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PERIODONTAL CONDITION IN RATS WITH EXPERIMENTAL DIABETES MELLITUS AFTER ORTHODONTIC SURGERY

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Abstract

Background. Determine periodontal condition in rats with experimental diabetes mellitus after orthodontic surgery.

Methods. In rats, type 1 diabetes mellitus (DM1) was reproduced with aloxane (100 mg / kg, intraperitoneally) once. Orthodontic surgery was performed by fixing the spring, starting from the 12th day. Animal euthanasia was performed on the 35th day of the experiment. The activity of urease, lysozyme, catalase, elastase, as well as the content of malondialdehyde (MDA) and hyaluronic acid were determined in the gum homogenate. In the alveolar bone homogenate, the activity of alkaline phosphatase (AlP) and acid phosphatase (AcP) and elastase was determined, as well as the content of calcium and protein. The antioxidant-prooxidant index (API) was calculated by the ratio of catalase activity and MDA content, and the degree of dysbiosis according to A. P. Levitsky was calculated by the ratio of the relative activities of urease and lysozyme. The mineralizing activity (MA) was calculated by the ratio of the activity

of alkaline phosphatase (AlP) and AcP in the bone tissue and the mineralization (MD) degree was calculated by the ratio of the concentration of calcium, and protein.

Results. In rats with DM1, the level of elastase, urease, MDA and the degree of dysbiosis increase in the gum, however, the level of lysozyme, hyaluronic acid, and the API index decrease. In the bone tissue of the periodontium of rats with type 1 diabetes, the level of alkaline phosphatase and MA decreases, but the level of AC increases. Orthodontic surgery significantly reduces the degree of dysbiosis in the gums and shows a tendency to increase API and decrease elastase activity. After orthodontic surgery, rats significantly increase the level of alkaline phosphatase and MA.

Conclusion. With type 1 diabetes, periodontitis, dysbiosis develops and the mineralizing activity of periodontal bone tissue decreases. Orthodontic surgery tends to improve periodontal conditions.

Keywords: periodontium; diabetes mellitus; orthodontics; dysbiosis; inflammation; mineralizing activity.

INTRODUCTION

Diabetes mellitus is characterized by the development of pathological processes in tissues of mouth [1-5]. Established development with diabetes oral dysbiosis [6, 7], inflammatory dystrophic processes in the mucosa oral and periodonticus. Of course, any operational intervention in the mouth on the background of diabetes must have a special character of the flow and require special of approach to prevent possible complications [8-10]. Purpose of this research was the definition of the state of the gums and bone periodontal rats after orthodontic operation on the background of diabetes.

MATERIAL AND RESEARCH METHODS

Experiments were carried out by 20 White rats line Wistar (males, 3 months, the average live weight 125 grams), distributed in 3 groups: 1st (7 rats) – intact, 2nd (8 rats), and 3-I (5 of rats) – with diabetes type 1, which caused by alloxane (100 mg/kg, in /abdominal, once). Rats 3rd group, since the 12th day of experience, fixed the spring [11]. Euthanasia animals was carried out on the 35th day of experience under thiopental anesthesia (20 mg/kg) by total loos blood from of the heart, excise gum and allocated alveolar bone mandible. In homogenate gums was determined activity urease (index of microbial seedling) [12], lysozyme (marker nonspecific immunity) [12],

elastase (biochemical marker of inflammation) [13], catalase (antioxidant enzyme) [13] and the content of malonic acid dialdehyde (MDA), indicator of lipid peroxidation [13], as well as content hyaluronic acid [14]. In homogenate of periodontal bone was determined activity alkaline (AlP), and acid (AcP) phosphatases [15], the content of calcium [15], protein [15] and activity elastase [13]. Ratio of relative activities urease and lysozyme calculated the degree of dysbiosis by A. P. Levitsky [12]. Ratio activity catalase and the content of MDA was calculated antioxidant-prooxidant index API [13]. Ratio AlP and AcP calculated mineralizing index (MI) [16], and on the ratio of the content of calcium and protein was determined the mineralization degree (MD) of bone [16]. The resiults of experiments were subjected to a standard statistics processing [17].

RESULTS AND DISCUSSION

In table 1 presents the results of determine the number of biochemical parameters of rats gums with diabetes type 1, who carried out orthodontic operations.

