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Platelet-rich plasma in dermatology and aesthetic medicine

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ABSTRACT

Introduction and purpose

Aesthetic medicine is one of the youngest fields of medicine. Initially, it focused on improving the quality of life of patients by using various treatments aimed at stopping the aging process. Over time, this branch of medicine has developed dynamically, and nowadays the treatments focus not only on improving the appearance of the skin and its defects, but are also used to treat many dermatological problems. Platelet-rich plasma (PRP) is an autologous concentrate of platelets in a small volume of plasma. having numerous applications in many fields of medicine. The aim of this work is to present the method, focusing on its positive effects in the problems of aesthetic and regenerative medicine, as well as in some dermatological diseases.

Material and methods

The review was baised on the articles obtained from Pubmed and Google Scholar scientific databases from recent years using the keywords: aesthetic medicine, platelet-rich plasma, dermatology.

Results
The presence of numerous growth factors and other active ingredients makes the action of PRP comprehensive and based on several mechanisms. Studies show a positive effect, especially in skin rejuvenation and anti-aging prevention, hair reconstruction, wound healing and reconstruction of scars of various etiologies, as well as in pigmentation disorders. Moreover, combining PRP with other methods such as laser therapy or microneedling produces a synergistic effect, improving overall treatment results.
Conclusions
Platelet-rich plasma is an autologous preparation obtained after centrifugation of blood collected from the patient. The properties of PRP make it widely used in many clinical situations. is used both in aesthetic medicine and in dermatological problems. It should be emphasized that further multi-center studies are needed to standardize treatment protocols and adapt them to specific problems.

Keywords: aesthetic medicine, platelet-rich plasma, dermatology.

Introduction

Aesthetic medicine is one of the youngest fields of medicine. Its origins date back to antiquity, but it emerged as a medical discipline in the 1970s, when French endocrinologist Jean Jacques Legrand founded the first Society of Aesthetic Medicine. It reached Poland in the 1990s, which resulted in the establishment of the Section of Aesthetic Medicine at the Polish Medical Association. Since 2010, the section has been operating as the Polish Society of Aesthetic Medicine and Anti-Aging. Initially, it focused on improving the quality of life of patients by using various treatments aimed at stopping the aging process. Over time, this branch of medicine has developed dynamically, and nowadays the treatments focus not only on improving the appearance of the skin and its defects, but are also used to treat many dermatological problems. This not only improves the appearance of patients, but also improves their self-esteem and mental comfort. Platelet-rich plasma (PRP) is an autologous concentrate of platelets in a small volume of plasma. having numerous applications in many fields of medicine, such as surgery, orthopedics, dentistry and dermatology. The aim of this work is to present the method, focusing on its positive effects in the problems of aesthetic and regenerative medicine, as well as in some dermatological diseases.

The definition of platelet-rich plasma and its beginnings in medicine

Platelet-rich plasma (PRP) is an autologous concentrate of platelets in a small volume of plasma. Normally, the concentration of platelets in the blood is 150,000. up to PLN 400,000 Per microliter. It is believed that for platelet-rich plasma to have high regenerative and therapeutic properties, the concentration of platelets should be at the level of 1 million per microliter [1]. The term platelet-rich plasma was first used in the 1950s as the standard concentrate of platelets for transfusion. In the 1970s, the main application was in hematology - replenishing platelets in patientswith thrombocytopenia.

Then, PRP was successfully used in surgical fields of medicine, such as cardiac surgery and maxillofacial surgery, using the hemostatic and proliferative properties of the preparation. In the late 1980s, platelet concentrate protocols were first introduced and called autologous wound healing factors. Since then, these techniques have been increasingly used in aesthetic and regenerative medicine. At the beginning of the 21st century, PRP gained even greater popularity thanks to its possible use in dentistry and orthopedics, as well as in dermatology - thanks to reports of a possible positive impact on the treatment of baldness [2]. The history of PRP dates back at least 70 years, thanks to many years of research and experience, it is successfully used nowadays in many fields of medicine.

