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Indicators of dental diseases, characteristics of clinical picture and methods of orthopaedic treatment of periodontal diseases in patients with diabetes mellitus (literature review)

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Summary. The analysis of scientific publications of foreign and domestic authors on the indicators of dental diseases, characteristics of the clinical picture and methods of orthopaedic treatment of periodontal tissue diseases in patients with diabetes mellitus have been carried out. Literary research shows that patients with diabetes, due to the presence of a large number of pathological changes in the tissues and organs of the oral cavity, require a special approach to orthopaedic dental treatment and further rehabilitation. Modern orthopaedic dentistry is actively developing, which has led to the emergence of new methods and materials in the design of dental prostheses to replace defects in the dentition. Studies aimed at optimizing the protocols for prosthetics in patients with concomitant diabetes remain extremely relevant, since they are aimed not only at the restoration of the lost functional capacity, but also at significant improving of the patient's life quality.

Key words: diabetes mellitus, periodontal disease, bone, orthopaedic treatment.

The analysis of the scientific literature was carried out within the framework of the fragment implementation of the research work of the Department of Orthopedic Dentistry and Orthodontics of the Private Higher Educational Establishment «Kyiv Medical University of UAFM» – «Improving the effectiveness of orthopedic and orthodontic treatment of patients with defects of teeth, dentition, abnormalities and deformations of the dental and maxillofacial apparatus» (№ ДР 0206U011147).

Diseases of the endocrine system, in particular diabetes mellitus, play an important role in the development of pathological conditions of the oral cavity. According to the observations of many authors, patients with diabetes almost always have dental pathology, which is caused by this disease [33, 55, 65]. High frequency of lesions of the oral cavity organs (up to 90 %) in diabetes is due to the changes in the microvascular system, resorption of bone tissue, reduction of local immune responses which lead to a reduction in the periodontal endurance. Thus, the usual chewing pressure becomes traumatic for the supporting teeth.

The analysis of the studies conducted by Sima C. and Glogauer M. (2013) proves that the intensity of periodontal lesions in patients with diabetes is higher than in the control sample. Thus, the value of the complex periodontal index in patients with diabetes mellitus is significantly higher in all examined age groups (3.4 – in individuals 35–44 years old; 3.8 – in the group of patients 45–54 years old; 4.1 – among patients 55–64 years old) vs. indicators in the control sample (2.9, 3.1, 3.2 correspondingly), although in the older age groups the intensity of the periodontal disease is increasing and in patients without diabetes [64].

The prevalence and intensity of periodontal lesions among patients with diabetes mellitus is confirmed by the results of an analysis of the index of need for periodontal disease treatment (CPITN index) [2]. In a study by Alves C. et al. (2007) an evident increase in the severity of periodontal disease in patients with diabetes was revealed [2]. Thus, the prevalence of all signs of the pathology of the periodontal disease in diabetes averaged 94 % with an intensity of 5.43 of affected segment per person. At the same time, the bleeding of the gums reached 16 % (intensity of 2.0 of the segment), dental calculus – 48 % (intensity of 3.1 of the segment), periodontal pockets with a depth of 4–5 mm – 19 % (intensity of 0.21 of the segment), pockets with depth greater than 6 mm – 11 % (intensity of 0.12 of the segment). The data in the control group included 19 % (2.2 of the segment), 50 % (2.7 of the segment), 9 % (0.11 of the segment), 4 % (0.06 of the segment) [2], respectively.

According to Mark A. (2016), the longer the period of the disease is, the higher the indicators of caries prevalence and periodontal diseases are. At the same time, 100 % of people suffer from the tooth caries, regardless of the history of the disease. The high prevalence and intensity of caries, especially the proximal and the cervical, is an aggravating factor in patients with diabetes. Periodontitis is registered in 100 % of cases with the duration of the disease for more than 10 years [41]. Tereshina T. et al. (2011) revealed a significant prevalence of chronic candidiasis in patients with diabetes mellitus (n = 26): in 62.5 % with a history of disease up to 5 years and in 80 % with a history of disease more than 10 years. Desquamative glossitis was observed in 90 % of patients with a long history of diabetes, and it was observed in 40 % with effects of glossalgia [69].

