

An Overview about Microneedling and its Use in Dermatology: Review Article

Abdulsalam Mohammed Bin Khalel*, Amin Mohamed Amer, Ayman EL Sayed Ahmed Youssef

Department of Dermatology, Venerology & Andrology, Zagazig University Hospital, Egypt.

*Corresponding author: Abdulsalam Mohammed Bin Khalel, Mobile: (+20) 01550801286,

E-Mail: kamonna2006@gmail.com

ABSTRACT

Background: Microneedling (MN) has been used to treat scars, rhytides, and dyschromia, among other dermatological conditions. Small channels of dermal as well as epidermal damage are created by puncturing the skin with needles. After being damaged collagen is removed, then new growth and remodeling. Neovascularization and neocollagenesis are aided by elastic fiber formation and fibroblasts as well as platelet-derived growth factors. In the end, scars, particularly atrophic scars, will look better. Cytokines such as interleukin-1 alpha, interleukin-6, tumor necrosis factor-alpha, and granulocyte and macrophage colony-stimulating factor are released quickly after microneedling, and keratinocyte migration as well as vasodilation occurs to heal micropunctured epidermal damage. **Objective:** This review article aimed to discuss general overview of microneedling and assessment of its uses in dermatology.

Methods: Microneedling, and Dermatology, 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 study from January 2000 to May 2021 was 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 Papers that did not fall under the purview of major scientific investigations, such as unpublished manuscripts, oral presentations, conference abstracts, and dissertations were omitted.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: Percutaneous collagen induction therapy, or microneedling, is a cutting-edge non-surgical method that involves puncturing the skin with a series of extremely thin needles in a short time. This approach has garnered widespread support among practitioners of many therapeutic modalities (cheap, effective procedure, which don't need much experience, safe and simple).

Keywords: Microneedling, Dermatology, Percutaneous.

INTRODUCTION

Subcision is a skin needling method first described in 1994 by Orentreich and Orentreich to remove fibrous strands responsible for depressed cutaneous scars and rhytides. Needle dermabrasion, a procedure involving the use of a tattoo gun that isn't filled with ink, was reported by Camirand and Doucet to improve the clinical appearance and texture of surgical scars after three years. In 2006, Fernandes presented the first microneedle stamping technology to the market ⁽¹⁾.

Using these ideas and a dermaroller equipped with very fine needles, Fernandes created percutaneous collagen induction (PCI) therapy. A current microneedling device has a barrel with a number of very thin needles (0.5 to 1.5 mm in length) on it. These needles are rolled over the skin, puncturing the stratum corneum and the papillary dermis multiple times. In response to these tiny injuries, the dermis produces new collagen and elastin fibers (through the release of growth factors) ⁽²⁾.

Acne atrophic scarring is typically treated with microneedling, which is performed in an office setting. Its clinical utility has been repeatedly demonstrated. In most cases, a series of 3–5 therapy sessions spaced out every 2–4 weeks will result in an improvement of 50%–70%. Microneedling has been compared to chemical peels, cryorolling, and carbon dioxide laser therapy for the treatment of acne scars, and these treatments are often used together for optimal results ⁽¹⁾.



Rechargeable Electric Micro Needle System



Figure (1): Wireless electric derma pen (1).

Mechanism of action:

Microneedling has been used to treat scars, rhytides, and dyschromia, among other dermatological conditions. This treatment employs needles to penetrate the skin, opening tiny channels in the epidermis and dermis. New growth and remodeling can occur after the damaged collagen has been removed. Neovascularization and neocollagenesis are aided by elastic fiber formation and fibroblasts, as well as platelet-derived growth factors. In the end, scars, particularly atrophic scars, will look better ⁽³⁾.

Cytokines such as interleukin-1 alpha, interleukin-6, tumor necrosis factor-alpha, and granulocyte and macrophage colony-stimulating factor are released quickly after microneedling, and keratinocyte migration as well as vasodilation occurs to heal micropunctured epidermal damage ⁽⁴⁾.

Specific device:

There are now two main varieties of microneedles: fixed needle rollers and electrically powered pens with single-use sterile needles. Bleeding on the skin's surface is how both manual and electrical devices work. As opposed to using a manual pen, an electrically powered one can be maneuvered with more ease, can cover more ground in less time, and has disposable needles, which greatly decreases the danger of spreading illness ⁽⁶⁾.

Dermatological Applications:

Microneedling has been the subject of a great deal of study over the past decade, with numerous studies detailing its clinical effectiveness, treatment details, histological analysis, and combination therapies. Scarring from acne, ageing skin, sagging skin, scars from trauma or burns, and drug delivery. Most commonly, dermatologists use microneedling to treat skin renewal, surgical scars, melasma, enlarged pores, drug delivery, and dyschromia ⁽¹⁾.

