

## Rehabilitation in patients with involutinal-dystrophic skin changes

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### Abstract

The study was aimed to assess the effectiveness of rehabilitation in patients with involutinal-dystrophic skin changes

Material and methods. The study was performed in the clinical department of the Ukrainian Research Institute of Medical Rehabilitation and Balneology of the Ministry of Health of Ukraine, as well as the Odessa Regional Clinical Medical Center of the Ministry of Health of Ukraine and the Kherson Regional Clinical Hospital in 2016-2020.

287 women of middle age (average age  $46.47 \pm 1.97$  year) with signs of functional changes in the skin were involved in the study. All patients required rehabilitation of impaired skin function (code b810 by ICF, LA22123-6 by LOINC).

General sample (n=287) was randomly divided into two groups. Patients in the control group (n = 187) received cosmetic measures in the form of ultrasonic peeling, cleansing, nourishing facial masks. Patients of the main group (n = 100) were injected intradermally and subcutaneously with platelet-enriched autoplasm up to 5 ml, which was obtained by double centrifugation.

Ultrasound scanning of the skin and laser Doppler flowmetry (LDF) were used to assess the structural features of the epidermis, dermis and subcutaneous fat. Dynamic control of skin structures included the study of the initial state of the skin at certain points of the face

(center of the cheek, center of the forehead, outer corner of the eye), which we set as standard. Assessment of the effectiveness of the rehabilitation was performed before first procedure and in 3 and 6 months after its completion. Statistical processing was performed using software Statistica 13.0 (TIBCO, USA)

**Results.** After 3 months of follow-up after PRP-therapy revealed even greater significant differences in the structural and functional parameters of the skin compared to baseline. There was an increase in the thickness of the epidermis by 16.7%, the level of hydration increased by 26.9%, the level of TEV by 29.5%, the oiliness of the skin or the level of seborregulation increased by 16.8% ( $p \leq 0.05$ ). Important characteristics of the protective effect of PRP therapy were an increase in the elastic properties of the skin by 31.8% and an increase in the microcirculatory network by 23.1% compared to baseline before the procedure of PRP therapy ( $p \leq 0.05$ ).

**Conclusion.** The proposed method can be used as a stand-alone complex conservative therapeutic method of treatment and is used after surgery to rejuvenate the skin of the face and neck in people over 40 years. It has been shown that the effectiveness of restoring the functional state of the musculoskeletal corset of the face increases when using PRP at the same time as massage. It is substantiated that the combination of activation massage and regenerative stimulation by the introduction of PRP should be carried out simultaneously during treatment throughout the course.

**Key words: rehabilitation; ageing; skin; PRP**

Medical rehabilitation is a set of measures, which includes ways to accelerate restitution, stimulate regenerative- processes, identify and strengthen compensatory mechanisms, correct the body's resistance and immunity. Along with drug therapy, non - drug methods that influence the mechanisms of sanogenesis, in particular the mobilization of specific reactions responsible for adaptation to a specific effect, which leads to the activation of nonspecific stress-implementing systems [1].

Restoration of body functions is based on both urgent (short-term) and long-term mechanisms of adaptation, and the magnitude of the rehabilitation effect in general depends on the proper application of various influences that simultaneously affect the mechanisms of recovery and pathogenetic mechanisms of specific pathology [1-3].

In the presence of pathological changes in the connective tissue, a combination of degenerative-dystrophic processes of the discs and intervertebral anatomical formations with skin lesions often occurs. They include age-associated involutinal changes and the effects

of harmful environmental factors. Often such lesions are based on local thermal and mechanical influences, which require the restoration of the regenerative abilities of morphological elements of the skin [4].

Among the tools that affect the regenerative processes, along with preformed physical factors, exercise therapy, massage and other manual techniques are widely used [5]. In recent years, biotechnologies of regenerative medicine have been introduced into practice, one of which is the use of platelet-enriched plasma (PRP), a new therapeutic tool of autologous nature, which has been widely used in sports medicine, in particular in the treatment of chronic tendinopathy and entesopathy. Clinical studies that have used PRP injections as a therapy for discogenic low back pain report good results [6].

The effect of PRP therapy on the regenerative processes of skin and spine pathology has not been studied so far. The effect of such drugs on the effectiveness of rehabilitation in combined pathology has not been studied.