Diabetes mellitus is associated with a reduction in bone mass and oppression of bone formation processes. Diabetic metabolic disorders lead to the development of osteoporosis and osteolysis, which further contributes to the damage of periodontal disease and partial or total loss of teeth. It is believed that more than 50 % of patients with type 1 diabetes mellitus have reduced bone mass compared to healthy, age-matched individuals and approximately 20 % of diabetic patients aged 20 to 56 years are diagnosed with osteoporosis [17, 36, 80].

Data on the relationship between the level of blood glucose and atrophy of the alveolar process are of particular interest. Osseous lesion in diabetes mellitus is explained by the fact that low blood insulin levels suppress the activity of osteoblasts, indirectly causes metabolic acidosis and under these conditions the activity of osteoclasts increases. There is a discrepancy between the clinical and X-ray symptoms of the disease: in moderate gingivitis, marked resorption of the bone tissue of the alveolar process is observed and deep periodontal pockets appear. It has been established that the X-ray symptom of periodontal diseases in diabetes is diffuse osteoporosis with varying degrees of bone tissue atrophy [20, 38].

The type of diabetes affects the frequency of periodontal diseases, however, in type 1 diabetes, periodontal disease develops earlier and more often results in the expressed destructive forms. With an increase in the duration of diabetes, the risk of periodontal disease increases in the same proportion as the risk of other complications of diabetes (retinopathy, nephropathy). Unsatisfactory metabolic control dramatically increases the risk of periodontal disease (with strict blood glucose control, the frequency of periodontal disease in diabetics is practically the same as in the population without diabetes) [26].

The rehabilitation of patients with diabetes who require orthopaedic dentistry remains a difficult problem, because apart from the general factor – diabetes mellitus, the mechanical and toxic factor such as a dental prosthesis, affects the organs and tissues of the oral cavity.

According to Rumyantseva Ye. et al. (2014), in the age group of 35–44, 78,3 % of patients with diabetes are in need of prosthetics, 95,4 % of patients require prosthetics in the age group of 45–64, and the need for prosthetics reaches 100 % at the age of 65–74 [58].

Analysis of literary sources shows that there is no systematic substantiation of prosthetics procedures, the choice of the design of a prosthesis in patients with diabetes. There are individual studies, revealing the indications for the application of this or that prosthesis design. The effect of prosthesis on periodontal tissues, especially in the long term, has been insufficiently and not fully covered.

It is important to study the clinical features of the tissues of the oral cavity in the development of diabetic periodontal disease to determine the most rational design for orthopaedic dental treatment of patients with diabetes. As it has been shown, in almost 100 % of cases in patients with diabetes, inflammatory periodontal diseases of varying severity are observed, which differ in marked clinical picture, aggressive course, resistance to traditional methods of treatment and prevention [1, 42, 60]. The state of oral hygiene in patients with diabetes is 2.5 times worse than in healthy individuals. For such patients prolonged wound healing is characteristic after the removal of teeth and other surgical interventions, and, in particular, tissue regeneration processes deteriorate [9, 70].

Diabetes mellitus is a factor contributing to the development of complications in orthopaedic treatment [4]. So, it is known that in patients with diabetes mellitus after tooth extraction the healing time of the holes is prolonged, and the postoperative period is often complicated, depending on the duration and severity of diabetes. The inflammatory process in patients with diabetes is characterized by rapid development and is accompanied by acute pain with very early symptoms of intoxication, when local manifestations of the inflammatory process are slightly expressed [23]. The most accurate indicator of the state of resistance of the body and tissues of the prosthetic bed is the protein content in the saliva. In patients with diabetes, the protein level differs from physically healthy individuals in the direction of increase. This is explained in different ways, but the general conclusion is that the protein level increases as an indicator of the inflammation of the oral mucosa [10, 32, 37].

It is known that the success of rehabilitation of patients with defects in hard tissues of teeth and dentition depends not only on the choice of prosthesis design, technologies and materials used, but it's also related to the general condition of the body [46]. With an increased level of sugar in blood it is advisable to postpone orthopaedic treatment to the phase of compensation of the disease. In such situations, treatment should be limited to the correct redistribution of the pressure [31]. Therefore, in case of periodontitis, it is impossible to achieve a positive result of drug therapy and surgical treatment without eliminating traumatic occlusion and functional overload of periodontal disease. For this purpose, at the beginning of the treatment orthopaedic measures are used, which consist in the normalization of occlusive relations and temporary splinting [30, 43].

