Use of dental alloys with minimal risk of manifestations of intolerance (Scientific and practical aspects)

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Medical materials that are in contact with body fluids and tissues for a long time can have significant negative effects through various mechanisms.

By the products of their dissolution, materials can produce toxic and allergic effects [five]. They can also have negative (and not only) functional effects due to their characteristic resonance spectra in the field of low-frequency electromagnetic radiation, the so-called"Spectral effects" [6].

Alloys due to electrochemical interaction with each other, as well as with diffuse remnants of alloys [3, 4] can provide significant negative exposure to electric current and electric field. Due to the electrochemical processes occurring on their surfaces, they may be subject intensive electrochemical dissolution and therefore
negatively impact same products of its dissolution. These products (and in some cases - diffusion products) can accumulate, be deposited in some tissues, forming the so-called "Diffuse residues" [1-4].

For obvious reasons, dentists were the first to encounter manifestations of intolerance to medical materials, here this problem is most acute. Over the past 50 years (the history of the phenomena of intolerance to dental materials is more than 130 years old), significant progress has been made in understanding the mechanisms of intolerance, several generations of materials have changed, quite advanced laboratory and electropuncture methods for their testing have appeared. However, in practice, these phenomena still form a problem that does not yet have a satisfactory solution [1, 6]. In particular, there are almost no specialists in the individual selection of dental materials and the treatment of manifestations of their intolerance, there is clearly insufficient control over the biological properties.
of dental materials during their certification and monitoring of these properties of materials entering the market. As a result, there has not yet been a decrease in the incidence of intolerance to dental materials. On the contrary, it grows with the increase in the frequency of allergic disorders [6]. Most of these manifestations (more than 65%) are caused by alloys [5].

The designated problem is essentially complex. It has organizational, technical (development of effective precision techniques and hardware for individual selection of materials and treatment of manifestations of their intolerance), scientific, methodological aspects.To solve it as soon as possible in practice - in particular, to organize the provision of the necessary diagnostic and therapeutic assistance to patients who need an individual selection of dental materials and treatment of their manifestations
intolerance - it is necessary to create a specialized unit (its possible name is Laboratory for Special Issues of Dentistry). Such a unit should perform the functions of a clinical, scientific, methodological center for this problem. One of its primary tasks should be the preparation of guidelines for the specifics of working with dental materials, essential to minimize the risk of manifestations of their intolerance, as well as guidelines for the individual selection of dental materials based on their testing and without it. Onlydue to methodological recommendations of the first and third types, their wide use in practice, even without individual testing of dental materials, the number of manifestations of their intolerance can be reduced several times. Nowadays, a dentist who installs dental structures made from substantially dissimilar alloys to a patient usually does not violate any instructions. It is urgent to close this gap, without waiting for the creation of the specified specialized unit. The proposed work is aimed at solving this problem.

The material presented here is not complete enough finished
a guide to working with dental alloys. In many ways, this article is just a sketch, the skeleton of such a guide. However, even in this form, according to the authors, it will be useful to dentists and specialists in individual selection.
dental materials. We also hope that it will contribute to the emergence of more complete, detailed works on this topic.

1. Statement of the problem

When working with a patient, the doctor with the necessary completeness must decide the following task: to minimize the total load from dental alloys and diffuse metal residues that will be located after treatment (generally interact, change) in the patient's body, and, accordingly, the risk of manifestations of their intolerance. In general, the patient's body may contain not only diffuse residues of dental alloys, but also diffuse copper residues that were introduced during electrophoresis or depophoresis procedures using preparations containing copper. The total load, obviously, should be below the dangerous level from which the development of manifestations of intolerance is possible. Ideally, it shouldn't exist at all. To solve this problem, you must:

- to allocate alloys and diffuse metal residues that need to be removed from the body patient (section 6);
- choose for the treatment sufficiently electrochemically stable in a particular case, and patient-portable alloys (section 6);
- the doctor and other specialists who ensure his work (foundry, technicians) must

fulfill all the standard requirements for working with alloys, and when treating a patient from the risk group [3, 6], there are also a number of additional requirements (section 4 [3]).

With a consistent approach to solving the problem formulated above, it is useful to classify dental alloys based on their composition, application, taking into account their electrochemical properties.

2. The main groups of dental alloys

Groups distinguished by chemical composition

one. Titanium based alloys.

