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RESEARCH ARTICLE

A GUIDE TO BOTOX THERAPY BY DR. SOMIL SINGHAL BASICS | INDICATIONS | USES

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INTRODUCTION

Skin regeneration as a therapeutic principle: Any damage to skin structure is associated with visible and some- times also perceptible changes in the skin, which may necessitate medical and/or cosmetic treatment. Wrinkles, lax skin, stretch marks or scars all represent potential indications for a corrective cosmetic procedure; this is particularly true in areas of skin that are permanently visible, such as the face and hands, but can also apply to any other part of the body. When structural damage to the skin needs to be remedied, one es- tablished therapeutic principle in esthetic medicine is based on initi- ating the skin's own regenerative potential, bringing about remod- eling and the formation of new structures, eventually resulting in repair of the altered tissues. The aim of such medical procedures is to improve the appearance and function of the skin, while avoiding post-interventional damage as far as possible.

Accordingly, the ideal therapeutic intervention that is aimed at im- proving the skin activates only those processes that are associated with natural skin regeneration:

- Repair of the epidermis, no ablation
- Stimulation of collagen synthesis, no fibrosis
- Stimulation of scarless wound healing
- Stimulation of endogenous growth factors.

The most widely used skin-rejuvenating methods, such as laser resur- facing or chemical peels, only go part of the way to meeting these requirements. Since their use (at least as regards the ablative and semi-ablative methods) is always associated with damage or even destruction of the epidermis, these procedures are risky and may not always result in improvement; instead, they may even cause worsen- ing of the initial condition. The method of percutaneous collagen induction, known primarily as "needling" in everyday practice, represents a method that ful- fills the requirements of skin-regenerating therapy to an optimal extent. As a result of its auto-regenerative but in no way destruc- tive effect, it allows structural changes ranging from minor to severe to be treated safely and effectively. The method is relatively new and not as widespread as it should be in many instances. Needling shows noteworthy advantages relative to the standard methods in the treatment of wrinkles and scars, and these advantages have now been substantiated both scientifically and clinically (see Chapter 2, *"Scientific basics,"* p. 34).

Needling – a purely regenerative treatment approach: The percutaneous collagen induction method is based on the dis- covery that repeated puncturing of the skin's surface with fineneed- les (also known as "needling") stimulates collagen production in the vicinity of linear and hypertrophic scars, as well as wrinkles, an ob- servation made during the 1990s by

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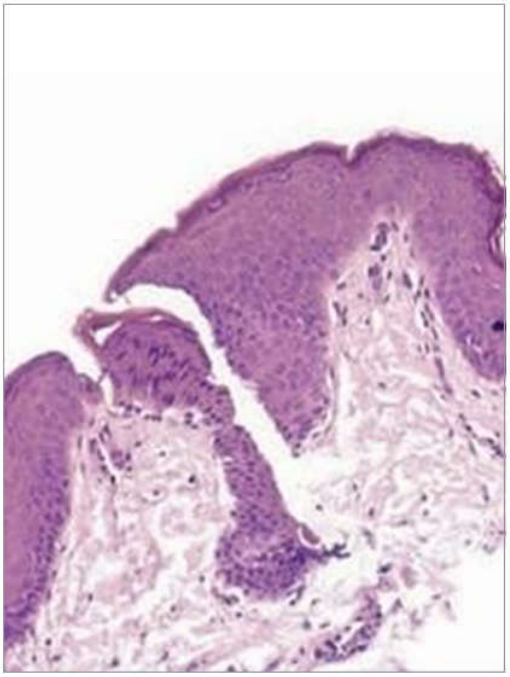
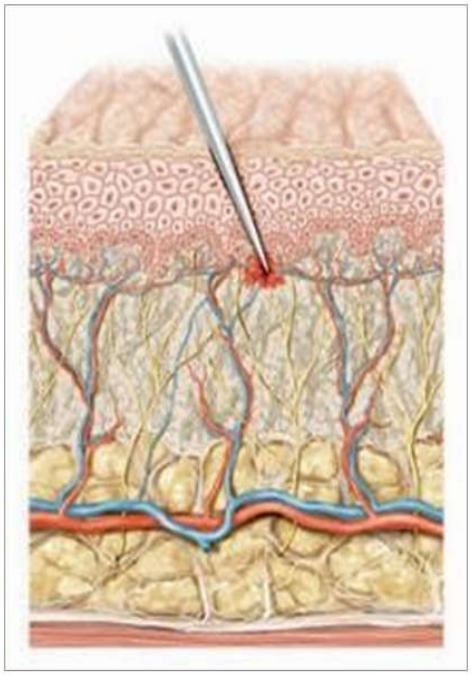
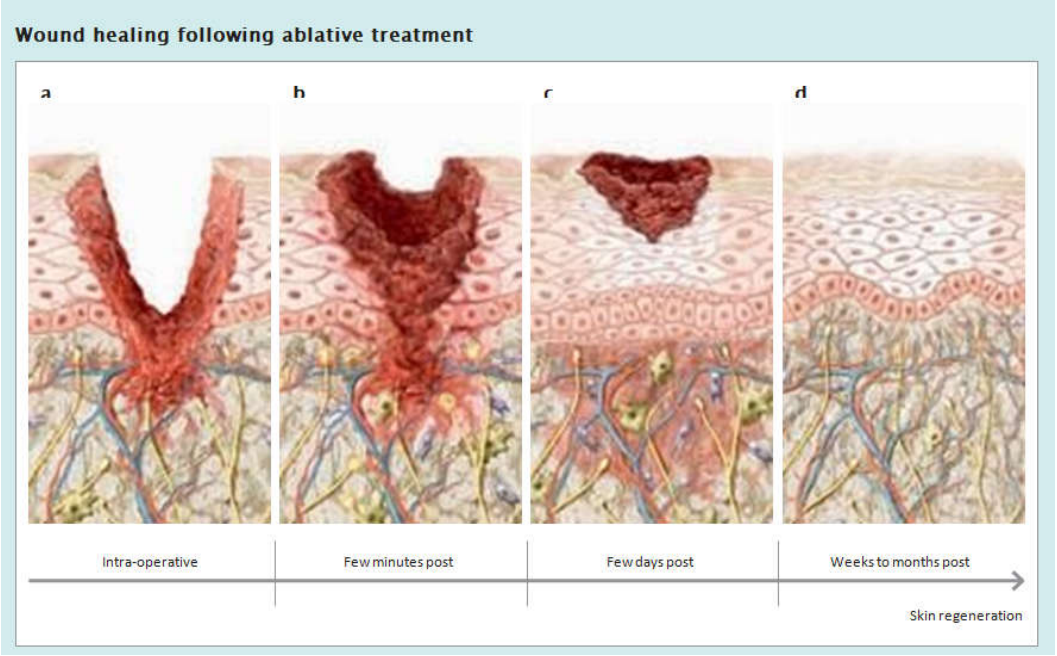


Needling, shown in histological skin section



Needling, shown in schematic skin section



two research groups (Camirand and Doucet 1997; Fernandes 2002). "Subcision" (Orentreich and Orentreich 1995) is similar but also substantially different because it has a mechanical principle of severing anchoring collagen fibers rather than needling for the chemical induction of growth factors. Using this principle as a basis, the South African plastic surgeon Dr. Fernandes developed a new treatment technique: percutaneous col- lage induction therapy, or simply "needling." In needling, fine needle pricks on the damaged skin region are used to produce intradermal hemorrhages and activate wound healing mechanisms without damaging the epidermis in the process. Post- traumatic regeneration of the skin with the formation of a new, nat- ural subepidermal collagen and elastin network and a thicker epi- dermis can be induced with virtually no downtime. Depending on the indication, a variety of needle lengths can be used, extending to just below the stratum corneum ("microneedling" or "Cosmetic Needling"), into the papillary dermis ("Medical Needling") or even as far as the reticular dermis or subcutis ("Surgical Needling"). Even with the deep treatments, the risk of complications is extremely low. The columns of epidermal cells are mainly forced apart by the needles, but are not significantly injured or even removed. The epi- dermis can close up fully within the first 24 hours after the proce- dure, minimizing the risk of infections and wound healing problems. While swellings, reddening and bruising can develop in the treat- ment region (depending on needle length) for a few days in the course of the desired inflammation, these usually abate without any complications and without

scarring. Furthermore, no post-inflamma- tory pigment changes are observed after the treatment, which is why needling can also be safely used in darker skin types.

Advantages of needling in the treatment of scars and wrinkles: Ablative methods such as laser resurfacing, chemical peeling or dermabrasion are regarded as the first-line options in the medical treatment of wrinkles, photoaging and stretch marks (striae). Sur- gical methods, such as excision (including serial excision) tissue ex-

Dermatology basics: Skin needling or Percutaneous Collagen Induction (PCI) therapy is a regenerative method used to improve skin structure. Very fine needle lesions stimulate the skin to renew itself, without any signifi- cant damage to the epidermal tissues. As a consequence, needling greatly reduces the risk of complications and side effects compared to ablative and semi-ablative skin procedures. These fine incisions can extend over up to 50 % of the skin surface without causing scars. The proviso is that the individual lesions are no bigger than 0. 3 mm in diameter. This very recent development has made useof the enormous regenerative potential of the biggest human organ, i. e. the skin. Clinical and scientific data underpin the efficacy of the method in the treatment of wrinkles and lines, stretch marks and various types of scars. This chapter describes the structure and function ofhealthy skin, as well as the molecular causes and histopathological features ofscarring and wrinkling as the key indications for needling. The regenerative and wound healing mechanisms of skin are also ex- plained in this context, since they form the basis for understanding the modes of action of this treatment method.