The main requirements for splinting are durability and reliable fixation of loose teeth, the absence of negative influence on periodontal tissue, the possibility of unhindered maintenance of hygiene and other medical manipulations. Temporary splints are inserted for the entire period of treatment until the moment of remission and until the fixed prosthesis is made. The function of these designs is to eliminate the traumatic effect of pathological mobility, which contributes to hemodynamic disorder in periodontium [44, 59]. Zakharova H. (2016) optimized the treatment of generalized periodontitis in patients with diabetes mellitus (n = 17) by optimizing the stage of temporary splinting and prosthetics [77]. After 3 months, a tendency towards the stabilization of splinted teeth was found, including the reduction of the number of teeth from 14 to 6 (which were removed) from the third level of tooth loosening. For permanent prosthetics fixed designs (cast metal and ceramic bridges and crown splints) were used in 6 people and a combination of fixed and removable designs (crown splints and partial removable prosthesis with a cast frame and support-retaining clasps) was used in 7 people. Four patients refused from prosthetics and wished to continue to use the primary splinting. According to the author's findings, the clinical effectiveness of this treatment protocol, which included complex antimicrobial and anti-inflammatory therapy, surgical sanation and prosthetics at the initial stage of treatment was proved. After 6 months, clinical and X-ray stabilization of the process was observed in most patients. The effectiveness of using clasp prostheses for long-term temporary prosthetics and splinting in cases of severe course of generalized periodontitis associated with diabetes has been confirmed [77].

High rates of development of orthopaedic dentistry have led to the emergence of new methods, materials for the design of prostheses and replacement of defects in the dentition. The creation and the use of dental prostheses which are biomechanically compatible with living tissues of the body, especially in patients with weakened per prosthesis, depending on the specific clinical situation, is a current problem.

Furtseva T. (2009) has proved that in patients with diabetes fixed stamped-soldered bridge-type prostheses with titanium nitride spraying are made in 79 %, partial removable laminar prostheses – in 63.4 % of cases. Metal-ceramic designs make up 5 %, solid-type clasp prostheses with clasp fixation make up 18,6 % of cases [19]. Repeated visits when using fixed designs were in 19 % of patients during the first and in 60 % during the third year after the prosthetics. With removable prostheses, visits in the first year reaches 70 % and is associated with correction, and in 30 % of cases – with repairing. The high clinical efficiency of using prostheses designs from ultra-elastic alloys based on titanium nickelide for orthopaedic treatment of patients with diabetes mellitus, which was 96 % in the immediate and long term, was proved. The use of ultra-elastic alloys based on titanium nickelide in the elements of the clasp dental prosthesis reduces the formation of irreversible residual deformations in bone tissues due to the uniformity of plastic deformations of the alloy and bone tissue [19]. Thus, the aim of another study by the author [18] was to evaluate the periodontal condition of the supporting teeth with the help of the Periotest-S device when prosthetics with clasp dental prostheses was performed on the clasp fixation with cobalt and chromium alloy (n = 21) and superelastic titanium nickelide alloy (n = 18) in patients with diabetes. Measuring the mobility of the teeth was carried out before the prosthetics, after 3 months, 6 months, 1 year and 2 years after the prosthetics. The mobility of the supporting teeth in the group of patients using superelastic designs of titanium nickelide has not practically increased, there was only a slight tendency to increase (the indicator to the prosthesis was 2.7 ± 0.2, in 2 years – $3,0 \pm 0,2$, which is not statistically reliable). In the group of patients with designs from cobalt and chromium alloy, the tendency to increase the tooth mobility was more significant and amounted to 2.4 ± 0.2 before the prosthetics, and in 2 years after the prosthetics it amounted to 3.1 ± 0.2. The obtained results indicate that there is no negative effect on the periodontitis of the supporting teeth in patients with diabetes during the use of superelastic designs [18].

The development of dental implantation opens up a number of new opportunities in orthopaedic dentistry. Dental implants become an integral part of dental practice, and, according to Hupp J. (2017), it is a big mistake to provide dental care to patients with only traditional orthopaedic designs without offering an alternative implant treatment plan [24]. The object

of the discussion is the choice of the optimal system for implant rehabilitation of patients with diabetes, as well as the method of fixing further orthopaedic design to the implant. Tatarakis N. et al. (2014) placed dental implants in 32 patients. 8 of these patients made up a control group. The authors noted early postoperative complications in 30 % of the cases, of which 75 % were detected in patients with concomitant diabetes. Data on disintegration or lack of primary implantation stability were not presented [66]. According to Tawil G.et al. (2008), the lowest risk of delayed complications was observed in the use of techniques and systems with screw fixation and, as a consequence, complicated methods of making orthopaedic designs, including the use of milled frames and systems of optical imprints [67].

