

## REVIEW ARTICLE

## THE ROLE OF ADAPTIVE-STRESS RESPONSE IN THE PATHOGENESIS OF PERIODONTAL DISEASES

DOI: 10.36740/WLek20220420119

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### ABSTRACT

**The aim:** The purpose of this work is to analyze the literature data of scientific research of Ukrainian and foreign scientists to assess the pathogenetic mechanisms of the adaptive stress response to the condition of periodontal tissues.

**Materials and methods:** Bibliosemantic and analytical methods were used in the trial. The materials of the trial are international experience in studying the pathogenetic mechanisms of the interaction of psycho-emotional disorders and the development of periodontal lesions.

**Conclusions:** Chronic stress and depression suppress the immune system, cause the hormonal imbalances, lead to metabolic disorders in tissues and increase the risk of dystrophic and inflammatory processes in periodontal tissues, which in turn lead to reduced masticatory function, tooth loss, severe emotional instability and significant reduction in quality of life. Psycho-emotional disorders in patients slow down the treatment of inflammatory processes in periodontal tissues and contribute to the early recurrence. Thus, the problem of studying the adaptive stress response of the organism requires further research for deeply understanding its role in the etiology and pathogenesis of dental diseases and justify effective treatment and prevention measures for its correction.

**KEY WORDS:** periodontal tissues, generalized periodontitis, psychoemotional stress, adaptation, maladaptation, psycho-emotional disorders

Wiad Lek. 2022;75(4 p2):1022-1025

### INTRODUCTION

Modern man is under the constant influence of unfavourable factors, including natural, techno-genetic, informational and psychological ones. Experimental and clinical studies show that increased emotional impressibility affects the metabolic and physiological processes of organs and systems of the human body, in particular periodontal tissues, which leads to inflammatory-dystrophic changes [1-3]. Health condition often depends on a person's ability to adapt to environmental conditions, and the effectiveness of the regulatory function of adaptation depends on the state of the body and mind. Overstrain of adaptive mechanisms leads to diseases in the case of intensive and long-term effects of stimuli on the human body. As a result, it develops a violation of homeostasis, starting a chain of adaptation, depending on the level of activity of adaptive reactions, which, in turn, occur at the cellular, subcellular and molecular levels in the form of resistance, and at high intensity and long-term negative influence leads to the development of maladaptation [4, 5]. In the case of maladaptation a violation of the higher autonomic centers of vasomotor regulation occurs, the tone of the parasympathetic division of the autonomic nervous system increases, which leads to a steady decrease in total peripheral vascular resistance [6-9]. In conditions of maladaptation, there is often a strengthening of personality qualities. In particular, the main clinical manifestation of the syndrome of psycho-emotional stress is anxiety of

various degrees, which leads to increased stress reactions, the development of distress and various psychosomatic diseases [10].

### THE AIM

The purpose of this work is to analyze the literature data of scientific research of Ukrainian and foreign scientists to assess the pathogenetic mechanisms of the adaptive stress response to the condition of periodontal tissues.

### MATERIALS AND METHODS

Bibliosemantic and analytical methods were used in the trial. The materials of the trial are international experience in studying the pathogenetic mechanisms of the interaction of psycho-emotional disorders and the development of periodontal lesions.

### REVIEW AND DISCUSSION

The main biochemical and physiological changes in the body under stressful situations are determined mainly due to the action of adrenaline and noradrenaline. Unlike adrenaline, norepinephrine is produced not only by the adrenal glands but also by neurons in the sympathetic nervous system. Thus, the mobilization of the body's reserve capacity in stressful situations depends on its activity. The

parasympathetic nervous system helps to preserve and accumulate energy reserves. A person's reaction to psychological stressors is individual and depends on many factors - the general condition of the body, its psychological characteristics [12]. An important role in the development of metabolic and hemodynamic disorders during psychophysiological loading is played by the lack of such compounds as tocopherol acetate, retinol acetate, vitamins B and ascorbic acid, which may be explained by their participation in antiinflammatory, antioxidant, osteotropic, immunomodulatory, capillary-strengthening, membrane protective mechanisms of development in pathological process [13]. Excessive stress in combination with violation of any organs and tissues under the influence of irritants can lead to failure of adaptation, as prolonged increase in catecholamines and stress hormones leads to nitrogen imbalance, destruction of cellular structures, promoting to the development of trophic disorders [11, 14-16].

Diseases of the maxillofacial area are often considered separately from the patient's personality, and if their relationship to somatic health is still taken into account, then the psychological, socio-psychological and social aspects of dental pathology remain without proper attention from researchers and clinicians. At the same time, the involvement of psychophysiological factors in the development of any pathological process and their importance for therapeutic action no longer needs proofs, which necessitates a systematic, comprehensive, interdisciplinary approach to the diagnosis and treatment of human health disorders, including dental [17-20].

Chronic stress syndrome is especially dangerous at a young age, as most people are exposed to bad habits (smoking, drinking, etc.) that can affect oral health. Stress caused by psychosocial factors can violate the lifestyle and hygiene of the oral cavity and affect the microbial ecology of the periodontium [21].