Platelet biology

Platelets, or thrombocytes, are a morphotic component of blood, deprived of a cell nucleus and unable to move. These are disc-shaped structures with a diameter of up to several micrometers, formed in the process of thrombopoiesis from the hematopoietic stem cell. The most important factor regulating the platelet system is thrombopoietin. Thrombocytes are involved in many processes in the human body, but the most important role they play is hemostasis. Through processes such as adhesion and activation and aggregation stop bleeding at the site of endothelial damage. Structurally, platelet can be divided into appropriate zones:

- The peripheral zone is rich in glycoproteins necessary to initiate key processes for hemostasis
- A zone rich in microtubules that help maintain the proper shape
- Organelle zone - rich in granules. α-granules contain numerous growth factors and cytokines, more about which in the following sections. Delta granules contain platelet-activating factors, including calcium, ADH and serotonin.
- The membrane zone contains membranes derived from the smooth endoplasmic reticulum of megakaryocytes, organized in a dense system of tubules, which is responsible for the synthesis of thromboxane A2. [3]
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Platelet-rich plasma is a source of signaling molecules. After platelet activation, growth factors and cytokines are released, which modify the pericellular microenvironment.

Composition of platelet-rich plasma and mechanism of action

As mentioned above, platelet granules contain numerous growth factors that are crucial. The presence of several growth factors has been demonstrated, the most important of which are: fibroblast growth factor (FGF), platelet-derived endothelial growth factor (PDGF), transforming growth factor β (TGF-β), epidermal growth factor (EGF), vascular endothelial growth factor (VEGF), insulin-like growth factor (IGF), [4].

TGF-β- stimulates the proliferation of undifferentiated mesenchymal cells; regulates endothelial, fibroblastic and osteoblastic mitogenesis (cell division); regulates collagen synthesis and collagenase secretion; regulates the mitogenic effect of other growth factors; stimulates endothelial chemotaxis and angiogenesis; inhibits the proliferation of macrophages and lymphocytes.

PDGF- mitogenic for mesenchymal cells and osteoblasts; stimulates chemotaxis and mitogenesis in fibroblasts, glia and smooth muscle cells; regulates collagenase secretion and collagen synthesis; stimulates chemotaxis of macrophages and neutrophils.
FGF- promotes cell proliferation and migration, especially fibroblasts and smooth muscle cells. Supports the growth and differentiation of chondrocytes and osteoblasts; mitogenic for mesenchymal cells, chondrocytes and osteoblasts.
EGF- promotes the proliferation of keratinocytes and fibroblasts, stimulates the mitogenesis of endothelial cells, plays a role in the proliferation and differentiation of epithelial cells, which is important for the regeneration of the outermost layer of the skin.
VEGF- stimulates angiogenesis and increases vascular permeability, stimulates mitogenesis of endothelial cells. It is the most important factor activating the process of creating new vessels.
IGF-1- Chemotactic for fibroblasts and stimulates protein synthesis. It supports bone formation through the proliferation and differentiation of osteoblasts [5].
Additionally, growth factors modulate the activity of various immune cells, e.g. macrophages, lymphocytes and neutrophils, minimizing the risk of chronic inflammation. The plasma itself, the concentration of which in PRP is 2 to 8 times higher than in whole blood, contains, among others: nutrients, vitamins, hormones, electrolytes, growth factors and proteins.

Manufacturing process
The first stage of creating platelet-rich plasma is collecting whole blood from a peripheral vein. Then the collected material is processed by centrifugation. Appropriately selected force of the device intended for this purpose causes the deposition of specific cellular components depending on the specific gravity. We can distinguish two techniques for producing PRP:

- Open - biological material has contact with the external environment as well with tools for processing the material, such as a pipette or syringe. In this situation, appropriate care must be taken to ensure that the material is not contaminated.
- Closed - uses certified commercial medical devices that have been specially manufactured for the production of PRP and can be used in a centrifuge, the biological material has no contact with the external environment.