Healthy human skin: Skin is the biggest human organ. Its main function is to provide a protective barrier by encasing all of the body's other structures. It is therefore known as the **integument**, from the Latin *integumentum commune* = outer covering. In addition to being a purely mechanical barrier and providing direct protection from UV radiation, the skin also plays an important role in temperature regulation and water homeostasis. However, this physical boundary also facilitates com- munication with the outside world. For this reason, the skin takes on the many and varied functions of stimulus conduction, which inform us about the state of our environment and, among other things, hold harmful influences at bay (sensory, contact and protec- tive function). In this context, the skin has evolved a variety of immunological ac- tivities. An equally diverse architecture of cellular and acellular com- ponents lies at the basis ofthis complex range of functions. The true upper skin or epidermis is ofectodermal origin, whereas the dermis (also known as corium) is of mesodermal origin. The basal membrane represents the link between these two structures, and may also be referred to as the junction zone or interface. Belowthe dermis lies the subcutaneous tissue or subcutis, a pad made up of adipose tissue.

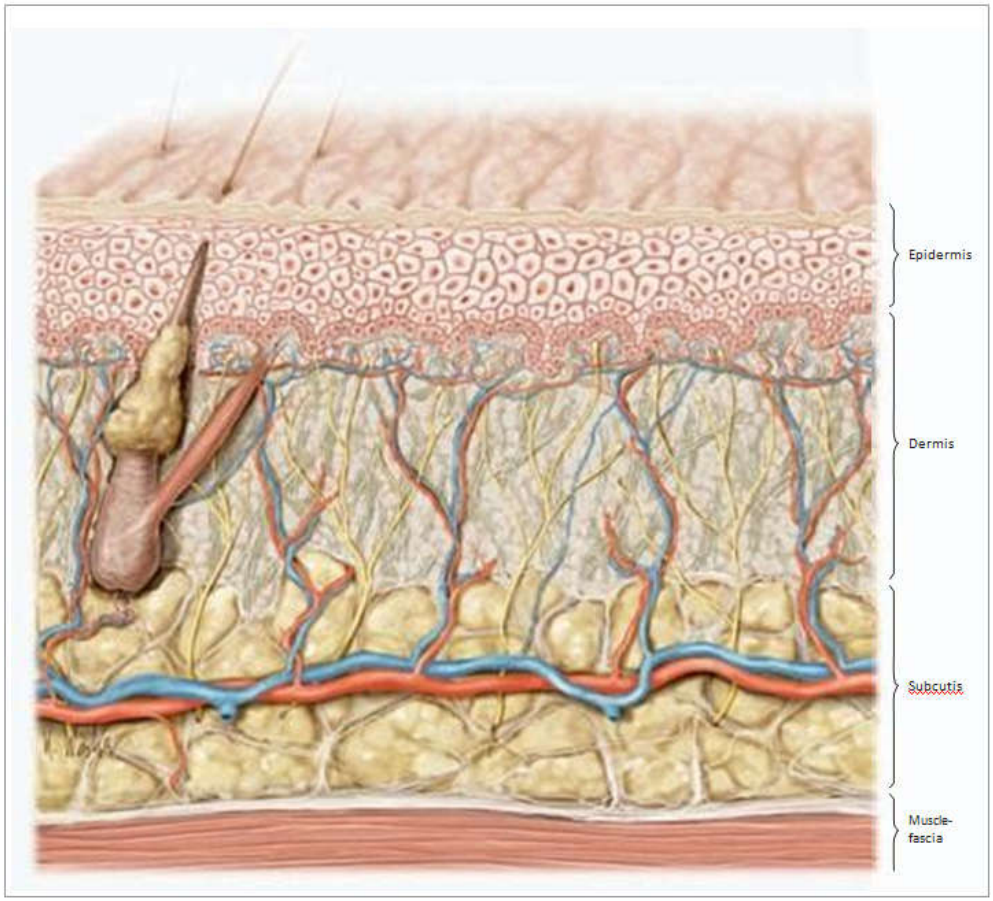


Fig. 1.3 Skin cross-section, schematic representation

Fig. 1.69 Once the acute inflammatory phase has ceased, acne leave behind deep scars with a "punched-out" appearance on the face (tertiary non-inflammatory efflorescences), which may be very unsightly and troubling .

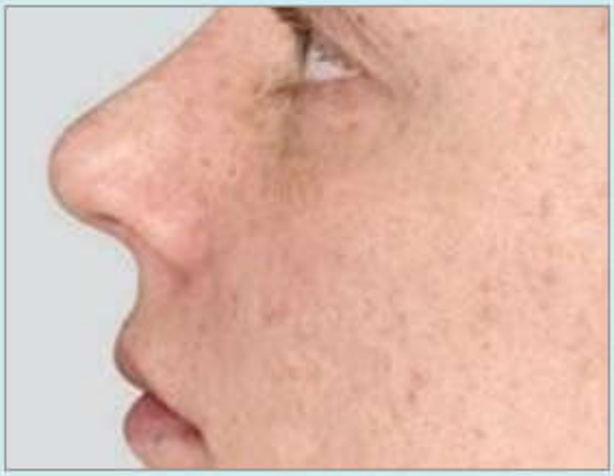


Fig. 1.70 There are numerous variants of acne scars with differing severities; they are referred to as ice pick, boxcar and rolling scars .

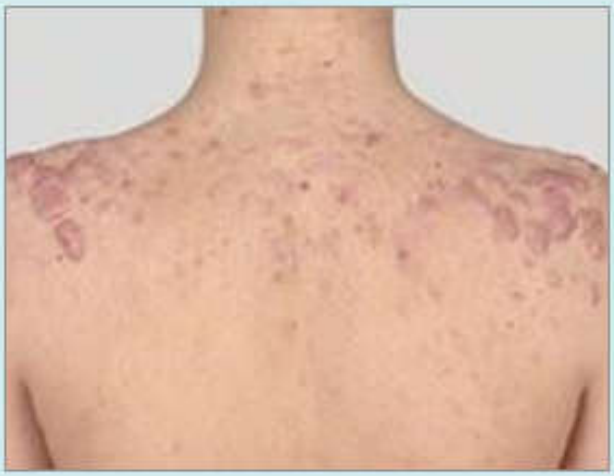


Fig. 1.7 1 Pronounced keloids following acne . Keloids on the shoulders interfere with movement and are difficult to treat because they are located on skin that is subject to mechanical stress .

Scientific basics: The percutaneous collagen induction method was first described by Dr. Desmond Fernandes in 1999 at the IPRAS Conference San Fran- cisco (Fernandes, 2002), since when it has been gaining a greater reputation in rejuvenating skin therapy, e. g. in the treatment of photoaging, scars, lax skin and stretch marks (striae). At first, there was no scientific evidence of the method's efficacy, even if the clini- cal results spoke for themselves. Thanks to targeted research work in recent years, impressive scien- tific data are now available to underpin the efficacy and safety of re- generative treatment by needling; a representative selection of these findings is presented below. This scientific foundation is backed up by convincing case histories which confirm the successes of needling in the clinical setting in a great variety of indications, encompassing lines and wrinkles, scars, lax skin and stretch marks; these will be pre- sented later (see Chapter 6, *"Applications,"* p. 98 onwards).

Keloids, clinical

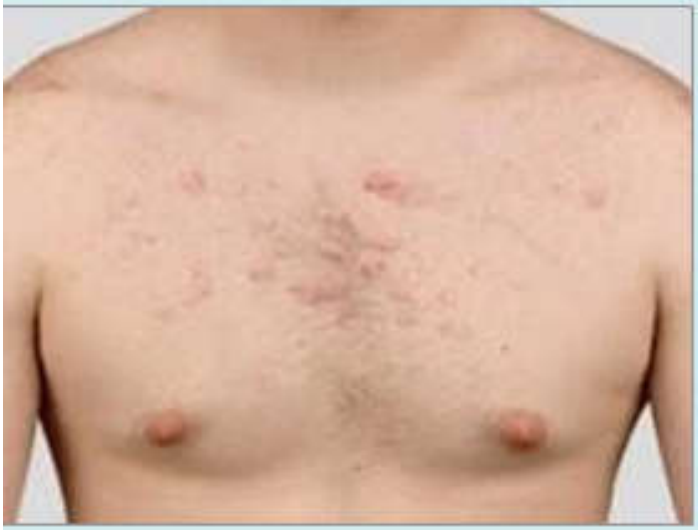


Fig. 1.72 Keloids may occur spontaneously, particularly in the sternal region .

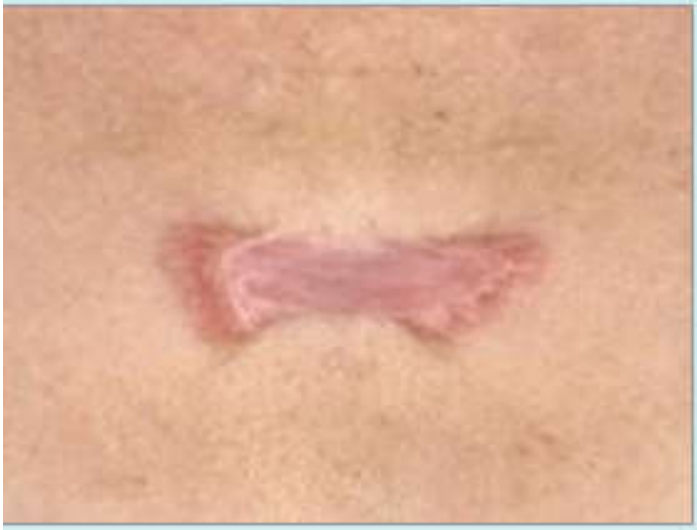


Fig. 1.73 During their active phase, sternal keloids often grow into a butterfly shape .