While it is well established that chronic psychological stress can have significant deleterious systemic effects, only in recent decades have begun to explore the biochemical, microbial, and physiologic impacts of chronic stress diseases on oral tissues. Currently, chronic stress is classified as a «risk indicator» for periodontal disease [1, 5]. Modern scientific studies have proven the relationship between psychological stress and periodontal disease, as periodontal tissues are highly sensitive to stressors [22-24]. Clinicians consider appropriate to distinguish a separate nosological unit - «periodontal emotional stress syndrome» [25]. Many scientists study the influence of stress on the pathological process in periodontitis, the functional state of the brain in periodontitis, structural changes of periodontal nerves in its lesions and attach importance to such factors as emotional stress, chronic psycho-emotional stress affecting periodontal tissue trophism [26-28].

In the pathogenesis of stress periodontal damage the reactions of the salivary glands have the sense, which respond by changing the secretion of hormones, mediators and other biologically active substances, which leads to changes in immune homeostasis of the oral cavity. Cytokines and

other humoral mediators of inflammation are powerful activators of the central stress response. Glucocorticoids, which are released under their influence, can regulate the involvement of immune cells in inflamed tissues to help the body in coping with psychological stress [26, 29].

Increased secretion of steroid hormones, in particular cortisol, causes in the oral cavity: gangrenous ulcers under the influence of viruses and bacteria due to immune deficiency; temporomandibular bruxism - with grinding or clenching of teeth; dryness in the mouth due to decreased salivation; gingivitis due to poor hygiene (56% of young people surveyed said that stress affected their ability to brush their teeth effectively, both with a brush and floss) [30]. Due to its immunosuppressive effect, stress also leads to slow healing of connective and bone tissue, apical migration of connective epithelium and the formation of periodontal pockets [31]. It is also one of the reasons for increasing the processes of lipid peroxidation (LPO) and weakening antioxidant protection and hemocirculatory disorders, reducing the synthesis of the organic matrix and enhancing bone resorption [32, 33].

Activation of LPO is the main mechanism of stress lesions of periodontal tissues with disruption of cell and subcellular membranes, and hence cell metabolism in general. Stress activation of LPO also initiates the damage of connective tissue, which is the substrate of periodontium and is characterized by weakened, compared to other tissues, antioxidant protection [34-36]. Fibroblasts have affinity receptors for cortisol and respond to glucocorticoids by reducing the synthesis of collagen and glycosaminoglycans. Acute stress stimulates the degradation of connective tissue biopolymers, as evidenced by increased blood levels of oxyproline [37]. In addition, there is an increase in the activity of anti-inflammatory enzymes - NO synthase and cyclooxygenase-2, which leads to increased oxidative processes due to the production of peroxynitrite and the release of radicals in the synthesis of prostaglandins. The dependence of the levels of LPO products and periodontal tissue damage under stress on the nature of emotional response and typological features of the nervous system has been established. Under the influence of adverse environmental factors, the intensity of free radical processes increases sharply, the antioxidant defence system is gradually depleted, which leads to the development of inflammatory-dystrophic process in periodontal tissues [38].

Psycho-emotional stress causes microcirculatory disorders and metabolic disorders in periodontal tissues [34]. Vascular dilatation, which occurs under stress, contributes to the pathological deposition of blood, which leads to impaired blood supply to periodontal tissues [38, 39]. In turn, the spastic reaction of blood vessels restricts blood flow to the tissues and promotes the development of ischemic damage to periodontal tissues. Deterioration of blood supply to periodontal tissues is directly dependent not only on the severity of periodontitis, but also on the depth of autonomic disorders with a predominance of the sympathetic system [40].

An important intermediate link that implements the pathogenic effects of chronic psycho-emotional stress are autonomic disorders. There is a direct relationship between the functional state of the autonomic nervous system and the severity of periodontitis. A number of authors have found that one of the causes of diseases of the oral cavity is a combination of vascular changes with impaired autonomic regulation [17, 23]. The study of the dynamics of autonomic parameters in patients with generalized periodontitis shows an increase in sympathotonic activity of the higher nervous system and decrease it after treatment. Comparative evaluation of the complex of autonomic reactions revealed a connection between the activity of the sympathetic nervous system, disorders of psychoemotional state (decreased levels of health, activity and mood) with quantitative changes in ultrasound hemodynamics of the main vessels of the dental system in patients with generalized periodontitis [12, 40].

## CONCLUSIONS

Chronic stress and depression suppress the immune system, cause the hormonal imbalances, lead to metabolic disorders in tissues and increase the risk of dystrophic and inflammatory processes in periodontal tissues, which in turn lead to reduced masticatory function, tooth loss, severe emotional instability and significant reduction in quality of life. Psycho-emotional disorders in patients slow down the treatment of inflammatory processes in periodontal tissues and contribute to the early recurrence. Thus, the problem of studying the adaptive stress response of the organism requires further research for deeply understanding its role in the etiology and pathogenesis of dental diseases and justify effective treatment and prevention measures for its correction.

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**Conflict of interest:**

The Authors declare no conflict of interest

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**Received:** 25.11.2021

**Accepted:** 30.03.2022

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