induction.

3. Microneedling Devices:

several types of microneedling devices has been developed within the period of 20- 30 years. Initially drum shaped rooller with studded with 192 needles used by dermatologists for acne scars. As new collagen fibers stimulated after the therapy it is also called collagen induction therapy. A newer alternative Derma pen is used now a days with mounted cartidge over it. The cartridge have round body with embedded 1-42 needles inside. These needles are fixed over a movable base. Now When dermapen starts the cartridge moves vertically and pears the skin. Deeper penetration needed for acne scars and scalp skin for hair rejuvenation. Lighter and shallow penetration is effective on face in hyperpigmented lesions like melasma and freckles. Various materials used to make microneedles. These are made up of , silicon, metal or may be of ceramic. The needles may be solid which are commonly used for skin and hair rejuveantion or these may be hollow which are used for intra dermal drug delivery.

4. Microneedling Techniques:

4.1 Manual Microneedling

Here a device called dermaroller is used. It is an instrument with drum shaped roller studded with microneedles of various lengths from .5 to 1.5 mm. Its better for personal use by self inducing collagen induction therapy. Used for acne scars and wrinkles. But after the popularity of derma pen its use is becoming less frequent

as uneven pressure of the needles manually exerted.

4.2 Motorized Microneedling

It is a pen like device with fitted motor inside. A microneedles cartridge is mounted when the procudere is to be done. The cartridge with needles move up and down manner i.e. vertically over the skin. It pears deep upto the dermis and stimulate collagen tissue and tone up the skin also help in hair rejuvenation.

4.3 Fractional Microneedling

Fractional microneedling is a minimally invasive cosmetic procedure that utilizes tiny needles to create controlled micro-injuries on the skin's surface. This technique promotes the natural healing response of the skin, stimulating the production of collagen and elastin fibers. Unlike traditional microneedling, fractional microneedling creates microscopic punctures in a fractionated pattern, leaving surrounding healthy tissue untouched. This fractional approach allows for quicker healing and minimal downtime. The controlled micro-injuries trigger the skin's ability to heal , leads in reduction in wrinkles, diminished scars, and a more youthful appearance. Fractional microneedling is an innovative treatment option that offers remarkable results in skin rejuvenation while maintaining a high level of safety and efficacy.

4.4 Radiofrequency Microneedling

The RF microneedling is a newer technique where radiofrequency energy waves also cause additional damage to the skin besides needles of dermapen cartridges. The additional stimulus of RF waves result in collagen tissue formation and rejuvenation.

Radiofrequency microneedling is an innovative aesthetic procedure that combines the benefits of two popular treatments: microneedling and radiofrequency energy. This non-surgical technique involves the use of a device that creates tiny punctures in the skin's surface while simultaneously delivering controlled radiofrequency energy to the deeper layers. The microneedles stimulate collagen production and promote skin rejuvenation, while the radiofrequency energy targets and heats the underlying tissues, triggering a tightening and remodeling effect. Radiofrequency microneedling is considered a safe and effective option for individuals looking to correct common skin problems, like post acne scars, melasma, wrinkles, and saggy skin. The procedure is typically performed by trained professionals in medical or aesthetic clinics, and multiple sessions may be recommended for optimal results. Overall, radiofrequency microneedling offers a promising solution for those seeking skin rejuvenation without invasive surgery.

5. Microneedling Penetration Depth and Needle Configurations

The depth of penetration of these needles can vary depending on the specific needs and goals of the individual. Microneedling pens typically offer adjustable needle depth settings, allowing for customization based on factors such as skin type, targeted area, and desired results. Commonly available penetration depths range from 0.25mm to 2.5mm. Several types of cartridges are available for many of the skin conditions. Cartridges with 1-42 needles are there for application on various parts of the body.

6. Clinical Applications of Microneedling:

Traditionally it is used as a collagen induction therapy for facial scars and to

rejuvenate skin. Now a days, It is also used as a transdermal delivery system for vaccines and therapeutic agents. Use of microneedling is increasing day by day to treat dark spots, large pores, sagging skin, acne scars, stretch marks, and fine lines, rhytids, uneven skin texture it leads to improved skin texture and appearance.

It has also shown promising results in reducing hyperpigmentation and melasma. Some rare type of skin disorders also getting results like in hyperhidrosis hair follicles become reduced eventually patient got benefit.. Moreover, microneedling is employed in the management of alopecia by stimulating hair follicle regeneration. In addition to its dermatological applications, microneedling has found utility in other medical specialties such as orthopedics and ophthalmology. It is also found helpful in transdermal drug delivery successfully.[3] Some time hollow needles also used to administer the drugs which is called mesotherapy.[3] It has been utilised to deliver medications directly into the affected tissues, enhancing drug penetration and efficacy.

7. Efficacy and Mechanisms of Action:

Microneedling is a cosmetic procedure that involves the use of small, sterile needles to create controlled micro-injuries on the skin's surface. The mechanism of action of microneedling is based on the skin's natural healing response. When the tiny needles penetrate the skin, they trigger a cascade of events. First, the micro-injuries stimulate the production of growth factors and cytokines, which are signaling molecules that promote tissue repair and remodeling. These factors initiate the formation of essential components for maintaining skin elasticity and firmness the collagen and elastin fibers. Ultimately skin become toned up besides this several skin conditions become

corrected as discussed earlier. Additionally, microneedling increases the absorption and penetration of topical products by creating microchannels in the skin, enhancing the delivery of therapeutic agents such as serums or creams.

8. Safety Considerations and Side Effects

Microneedling is a cosmetic procedure that involves the use of fine needles to create controlled punctures in the skin. While generally considered safe, there are several safety considerations and potential side effects associated with microneedling. Some of the common side effects are bruising, bleeding redness, tightness and skin. [5, 8] To minimise the adverse effects it is important to ensure that the procedure is performed by a trained and experienced professional using sterile equipment to minimize the risk of infection. To avoid pain topical anesthetics may be used and to rule out any bleeding disorder Clotting and bleeding time is measured. [8] Additionally, individuals with some skin problems, such as acne, dermatitis, or psoriasis and patients with keloidal tendency should avoid microneedling as it can exacerbate these conditions. It is also contraindicated in patients on chemotherapy or radiotherapy. Common side effects of microneedling include mild inflammation, erythema and mild distress and discomfort, which

II. CONCLUSIONS

In this review article, we provide an extensive overview of micro-needling, covering its techniques, clinical applications, mechanisms of action, efficacy, safety considerations, and potential side effects. Microneedling has emerged as a versatile and effective procedure in dermatology, offering promising outcomes in skin rejuvenation, scar revision, hair regrowth, and various other dermatological conditions. While the existing literature supports its efficacy and safety, further research is needed to make proper SOPs, establish standard guidelines, and explore the full potential of micro-needling in combination with other therapies. Overall, micro-needling represents a valuable tool for dermatologists, with the potential to revolutionise the field of minimally invasive aesthetic and therapeutic interventions.

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