






Microneedling: a review

Microagulhamento: uma revisão

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■ ABSTRACT

Introduction: Microneedling, also called percutaneous collagen induction therapy (PCIT), is a technique applied with an equipment called roller. It is suitable for rejuvenation, alopecia, all types of scars, acne, photo rejuvenation, stretch marks, skin flaccidity, melasma, expression wrinkles, and improvement of the general aspect of the skin. **Objective:** Perform a literature review to identify the major clinical applications of microneedling. **Methods:** The research was done from 2009 to 2018, in electronic databases PubMed and Scielo. The studies recovered were described and analyzed. **Results:** We selected 12 articles and two books for their relevant content. **Conclusion:** Microneedling is a simple technique, an innovative treatment that has been used for different dermatological pathologies. This method acts by naturally stimulating collagen by responding to the inflammatory process and also by activating the transdermal ingredient access system (TIAS), known as Drug Delivery.

Keywords: Collagen; Wound healing; Rejuvenation; Striae distensae; Wounds and injuries.

■ RESUMO

Introdução: O microagulhamento também denominado como terapia de indução percutânea de colágeno (TIPC), consiste numa técnica aplicada através de um equipamento chamado *roller*. A técnica é indicada para rejuvenescimento, alopecia, todos os tipos de cicatrizes, acne, foto rejuvenescimento, estrias, flacidez de pele, melasma, rugas de expressão e melhora do aspecto geral da pele. **Objetivo:** Realizar revisão da literatura para identificar as principais aplicabilidades clínicas no uso do microagulhamento. **Métodos:** A pesquisa foi realizada no período de 2009 a 2018, em bases de dados eletrônicas PubMed e Scielo. Os estudos assim recuperados foram descritos e analisados. **Resultados:** Foram selecionados 12 artigos e 2 livros por apresentar conteúdo relevante. **Conclusão:** O microagulhamento é uma técnica simples, tratamento inovador e vem sendo utilizado para diferentes patologias dermatológicas. A técnica age pela estimulação natural de colágeno através da resposta ao processo inflamatório e outra facilitando o sistema de acesso transdermal de ingredientes (SATI), conhecido como *Drug Delivery*.

Descritores: Colágeno; Cicatrização; Rejuvenescimento; Estrias de distensão; Ferimentos e lesões.

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INTRODUCTION

Microneedling, also called percutaneous collagen induction therapy (PCIT), is a technique applied with a device called roller¹. The first roller was developed in 1993, in France, by a South African surgeon named Dr. Desmond Fernandes¹, who is considered the father of microneedling.

This equipment consists of a polyethylene roll that has embedded sterile stainless steel or titanium needles, whose number varies between 190 and 450 needles, according to the manufacturer^{2,3}. In the literature, we find some nomenclatures used, being the most appropriate: microneedling, percutaneous collagen induction, CIT (collagen induction therapy or collagen therapy), roller technique, or just roller.

The technique is indicated for rejuvenation, alopecia⁴, all types of scars, acne, photo rejuvenation, stretch marks, sagging skin, melasma, wrinkles, expression lines, and to improve the overall appearance of the skin^{1,2,3,5,6}.

Therefore, the objective of this study is to support the clinical applicability of microneedling in the literature.

METHODS

To carry out this study, we have searched the PubMed and Scielo electronic databases, using as keywords: “microagulhamento”, “drug delivery” and “microneedlings.”

The inclusion criteria were: clinical studies on the use of microneedling to treat aesthetic disorders, in Portuguese, English and also textbooks with relevant content, in the period from 2009 to 2018. The exclusion criteria were: experimental work, study of bibliographic review and those that were not related to the topic.

After selecting the studies, the data were organized in a table that considers the following items: identification of the author, year and title of the work, material, treatment location, treatment technique, number of sessions, use of assets after microneedling, anesthetic use, associated resources and complications, evaluation methods, results and conclusions.