In addition to studies on screw-retained implants, there are data on the features of the use of cylindrical implants, as well as implants with memory shapes. King S. et al. (2016) evaluated histological sections of the peri-implantation zone on the example of groups of rabbits with diabetes of different severity of clinical manifestations [28]. Cylindrical titanium implants, porous cylindrical and laminar implants from titanium nickelide were used. In groups with compensated diabetes and a mild degree of decompensation (blood sugar level from 7.5 to 9.0 mmol/L, aglucosuria), a layer of mature connective tissue with proliferation of fibroblasts was being formed during the first month on the line of the bone and implant. There was a germination of connective tissue in the pores of implants. By the end of the 3rd month there were foci of decalcification, especially around porous implants, and periodontal connective tissue was formed. By the 6th month, the formed bone tissue was detected in the peri-implantation zone [28]. In groups with severe decompensation (blood sugar level more than 10 mmol/L, glucosuria, ketonuria), by the end of the first month, expressed mobility of the established implants was noted. Histologically, there are evident disorders in the formation of bone tissue. In the case of implant in the bone for up to 3 months, areas of chaotic overgrowth of the connective tissue were observed on the sections and the mobility of the implants was maintained. At the 6th month, it was possible to see the formation of lumpy bone tissue, the phenomenon of thrombus formation in microvessels of the peri-implantation zone and osteoclastic resorption. There was no osseointegration by that time [28].

Molon de R. et al. (2013) have shown experimentally that bone quality around the dental implants in rats with diabetes did not have significant differences in comparison with the control group, while the ability to osteointegration significantly decreased in the presence of diabetes [13]. Oates T. et al. (2009) was examining the stability of 42 dental implants in 30 patients during 4 months (10 of these patients were in the control group). It has been established that patients with poor control of blood sugar level require a longer resting period of the implant before the occlusion pressure begins to act on it [51]. Javed F. and Romanos G. (2009) were observing 601 implants in 278 patients for 3 months, of which 346 implants were placed in 140 patients without diabetes. The results of the study showed a significant reduction in osteointegration in patients with diabetes. In the control group, success was achieved in 86 % of cases, while in patients with diabetes – in 32 % [25].

Balshi S. et al. (2007) observed a patient with type 2 diabetes, who had 18 implants and who had undergone prosthetics according to the protocols for immediate pressure. After 30 months, researchers described the stability of all placed implants and the favourable functioning of designs based on them [7]. At the same time, data on the use of the protocol for immediate pressure in patients with diabetes are not enough to make clear conclusions about the appropriateness of the use of the protocol for immediate pressure to this patient population.

The literature data show contradictory indicators of the success of orthopaedic treatment of patients with diabetes – the usefulness of functional, psychological and aesthetic rehabilitation of these individuals. Turkayilmaz I. (2010) evaluated the clinical success of implantation and orthopaedic pressure on the durability of the design for 12 months. Patients (n = 10) were placed 23 implants and designs with cement and screw fixation (removable and fixed) were made. All implants remained stable until the end of the supervision [73]. In the long-term observation conducted by Marchand F. et al. (2012) the stability and osteointegration of implants placed from 1 to 10 years ago was investigated: 59 implants were placed in patients with diabetes and 111 identical implants in people without diabetes. The results of the durability analysis of the design showed the stability in 93 % of implants in the group of patients with diabetes and 94 % of implants in the control group [39] Mellado-Valero A. et al. (2007) noted the stability in 95 % of dental implants in patients with diabetes at the time of the first surgical stage. After the final restorations were made, 99 % of implants were stable [45].

Other observations show data different from those listed above. Moy P. et al. (2005) for 10 years were observing implants in 48 patients with diabetes with a stability of 68.7 % of them. The authors concluded that the risk of failure in prosthesis on implants of patients with diabetes, even with compensated forms of the disease, is very high [48]. At the same time, it should be noted that due to the similarity in pathogenesis and manifestations in the oral cavity of type 1 and 2 diabetes, which are the consequences of hyperglycaemia, experts recommend to consider not so much the differentiation by types of the disease, how much the degree of compensation as a factor affecting the success of rehabilitation [15].

