Journal of Medical Case Reports and Reviews
Received 14 Apr 2019 | Revised 20 Apr 2019 | Accepted 19 Jun 2019 | Published Online 23 Jun 2019

JMCRR 02 (06), 277-281 (2019) ISSN (O) 2589-8655 | (P) 2589-8647

JMCRR

MICRONEEDLING IN MATURE BURN SCARS

Matilda I.E. Svenning,[1], Jennifer Berg Drejøe[1]

[1]Department of Plastic Surgery and Burns Treatment, Rigshospitalet, Copenhagen University Hospital, Denmark

Abstract:

Background: Thermal injuries can lead to severe hypertrophic scarring and be psychologically devastating for patients. Patients often seek help to improve aesthetic appearance and function of hypertrophic scars and contractures. This study aims to share our experience with microneedling also called "percutaneous collagen induction" of mature hypertrophic scars from thermal injuries in all ages.

Patients and method: This prospective study includes patients of all age groups, deemed suitable for treatment of mature hypertrophic scars. Patients were excluded if they had skin infections, unrealistic outcome expectations or immature scarring. Suitable patients were instructed in pre- and post-operative treatment with vitamin A and use of microneedling (Dermaroller®). Surgeries were performed under General Anesthesia. Patients were assessed in outpatient clinics post-operatively and offered further treatment if necessary. After completed treatment self-assessment forms were filled out by the patients.

Results:19 patients (F:M 12:7), age 4-82 years (median 18,5). Burn mechanism was mainly flash burns or scalding. Interval from time of injury to treatment varied from 10 months – 17 years. Interval from time of treatment to evaluation ranged from 2,5 weeks - 7 months. 14 patients reported an overall improvement on the self-assessment scale. 12 patients reported improvement in thickness, irregularity and colour, 10 patients in elasticity, 7 patients in pain and 8 in pruritus. 8 patients would recommend treatment to others. 13 patients reported post-operative discomfort (itching, erythema, swelling). Majority of these adverse effects resided within 3 weeks.

Conclusion: We can conclude that microneedling is a safe treatment for patients suffering scarring following thermal injuries. Results may vary but no harmful side effects were recorded. Further studies are needed to improve objective outcome measurements, as this proved to be the most challenging factor in the study.

Keywords: microneedling, percutaneous collagen induction, burns, burn scar treatment

⋆**Corresponding Author: Matilda I.E. Svenning,** Rigshospitalet, Blegdamsvej 9,2100, Copenhagen N, Denmark

Introduction:

Thermal injuries can lead to severe hypertrophic scarring and be both physically and psychologically debilitating for the patient, resulting in low self-esteem and difficulties with reintegration into society.[1] Patients often seek help to improve aesthetic appearance and function of hypertrophic scars and contractures after trauma to the skin.[2, 3] There are many well-known methods to treat mature hypertrophic burn scarring such as reconstructive surgery, laser treatments, pressure garments, and moisturisers.[4, 5]. Fernandes and Orentreich independently described percutaneous collagen induction in 1997 as a single needle subscision to break up scar formation, which was further developed to a drum shaped roller with hundreds

of needles, to allow treatment of larger areas. They hypothesized two different forms of scar treatment provided by the needling. The first is the physical release from the underlying deeper, connective tissue, and the second is the controlled trauma that stimulates the inflammatory response leading to collagen deposition.[6, 7] Other treatments, such as laser and surgical reconstruction, are ablative or invasive with removal of the epidermal layer and can have side effects such as skin necrosis, hyperpigmentation and ulceration, whilst others show varying and inconclusive results.[8, 9] The destruction of the epidermis makes the skin more prone to hyperpigmentation. When the epidermis is destroyed it stimulates an inflammatory response of collagen formation in the dermis. Fibroblasts produce thick bundles of scar collagen that is laid down in a parallel orientation rather than the lattice pattern that is seen in normal skin.[8] Ablative treatments make the surrounding skin more depressed to match the scar, instead of increasing the height of the scar to match the surrounding normal skin.[6, 7] Aust et al hypothesised that the optimal treatment would be to do the opposite and build up the scar tissue to the level of normal skin and promote tissue growth factor beta (TGF-B) to regenerate collagen and scarless wound healing. Percutaneous collagen induction creates micro wounds in the dermis but preserves the epidermis, giving the same stimuli to the dermis but without the downsides of damaging the epidermis. As the epidermis is only pricked and not completely removed, there is no risk of post inflammatory hypo- or hyper pigmentation of the skin from exposure to air.[2, 6-8]

