Hidden Sources of Dental Alloy Intolerance

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According to the statistics of the phenomena of intolerance to dental materials, its main source is alloys [1-3]. They manifest their side effects most actively when significant electrochemical

interactions.

In this respect, forged-brazed stainless steel structures are always potentially dangerous. However, according to our observations, individual stamped stainless steel crowns are also capable of creating a potential difference of more than 120 mV among themselves in some cases.

This article is devoted to the sources of a special kind of intolerance - combinations of alloys of various stresses, some of the active surfaces of which (the surfaces of the corresponding metal parts of dental structures) are in contact with temporary cements, with canal filling pastes, or with their residues. The active surfaces of alloys are such surfaces of the corresponding metal parts of dental structures on which they are "formed" (can

form) significant electrochemical interactions with other alloys in the oral cavity.

The key element in these combinations is the inner surfaces of crowns, as well as the surfaces of inlays, metal fillings, anchor and parapulpal metal pins [1, 5, 6], which come into contact with these materials.

The electrochemical activity of a metal surface substantially depends on the surrounding electrolyte and on the presence in the oral cavity of other alloys or their diffuse residues with other values of the standard electrode potential.

In addition, the electrochemical stability of an alloy is often determined by the presence of a passivating oxide film on its surface. Such films significantly reduce the electrochemical activity of titanium and aluminum.

We found a significant increase in the electrochemical activity of titanium (for titanium - the most significant) and cobalt-chromium alloys (for clasps and under cermets) in the oral cavity upon contact with temporary Temp Bond cement and Endometasone canal filling paste. Subsequently, similar observations on other dental alloys showed that the enhancement effect

electrochemical activity on contact with these materials also takes place for them. In nickel-containing alloys of the nickel-chromium type, this effect was significantly less pronounced than in cobalt-chromium alloys. For alloys based on gold and silver, it is comparable to that characteristic of the latter. For "loosening", depassivation of surfaces
of dental alloys, catalysts that are used in similar cements and pastes turned out to be responsible.

Evaluation of the electrochemical activity of alloys and their combinations was carried out indirectly (by measuring some electrical

characteristics), and indirectly - on the basis of Voll measurements of the load from them in different situations (with and without temporary cements or pastes for filling canals on active surfaces).

A similar effect of enhancing the electrochemical activity dental alloys are caused not only by Temp Bond, but also by other temporary cements. In particular, it is observed in Provicol temporary cement, but it is expressed, approximately two times weaker than that of Temp Bond (the most common temporary cement in our country). It turns out to be even much weaker when using temporary cement P-Cem Tuben (Bevern, Germany). So that when using the last cement, the effect
depassivation was minimal, it is essential that when mixing it, the minimum required amount of "catalyst" is added and
thorough mixing was carried out.

When studying pastes for filling canals, it turned out that Dentsply's AH Plus paste depassivates metal surfaces significantly weaker than Endometasone. However, for titanium and silver, this effect is still significant, which should cause caution when using inlays, and especially anchor pins based on these alloys, if there are such “caustic” pastes in the channels.

To a somewhat lesser extent than is typical for temporary cements and pastes for filling canals, the effect of depassivation of dental alloys is also typical for permanent cements. In particular, it is very pronounced in Fuji cements. To a much lesser extent, it is inherent in Harvard Cements.

Its useful to note, what effects depassivation define the occurrence of loads that are significant for the patient from dental alloys, primarily in the cases declared at the beginning of the article (in bold). In other cases, they can be significant only if the patient has a special sensitivity to specific alloys. In a significant part of such cases, the occurrence of manifestations of intolerance is possible without the participation of such depassivation effects.

The fact that closed metal surfaces - anchor pins, inlays, fillings, inner surfaces of crowns - can exhibit significant electrochemical activity and, accordingly, have significant negative effects (electric field, electric current, alloy dissolution products) by many dentists is perceived with distrust. It is useful for such skeptics to familiarize themselves with the works [1, 5, 6], where observations of the pronounced electrochemical activity of anchor pins are described.

A good demonstration of such phenomena can be the measurement of the potential difference in the oral cavity according to the following scheme (Gozhaya L.D. repeatedly carried them out in the classroom with cadets). In cases where the patient has separate crowns of the same alloy, which do not have a full veneer and do not contact each other and with other dental alloys, and there are anchor pins under some of these crowns (not all), the potential difference between these crowns and the surface was measured language. On crowns, under which there are anchor pins, it is often much larger.

The phenomenon of depassivation of dental alloys can also be demonstrated in the following simple experiment. Two identical lumps of this alloy were taken from the package of the Supermetal's Budodent CCN alloy. Plain boiled water (layer height 3 mm) was poured into two separate enameled flat-bottomed cuvettes. One chock was placed in each of these cuvettes (end-to-end to the bottom). Further, the device "MINIEKSPERT-D" with the ability to measure voltages and currents in the oral cavity [4] measured the potential difference between each of these chocks and a special brass ("dental") electrode. For the first sample, its value turned out to be 34 mV, for the second sample - 37 mV. Then a part of the end surface of the first sample (approximately one third) was covered with Endometasone paste, and on this end the sample was again placed in a cuvette with water. Again, the potential difference was measured between this sample and the "dental" brass electrode, the end of which was placed in water in the same cuvette. The potential difference was 72 mV. In this case, a similar value for the second sample remained unchanged.

It was possible to find cements for temporary and permanent fixation, in which the effect of depassivation of metal surfaces is completely absent. They are GC Freegenol temporary cement and VOCO Aqua Meron permanent cement. Freegenol cement is also a good material in terms of its own biocompatibility, it is convenient for the dentist to work with. The intrinsic biocompatibility of Aqua Meron cement is hardly satisfactory.

The pronounced effect of depassivation of metal surfaces is characteristic of euginol and, accordingly, all euginol-containing pastes for filling of canals, cements for temporary fixation.

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