Most devices designed for this purpose consist of a tube with an anticoagulant into which material can be directly collected or a medical device with which the material is collected into a tube with an anticoagulant. Depending on the manufacturer of the ready-made sets, the recommended parameters of the centrifugation process are the number of centrifugation cycles, centrifugation time and its speed. Selecting appropriate parameters limits the lysis and fragmentation of some platelets and premature release of active growth factors, thanks to which the quality of the preparation is high. After the centrifugation process is completed, three clearly distinguishable layers are visible in the test tube: red blood cells, leukocytes, platelets and plasma, which have the lowest density [6]. The PRP preparation prepared in this way should be transferred to the syringes that will be used to perform the treatment. Too long storage may cause PRP to become contaminated with other cellular components, e.g. erythrocytes.

Contraindications to the use of PRP

Absolute contraindications to the use of PRP are a critical platelet level, platelet dysfunction, hemodynamic instability, sepsis, local infections, and lack of patient consent to the procedure. Relative contraindications include thrombocytopenia (platelet count below 150,000/ul), anemia, smoking, fever or recent infection, use of NSAIDs 48 hours before the procedure, steroid injections at the site of the procedure within a month, use of glucocorticoids generally 2 weeks before the procedure, cancer. (especially bone cancer and hematological malignancies).

Side effects and long-term safety

The procedure using PRP may result in a reaction at the injection site. These reactions usually manifest themselves with pain, swelling and bruising, which usually disappear after a few days. The route of administration of the preparation causes a potential risk of infection, but appropriate asepsis and maintaining sterility reduce this risk to a minimum. Even though the preparation is autologous, an allergic reaction may occur. This is related to the patient's hypersensitivity to any of the ingredients of the preparation or the materials used in the preparation process. A thorough interview allows us to identify patients with a higher allergic potential. Long-term and repeated use of PRP may carry a potential risk of tissue hypertrophy caused by excessive cell growth and proliferation in response to exposure to growth factors. PRP comes from the patient's blood, but repeated use may increase the risk of immunological and alloimmune responses. Despite the origins over time, hypersensitivity reactions to specific ingredients in PRP may occur [7].

Alopecia therapy

The term alopecia means faster than physiological loss of terminal hair and it is most often used in relation to the scalp. This problem causes an aesthetic defect, but may also cause psychological discomfort in patients. Common causes include genetic factors, stress, hormonal disorders, chronic diseases and medications. Non-scarring alopecia is characterized by hair loss, but hair follicles are preserved (potentially reversible), while in scarring alopecia, hair follicles atrophy and connective tissue is formed [8]. To understand the mechanism of action of PRP in the treatment of baldness, it is necessary to present the structures that affect hair follicles during therapy. The bulge area and the matrix area are the two main areas of the hair follicle that contain hair follicle stem cells that have receptors for growth factors. The bulge area is located between the muscle attachment and the opening of the sebaceous gland, while the matrix area is located at the bottom of the hair follicle near the dermal papilla. By binding to receptors, growth factors contained in PRP have positive effects in the treatment of baldness [9]. Platelets influence the hard structure of the hair and its healthy appearance. Additionally, they moisturize the scalp and regulate the functioning of the sebaceous glands. By acting directly on hair follicle cells, TGF-β strengthens intercellular connections, thereby strengthening the hair structure. PDGF and VEGF stimulate angiogenesis around the follicles, as well as the permeability of blood microvessels, improving their nutrition, EGF stimulates collagen synthesis. The activity of all growth factors causes the matrix cells to divide faster and multiple times, which results in faster hair growth [10].