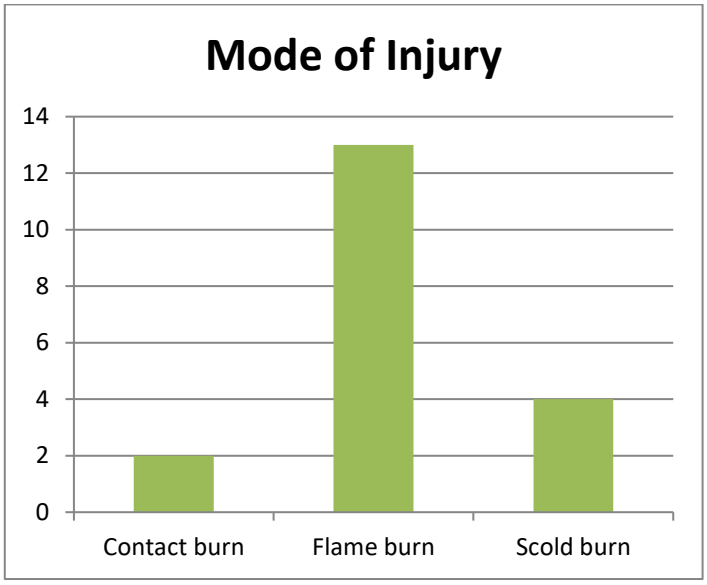
This study aims to share our experience with microneedling in a group of 19 patients of all ages, with mature hypertrophic scars from thermal injuries.

Method:

A group of 19 patients were consecutively included in the study. They were selected consecutively for treatment by an experienced senior burns consultant over a period of 20 months (April 2016-December 2017). Patients were included if they met the inclusion criteria chosen prior to commencing the study. Patients of all ages and both sexes with mature hypertrophic burn scars (at least 10 months post injury) were included, and patients with immature burn scars, ongoing or active infections, or patients with unrealistic expectation outcome were excluded from the study.

The study population consisted of 19 patients, 7 males and 12 females. Mean age was 22,5 years ranging from 4 to 82 years of age. Interval from time of injury to treatment with percutaneous collagen induction ranged between 10 months to 7 years. All type of burn injury mechanisms were included, majority being flame burn, followed by scald burn and contact burn. (Table 1).

Table 1. Mode of initial injury.

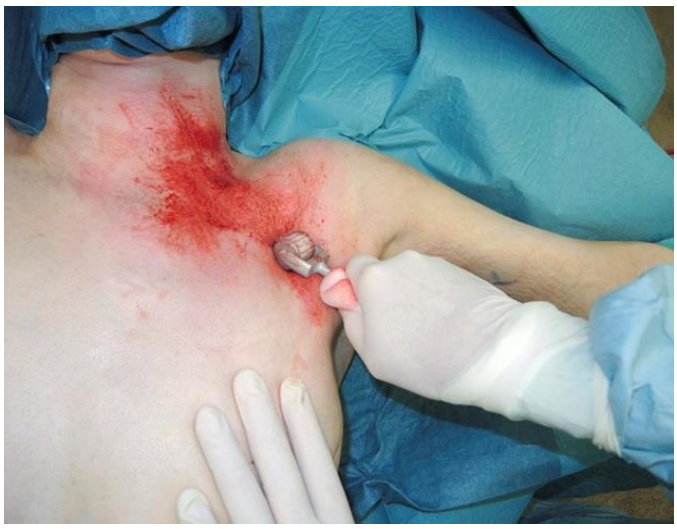


All patients were seen pre-operatively and informed consent achieved in a pre-operative consultation. The patients were questioned about their symptoms and the scars were evaluated clinically. Scars which were irregular, thickened and inelastic were included. Due to the big heterogeninicity within the scars the VSS and POSAS scales turned out to be inconsistent and irreproducible and was not used.

