

# Regenerative potential of skin exposed to stress factors and cosmetological peri-procedure practice

## *Potencjal regeneracyjny skóry narażonej na czynniki stresowe a kosmetyczna praktyka okolicy zabiegowej*

### ABSTRACT

Dysfunctional skin, exposed to stress factors, represents a significant challenge in the work of cosmetologists. Adequate skin regeneration is fundamental to the effectiveness and safety of treatments, especially in the context of the increasing popularity of stimulating procedures.

The study aimed to analyse current scientific research on the impact of emotional stress on the skin's regenerative capacity.

Consideration of this aspect plays a key role in developing effective skin care and treatment plans, in line with modern approaches in cosmetology.

**Keywords:** emotions, psychological stress, skin, healing, cosmetological treatments

### STRESZCZENIE

Skóry dysfunkcyjne, narażone na działanie czynników stresowych, stanowią istotne wyzwanie w pracy kosmetyków. Właściwa regeneracja skóry jest fundamentem skuteczności i bezpieczeństwa terapii, zwłaszcza w kontekście rosnącej popularności zabiegów stymulujących.

Celem pracy była analiza aktualnych badań naukowych dotyczących wpływu stresu emocjonalnego na zdolności regeneracyjne skóry.

Uwzględnienie tego aspektu odgrywa kluczową rolę w tworzeniu skutecznych planów pielęgnacyjnych i zabiegowych, zgodnych z nowoczesnym podejściem w kosmetyce.

**Słowa kluczowe:** emocje, stres psychologiczny, skóra, gojenie, zabiegi kosmetyczne

### INTRODUCTION

Following trends, ignoring the needs of one's own body and the modern problem of overstimulation, often lead to chronic stress. The mechanism of action of the skin's neuroendocrine system demonstrates the importance of emotional factors on the health and proper functioning of the skin, as well as the development of many dermatoses. Psychological stress significantly impairs the skin's ability to protection against damage and limits its regenerative potential. In the context of stimulative treatments that intentionally induce microdamage and inflammation, properly assessing the skin's readiness for such stimulation is crucial.

### HEALING PROCESSES IN THE EXPERIENCE OF CHRONIC STRESS

#### Physiology of damage repair

Regardless of the cause of the injury, restoring anatomical continuity and tissue function requires adherence to particular stages. The first one, the exudative (inflammatory) phase, associated with redness, swelling and elevated tissue temperature, reflects the involvement of the vascular system in mobilising immune cells to migrate to sites of injury and ultimately lead to wound anastomosis. At this point, it is crucial to recognise that inflammation should not be considered as

an undesirable occurrence, because it signifies a physiological reaction of the organism, essential for combating a stressful stimulus. It is crucial to recognise this as significant information concerning the body's imbalance and to focus efforts on determining its source. An inadequate attempt to suppress the reaction can be dangerous and disrupt the body's return to homeostasis [2, 3].

Approximately 5 days after wounding, the beginning of the proliferative phase is observed, in which cells divide and migrate intensively. It is dominated by two processes: neovascularization, associated with the formation of new blood vessels, and reepithelialisation, which aims to produce a keratinized epidermis. The essence of the remodelling phase is the dissolution of collagen and its conversion from type III to type I, carried out by matrix metalloproteinases (MMPs,) acting under the control of specific inhibitors. Collagen fibers form networks and then bundle to stabilize the resulting scar. In the case of light trauma, such as abrasions, the small degree of damage allows for so-called regenerative wound healing, by definition devoid of the risk of scarring. Such a process illustrates the skin's ability to adapt, aiming to quickly restore safety and comfort to the body [3].

### Healing hindered by emotional distress

A sustained heightened state of anxiety prompts the body to activate a chronic stress response, akin to a continuous internal inflammation. The cytokines that initiate it also serve as modulators of mood and cognitive function. They reduce monoamine levels in the brain and activate several neuroendocrine responses, leading to an impairment of its plasticity. The reciprocal driving of inflammation and neuropsychiatric disorders in this two-way loop is observed in conditions such as depression and schizophrenia. Increasing levels of alarmins (DAMP, *danger/damage-associated molecular patterns*), endogenous molecules released following damage or cell death, and pathogen-associated molecular patterns (PAMP) are recognized by keratinocytes and lead to a downstream inflammatory response associated with activation of the inflammasome. These molecules indicate the presence of pathogens or other tissue-damaging agents, and keratinocytes, as sentinel cells and important components of the skin immune system (SIS), read them as information about a potential threat. Elevated levels of DAMP, as well as many other inflammatory mediators, including acute-phase reactants such as C-reactive protein (CRP), are observed in people exposed to psychosocial stress [4, 5].