It is known that dental orthopaedic rehabilitation of patients with diabetes is accompanied by certain difficulties due to numerous pathological manifestations of the disease: decreased resistance of the blood vessels, progressive atrophy of the alveolar appendix, increased pain sensitivity and inflammatory conditions in oral mucosa [40]. Understanding the essence of etiology and pathogenesis, the development of modern diagnostic and therapeutic technologies still do not allow to prevent the impact of adverse endogenous and exogenous factors that worsen the conditions for the reparative capacity of the tissues of the oral cavity and maintaining its homeostasis. The slight irritability of oral mucosa and depression of regeneration processes in it, on the one hand, and microbial aggression, on the other, create unfavourable conditions for adaptation to prostheses in patients with diabetes [8]. The above causes difficulties in developing a complex of therapeutic and preventive measures, determining their volume, duration, and rationality of the combination of all types of dental care during orthopaedic rehabilitation of periodontal tissue diseases in patients with diabetes.

Orthopaedic interventions in diabetes mellitus require special attention to the selection of compatible materials; at the same time, local therapeutic effect on the affected periodontal disease in such patients is often ineffective. The influence of glucocorticoid immunosuppression on the degree of periodontal damage in patients with diabetes has been revealed. It dictates the necessity to include new immuno-correction regimens into the complex therapy of periodontitis for the restoration of the activity of antiglucocorticoid immunity protection system [61]. Indicative effect of chitosan-containing compositions on periodontal tissues of rats with a model of alloxan diabetes mellitus. In the study, the rats were divided into groups which received various prescriptions of chitosan-containing compositions. After the end of the month experiment, the morphological study found that the maximum therapeutic effect was found in the group of rats receiving treatment with 50 % chitosan-alginate-hydroxyapatite gel: its use makes it possible to eliminate the inflammatory process, improve blood flow and slow down the destruction of periodontal tissues [71].

Prostheses made according to generally accepted methods, without taking into account the condition of the oral mucosa of the prosthetic bed, require numerous corrections and enhance the pathological situation in the oral cavity [63]. Kerimov R.

(2013) conducted an analysis of 147 medical records of patients with diabetes [27]. The duration of the disease varied from 3 to 26 years. 434 fixed and 23 removable designs were observed out of the total number of patients. 19,35 % of stamped-soldered bridges made of stainless steel, 74,65 % of metal ceramic bridges and 5,99 % of metal-plastic bridges were made from fixed designs. Among the removable designs complete removable laminar plastic prosthesis prevailed – 65,21 %. Partially removable prostheses were made in 30.43 % and clasp prosthesis with clasp fixation was found in one case (4.34 %). 16.32 % of the patients who had stamped-soldered bridge prostheses applied again to the dentist during the first year after prosthetics with complaints of teeth mobility and gum disease, and in 11.06 % of patients after 3–4 years the prosthesis was functionally ineffective. Among the patients who had removable prostheses, 66.66 % out of 18 patients during the first year applied again with complaints of gum pain from pressure in the first 14 days after the prosthesis was placed. After 3–4 years, 39,13 % of the patients complained of loosening and loss of teeth which were the basis for the clasps. The author noted that in the patient's card there was no information on the effect of the prosthesis materials on the tissues of the oral cavity, as well as data on the general somatic, mental and immune status which is very important in diabetes [27].

An important role in the development of inflammatory changes in the tissues of the prosthetic bed in diabetes plays an increase in the pathogenic effect of microflora of the oral cavity, a decrease in the overall reactivity of the organism, an increase in the intensity of oxidative and nitrosative stress against the background of inadequate activity of antioxidant protection factors [3, 12, 54].

The surface of the prosthesis is in direct contact with the body's environment. In this case, the surface of «foreign» material becomes a place of attachment and reproduction of microorganisms [68]. Minimum plaque formation is observed on samples from porcelain, maximum on gold chromium-nickel alloys [75]. At the same time, there are studies that show the independence of the degree of dental plaque formation from the type of material [16, 29].

Zhyrnova A. et al. (2015) presents data on the characteristics of the oral microbiocenosis of 36 patients suffering from type 2 diabetes before and after the prosthetics with metal-ceramic and stamped crowns [78]. According to the results of the study, before the end of the orthopaedic treatment in patients with stamped crowns, the frequency and the number of microorganisms of the genus Streptococcus, Staphylococcus (including S. aureus), Peptostreptococcus and Candida) were significantly higher than in patients with metal-ceramic designs. High prevalence of representatives of normoflora, in particular lactobacilli (60 %), on the mucous membrane of gums in patients after prosthetics with metal-ceramic crowns has been revealed [78].