Suitable patients were instructed in pre-operative care at home with a Home-kit. The kit included a 0,2 mm microneedling drum and Lipopeptid A topical treatment which was used daily for 2-3 weeks prior to treatment.

All microneedling treatment was carried out in theatre and due to the size of areas being treated all treatments were performed under general anaesthetic using a sterile technique. The scars were treated by rolling the microneedling drum with an even, continuous pressure, vertically, horizontally and diagonally over the scarred area until appropriate punctuate bleeding was obtained. (Figure 1). Extremities, torso and neck were treated with 2,5 mm long needles, whilst face, hands and palms were treated with 1,5 mm long needles. Immediate post-operative care included Liopeptid A creme, jelonet and gauze. Patients were seen in outpatient clinic and evaluated after final treatment ranging between 2,5-7 months post-operatively. Self-assessment scales and photos were used to evaluate results of treatment.

Figure 1.



Results:

Majority of the patients (12) received one treatment, 5 patients received 2 treatments and 2 patients received 3 treatments. Outcomes measured in the self-assessment forms were pain, pruritus, elasticity, colour, thickness, irregularity and overall satisfaction with the treatment results. Results from the self-assessment scales were mixed but reported an overall improvement in 74% (14) of the patients. 63% (12 patients) reported improvement in irregularity, thickness and colour, 53% (10 patients) reported improvement in elasticity and 42% (8 patients) in pruritus. 37% (7 patients) reported improvement in pain. This can be seen summarised in Table 2.

Table 2. Results over improvement in burn scars after ended treatment.

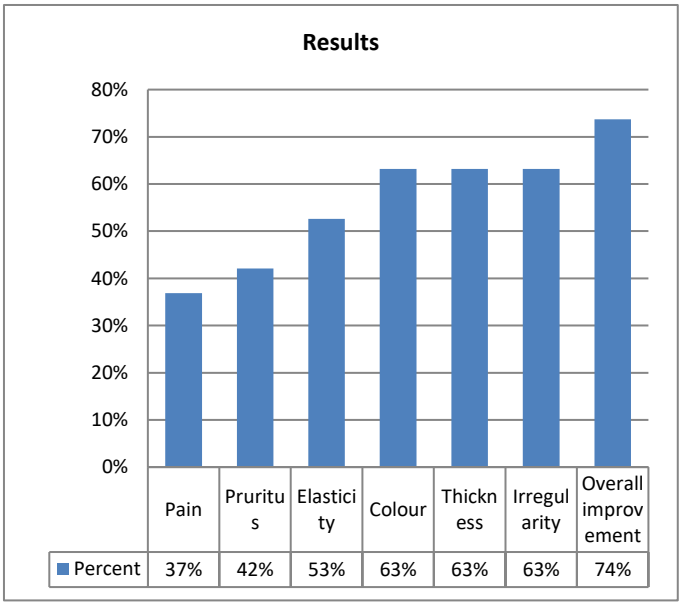


Figure 2 shows the results after two treatments with microneedling in a 29-year-old female who sustained a flame burn to her arm. Figure 3 shows the results after two treatments with microneedling in a 40-year-old female who sustained a flame burn to her chest.

Immediate adverse effects that can be expected after microneedling treatment include swelling, erythema, pain and pruritus. Post-operative bleeding and oozing are also to be expected immediately after treatment.[10] 68% (13) of the patients experienced one or more of these expected adverse effects. 68% (13 patients) reported erythema, 53% (10 patients) reported pruritus, 47% (9 patients) reported swelling and 26% (5 patients) reported pain. All adverse effects were minor and did not require additional treatment. Apart from one patient who reported erythema on check-up 6 months post-operatively, all adverse effects disappeared within 3 weeks after receiving treatment.

Figure 2.

