**DOI** 10.29254/2077-4214-2022-3-166-18-22
**UDC** 616.53-002.25:615.841.19

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# PECULIARITIES OF THE PHYSIOTHERAPEUTIC METHODS USE IN THE TREATMENT OF ACNE

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*Acne vulgaris is a skin disease caused by chronic inflammation of the follicles (including the hair follicle, hair shaft, and sebaceous glands) that affects approximately 650 million people worldwide. The sebaceous glands moisturize the skin and protect it from environmental influences. But sometimes the ducts of the sebaceous glands are clogged with dead tissues, and the infection itself can penetrate the gland.*

*At the same time, the human immune system blocks the infectious process, and the manure formed in the process is localized under the upper layer of the skin – comedones appear, or, as patients say, acne.*

*Manifestations of acne are quite characteristic, but in order to effectively cure it, you need to accurately determine its causes. To do this, an examination is carried out, if necessary, laboratory tests are prescribed: a biochemical blood test, a study of hormone levels, etc. It is also important to inform the doctor about previous serious illnesses. Based on the information collected, the doctor selects treatment tactics.*

*Recently, with the development of scientific progress, there are various physiotherapeutic methods and equipment that are used to treat acne. This problem is relevant in our present and requires its solution. This article presents the subject of analysis and treatment of acne. One of the methods of treatment is physiotherapy, consisting of different types of therapy. An important component of acne treatment is laser technology in modern cosmetology and dermatology. The processing of literature data indicates the prospects for the use of physiotherapeutic methods in the treatment of acne.*

***Ключові слова:*** *acne, physiotherapeutic methods, laser technologies, dermatology, cosmetology.*

**Relationship of the publication with the planned research works.** The work is a fragment of the planned research of I. Horbachevsky Ternopil National Medical University Ministry of Health of Ukraine «Features of the structural reorganization of the nervous, digestive, endocrine systems, hematopoietic organs and immune protection under conditions of thermal injury and the use of corrective factors», № state registration 0120U104152.

**Introduction.** Acne (from Greek sharp point, height, flourishing) or acne, acne is the most common inflammatory chronic recurrent skin disease caused by changes in dust-sebaceous structures [1]. Acne of varying severity affects 80-85% of people (data in the literature vary: from 35-90%) aged 12-25 years and 11% over the age of 25 [2, 3, 4, 5, 6]. The prevalence of the comedonal form during puberty approaches 100% [4]. Representatives of all races and both sexes are affected. The disease is not life-threatening, but significantly reduces its quality.

Acne vulgaris is a chronic inflammatory dermatosis characterized by the presence of open and closed comedones (inflammatory manifestations of acne) and inflammatory skin lesions, including papules, pustules and nodules. It should be remembered that acne has a wide range of clinical manifestations. There is no universal classification of acne, but the most common and relatively simple classifications can be used for the work of practitioners, for example:

• non-inflammatory or comedonal acne [7, 8] – predominantly represented by microcomedones, open comedones (blackheads) and closed comedones (whiteheads) with little or no inflammation. It is a pathology of the sebaceous glands, which are practically not associated with the hair follicle of vellus hair, therefore these acne occur exclusively on smooth skin;

• inflammatory acne – characterized by manifestations of inflammation in the form of elements – pustules, papules, nodes and can be divided into papulopustular, nodular, conglobate, depending on the predominant type of lesion. It is also a pathology of the sebaceous glands of another type and an integral part of the hair follicles (cannon, bristle and long hair). Therefore, these acne can occur both on smooth skin and on the scalp;

• severe forms of acne: conglobate (spherical, accumulated, confluent), nodular cystic, phlegmonous (abscessing) – these rare forms of acne are characterized by inflammatory lesions, progressing with the formation of abscesses and granulomas. In modern world publications, it is customary to distinguish four main factors in the development of acne:

1. Pathological hyperkeratosis vulgaris – follicular-epidermal hyperproliferation with thickening of the stratum corneum of the gland ducts: proliferation of keratinocytes increases and desquamation decreases. As a result, a hyperkeratotic plug is formed, consisting of sebum, keratin (microcomedone) in the follicular canal.