RESULTS

The research consisted of 12 articles; five of them were selected and placed in a table for a better understanding of the studies, the other seven were not included in the table because they were experimental, review, master's thesis and course completion papers, however, because present relevant content, were used for the study, in the same way as two more books (Table 1)

DISCUSSION

Microneedling is a technique that uses a device called a roller, it consists of a polyethylene roller embedded in sterile stainless steel or titanium needles, its number varies from 190 to 450 needles whose length ranges from 0.5mm to 2.5mm^{2,7}.

The 0.25mm and 0.5mm needles are used to deliver drugs in fine wrinkles and to improve the shine and texture of the skin; those of 1.0mm and 1.5mm are used for sagging skin, medium wrinkles and global rejuvenation; those of 2.0mm and 2.5mm are used for distensible depressed scars, stretch marks, wavy and retractable scars³.

Regarding the use of anesthetics, sizes from 0.2mm to 0.3mm do not require the use of anesthesia, while sizes from 0.5 to 2.0mm need topical anesthetic and needles from 2.0mm to 2.5mm need general anesthesia^{3,8}.

The technique works in two ways: the first one by stimulating the natural production of collagen (NPC) by responding to the inflammatory process and the second by facilitating the Transdermal Ingredient Access System (TIAS), known as “drug delivery,” that is, increased permeation of actives².

The stimulus to collagen production begins with the loss of the integrity of the skin barrier, targeting the dissociation of keratinocytes, which results in the release of cytokines such as interleukin, resulting in dermal vasodilation and migration of keratinocytes to restore damage epidermal¹.

The healing process occurs in three phases: In the first, injury, there is the release of platelets and neutrophils responsible for growth factors with action on keratinocytes and fibroblasts. In the second, neutrophils are replaced by monocytes, and angiogenesis, epithelialization, and proliferation of fibroblasts occur, followed by the production of type III collagen, elastin, glycosaminoglycans and proteoglycans. In the third, maturation, type III collagen, which is predominant in the initial phase of the healing process and which is slowly being replaced by type I collagen, which is more durable, persisting for a period ranging from five to seven years.⁷

The mechanism of action of drug delivery is as follows: when rolling the equipment over the skin, microchannels are created, and in this way, the applied cosmetics or formulations permeate the skin much more effectively and quickly. In the literature, there are a range of studies that report the effectiveness of the technique in increasing the permeation of the actives, this can vary from 80% to 500%. Thus, the active ingredients present in the treatment products can reach the deeper parts of the skin with more efficiency than if they were applied only topically².

Table 1. Summary of Included Studies.