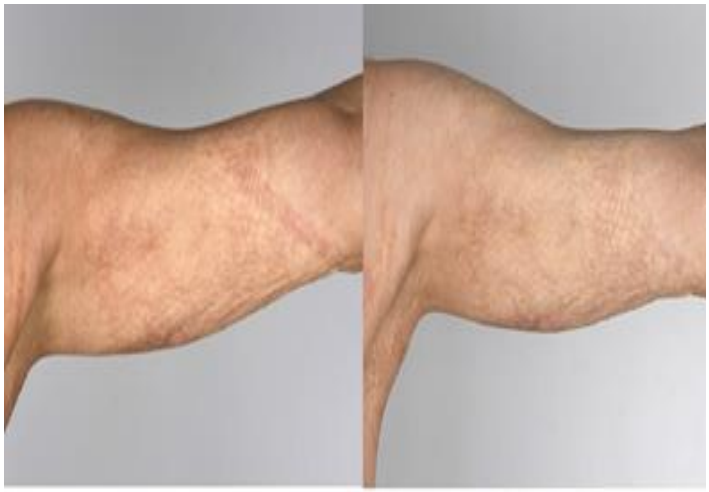


Figure 2. 29-year-old female. Pictures showing left upper arm before and after two micro needling treatments, after initial flame burn. Rated 9/10 on overall improvement score.

Figure 3.

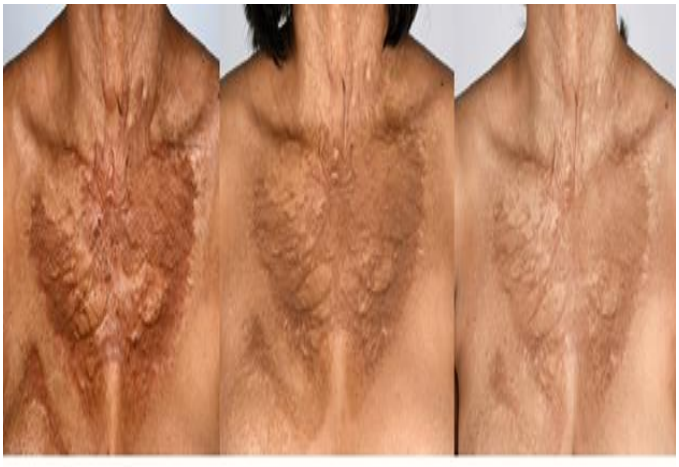


Figure 3. 40-year-old female. Pictures showing pre-treatment and results after one and two treatments. Initial injury was a flame burn. Rated 8/10 overall improvement after 2 treatments.

Discussion:

Our study finds microneedling to be a safe treatment for mature hypertrophic burns scars, with mixed but overall satisfactory subjective results.

A scar can differ greatly in appearance both within the scar itself, but also depending on anatomical location and size of the scar.[5, 11, 12] The patients included in our study showed great inter-individual variation in scarring and also great intra-individual variation within their scars. Therefore, results will vary due to heterogeneous scarring of the specific area being treated, and from patient to patient.

It has been shown that Vitamin A and C are necessary for the formation of new collagen. Vitamin A is a known key regulator of cell proliferation and differentiation in the dermis and epidermis, as well as stimulating tissue growth factor (TGF) B3 over B1 and B2. TGF-B1 is a known pro-fibrogenetic factor leading to healing with scarring, whereas TGF-B3 is a known anti-fibrogenic factor and has shown to lead to healing with less scar formation. Vitamin C is needed to produce collagen as well as the healing process after trauma to the body.[3, 8] Zeitter et al showed in a study on rodents that the group treated with repetitive surgeries with 1 mm needles and topical vitamin A and C improved the most in comparison to the control group (no treatment) and the groups treated with 1 mm vs 3 mm microneedling combined with and without vitamin A and C topical treatments. They measured improvement in epidermis thickening, collagen type 1 in relation to type 3, collagen pattern, and the recruitment of TGF B 3 compared to TGF-B1 and TGF-B2 in the dermis.[3] Our patients were treated mainly with Vitamin A, and some with Vitamin C added at a later stage. Not all patients were suitable for home-kit treatment with vitamin A and C, this was primarily due to compliance.

