Methods Of The Individual Selection Of Dental Structural Metal Alloys For The Treatment Of Patients With Teeth And Dentition Defects

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Abstract: Pathological reactions of the body associated with the development of a patient's symptom complex of intolerance to metal alloys are some of the complications in prosthodontics. This work is aimed at optimizing the results of the individual selection of dental metal alloys for preventing the development of intolerance to orthopedic fixed structures. A survey was conducted with the participation of 73 patients (30 males and 43 females) aged 22 to 70 years. They were divided into two groups. The first group included patients (n=31), who did not have orthopedic metal structures (control group). The second group consisted of patients (n=42) with stamped-brazed metal orthopedic structures with a nitride-titanium coating, as well as ceramic-metal and metal-plastic dentures. Various manifestations of intolerance to metal alloys were observed in all patients of this group. A study was made of the electrical conductivity of biologically active points of the "lymphatic meridian state" and "head allergy" in patients with intolerance to metal orthopedic dental structures, based on the methods by V. Nakatani and R. Voll. Such denture construction materials as stainless steel 20Kh18N9T, cobalt-chromium alloy "Vitalium" and nickel-chromium alloy "Viron-88" were tested. It was revealed that when using the Vitalium alloy, the risk of individual hypersensitivity to dental structural metal alloys is the least. The survey results indicate the dominant role of concomitant pathology (92.85%) in the development of "intolerance to structural metals" and demonstrate the formation of an endless circle (concomitant pathology leads to the emergence of "intolerance", which in turn worsens the course of somatic diseases). The development of "intolerance" when using combined constructions (metal + ceramics) makes it difficult to conduct differential diagnosis and, accordingly, treatment tactics. The analysis of the results shows the sufficient sensitivity of electropuncture diagnostic methods in identifying intolerance to metal orthopedic structures. These methods make it possible to determine a patient's predisposition to individual hypersensitivity to dental alloys, to identify the incompatibility of certain metals with a patient's body, and to select the most compatible materials with regard to the role of concomitant pathology. The conducted study allowed us to develop a two-step algorithm of diagnostic measures for patients at risk of hypersensitivity to dental metal alloys.

Index Terms :dental structural metal alloys, electropuncture diagnostics

1. INTRODUCTION

PATHOLOGICAL reactions of the body associated with the development of a patient's symptom complex of intolerance to metal alloys are some of the complications in the practice of prosthodontics. These types of complications belong to the "iatrogenic" group. Prosthodontists may be faced with precedents for a conflict situation related to the selection of a structural metal alloy when choosing therapeutic orthopedic measures [2,4,8,10]. Therefore, the need to study the causes of patients' increased sensitivity to structural metal alloys and to develop unified approaches to the selection of orthopedic treatment methods and means is relevant [5,9]. Currently, in order to diagnose the state of the human body as a whole and its individual systems, those methods based on the study of the electrophysiological parameters of so-called biologically active points (BAP) are used. Such methods are also widely used to detect intolerance to dentures [3-4]. Carrying out a comparative assessment of methods for diagnosing intolerance to metallic inclusions in the oral cavity, researchers testify to the high efficiency of the methods of ryodoraku (from Japanese ryo – good, do – (electro) conductivity, raku – line) by V. Nakatani (Nakatani V., Amer S. 1956) [1,12] and electroacupuncture by R. Voll, when measuring the electric potentials of dentures, as well as allergic tests performed with metal alloy samples, in contrast to the low informativeness of the pH-test of mixed saliva [3,11,13,14].

Nowadays, when almost the entire population suffers from allergies of varying severity, this test helps doctors to choose medications that will not cause allergic reactions in patients. A similar principle of drug-induced testing is the basis for the selection of household chemicals and food products. It is directly important for the selection of denture and filling materials. As known, the human autonomic nervous system works in the following way – it gives a command to stimulate or inhibit various processes in the body. Therefore, when the organs recognize the drug substance, they give a signal through the autonomic nervous system, which, in turn, changes the electrical conductivity at the acupuncture point [6-7]. The purpose of the present work is to optimize the results of the individual selection of dental metal alloys for preventing the development of intolerance to orthopedic fixed structures.