Ovcharenko Ye. (2014) presents the results of a microbiological study indicating changes in microbiocenosis of the oral fluid after prosthetics using nickel-chromium and cobalt-chromium alloys of orthopaedic designs in patients with type 2 diabetes. It is shown that more significant changes in the microflora of the oral cavity occur when using prostheses from nickel-chromium alloys [53]. In patients with diabetes, certain clinical features of the condition of tissues of the oral cavity have been revealed, depending on the type of design material of the prosthesis [79].Patients using a partial removable prosthesis with an acrylic basis (n = 30) were 80 % more likely to have inflammatory changes of the oral mucosa of the prosthetic bed at the prostheses' correction stages, and 26 % of patients more often showed the hyperaemia of the oral mucosa of the prosthetic bed in 3 months than patients using partial prostheses with a basis from cobalt-chromium alloys (n = 30). Also, in patients with partial removable acrylic prostheses, the frequency of poor oral hygiene and periodontal lesions of moderate severity was 7 % higher than in patients with partial removable prostheses with a basis from cobalt-chromium alloys. The adaptation process of patients to prostheses with a basis from cobalt-chromium alloys occurred during the first 7 days in 47 % of patients, and 53 % adapted during the period from 7 to 14 days. Only 3 % of patients adapted to partial removable acrylic base prostheses in the first 7 days, 63 % – during the period from 7 to 14 days and 34 % needed more than 14 days to adapt [79].

It is known that the bases of acrylic prostheses contain monomer which is unbound during the polymerization. Residual monomer is able to wash off the prosthesis, causing irritation and inflammation of the oral mucosa. Also, there is the notion of «free monomer», which is formed during the aging of plastics and also can cause irritation of the oral mucosa after many years of use of the prosthesis. This mechanism especially affects the state of the oral mucosa in patients with diabetes due to pathogenetic predisposition of the oral mucosa of the prosthetic bed [21, 52, 57, 62].

Badalov R. (2011) experimentally (36 white outbred rats with simulated diabetes mellitus) substantiated the need for additional preventive preparation of the oral mucosa in the process of adaptation to removable plate prostheses in patients with diabetes [6]. The experiment was conducted within 30 days. It was established that the residual monomer of removable prostheses is a factor that induces a decrease in the functional activity of the salivary glands in patients with diabetes on the background of a general decrease in their salivation rate. The author also suggests that one of the mechanisms of xerostomia, developed with the use of removable dental acrylic prostheses, is the effect of monomer which initially leads to hyperfunction of large salivary glands and then to their depletion and hypofunction. Another mechanism, according to the author, is directly related to the prosthesis which presses on the oral mucosa: «irritation of the mucosa – inflammation – atrophy – a decrease in the secretion of small salivary glands». When using Echinacea purpurea, the dryness of the mucous membrane of the oral cavity is levelled, which prevents the onset of an inflammatory reaction and a decrease in the salivation rate [6].

Since in patients with diabetes there are changes in the salivary glands, there are also changes in the composition of the oral fluid and the tissues of the oral cavity [47, 50]. That is why, during the prosthetics in this population of the patients, various complications are often observed, and the effectiveness of prosthetics is reduced [56]. In order to stabilize the microelement composition of the oral fluid and in the tissues of the prosthetic bed, in patients with diseases of the salivary glands during prosthetics, Atmazhov I. (2013) offered a mineral complex, which eliminates microelement changes in prosthetics with removable and fixed prostheses (n = 21) [5]. In the first month after the prosthetics, a complex of trace elements containing calcium glycerophosphate 0.2 g was administered 3 times a day and kalium-normin 0.3 g was administered 3 times a day. Patients were divided into groups: Group 1 – patients with diseases of the salivary glands who did not receive preventive treatment; Group 2 – patients who were prescribed calcium glycerophosphate; Group 3 – patients who took the mineral complex. It was established that calcium glycerophosphate stabilizes the decrease of phosphate concentration in the oral fluid practically to the level before the prosthetics in group 2, and in group 3 it even leads to an increase in the indices. In groups 2 and 3 after the prosthetics, the concentration of the oral fluid calcium normalized to the initial values, indicating the effectiveness of the use of calcium glycerophosphate in the processes of stabilizing the mineral composition of the oral fluid. The use of a potassium-normal drug increased the accumulation of calcium and phosphate in the oral cavity, which improved the adaptation of the tissues of the oral cavity to prosthetics. After 1 month of use of this complex, the indices of mineral composition of saliva normalized to the level of people without damage to the salivary glands who had similar designs [5].

