The Distribution of dental alloys; Corrosion; Galvanism

Lecture: Dental materials for 2 study year
Study branch: Dental medicine
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Introduction:

- the dental prothese are not made of pure metal
- for the dental purpose are used the dental alloys
- the composition of individual metal is so that the properties of whole alloy was to the best advantage
Development of dental alloys:

- the first cast construction were discovered as the 18. century

- The development of metal alloys arrived at the ending of 19. Century, when Mr. Bing constructed the first inlay’s bridge

- at the 1880 year was characterised Richmond’s crown

- at the 1883 y. Dexter constructed first removable bridge

- at the 1886 y. Starr constructed the first bridge with telescopic crown

- at the 1899 y. Staiton constructed first classic flushing bridge

- at the 1890 y. Parr constructed first removable partial denture with clasps
Distribution of dental alloys:

1/ The alloys with the high content of aurum and platinum (ISO 1562)

2/ The alloys with flat content of aurum and platinum, they are the alloys of argentum and palladium (ISO 8891)

3/ The alloys of general metals (cobalt, nickel) (ISO 6871)

4/ The alloys for ceramic burning (titanium too) (ISO 9693)

5/ The alloys as a aluminium bronze

- the main criterium for this distribution and for assigning of ISO standard is hardness of material

- the hardness of dental material can characterised by the Vickers and by the Brinell
1/ The distribution of gold alloys:

Alloys of type 1:
- flat mechanical stability (smooth alloys)
- they are indicate for lightly mechanical weighted, e.g. inlays
- they are the alloys with high content of aurum (87%) and lower content of others components as a cooper (4%), argentum (9%)
- the hardness is 47-70 HB

Alloys of type 2:
- they are characterised by the middle hardness
- they are indicated for individual crowns and small bridges
- the hardness is 80-90 HB
- these typical alloys of this type have a high content of cooper (8%) and palládium (2.5%)
1/ The distribution of gold alloys:

Alloys of type 3
- they are the alloys with a high hardness
- they can be indicate for a mechanical very weighted inlays and large bridges
- hardness is 95-115 HB
- they content more cooper (10%) and palladium (3%)

Alloys of type 4
- they are extra strong
- they are the best for large bridges, for metal construction of removable partial denture, attachments
- the hardness is 130-160 HB
Alloys of gold-platinum (ISO 1562):

- for they is characterised, that they have no cooper
- platinum does high of resistance
- the chemical resistance is similar as a resistance of pure aurum
- they are indicated for large bridges
- they content of aurum 75-90 %, 8-19% platinum, 4-10 % palladium, ferrum, iridium
Alloys of gold-platinum (ISO 1562):

- Iridium easily oxidizes and makes adhesion to the ceramic.
- Palladium has a high melting temperature, higher mechanical resistance, and lower price.
- A disadvantage is that palladium discolors the yellow color of aurum.
- So, these alloys have a white color despite a high content of aurum.
- The typical color of these alloys after oxidation is grey or brown-grey.
2/ The alloys with flat content of aurum and platinum, alloys of argentum-palladium (ISO 8891):

- the basic metal of these alloys is argentum (60-75%)
- residual is palladium and very little part is other metals
- their resistance before corrosion is depend on content of palladium
- when they have a high content of cooper, so the resistance before corrosion decreased
- when the content of palladium is less than 25%, they are not up to standard ISO
2/ The alloys with flat content of aurum and platinum, alloys of argentum-palladium (ISO 8891):

- when we can use these alloys for metaloceramic, must be the content of palladium higher than 50% and content of argentum must be 30%

- the target of this complicated composition is decreased the temperature of melting (less than 1550°C – palladium)

- these alloys are very exactly by the casting
The alloys of general metals (ISO 6871):

- in general, the basic of these alloys is cobalt or nickel

- next they include chrom (min 20-25%), molybdenum (4%), ferrum, manganase, wolfram, berilium, titanium, carbon, nitrogen, silicium

- by the both alloys, nickel and cobalt alloys, must be the content of chrom, cobalt and nickel minimal 85%

- chrom very increased the hardness of material

- they are indicate for metal construction of removable partial denture

- when they are indicate for metaloceramic, must have less content of chrom and so can be indicate for fixed bridge

- very heavy disadvantage is volumetric contraction by the freezing
The alloys as a alluminium bronze:

- these material are not use in dental prax, they install here for assembling
- they are the alloys of cooper (80%), alluminium (8-9%), iron and nickel (4-5%)
- they belong to the alloys with midlle or high hardness
- their advantage is easy processing and yellow color, which is conditional of cooper
- to the disadvantage belong thin mechanical resistance to the corrosion, toneless surface after oxidation and intolerance from patient
Titanium (ISO 9693):

- Titanium is absolute, biokompatible with high resistance before corrosion.
- It is indicated for implants, fixed bridge and removable partial denture.
- It is one material, which is used as a pure metal, not as an alloy.
- To the advantage belong very low weight, high mechanical resistance and low termic conduction.
- The disadvantage is, that individual titanium part, can be not soldered together.
- When it is necessary, for soldering must be used laser.
Solders:

- the international standard need, that all type of dental alloys must have solder for connection of individual alloys part

- the solder must be on the same base as a alloy

- the basic properties of dental solders are stated by standard ISO 9333

- quality solder is characterised by:
  - convergence
  - low viscosity (for the adhesion between individual metal type in alloy)
  - resistance before corrosion
  - color stability
  - the point of meltings must be 50-100°C less than the melting point original alloy
Plates, Wires:

- besides the alloys for casting, in prosthodontic can be used plates and wires
- these materials are not absolutely adequate for casting
- their structure is fibrous. It is necessary for good elasticity by the high hardness, 300 HB
- high temperature makes decreasing of hardness
Corrosion of dental materials:

- It is true, that resistance before corrosion is very high by all dental materials.
- From the chemical view, corrosion is defined as an oxidation of metal. The target of this process is very good soluble compounds.
- These soluble compounds and their cations interfuse to the organism (gingiva, oral mucosa).
- The problem of corrosion is not in loss of material, but in dumping of metal framework prostheses and it results in the change of function and loss of aesthetic properties.
- Alloys with a high content of aurum and platinum are the most resistant before the corrosion.
- On corrosion have a main participation iron, argentum, cooper.
Corrosion products and organism:

- the rise of corrosion is depend on:
  - type of alloy, processing and composition of alloy
  - saliva composition and fluid in sulc
  - presence and composition microbial plaque

- The corrosion products makes on the gingiva and mucosa blue or blue-grey colorations

- it was detect than by rise of this coloration is in the sulcus very strongly high of IgE

- from metal components they are argentum, mercury, nickel, cadmium and paladium
Corrosion products and organism:

- it is true, that more often rised the coloration by the patient with allergic predisposition on:
  - jewellery
  - blight, draf, bloom, food
  - allergy on strike of insect, astma bronchiale
  - autoimunitné ochorenia (Sjogrenov sy, sklerodermia)
  - endokrinopatie (ochorenia štítej žľazy)
  - Parkinsonova choroba
  - chronický únavový syndróm
  - neurovegetatívne ťažkosti
  - dlhodoba zvýšená sedimentácia a počet monocytov

The prevention by these patients is indication of non-metallic materials by the conservative and prosthetic treatment
Galvanism:

- is defined as a complex of processes, which are result from elektrochemical reactions
- in general, it is rise of electric tension between two electrodes, which are coupled with fluid
- the chemical energy is changed on electric energy and on the contrary too
- the basic of galvanism is ability of metals to release from surface the cations
- so than can be marked these metals as a elements easy doing cations
Galvanism:

- the cation rise as a allocation of minimally one electron from electron shell
- the cations, which are allocated from the electron shell are skiping to the electrolyte and the electrons stay on the surface of metal
- released ions make on the metal surface electrochemical corrosion
Galvanický makročlánok - schéma:
**Galvanic contribution:**

- Galvanic contribution rises as a connection between two metals by the one fluid (in mouth it is saliva).
- As a galvanic contribution can operate two metals, when they are in contact.
- It rises closed electric circuit.
- When this circuit is interrupted, so galvanism and electric current disappears.
- Metal connection can do metal framework of removable partial denture.
- Electric current goes from the anode to the cathode.
Stomatitis galvanica:

- by the some patients is galvanism very strong

- to the symptoms belong: parestesia, stripes, disorders smack, strog attack of pain neuralgiform character

- they are clinical manifestation of galvanic stimulus. It names as a stomatitis galvcaniac

- so it is glossitis or stomatitis
END.