Author / Year	Paper Title	Material / N° Sessions	Place and treatment technique	Use of actives and anesthetics	Associated resources / complications	Evaluation methods	Results	Conclusion
1. Kalil et al. (2015) ¹²	Treatment of acne scars with the microneedling technique and drug delivery	Sterile Dr. Roller® device; 192 2mm needles; Three sessions interval of one to two months between sessions.	Atrophic scars of moderate to severe acne on the face. The rollers directed in a horizontal and oblique position, imitating the shape of the wind rose, with ten repetitions in each direction	Applying a mask; EGF - Epidermal growth factor 1%, IGF - Insulin growth factor 1%, TGFβ3 - Transforming growth factor 0.5%, Hyaluronic acid 0.5%, Acid Vitamin E 2%, Portulaca extract 1%, Gel mask containing growth factor; Dermomax® topical anesthetic for 60 min.	Did not associate; Edema and Erythema.	Pre- and post-procedure photos. Skin biopsy before and after 30 days of treatment.	Eight patients completed the study. Overall improvement in the appearance of the skin and slight improvement of distensible atrophic scars. Atrophic scars like ice picks did not improve with the procedure.	Modest improvement of atrophic scars; ice picks improvement with the procedure.
2. Kalil et al. (2015) ¹³	Randomized, double-blind comparative study of microneedling associated with drug delivery to rejuvenate the skin of the anterior chest	Dr. Roller®; 192 needles 0.07mm surgical steel thickness and 1.5mm in length. 3, with monthly interval.	Anterior region of the chest. With minimal 45° angle pressure, ten spreading movements in four directions: horizontal, vertical, diagonal right, and left.	Juvenile® 2%; Phytocelect Malus Domestic® 0.5%; Cell to Cell® 2%; Homeostatine®; Hyaluronic Acid 2.5%; Fluid Anhydrous Serum q.s.p 30. Anesthetic cream topic.	Home application of the same product, or the placebo, with gentle massages with the fingers until complete absorption 1x a day, at night Phenol Peeling 88%, before microneedling; No adverse effects were observed in the treated patients.	Pre and post 30-day evaluation of the procedure through photography, performed by a dermatologist unrelated to the study, and by applying self-assessment questionnaires by patients.	Twenty-two patients, three months of treatment, 100% improvement of patients; 28% improvement in overall rejuvenation with the use of the test product compared to placebo. Improvement 30% in patients treated with the use of microneedling and test product on skin texture, smoothness and firmness	To obtain results for advanced global rejuvenation, it is necessary to add specific actives for drug delivery. Significant improvement in overall appearance, demonstrating a well-tolerated procedure, with minimal adverse effects and a high patient satisfaction index
3. Lima (2015) ⁷	Association between microneedling and phenol therapy: a new therapeutic proposal for sagging, wrinkles, and acne scars on the face. Periorbital wrinkle treatments by collagen induction therapy	Instrument with 192 2.5mm needles, arranged in 8 rows, DR Roller® one session.	Face Back and forth movements until obtaining uniform bloody dew. Periorbital wrinkles. Rolling the device back and forth, with the same pressure; horizontally, vertically and diagonally to the right and left.	Skin regenerator 3x a day; industrialized depigmenting agent (0.05% retinoic acid, Hydroquinone 4%, fluocinolone acetonide 0.01%), alternating with the skin regenerator for 15 days; sunscreen with protection factor 50. Anesthetic block of infra-orbital and mentonian nerves, followed by infiltrative anesthesia with 2% lidocaine solution.	Patient B also had as adjunctive treatment lymphatic drainage and regular physical activities. Patients A and D had only physical activity, C and E did not undergo physical activity during the follow-up; Erythema, edema, post-inflammatory hyperpigmentation, and infections	A clinical and photographic evaluation was performed by the investigator three months after the procedure, using a scale with the items very good, good, reasonable, and bad. Patient satisfaction questionnaires were also applied.	Twenty-eight patients were treated; 12 of them had wrinkles and sagging, five only acne scars, and ten patients with wrinkles, sagging, and acne scars. Result from good to very good; 100% of patients reported satisfaction with the results.	It can produce improvement in the quality of the skin, attenuating wrinkles and correcting depressed acne scars. The procedure of the evaluated group presented an excellent safety profile; The addition of 88% phenol before microneedling enhances the results for acne, sagging, and rhytid scarring treatments.

