

## Possible Role of Microneedling in Dermatology. Especially Androgenic Alopecia: Review Article

Ola Mahmoud El Sayed \*, Mohamed Hamed Khater, Hagar Awad

Department of Dermatology, Venerology & Andrology, Faculty of Medicine, Zagazig University

\*Corresponding author: Ola Mahmoud El Sayed, Mobile: (+20) 0 106 951 5859, E-Mail: drolamkhater@gmail.com

### ABSTRACT

**Background:** Microneedling (also called "percutaneous collagen induction") is a minimally invasive technique used to treat a wide variety of skin disorders. This treatment's creation was come to light in 1995, when Orentreich and Orentreich employed dermal needling to address subcision scars. To do this, subcuticular incisions were made by putting needles under the skin and guiding them to the desired location. One of its recent developments is the use of microneedling to treat androgenic alopecia (AGA) on the scalp. Microneedling has been demonstrated to improve results when compared to using minoxidil alone.

**Objective:** This review article aimed to throw the light on possible role of microneedling in dermatology, especially androgenic alopecia.

**Methods:** Microneedling, Dermatology, and Androgenic Alopecia were all looked for in PubMed, Google scholar, and Science direct. References from relevant literature were also evaluated by the authors, but only the most recent or complete studies from 2008 to 2022 were included. Due to the lack of sources for translation, documents in languages other than English have been ruled out. Papers that did not fall under the purview of major scientific investigations, such as unpublished manuscripts, oral presentations, conference abstracts, and dissertations, were omitted.

**Conclusion:** Several clinical studies demonstrated in most cases, a positive outcome for microneedling as an adjunct therapy for androgenic alopecia.

**Keywords:** Microneedling, Dermatology, Androgenic alopecia.

### INTRODUCTION

Androgenetic alopecia, also known as pattern alopecia, is a hereditary hair loss condition that affects a disproportionate number of people of both sexes. The incidence of AGA is thought to be higher in males than in females. Because of this disorder, terminal hair gradually transforms into vellus hair, although the total number of hair follicles in an affected area remains unchanged over time. The etiology is complicated by the involvement of both environmental and genetic variables. Sites of usual involvement include the front of the head, the center of the head, the sides of the head, and the top of the head (the vertex). Common names for this ailment include male and female pattern baldness <sup>(1)</sup>.

In patients with AGA, both quality of life and self-esteem can be negatively impacted, and patients' hopes for therapy's effectiveness are often too high. Since improvement and regrowth may not have always been accomplished, it is crucial to emphasize that the primary treatment aim is to stop progression and prevent additional thinning <sup>(2)</sup>.

Surgical treatment for AGA can result in long-lasting improvement. Follicular unit hair transplantation has become the standard surgical therapy for hair loss. Scalp reduction and flap procedures, which are more invasive and difficult, are now seldom undertaken with the intention of reorienting vast portions of hair-bearing skin. Patients with stable or medically managed AGA who want lasting improvements in hair loss and who have a sufficient reserve of hair for transplantation are the best candidates for hair transplantation <sup>(3)</sup>.

Hair transplantation operates on the premise of "donor dominance." When hair follicles are taken from the non-balding occipital scalp and transplanted into

areas afflicted by AGA, the recipient area will take on the same qualities as the donor spot. Hair transplants will continue to grow to a full size because to the occipital region's naturally high resistance to androgenetic alopecia. Follicular units, or groups of one to four hair follicles found naturally in the scalp, are the building blocks of today's hair transplant methods. The terms "follicular unit transplantation" (FUT) and "follicular unit extraction" (FUE) refer to two different methods of doing a hair transplant using follicular units <sup>(1)</sup>.

### Microneedling:

The stratum corneum is punctured by microneedling, a less invasive dermatological technique that involves rolling small needles over the skin. Neovascularization and growth factor synthesis are induced in treated regions, which stimulates dermal papillae stem cells and hair development. Microneedling has been found to enhance hair follicle development when combined with other hair growth stimulating treatments such minoxidil, platelet-rich plasma, and topical steroids. It has been hypothesized that microneedling makes it easier for these first-line drugs to enter the skin <sup>(4)</sup>.

Percutaneous collagen induction (PCI) or "microneedling" is a minimally invasive technique used to treat a wide variety of skin disorders. This treatment's foundation was laid in 1995, when Orentreich and

Orentreich employed dermal needling to address subcision scars. This reduced the visibility of scars by making subcuticular incisions with inserted needles<sup>(5)</sup>.

Applying these concepts, Fernandes created dermaroller PCI treatment. Micropunctures are made into the stratum corneum and the papillary dermis using a dermaroller, a handheld device with a cylindrical shaped roller studded with small needles varying in length from 0.5 to 2.5 mm. These tiny punctures set off a chain reaction in the dermis, resulting in the production of collagen and elastin. Microneedling's ability to induce pore formation in the stratum corneum also makes it a useful tool for improving transdermal drug delivery (TDD)<sup>(6)</sup>.

The roller isn't the only microneedling instrument available; the pen and stamp are also useful for targeting specific regions of skin and hair. The pen is a tiny, battery-operated device that employs fine needles to punch vertically into the skin at speeds of up to 25+ times per second<sup>(4)</sup>.

#### **Principle and mechanism of action:**

In order to create a controlled skin injury without really harming the epidermis, microneedles penetrate the skin several times using very small needles. Minimal bleeding occurs at the wound's surface, and growth factors such as connective tissue activating protein, fibroblast growth factor, connective tissue growth factor and platelet-derived growth factor as well as TGF- $\alpha$  and - $\beta$  are secreted to initiate the wound healing cascade<sup>(7)</sup>.

