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STUDY OF THE MINERAL STRUCTURE OF THE ORAL FLUID IN PATIENTS WITH CHRONIC DISEASES OF THE SALIVARY GLANDS USING DIFFERENT FIXED DENTURES

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Abstract

The paper is devoted to a question of improvement of the prosthetics quality with fixed dentures in patients with inflammatory affections of the salivary glands.

The comparative analysis of prosthetics results with metal and ceramic bridge dentures has shown that the level of the saliva osmolality in patients with CDSG was by 14.5 % higher. Their indices remain by 34.9 % decreased in application of the metal constructions, by 26.0 % - in metal - ceramic prosthetics and by 10.4 % - in prosthetics with whole cast ceramic constructions.

Keywords: oral fluid, dentures, microelements, osmolality, phosphates, calcium of the saliva.

Urgency of the topic. Morphology and physiology of the salivary glands has been serving as an object of research attention for many decades and has been fairly recognized as fully enough investigated [1, 2, 9, 10, 11, 12, 13]. The certain peculiarities of salivation and saliva remain not integrated with a number of concepts of modern physiology and morphology, and, on the other hand, they demand accumulation of new facts enriching or rejecting general scientific notions in physiology of the salivary glands, its applied aspects [3]. Therefore, physiology of the person's salivation is important in the general scientific and applied plan, being one of directions of dentistry.

Wide variability of salivation, structure and properties of the saliva is well-known, however, explanation for this phenomenon is not considered full enough only on the basis of double innervation of the glands with a different set of glandulocytes in their structure [4]. However, the study of changes in the saliva and oral fluid is interesting in partial adentia and application of various kinds of prosthetics. A number of researches of modern scientists [5, 6] are devoted to this aspect. However, the study of these changes in patients already having disturbances in the salivary glands – those suffering from chronic inflammatory diseases of these glands- are important enough. The given work is devoted to this question. The purpose of the research is to investigate changes of the oral fluid structure in patients suffering from chronic diseases of the salivary glands (CDSG) and using fixed dentures in the comparative aspect.

Materials and methods of studies. There were examined 83 patients suffering from chronic diseases of the salivary glands who were divided into groups depending on the kind of prosthetics and therapeutic management. There was also a control group of the practically healthy persons. By the kind of prosthetics all patients were distributed as it was shown in Table 1.

Collection of the oral fluid under the conditions of spontaneous salivation in all examined patients was made on an empty stomach at 9.00 a.m. Saliva was collected during 15 min, then all examined patients rinsed the mouth fivefold with 0.9 % solution of chemically pure sodium chloride (osmolality value of the salt solution was 280 mOsm/kg H₂O) during 3 min. Repeated collection of the saliva was made in 30 min after finishing the oral cavity rinsing according to the above described technique. During collection of the saliva the examined were at rest, in the sitting position, in the comfortable temperature conditions. Immediately after collection of the saliva samples the fluid has been centrifuged for 20 min at 3000 rev/min and supernatant layer was also collected for further biochemical analysis. In the received samples of the saliva the osmolality value was determined by the cryoscopic method by the osmometer 3D3 (manufactured by the firm “Advanced Instruments” (USA). The concentration of nitrites and nitrates in the saliva was determined in the presence of Griss reactant photometrically ($\lambda = 540$ nanometers) by the spectrophotometer SF-46 (Russia) [7]. The concentration of the general calcium in the saliva was determined by the photometric method ($\lambda = 590$) by the spectrophotometer SF-46 (Russia) in reaction with Arsenazo -III, using standard sets for in vitro diagnostics manufactured by the firm Simko Ltd (Ukraine). The concentration of inorganic phosphates in the saliva was determined by the photometric method ($\lambda = 670$ nanometer) by the spectrophotometer SF-46 using molybdenum- acidic ammonium [8]. The saliva samples were subjected to preliminary deproteinization in presence of the aqueous trichloroacetic acid. The content of the molecules of the average weight was judged by values of supernatant extinction, obtained after treatment of the saliva by the solution of the trichloroacetic acid. The value of optical density was determined in the spectrum ranges of 254 and 280 nanometers by the CF-46 according to the technique described in the literature [9].

The analysis and discussion of the research results. In prosthetics with metal constructions without covering in correlation with presence/absence of chronic diseases of the salivary glands the following laboratory indices (Table 2) have been obtained.

It is established that in prosthetics with these constructions there is observed a distinct increase (by 26.1%) of the saliva osmolality value against the background of reduction (by 73.9%) of the nitrite-anions concentration index in the saliva. There was revealed an increase of the phosphate level of persons with chronic diseases of the salivary glands (by 91.4%), and increased concentration of calcium (by 49.3%) in comparison with I group under study (somatically healthy persons without dentures).

It is also necessary to note that the amount of molecules of the average weight in the group of patients suffering from CDSG, and earlier having metal dentures, increases considerably - 2.2 times regarding the control group.

Analyzing the results obtained, it should be noted that the specified constructions lead to further reduction in the saliva osmolality, which is already marked in persons with defects of dentitions and suffering from the salivary gland affection (Fig. 1). In our opinion it is caused by the increased salivation amount as reaction to the presence of a cobalt-chromic alloy in the mouth and the alloyed admixtures.

