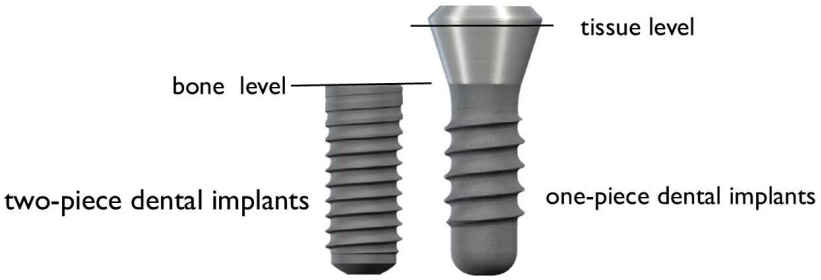
12 Dental materials

12.1 Which materials an oral surgeon does use to build an artificial tooth?

Oral surgeons, in general, use different materials for tooth root (metal) and crown (ceramic).

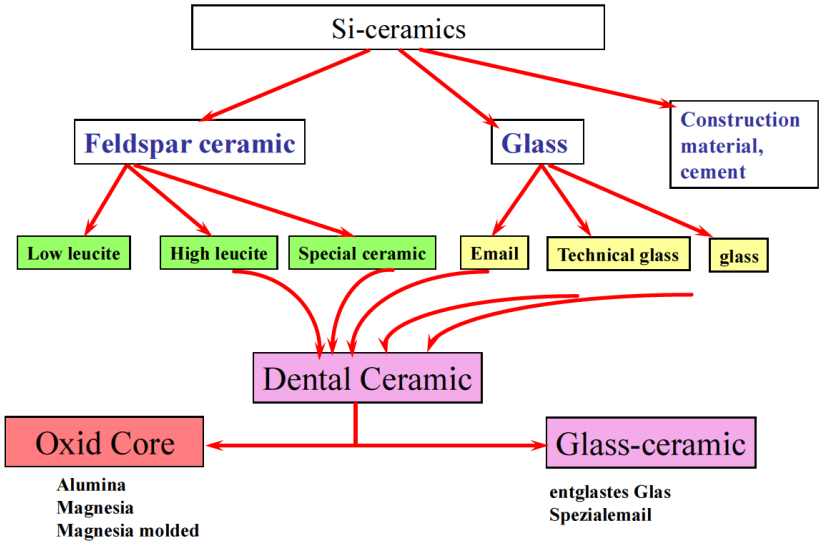


There is a wide variety of dental materials.

- Filling materials (Amalgam, Composites)
- Metals and Alloys
  - NPA-Alloys (non precious alloys):
    - Ni-Basic-alloys
    - Co-Basic-alloys
    - Titanium-alloys
  - PA-Alloys
    - Pd-Basic-alloys

- Pt/Ir-Alloys
- high precious Au-Alloys
- Au-reduced Alloys

- Other metals (Goldinlays, -onlays, Galvanoinlays, Titaniuminlays)
- Ceramic



Filling Materials:

Direct		Indirect
Definitive	Temporary	Composites
Amalgam	Cements	**Ceramics**
Composites	Glasionomer, Plastics (zB. Fermit)	Metals (Goldallloys, Titanium)
CAD/CAM-Systems: „Cerec" – Systems		

Materials of dental implants:

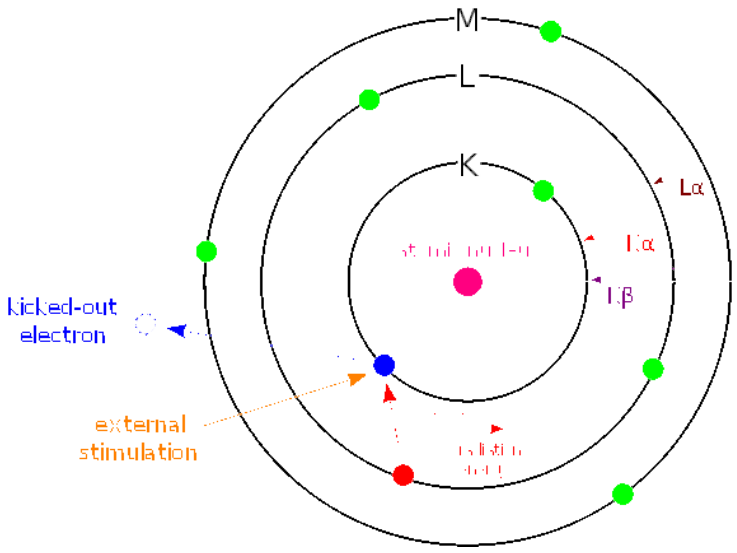
- plastic
- ceramics
- cement
- metals and alloys
  - precious metals (au, ag, pt, pd)
  - non precious metals (ni, co, cr, ti)

