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RELATIONSHIP BETWEEN PERIODONTAL PATHOLOGY AND GASTROINTESTINAL TRACT DISEASES: A NARRATIVE OVERVIEW

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The correlation between periodontal diseases and numerous general systemic diseases, including gastrointestinal disorders, is very close. The initial clinical indications of the digestive system disorders can be the inflammatory processes in the oral cavity, and the presence of systemic diseases in the body can affect the ethiology and pathogenesis of periodontal diseases.
***The aim of research** – based on the analysis of literature data to outline relationship between periodontal and gastrointestinal tract pathology and the impact of periodontal disease on the overall homeostasis of the human body.*
***Conclusions.** 1. Summarizing scientific data proves that gastrointestinal pathology weakens body defenses and can activate periodontopathogenic microflora.*
Disorders of gastrointestinal tract and hepatobiliary system influences negatively salivary gland leading to their dysfunction. Peptic ulcer disease, gastroesophageal reflux disease, chronic gastritis, pancreatitis, and colitis accompanies gingivitis and periodontitis. 2. Therefore, periodontal diseases and gastrointestinal tract disorders are closely linked, and the functional relationship between them should be considered in the diagnosis and treatment of both types of diseases. The findings of this review suggest that periodontal diseases can have a significant impact on the overall homeostasis of the human body.

Ключові слова:
захворювання шлунково-кишкового тракту, тканини пародонту, пародонтит, гінгівіт.

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ЗВ'ЯЗОК МІЖ ПАТОЛОГІЄЮ ПАРОДОНТУ І ЗАХВОРЮВАННЯМИ ШЛУНКОВО-КИШКОВОГО ТРАКТУ: ОГЛЯД ЛІТЕРАТУРИ

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Кореляція між захворюваннями пародонту та численними загальними системними захворюваннями, у тому числі шлунково-кишковими, дуже тісна. Початковими клінічними ознаками розладів травної системи можуть бути запальні процеси в ротовій порожнині, а наявність системних захворювань в організмі може вплинути на етіологію та патогенез захворювань пародонту.
***Мета дослідження** – на підставі аналізу даних літератури окреслити взаємозв'язок патології пародонту та шлунково-кишкового тракту та вплив захворювань пародонту на загальний гомеостаз організму людини.*
***Висновки.** 1. Узагальнення наукових даних засвідчують, що патологія шлунково-кишкового тракту послаблює захисні сили організму і може активізувати пародонтопатогенну мікрофлору. Розлади шлунково-кишкового тракту та гепатобіліарної системи негативно впливають на слинні залози, що призводить до їх дисфункції. Виразкова хвороба, гастроезофагеальна рефлюксна хвороба, хронічний гастрит, панкреатит, коліт супроводжують гінгівіт і пародонтит. 2. Отже, захворювання пародонту та розлади шлунково-кишкового тракту тісно пов'язані між собою, а функціональний зв'язок між ними слід враховувати при діагностиці та лікуванні обох типів захворювань. Результати цього огляду показують, що захворювання пародонту можуть мати значний вплив на загальний гомеостаз організму людини.*

Introduction

Periodontal tissue diseases are one of the most complex problems of modern dentistry [1]. Loss of teeth and normal chewing efficiency, cosmetic defects, and adverse effects of periodontal infection foci on the body determine the medical and social significance of this problem [2]. Epidemiological studies of recent years have shown the widespread prevalence of periodontal diseases throughout the world [3]. They are found in different age groups of the population, have different degrees of severity and tend to progress with age [4]. Ukraine belongs to the countries with a significant prevalence of periodontal diseases: depending on the region and the age of the examined, it reaches 85-95 % [5, 6, 7].

In addition to the high prevalence of periodontal diseases, their combination with a large set of various general systemic diseases is noted in association of a significant decrease in the body's protective forces [8, 9]. The research of numerous scientists has proven a close relationship between general diseases of the body,