Values of the Na^+ and K^+ concentrations in the oral fluid of these groups of patients are presented in Fig. 2. Taking into account the data obtained, it is seen that the Na^+ and K^+ ion concentrations in the given series of studies show the identical tendency. So, their concentration increases in patients suffering from CDSG and having metal constructions, though inconsiderably – by 13.3 and 1.3 % accordingly (III group) against the background of certain reduction in somatically healthy persons, having the same constructions – by 3.7 and 8.8 % accordingly.

At the same time while studying the oral fluid of patients with metal - ceramic and whole cast ceramic bridge dentures we have received the following results (Table 3)

In comparison with the results of prosthetics with metal constructions using metal-ceramic the level of the saliva osmolality in patients is by 14.5% higher. The patients with chronic dysfunction of the salivary glands have the index decreased by 26.0 % in prosthetics with the bridge dentures with covering and by 10.4 % in prosthetics with whole cast ceramic constructions.

As to the concentration of nitrites there is observed insignificant and not always reliable ($p > 0.05$) decrease of the index.

The concentration of phosphates in prosthetics is reliably ($p < 0.01$) different in prosthetics with whole cast ceramic dentures in this specific group of patients in comparison with a group with metal dentures by 34.0 % (Table 3).

The concentration of calcium was more optimum in prosthetics of the patients with whole cast ceramic constructions in comparison with metal-ceramic ones (less by 6.4 %) and was essentially reliably ($p < 0.01$) lower in comparison with metal constructions (by 11.5 %).

It should be also noted that the amount of molecules of the average weight in the group of patients suffering from diseases of the salivary glands and having ceramic constructions is restored almost up to the level before prosthetics.

Values of the Na^+ and K^+ concentration in the oral fluid in prosthetics by metal - ceramic- dentures are presented in Fig. 4 and 5.

Taking into the account the data obtained, it is obvious that the concentration of Na^+ ions in patients with CDSG reaches its peak in their prosthetics with metal constructions. It is especially evident compared with the data obtained in comparison with results of prosthetics of the somatically healthy persons. It is also obvious that prosthetics with ceramic dentures is the most effective from the point

of view of minimization of the influence on the structure of the oral fluid and negative influence on the salivary glands

While considering the situation with K^+ ions the situation is even more informative, as the concentration in prosthetics with ceramic dentures is lower than the level before prosthetics.

On the whole the data obtained allowed to mark that in prosthetics with ceramic-metal constructions of the patients suffering from CDSG, the optimal variant of the fixed construction is minimization of interaction of the metal and oral cavity, indirectly- salivary glands.

Conclusions. The patients suffering from chronic diseases of the salivary glands are observed to have significant deviations in the mineral structure of the saliva, namely increased concentration of cations of calcium and inorganic phosphates. In its turn it leads to significant reduction in the level of hygiene in this category of patients resulting in difficulty of using fixed constructions.

The concentration of sodium and potassium ions increases in the patients suffering from CDSG and having metal constructions, though inconsiderably – by 13.3 and 1.3 % accordingly against the background of certain reduction in somatically healthy persons having the same constructions– by 3.7 and 8.8 % accordingly.

The data obtained have allowed to note that in prosthetics with metal constructions the patients suffering from CDSG are observed to have negative changes in the oral fluid structure.

In comparison with results of prosthetics with metal constructions the application of metal-ceramic constructions the level of the saliva osmolality in patients is by 14.5 % higher. The index remains by 26.0 % decreased in patients with chronic dysfunction of the salivary glands and by 10.4 % in prosthetics with ceramic constructions.

Dentures in patients with chronic diseases of the salivary glands lead to a change in the concentration of the mineral elements in the oral fluid. The metal – ceramic dentures exert the least influence on mineral homeostasis of the oral fluid (only the increased concentration of sodium ions is noted), ceramic dentures cause moderate increase in the concentration of phosphates; calcium ions.