2. Nickel-chromium alloys.

Among them, it makes sense to single out subgroups NC9 and NC-.

NC9. Stable nickel-chromium-molybdenum alloys. Representatives: Wiron99 by BEGO and NHDENT NL by Supermetal.

NC-. Unstable nickel-chromium alloys. Representative - DENTAL NSA vac.

3. Nickel-free (or less than 5% nickel) cobalt-chromium alloys.

Divided into:

a) alloys for cermets.

b) clasp alloys and alloys for combined work. From the last subgroup, it is advisable to single out the subgroup

b1) especially electrochemically resistant cobalt-chromium alloys. Representatives: domestic "old" KHS, Wironit extrahart by BEGO, BUGODENT CCS VAC by Supermetall.

4. Alloys based on precious metals: gold, silver, platinum.

five'. Stainless steel.

6 ". Amalgams, as well as alloys with a copper content above 5% (representatives of the latter are brass anchor pins).

Group allocated by performance properties

0. Alloys especially electrochemically resistant in combination with other dental alloys. These are alloys, subgroups 2. NC9 and 3b1.

Group of metal dental structures, allocated for their use

BUT. Anchor and parapulpal pins.

It is advisable to single out a subgroup from this group

A.Zh) Yellow pins (brass, gold plated, titanium nitride coated) and electrochemically unstable pins. A typical representative of the latter: Titanium parapulpal pins.

3. Electrochemical stability of various dental alloys and their combinations

For the convenience of using this material in practice, we consider it expedient to present here a completely new Appendix 3 to Leaflet No. 1 [3].

Table 1

Electrochemical stability of various combinations of dental alloys

Combinations	Electrochemically stable	Not quite stable	Unstable
KHS old	Cu, Hg, PD, Amalgams, left-handed alloys	Ag, Au *	
Wironit extrahart	Ag, Au, left alloys	PD, silver solder	Cu, Hg, amalgams
Vyugo-dent CCN	PD, left-handed alloys	Ag, Au, Cu, Hg, amalgams	
Wironit LA	left-handed alloys	Ag, Au, Cu, Hg, amalgams	
Brealloy F400	left-handed alloys	Ag, Au, Cu, Hg, amalgams	
Wiron 99	Ag, Cu, Hg, amalgams, st. steel	Au *	
NHDENT NL	left-handed alloys, PD (with a stretch)	Ag, Hg, amalgams	Au, Cu
Wiro-bond C	left-handed alloys	Ag, amalgams	Au, Cu, Hg
Heraeni-um P	stable left-handed alloys	Au	Ag, Cu, Hg, amalgams
REMATITAN Ti4	Left hand alloys	PD, Silver solder, amalgams	Au, Ag, Cu, Hg
Titanium nitride	left-handed alloys	Ag, amalgams	Au, Cu, Hg
PD 190	stable left-handed alloys	Au	Ag, Cu, Hg, amalgams

Gold 900	Au, Ag, Wironit extrahart	KHS old, Heraenium P, Wiron 99, especially processed surface "Implant" titanium	Amalgams, Hg, Ti4sand., Cu, unstable left alloys, Wirobond C

Au - 900 standard gold and gold-based alloys (over 60%). Ag - silver and silver-based alloys, except for alloys which in this line can be highlighted in separate positions. Cu - copper, brass.

Hg - diffuse residues of mercury.

PD - palladium-silver alloys.

Right-handed alloys: precious metals, copper, cadmium, mercury and alloys based on them. Left hand alloys: All dental alloys except right hand ones.

Unstable left-handed alloys: st. steel, unstable nickel-chromium alloys.

* With gold-based alloys KHS (old) slightly more electrochemically resistant than Wiron alloy 99. In some cases, this difference is significant.

Diffuse metal residues are generally more electrochemically active than the metals themselves.

The oxide film of most alloys is less stable and more electrochemically active (if it is a conductor) than the alloy itself. This is not the case for a titanium.

Alloys and their diffuse residues are more electrochemically active in an acidic environment. The metal surfaces of dental structures can be depassivated (ie, their surfaces can become more electrochemically active) by many (but not all) pastes for filling canals, cements for temporary and permanent fixation, and a monomer of plastics [4].

Nickel-containing alloys are less susceptible to depassivation than nickel-free cobalt-chromium alloys.