lesions of the hard tissues of the teeth and the state of the periodontal tissues [10, 11, 12]. Inflammatory processes in the oral cavity can be the first clinical signs of disorders in diseases of the body's digestive, cardiovascular and other systems [13, 14]. The presence of systemic diseases in the human body significantly affects the etiopathogenesis of periodontal diseases. A mutually burdened course of diseases characterizes combined pathology due to a close functional connection between the affected organs. An example can be the digestive tract. On the other hand, the oral microbiome can significantly impact the gastrointestinal system's health, as reported in high-impact dental and medical journals [15]. Human and animal studies suggest that *P. gingivalis*, for instance, may cause dysbiosis in the gut by influencing the gut microbiota despite the digestive tract having a much higher bacterial density than the oral cavity [16]. As seen in periodontitis, ingesting *P. gingivalis* over a long period may contribute to intestinal dysbiosis. *Actinomycetemcomitans*, another periodontopathogen, may also alter the gut microbiota [17]. Still, it's not just these two periodontopathogens that can migrate to extraoral sites. A wide range of oral species can reach the intestinal microbiota by swallowing, regardless of periodontal status. However, only a subset of these bacteria appears to colonize the gut when the microbiota is dysbiotic [18].

The aim of research

Based on the analysis of literature data to outline relationship between periodontal and gastrointestinal tract pathology and to emphasize the impact of periodontal disease on the overall homeostasis of the human body.

Main part

The gastrointestinal tract and periodontal tissues have a close anatomical, nervous and humoral relationship. They are different parts of a single morphological and functional system; therefore, the oral cavity subtly reacts to the changes that occur in it. Periodontal disease in the pathology of the gastrointestinal tract occurs in 68-90 % of the examined patients [19]. The leading link in the development of such syntropy is a violation of several regulatory mechanisms: an imbalance of the immune and endocrine systems, disorders of microcirculation, neurohumoral regulation, psychosomatic relationships, and changes in the metabolism of the connective tissue, mineral metabolism, and vitamins deficiency [20]. Accompanying pathology of the digestive tract weakens the body's defense and creates conditions for reducing the resistance of periodontal tissues to plaque bacteria and activation of periodontopathogenic microflora [21, 22]. In addition, diseases of the digestive organs influence negatively the functional activity of the salivary glands, and the dynamic balance of enamel demineralization and remineralization processes are disturbed [23, 24, 25].

Another critical factor in the development and progression of periodontal diseases is the functional activity of the salivary glands. Saliva plays a crucial role in maintaining oral health by providing lubrication, neutralizing acids, and aiding in the remineralization of teeth. Salivary gland dysfunction can lead to a decrease in the quantity and quality of saliva, which can contribute to the development of periodontal diseases [26]. Reduced salivary flow can result in the accumulation of plaque and the growth of bacteria, leading to inflammation and eventual destruction of the periodontal tissues [27]. Salivary dysfunction can occur due to various reasons, including ageing, medications, radiation therapy, autoimmune diseases, and hepatobiliary tract diseases [28].

Analyzing the relationship between periodontal diseases and the gastrointestinal tract, most authors found that the pathology of the digestive organs often precedes the appearance of periodontal diseases (Fig. 1).