As an important hormone involved in the processes described, cortisol is characterised by a complex action, combining pro-inflammatory and anti-inflammatory properties. Cortisol, which belongs to the glucocorticoids, regulates the function of the hypothalamic-pituitary-adrenal (HPA) axis and the immune system by binding to specialized

glucocorticoid receptors. Their activation, at the level of the cell nucleus, increases the expression of anti-inflammatory genes, such as interleukin 10 (IL-10), and inhibits the transcription factor NF- $\kappa$ B (*nuclear factor kappa-light-chain-enhancer of activated B cells*) essential for genes encoding pro-inflammatory cytokines. Stress in itself is a healthy response. In its absence, the body would be vulnerable to any harmful agents, rendering it defenceless. Under the influence of a short-term stressor, cortisol acts to regulate and strengthen immunity. Chronic stress, experienced, for example, in depression, has a suppressive effect on the immune system, develops resistance to the anti-inflammatory effects of steroids (which also applies to drug treatment) and leads to unrestrained inflammatory reactions [4]. In oncology patients experiencing chronic stress due to ongoing malignancy in the form of breast cancer, increased skin reactions are observed during radiation therapy. In the case of acute stress during anxiety episodes, the escape response associated with the release of adrenaline is activated. Its purpose is to ensure the fastest possible response to any form of danger, hence the sudden blood flow to organs, increased respiratory and heart rate, blood pressure, body temperature or pupil dilation observed in such conditions.

Adrenaline negatively affects the healing process, disrupting each of the three phases of recovery described earlier. Already at the initial stage, constricting peripheral vessels, restrict the supply of oxygen and nutrients, which are crucial for the proper course of tissue regeneration. It causes a decrease in keratinocyte motility, which slows re-epithelialization, and furthermore limits the migration of fibroblasts essential for collagen production [6].

Emotional factors greatly influence the barrier function of the skin in the context of its physiology. In the article of Fukuda et al. the epidermal permeability barrier function was assessed by examining transepidermal water loss (TEWL). During periods of increased stress, the value of TEWL increases and, consequently, the hydration of the stratum corneum decreases, which may result in exacerbation or prolonged healing of lesions in the course of dermatoses [7]. Emotional stress affects the skin by, among other things, modifying the composition of lipids on the skin's surface, which are essential for maintaining normal barrier function. It can increase the proportion of saturated fatty acids that are ligands for toll-like receptor 4 (TLR4). Subsequently, through the NF- $\kappa$ B factor pathway, inflammatory mediators are augmented. At the same time, there is a decrease in the level of the antimicrobial 6-hydroxysingosine [8].

Stress affects people on many levels, interfering with the satisfaction of the body's basic needs. It can lead to sleep problems, lack of appetite or, on the contrary, compulsive overeating as a form of escape, as well as promote the use of stimulants. Meanwhile, proper satisfaction of these needs

plays a key role in the body's ability to cope with stress and damage factors, promoting regeneration and skin functions that are important in the recovery process [4]. Regenerative processes occur mainly at night. Biologically, this is the time programmed for rest. Nowadays, especially in a highly urbanized area, living according to diurnal rhythms is difficult to achieve. In a study conducted on study-burdened medical students exposed to stress and sleep deprivation, a clear correlation of these factors with skin barrier homeostasis was noted. The closer they got to the end of the semester and upcoming exams, a progressive decrease in skin hydration was noted, as well as increased sebum secretion, which may have exacerbated acne symptoms. Dermoscopic examination also included the eye area and showed a worsening of the dark circles problem under the eyes [9].

Modulating the course of the inflammatory response, melatonin acts both as its activator and inhibitor. In the early phase of the inflammatory response, it activates the synthesis of inflammatory mediators. In the feedback response, the same cytokines inhibit melatonin synthesis in the pineal gland, so that the development of inflammation is adequate to the stimulus that triggered it. Efficient regulation of these processes is tantamount to concern for good quality sleep since the peak of melatonin synthesis occurs at night. In addition, neglect of sleep hygiene causes dysbiosis of the skin microbiome and intensifies ongoing inflammatory processes in the skin. Unique self-healing mechanisms occur at night, when microcirculation accelerates and cellular availability to nutrients enhances [10, 11].