2. Increased secretion of the sebaceous glands (seborrhea) – the sebaceous glands increase during the adrenarche period (the period of early puberty), at the same time, the production of sebum increases, which, together with follicular hyperkeratosis and the formation of comedones, provides favorable conditions for the growth of P. acnes bacteria: lipid-rich environment (triglycerides). The components of sebum, triglycerides, play a significant role in the development of acne, being a breeding ground for bacteria.

3. Propionibacterium acne is a gram-positive anaerobic bacterium of the sebaceous gland, the cell wall of which contains an antigen that stimulates the appearance of antibodies with complement activation, initiating a cascade of pro-inflammatory reactions. P.

acne also produces lipases, proteases, hyaluronidase, a chemotactic factor, stimulates increased regulation of cytokines by binding to receptors of monocytes and polymorphonuclear cells surrounding the sebaceous gland [9, 10].

4. Inflammation is a process that is promoted by many factors, namely: P. acne: enzymes produced by bacteria contribute to the degradation of the follicle wall and its rupture, the surface protein of the bacteria can play a role as an antigen that triggers humoral and cell-mediated immune, shock proteins, highly immunogenic, are also produced by these microorganisms, like porphyrins; toll receptors that bind to bacteria promote the release of cytokines (IL-8, IL-2), resulting in the release of lysosomal neutrophil enzymes.

Understanding the main stages of the pathophysiology of acne allows us to formulate the main therapeutic principles of this disease: correction of follicular hyperkeratosis/desquamation disorder; reduction of manifestations of seborrhea; a decrease in the bacterial population of the hair follicle, especially P. acne; anti-inflammatory action.

**The purpose of the study:** analysis and generalization of literary sources on the state and prospects for the use of physiotherapeutic methods in the treatment of acne.

**Main part.** Recently, with the development of scientific progress, there are various physiotherapy methods and equipment used for the treatment of acne. Photodynamic therapy. This method is aimed at the destruction of P. acne and the destruction of the cells of the sebaceous glands. The mechanism of action of photodynamic therapy is based on the selective destruction of cells as a result of a light-activated chemical reaction. The reaction is carried out in the presence of a substance – a photosensitizer. This technique uses exogenous photosensitizers, which are mainly absorbed by dust-separating elements and enhance the effect of light procedures [11, 12, 13, 14, 15, 16]. In our present, there are a large number of different photosensitizers, however, in dermatological practice, derivatives of aminolevulinic acid are most often used. The skin is affected by blue and violet light with a peak of 415 nm. This spectrum of light is absorbed by porphyrins, which are the waste product of P. Acne bacteria. Under the action of such a spectrum of light, porphyrins enter an excited state and generate reactive oxygen species, leading to the death of P. Acne bacteria and the destruction of sebaceous gland cells. In addition, the effectiveness of the above method is associated with an anti-inflammatory effect and stimulation of cellular immunity. To carry out photodynamic therapy procedures, various devices are used that generate photons of blue and violet light with a wavelength of 400 to 1000 nm. For the treatment of acne, the radiation spectrum with a wavelength of 409-419 nm is more often used. IPL (Intensive Pulsed Light) therapy is a therapy based on the use of special intense pulsed light. When using the IPL technique, the skin surface is irradiated with incoherent pulses of visible light with a wavelength of 500-1200 nm. These pulses are believed to penetrate deeper acne [17] Evidence on the effectiveness of this technique is conflicting, and new devices combine an IPL light source with suction devices (photopneumatic devices) to improve efficiency [18].