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287 women of middle age (average age  $46.47 \pm 1.97$  year) with signs of functional changes in the skin were involved in the study. All patients required rehabilitation of impaired skin function (code b810 by ICF, LA22123-6 by LOINC) [7, 8].

General sample (n=287) was randomly divided into two groups. Patients in the control group (n = 187) received cosmetic measures in the form of ultrasonic peeling, cleansing, nourishing facial masks. Patients of the main group (n = 100) were injected intradermally and subcutaneously with platelet-enriched autoplasm up to 5 ml, which was obtained by double centrifugation.

Ultrasound scanning of the skin and laser Doppler flowmetry (LDF) were used to assess the structural features of the epidermis, dermis and subcutaneous fat. Dynamic control of skin structures included the study of the initial state of the skin at certain points of the face (center of the cheek, center of the forehead, outer corner of the eye), which we set as standard. Assessment of the effectiveness of the rehabilitation was performed before first procedure and in 3 and 6 months after it completion.

Statistical processing was performed using software Statistica 13.0 (TIBCO, USA)

Results. According to the classification of involutinal-degenerative changes of facial skin, 3 morphological types have been identified [9], which characterize the nature and severity of age signs: wrinkled, deformed and mixed.

Analysis of the condition and structural changes of the skin allowed us to identify 3 morphological types and age gradation of involutinal-degenerative changes. Types of morphological involutinal changes are presented in table 1.

Table 1 - Distribution of women depending on the morphological type of skin and age

Skin type	Amount (n=287)	Age		
		42-50	50-58	58-65
Wrinkled type	n=72 (25 %)	12 (16,67 %)	22 (30,55 %)	38 (52,78 %)
Deformation type	n=96 (33,5 %)	28 (29,17 %)	32 (33,33 %)	36 (37,5 %)
Mixed type	n=119 (41,5 %)	32 (26,9 %)	34 (28,6 %)	53 (44,5 %)

For the wrinkled type, the characteristic dominant feature is wrinkles on the face and skin. This type of aging is characterized by dry skin, pronounced "goose bumps" in the orbital region, wrinkles of the upper and lower eyelids, "corrugation" in the upper lip and chin.

A distinctive feature of the deformation type is a decrease in the elasticity of the soft tissues of the face and neck, with a typical picture of a "tired person", which intensifies by the end of the day. Characteristic external signs of aging of this type are pasty, pronounced nasolabial folds, drooping corners of the mouth. This type of aging is typical for people with oily skin. Often there is a violation of the oval face, sagging cheeks, double chin, neck folds. Wrinkles may be almost non-existent, except for facial expressions. Also a characteristic external sign of aging is an excess of skin in the upper and lower eyelids.

The mixed type is characterized by a combination of features of wrinkled and deformation type. As a rule, this type of aging is characterized by thin skin, with hyperkeratosis, pigmentation, pronounced "goose bumps" in the periorbital region, folds in this and perioral area, as well as swelling, pronounced nasolabial folds, oval face disorders.

In the pathogenesis of involutinal-degenerative skin disorders in the above-described morphological types, the general pattern is vascular dysfunction. Thus, with wrinkled skin type, the signs of involution are usually due to impaired microcirculation in the dermis due to insufficient arterioles, which leads to reduced arterial blood flow to the surface layers of the skin and the development of atrophic changes. Disruption of microcirculation in the

deformation type is caused by insufficiency of venules, which leads to the development of intercellular edema, stagnation, pastosity, compaction of the epidermis. In turn, with a mixed type of microcirculation disorders in the upper layers of the dermis are mixed: there are signs of insufficiency of both arterioles and venules. For pathogenetically determined correction of involutinal-degenerative disorders of the skin, an important area of rehabilitation measures is the standardization of tactics and criteria for treatment effectiveness, taking into account the morphological features of cell-tissue and vascular components of the skin.

Comparative characteristics of the structural and functional state of facial skin are presented in table. 2. According to the indicators of involutinal-degenerative changes given in the table, no statistical differences between groups were found before treatment ( $p>0,05$ ).