Needles help break up old, stiff scar tissue and promote revascularization. Fibroblast migration, proliferation, and intercellular matrix deposition initiate neocollagenesis and neovascularization. Collagen III, which is deposited after 5 days post-injury, causes skin tightening that lasts for another 7 years<sup>(7)</sup>.

Six months after treatment, skin that had four microneedling sessions spaced one month apart showed up to a 400% increase in collagen and elastin deposition, whereas a year later, the stratum spinosum was thickened and the rete ridges were normal. Unlike the parallel arrangement seen in scar tissue, the collagen fibers in normal tissue seem to be bundled in a lattice structure<sup>(7)</sup>.

#### **Dermatological microneedling applications:**

Numerous clinical investigations have shown the benefits of microneedling for a variety of conditions. Both on its own and in conjunction with other therapies including radiofrequency, subcision, platelet-rich plasma, punch elevation, chemical peels, and lasers, it has been attempted for many conditions. With a topical formulation, it increases the efficacy and depth of penetration<sup>(7)</sup>.

#### **Application of Drugs to the Skin (Transdermal):**

Microneedling is a procedure used to improve medication delivery through the skin's protective barrier.

It has been shown that bigger molecules are absorbed better in in-vitro skin models. Microneedling has been used for the transdermal delivery of a wide range of drugs, from macromolecular biopharmaceuticals like heparin, insulin, growth hormone, and albumin to immunobiologicals like influenza vaccines, hepatitis B and tetanus toxoid, and even proteins, peptides, and drugs like minoxidil, aspirin, tretinoin, and L-ascorbic acid. For even deeper medication penetration, microneedling has been used in tandem with other cutting-edge methods including micropumps, sonophoresis, iontophoresis, and electroporation<sup>(7)</sup>.

With respect to dermatology, microneedling is often combined with topical vitamin C and tretinoin for the treatment of acne scarring and skin rejuvenation. An additional use is improving the effectiveness of minoxidil and platelet-rich plasma in the treatment of AGA by increasing their penetration. Photodynamic treatment with 5-aminolevulinic acid is improved by microneedling. Both photoaging and actinic keratosis have responded well to their combined usage<sup>(7)</sup>.

#### **Microneedling in Alopecia:**

In alopecia, microneedling has been shown to promote hair regrowth by activating the hair bulge and triggering the release of wound-healing-related growth factors like epidermal growth factors, vascular endothelial growth factor, platelet-derived growth factor, and transforming growth factors  $\alpha$  and  $\beta$ . Expression of Wnt proteins including Wnt3a and Wnt10b is also boosted by microneedling. Evidence suggests that these proteins specifically promote hair development by activating dermal papillae stem cells. Microneedling has been found to increase hair follicle development when combined with other therapies for hair growth, such as minoxidil, platelet-rich plasma, and topical steroids. It's theorised that microneedling helps such first-line drugs get to their target tissues<sup>(4)</sup>.

One of the latest developments in this field is microneedling's use in treating alopecia of the scalp. Research has shown that when combined with microneedling, the effects are significantly greater than those of minoxidil alone. Patients are advised to utilise minoxidil with at-home dermarollers, and the results include improved hair growth. Microneedling therapy was recently compared to topical minoxidil, although the results showed that minoxidil alone was still superior. Combining microneedling with topical triamcinolone acetonide in alopecia areata has been shown to improve response<sup>(7)</sup>.

#### **Adverse effects:**

Almost no serious side effects have been linked to microneedling. Microneedling, unlike ablative and resurfacing operations, leaves the epidermis intact and the quantity of melanocytes mostly unaltered in a 24-hour histologic evaluation, meaning that there is less downtime and less danger of dyspigmentation. In terms of the potential for dyspigmentation, it has a higher

safety profile across the board. Effects that are harmful are uncommon and usually short-lived<sup>(8)</sup>.

Possible erythema and irritation are the most prevalent negative reactions to microneedling, although they often go away after a few hours. Post-inflammatory hyperpigmentation, acne flare-ups, systemic hypersensitivity, herpes reactivation, allergic responses, granulomatous reactions, and local infections are some other potential complications of using a dirty tool. There have also been reports of people developing allergic contact dermatitis from coming into touch with the needles. A patient with acne scars who had two sessions of microneedling described a tram-track effect, wherein the scars became evenly spaced linear papular scars across bony prominences of the face. Avoiding this is possible by using smaller needles and using less pressure<sup>(7)</sup>.

As an adjunct to already-existing hair loss treatments, microneedling was evaluated in two separate trials<sup>(9, 10, 11)</sup>.

**Burns et al.**<sup>(9)</sup> discovered that 11/11 women whose Ludwig scores had plateaued after 6 months of various hair loss therapies had improvements after starting bimonthly microneedling in combination with 5% minoxidil. Those who had been utilizing hair loss therapies for almost a year before adding microneedling had an increase in hair counts, as demonstrated by **Starace et al.**<sup>(10)</sup>.

#### **Contraindications:**

Herpes labialis or other local infections like warts, aggressive acne, blood dyscrasias, patients on anticoagulant medication, moderate to severe chronic skin condition such eczema and psoriasis, irresistible keloidal propensity in a patient undergoing chemotherapy and radiation<sup>(7)</sup>.

#### **CONCLUSION**

Several clinical studies demonstrated in most cases, a positive outcome for microneedling as an adjunct therapy for Androgenic Alopecia.

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