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<p>4. Fabbrocini et al. (2009)¹¹</p>	<p>Periorbital wrinkle treatments by collagen induction therapy</p>	<p>Rolling cylinder 20mm wide, with 192 needles in eight rows, 1.5mm long and 0.25mm in diameter; according to the applied penetration, they were introduced into the skin from 0.1 to 1.3mm. 2 sessions with an interval of 8 weeks between them</p>	<p>Periorbital wrinkles. Rolling the device back and forth, with the same pressure; horizontally, vertically and diagonally to the right and left.</p>	<p>Did not use; Topical anesthesia (EMLA applied and left for 60 min).</p>	<p>Did not describe; Redness and swelling.</p>	<p>The evaluation was taken on a digital camera and images computerized. Silicone rubber molds were used to assess the depth of the wrinkles and print their micro-relief.</p>	<p>Eight weeks after the first CIT session, all patients had smoother skin, a slight reduction in the severity of injuries and minimal aesthetic improvement; thirty-two weeks after the second session of CIT, the improvement of periorbital wrinkles was evident.</p>	<p>It shows that CIT is a simple technique and that with a specialized tool you can have an "immediate effect" on improving periorbital wrinkles. The degree of severity of periorbital wrinkles after just two sessions were highly reduced, and overall aesthetic improvement was also remarkable.</p>
<p>5. Contin (2016)⁴</p>	<p>Male androgenetic alopecia was treated with micro-needling isolated and associated injectable minoxidil using the skin micro-injection technique.</p>	<p>Cylinders with needles, which produce punctures 1.5 mm deep; Tattoo machine with 17 micro-needles in a row (MMP). Case 1: 4 monthly sessions; Case 2: 3 sessions.</p>	<p>Scalp. Moves back and forth until a bleeding dew is produced.</p>	<p>Case 1: Minoxidil 0.5%; neutral shampoo; simple painkillers; Case 2: Microneedling without drug infusion. Lidocaine 4% cream.</p>	<p>Gentle washing with neutral shampoo six hours after the procedure and use of simple painkillers if there is local pain. Ache</p>	<p>Photographic record before the procedure and one month after the last session.</p>	<p>Partial and satisfactory response in both cases, one of them had the infiltration of minoxidil and the other only to the microneedling process.</p>	<p>Partial and satisfactory response in both cases.</p>

The created microchannels show a retraction after 5 minutes, but their complete closure occurs after 24 hours⁹. And the absence of retraction after 15 minutes has also been reported¹⁰.

Its use is individual and comes sterilized at the factory and registered in ANVISA (Agência Nacional de Vigilância Sanitária). The treatment can be done by several professionals such as physiotherapists, doctors, biomedical, and other professionals in the aesthetic and health area.

The microneedling technique has been used in several aesthetic procedures. The present study consists of 5 articles, namely, an article on the treatment of alopecia⁴, one on periorbital wrinkles¹¹, one on acne scars¹², one on skin rejuvenation of the anterior chest¹³ and one on flaccidity treatment, wrinkles and acne scars on the face⁷.

The microneedling interspersed with 5% retinoic acid peeling at 21-day intervals between sessions was also useful in the treatment of melasma and aging associated with growth factors. It was possible to observe a significant improvement in the two dysfunctions.⁸

It also presents promising results for gynoid lipodystrophy; changes in patients' lifestyle and behavioral habits contribute significantly to the success of therapy, as well as the appropriate drug and a correct technique¹⁴.

The method proved to be effective in the treatment of stretch marks with a reduction in size (millimeters) when they were associated with growth factors. By assisting in the process of collagen formation, it reconstructs the broken fibers, promoting skin filling. The technique does not provide a significant improvement in cases of phototype VI, although the depigmentation process is reversible, it is slow.¹⁵

Comparing the results for the treatment of atrophic acne scars between the non-ablative fractional Erbium laser and microneedling, the degree of post-treatment improvement evaluated by the participants on a scale of 0 to 10, had an average of 7.65 in the microneedling and 7.95 in the laser group. The difference between the groups was not significant, showing that the technique is as effective as fractional technology⁵.

Concerning the correct form of application and prior care with the area to be treated, we analyzed an article that used back and forth movement⁴; one with horizontal, vertical, diagonal movements, 15 to 20 times each⁷; one with horizontal, diagonal, vertical movements to the right and left¹¹; one with movements in multiple directions until slight bleeding and four times in all directions until the petechiae appear^{8,14};

one with movements in four directions: horizontal, diagonal, vertical to the right and left, ten times each¹³; and an article with repetitions of 10 times in each direction, following the shape of the wind rose¹².

Another proposal recommends that the movements be performed in the same directions, being applied first horizontally in the direction of the lymphatic path, then vertically and finally in one of the diagonals (except for the center of the frontal region and nose, for which it is suggested to use the two diagonal lines)¹⁷.

The application of the roller should be per quadrant, working in small regions, around twice the width of the roller for facial and capillary areas, and four times for the body. When applying it in four directions (vertical, horizontal, diagonal right, and left), you must pass ten times over each direction, with five reciprocating movements in each one².