2 MATERIALS AND METHODS

A survey was conducted with the participation of 73 patients (30 males and 43 females) aged 22 to 70 years. They were divided into two groups. The first group included patients (n=31), who did not have orthopedic metal structures (control group). The second group consisted of patients (n=42) with stamped-brazed metal orthopedic structures with a nitride-titanium coating, as well as ceramic-metal and metal-plastic dentures. Various manifestations of intolerance to metal alloys were observed in all patients of this group. For the individual selection of structural metal alloys, the study used the methods of ryodoraku by V. Nakatani and electroacupuncture by R. Voll [1,3,11]. The individual selection of structural metal alloys in the second group patients with the diagnosis of intolerance was carried out after the removal of orthopedic structures, as well as the examination and treatment of

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concomitant pathology by specialists of the corresponding profile. Electropuncture testing using the ryodoraku method was carried out in two stages: stage 1 – in the initial state of the dentition; stage 2 – 24 hours after fixing the mouthguard with the metal alloy used. The measurements by the method of V. Nakatani were performed using the digital measuring instrument "Garmoniya" ("EIT EURASIA" NGO), designed for electropunctural testing by measuring the electrical conductivity of the human body surface in the vicinity of the representative points of twelve paired meridians with subsequent data processing. The relative electrical conductivity of the skin was determined near the representative BAPs (P9, G15, E42, RP3, C7, JG5 (JG4), V65 (V64), R3 (R4), MC7, TR4, VB40, F2 (F3)) of each of the twelve paired meridians under exposure to direct current. The brackets show additional points used in the case of damage to the skin at the locations of the main representative points. Electroacupuncture testing according to R. Voll was carried out using the computer-connected device "Mini-Expert-DT" (Immedis-Voll). At a doctor's office, patients are required to: take off their clothes and wrap themselves in a white cotton sheet; remove all jewelry, watches, hairpins, glasses, removable dentures, etc.; sit down on a wooden chair and put their feet on a wooden stand. The measurements were carried out at two points: the "lymphatic meridian state" point, located in the distal metacarpal bone of the first finger from the radial side, and the "head allergy" point, which reflects the allergization of the whole organism as well as the state of lymphodynamics in case of vascular lesions, located in the distal metacarpal bone of the third finger on the border between the back and palmar surfaces. The measurement of electrical conductivity according to R. Voll also consisted of two stages: first, the initial state of BAPs was measured, then, after 24 hours, the measurements were made at the same points in contact with structural dental alloy samples. The study used mouthguards containing the tested structural metal alloy (stainless steel 20Kh18N9T, cobalt-chromium alloy (CCA) "Vitalium" and nickel-chromium alloy (NCA) "Viron-88") in a chamber located in the vestibular surface area of the alveolar bone. These mouthguards were made from Softray vinyl blanks according to the generally accepted technique, but with a pre-shaped chamber. The chamber for examining a metal sample was made as follows: on the vestibular surface of the alveolar bone of the lower jaw gypsum model, a metal sample was fixed with glue, on which the Softray blank was placed with the subsequent installation of the model in a vacuum shaper. The experimental results were processed by the methods of variation statistics with the assessment of the significance of differences using the Student-Fisher test.

3 RESULTS AND DISCUSSION

An. Vitae and An. Morbi were studied in more detail in the second group patients, which made it possible to identify concomitant pathology and analyze the clinical aspects of complaints in patients with the developed symptom of intolerance after orthopedic treatment with fixed orthopedic structures (Tables 1 and 2).

TABLE 1

THE EXAMINATION RESULTS OF THE SECOND GROUP PATIENTS

Pathology	Number of patients, n
Complaints of oral mucosa burning, metallic taste, headaches, fatigability, weakness	42 (100%) (n=42)
Concomitant pathology of organs and systems	39 (92,85%) (n=42)
Neuralgic pain	5 (11,9%) (n=42)
Exacerbation of somatic diseases after the application of metal orthopedic structures	36 (85,71%) (n=42)
Occupational hazards	9 (21,42%) (n=42)

TABLE 2

CONSTRUCTION DENTURE MATERIALS IN THE SECOND GROUP PATIENTS

Materials	Number of patients, n
Stainless steel 20Kh18N9T with a nitride-titanium coating	18 (42,85%)
Cobalt-chromium alloy "Vitalium"	3 (7,14%)
Nickel-chromium alloy "Viron-88"	9 (21,42%)
Combined constructions Ceramics + "Viron-88" Ceramics + "Vitalium"	 8 (19,04%) 4 (9,52%)

As can be seen from Table 1, 39 (92.85%) patients from n=42 had a concomitant pathology of organs and systems, 36 (85.71%) patients indicated the development of "intolerance to structural materials", the exacerbation of existing chronic diseases after applying dentures, and the worsening of their general well-being in the form of rapid fatigability, weakness and irritability. Among the materials that caused "intolerance" in patients, the highest indicators were observed in stainless steel – 18 (42.85%) people and nickel-chromium alloys – 9 (21.42%) people. At the same time, gastroenterological, nephrological, endocrine diseases and metabolic syndrome were detected using the method of Voll and the subsequent generally accepted examination (ultrasonography of the abdominal organs, gastroscopy, blood biochemistry, antibody titer for the parasitic group, etc.). In these cases, patients were referred to the appropriate specialists for in-depth examination and treatment. Some patients – 5% (6 people) – expressed a desire to additionally receive homeopathic treatment. 3-6 months after the treatment, dental alloys were repeatedly selected for fixed denture structures, and orthopedic treatment was successfully performed. Thus, the survey results indicate the dominant role of concomitant pathology (92.85%) in the development of "intolerance to structural metals" and demonstrate the formation of an endless circle (concomitant pathology leads to the emergence of "intolerance", which in turn worsens the course of somatic diseases). The development of "intolerance" when using combined constructions (metal + ceramics) makes it difficult to conduct differential diagnosis and, accordingly, treatment tactics. The results of the study of electrical conductivity in the corresponding BAPs are given in Table 3.