The reaction of the oral mucosa to a removable prosthesis depends on the direct reaction to mechanical, thermal, allergic, toxic stimuli, as well as on the microbiological and immunological factors, and depends on the individual reactive properties of the organism, especially in people with general-somatic pathology [49, 72]. The most aggressive in this regard is the metabolic syndrome (MS), one of the components of which is type 2 diabetes [97]. According to Yakimenko D. et al. (2013), patients with MS (n = 60) who used acrylic removable prostheses experienced itchiness in the oral cavity, pain in the area of the prosthetic bed, dry mouth, paraesthesia [76]. After the treatment with the use of thiotriazoline ointment, the salivation rate and pH of saliva, as well as the activity of neutrophils, increased in the patients. This contributed to the improvement of the local antimicrobial protection. Authors explain such effects of the ointment by its beneficial effect on the mechanical contact of the prosthesis and the oral mucosa, and also on the activating effect of thiotriazoline on the aerobic metabolism of cells of the oral mucosa and phagocytic neutrophils. According to the authors, the use of ointments with thiotriazoline in the complex treatment of patients with prosthetic stomatitis and MS reduces the prevalence of clinical manifestations of stomatitis, increases the initially decreased salivation rate, causes activation of various parts of local resistance [76].

According to the conclusions of Dimcheva T. (2012), the migration of leukocytes in the oral cavity after prosthetics significantly increased in a patient with diabetes who had removable acrylic prostheses, which is a reaction-response to the spread of inflammatory process in the oral cavity [14]. Other designs materials (nylon, ceramics and non-metal ceramics) did not significantly affect the content of leukocytes in the oral fluid. In individuals with acrylic prostheses, the bacterial content of the oral mucosa in the area of the prosthetic bed has increased by Candida albicans (in 2 weeks after the prosthetics by 37 %, 1 month later by 47 %, compared with the initial level). Other prostheses did not significantly affect the growth of Candida albicans. The results of the study show that the most indifferent for the oral mucosa of patients with diabetes are: fixed – non-metallic (zirconium) prostheses and removable nylon prostheses. During the prosthetics of the patients with diabetes with removable prostheses using acrylic plastic, it is necessary to provide preventive treatment of the oral mucosa and further preventive measures to neutralize the action of the monomer [14].

The mild irritation of the oral mucosa and the inhibition of regeneration processes on the one hand, and microbial aggression on the other, create unfavourable conditions for adaptation to removable prostheses in patients with diabetes [11, 74]. It is necessary to optimize the processes during the prosthetics of this particular patient population. Data obtained by Hryzodub V. and Badalov R. (2013) indicate a slowdown in adaptation processes to removable plate prostheses in patients with diabetes [22]. This is manifested by subjective feelings of discomfort in the oral cavity, confirmed by indicators of the condition of the prosthetic bed. Slowdown of adaptation is associated with disturbances of the oral mucosa tropism caused by diabetes mellitus. The use of Echinacea tincture as an addition to basic hypoglycaemic therapy was accompanied by an increased rate of adaptation, which was confirmed both by subjective and objective data. According to the authors, the positive effect of the drug is due, first of all, to the antioxidant properties of the medicinal product [22].

The research of Lapina N. (2011) was devoted to the study of the possibility of adaptation of occlusive relationships in orthopaedic patients with a partial absence of teeth with medically compensated diabetes and some other concomitant diseases [34]. Hard occlusal splints were made for one group of patients for the adaptation of the periodontal and the neuromuscular system. The other group did not use occlusal splints and in 72 % of cases there was an exacerbation of the concomitant disease. These patients underwent prosthetics in 1.5-2 months after the stabilization of the general condition of the organism. According to the author's conclusion, in patients with concomitant diseases, selective sandblasting of the teeth with their partial absence should be conducted under the control of occlusal splints to create a relatively stable occlusion. This prevents the development of symptoms of muscular-articular dysfunction [34]. In another work of the author it has been demonstrated that the use of occlusion splints helps to increase the efficiency of orthopaedic treatment of patients with partial absence of teeth and displacement of the mandible in people in whose anamnesis there are neurotic disorders, diabetes and hyperacid gastritis. Orthopaedic treatment was conducted for 15 patients in the period of remission and pharmacological compensation of concomitant treatment. For all patients were made occlusive splints on the upper jaw with separation of interocclusal distance of 2–3 mm, imprints of the antagonists and inclined plane in the frontal or lateral sections were made. Patients used occlusal splint for 1–1.5 months. The final stage of the treatment was a rational prosthetics. Pain and feeling of discomfort in chewing muscles and periodontitis were absent in all patients [35].