"Closed" pins, inlays, amalgams are generally no more protected from electrochemical processes than similar open objects.

The electrochemical stability of the alloy surface is also affected by its mechanical treatment. According to the stability of the resulting surface, different types of processing are arranged in the following order (from bottom to top): turning with a boron, sandblasting, thorough mechanical polishing. It is also influenced by compliance with the melting regime, the addition of sprues.

The alloy (in the solid state) can become unstable due to significant uneven heating and / or cooling.

Unstable nickel-chromium alloys (subgroup NC-), for example, DENTAL NSA should not be used at all.

Subgroup pins A.Zh (yellow anchor pins, pins from alloys titanium-based (here, as well as for implants, only pure titanium is suitable), ...) should not be used at all.

The electrochemical stability of an alloy is a necessary, but insufficient condition for its portability (biocompatibility) in a particular case.

For a particular patient, an alloy that is less stable (with sufficient electrochemical stability in this particular case) can have significantly higher biocompatibility values than another much more stable alloy of the same or another class. Thus, in cases of sufficient electrochemical stability, Wironit LA and Brealloy F400 alloys usually have higher biocompatibility values than Wironit extrahart alloy, and Heraenium P alloy, accordingly, has higher biocompatibility values than Wirobond C alloy.

The indicators of electrochemical stability and biocompatibility of the Remanium 2000 alloy are so low that its use in practice can hardly be considered expedient.

Titanium based alloys in terms of electrochemical resistance, they differ quite significantly. Titanium implants can be found that are highly stable with virtually any dental alloy in the mouth; and titanium-based alloys can be found (eg Titanium parapulpal posts, Unimetric anchor posts, Anthogyr implants) that can create meaningful electrochemical interactions with all right-handed alloys and more. The properties of an alloy are determined not only by its composition. The technology of obtaining the alloy, all kinds of trace impurities is of great importance. In titanium-based alloys, such nuances manifest themselves especially expressively. So, the REMATITAN Ti1 (for cermets) and Ti4 (for clasps) grades differ significantly in hardness and, accordingly, in electrochemical stability. Moreover, each of them contains titanium

- 99.5%. Titanium dental alloys that form stable combinations, practically, with all alloys of groups 1–7 ', they exist only in the form of expensive implants produced by some well-known companies.

Titanium and titanium-based alloys are most susceptible to depassivation [4] (Section 5). Therefore, for their fixation, it is always advisable to use non-passivating cements, and the channels in which the pins and inlays from group 1 alloys will be installed should preferably be sealed with non-passivating pastes.

Alloys of the NC9 subgroup are among the most electrochemically stable.
It should be noted that these are alloys with a high nickel content (over 50%). Therefore, regardless of their durability, all uncoated areas of surfaces (external and internal) of the corresponding parts must always be carefully processed according to the recommendations [3], section 4 of this article. In terms of electrochemical stability, the Wiron 99 alloy is slightly superior

NKHDENT NL alloy.

No less electrochemically stable are nickel-free cobalt-chromium clasp alloys of subgroup 3b1. In some combinations, in this regard, they even surpass the alloys of the NC9 subgroup.

An important advantage of nickel-free cobalt-chromium alloys is the absence of nickel (and other especially toxic metals) in them. The main disadvantage of such alloys, which do not fall into the ("particularly stable") subgroup3b1, are their insufficient electrochemical stability in the presence of most "right-handed" dental alloys. Electrochemical resistance of alloys of the third groupusually increases with increasing hardness of the alloy. In this regard, one of the least electrochemically resistant is the comparatively soft alloy Heraenium P. One of the most resistant alloys of the subgroup 3a) is one of the hardest of its representatives - Virobond C. And one of the most resistant alloys of the group 3 is perhaps its hardest representative - Wironit extrahart.

Alloys group 3a) highly susceptible to depassivation. In this regard, they are second only to titanium alloys.

Precious metal alloys usually go well with each other. Among the left-handed alloys, sufficiently stable combinations for them should be sought only in the group0, taking into account the data of the table. one.

Into groups 5 ', 6 " and a subgroup NC- includes unstable alloys containing highly toxic components. On them, the processes of electrochemical corrosion can occur quite actively even in the absence of alloys of other groups in the oral cavity.

