Dental Material

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Lecture 5

Metal and metals alloys

Metal : metals represent one of the three major classes of materials used for the reconstruction of damaged or missing oral tissues.

Classification of metals

Metals can be classified according to nobility as:

- ✓ **Noble metals** like (gold , platinum , palladium, rhodium, ruthenium , iridium , osmium and silver.
- ✓ **Non noble (base metal)** like (chromium, cobalt, nickel, iron, copper, manganese.

Nobility in relation to Tarnish and corrosion resistance

Tarnish: is loss of luster from the surface of metal or alloy due to the formation of a surface coating of metal oxide.

Corrosion: is the gradual destruction of materials (usually metals) by chemical or electricchemical reaction with their environment.

*****Noble metals usually have a good tarnish and corrosion resistance except Silver which has low tarnish resistance.

*****Non noble (base metal) generally have low tarnish and corrosion resistance

(GOLD)

Gold foil filling (pure gold)

Pure Gold is very malleable and ductile. Gold foil is in the form of thin sheat or foil about 0.001 mm thickness. It is condensed in to the cavity and each

layer of foil become welded to material already condensed

Advantages of gold foil filling:

- ✓ Perfect corrosion resistance.
- ✓ Adequate mechanical properties.
- ✓ Very durable.

Disadvantages of gold foil filling

- ✓ Highly expensive.
- ✓ Not esthetic.
- ✓ The technique is time consuming and depends on the skill of
- ✓ operator.

Alloys: An alloy is substance with metallic properties that consists of two or more chemical elements, at least one of which is a metal.

Applications of alloys

1. Construction of metallic framework of removable partial denture

2. Construction of crown and bridge

3. Making orthodontic wires, bands, brackets.

4. Making endodontic instrument

5. Construction of dental implants

Classification of dental alloys

A- According to nobility

That is mean the alloy is classified according to percentage of noble (precious) metal especially gold for example:

1. High noble alloys "precious": at least 60% noble. 40% of which is gold. The

remaining 40% is base metal

2. Noble alloys (semiprecious): at least 25% noble (no gold requirements). 75% base metal

3**. Base metal alloys:** contain less than 25% noble.

B- According to major element

That is mean the alloy is classified according to metal that has high percentage in alloy for example: gold based alloys, silver based alloys , nickel alloys , cobalt alloys, titanium alloy

C- According to principal elements

That is mean the alloy is classified according to metals that has high percentage in alloy for example:

(Cobalt –chromium alloys), (Nickel – chromium alloy), (Palladium – silver alloy)

(Gold – palladium- silver alloys), (Titanium – aluminum – vanadium alloys).

Shaping the alloys: Alloys are **either wrought alloy or casting alloy.**

1-Wrought alloys: Defined as alloys which are shaped without applying heat (room temperature) by hammering, drawn or bent into shape (cold working). Stainless steel is a wrought alloy of iron, carbon, chromium, nickel and manganese. it is used for making dental instruments, burs, wires.

2-Casting alloy: Defined as alloys which are shaped by heating the material until it becomes molten, when it can be forced into an investment mould which has been prepared from a wax pattern.

Requirements of casting alloys:

1. They must not tarnish or corrode in the mouth

2. They must be sufficiently strong

3. They must be biocompatible (non toxic , non allergic)

4. They must be easy to melt ,cast ,cut, grind (easy to fabricate)

5. They must flow well and duplicate fine details during casting

6. They must have minimum shrinkage on cooling after casting

7. They must be easy to solder

Applications of casting alloys in dentistry

1- Removable denture alloys Casting dental alloys used to make the metal part of removable denture.

Requirements of Removable denture alloys :

• Should have low weight

• Should have high stiffness which help in making casting thinner which is important in the palate

• Should have good fatigue resistance it is important for clasp

• Should not react with denture cleaners

• Should have low cost

2- Metal ceramic alloys

They are alloys that are compatible with porcelain and capable of bonding to it (a layer of porcelain is fused to the alloys to give it natural tooth like appearance) Metal ceramic alloy can be High noble (gold alloys), Noble (palladium alloy) or Base metal alloys

Requirements of metal ceramic alloys

1. Melting temp should be higher than the porcelain firing temp.

2. Coefficient of thermal expansion should be compatible with that of porcelain

3. Should be able to bond with porcelain

4. Should have high stiffness (high modulus of elasticity)

5. Should not stain or discolor porcelain

6. It should resist creep