Microcurrent therapy is a method of physical impact on the human body with the help of modulated pulsed currents of low strength (up to 1 mA) and minimum voltage with different frequency data to obtain a therapeutic or cosmetic effect. It is widely used in dermatology and aesthetic cosmetology for the treatment of acne and post-acne phenomena. When carrying out such a procedure, not only the epidermis is involved, but also the intradermal layer, blood vessels, muscles. It is believed that the influence of low voltage currents has a very positive effect on cellular metabolism and increases the synthesis of adenosine triphosphoric acid. After the procedure, activation of fibroblasts is observed, microcirculation improves, the work of the sebaceous glands and the reduction of pores are normalized.

Laser technologies used in dermatology and cosmetology can be divided into two main types [19, 20, 21, 22].

The first type is ablative, in which damage occurs to the area of the affected skin, including the epidermis, while laser radiation is approximately equally absorbed by all layers of the skin.

The second type is non-ablative, which results in selective removal of pathological structures without damaging the epidermis, in which radiation is selectively absorbed in these structures, but not in the epidermis.

The study of the nature of the ablation phenomenon is one of the fundamental but not completely solved problems of modern physics [22, 23, 24, 25]. In 2004, D. Manstein and co-authors developed a new technology for the treatment of dermatological diseases, called fractional laser photothermolysis (FLP).

The scientific concept behind (FLP) is the use of microscopic beams of highly focused point light, which cause the appearance of microthermal zones (MTZ) of damage surrounded by zones of intact tissue. Controlled thermal stress of the epidermis and dermis during laser damage stimulates skin regeneration and repair, activating re-epithelialization and collagen remodeling.

Currently, both ablative and non-ablative FLP are used in practice. Non-ablative FLP is an effective treatment for pigmentation disorders and atrophic post-acne scars. This method can be used when a noticeable result is needed without intensive exposure and a long rehabilitation period.

In the work of L. Bencini et al., it was shown that when using a non-ablative (FLF) erbium laser with a wavelength of 1540 nm for the treatment of post-acne scars, their severity decreases. 6 months after the end of treatment, a marked improvement was observed in 98% of patients with grade II and in 83% of patients with grade III scarring.

Ablative FLP is widely used to remove scars of various origins, CO2 laser treatment is the gold standard for such tasks.

CO2 laser is used in laser dermabrasion, i.e. layer-by-layer removal of the surface layers of the skin [26]. It creates a mesh of damage MTZ with adjustable density and depth. In this case, ablation and coagulation of the dermis and epidermis, including the stratum corneum, occur no more than MTZ. After the procedure, there is a persistent remodeling of collagen and an improvement in the appearance of scars, including post-acne scars.

Pulsed dye lasers (PDLs) induce selective photothermolysis of dilated blood vessels during acne. Although this method does not have a direct effect on propionobacteria acne or sebum production, the activity of dissolving transforming growth factor (TGF)-β (a cytokine involved in wound healing) is increased after non-ablative PDL therapy TGF-β appears to mediate anti-inflammatory an effect that manifests itself as a global improvement in the appearance of acne, and is not limited to the treated area. The lack of high-quality controlled studies precludes definitive interpretation of the controversial PDL efficacy reports [27, 28, 29].

Mid-infrared lasers attracted attention when a 1450 nm diode laser showed sebaceous gland damage in a rabbit ear and human skin model ex vivo [29]. Photothermolysis at the level of the sebaceous glands and changes in follicular hyperkeratosis may play a therapeutic role. A preliminary randomized controlled study of selected areas of the back showed a significant decrease in the number of acne elements in the treated areas compared with controls. In another study, there was a significant improvement in skin condition in the form of a reduction in acne manifestations after the use of this type of laser [30]. In 2012, Sakamoto et al. [31] directed efforts to explore the use of selective photothermolysis of lipids within the sebaceous glands. Anderson et al. [32] identified the 1210 and 1720 nm wavelengths at which the absorption coefficient of lipids exceeds such water. In vitro studies of fresh porcine skin samples have demonstrated selective thermal damage to fat, but not to overlying skin, at a wavelength of around 1210 nm. In addition, the secretion of the sebaceous glands of the monkey has been artificially isolated at about 1210, 1728, 1760, 2306, and 2346 nm [33]. These data suggest that sebum potentially plays the role of a similar chromophore in selective photothermolysis of the sebaceous glands. Previous studies (on ex vivo skin samples) have shown that a wavelength of 1-700 nm with a pulse duration of 100-135 ms is directed selectively to the sebaceous glands and does not damage the epidermis or dermis.