Studies have shown the use of various active substances or drugs such as hyaluronic acid and vitamin E¹⁴, growth factor^{8,13}, skin regenerator, hydroquinone⁷, retinoic acid, vitamin C⁸ and minoxidil.⁴

The results vary according to the therapeutic proposal and the definition of needle sizes ranging from 0.25mm to 2.5mm³. In the treatment for alopecia⁴, there was a partial and satisfactory response, applying one treatment only with microneedling and the other together with minoxidil. In the stretch mark study¹³ it was shown that the technique is effective in reducing its size in millimeters, the growth factors used helped in the process of collagen formation.

The application in the treatment of wrinkles and acne scars¹¹ can produce improvement in the quality of the skin, attenuating wrinkles and correcting depressed acne scars. The addition of 88% phenol applied with gauze until substantial bleaching is achieved, followed immediately by microneedling enhances the results for acne scar treatments.⁷

Although considered a simple technique with a specialized tool, it can have an "immediate effect" on the improvement of wrinkles, showing after two sessions that they were highly reduced and that the overall aesthetic improvement was also important¹¹.

In another article, it shows a slight improvement in atrophic acne scars, in which the increase in hemoglobin is related to the initial tissue injury, providing neocollagenesis. Ice-pick scars did not improve with the procedure¹².

Concerning the rejuvenation treatment¹⁴, the author says that the technique is safe and established. Still, to obtain results for advanced global rejuvenation, the action of specific actives for skin rejuvenation in drug delivery is necessary, promoting significant

improvement in the overall appearance, with minimal adverse effects and high patient satisfaction index.

Regarding the study of rejuvenation and melasma, it is stated that it is essential to carry out more in-depth scientific studies to corroborate the data presented in this work and to be able to evaluate the effectiveness of the therapy⁸.

For the article on gynoid lipodystrophy, it is worth mentioning that it is a promising treatment, significantly contributing to the success of therapy¹⁴, the choice of an appropriate drug, a correct technique, and changes in patients' lifestyle and behavioral habits.

It can be said that the association of the technique with several actives provided the optimization of results, as well as the low cost and easy application if compared to other treatments on the market. But it is emphasized that there is a need for more research on the topic.

Some care must be taken about the application of the technique: the first has to do with the choice of equipment that must be sterile and registered with ANVISA; on the other hand, the skin can be previously cleaned with, for example, alcohol 70%¹³. One article mentions that the skin was disinfected, but does not describe what was used¹¹; in another case, it is said that the procedure was performed after cleaning the face¹², asepsis with chlorhexidine degermante solution¹⁴ and also the degreasing of the skin with liquid soap and asepsis with chlorhexidine⁷.

Regarding the evaluation criteria used in the studies, photographic records were pointed^{4,7,11,12,13}, volunteer satisfaction questionnaires^{7,13}, histological analysis¹², and silicone molds from digitalized photographs to measure the depth of wrinkles¹¹. In this way, we can observe that the standardized photographic record before and after the treatment, as well as a satisfaction questionnaire concerning the results found, can be performed because it is easy to apply and low cost

CONCLUSION

Based on the results found in this review, we can say that microneedling is a simple, promising, and easy to apply technique. This innovative treatment has been used for different dermatological pathologies. The method works in two ways: the first by stimulating natural collagen production (NCP), by responding to the inflammatory process, and the second facilitating the Transdermal Ingredient Access System (TIAS), known as "drug delivery," that is, increasing the permeation of actives.

The technique can be painful, and this is related to the size of the needles. The use of local anesthetics may be indicated in some cases.

However, it is necessary to generate more knowledge with other studies to reach more reliable conclusions regarding the maintenance of long-term results, as well as about the repaired tissue.

COLLABORATIONS

ASF	Project Administration, Writing - Review & Editing
DLA	Supervision
MAM	Data Curation, Writing - Original Draft Preparation

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