Table 2 - Initial structural and functional characteristics of the facial skin of the studied women before the massage

Structural and functional features of the skin (physiological indicators)	I group	II group	P
The thickness of the epidermis microns	102,4±5,3	101,2±4,6	$P\geq 0,05$
Acoustic density of the epidermis, c.u.	89,7±3,5	91,3±4,2	$P\geq 0,05$
The thickness of the derma, mcm	1654,3±41,2	1579,5±39,8	$P\geq 0,05$
The level of hydration (corneometry method), c.u.	46,21±3,5	45,6±3,8	$P\geq 0,05$
The level of transepidermal moisture loss sq.m. p/h	21,6±4,5	19,8±4,7	$P\geq 0,05$
The level of seborregulation, ng / cm <sup>2</sup>	162±59,6	157,2±49,3	$P\geq 0,05$
The level of elasticity, resilience, %	57,7±6,3	59,3±7,2	$P\geq 0,05$
IDF, ml per min.	6,5 ± 1,4	6,2 ± 1,7	$P\geq 0,05$

The decrease in the distribution of echoes in the dermis indicated the dystrophic nature of changes in the skin, in particular, a decrease in the density of the connective tissue component of the dermis. This picture reflects the involutinal changes in the fibrous composition of the dermis: disorganization, compaction and fragmentation of collagen and elastin fibers, loss of skeletal function in the skin. Reduction of the tissue component of the main amorphous substance - the main metabolic link of connective tissue was expressed in a decrease in dermal thickness by 11%, which was not statistically significant, but reflected

dystrophic changes in the form of separation of cell-tissue interaction in the nipple and reticular layer of the dermis.

The level of hydration revealed a significant suppression of moisture in the stratum corneum of the epidermis by 22.3% ( $p \leq 0.05$ ) compared with normal. In the epidermis there are quite large hydrophilic pores in the intercellular "lipid cement" of the stratum corneum. Since the water balance of the stratum corneum of the epidermis is under the control of quantitative and qualitative composition of lipids of the epidermis.

Assessment of a clinical sign of aging skin, such as dryness, is associated with changes in hydration and the amount of sebum and transepidermal water loss (TEVV). The complex of disorders that lead to dysfunction of the skin barrier during involutionary changes includes increased TB and dehydration of the skin. The degree of hydrophilicity of keratinocytes is determined mainly by ceramides, in particular glycosphingolipids. Sebaceous glands also play a huge role in the regulation of water balance. The epidermis contains a lot of saturated fatty acids, which do not penetrate well into the epithelial layers and form an occlusive film that delays the evaporation of water. Violation of the lipid barrier is associated with impaired skin permeability and TBI. A significant increase in TEVV by 23.5% compared to normal was evidence of dehydration and dry skin.

Fluid loss by the skin is one of the pathogenetic links of involuntional-degenerative disorders: fluid deficiency in the intercellular substance is accompanied by inhibition of the synthesis - glycosaminoglycans - the main biosynthetic material of physiological regeneration of connective tissue.

Measurement of the amount of sebum on the skin surface by sebometry showed a significant reduction in this indicator by 16.5% in women with dry wrinkled skin type compared to normal. Violation of the formation of an oily film on the surface of the epidermis negatively affected the functional characteristics of the skin: dryness, peeling, redness and susceptibility to microdamage and penetration of infectious agents.

The elastic-elastic properties of the skin were studied by the method of kutometry. Significant reduction of skin elasticity by 25.9% is shown, which is associated with disorganization, defibering and destruction of collagen and elastic fibers of the dermis and clinically manifested by flabby, atonic, sagging skin with reduced turgor and soft tissue ptosis. This pathogenetic mechanism is more characteristic of the deformation type of involuntional skin changes.

According to laser Doppler flowmetry (LDF), it was found that the microcirculation of the skin changed significantly with a significant decrease of 20% compared with the physiological norm.

The obtained data indicate the predominant influence of the state of the microcirculatory tract on metabolic processes and structural organization of the skin.

Thus, the pathogenetic validity of the correction and treatment of involutonal-degenerative changes of the skin system should be aimed at improving the state of metabolic processes in cells and intercellular substance, improving hemo- and lymphomicrocirculation, the formation of a balance of prooxidant and antioxidant systems.

It is shown that the use of PRP therapy had a very pronounced clinical effect in 1 month after the introduction of autologous plasma (Fig. 1).