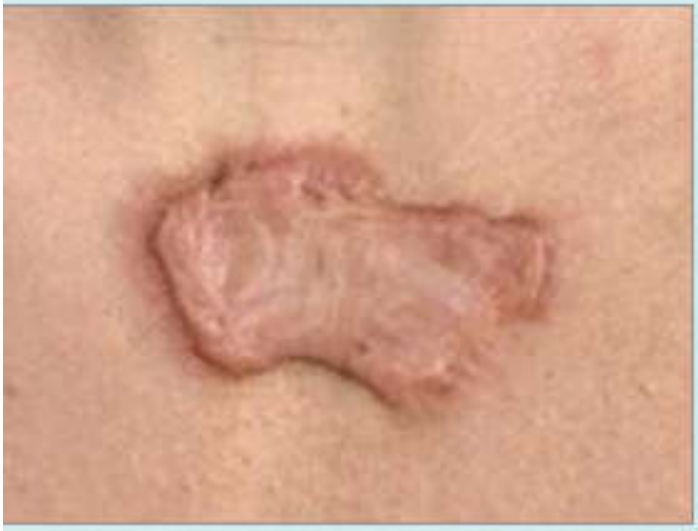


Fig. 1.74 A dark red margin surrounding a faded center is a sign of keloid activity .

The scientific studies presented here focus on the effects of percuta- neous collagen induction on:

- The post-traumatic wound healing cascade with the potential for scarless healing
- The stimulation of endogenous growth factors and the skin re- generation associated with it

- The structure of the dermis and epidermis
- The potential negative sequelae of wound healing, e. g. dyspig- mentation.

The skin was analyzed first of all in a comprehensive clinical study on patients, with post-interventional evaluation of skin improvements. Then skin laboratory investigations using animal models examined the results of needling both qualitatively, based on histological sec- tions, and quantitatively, using microarray analyses. The animal trials (Aust et al. , 2010) were performed using the rat model (Sprague- Dawley rats): these animals show a skin structure very similar to that of humans, but with more rapid cell turnover. The clinical study in- cluded 480 patients (Aust et al. , 2008), who were investigated for a period of up to 9 years to evaluate the results on scars, stretch marks and wrinkles. This study was the first to analyze histological samples and patient satisfaction post-needling in a representative number of subjects. To summarize, the results of the scientific analyses verified the following effects of needling:

- induction of the post-traumatic wound healing cascade
- higher than average stimulation of the TGF-□3 signal cascade and collagen I synthesis (scarless healing)
- neosynthesis of a normal, healthy elastin–collagen framework (remodeling)
- thickening of the epidermis
- no dyspigmentation
- production of growth factors and skin regeneration.

Consultation: A patient will consult a specialist in esthetic medicine if s/ he is dissat- isfied with her/ his appearance and wants to make changes. In con- trast to a classical consultation, the main focus here is not on making a diagnosis, but on the patient's requirements. The specialist being consulted needs to determine these both objectively and subjectively, and assess them with regard to the potential treatment options. Carefully determined and accurately documented clinical findings form the basis for planning and performing a successful corrective procedure in esthetic medicine. This involves a comprehensive con- sultation and a thorough examination by a plastic or esthetic sur- geon or dermatologist. Points to be established are the patient's ideas and wishes on the one hand, and her/ his clinical requirements on the other. The doctor's task, while taking account of the patient's requirements and wishes, is to select the best available and most suitable treatment method and to implement it appropriately. Since esthetic correction is generally an elective procedure, an ex- tensive information talk and professional documentation of all the aspects of the treatment are elementary aspects of the procedure's quality assurance process. Ideally, an accurate preoperative consulta- tion should include the following steps:

- Clarifying expectations
- Medical history and examination
- Establishing indications for the treatment 4. treatment planning
- Information and consent 6. documentation.

Clarifying expectations: The specialist in esthetic medicine is not faced with the task of making a diagnosis, but with the challenge of bringing the patient's expectations or wishes in line with the available treatment options. Above all, it is important for the doctor to make a realistic and re- sponsible assessment whether and with what method the patient's wishes can be realized, and to do so right at the outset, in the first consultation. In this context, the history should also include questions, e. g. what esthetic treatments have already taken place and how the patient has rated the success of these. If the patient decides to have an esthetic intervention, they need to be given honest and transparent information about the improvement to be expected after the treatment. Even a successful treatment can be put into a nega- tive light by unrealistic expectations about its results; consequently, such expectations need to be corrected before any treatment takes place.

Examination and clinical findings: A meticulous examination is essential to establish if the patient's de- mands can be realized as a therapeutic goal. The potential treatment areas are specifically examined for the skin change(s) perceived as troubling and also to determine general skin qualities. To begin with, these skin changes (e. g. wrinkles or a scar) are assessed by inspec- tion. This is followed by skin palpation, which provides information about qualities including skin elasticity, temperature, thickness and turgor. The patient's degree of skin pigmentation is not relevant as regards needling, since the melanocytes remain unaffected by the treatment (see Chapter 2. 4, p. 40). The clinical examination forms the basis for establishing indications for the treatment. Depending on the findings of the examination, and any objective measures that are determined, the clinician can decide whether and with what treatment technique (e. g. needle length) the procedure can be carried out.

Degree of skin aging: If the patient wants skin rejuvenating therapy, the degree of skin aging and the wrinkle type are the key criteria for selecting the cor- rect method or, more specifically, the most suitable needling tech- nique. Glogau introduced a reliable classification for skin aging (see Tab. 3. 1). According to this system, actinic damage in a skin area is classified into mild (c. 28–35 years), moderate (c. 35–50 years), ad- vanced (c. 50–60 years) or severe (c. 65–70 years). Whereas the qual- itative changes can be readily evaluated, the age group classification needs to be adjusted to the genetic and geographic context.

Skin firmness and skin health: As in every examination by the plastic surgeon or dermatologist, the skin should be examined for its overall quality, its elasticity and its health. Healthy skin possesses intact regenerative mechanisms and is generally likely to respond better to treatment, which includes needling.

Clinicaleffectofneedling

Fig. 2.1 Minute petechial hemorrhages pro- duced by 1-mm needling .

Fig. 2.2 The 3-mm needling method leads to heavier bleeding …

Fig. 2.3 … with the aim of producing marked edema and hematoma to induce therapeutically effective collagen production during the course of wound healing

Needling causes multiple petechial hemorrhages and, when the procedure is continued, can lead to extensive but minute hematoma and marked swelling of the skin . These clinical effects are required for the induction of the desired wound healing cascade and collagen I synth esis, and activation of the TGF-□ signal transduction pathway .

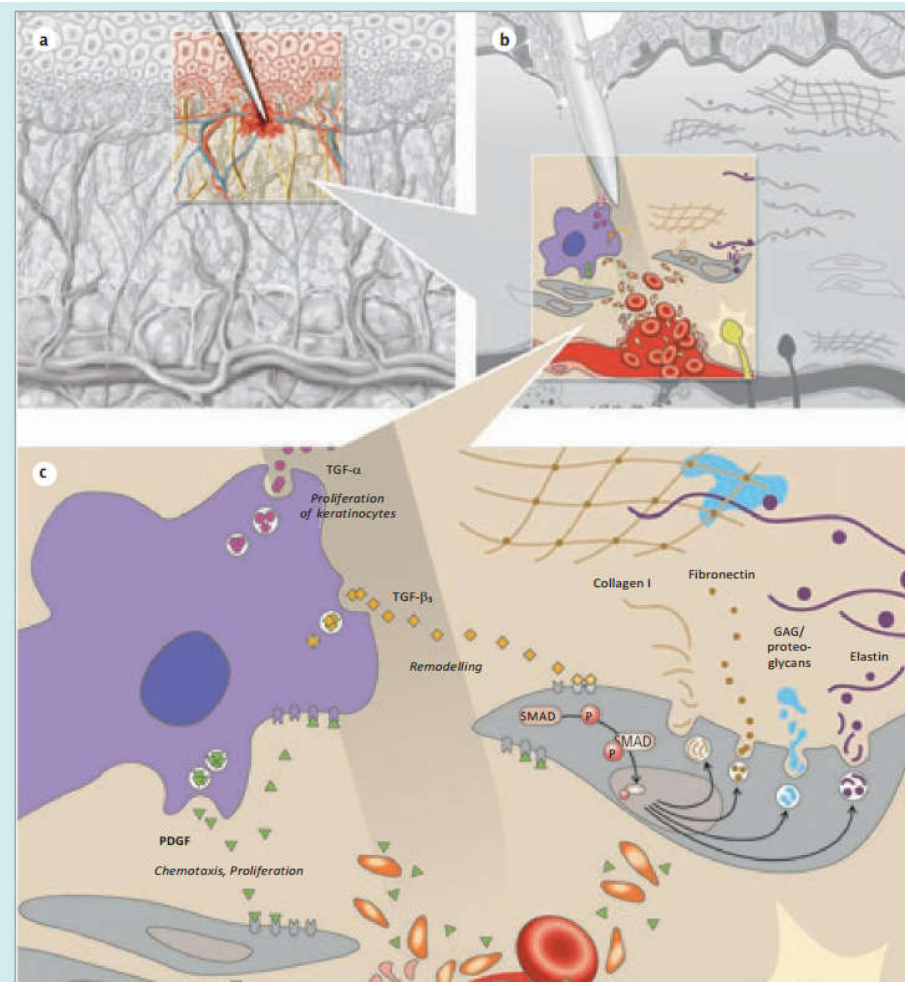


Fig. 2.4 Schematic representation of the effects of a needling treatment (a) in a skin section, (b) at the cellular and (c) at the molecular level . The intra- dermal hemorrhage produced by needling activates the post-traumatic wound healing cascade and, in particular, the TGF-□$_3$ signal transduction pathway . Increased secretion of these and other growth factors (e .g . EGF, VEGF, PDGF) and the synthesis of new extracellular matrix proteins such as collagen I in the fibroblasts leading to skin regeneration . Needling therapy results in the formation of a particularly firm, natural collagen matrix, which contains a higher than average proportion of type I collagen

At the same time, skin defects involving disruption of the skin's parameters, such as reduced elasticity or an impaired barrier function, represent key indications for percutaneous collagen induction. Qualities such as temperature, surface consistency and skin tension can be determined by palpation. The snap-back test can be used to evaluate turgor, the tension of the skin, which is dependent on its fluid content. To perform the test, a fold of skin is briefly grasped between thumb and forefinger and then released (see Fig. 3. 6). The skin normally snaps back straight away. If the fold remains in place and disappears slowly, this indicates a reduced fluid content. These days, skin inspection and palpation can be supplemented with a va-riety of analytical methods to measure skin parameters, allowing skin and scar status to be evaluated objectively (see Fig. 3. 7, see Chap- ter 4, p. 67 onwards). Any loss of tissue firmness and changes in the relief of the skin sur- face (which can produce contour changes particularly in highly sus- ceptible parts of the body, such as the upper arms, thighs, abdomen, buttocks and hips) need to be evaluated during the examination and assessed with regard to treatment by needling.