Alloys of group 5 ' are mainly used in the form of wire and stamped parts. Electrochemical instability of parts made from alloys of this group is characteristic, first of all, for stamped crowns. This property is largely determined by the imperfection of the factory technology for the manufacture of steel sleeves. Studying old samples of such crowns, one can come to the conclusion that there are large reserves here.

For the convenience of solving applied problems, we have identified two more groups of alloys - 0 and BUT - not based on their composition.

IN group 0 includes alloys especially electrochemically resistant in combination with other alloys. When all the requirements of Section 4 are met, they do not create significant electrochemical processes with "left-handed alloys". According to the table. 1, they can also form stable (but not only) combinations with "right" alloys.

IN subgroup A.Zh includes anchoring and parapulpal pins, when using which it is impossible to be sure (at least without the conclusion of a highly qualified specialist in the individual selection of dental materials) that they alone or in combination with other alloys that are supposed to be used for patient treatment will not create significant for the patient of electrochemical processes.

4. Standard and "additional" requirements when working with dental alloys

Standard Requirements

At the melting stage:

- observance of temperature and time regimes of melting,
- ensuring a sufficiently high vacuum for melting and casting;
- compliance with the restrictions on the addition of sprues, their preliminary cleaning.

In cases of excessive addition of gates or repeated "remelting" (the latter is often made with alloys based on precious metals), it is necessary to perform "restoration of the alloy" by removing oxides and other impurities from the melt, and by degassing. For this, special fluxes are used, holding molten metal in a vacuum. These operations are not usually performed in dental foundry laboratories. But even in cases of their implementation, it is possible (with repeated remelting) to change the original composition and structure of the alloy.

During the work of the technician: removal of oxide films, polishing of the outer uncoated surfaces of metal parts.

During the work of an orthopedist: polishing the outer uncoated surfaces of metal parts.

When mixing two-component cements, exact proportions and thorough mixing.

When treating patients from the risk group [3, 6] or, if necessary, using combinations of alloys for treatment, the electrochemical stability of which is on the verge of stability, additional requirements must be observed.

Additional requirements

At the melting stage:

- do not add sprues,
- after melting, remove oxide films from the frameworks by etching. When the technician is working:
- acid etching (bleaching) of oxide films after ceramic deposition;
- Thorough sandblasting of inner surfaces of crowns and surfaces of inlays with non-glass beads (Forged crowns should not be sandblasted. Oxide films should be removed from their inner surfaces by etching. Sandblasting of inner surfaces of stamped crowns and surfaces of inlays made of gold-based alloys is optional in all cases);
- thorough mechanical polishing of external uncoated metal parts using surfaces polishing pastes;
- exact adherence to the technology of polymerization of plastics, preventing the preservation of the monomer in them.

When working as an orthopedist:

- thorough mechanical polishing of external uncoated metal parts using surfaces polishing pastes;
- if there are any corresponding violations, careful sandblasting processing of inner surfaces of crowns and surfaces of inlays with non-glass beads;

- use for temporary and permanent fixation of metal-containing structures of non-passivating cements and pastes.

Acid, which is part of almost all cements for permanent fixation (except for dual-curing cements), can depassivate metal surfaces and make electrochemical processes more active on them. A significant excess of such acid can be caused by an excess of the corresponding component when mixing the cement or insufficient mixing.

Metal surfaces can be depassivated not only with acids, but also with other compounds, in particular, euginol, a monomer of plastics.

Alloys of groups 1, 3a) and 5 'are most susceptible to such depassivation. To a much lesser extent, the effect of depassivation is expressed in alloys, groups 3b), 4. It should also be noted that a thoroughly polished surface is subject to depassivation to a much lesser extent than a sandblasted surface (of the same alloy).

However, polishing inlays, internal surfaces of crowns and bridges cannot be considered the correct approach to reduce this undesirable effect. For on a thoroughly polished surface, in the general case, the adhesion of cement is weaker. Non-passivating cements provide a complete solution to this problem. These, in particular, are cements:for temporary fixation - Freegenol by GC, for permanent fixation - PANAVIA F by KURARAY MEDICAL INC. Significantly less depassivation of the metal surface in comparison with euginol-containing pastes for filling canals is produced by the Dentsply AH Plus paste.