Multiple studies have demonstrated that MN is effective in treating scars. Ten patients with atrophic facial scars from acne were included in a pilot study by **El-Domyati et al.** ⁽⁷⁾ in which the histological changes generated by MN were measured. Samples of the skin were taken before and after the Dermaroller was used. Towards the end of treatment, there was a statistically significant uptick in the formation of collagen types I, III, and VII, and a decrease in total elastin. Mild pain and swelling at the treatment site were noted by all patients, however these subsided within 24 hours. On the whole, no untoward consequences were detected. Eighty-five to ninety-five percent of patients reported being satisfied with the treatment, with the majority (51%) reporting an improvement in scar appearance, 40% reported an improvement in skin texture, and 5% reported no change after three months and six rounds of treatment.

Dhurat et al. ⁽⁸⁾ discovered that treating 100 male patients with MN and minoxidil was more effective than treating them with minoxidil alone for androgenic alopecia. Eighty percent of the subjects who received Dermaroller treatment plus 5 percent minoxidil lotion over the course of 12 weeks experienced moderate or significantly increased hair regrowth, as determined by the study's authors. Subjective hair growth improvement of over 50% was observed by 82% of the same group of patients. Patients who received only minoxidil 5% had a much lower rate of improvement (4.5%) than those in the other treatment groups. The MN group had a larger mean change in hair count by study's conclusion. In addition, the MN group had fresh hair growth begin at 6 weeks, but the minoxidil alone group had to wait 10 weeks. None of the test subjects experienced any negative side effects.

An alternative to standard treatment for alopecia areata, MN has been proposed. Currently, intralesional corticosteroids such as kenalog are the basis of treatment

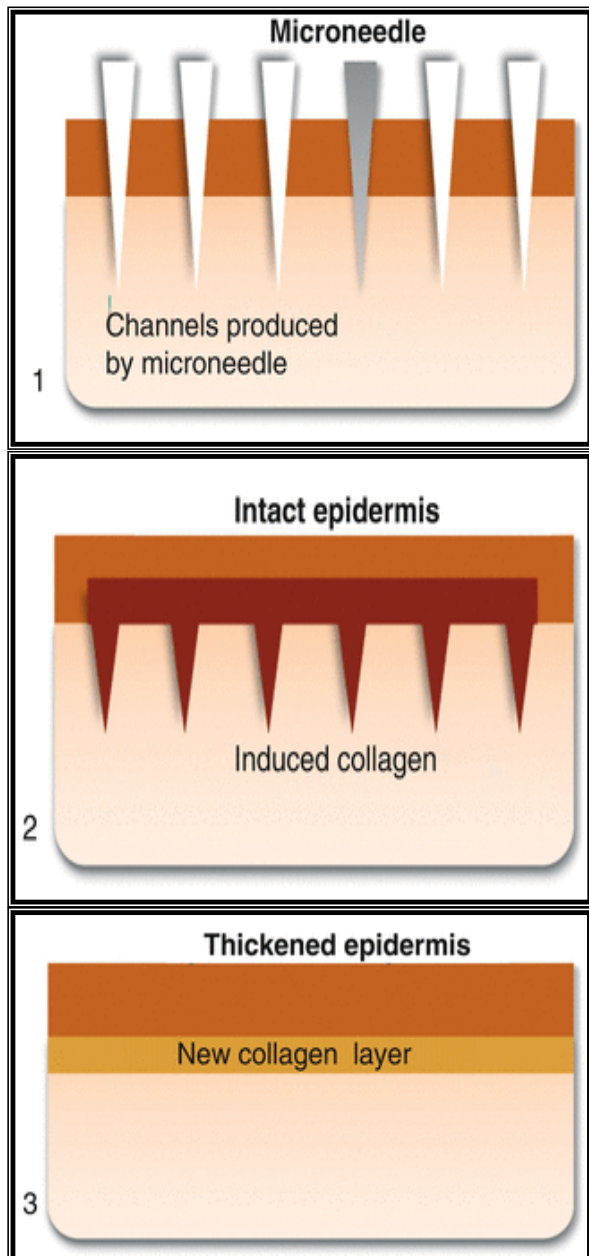


Figure (2): How Dermaroller works ⁽⁵⁾.

for alopecia areata (ILK). It is believed that MN's ability to generate collagen will protect against steroid-induced atrophy and that it will be less painful to inject than steroids⁽⁹⁾.