Perioperative management: The signing of the consent form marks the point when the medical procedure has been determined. The subsequent planning and prep- aration for the needling treatment needs to encompass a number of features, in addition to the procedure itself, which have a decisive effect on the outcome. This includes the elementary aspect of ad- equate pain management during and – where necessary – after the treatment. It will also be obligatory to discuss the preoperative topi- cal vitamin treatment with the patient and to initiate it in good time. Detailed preparatory information about the postoperative skin reac- tion during wound healing will need to be given to the patient again, to ensure that the temporary swelling and bruising do not come as an unwelcome surprise. The ground rules for the perioperative preparation of a needling treatment need to be followed, depending on the treatment tech- nique being planned, i. e. the needle length selected. In principle, needling can be classified into cosmetic, medical and surgical tech- niques, which differ with regard to the intensity of the physiological effects and the postoperative regime that they require.

Needling techniques: The variety of indications for the use of needling is maximized by the option of using different lengths of needle. Since the physiology, course and perioperative management of the treatment vary accord- ing to the needle length used, it is appropriate to talk of different treatment techniques (see Tab. 5. 1). These "needling techniques" are distinguished primarily in terms of the extent of the intradermal hemorrhage they produce and the resultant wound healing reaction, rather than, say, in terms of the instrument manipulation technique during the procedure (another conceivable classification option), which is quite similar in all the variants of needling (see Chapter 5. 1. 5 S. 82 ff.). The longer the needles used, the more extensive is the potential post-interventional collagen induction and the regenerative effect on the skin. Moreover, there is also an increase in the pain as- sociated with the treatment, as well as the postoperative edema and bruising. This has to be taken into account when planning the treatment, making sure that the final decision is in accordance with the wishes of the patient.

We can distinguish between the following needling techniques as re- gards the intended physiological and clinical effects of the treatment:

- Cosmetic Needling (0. 1–0. 3-mm needles, this type of needling does not cause percutaneous collagen induction [PCI] – it is merely a method to enhance penetration of topically applied active ingredients)
- Medical Needling (1–2-mm needles, at this depth one can expect PCI)
- Surgical Needling (3-mm needles, PCI).

The percutaneous collagen induction (PCI) method only includes needling treatments with needles from 1 mm in length, which reach the dermis and produce at least a minimal intradermal hemorrhage. "Cosmetic Needling" with needles 0. 1–0. 3 mm in length does not lead to percutaneous collagen induction as such, but is used pre- dominantly to encourage the transepidermal transport of topical active substances. It is a purely cosmetic treatment. However, as a close relative" of the Medical Needling methods, Cosmetic Need- ling will also be mentioned here. Percutaneous collagen induction therapy methods using needles from 1 mm in length can also be distinguished with respect to their indi- cations and the perioperative organization that they require. Treat- ment with 1-mm needles reaches just beyond the basal membrane and leads to minimal petechial hemorrhages in the papillary dermis. This already leads to activation of the TGF-□ signal cascade with col- lagen synthesis and a skin-regenerating effect. However 1 mm need- ling can easily be done with effective topical anesthetics so there is no need for a general anesthetic. The intradermal lesions are so small that there is minimal downtime; on the other hand, the clinical efficacy of the method may be less impressive than intensive treatments with either 1-mm or 3-mm needles. This outpatient technique may be referred to as "Medical Needling" and should be distinguished from "Surgical Needling" with 3-mm needles; because of the ex- tensive intradermal hemorrhages produced by the latter, which is usually carried out in the operating theater under general or regional anesthesia, and may also require a stay in hospital. The potential es- thetic correction of the 3-mm technique is considerably greater, but the treatment also leads to a correspondingly greater wound heal- ing reaction with more prolonged reddening, swelling and bruising.

Cosmetic Needling: In practical terms, Cosmetic Needling (also known as microneedling) or the needling-mediated transport of topical active substances, is also included among the needling techniques, but is not a percuta- neous collagen induction therapy method and is also suitable for use by the patient. Needle lengths of 0. 1–0. 3 mm are used in Cosmetic Needling in order to puncture the superficial layers of the stratum corneum, primarily to improve the penetration of topically applied active substances. Since the needle-pricks remain in the epidermis, there is no intradermal bleeding and also no collagen induction. In some cases, it may stimulate desquamation and improve the surface quality of the skin. Indications for "bloodless" needling include su- perficial structural damage associated with mild skin aging (Glogau type I) and skin therapy with topical active substances. Basically, if active ingredients are not used topically, then there will be no signifi- cant change to the skin.

Tab. 3.1 Glogau classification and suitable needle lengths for skin-rejuvenating treatment using needling .

Glogau type	Degree of aging	Age in years	Characteristics	Suitable needle length
I	Mild	28–35	• Few, small wrinkles, caused primarily by facial mobility • No other epidermal changes	<1 mm
II	Moderate	35–50	• Early wrinkles, caused primarily by facial mobility • Occasional dyspigmentation and actinic keratosis	1 mm
III	Advanced	50–60	• Persistent wrinkles in mobile facial areas • More widespread dyspigmentation and elastosis • Teleangiectasias	1 mm–3 mm
IV	Severe	65–70	• Persistent wrinkles in mobile and non-mobile facial areas • Dyspigmentation with transition into benign and malignant forms • Teleangiectasias • Regions of actinic keratosis with and without transition into invasive growths • Pronounced elastosis	3 mm

Inspection of the face and body

Fig. 3.1 The face is inspected from the front, in semi-profile and in full profile

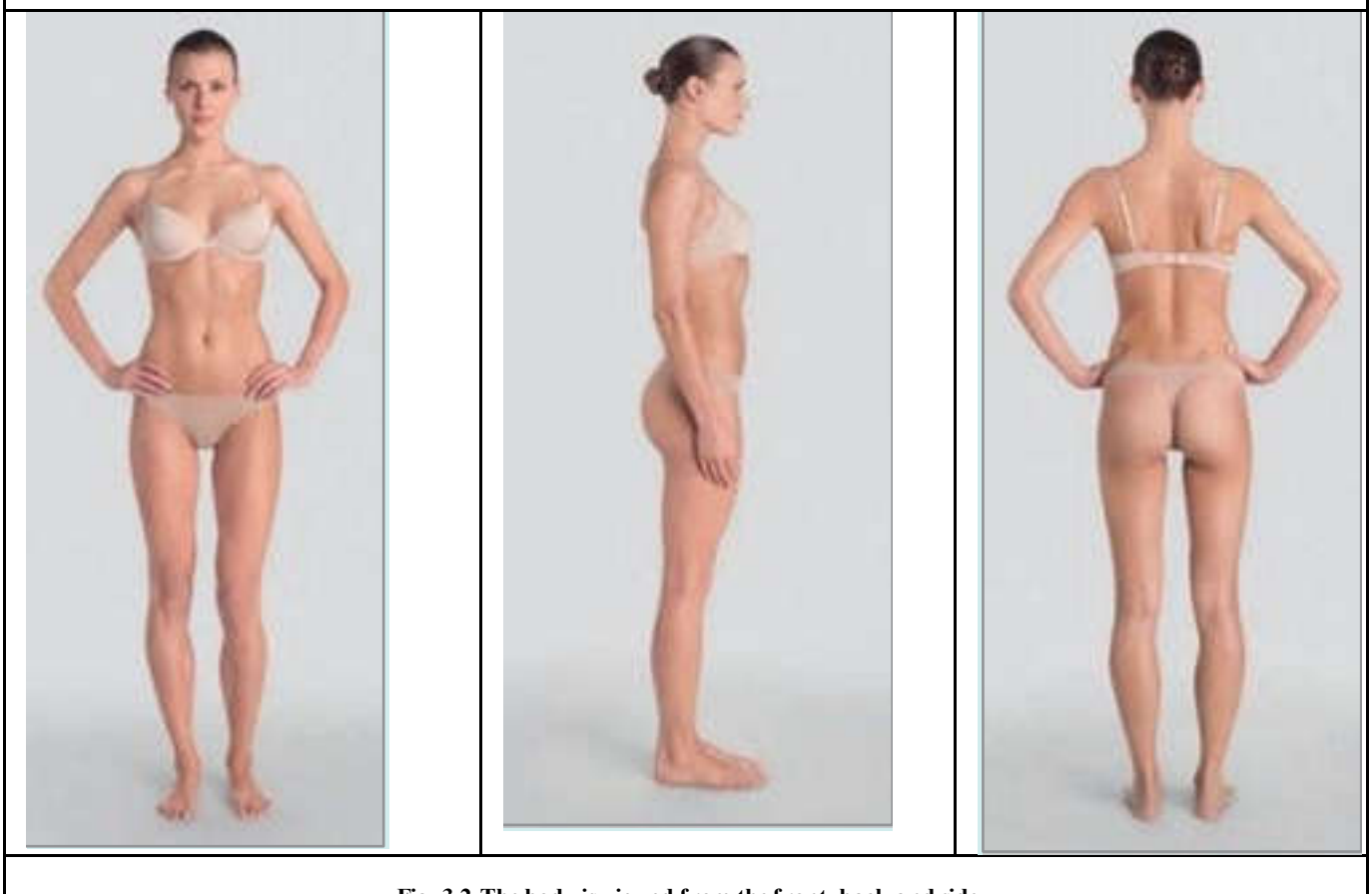
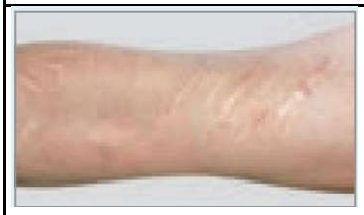
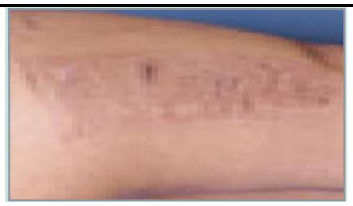
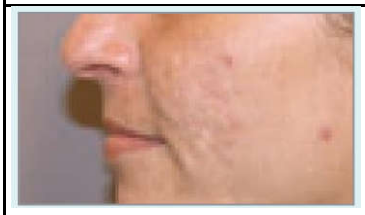
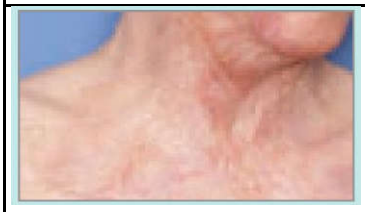
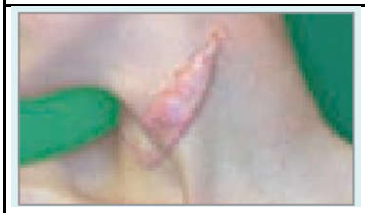
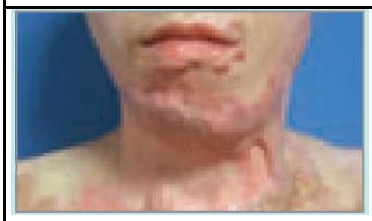
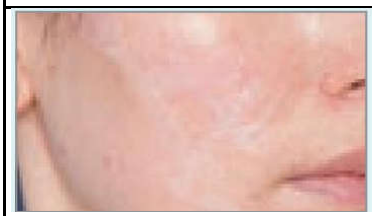
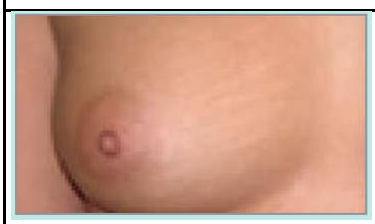