Research confirms that the use of PRP also affects the change of hair growth phases, including faster hair transition from telogen to anagen. Additionally, increasing the FGF-7 and β-catenin signaling pathways prolongs the anagen phase, IGF-1 stimulates the proliferation of cyclic keratinocytes inducing and prolonging the anagen phase, and the GDNF factor present in blood platelets protects the hair follicle against premature catagen transition. Autologous PRP affects the proliferation of papillary cells in the dermis, while increasing the expression of the above-mentioned factors (FGF-7, β-catenin) as well as anti-apoptotic factors (BCL-2, Akt), which additionally suggests a mechanism of hair reconstruction [11]. Some studies show no improvement or minimal improvement in hair regeneration, which may be due not to the lack of effectiveness of the therapy, but to an incorrect treatment protocol or incorrect depth of application of the preparation. Initially, the therapy should include treatments spaced about a month apart until the first effects of the therapy appear. Then continued at intervals of ± 3 months. It is believed that 3 treatments a year is the minimum number to obtain and maintain a beneficial therapeutic effect [1].

Androgenetic alopecia

Androgenetic alopecia is the most common form of hair loss in both men and women and is characterized by progressive miniaturization of hair follicles [12]. The pathogenesis is characterized by the sensitivity of hair follicles to dihydrotestosterone (DHT). This shortens the anagen phase of hair growth, resulting in the conversion of terminal hair into vellus hair with a reduction in their diameter. Clinically, this manifests as thinning of the top and front of the scalp in men and general thinning of hair in women. Finasteride and minoxidil are registered for the pharmacological treatment of androgenetic alopecia. Additional drugs used off-label are spironolactone and cyproterone acetate. Although these medications are effective in some patients, they must be used indefinitely. Due to side effects and varying effectiveness, new treatment methods are constantly being sought [13]. The effect of PRP in this case is based on the extension of the anagen phase through the action of IGF-1, FGF-7, VEGF. Additionally, the Wnt/β-catenin signaling pathway is activated, which supports the development of hair follicles [14]. The activated ERK/Akt signaling pathway and increased BCl2 levels inhibit apoptosis, and the increased concentration of PDGF and VEGF promotes angiogenesis in the hair follicle area [15,16]. These actions also translate into increased density and thickness of hair shafts. Growth factors probably counteract the effects of dihydrotestosterone, the hormone responsible for androgenic alopecia [17].

Alopecia areata

Alopecia areata is an autoimmune disease causing local, uneven hair loss. This process may go away on its own, but hair regrowth may take from several months to several years. Traditional treatment methods include corticosteroids, immunosuppressive drugs, immunotherapy and phototherapy, but new methods are still being sought. The use of PRP may reduce local inflammation and promote immune suppression caused by increased TGF-β activation. The above-mentioned TGF-β is an inhibitor of the cytokine MCP-1, which is involved through chemotaxis in the recruitment of monocytes and T lymphocytes. It has been established that the activity of this cytokine modulating the immune system is associated with the occurrence of this disease [9].

Additionally, PRP activates anti-apoptotic factors, which extend the anagen phase and the survival time of papillary cells [13]. In addition, of course, it improves blood supply to the skin by increasing the density of vessels, which promotes cell proliferation and differentiation, accelerating hair regrowth. Studies have shown that PRP therapy causes significant regrowth of fully pigmented hair, a reduction in the percentage of hair with short fluff and dystrophic hair (assessed by dermatoscopic examination), and a reduction in the intensity of burning and itching. Additionally, the yellow dots characteristic of this disease are reduced [18]. In another study, an improvement in the final hair density and shaft thickness was achieved after the use of PRP. The advantage of this therapy is undoubtedly the fact that side effects rarely occur and are of minor intensity, compared to corticosteroids or immunosuppressive drugs that have a systemic effect.

Cicatricial alopecia

Treatment of scarring alopecia is difficult due to the progressive damage to the hair follicle and its replacement with fibrous tissue. The aim of treatment is to stop the progression of the disease, as there is currently no effective method for hair regrowth in the place of fibrosis. Some studies showed an improvement in hair density, a reduction in perifollicular erythema and peeling after the use of PRP [13]. It is believed that these effects may be caused by anti-inflammatory effects and the possibility of collagen remodeling, but this has not been confirmed and further research is necessary to determine the role of PRP in the treatment of scarring alopecia [19]. The anti-inflammatory effect and the ability to remodel collagen and ECM may be the reason for potential therapeutic success.