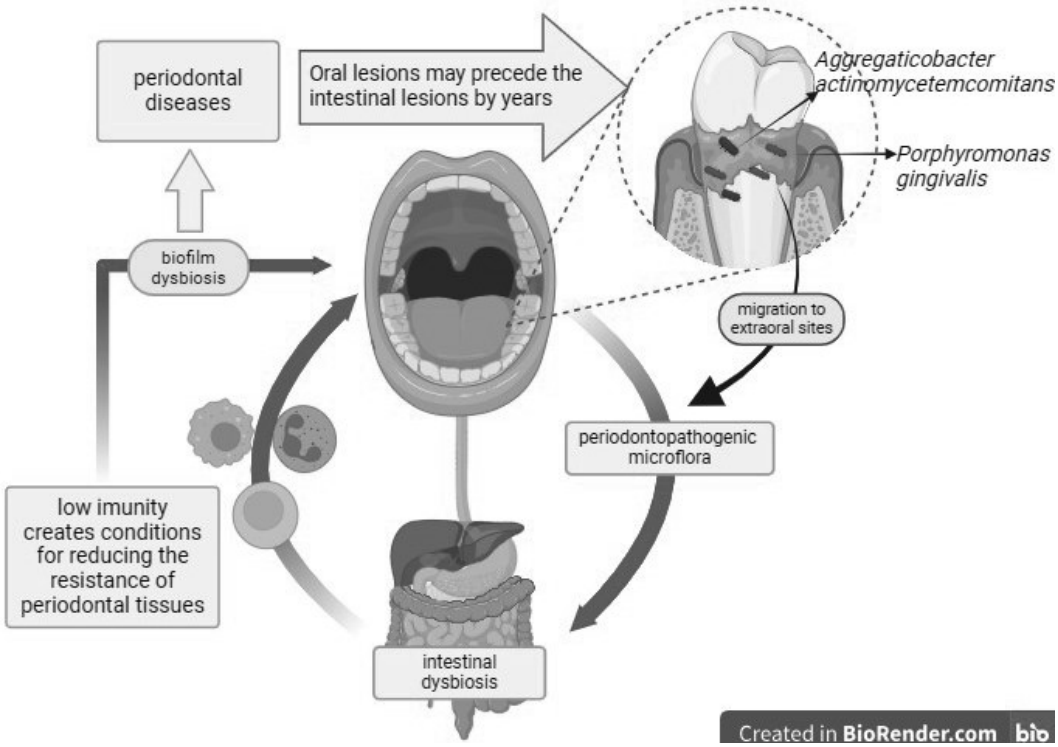

Fig. 1. The Interconnection between periodontal disease and gastrointestinal tract pathology and impact of periodontal disease on the overall homeostasis of the human body (Figure is created by authors).

The frequency and intensity of periodontal diseases increased in proportion to the duration and severity of the underlying disease [29]. Thus, the pathology of the gastrointestinal tract is a risk factor for the development and adverse course of chronic inflammatory and inflammatory dystrophic periodontal diseases. Due to the presence of comprehensive relationships between the organs of the oral cavity and the gastroduodenal zone, the development of gingivitis and generalized periodontitis is considered a consequence of diseases of the gastrointestinal tract, namely peptic ulcer disease of the stomach and duodenum, gastroesophageal reflux disease, chronic gastritis, pancreatitis, colitis.

Clinical dental examination of patients with gastroesophageal reflux disease showed that changes in periodontal tissues are noted in 84 % of cases. At the same time, in 67 % of cases, chronic catarrhal gingivitis was registered, and in 23 %, chronic generalized periodontitis of I-II grades of severity [30]. The unity of the processes in the oral cavity and the gastrointestinal tract is evidenced by the grade of inflammatory-destructive processes in the periodontium, which correlates with the activity of inflammation in the esophagus [31]. Confirmation of the existence of a close relationship between the oral cavity and the gastrointestinal tract has a pronounced positive effect on the dynamics of local immunological indicators in patients with periodontitis. As a result of the correction of intestinal dysbacteriosis a significant decrease is established in the depth of periodontal pockets and partial regeneration of periodontal bone tissue during orthomolecular rehabilitation of the intestine [32].

Conducted studies show that in patients with duodenal ulcers, the frequency of periodontal tissue lesions ranges from 84.6 to 97.3 %. It should be noted that in patients with complicated forms of expressive disease, periodontal pathology occurs even more often and is characterized by a severe course [33]. Periodontal disease occurs in 92 % of patients with peptic ulcer disease, of which 15.4 % have catarrhal gingivitis and 76 % have generalized periodontitis [33]. Most authors suggest the possible similarity of pathophysiological and pathomorphological processes in the stomach and periodontium mucous membrane [34]. It should be noted that with peptic ulcer disease of the stomach and duodenum, conditions are created for inflammation in the periodontium because there is a violation of a number of regulatory mechanisms [15]. As a result, the body's resistance weakens, leading to gingivitis and periodontitis. One of the reasons for the rapid progression of inflammatory periodontal diseases associated with peptic ulcer disease is an increase in the level of calcium in the blood of patients, the regulating hormones parathyroid and calcitonin. It is assumed that the trigger mechanism of this process is the increased production of gastrointestinal hormones (gastrin, cholecystokinin, etc.) in peptic ulcer disease. These hormones help to increase the production of calcitonin and, accordingly, improve the resorptive processes in the periodontium [35]. Modern concepts of the pathogenesis of the combined course of periodontal diseases and peptic ulcer disease predict a connection between a violation in the system of protective mechanisms and, above all, in the immune system and antimicrobial resistance of the body and the course of reparative processes. This concept is based on the assumption that the pathological process in the mucous membrane of the stomach and duodenum is accompanied by autoimmune reactions that lead to gum tissue damage. When peptic ulcer disease and periodontitis are combined, a shift in cellular immunity is observed: a decrease in the content of T-lymphocytes and their functional activity [12].