Fig. 3.2 The body is viewed from the front, back and side

Tab. 3.3 Overview of the etiological classification of scars and striae .

Clinical findings	Etiology	Conventional treatment methods
	Self-harming scars	• Minimally invasive laser treatments • Possibly surgical procedures • Serial excision
	Surgical scars following the removal of split-thickness skin grafts	• Minimally invasive laser treatments • Possibly repeat surgery
	Acne scars	• Laser ablation • Deep chemical peels
	Scars left by third-degree burns	• Adhesive and pressure dressings • Minimally invasive laser treatments • Cryotherapy • Plastic surgery (skin grafts etc .)
	Scar hypertrophy during/shortly after wound healing	• Surgical revision • Laser treatments • Cryotherapy • Cortisone injections • Scar creams
	Keloid formation, proliferation of the scar tissue beyond the level of the injury	• Pressure dressings • Ssilicone scar creams • ACE inhibitors • Minimally invasive laser treatments • Cryotherapy • Cortisone injections • Scar excision with postoperative radiotherapy
	Scarring following a full-depth TCA (or Phenol) peel with post-interventional infection	• Laser treatments • Cryotherapy • Scar creams
	Stretch marks on the breasts, growth-related	• Laser treatments • Cryotherapy • Topical TCA or vitamin A acid

Medical Needling: Outpatient needling is generally done with needles 1 mm long, which extend to just below the stratum basale into the superficial dermis, where they cause multiple, minimal petechial hemorrhages. Its indications lie primarily in the cosmetic rejuvenation field, for the treatment of moderate wrinkles and photodamage (Glogau types II–III) and to improve skin quality and elasticity.

Fig. 3.6 The tension level, which is dependent on the skin's fluid content, can be determined by palpation

Fig. 3.7 A variety of analytical scientific instruments are available for the precise and objective assessment of the condition of the skin

Note: Mild to moderate skin laxity generally responds well to skin regeneration treatments such as nee- dling; however, surgical intervention with a scalpel is usually indicated in severe cases of loose skin.

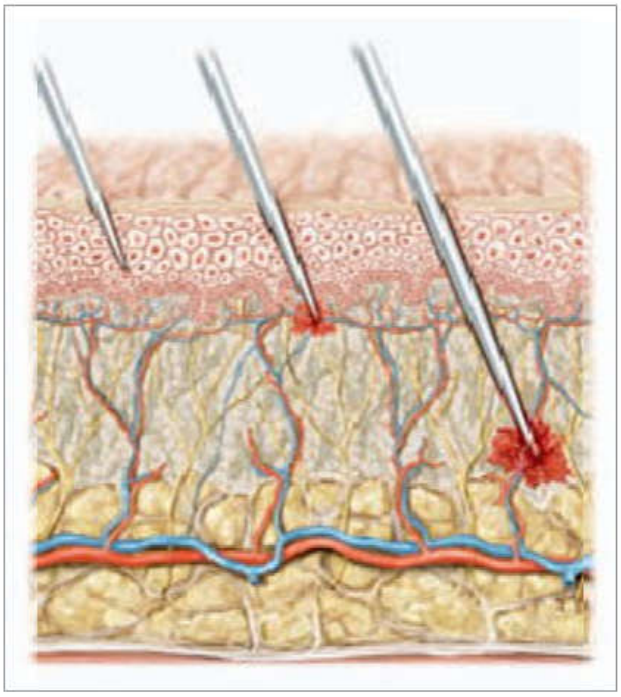
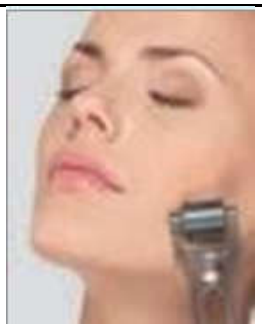
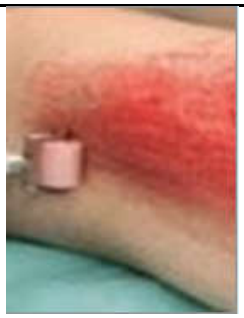
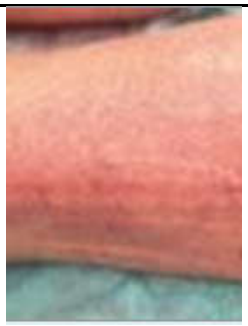


Fig. 5.1 Schematic skin section showing the needling techniques . Depend- ing on the indication, different needle lengths are used in practice . In addi- tion to the purely epidermal "Cosmetic Needling," used primarily to trans - port topically applied active substances, there are two different methods of needling for collagen induction . These are "Medical Needling," using 1-mm (to max . 2-mm) needles, which extend to just below the stratum basale and cause minute hemorrhages in the papillary dermis, and "Surgical Needling" with 3-mm needles, which reach from the reticular dermis to the subcutis, leading to heavier intradermal bleeding .

Tab. 5.1 Overview of the standard needling techniques, their intended effects and treatment principles

Technique name	Needle length	Desired clinical effect	Desired physiological effect	Postoperative reaction	Anesthesia	Indication	Can be repeated after
Cosmetic Needling	0.1–0.3 mm	Increased epidermal permeability to aid active substance transport	Epidermal regeneration only if active substances are used	No post-interventional reaction	None	Superficial structural damage, transport of topical active substances	1 day
							
Medical Needling*	1–2 mm	Lesions of the finest capillaries below the stratum basale, minimal petechial hemorrhages	Superficial remodeling	Limited edema and bruising, comparable to a heavy sunburn	Local anesthetic cream, done on an outpatient basis	Wrinkles and photodamage, mild elastosis, stretch marks and shallow scars	1 week to 1 month
							
Surgical Needling	3 mm	Heavier intradermal hemorrhages due to lesions of the whole dermis to upper subcutis	Remodeling of the whole dermis	More severe swelling and bruising, lasting c. 4–7 days	General or regional anesthesia	Wrinkles and lines, conspicuous scars, burn scars, keloids	1 week to 3 months
							

*In the 1-mm technique, the anesthetic cream should be wiped off before needling, although some practitioners leave it on which has not caused any problems to date.

The prerequisite for this is that the treatment can be performed under a local anesthetic and that it does not lead to any downtime. However, depending on the indication and the patient's wishes, it is also possible to use longer needles, e. g. 1. 5 mm or at most 2. 0 mm, which penetrate slightly deeper into the dermis and increase the intensity of the hem- orrhages that are produced. The aim of Medical Needling in this context is to achieve superficial remodeling and to improve the appearance of the skin, primarily for a rejuvenating effect. However, other potential indications include stretch marks, lax skin or scars – especially if the patient refuses the 3- mm technique.

The postoperative edema and hematoma are lim- ited and comparable to a heavier sunburn. This level of needling works best when it is repeated at intervals of 1–2 weeks. Fernandes believes, after reviewing his results starting 1996, that the results are less impressive when 1-mm facial needling treatments were done at 1- month intervals. Since 2007 he has particularly researched need- ling done at weekly intervals for about six weeks and believes this produces the best results. Many patients, however, chose to do a series of 6- weekly treatments and then do monthly treatments for extended periods.

Surgical Needling: Long needles 3 mm in length are used for more severe clinical condi- tions, mostly involving medical indications, such as conspicuous and hypertrophic scars (e. g. burn scars, ice-pick acne scars). Scar tissue hy- pertrophy requires

Tab. 5.2 Needle rollers, needle stampers and mechanized fractional need- ling therapy system (FN-II) for various indications and regions of the body .

Recommendedproduct	Needle length	Manufacturer
Cosmetic Roll-Cit 	0 .2 mm	Environ
Cosmetic Body Roll-Cit 	0 .2 mm	Environ
Medical Roll-Cit 	1 mm	Environ
Medical Focus-Cit 	1 .5 mm	Environ
Surgical Roll-Cit 	3 mm	Environ
Surgical Focus-Cit 	3 mm	Environ
FN-II 	0 .2 mm– 2 mm attachments	Dr . Back 10 Story

Note: The longer the needles, the more extensive the induced hemorrhage and wound healing reaction, and the greater the potential improvement. The aim is to select the most suitable needling technique for each individual patient. E.g. Should the patient not want any downtime or general anesthesia, shorter needles may need to be used even in indications for 3-mm needling.