Anti-aging prevention

Skin aging is a complex process that involves numerous biological, biochemical and physical interactions. It covers various layers of the skin, including supporting tissues. The epidermis is smoother, cell renewal is reduced and keratinocyte proliferation is slower. The dermal-epidermal junctions become weaker. The dermis atrophies, with a decrease in cellularity, vascularity and extracellular matrix. Reduced proliferation and activity of fibroblasts causes the amount of hyaluronic acid to decrease and the skin to be less moisturized. In addition, changes in the interaction of these fibroblasts with other skin cells such as mast cells, keratinocytes and adipocytes also influence the aging process. Subcutaneous fat tissue and muscle fibers also disappear, and fat pads migrate in accordance with gravity. These phenomena cause thinning of the skin and weakening of the musculoskeletal support. Clinical signs of skin aging include: the appearance of wrinkles, loss of skin tension, and hyperpigmentation. Aging is associated with a defect in the healing process, which favors the appearance of chronic wounds, ulcers and pressure sores [20]. PRP stimulates the proliferation of fibroblasts, increases collagen synthesis, increases the amount of hyaluronic acid, which in turn improves elasticity and volume, increasing the tension and smoothing of the skin. Additionally, it reduces the production of melanin, which has a positive effect on the skin tone and reduces discoloration [21]. PRP promotes angiogenesis by positively influencing microcirculation, making the skin better nourished, brighter and more radiant [17]. To verify the effectiveness of the rejuvenating effect, in one study a skin biopsy was performed before the administration of PRP and one month after the administration.

It was shown that the number of collagen bundles in the dermis and the number and thickness of elastic fibers were significantly higher after using the preparation [19]. Several studies analyzing patients undergoing facial treatments using PRP showed improvement in the uniformity of skin color, texture, firmness, elasticity and wrinkle reduction compared to the baseline using biometric parameters. Importantly, patients reported cosmetic improvement, and the results of the procedure were assessed as satisfactory [4]. Exposure to UV radiation and its interference with various skin components (proteins, growth factors) contributes to the formation of reactive oxygen species that damage the extracellular matrix (ECM). The ingredients contained in platelet-rich plasma increase the expression of matrix metalloproteinase (MMP), tyrosinase, fibrillin and tropoelastin genes, which play an important role in the degradation of ECM components. This causes ECM remodeling and stimulates skin cell proliferation and differentiation [22,23]. This indicates the positive effect of PRP in preventing skin photoaging.PRP treatment in monotherapy brings positive results, but combination with other treatments such as laser treatments, microneedling, or treatments using hyaluronic acid may further improve the quality of the skin [1]. It is worth noting that with age, the ability of cells to proliferate decreases, the production of growth factors decreases, and the ability of fibroblasts to produce collagen decreases. It has been shown that "young" fibroblasts respond much better to PRP compared to fibroblasts from an older patient, which may suggest that the use of this treatment in skin rejuvenation or anti-aging prevention is particularly recommended in young patients [21].

Healing of acute and chronic wounds

In acute wounds resulting from trauma or surgery, the most important aspect is the rapid initiation of the healing process. Effective and efficient closure of the wound minimizes the risk of complications and influences optimal patient treatment results. Growth factors stimulate processes critical to healing such as cell proliferation, collagen synthesis, and the formation of new blood vessels. Tissue repair is accelerated and inflammation is reduced. Research shows that patients experience benefits from PRP therapy in terms of faster wound closure, minimized inflammation, and improved overall healing outcomes. Moreover, these activities lead to the development of less visible scars, which in the aesthetic aspect seems to be of key importance for the mental comfort of patients. Considering chronic wounds, treatment effects are based on the same mechanisms as in the case of acute wounds. Moreover, the immunomodulatory effect of factors contained in PRP alleviates chronic inflammation, which prevents further tissue destruction. Studies have established that patients with difficult-to-heal wounds resistant to conventional treatment improved tissue regeneration and reduced the wound area [24]. The number of local infections is also reduced [7]. Chronic wounds also include ulcers, which are most often a complication of poorly controlled or untreated diabetes. Many clinical studies have confirmed that the use of a series of PRP treatments is associated with a significant reduction of the ulcer surface, which leads to faster healing [13].