From a holistic perspective, the regenerative potential of tissues also depends on diet. Chronic stress promotes the development of negative health behaviours such as sedentary lifestyles, poor diet and smoking. These factors have the effect of impairing the healing process. For example, obesity is defined as a state of chronic inflammation caused by elevated levels of interleukin-6 (IL-6), tumour necrosis factor (TNF- $\alpha$ ) or CRP protein. Furthermore, as much as 30% of circulating IL-6 may originate from adipose tissue, since adipocytes possess the ability to synthesise it independently. It is estimated that people with major depressive disorder (MDD) have a 58% higher risk of obesity [4]. Malnutrition, like obesity, can be a cause of impaired healing processes. An adequate supply of protein and cofactors, i.e. vitamin A, vitamin C and zinc, which regulates inflammation and have antioxidant effects, are required in collagen synthesis, which is necessary for the formation of a new extracellular matrix [12]. B vitamins are mostly important in cell division and growth processes. Of particular note is vitamin B<sub>12</sub>, which plays an important role in the synthesis of many neurotransmitters and hormones. Its supplementation is particularly important in a vegan diet, where natural sources of this vitamin are limited [3]. Proper nutrition, healthy dietary practices, and a balance between the

enjoyment of food and its significance enhance the capacity of tissues to regenerate and protect against threats. Substitutes play an important role in healing processes. Smoking is recognized as a factor that increases the risk of complications after surgery due to the toxic compounds found in cigarette smoke, i.e. nicotine or carbon monoxide, which contribute to tissue hypoxia and thus delay the healing process. Oxygen is essential for every phase of healing as it enables cell migration to the wound site, the course of angiogenesis, fibroblast proliferation and collagen metabolism [13, 14]. CRP protein, an important marker of systemic inflammation, also reaches alarming values in excessive alcohol users. The concentration of this protein rises sharply in response to pro-inflammatory cytokines, i.e. IL-1 $\beta$ , IL-6 or IL1-7. In the case of addicted adults, the reason for the development of such chronic inflammation may be the experience of stress or trauma in early childhood. The body then reacts with hypersensitivity even under weak damaging stimuli or negative emotions associated with a period of abstinence [4, 15].

### Side effects of psychiatric treatment

The methods that patients choose to aid the body during the initial phase of combating the harmful agent are equally crucial for an effective healing process. Despite appearances, a quick return to comfort, pain relief or temporary alleviation of symptoms does not always bring real benefit to the body. An example are painkillers that do not infrequently are used as the first-choice drug in reducing the stress caused by discomfort. This type of remedy, like other pharmacological agents, is associated with several side effects. The abuse of analgesics is the subject of much discussion, which emphasizes the irreplaceable role of inflammation in healing processes and the fact that a large number of pain-killing drugs belong to the group of non-steroidal anti-inflammatory drugs (NSAIDs) [3].

The action of NSAIDs is based on two main processes: their concentration at the site of inflammation and inhibiting it, for example, by reducing the production of inflammatory mediators, and their effect on pain receptors (nociceptors). The perception of pain is subjective, and, according to one source, relaxing tissue and muscle tension, which does not require pharmaceutical intervention, can be just as effective as reducing it. Pain medications can impair the production of new matrix by inhibiting exudative and proliferative processes, while increasing the risk of scar overgrowth. They also reduce the activity of vascular endothelial growth factor (VEGF) important for protein synthesis and angiogenesis. Acetylsalicylic acid, through its effect on reducing blood clotting, can increase the risk of hematoma formation within the wound. This is particularly relevant in the first days after injury [3]. In addition, high doses of NSAIDs reduce the tensile strength of the wound by delaying wound contraction and epithelialization [16, 17].

On the other hand, pain relief is a key component of chronic wound management. Physical pain can cause psychological pain, disrupting the healing process and reducing quality of life. Powerlessness in the face of pain takes away the desire to experience daily joys and can lead to indifference, social isolation and feelings of loneliness. Struggling with these emotions often leads people to seek help from specialists. A combination of pharmacotherapy and psychotherapy becomes a chance for many people to regain their balance and bring the desired relief [12]. Among medications described as antidepressants, the most widely used are those from the group of selective serotonin reuptake inhibitors (SSRIs) providing a generalized neutralizing effect and calming negative emotions. A survey of psychiatrists showed that the most commonly suggested drug for generalized anxiety disorder, panic attacks and social phobia was escitalopram characterized by good efficacy with limited side effects [18]. The same drug was used in a study on rats. Acute wounds resulting from trauma caused a reaction similar to depression in humans. After administration of the drug, improved wound healing was noted, which was related to its anti-inflammatory effect. Concentrations of TNF- $\alpha$ , IL-1 $\beta$ , IL-6 and IL-10 were found to be lower than in untreated rats. The authors of the study pointed out that although inflammation is a physiological stage of healing, exacerbated by severe stress, it has a negative impact on regeneration processes [19]. Still, another study showed that tandospirone administration reduces stress-induced mast cell degranulation associated with type 1 hypersensitivity reactions, which can alleviate symptoms of atopic dermatitis (AD) [20].