12.2 How the dentist can determine the composition of a metal within the oral cavity of the patient?

Methods of examination:

- optical examination
- scanning electron microscopy
- EDX - analysis (splintertest) - can determine the composition of a metal within the oral cavity of the patient

  Energy-dispersive X-ray spectroscopy (EDS or EDX or EDAX) is an analytical technique used for the elemental analysis or chemical characterization of a sample. It relies on the investigation of an interaction of a some source of X-ray excitation and a sample. Its characterization capabilities are due in large part to the fundamental principle that each element has a unique atomic structure allowing X-rays that are characteristic of an element's atomic structure to be identified uniquely from one another.



12.3 Please explain the corrosion of metals in the oral cavity.

The corrosion of dental biomaterials is a pertinent clinical issue. In spite of the recent innovative metallurgical and technological advances and remarkable progress in the design and development of surgical and dental materials, failures do occur. The oral cavity is subjected to wide changes in pH and fluctuation in temperature.

Corrosion - visible destruction or decay of a metal or alloy by reaction with the environs.

Corrosion, the gradual degradation of materials by electrochemical attack is a concern particularly when a metallic implant is placed in the hostile electrolytic environment provided by the human body. The term corrosion is defined as the process of interaction between a solid material and its chemical environment, which leads to a loss of substance from the material, a change in its structural characteristics, or loss of structural integrity. During corrosion, casting alloys release elements into the body over the short-term (days) and long-term (months). The corrosion of biomaterials depends on geometric, metallurgical and solution chemistry parameters. Resistance to corrosion is critically important for a dental material because corrosion can lead to roughening of the surface, weakening of the restoration, and liberation of elements from the metal or alloy. Liberation of elements can produce

discoloration of adjacent soft tissues and allergic reactions in susceptible patients. Corrosion can severely limit the fatigue life and ultimate strength of the material leading to mechanical failure of the implant.

The features that determine how and why implant corrodes are:

1. Thermodynamic driving forces, which cause corrosion (oxidation and reduction) reactions. These forces correspond to the energy required or released during a reaction.

2. Kinetic barriers to corrosion, which are related to factors that physically, impede or prevent corrosion from taking place. The well-known process of passivation or the formation of a metal oxide passive film on a metal surface, is an example of kinetic limitation to corrosion.

cleft corrosion:

- missing of oxygen airing
- sinking of pH value
- forming of acid
- forming of metal ions
- forming of OH-ions

Guide symptom - taste of metal.

12.4 Which properties are needed for an impression material used in dentistry?

Traditional Impression materials

Chemical-physical impression materials:

- reversible non-elastic materials
  - therm. impression compound (1856)
  - gutta percha (1864)
  - waxes (1756)

- irreversible non-elastic materials
  - impression cast (1900)
  - zinc oxide eugenol (1935)
  - Kunststoff-Abformstoffe (1940)
- reversible elastic materials
  - Hydrocolloids (1925/1927)
- irreversible elastic materials
  - Alginate (1940)
  - Elastomers
    - thiokols (Polysulfide) (1954)
    - silicones siloxanes (1955)
    - polyethylene (1965)
    - Polyvinylsiloxane (1975)

The basic requirements for accuracy are exact impressions with adequate materials and assembly of casts.
Factors:

- low coefficient of thermic expansion
- minimal change of volume
- 100% -elastic retraction
- low blister
- high contrast reproduction
- flowability
- individualized trays
- cast materials (Type 1-4)
- Model-Trays (Sockelverfahren)