Acne scars

Acne vulgaris is a chronic inflammatory skin disease affecting the pilosebaceous system. Typical changes include hair follicles, sebaceous glands and their associated sebum production. Cutibacterium acnes colonization and inflammation occur [25]. Despite numerous treatment methods available, many patients experience the effects of ineffective treatment in the form of acne scars, which are most often located on the face, neck, back and arms. This has a significant impact on the well-being and psychological comfort of patients [26]. Scar treatment methods include: peelings, laser therapy, microneedling and platelet-rich plasma. PRP, as a preparation rich in growth factors, initiates fibroblast proliferation and angiogenesis, which leads to increased collagen production. This accelerates tissue repair, improves the texture of scars and reduces their depth [17]. Moreover, its immunomodulatory and anti-inflammatory properties are crucial in mitigating chronic inflammation and limiting tissue damage [7]. After using PRP as monotherapy, histological examination showed increased formation of collagen bundles and a thicker epidermal layer, which has a positive effect on tissue regeneration in the place of the atrophic scar. More spectacular treatment effects can be achieved by using combined techniques. The combination of PRP with microneedling intensifies the natural wound healing cascade by accumulating the patient's own growth factors activated during puncture and those contained in PRP. Studies comparing the two methods have shown significantly better improvement with the combined technique than with separate treatments. Taking into account other combined therapies, microneedling + PRP was associated with a better effect than, for example, microneedling + peeling. In another combined technique, which is laser therapy + PRP, the positive effect of platelet-rich plasma not only focuses on the reconstruction and regeneration of tissues, but also significantly reduces erythema, swelling and pain after the use of the laser. This may have a significant impact on patient comfort by shortening the duration of post-procedure side effects [21].

Burn scars

Skin burns are lesions resulting from the action of high-temperature factors. They may affect the epidermis (superficial burn), the epidermis and papillary layer of the skin (medium-depth burn), or reach the reticular layer (deep burn). Platelet-rich plasma plays a significant role in the healing of wounds and burn scars by improving pigmentation, texture, and relieving pain and itching. The effects are responsible for growth factors that promote neoangiogenesis, proliferation and migration of epithelial cells, formation of collagen fibers and extracellular matrix proteins. It is believed that the analgesic effect is caused by the presence of nerve growth factors responsible for the regeneration of neural structures [17]. Rapid regeneration and repair of tissues is important because delays in this process or persistent inflammation are responsible for the formation of hypertrophic scars, which are difficult to treat.

Hypertrophic scars

In the pathogenesis of the formation of hypertrophic scars, an important role is attributed to a high level of TGF-β, as well as low collagenase activity, which leads to uncontrolled cell proliferation, an increased amount of collagen, which in turn gives an image of excess tissue. The mechanism of action of PRP in the treatment of hypertrophic scars is not fully understood, but TGF-β1 is believed to play an important role. A high concentration of this factor in PRP may lead to negative feedback in its signaling pathway, which ultimately leads to a decrease in the transcription of the CTGF gene and a decrease in the level of connective tissue growth factor (CTGF), which may be of key importance in limiting the hypertrophic process [27, 28].