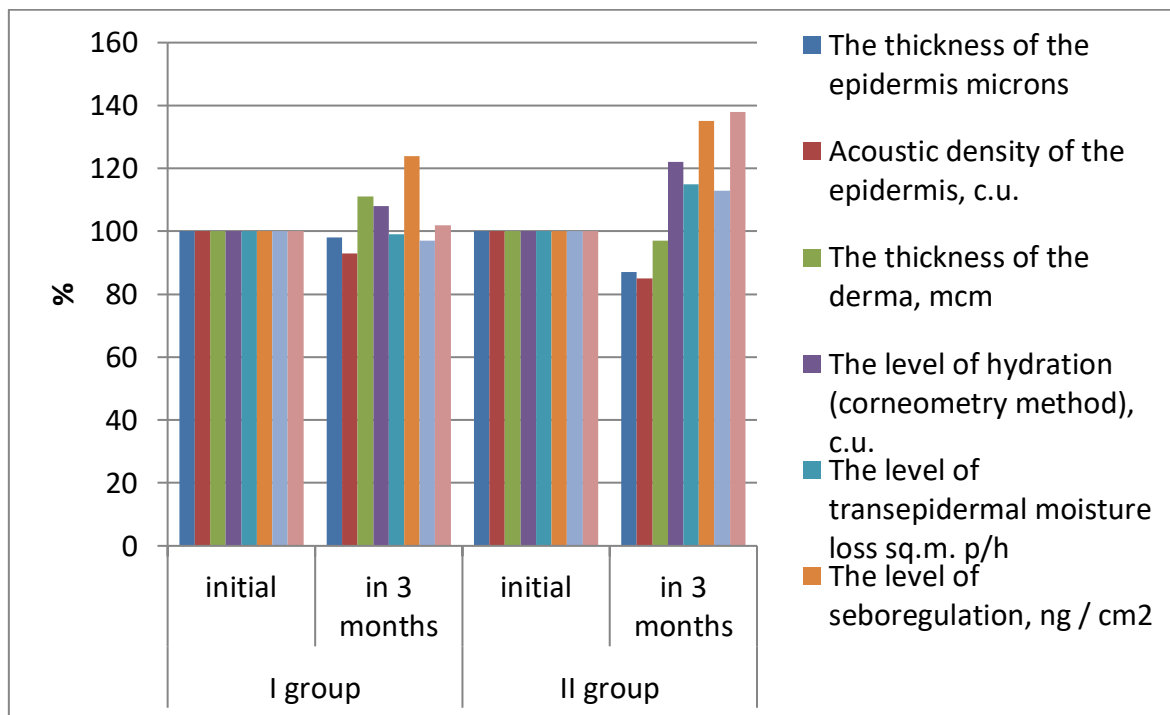


Fig. 1 - Comparative characteristics of structural and functional indicators of skin before ZTP therapy and in 1 and 3 months after its application

According to sonography, positive changes in age-related disorders on the background of PRP-therapy were qualitative and quantitative parameters. After 1 month, an increase in the thickness of the epidermis, the thickness of the dermis, the echogenicity of the entire dermis and separately the upper and lower layers.

But after 3 months of follow-up after PRP-therapy revealed even greater significant differences in the structural and functional parameters of the skin compared to baseline. There was an increase in the thickness of the epidermis by 16.7%, the level of hydration increased by 26.9%, the level of TEV by 29.5%, the oiliness of the skin or the level of seboregulation increased by 16.8% ( $p \leq 0.05$ ). Important characteristics of the protective effect of PRP therapy were an increase in the elastic properties of the skin by 31.8% and an increase in the microcirculatory network by 23.1% compared to baseline before the procedure of PRP therapy ( $p \leq 0.05$ ).

In our opinion, a powerful stimulus to restore water balance, mechanical properties of the skin and its metabolism was the influence of growth factors on the vascular component - an increase in vertical capillary loops in the papillary layer, an increase in the number of venules, which is probably due to tissue basophils or mast cells involved in the synthesis of heparin, histamine - powerful angiogenic factors.

The expediency of its use to stimulate skin regeneration with involutinal-dystrophic changes was revealed, which allowed to quickly reduce the number, depth and length of wrinkles, significantly increased turgor, elasticity, relief and general condition of facial skin, improved its general appearance significantly increased turgor, elasticity, regression. , improved the general condition of the skin and its appearance.

#### Conclusion.

The proposed method can be used as a stand-alone complex conservative therapeutic method of treatment and is used after surgery to rejuvenate the skin of the face and neck in people over 40 years. It has been shown that the effectiveness of restoring the functional state of the musculoskeletal corset of the face increases when using PRP at the same time as massage. It is substantiated that the combination of activation massage and regenerative stimulation by the introduction of PRP should be carried out simultaneously during treatment throughout the course.

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