Assembling the roller before use

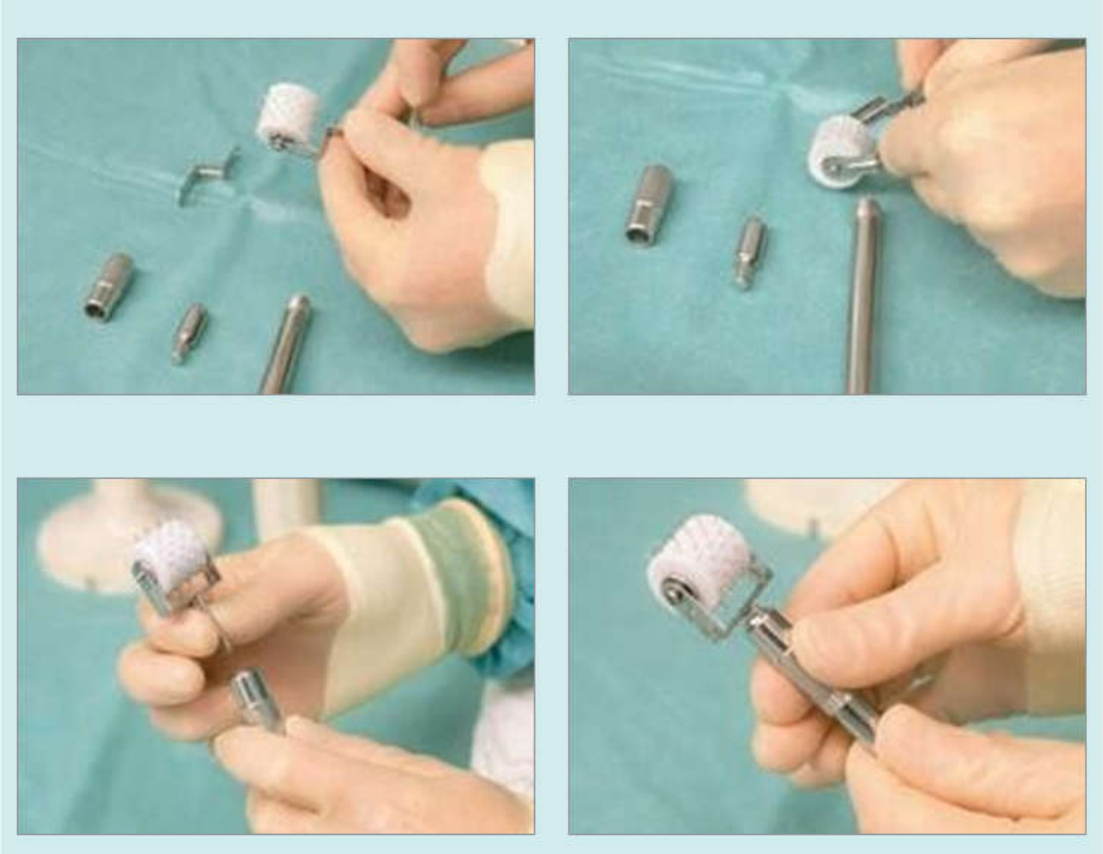
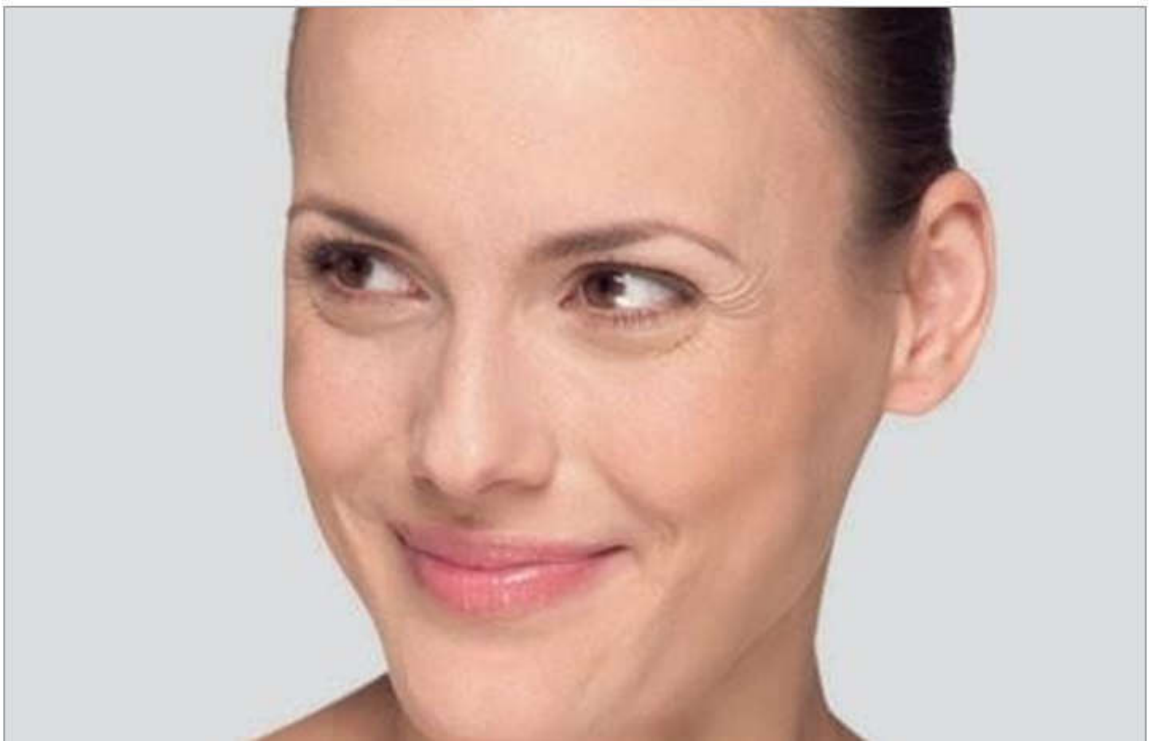


Fig. 5.2 The individual sterile-packed parts need to be assembled according to the instructions for use …

Periorbital wrinkles



Note: As the epidermis and dermis here are thin, perior- bital needling may lead to more severe edema and bruising. During the initial briefing, the patient will need to be prepared for the longer period of recov- ery before returning to normal social activities.

Treatment protocol

Before the procedure	
History	• Should include questions about previous filler and Botulinum toxin treatments
Pretreatment	• For at least 1 month with high-dose topical vitamin A and C products
During the procedure	
Cleaning the treatment area	• Make-up removal • Degreasing and skin alkalinization . The skin does not need to be treated with alcohol, ether or acetone because it is easily anesthetized .
Anesthesia	• Topical anesthesia with anesthetic products usually gives fairly dense anesthesia of the lower eyelid and the crow's feet region • Regional infiltrative anesthesia is usually easy and effective in patients who have a low pain threshold
Needling	• Remove the local anesthetic cream • Stretch the skin over the orbital margin • Carefully pass the roller over the eyelid region, applying moderate pressure, until multiple petechial hemor- rhages appear and edema develops . The use of a stamping or mechanized tool makes it easier to needle this area effectively . • Caution: proceed with extreme care to avoid injuring the eye
Wound care	• Clean the treated area with sterile water • Apply saline or sterile water-soaked swabs to the area until blood has stopped oozing through the skin • Apply high-dose vitamin A and C products to the treated region • Cool the affected area with cool wet swabs as much as possible for the first 24 to 48 hours to reduce swelling
Debriefing the patient	• Information on adequate wound care (see Chapter 5 .5 .2, p . 94) . Remind the patient that they will be more swollen than they expect and they may even find it difficult to open their eyes the next day . Otherwise treat the skin as normal .
After the procedure	
Wound management until healing is complete	• Tea tree oil washing lotion twice daily • Vitamin A and C products twice daily
Make-up	• Can only be applied after 24 to 48 hours
Follow-up treatment recommended after ...	• 1 week to 6 months . In general the patients prefer to wait to see the final result before doing this treatment again as an isolated treatment .

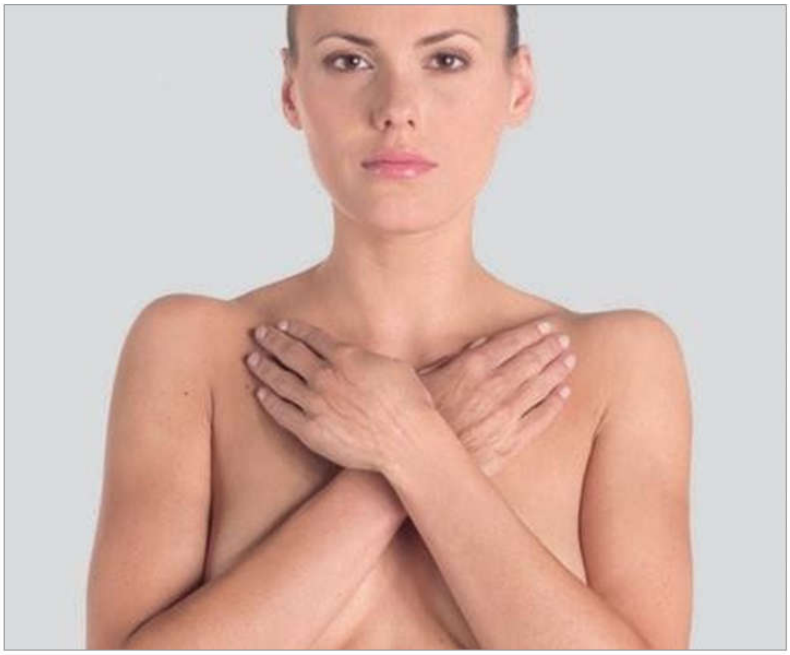
Treatment tips

	
A targeted supraorbital and infraorbital nerve block enables totally painless needling of the sensitive eyelid region, but the crow's feet have to be treated specifically.	**For best access to all the periorbital wrinkles, it is advisable to hold the skin tightly stretched above and/or below the orbital margin. The authors do not needle the upper eyelid below the upper edge of the tarsal plate.**