Despite the considerable amount of research conducted, the role of *H. pylori* in the occurrence and course of diseases of the oral cavity remains unclear. Many studies are devoted to the influence of *H. pylori* on the specificity of the dental statute in an adult population. The data from several studies indicate the negative impact of *H. pylori* infection on the course of periodontal diseases [36, 37]. It has been established that chronic generalized catarrhal gingivitis and periodontitis are more common and have a more severe form in adult patients with *H. pylori*-associated pathology of the gastrointestinal tract. There is an assumption that the process of colonization of the mucous membrane of the oral cavity by *H. pylori* is influenced by microorganisms that participate in the pathogenesis of periodontal diseases [38]. It has been proven that the activity and degree of contamination of the gastric mucosa by *Helicobacter pylori* is variably correlated with the prevalence and severity of chronic generalized periodontitis and catarrhal gingivitis.

Chronic gastritis significantly changes the clinical picture and severity of the pathological process in the periodontium. The course duration of this disease determines the frequency of periodontal pathologies [39]. There is an assumption that the complex folded topography of the mucous membrane of the stomach and duodenum is a place of accumulation of random microflora. It is possible that the microorganisms that colonize the oral cavity and cause periodontal disease get into the stomach persist in its pre-epithelial mucous layer, and, accordingly, deepen the gastritis clinic [40].

It has been established that in patients with chronic pancreatitis, periodontal tissue pathology is noted in 90 % of cases. At the same time, the frequency of occurrence and severity of the course are correlated with a violation of the formation of active prothrombinase, antiaggregation, anticoagulation, and fibrinolytic activity of the vascular wall, a decrease in the general coagulation ability of venous blood, which occurs in chronic pancreatitis [41].

When examining the oral cavity of patients with intestinal dysbiosis, poor oral hygiene and the presence of hard and soft dental deposits were observed in most cases, which is a prerequisite for an inflammatory process in the periodontium [42].

In patients with diseases of the liver and biliary tract, 100 % of periodontal tissue damage is noted. The liver is the largest organ in the digestive system, and it plays an important role in maintaining the health of living organisms. During the process of digestion, nutrients in food are absorbed through the numerous fine capillaries of the intestinal wall and they are carried into the veins [43]. One potential communication route between the oral cavity and the liver is transporting oral bacteria through the gastrointestinal tract. A person swallows up to 1,5 L of saliva, equating to 1,5 x 10^{12} oral bacteria

per day. An etiological connection between chronic liver diseases and marginal periodontal disease is reported. In particular, a greater frequency of dental pathology is found at chronic hepatitis than in healthy people, and the presence of liver cirrhosis significantly affects the depth of periodontal pockets and loss of attachment [44]. At the same time, there is significant damage to the vessels of the microcirculatory bed, especially capillaries, in combination with dystrophic changes in the epithelium and stroma of the gums [45].

Periodontal diseases were detected in 97.4 % of patients with non-specific inflammatory bowel diseases: Crohn's disease and ulcerative colitis [46]. Oral manifestations that can occur in patients with Crohn's diseases are divided into specific ones in the form of cobblestone mucosa, granulomatous cheilitis, and seals on the mucosa, and non-specific ones in the form of aphthae, fissures, other types of cheilitis, lichen planus, periodontal disease, dental caries, and others [47]. Involvement in the pathological process of organs that are functionally connected with the large intestine is accompanied by a violation of their activity. The disease of the digestive system leads to a decrease in the body's non-specific resistance, which in its turn contributes to a negative effect on the periodontium and the mucous membrane of the microflora located in the oral cavity [48]. Data in the literature shows that the quantitative and qualitative composition of the oral cavity's microflora depends on the organism's reactivity [49].

Recent research indicates that an imbalance in the microbial ecosystem of the mouth can affect the microbial composition, abundance, or diversity in the distant gut, which can lead to the development of digestive cancer. Furthermore, there is a strong correlation between specific gastrointestinal disorders and periodontal disease, which is linked to the migration and settlement of oral pathogens and the subsequent activation of microbe-reactive T-cells in the intestines [50].

Conclusions

1. Summarizing scientific data proves that gastrointestinal pathology weakens body defenses and can activate periodontopathogenic microflora. Disorders of gastrointestinal tract and hepatobiliary system influences negatively salivary gland leading to their dysfunction. Peptic ulcer disease, gastroesophageal reflux disease, chronic gastritis, pancreatitis, and colitis accompanies gingivitis and periodontitis.

2. Therefore, periodontal diseases and gastrointestinal tract disorders are closely linked, and the functional relationship between them should be considered in the diagnosis and treatment of both types of diseases. The findings of this review suggest that periodontal diseases can have a significant impact on the overall homeostasis of the human body.

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