Despite the benefits that antidepressants can bring in terms of both mental health and skin comfort, it is valuable to know the dermatological effects of their use. In a survey conducted, as many as 54.5% of respondents undergoing such therapy reported its skin manifestations. The most common of these involved problems with excessive dryness of the skin, which could affect the reduction of its barrier function, and thus the efficiency of regeneration processes. In addition, increased seborrhea, acne symptoms, erythema and generalized deterioration of hair and nails were observed. Many literature sources also indicated the appearance of skin rashes and pruritus under the influence of SSRIs. Likely, the cause was not the drug itself, but the rapid increase in serotonin. C-type nerve fibres stimulated by serotonin are responsible for various sensory experiences, i.e. the aforementioned itching. In addition, most drugs in this group generate excessive sweating [21]. Hypersensitivity to light and photoallergic reactions, the risk of which can be caused by antidepressants, is also an important issue. An example is fluoxetine, which under the influence of light undergoes photodegradation causing skin irritation. As a consequence of the unfortunate combination of citalopram with sun

exposure, infiltrated erythema and even blisters can occur all over the body. Among tricyclic antidepressants, amitriptyline, which causes sun discoloration, or imipramine, which causes erythema, are pointed out. Cosmetologists who perform laser therapy treatments and those who stimulate the skin and cause targeted inflammation should pay particular attention to the risk of such reactions. Emotional factors, possible drug treatment and the issue of adherence to post-treatment recommendations can determine not only the sensibility or effectiveness of the procedures introduced but above all affect their safety [22].

## SELECTED ASPECTS OF COSMETOLOGICAL CARE OF SKIN SUBJECTED TO STRESS FACTORS

### Scars and hyperpigmentation as complications after aesthetic procedures

The scar symbolizes that any damaging stimulus, whether related to physical or psychological pain, carries its consequences, and the damaged tissue never returns to its full functionality before the injury. The scar differs from normal skin during the initial healing period, up to six months after the injury. Due to the ingrown capillaries between the collagen fibres, it is reddened. Over time, as a result of inhibition of fibroblast proliferation, progressive apoptosis of microvessel cells and degradation of type III collagen fibers in favor of stronger ones - type I, it becomes paler than the surrounding skin. It is devoid of glands and hair follicles, its surface is shiny, and it lacks the characteristic feature of healthy skin - the mottling. The final appearance of the scar and the process of its formation depends on many factors, such as the mechanism and location of the original injury, as well as individual characteristics such as age, gender, skin type and any circumstances affecting the healing process. The most difficult wounds to heal are those in areas of increased muscle tension, high mobility, close to the periosteum [23]. The division of scars includes immature scars, which are in the remodelling phase; physiological - after optimal healing, slightly different from healthy tissue; sclerotic - inelastic with a tendency to retraction; atrophic - often acne type of chickenpox, *ice pick*, or *rolling*, which characteristics are collagen deficiency in the healing process and poor vascularization; hypertrophic - raised above the level of the skin as a result of excessive collagen production, but not growing beyond the edges of the wound; keloids - forming infiltrations into healthy tissues and active scars, in which chronic irritation is observed, with features of hypertrophy and vascularization unusual for this phase [3].

A similar response to a stressor is the formation of hyperpigmentation. Increased melanin production is the body's defensive response to a damaging factor. It can be not only overexposure to ultraviolet radiation (UV), but also

prolonged inflammation, stress associated with mechanical trauma, changes in hormonal balance or the effects of certain drugs. Melanin is formed in melanocytes located in the basal layer of the epidermis, from where it is transported in melanosomes and reaches the keratinocytes of higher layers via dendritic protrusions. Its unique cell protective role is evidenced by its accumulation in the area of cell nuclei, for which it constitutes a kind of shield. During melanogenesis, a shift in environmental pH from an initial acidic value of 5.0 to almost neutral at 6.8 occurs, indicating that the enzyme tyrosinase, crucial for melanin formation, achieves optimal activity under these conditions. Maintaining the correct pH gradient by lowering it in the stratum corneum and supporting an efficient hydrolipid barrier of the skin is an important element in the prevention of hyperpigmentation. Prolonged inflammation caused by impaired healing processes can result in hydrolysis of intercellular lipids, change their composition and spatial structure and affect the integrity of the stratum corneum, as well as its barrier function. Given the significant involvement of emotional factors in tissue repair processes, it can be presumed that any type of discomfort in this area will pose a risk of scarring and discoloration [24, 25].