deep penetration into the dermis and heavy intra- dermal bleeding if the desired remodeling of the papillary and reticular dermis and the associated significant improvement in skin quality is to be achieved. This extensive intradermal hemorrhage is achieved with the use of long needles that are rolled over or pressed onto the skin with very firm pressure. The treatment is painful and requires regional or general anesthesia. The postoperative edema and bruising may be considerable and may last for more than a week. However, this reac- tion is desirable to induce the intended, extensive wound healing re- action. It is generally not associated with any other complications. The patient needs to be informed about this in the pre-treatment briefing. Needle devices" Classical needling is performed with the aid of special needle roll- ers (also know as skin rollers or dermarollers), with various designs readily available at a reasonable price (e. g. via the Environ compa- ny's sales department, see Appendix, p. 198). They consist of a roller studded with needle-points, which is passed over the skin. A choice of various needle lengths (0. 1 mm–3 mm) and roller sizes for small or large areas are available, depending on the indication and the region being treated (see Tab. 5. 2). The product is available either ready as- sembled as a single unit or with a separate sterile roller head and handle which need to be assembled before the roller is ready for use (see Fig. 5. 2 and Fig. 5. 3). After use, the 1-mm roller heads can be autoclaved or sterilized by other methods according to the instruc- tions of the manufacturer and may only be reused on the same pa- tient. The 3-mm roller heads, on the other hand, are often used only once and discarded following the procedure. They may however, also be autoclaved or sterilized depending on the instructions from the manufacturer. The handle can be sterilized and reused.

Another useful device is a stamp containing up to 14 needles of vari- ous lengths from 0. 2 to 3. 0 mm. This device is used in a stamping action with rotation to ensure more even distribution of the holes. This type of device is useful for treating simple scars

Photoaging of the hands



Before the procedure	
History	• Should include questions about previous filler, botox or laser treatments
Pretreatment	• For at least 1 month with a high-dose vitamin A and C products
During the procedure	
Cleaning the treatment area	• Camouflage removal • Disinfection
Anesthesia	• Topical anesthesia with suitable anesthetic products • Hand block may be necessary
Needling	• Pass the roller over the back of the hand with quite firm pressure • Continue the procedure until multiple petechial hemorrhages of the desired intensity are produced or the patient reports an unpleasant sensation
Wound care	• Clean the treated area and remove the local anesthetic cream and any blood with sterile water • Apply high-dose vitamin A and C products to the treated region • Cool the affected area if required
Debriefing the patient	• Information on adequate wound care (see Chapter 5 .5 .2, p. 94) and the slow onset of action
After the procedure	
Wound management until healing is complete	• Tea tree oil washing lotion twice daily • Vitamin A and C products twice daily
Follow-up treatment recommended after ...	• 1 week to 6 months

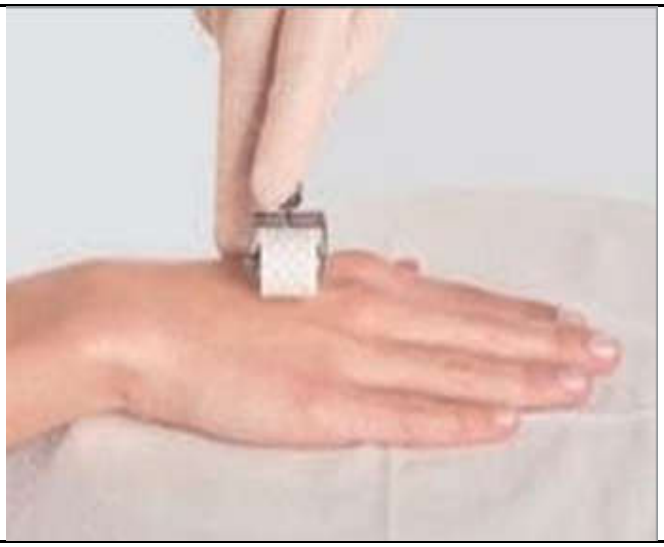
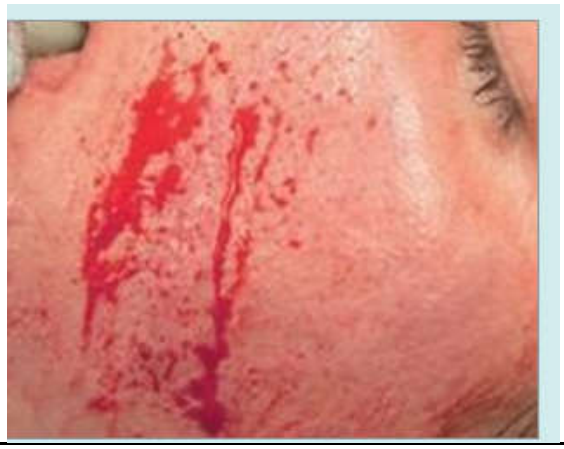
and smaller focal areas such as the upper lips, or cheeks. Apart from the classical rollers and stamps, other more recently modified tattooing instruments for percutaneous collagen induction are available. An example is from the Korean company Dr. Best 10 Story which has adjustable speeds and needle lengths for Cosmetic up to Medical Needling. This type of device is also more useful for localized areas and is more precise in treating the vermillion margin of the lips or for going closer to the eyelashes than with a roller or stamping device.

Treatment aim: The aim of needling is to reduce the periorbital laughter lines ("crow's feet") and/or the fine wrinkles in the upper and lower eyelid region by naturally improving and tightening of the skin while preserving full facial mobility.

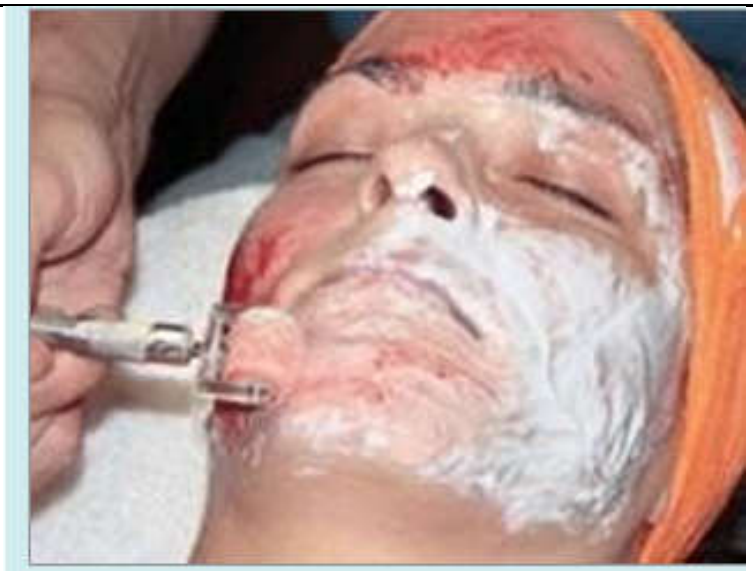
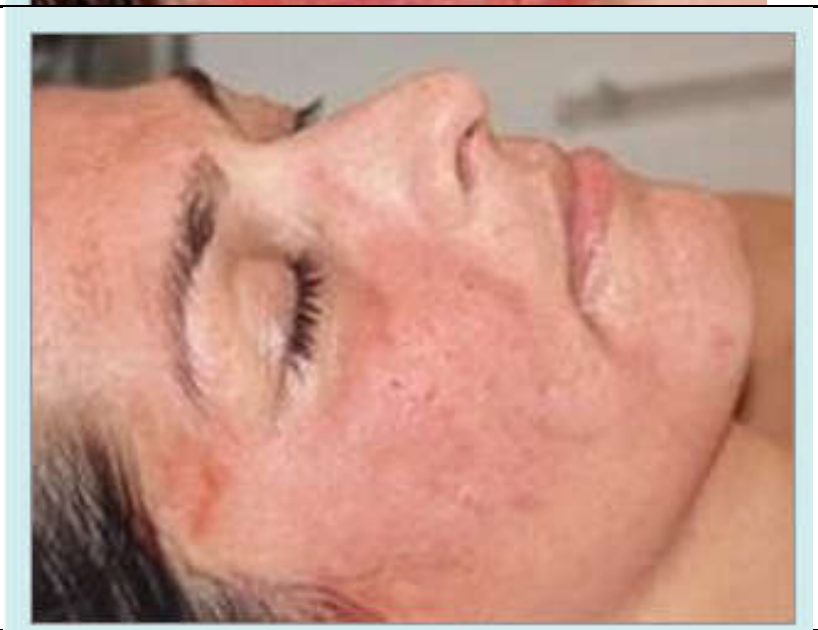
Evaluation of the treatment: Needling is particularly suitable for wrinkle reduction in the sensi- tive periorbital region, whereas other minimally invasive methods are often more difficult to perform here. Drug-related complications, such as the ptosis, ectropion or double vision that may occur follow- ing wrinkle treatment with Botulinum toxin, can be ruled out with needling. Since the anatomy of the eyelid region means that the skin here is very thin, even short needles can induce significant bleeding and collagen induction, which then leads to the desired smooth- ing of the wrinkles. Consequently, the 1-mm technique can already produce very nice results. On the other hand, there is no risk even if 3-mm needles are used: if the needles reach the subcutis, the re- sultant stimulation of the endogenous growth factors in the adipose tissue can further promote the desired skin regeneration and wrinkle smoothing. One or more sessions will be needed for a good result, depending on the initial findings.

Suitable needle lengths: In principle, needles 1 to 3 mm in length may be used, depending on the severity of the clinical findings, the patient's wishes and in- formation about the resultant swelling and the anesthetic options.

