GALVANOSIS AND ITS DIAGNOSTIC METHODS IN THE CLINIC ORTHOPEDIC DENTISTRY

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Abstract. *In modern orthopedics, about 20 metals are used to make prostheses from various metal alloys. If there are prostheses made of different metals in the oral cavity, a pathological condition called galvanosis may be observed.. The occurrence of this phenomenon is caused by electrochemical effects from saliva. Each metal has its own potential value. If there are alloys of metals with different potentials in the oral cavity, then when they are closed, galvanic cells are formed, and the metal with a higher potential will dissolve.*

Key words*: galvanosis, differential diagnostics, examination.*

ГАЛЬВАНОЗ И МЕТОДЫ ЕГО ДИАГНОСТИКИ В КЛИНИКЕ ОРТОПЕДИЧЕСКОЙ СТОМАТОЛОГИИ

Аннотация. *В современной ортопедии для изготовления протезов из различных металлических сплавов используют около 20 металлов. При наличии в полости рта протезов из разных металлов может наблюдаться патологическое состояние, называемое гальванозом. Возникновение этого явления обусловлено электрохимическим воздействием со стороны слюны. Каждый металл имеет свое значение потенциала. Если в полости рта находятся сплавы металлов с разными потенциалами, то при их замыкании образуются гальванические элементы, и металл с более высоким потенциалом растворяется.*

Ключевые слова: *гальваноз, дифференциальная диагностика, обследование.*

To eliminate dental defects in orthopedic dentistry, prosthetics with fixed structures made from base metal alloys are widely used. For orthopedic treatment, stainless steels, cobalt-chromium and silver-palladium alloys, gold-based alloys, platinum, etc. are currently used, which include the following metals: iron, chromium, nickel, titanium, manganese, silicon, molybdenum, cobalt, palladium, zinc, silver, gold, etc. To connect the parts of dental prostheses, solder is used, the components of which are silver, copper, manganese, magnesium, cadmium. Thus, about 20 metals are used to make prostheses from various metal alloys.

In the presence of dentures made of different metals in the oral cavity, the phenomenon of galvanism is observed, which over time develops into a pathological condition - galvanosis.

Saliva as an electrolyte is a complex biochemical environment. Saliva contains water

(98%), minerals (1–2%) and organic substances (nitrogen-containing products, 133.9 mg%), non-protein products – free amino acids: lactic, pyruvic, acetic, citric, malic, oxaloacetic; urea (14–75 mg%); uric acid (2.5 mg%); tyrosine (0.98 mg%); tryptophan (0.86 mg%); B vitamins (thiamine, riboflavin, pyridoxine), biotin, ascorbic acid, etc.; enzymes: diastase, ptyalin, oxidase, peroxidase, catalase, lactate dehydrogenase, acid and alkaline phosphatases, proteinases, etc.

Of the inorganic substances, saliva contains chlorine, bromine, iodine, and fluorine anions. Phosphate and fluorine anions contribute to an increase in electrochemical potentials, while the chlorine anion contributes to the transfer of ionic charges and is a depolarizer (a factor that accelerates anodic and cathodic processes).

Microelements are determined in saliva: iron, copper, silver, manganese, aluminum, etc. – and macroelements: calcium, potassium, sodium, magnesium, phosphorus.

Microelements are essential for the body in biotic quantities, as they are activators of biochemical reactions, being part of enzymes, vitamins, and hormones.

Thus, cobalt is a part of vitamin B12, arginase (decomposes proteins), activates oxidases. Copper is a part of oxidase, hemosiderin, participates in the formation of leukocytes, hemoglobin, ascorbic oxidase, oxidizing vitamin C. Iron is a part of hemoglobin, oxidase, catalase.

Saliva has buffering and neutralizing properties. The buffering capacity of saliva is the ability to neutralize acids and alkalis and is considered a protective mechanism. The buffering properties of saliva are determined by the bicarbonate, phosphate systems, and also by the protein of saliva (total protein 0.18%).

The buffer capacity of saliva increases with the consumption of proteins and vegetables, decreases with tooth loss, carbohydrate intake, and depends on the concentration of hydrogen ions (pH) of saliva. This indicator fluctuates within the range from 5.0 to 8.0.

The average pH of saliva is 6.9. A shift in pH to the acidic side occurs in periodontitis (locally, in the gingival pocket), in inflammation foci in diseases of the oral mucosa, and in diseases of the gastrointestinal tract. Thus, saliva as an electrolyte largely contributes to electrochemical processes between metal prostheses in the oral cavity.