Table 1. Biochemical parameters of the gums of rats with type 1 diabetes mellitus and orthodontic treatment

№№	Indicator	First group intact	Second group diabetic (DM1)	Third group DM1+orthodontic surgery
1	Urease, mk-kat/kt	0,95±0,24	1,82±0,29 p<0,05	1,18±0,33 p>0,3; p_1>0,05
2	Lysosyme, units /kg	196±14	167±16 p>0,1	184±27 p>0,3; p_1>0,3
3	Elastase, mk-kat/kg	34,5±1,5	40,8±1,9 p<0,05	38,9±2,3 p>0,05; p_1>0,3
4	MDA, mmol/kg	13,9±1,6	22,9±1,5 p<0,01	16,7±1,4 p>0,1; p_1>0,05
5	Catalasa, mkat/kg	6,3±0,3	6,8±0,3 p>0,05	6,4±0,2 p>0,5; p_1>0,1
6	Hyaluronic acid, mg/kg	2340±430	1786±226 p>0,2	2120±265 p>0,3; p_1>0,3
7	Degree of dysbiosis	1,00±0,15	2,42±0,26 p<0,01	1,31±0,19 p>0,1; p_1<0,05
8	API	4,53±0,38	2,97±0,29 p<0,05	3,83±0,37 p>0,1; p_1>0,05

Note: p – in comparison with gr. 1; p_1 – in comparison with

As seen from these data activity urease rats with diabetes significantly increases (2 times), indicating the increase in microbial seedling periodontal tissues. After orthodontic operations activity urease normal, indicating a favorable the influence of this operation on oral microbiocenosis. Activity elastase in gums rats with diabetes significantly increases, indicating the development of inflammation (gingivitis). The second marker of inflammation – MDA also increased 65 % in rats with diabetes. Orthodontic operation almost normalizes both a marker of inflammation that again shows favorable the influence of orthodontic operations on parodontis. Activity lysozyme, catalase and the content of hyaluronic acid in gums of rats with diabetes change is insignificant, but also little change after surgery.

Degree of dysbiosis gums of rats with diabetes is increased 2.4 times, and after orthodontic operations was normal. Index IPA, on the contrary, decreases with diabetes and normal after orthodontic operations. In table 2 results of determine the number of biochemical parameters bone periodontal. It is clear that the activity of alkaline phosphatase significantly reduced in rats with diabetes and fully recovered after orthodontic operations. Activity acid phosphatase significantly increases with diabetes and little changed after surgery. Calcium content, protein and activity elastase in bone not undergo significant changes in diabetes or in combination of diabetes with orthodontic operation. Does not change also exponent mineralization periodontal bone, but meniralizing index MA determined by the relation AlP/AcP, reduced rats with diabetes more than 2 times, but orthodontic operation it restores almost to the norm.

Thus, conducted by us study have confirmed data literature [6, 7] on the development of dysbiosis and inflammation in parodont at diabetes and reducing mineralizing activity of bone. New is that we managed to show beneficial effect orthodontic operations on the rats with diabetes: they have decreased microbial seedling, the degree of dysbiosis, inflammation and normalized mineralizing activity of bone.

Obtained us data indicate of the possibility of the implementation of orthodontic operations in patients with diabetes, without fear of the development of complications. On the contrary, orthodontic operation has a favorable stimulating defenses, the effect.

Table 2. Biochemical parameters of periodontal bone tissue of rats with type 1 diabetes mellitus and orthodontic treatment.

№№	Indicator	First group intact	Second group diabetic (DM1)	Third group DM1+orthodontic surgery
1	Alkaline phosphatase, mk-kat/kg	93,0±7,2	55,7±10,0 $p<0,05$	90,3±10,4 $p>0,5$; $p_1<0,05$
2	Acid phosphate, mk-kat/kg	7,2±0,8	10,4±0,6 $p<0,05$	9,9±1,8 $p>0,05$; $p_1>0,3$
3	Calcium, mol/kg	1,55±0,14	1,39±0,09 $p>0,3$	1,25±0,23 $p>0,1$; $p_1>0,3$
4	Protein, g/kg	24,6±2,4	20,7±1,5 $p>0,05$	22,9±1,3 $p>0,3$; $p_1>0,1$
5	Elastase, mk-kat/kg	14,4±1,7	14,0±1,8 $p>0,5$	16,2±1,8 $p>0,3$; $p_1>0,3$
6	MA	12,90±1,05	5,35±0,64 $p<0,01$	9,12±1,10 $p>0,05$; $p_1<0,05$
7	CM	2,52±0,23	2,69±0,26 $p>0,3$	2,18±0,22 $p>0,3$; $p_1>0,05$

Note: see tables

CONCLUSIONS

1. Diabetes is the development of the parodont dysbiosis, inflammation and reduction mineralizing activity bone.

2. Orthodontic operation has a benefit with diabetes, which gives a reason to implement such operations in persons with diabetes.

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