Conclusions

Thus, the pathogenetic mechanisms of lesions of the oral tissue in diabetes are complex and multicomponent. Numerous studies have proved the interrelation of diabetes with the development of inflammatory and destructive changes in periodontium. At the same time, against the background of diabetes, periodontal diseases occur at an earlier age, have more severe course and progress faster than in people without concomitant endocrine pathology. When providing dental care to patients with diabetes, it should be taken into account that diseases of the oral cavity have a specific course due to metabolic disorders and systemic angiopathy. In addition to changes caused by the damage of peripheral microvessels, there are also disorders caused by increased glucose content in saliva, which creates a favourable background for the development of microorganism colonies and changes in the ratio between opportunistic and pathogenic microorganisms. Based on data from the analysis of scientific sources, it can be affirmed that the presence of periodontal diseases which are associated with diabetes makes it difficult to plan and to prognose the results of orthopaedic treatment. In this population of patients, the achievement of periodontitis remission depends on the severity of the course and the degree of compensation of diabetes. It is necessary to take into account the clinical picture of periodontitis, the condition of dental tissues of the supporting teeth and the physical condition of the patient, which significantly prolongs the duration of the preparatory treatment, as well as the use of a differentiated approach in planning of orthopaedic interventions. Orthopaedic dentists when choosing the design of prosthesis for patients with diabetes should take into account not only the type of the design and the material from which it is made, but also the defect extent, the condition of the periodontium of the supporting teeth, the integrity of the hard tissues of the tooth, the immunological and the physical condition of the patient, the degree of compensation of diabetes. The prosthesis made must meet all the requirements for the correct redistribution of the pressure.

LITERATURE

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Показники стоматологічних захворювань, особливості клінічної картини і методи ортопедичного лікування захворювань тканин пародонта у хворих на цукровий діабет (огляд літератури)

Германчук С.М.

Резюме. Проведено аналіз наукових публікацій закордонних та вітчизняних авторів щодо показників стоматологічних захворювань, особливості клінічної картини і методи ортопедичного лікування захворювань тканин пародонта у хворих на цукровий діабет (ЦД). Літературне дослідження засвідчує що, пацієнти з ЦД, внаслідок наявності великої кількості патологічних змін в тканинах і органах порожнини рота, потребують особливого підходу до ортопедичного стоматологічного лікування і подальшої реабілітації. Сучасна ортопедична стоматологія переживає активний розвиток, що призвело до появи нових методів, матеріалів в конструюванні зубних протезів для заміщення дефектів зубного ряду. Дослідження, направлені на оптимізацію протоколів протезування пацієнтів з супутнім ЦД залишаються надзвичайно актуальними, оскільки спрямовані не лише на відновлення втрачених функціональних можливостей, але й на істотне підвищення якості життя пацієнтів
Ключові слова: цукровий діабет, пародонт, кістка, ортопедичне лікування.

Показатели стоматологических заболеваний, особенности клинической картины и методы ортопедического лечения заболеваний тканей пародонта у больных сахарным диабетом (обзор литературы)

Германчук С.М.

Резюме. Проведен анализ научных публикаций зарубежных и отечественных авторов по показателям стоматологических заболеваний, особенности клинической картины и методы ортопедического лечения заболеваний тканей пародонта у больных сахарным диабетом (СД). Литературное исследование показывает что пациенты с СД, вследствие наличия большого количества патологических изменений в тканях и органах полости рта, требуют особого подхода к ортопедическому стоматологического лечения и последующей реабилитации. Современная ортопедическая стоматология переживает активное развитие, что привело к появлению новых методов, материалов в конструировании зубных протезов для замещения дефектов зубного ряда. Исследования, направленные на оптимизацию протоколов протезирования пациентов с сопутствующим СД остаются чрезвычайно актуальными, поскольку направлены не только на восстановление утраченных функциональных возможностей, но и на существенное повышение качества жизни пациентов
Ключевые слова: сахарный диабет, пародонт, кость, ортопедическое лечение.

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