Note also one condition, which can be considered a must when working with alloys. At all stages of working with dental alloys (except, possibly, the melting process), their intense uneven heating and cooling must not be caused. Failure to comply with this requirement can lead to the formation of residual stresses in the alloy, its and, as a result, to the loss of the characteristic electrochemical resistance.

High mechanical stress on some area of metal parts dental structures (arising from external causes) can also cause intense dissolution of the alloy. Most often, such situations arise at the "junction" of the console with the main supporting part of the structure, especially if there is soldering at this junction.

5. Hidden sources of intolerance

To solve problems associated with identifying the causes of the observed or possible in the future manifestations of intolerance, we consider it useful to introduce the concept: hidden sources of intolerance [4].

Latent (real or potential) sources of type 1 intolerance we will call “closed” metal surfaces of dental structures (metal spraying, permanent cement, filling) on which significant dissolution of the alloy occurs and / and which form or may form significant electrochemical interactions with other alloys and / and diffuse alloy residues.

Such closed, visually inaccessible metal-containing dental structures can be: anchor and parapulpal pins [1, 3, 4, 8, 9], inlays, inserts, amalgam fillings and, of course, the inner surfaces of crowns.

Among the sources of intolerance of the first type, it makes sense to single out a subset of I / D.

Sources of I / D intolerance are closed metal surfaces, which are significantly depassivated by cements in contact with them for temporary or permanent fixation or pastes for filling canals.

Latent (real or potential) sources of type 2 intolerance we will refer to diffuse alloy residues that form or may form significant electrochemical interactions with other alloys and / or which themselves exert significant stresses.

Since the bone tissue of the tooth has the properties of an electrolyte (which is used in electrodental diagnostics), the sources of intolerance of the first or second type hidden behind it or in it can, just as successfully, as usual (open metal surfaces), create significant electrochemical interactions with other alloys and their diffuse residues in the patient's body.

6. The choice of alloys for dental treatment

The first requirement that must be met by the alloys chosen for the treatment of the patient is sufficient electrochemical stability in combinations with each other, with all other alloys and diffuse metal residues remaining with him. Due to this, the choice of alloys for the treatment of a particular patient should be carried out taking into account which alloys (in general, not only dental ones) and the diffuse residues of which metals are present in his body.

The problem indicated in the title of the section often cannot be solved successfully enough without significant preliminary preparation. At the first stage, the doctor must find out: what alloys are in the patient's body, and the diffuse residues of which metals in significant concentrations with a largeprobability can be contained in some of its tissues, and also, to evaluate the electrochemical stability of the present combinations of alloys and diffuse metal residues. This is clarified by taking anamnesis, studying X-rays, visual inspection (the presence of oxide films, the quality of polishing or sandblasting, the presence of obvious traces of electrochemical corrosion). It should be noted that on the basis of this kind information (without direct laboratory tests or without electropuncture testing of special nosodes or inverse influences from metal samples) it is possible to judge just about the probability finding diffuse residues of certain metals in the patient's body.

At the time of solving this problem, alloys and diffuse metal residues may be present in the patient's body, between which there is a significant electrochemical interaction. Some elements that form such active combinations must certainly be removed, to "destroy" them. Besides,diffuse metal residues that exert significant loads should be removed from the patient's body regardless of whether or not they form electrochemically active combinations.

To remove diffuse residues of metals, nosodes (usually in potencies from C30 to C200, much less often - C500, C12) and allopathic drugs can be used: based on selenium (for removing diffuse residues of mercury and silver from amalgams) and ACC (for removing diffuse residues stamped - brazed stainless steel structures) [7]. Accurately enough, the treatment with these drugs can only be carried out by a specialist who is well versed in drug testing.

Without such "cleaning", the portability of alloys in the general case will be significantly lower and, accordingly, the range of materials to be transferred is much narrower. Any alloy is intolerable for a patient if the content of some elements (included in its composition) in his body exceeds a certain "threshold" level. It is for this reason that, in some cases, all alloys are intolerable when tested. This picture changes significantly after the removal of diffuse metal residues from the patient's body. Loads from such diffuse residues can cause or potentially cause significant harm to the health of the patient.

Based on the collected data, using reference information (such as Table 1), the selection of alloys for treatment should be made (as indicated above, the alloys and diffuse metal residues that need to be removed are determined first). In the presence of certain indications [3], this should only be done by a specialist in the individual selection of dental materials and the treatment of manifestations of their intolerance.