It is still unknown whether or if MN is effective when used in combined treatment for vitiligo. Contrasting narrowband ultraviolet B and topical 0.005% latanoprost solution with and without Dermaroller. **Stanimirovic et al.**⁽¹⁰⁾ studied repigmentation in individuals with refractory bilateral symmetrical vitiligo. Repigmentation occurred in 38% of treated lesions for 17 patients in each group, with only 8.8% of repigmented lesions achieving full repigmentation. However, repigmentation did not differ significantly among the groups.

Several studies have suggested MN as an alternative to standard treatment for melasma, vitiligo, and periorbital hyperpigmentation, all of which disproportionately affect those with darker skin tones. MN improved transdermal medication absorption that has proven to be more effective in treating melasma than traditional skin lightening methods alone⁽¹¹⁾.

Advantages of Microneedling:

When compared to traditional resurfacing techniques, the risk of several cutaneous adverse effects is lower with microneedling therapy. Low impact on skin coloration, helps prevent further injury, infection and scarring, keeping some of the epidermis intact speeds healing and preserves the skin's protective barrier⁽¹²⁾.

Disadvantages of Microneedling:

Unlike laser resurfacing, the results don't immediately become apparent. Compared to 3-mm needling, 1-mm needling results in far less external bleeding, which means less exposure to blood. For the first four days after a 3-mm incision, there will be visible swelling and bruising, and the technique can be rather uncomfortable⁽¹³⁾.

CONCLUSION

Percutaneous collagen induction therapy, or microneedling, is a cutting-edge non-surgical method that involves puncturing the skin with a series of extremely thin needles in a short time. This approach has garnered widespread support among practitioners of many therapeutic modalities (cheap, effective procedure, which don't need much experience, safe and simple).

Financial support and sponsorship: Nil.

Conflict of interest: Nil.

REFERENCES

1. **Alster T, Graham P (2018):** Microneedling: a review and practical guide. *Dermatologic Surgery*, 44 (3): 397-404.
2. **Hou A, Cohen B, Haimovic A et al. (2017):** Microneedling: a comprehensive review. *Dermatologic Surgery*, 43 (3): 321-339.
3. **Schoenberg E, O'Connor M, Wang J et al. (2020):** Microneedling and PRP for acne scars: A new tool in our arsenal. *Journal of Cosmetic Dermatology*, 19 (1): 112-114.
4. **Kalil V, Campos V (2021):** Drug Delivery. In: *Dermatology Fundamental and Practical Applications*. Springer. Pp: 55-64. <https://link.springer.com/book/10.1007/978-3-030-81807-4>
5. **Skroza N, Proietti I, Potenza C et al. (2016):** Mechanic Resurfacing, Needling, Dermoabrasion and Microdermoabrasion. In: *International Textbook of Aesthetic Surgery*. Springer, Pp: 1167-1182. https://link.springer.com/chapter /10.1007/978-3-662-46599-8_80
6. **Ziaefar E, Ziaefar F, Mozafarpour S et al. (2021):** Applications of microneedling for various dermatologic indications with a special focus on pigmentary disorders: A comprehensive review study. *Dermatologic Therapy*, 34 (6): 159-63.
7. **El-Domyati M, Barakat M, Awad S et al. (2015):** Microneedling Therapy for Atrophic Acne Scars: An Objective Evaluation. *The Journal of Clinical and Aesthetic Dermatology*, 8 (7): 36-42.
8. **Dhurat R, Sukesh M, Avhad G et al. (2013):** A randomized evaluator blinded study of effect of microneedling in androgenetic alopecia: a pilot study. *International Journal of Trichology*, 5 (1): 6-11.
9. **Chandrashekar B, Yepuri V, Mysore V (2014):** Alopecia areata-successful outcome with microneedling and triamcinolone acetonide. *Journal of Cutaneous and Aesthetic Surgery*, 7 (1): 63-64.
10. **Stanimirovic A, Kovacevic M, Korobko I et al. (2016):** Combined therapy for resistant vitiligo lesions: NB-UVB, microneedling, and topical latanoprost, showed no enhanced efficacy compared to topical latanoprost and NB-UVB. *Dermatologic therapy*, 29 (5): 312-316.
11. **Fabbrocini G, De Vita V, Fardella N et al. (2011):** Skin needling to enhance depigmenting serum penetration in the treatment of melasma. *Plastic Surgery International*, 11: 241-45.
12. **Cohen E, Elbuluk N (2016):** Microneedling in skin of color: a review of uses and efficacy. *Journal of the American Academy of Dermatology*, 74 (2): 348-355.
13. **Singh A, Yadav S (2016):** Microneedling: Advances and widening horizons. *Indian Dermatology Online Journal*, 7 (4): 244-254.