Stretch marks

Stretch marks are spindle-shaped atrophic bands that appear most often on the skin of the thighs, buttocks, abdomen or back. The causes include: hormonal factors, significant increase in body weight in a short period of time, pregnancy, genetic factors, connective tissue disorders and long-term use of corticosteroids. They occur as a result of excessive stretching of the skin and breaking of collagen and elastin fibers. Their development begins with the inflammatory phase - then the stretch marks have a characteristic dark red or blue color. Collagen fibers are distorted and the dermis is swollen. Over time, the process enters the atrophic phase, in which there is a significant decrease in elastin and collagen, and the stretch marks fade and form a concave and wrinkled structure. They do not pose a threat to life in themselves, but they cause an aesthetic defect that may cause mental stress in people who develop them. Treatment is difficult, but better results can be achieved during the inflammatory phase. The growth factors contained in the PRP preparation are crucial for the reconstruction and reduction of stretch marks. They stimulate fibroblasts, which increases the amount of collagen and elastin. They stimulate the proliferation and differentiation of epithelial cells, which increases the thickness of the epidermis. The anti-inflammatory effect reduces the perivascular infiltration of immune system cells and the swelling of the dermis. Additionally, a higher concentration of fibronectin strengthens the adhesion between fibroblasts [29]. Research indicates that a good treatment method may be combination therapy including platelet-rich plasma and a high-energy device. Treatment with multiple stimuli may be crucial for improving the local condition [30,31]

Vitiligo

Autoimmune mechanisms leading to the destruction of melanocytes play an important role in the pathogenesis of vitiligo. This results in discolored or hypopigmented spots appearing on the skin. In the treatment of this disease, PRP may work through several mechanisms. Growth factors such as FGF can stimulate the regeneration and migration of melanocytes, proliferation of fibroblasts and keratinocytes. The anti-inflammatory effect inhibits the release of cytokines such as interleukin-1, tumor necrosis factor α, interferon-c, which has a beneficial effect on the interaction between melanocytes and keratinocytes. Fibronectin and vitronectin present in PRP strengthen the adhesion between fibroblasts, keratinocytes and melanocytes. Akt and BCL-2 stimulation prevent melanocyte apoptosis.

Akt inhibits the enzyme that breaks down β-catenin, causing its concentration to increase, which stimulates the proliferation of melanin-producing cells [9]. Moreover, TGF-β deficiency has been demonstrated in vitiligo, and its content in PRP may lead to a better response to treatment [19].

Melasma

Melasma is a disorder characterized by the overproduction of melanin by melanocytes, which results in the appearance of brown-yellow spots, especially on skin exposed to UV radiation [32]. The potential of PRP in the treatment of this disease results from the angiogenic and proliferative properties of the growth factors PDGF, TGF-β1, and TGF-β2. Specifically, TGF-β1 reduces melanogenesis by inhibiting tyrosinase. This effect is probably achieved by influencing transcription factors such as the microphthalmia-related transcription factor and by delayed activation of extracellular signal-regulated kinase [17]. It has been established that the levels of interleukin 17, leukocyte differentiating antigen 4 and cyclooxygenase 2 are higher in the skin of patients suffering from melasma. This allows us to assume that the anti-inflammatory effect of PRP is also involved in the therapeutic effect. Other growth factors stimulate collagen synthesis and ECM remodeling, which has a beneficial effect in reducing melasma [9]. Research shows that the method is effective in treatment, and more spectacular effects can be achieved by using combined therapy. Particularly in this case, the combination of PRP with microneedling seems to be beneficial [33].

Conclusions

Platelet-rich plasma is an autologous preparation obtained after centrifugation of blood collected from the patient. The properties of PRP make it widely used in many clinical situations. is used both in aesthetic medicine and in dermatological problems. Please remember that the most important thing for the success of PRP therapy is to properly collect blood from the patient and prepare it correctly. A key role is played by growth factors and immunomodulators present in platelet granules, whose premature activation is not desirable as it may limit the effects. The advantage of the method is undoubtedly the fact that the preparation is of autologous origin, which is associated with a small risk of side effects. If there are no contraindications to the procedure, spectacular therapeutic effects can be achieved. The presence of numerous growth factors and other active ingredients makes the action of PRP comprehensive and based on several mechanisms. Studies show a positive effect, especially in skin rejuvenation and anti-aging prevention, hair reconstruction, wound healing and reconstruction of scars of various etiologies, as well as in pigmentation disorders. Moreover, combining PRP with other methods such as laser therapy or microneedling produces a synergistic effect, improving overall treatment results. It should be emphasized that further multi-center studies are needed to standardize treatment protocols and adapt them to specific problems.

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