The most insidious and dangerous in practice are the hidden sources of intolerance. This is partly due to the fact that many doctors believe that hidden (closed) metals cannot be dangerous, and they usually do not know and do not want to know about diffuse metal residues. Another aspect: often without the involvement of an experienced highly qualified specialist in the individual selection of dental materials (there are still fewer of these in our country than fingers on one hand), it is impossible to determine the material of the hidden pin or inlay and, accordingly, decide which of them is a real or potential source of intolerance ... Without such a specialist, it is often also impossible with the desired certainty to identify all the diffuse remnants of the alloys present in significant concentrations. It should be remembered that diffuse residues are usually more active in terms of the occurrence of electrochemical interactions,

Any guarantees for the biocompatibility of the set of alloys that will end up in the patient's body as a result of treatment can only be said if all unstable alloys and unstable metal structures are also removed from him. In this regard, all kinds of brass, bronze pins, amalgam seals, stamped-brazed stainless steel structures, and then, possibly, all pins with a yellow coating are to be removed.

Fiberglass pins are ideal in terms of the absence of electrochemical interactions they create with alloys in the patient's mouth.

IKADENT titanium pins do not create significant electrochemical interactions with alloys of the first five groups. But they are not ideal in this regard in the presence of alloys or diffuse residues of groups 4, 6 in the patient's body.

If a patient has never previously received dental structures made of unstable alloys or containing right-handed alloys, it is advisable to choose nickel-free cobalt-chromium alloys with high biocompatibility for its treatment (examples of such alloys: Heraenium P, Brealloy F400, Wironit LA, but not Wironit extrahart).

In a different situation, if their testing is not used when choosing alloys, one should rely on the information presented in Table 1.

Moreover, if the patient's body has gold-based structures that are stable, well tolerated and do not form electrochemically unstable combinations (with other alloys and diffuse metal residues in his body), then for treatment (if there is such an opportunity, structural and material), you can use these or other, equally stable in a particular case, portable precious metals. Otherwise, you should try to choose alloys from group 0 for treatment (sections 2, 3).

Literature

1. Gozhaya L. D. Diseases of the oral mucosa caused by materials dentures (etiology, pathogenesis, diagnosis, treatment, prevention). Dis. ... doct. honey. sciences. - Moscow, 2001.

2. Gozhaya L. D. Changes in the composition of trace elements in the lower jaw of a person with using metal dentures. In the book: Actual problems of stomatoneurology, prosopalgia. - M., 1974. - S. 190–204. (Co-author Semenyuk V.M.)

3. Kozin V.N., Dzhirikov Yu.A. etc. Memo number 1. Organization of dental treatment and basic techniques for minimizing the risk of manifestations of intolerance to dental materials when working with patients at risk // In: Abstracts and reports of the XI International conference. M .: IMEDIS, 2005.

4. Kozin V.N., Malik M.V. and others. Hidden sources of dental intolerance alloys // Abstracts and reports of the XI International conference "Theoretical and clinical aspects of the use of bioresonance and multiresonance therapy". - M .: IMEDIS, 2005.

5. Markov B.P., Dzhirikov Yu.A., Pustovaya E.P. Clinical manifestations of intolerance metal dentures // Problems of neurostomatology and dentistry. - 1997. - No. 1. - WITH.

56-59.
6. Markov B.P., Kozin V.N., Dzhirikov Yu.A., Malik M.V., Berdnikova N.P. Complex approach to the problem of individual intolerance to dental structures from various materials // Dentistry. 2003. - No. 3. - S. 47-51.
7. Semenyuk V.M., Konvay V.D. etc. Rehabilitation of patients with symptoms of intolerance materials of dentures // Actual problems of dentistry .: Sat. scientific. tr. To the 90th anniversary of V.Yu. Kurlyandsky / MMOMA. - M., 1998. - S. 185-186.
8. Lindermann W., Handtmann S., Schulte W., Huttemann H. Korrosionserscheinungen an Silberstiften imWurzelkanal (II). Dtsch. zahnärztl. Z 1987; 42: 7: 639–646.
9. Sillness J., Gustavsen F. Distribution of Corrosion Products in Teeth Restored with Metal Crowns Retained by Stainless Seel Posts. Acta odont. scand. 1979; 37: 6: 317-321.

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