Evaluation of a burn scar is known to be a challenging task and often influenced by subjective impression. Acceptable evaluation methods widely used include self-assessment scales, assessment scales by professionals, such as Vancouver Scar Scale and the POSAS scale and photographs[5, 8, 12, 13]. We found objective evaluation of our results to be the most challenging aspect of the study. Patient self-assessment scales are all subjective and risk being biased by human factor. Photographs can create bias in the appearance of a scar depending in technicalities of the photo for example lighting, angle, magnification etc.[5] Initially the patients were evaluated with both the Vancouver Scar Scale and the POSAS scale. However, due to the heterogeneity of the patients scars we found the scales to show considerable inter- and intra-observer variability and difficult to use. N. Moimen et al showed in their systematic review of objective scar measurement, that the most accurate way to objectively measure a scar would be with a panel of devices with different abilities for example 3D cameras for surface area and volume, colorimeter for colour, high-frequency ultrasound for scar thickness and cutometer for skin elasticity and pliability. When measuring subjective outcomes such as pruritus and pain one would have to rely on self-assessment scales.[12] In a future setting clearer instruction on how to fill out the scales and even better tools to evaluate the scars is preferable.

Even with the limitation in evaluation in our study, other studies in similar settings have found the similar results. Lange et Al found in treating 47 children with percutaneous collagen induction, an overall subjective improvement and general satisfaction. Frequently the patients reported the scar being more elastic, less tight and more homogeneous.[13] Aust et al did a study of 480 patients over 9 years. The patients were suffering from wrinkles, scars and stretch marks or lax skin. Most patients received one treatment with PCI and all patients were treated with vitamin A and C topically. Histology samples 6 months post treatment showed a considerable increase in collagen and elastin with a normal lattice pattern compared to pre-operative parallel collagen pattern. All three groups improved significantly on the visual analogue scale used for evaluation.[2]

Conclusion:

From our study we can conclude that microneedling is a safe treatment with acceptable minor adverse effects, and mixed but satisfactory overall subjective improvement in scar appearance. It seems the most suitable patients are patients with hypertrophic, irregular and firm scars. These patients reported the best improvement in elasticity and thinning of the scars. Evaluation of the treatment can be improved by using objective devices to specifically measure improvement in different properties of the scar.

References:

[1.] Puri, V., et al., *Holistic burn care: Survival and beyond.* Burns, 2017. **43**(5): p. 1131-1132.

[2.] Aust, M.C., et al., *Percutaneous collagen induction therapy: an alternative treatment for burn scars.* Burns, 2010. **36**(6): p. 836-43.

[3.] Zeitter, S., et al., *Microneedling: matching the results of medical needling and*

repetitive treatments to maximize potential for skin regeneration. Burns, 2014. **40**(5): p. 966-73.

[4.] Dover, J.S. and G. Hruza, *Lasers in skin resurfacing.* Australas J Dermatol, 2000. **41**(2): p. 72-85.

[5.] Busch, K.H., et al., *Medical Needling: Effect on Moisture and Transepidermal Water Loss of Mature Hypertrophic Burn Scars.* Cureus, 2018. **10**(3): p. e2365.

[6.] Fernandes, D., *Percutaneous collagen induction: an alternative to laser resurfacing.* Aesthet Surg J, 2002. **22**(3): p. 307-9.

[7.] Aust, M.C., et al., *Percutaneous collagen induction therapy: an alternative treatment for scars, wrinkles, and skin laxity.* Plast Reconstr Surg, 2008. **121**(4): p. 1421-9.

[8.] Ramaut, L., et al., *Microneedling: Where do we stand now? A systematic review of the literature.* J Plast Reconstr Aesthet Surg, 2018. **71**(1): p. 1-14.

[9.] Najafi Ghezeljeh, T., F. Mohades Ardebili, and F. Rafii, *The effects of massage and music on pain, anxiety and relaxation in burn patients: Randomized controlled clinical trial.* Burns, 2017. **43**(5): p. 1034-1043.

[10.] Orentreich, D.S. and N. Orentreich, *Subcutaneous incisionless (subcision) surgery for the correction of depressed scars and wrinkles.* Dermatol Surg, 1995. **21**(6): p. 543-9.

[11.] Bloemen, M.C., et al., *Prevention and curative management of hypertrophic scar formation.* Burns, 2009. **35**(4): p. 463-75.

[12.] Lee, K.C., et al., *A systematic review of objective burn scar measurements.* Burns Trauma, 2016. **4**: p. 14.

[13.] Kubiak, R. and B. Lange, *Percutaneous collagen induction as an additive treatment for scar formation following thermal injuries: Preliminary experience in 47 children.* Burns, 2017. **43**(5): p. 1097-1102.