**Conclusions.** The processing of literature data indicates the prospects for the use of physiotherapeutic methods in the treatment of acne. The rational combined prescription of drugs for external and systemic use in combination with physiotherapeutic methods allows achieving a good clinical effect and improving the quality of life of patients with various forms of acne.

**Prospects for further research.** In the future, further research is planned to analyze the literature on the use of phytotherapeutic combined treatment of acne.

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**ОСОБЛИВОСТІ ЗАСТОСУВАННЯ ФІЗІОТЕРАПЕВТИЧНИХ МЕТОДІВ ПРИ ЛІКУВАННІ АКНЕ**

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**Резюме.** Акне розвивається внаслідок надлишку шкірного сала, що блокує волосяні фолікули і пори в шкірі. У таких випадках клітини шкіри та шкірне сало можуть злипатися та утворювати у закупорки, до яких з часом приєднуються бактерії Propionibacterium acnes, внаслідок чого розвивається запалення та з'являються комедони або прищі. Бактерії Propionibacterium acnes представляють собою пропіонобактерії, які являються частиною мікрофлори шкіри та сприяють розвитку прищів. Дослідження науковців-попередників наочно демонструють, що тяжкість та частота загострень вугрової хвороби напряму залежать від штаму пропіонобактерій. Проте варто відмітити, що існує низка інших факторів, що однозначно посилюють протікання вищезазначеного захворювання.

Один із ефективних фізіотерапевтичних методів, спрямованих на знищення бактерій Propionibecterium acnes та руйнування клітин сальних залоз є фотодинамічна терапія.

Механізм дії фотодинамічної терапії полягає у виборчій деструкції клітин в результаті активованої світлом хімічної реакції. Реакція здійснюється за наявності речовини – фотосенсибілізатора. У вищезазначеній методиці використовуються екзогенні фотосенсибілізатори, які переважно абсорбуються пілосебаційними елементами і підсилюють ефект світлових процедур.

Аналізуючи дані сучасної літератури, можемо стверджувати ,що станом на сьогодні існує досить велика кількість різних фотосенсибілізаторів, однак у щоденній практиці лікарі-дерматологи найчастіше віддають перевагу похідній амінолевулінової кислоти.

Варто зазначити, що останнім часом широкого застосування набула мікрострумова терапія в дерматології та естетичній косметології з метою лікування акне та явищ постакне. Вона є методом фізичного впливу на людський організм за допомогою модульованих імпульсних струмів малої сили та мінімальної напруги з різними частотними даними для отримання лікувального чи косметичного ефекту. При проведенні вищезазначеної процедури залучається не лише епідерміс, але й інтрадермальний шар, кровоносні судини, а також м'язи. Вважається, що вплив струмами малої напруги дуже позитивно впливає на клітинний метаболізм та підвищує синтез аденозинтрифосфорної кислоти. Після процедури спостерігається активізація фібробластів, покращується мікроциркуляція, нормалізується робота сальних залоз та скорочення порів. Отже, підводячи підсумок огдяду літературних джерел – можна дійти висновку про доцільність та ефективність використання фізіотерапевтичних методів, спрямованих на знищення бактерій Propionibecterium acnes в комплексному лікування акне.