Aesthetic defects stemming from unforeseen incidents or uncontrollable reasons are generally more readily accepted than those resulting from attempts to enhance beauty that yield undesirable results. Therefore, in the practice of an informed cosmetologist, any action on a patient's skin should be preceded by a detailed interview. Attentiveness and empathy are key here, allowing also to take into account aspects of emotional health and history of possible psychiatric treatment. In line with the priority of supporting the skin's regenerative processes, over-stimulating the skin or exposing it to great pain and discomfort seems senseless and even harmful. Subjecting dysfunctional skin with limited regenerative capacity to an invasive procedure may be counterproductive or even cause deterioration [5]. In the individual assessment of the safety of the procedure, elements of laboratory diagnostics can be helpful. Analysis of even basic parameters gives an idea of the course of healing processes and can facilitate the decision to perform the procedure. For example, a group of patients with significant impediments to healing of the surgical wound shows higher potassium levels, and lower platelet and CRP levels compared to patients with no or slight impediments to healing [26]. To minimise the adverse effects of cosmetic treatments, it is crucial to inform patients about the significance of following postoperative guidelines and to assist them in selecting home care that facilitates the healing process [5].

### **Emotional stress in skin aging processes**

Experiencing chronic emotional stress corresponds to the development of chronic inflammation, which involves

the entire body not excluding the skin. Persistent chronic subthreshold inflammation reflects elevated levels of pro-inflammatory mediators i.e. IL-1, IL-6, CRP protein, or reactive oxygen species. The body exhibits a constant state of readiness to combat the stressors to which it has adapted. The processes it initiates together with their repercussions may be incorporated into the definition of inflammaging. It involves an altered number of immunocompetent cells and restrictions on the functioning of the immune system, through which the amount of damage begins to exceed the body's ability to regenerate. The histological picture of the skin shows a disturbed proliferation of fibroblasts and a subsequent reduced production of elastin and collagen. The skin undergoes atrophy, the epidermis becomes less tight, and its barrier function progressively deteriorates. From this viewpoint, the impact of emotional aspects on tissue regenerating capacity pertains to the intricate mechanisms of ageing and captivates all those intrigued by the subject of longevity [5].

Anti-ageing treatments in a cosmetologist's office are not limited to invasive and highly stimulating procedures. Equally important in the prevention of aging are all those cosmetological methods that serve to reduce emotional stress, and provide relaxation. Among them are white cosmetics, i.e. responding to the basic needs of the skin, i.e. cleansing, moisturizing and protecting it from external factors. Regenerated and epidermally cared skin is ready for further stimulation. When deciding on skin stimulating and remodelling treatments (from the field of laser therapy, using micro-punctures, needle mesotherapy, radio waves or combined techniques involving acids, etc.), it is necessary to take into account the body's ability to regenerate, which diminishes with age, to surround the patient with perioperative care and to indicate specific products that will promote the healing process. This article discussed just a few of the many active ingredients that are effective in soothing stimulated skin [5].

The first is allantoin, which is distinguished by its safety of action and easy availability. As a modulator of inflammation, allantoin inhibits the recruitment of inflammatory cells to the site of injury, promotes fibroblast proliferation and extracellular matrix synthesis, essential for tissue reconstruction. Similar soothing properties are demonstrated by glycyrrhetic acid, extracted from liquorice, which versatile action is part of modern skin care trends. In addition to regulating the levels of pro-inflammatory cytokines, i.e. IL-6, TNF- $\alpha$  or IL-10, glycyrrhetic acid increases the activity of antioxidant enzymes - superoxide dismutase and glutathione peroxidase, and prevents the abnormal expression of metalloproteinases MMP-1 and MMP-3 that degrade components of the extracellular matrix. Its anti-allergic effect is evidenced by its effect on the balance of Th1