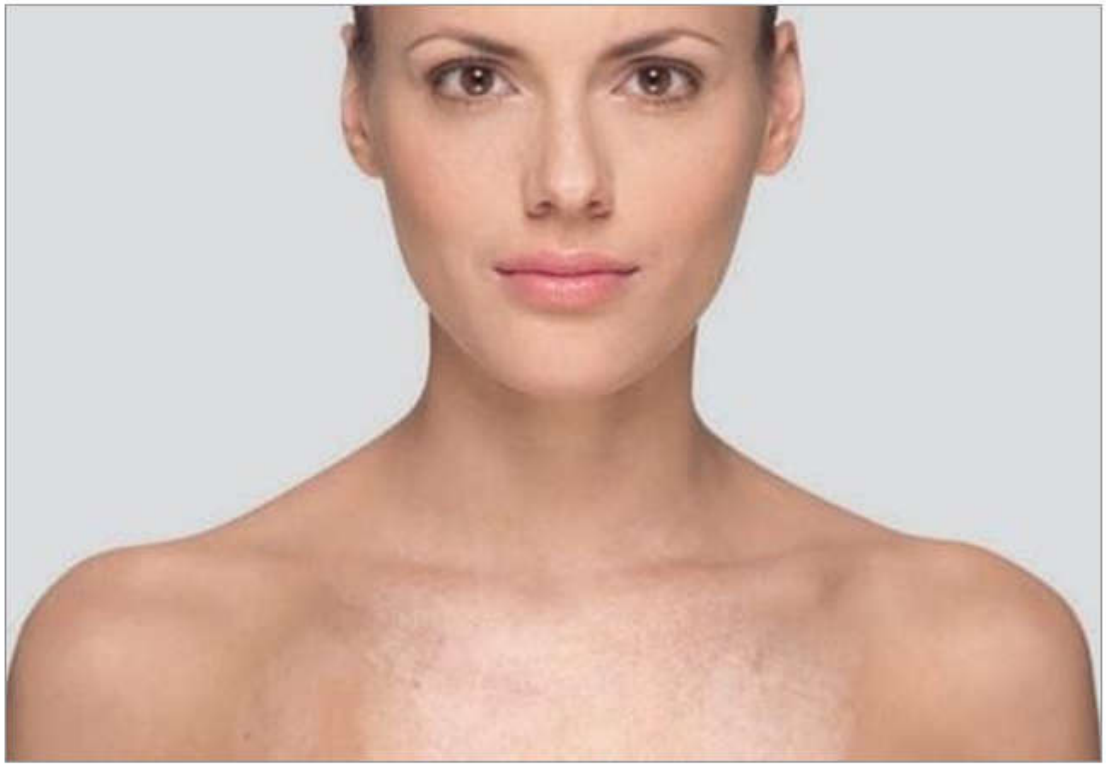
Treatment tip

	During the treatment, the hands should be held higher than the heart, to ensure that their dorsal veins are fully collapsed, to minimize hematoma . Petechial hemorrhages are also essential on the hands if an optimal result is to be achieved .
Clinical course: 3-mm needling, cheek	
	A 3-mm needling on the cheek to treat acne scars produces the desired intense bleeding more quickly than other areas, e .g . on the extremities .
	Blood oozes out of the tiny incision channels, while edema and small hemorrhages begin to develop underneath the skin .
	At the end of the procedure, the cheek is swollen with bluish-purple discoloration . The initial bleeding stops quickly .

Clinical course: 1-mm needling, acne scars

	Significant intradermal bleeding is desirable with 1-mm needling, and this requires more pressure to be applied . The treatment is completely painless for the patient if a local anesthetic infiltration or nerve block is done . One cannot usually get dense anesthesia with topical anesthetics, but one can get sufficient anesthesia to do a significant amount of needling, though one may not be able to press firmly . The roller should better not be passed directly over the applied anesthetic cream, as shown here . The authors recommend always removing the cream before the Medical Needling .
	The treatment should be stopped when the induced hemorrhage in the treatment area appears sufficiently dense and uniform, or if the patient reports an unpleasant sensation .
	The initial bleeding stops within a very short time and, once the skin is cleaned, no signs of a procedure remain, apart from slight reddening and swelling .

Depigmented scars



Treatment protocol

Before the procedure	
History	• Should include details of how scars were produced
Pretreatment	• For at least 1 month with a high-dose vitamin A and C products
During the procedure	
Cleaning the treatment area	• Removal of make-up or camouflage • Disinfection
Anesthesia	• General anesthesia when treating large surfaces • Infiltration anesthesia may be possible for a small treatment area
Needling	• Pass the roller over the treatment area horizontally, vertically and diagonally, applying firm pressure, until multiple petechial hemorrhages appear • Continue the procedure until the bleeding into the skin becomes extensive
Cleaning	• Clean the treated area and remove blood with sterile water
ReCell	• Spray the cell suspension obtained from the skin biopsy onto the needled skin
Occlusion	• With plastic wrap (film) for 1–2 days
After the procedure	
Removal of the film	• After 1–2 days (when it comes off by itself) • Then high-dose vitamin A and C products
Postoperative monitoring	• For 1–2 days with daily check-ups
Debriefing the patient	• Information on adequate wound care (see Chapter 5 .5 .2, p . 94) and the healing phase
Wound management during the exudation phase	• No daily dressings or compresses • Pain management for a few hours
Wound management until healing is complete	• Tea tree oil washing lotion twice daily • Vitamin A and C products twice daily
Check-up appointments	• After 1, 2 and 4 weeks • After 3 and 6 months
Follow-up treatment recommended after ...	• 3–6 months

Repeated sessions with the 1-mm method, which is associated with minimal pain and downtime, are the best option for cosmetic indica- tions, but 1-mm needling can produce bruising and swelling.

Anesthesia: The eye region is very easily anesthetized with topical anesthetics and it is generally not necessary to use more intense anesthesia. Even treatment with 3-mm needles may be accomplished quite painlessly with topical anesthesia, but local anesthetic infiltration may be re- quired in some cases. It should never be necessary to do 3-mm need- ling around the eyes under a general anesthetic.

ReCell

Before the start of the needling procedure, a piece of healthy split -thickness skin including the basal cell layer is removed from the patient and broken down enzymatically with the aid of a special enzyme kit . The autologous cell suspension, which also contains melanocytes, is then sprayed onto the freshly needled and still permeable skin . The intact cells lead to improved regeneration and repigmentation of the treated region . This can optimize the skin improvement produced by needling, allowing even hypopigmented scars to be satisfactorily treated .

Treatment aim: Needling can be used to naturally improve skin structure on the hands, producing a long-term reduction in the signs of aging that occur there (e. g. prominent tendons, lentigines).

Evaluation of the treatment: Like the neck and décolletage zone, the hands are becoming more and more important in minimally invasive anti-aging therapy. To date, approaches used to rejuvenate the hands have included hyaluronic acid injections or fat grafts for volume augmentation of the subcutaneous tissue, or laser treatments and peels with their well- known post-interventional risks and restrictions. Needling treatment leads to uncomplicated dermal remodeling, with resultant regeneration of the photodamaged skin with regard to structure, pigmentation and elasticity. Age spots, wrinkles and elastosis can be effectively treated with this technique. Depending on the severity of the clini- cal findings, one or more treatments will be needed to achieve the desired result.

Suitable needle lengths: In principle, needles 1 to 3 mm in length may be used, depending on the severity of the clinical findings, the patient's wishes and infor- mation about the resultant swelling and the anesthetic options. The 1- mm technique, associated with moderate edema and no down- time, is the best option due to its suitability for routine use, but it will need to be repeated at regular intervals to ensure a lasting result.

Anesthesia: Local anesthesia is usually sufficient in 1-mm needling due to the moderate pain it produces. Moreover, like the perioral region, the backs of the hands also offer good conditions for regional conduction anesthesia by blocking the radial, ulnar and median nerves, en- suring a totally painless procedure. Using this method (depending on indication and the patient's wishes), even 3-mm needling can be carried out on the backs of the hands without a general anesthetic.

Treatment aim: Extensive repigmentation effects can be unreliable with needling alone. Work on vitiligo and smaller surgical and burn scars has shown complete re-pigmentation of the affected areas. The failure to induce post-inflammatory hyperpigmentation should not be mis- interpreted as absolutely no effect on melanocytes. As long ago as the early 1990's, (Camirand, 1997) the concept of needling white scars to re-pigment those scars was first introduced. For some reason as yet not elucidated (probably normalization of the activity and dis- tribution of melanocytes), white scars become skin colored. However, a combination of needling and ReCell treatment can also be used on hypopigmented scars covering a large area, to produce a natural improvement in skin structure and scar quality, with simulta- neous repigmentation. A negative point is that skin grafts need to be harvested and that may cause a cosmetic problem as well. The donor site could be needled to make it less obvious.

Evaluation of the treatment: Scar treatment with needling plus ReCell combines the effects of two different skin-regenerating methods, optimizing the improvements in the skin produced by needling by also inducing repigmentation. The ReCell method is a novel technique, in which a split-thickness skin biopsy is used to introduce intact melanocytes (among other cells) into the skin, where they cause repigmentation of the skin. To do this, the skin biopsy is subjected to enzymatic breakdown and the resultant cell suspension is sprayed directly onto the needled skin. The combination of these two techniques results in a simple and safe skin-regenerating treatment, which has led to notable clinical successes, e. g. with hypopigmented scars. Since the clinical effect is based on endogenous processes, the improvement reaches its opti- mum level only after a few months.

Needle length selection: In principle, 3-mm needles are best suited for the treatment of scars. If the patient insists, then repeated sessions of 1-mm needling with topical anesthetic is also possible, provided that expectations have been put into perspective beforehand.

Anesthesia: Since the needling of scars involves working with firm pressure, general anesthesia should be used particularly when treating larger areas. For smaller areas, it may also be possible to perform the pro- cedure under infiltration anesthesia.

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