**Ключові слова:** акне, фізіотерапевтичні методи, лазерні технології, дерматологія, косметологія.

**PECULIARITIES OF THE PHYSIOTHERAPEUTIC METHODS USE IN THE TREATMENT OF ACNE**

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**Abstract.** Acne develops as a result of excess sebum blocking hair follicles and pores in the skin. In such cases, skin cells and sebum can stick together and form in blockages, which Propionibacterium acnes bacteria eventually attach to, resulting in inflammation and comedones or pimples. Propionibacterium acnes bacteria are propionobacteria that are part of the skin microflora and contribute to the development of acne. The studies of the predecessor scientists clearly demonstrate that the severity and frequency of acne exacerbations directly depend on the strain of propionobacteria. However, it should be noted that there are a number of other factors that clearly increase the course of the above-mentioned disease. One of the effective physiotherapeutic methods aimed at the destruction of Propionibacterium acne bacteria and the destruction of sebaceous gland cells is photodynamic therapy. The mechanism of action of photodynamic therapy is the selective destruction of cells as a result of a light-activated chemical reaction. The reaction is carried out in the presence of a substance – a photosensitizer. This technique uses exogenous photosensitizers, which are mainly absorbed by dust-separating elements and enhance the effect of light procedures.

Analyzing the data of modern literature, we can state that as of today there are a fairly large number of different photosensitizers, however, in daily practice, dermatologists most often prefer the derivative aminolevulinic acid.

It should be noted that recently, microcurrent therapy has been widely used in dermatology and aesthetic cosmetology for the treatment of acne and post-acne phenomena. It is a method of physical influence on the human body using modulated impulse currents of low strength and minimum voltage with different frequency data to obtain a therapeutic or cosmetic effect. When carrying out the above procedure, not only the epidermis is involved, but also the intradermal layer, blood vessels and muscles. It is believed that the influence of low voltage currents has a very positive effect on cellular metabolism and increases the synthesis of adenosine triphosphoric acid. After the procedure, activation of fibroblasts is observed, microcirculation improves, the work of the sebaceous glands and the reduction of pores are normalized. So, summing up the review of literary sources, we can conclude that it is expedient and effective to use physiotherapeutic methods aimed at destroying Propionibacterium acnes bacteria in the complex treatment of acne.

**Key words:** acne, physiotherapeutic methods, laser technologies, dermatology, cosmetology.

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Conflict of interest:
The Authors declare no conflict of interest.

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**A** – Work concept and design, **B** – Data collection and analysis, **C** – Responsibility for statistical analysis, **D** – Writing the article, **E** – Critical review, **F** – Final approval of the article.

***Received 22.03.2022***
**Accepted 10.09.2022**

**DOI** 10.29254/2077-4214-2022-3-166-22-35
**UDC** 616.72-002.77-085

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## PALLIATIVE CARE FOR RHEUMATOLOGYCAL PATIENTS WITH CO-MORBIDITY

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*According to the literature analysis, rheumatic diseases and syndromes are widespread pathologies. In the structure of primary disability, they occupy a second place among diseases of internal organs. Therefore, knowledge by family doctors of the most critical issues of palliative and hospice care for patients with rheumatological diseases is of fundamental importance. Palliative and hospice care, i.e., professional medical and psychological care for patients suffering from severe, incurable diseases and with limited life expectancy and prognosis, has become, in recent years, one of the most socially important and priority directions of reforming the national health care system in Ukraine. Today, there are already about 3 million people aged 75 and older in Ukraine. The purpose of the study is to search and analyze data from the literature on palliative and hospice care for comorbid patients with rheumatological diseases. Based on the primary goal of palliative and hospice care, which consists in maintaining the patient's quality of life in the final period of the illness, maximally alleviating the physical and moral suffering of the palliative patient and his relatives, preserving the patient's human dignity, the pharmacological component of palliative and hospice medicine is mainly the central component in a system of measures aimed at combating the symptoms of the underlying disease and/or, if necessary, the consequences of medical intervention that cause the most significant suffering to the patient. The presence of pain as a predominant clinical symptom in palliative patients is better documented in cancer than in other serious diseases. Older people with comorbid pathology suffer from pain more than representatives of other age groups. The approach to prescribing painkillers is based on the determination of pain intensity by the patient and medical professionals according to the methods of pain syndrome assessment. According to WHO recommendations, there are three primary levels of analgesia for chronic pain syndrome in palliative patients.*

***Key words:*** *palliative care, hospice care, pain, rheumatological diseases.*