TABLE 3

THE AVERAGE VALUES OF ELECTRICAL CONDUCTIVITY IN THE CORRESPONDING BAPS IN TESTING WITH VARIOUS STRUCTURAL MATERIALS

BAP	Electrical conductivity, $(Ohm \cdot m)^{-1}$				
	I group (control) n=31	II group (experimental) n=42			
		Source data ("background" level)	After testing (24 hours)		
			Stainless steel 20X18H9T	NCA "Viron-88"	CCA "Vitalium"

BAP of jaw lymph flow	56,3±1,4	51,4±1,5 p_2 <0,05	37,3±1,7 p_1 <0,001 p_2 <0,001	44,6±1,9 p_1 <0,01 p_2 <0,01	48,3±2,1 p_1 >0,05 p_2 <0,011
BAP of oral cavity allergy	64,7±1,6	58,3±1,4 p_2 <0,01	32,5±2,1 p_1 <0,001 p_2 <0,001	41,3±1,8 p_1 <0,001 p_2 <0,001	57,2±2,0 p_1 >0,05 p_2 <0,011
***Note: 1 - differences with the source data; 2 - differences with control.					

The obtained quantitative indicators of electrical conductivity establish the following line of correspondence to an increase in intolerance to the tested metal orthopedic structures: CCA "Vitalium" < NCA "Viron-88" < stainless steel 20Kh18N9T. As can be seen from the study, when using the CCA "Vitalium", the data of the ryodoraku increased almost to the background level on the day after removing the mouthguard. The effect of stainless steel 20Kh18N9T on the electrical conductivity of the BAP of the jaw lymph flow and the BAP of the oral cavity allergy is estimated by a decrease in the indicators relative to the background level by 50.94% and 88.61%, respectively. When using the NCA "Viron-88", the electrical conductivity in the indicated BAPs is reduced compared to the source data by 26.23% and 48.43%, respectively. This method makes it possible to select the most optimal metal alloys, plastic compositions from the available kit, filling materials and anesthetic agents within a few minutes. At the same time, an assessment was made of the state of patients' organs and systems with a focus on a more thorough examination of the gastrointestinal tract. One should note once again the non-invasiveness and complete safety of this technique. At the same time, the test is quite convincing and causes a positive reaction in patients, which gives a good psychotherapeutic effect. The applied method helped to select the compatible (neutral) materials for the body, while significantly reducing the material and time costs of patients. Thus, this analysis shows the sufficient sensitivity of electropuncture diagnostic methods in identifying intolerance to metal orthopedic structures. These methods make it possible to determine a patient's predisposition to individual hypersensitivity to dental alloys, to identify the incompatibility of certain metals with a patient's body, and to select the most compatible materials with regard to the role of concomitant pathology. The conducted study allowed us to develop a two-step algorithm of diagnostic measures for patients at risk of hypersensitivity to dental metal alloys:

1. The electropuncture diagnostics of intolerance to structural dental metal alloys for the purpose of individual selection;
2. The manufacture of dentures with regard to the individual selection of structural materials.

4 CONCLUSION

1. Electropuncture diagnostics using the methods by Nakatani and Voll are highly sensitive with respect to the risk of developing the phenomena of individual hypersensitivity to dental structural metal alloys. These methods make it possible to evaluate the biocompatibility of various dental structural metals with a patient's body and can serve as a method of choice for their individual selection.
2. The absence of cases of hypersensitivity to structural metal alloys in patients at risk after orthopedic treatment indicates the advisability of using their individual selection. The occurrence of relapses in the intolerance group patients, even after the individual selection of materials, presumably indicates the complexity of the metallotoxic effect of ionized alloy elements on tissue proteins that provokes an immune response.
3. Based on the conducted study, a scientifically based algorithm for the phased diagnosis of hypersensitivity to structural metal alloys has been proposed and tested.

This algorithm for the phased diagnosis of hypersensitivity to structural metal alloys is effective and simple to implement, which makes it possible to recommend it for wider implementation in practice.

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