Products of electrochemical reactions: galvanic currents, microelements such as copper, cadmium, chromium, tin, etc., are the causative factors of toxicochemical diseases (galvanosis, toxic stomatitis).

The occurrence of such phenomena is caused by the electrochemical activity of the oral cavity, the liquid secretion of which – saliva – is a complex electrolyte. The prosthesis introduced into the oral fluid is subject to electrochemical effects from the saliva and acquires an electronic potential.

Each metal has its own potential value. If there are alloys of metals with different potentials

in the oral cavity, then when they are closed, galvanic cells are formed, and the metal with a higher potential will dissolve**.**

Galvanosis is a disease caused by the action of galvanic currents that appear as a result of electrochemical processes in the oral cavity between metal dentures. It is characterized by a pathological symptom complex: metallic taste in the mouth, a feeling of acid, taste perversion, burning of the tongue, changes in salivation (dryness).

Changes in neurological status are noted: irritability, headaches, cancerophobia, general weakness, etc. Subjective sensations are noted by patients 1–2 months after metal prosthetics stainless steel prostheses or after repeated orthopedic treatment with the addition of a new bridge prosthesis made of gold alloy, or a clasp prosthesis made of chromium-cobalt (other combinations of metal alloys are possible).

Typical complaints are a metallic taste in the mouth, a feeling of acidity. This unpleasant sensation is constant and intensifies when eating sour food. Taste perversion (taste sensitivity) is expressed in the fact that the intake of sweets is not fully perceived or as a feeling of bitterness.

It is known that the taste effect of any substance depends on its chemical composition. The position that taste is determined by the elements of the periodic table is confirmed by the microelement composition of saliva.

According to spectral analysis, the saliva of people with galvanosis on stainless steel dentures increases the quantitative content of copper, chromium, manganese and other microimpurities. Burning of the tongue, more often the tip or lateral surfaces, is due to the fact that the tongue is a powerful reflexogenic zone.

The simplest method is examination. When examining the oral cavity, changes in the mucous membranes are often not detected, with the exception of the tongue. The lateral surfaces and tip of the tongue are hyperemic, the tongue is somewhat swollen.

Crowns, inlays, fillings made of different metals are detected: stainless steel, gold alloys, chromium-cobalt alloys and various combinations thereof. Large oxide films are visible in the places of adhesions. The devices used to measure various parameters of the galvanic element of the oral cavity are: laboratory pH-meter-millivoltmeter pH-340, microammeter M-24, potentiometers of the PP-63, UPIP-601 type.

The microcurrent values that arise between gold bridge prostheses in practically healthy individuals are considered normal; they range from 1 to 3 μA (up to 50 mV). With galvanosis, the current strength increases. A direct relationship between electrical values and the severity of the clinical picture has not been established.

On the contrary, electrochemical processes, according to spectral analysis, indicate a direct connection between the change in the qualitative composition and quantitative content of

microelements of saliva, such as iron, copper, manganese, chromium, nickel, etc., and the clinical picture. With galvanosis, the pH shifts slightly to the acidic side (pH 6.5–6.0).

Differential diagnostics is of no small importance:

1.Galvanosis should be differentiated from glossalgia (paresthesia of the tongue). In glossalgia, patients complain of pain in the tongue, while in galvanosis, they complain of a burning sensation in the tongue. When examining the oral cavity of patients with glossalgia, hyperemic, shiny mucous membranes and sometimes swelling of the tongue are noted. Saliva is viscous, foamy, and sometimes hyposalivation occurs

2. Galvanosis is also differentiated from trigeminal neuralgia. In neuralgia, pain is paroxysmal, there are so-called trigger zones. Pain is provoked by talking and eating. In neuritis of the lingual nerve, patients complain of pain, paresthesia, sensory disturbances and increased pain during talking and eating; palpation of the tongue is painful.

3. It is necessary to differentiate galvanosis from allergic and toxic stomatitis caused by denture materials. Differentiation is performed based on blood parameters: leukocytosis, erythropenia, increased ESR – in toxic stomatitis; lymphocytosis, leukopenia, monocytosis, decreased content of segmented leukocytes – in allergic stomatitis. In galvanosis, blood parameters are unchanged.

Conclusions

I studied the literature on methods of galvanosis diagnostics and found that there are such diagnostic methods as: differential diagnostics, diagnostics using the determination of electrochemical processes between dissimilar metals, examination and use of special diagnostic crowns.

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