and Th2-dependent lymphocyte responses. The properties of glycyrrhetic acid play an important role in protecting the skin from environmental factors, oxidative stress and photoaging. It is an ingredient particularly recommended for the prevention of hyperpigmentation. The extract of *Centella Asiatica* is increasingly appearing in cosmetics designed for sensitive and stressed skin. Among the most valuable components of this plant stand out asiaticoside and madecassoside, known for their versatile regenerative and soothing properties. Asiaticoside stimulates the synthesis of type I collagen, glycosaminoglycans and increases antioxidant levels during the initial stages of healing. Madecassoside is valuable especially in supporting the healing of burn wounds. *Centella* extract is distinguished by its strong moisturizing effect helping to restore the skin's barrier function. Most associated with anti-inflammatory activity, panthenol, or more precisely, D-panthenol (dexpanthenol) owes its biological activity to enzymatic conversion to pantothenic acid, a component of coenzyme A. Topical application of D-panthenol effectively soothes skin irritation caused by detergents and hygiene products, such as sodium lauryl sulfate (SLS), which is responsible for creating foam and removing impurities and excess sebum from the body and hair. Numerous clinical studies also confirm the ability of D-panthenol to promote wound healing. It improves the migration of cells involved in remodeling processes and stimulates collagen synthesis. In addition, it strongly moisturizes, supports skin barrier function and can be used adjunctively in the treatment of AD [27].

### Holistic care for skin with dysfunctions

Skin exposed to stress factors will not fully recover until the body's balance is restored. The care of such skin should be closely linked to care for the holistic health of the entire body. Living following circadian rhythms, getting good quality sleep, taking care of proper hydration and nutrition of the body, and being on the move have a real impact on one's well-being and can gradually lead to a lost balance. Healthy skin, in the subjective perception, exudes beauty. Cosmetology, as an interdisciplinary field, should use every interaction with the client to educate and, within the limits of its competence, offer support in the client's recovery [1].

Expanding and updating knowledge, keeping up-to-date of the latest trends and being able to critically evaluate them are key qualities that every beauty professional should develop. Concerning the care of emotionally stressed skin, this may include mood-modulating factors. One of the newer and increasingly interesting issues in cosmetology is the endocannabinoid system, which regulates almost all processes in the body, especially those related to the functioning of the central and autonomic nervous systems. It participates in memory processes, ensures the proper

transmission of information in the brain, affects the perception and perception of pain, and regulates the secretion of neurotransmitters responsible for the feeling of satiety and affecting mood. Its function is also sometimes referred to as the "bridge" between the body and mind, which serves to maintain internal balance. Diet and supplementation can modulate the function of this system [28]. Receptors of the endocannabinoid system, present in various organs, tissues and cells, including functional skin structures, respond to both endocannabinoids produced by the body and phytocannabinoids derived from plants. Their leading representative is cannabidiol (CBD), which belongs to one of the many groups of active ingredients and is responsible for popularity of the hemp oil nowadays. Recent studies show its potential to inhibit the release of inflammatory mediators, i.e. IL-8, VEGF or metalloproteinase-9 (MMP-9), as well as its positive effect on skin barrier function. In addition to oral supplementation, topical application of hemp products, e.g. hydrogels, which effectively eliminate the harmful effects of SLS, may also prove beneficial. They can accelerate the return to the skin's initial hydration state and reduce TEWL. In one observational study, the application of such a gel to irritated skin resulted in a reduction of pruritus in 67% of subjects, in addition, an improvement in skin lesions associated with atopy was noted. Hemp extracts were also observed to be involved in the inhibition of elastase and collagenase, which have anti-aging implications [29-33].

In the course of chronic wound inflammation, dietary factors may be significant. This is due to parallel processes between the gut-brain axis and the skin-brain axis. Intestinal dysbiosis associated with poor diet or stress may play a key role in the regulation of anxiety behaviour and cognitive function, while also leading to the development of skin diseases (increasing interest in probiotic therapy) [34, 35]. When considering these issues, it is impossible to ignore the beneficial effects of positive emotions on healing processes, which prove worthwhile to trigger and nurture them in ourselves. For example,  $\beta$ -neoendorphin ( $\beta$ -NEP) plays an important regulatory role in these processes by accelerating, among other things, the migration of keratinocytes [36].

### SUMMARY

The skin's regenerative capacity can be affected by several factors concomitant with experiencing emotional stress, i.e. the body's unmet needs related to sleep hygiene or diet, as well as undergoing psychiatric treatment. Discussing emotional health in the cosmetology office plays an important role in properly qualifying the client for treatment. It enables the prevention of adverse reactions, the precise selection of post-treatment care and, if necessary, the introduction of alternative, less invasive procedures suitable for stress-prone complexions.

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