References

1. Aquaporins in salivary glands and pancreas / Delporte C. // *Biochim Biophys Acta*. 2013 Aug 15. : S0304-4165.
2. Parotid gland involvement as initial presentation of Wegener's granulomatosis: a diagnostic pitfall / Kenis I, Zahavi T, Korzets Z. // *Isr Med Assoc J*. 2013 Mar;15(3):186-7.
3. Elichev I.V. Salivodiagnosics in characteristic of conditions of the dentition / Thesis of doctor of philosophia. – Krasnodar, 2004. – 231 p.
4. Wegener's granulomatosis and the salivary glands / Nahlieli O. // *Isr Med Assoc J*. 2013 Mar;15(3):178-9.
5. Association of masticatory performance with age, gender, number of teeth, occlusal force and salivary flow in Japanese older adults: is aging a risk factor for masticatory dysfunction? / Ikebe K, Matsuda K, Kagawa R, Enoki K, Yoshida M, Maeda Y, Nokubi T. // *Arch Oral Biol*. 2011 Oct;56(10):991-6.
6. Saliva secretion and oral health in a hospitalized geriatric population in Israel / Last Pollak M, Eliav E, Glick Z, Zusman SP. // *Refuat Hapeh Vehashinayim*. 2002 Jul;19(3):74-8, 91.
7. Evaluation of intoxication by an imbalance between accumulation and binding of toxins in the plasma / Gavrilov, VB, Bidula MM, Furmanchuk DA, Konev SV, OV Aleinikova // *Clinical laboratory diagnostika*.-1999. - № 2.-P.13-17.
8. Menshikov VV Handbook. Laboratory Methods in the clinic. - Moscow: Medicine, 1987.-368 s.
9. Universal method for determining nitrate in biological media of the body / Yemchenko NL, Tsiganenko OI, Kovalevskaya TV // *Clinical and laboratory diagnostika*.-1994. - № 6.-P.19-20.
10. S.I. Dolomatov, W. Zukow, I.D. Atmazhov, R. Muszkieta, and A. Skaliy. The use of hormones indicators in human saliva in diagnosing parodontitis in pregnant women. *Indian Journal of Human Genetics*. Sep-Dec 2012; 18(3): 305-309.
11. Dolomatov, S., Zukow, W., Atmazhov, I. D., Muszkieta, R., & Skaliy, A. (2012). The use of biochemical indicators in human saliva for diagnostics periodontitis during pregnancy. *Journal of Health Sciences* 2(4): 89-102.
12. И. Д. Атмажов, Е. Д. Бабов, Оценка уровня гигиены полости рта и протезов у лиц, страдающих хроническими заболеваниями слюнных желез. *Dosiagnenia biologii ta medycyny*. 2012. 20 (2): 29-33.
13. Атмажов, И. Д., Бабов, Е. Д., Atmazhov, I. D., & Babov, Y. D. (2001). Evaluation of oral hygiene and dentures in individuals with chronic diseases of salivary glands. The article is devoted to the actual problem of dentistry—improving the quality of prosthetic dentures of persons suffer. *Пародонтология*, (1/2), 13.

Table 1.

Distribution of patients into groups taking part in the studies

A kind of prosthetics	Somatically healthy persons (subgroup A)	Patients with CDSG	Total		
			With dentures (subgroup B)	With dentures and application of the preventive methods (subgroup C)	
1 group – Whole cast bridge prosthesis	12	11	9	35	
2 group – Metal ceramic bridge prosthesis	9	7	8	26	
3 group – Whole cast ceramic bridge prosthesis	8	6	8	22	

Total:	29	24	25	83
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Table 2

Biochemical indices of the saliva in patients with whole cast bridge prosthesis depending on affection of the large salivary glands, $\bar{M} \pm m$

Indices studied	Without diseases	gland		With CDSG	
				Before prosthetics	In 1 year
Osmolality, mOsm/kg H ₂ O			84.0±9.0	65.0±7.0 p<0.05	62.4±0.5 p<0.05
Nitrite concentration, mcmol/l			2.3±0.3	2.6±0.2 p<0.01	1.7±0.2 p>0.01
Phosphate concentration, mmol/l			3.5±0.2	3.7±0.4 p>0.05	6.7±0.6 p<0.01
Calcium concentration, mmol/l			1,=.40±0,05	1.89±0.10 p>0.05	2.09±0.07 p<0.01
Molecules of the middle mass, λ=254 nm			56.0±8.0	89.0±7.5 p 0.05	125±12 p<0.01
Molecules of the middle mass, λ=280 nm			83.0±9.0	102,0±7,5 p<0.05	137±13 p<0.05

Note: p – index of reliability of differences in comparison with a group A of somatically healthy persons

Table 3

Biochemical indices in patients using metal-ceramic dentures depending on affection of the large salivary glands, $\bar{M} \pm m$

Indices studied	Somatically healthy persons	With CDSG			
		Metal-ceramic dentures	Whole ceramic dentures	Metal-ceramic dentures	Whole ceramic dentures
Osmolality, mOsm/kg H ₂ O		96.2±8.5	107.9±4.5 p>0.05	71.2±5.5 p<0.05	86.2±3.3 p<0.05
Nitrite concentration, mcmol/l		2.1±0.2	2,7±0.1 p<0.05	2.6±0.4 p>0.05	2.0±0.1 p>0.05
Phosphate concentration, mmol/l		3.57±0.04	4.59±0.05 p<0.01	6.10±0.4 p<0.01	4.42±0.07 p<0.01
Calcium concentration, mmol/l		1.81±0.02	2.45±0.05 p<0.01	1.97±0.03 p<0,01	1.85±0.05 p>0.05
Molecules of the middle mass, λ=254 nm		54.5±3.0	46.2±2.0 p<0.05	90,5±4,0 p<0.01	69.5±1.0 p<0.01
Molecules of the middle mass, λ=280 nm		85.2±2.0	77.7±4.0 p>0.05	96.2±2.0 p<0.05	82.4±2.5 p>0.05

Note: index of reliability of differences in comparison with a group with whole cast dentures.