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Preclinical dentistry I.

Permanent filling materials

Permanent filling materials

Amalgam

Composites

Glassionomers

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Amalgam

Amalgam

Metal-like restorative material composed of silver-tin-copper alloy and mercury.

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Particles of the alloy

- ✓Irregulary shaped (filings - lathe cut)
- ✓Microspheres
- ✓Combination of the two.

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Particles shape

High – Copper Amalgam

Microsphers of the same composition

(unicompositional)

Mixture of irregular and spherical particles of different or the same composition (admixed)

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Production of irregular particles

Metal ingrediences heated, protected from oxidation, melted and poured into a mold to form an ingot.
Phases of the alloy: (intermetallic compounds)
Ag_3Sn - γ
Cu_3Sn - ε
Cu_6Sn_5 - η
Ag_4Sn - β

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Production of irregular particles

cooled slowly

Ingot heated at 400°C (6 – 8 hours)
(homogeneous distribution of Ag_3Sn)

Ingot cut on the lathe, particles passed trough a fine sieve and ball milled to form the proper particle size.

Aging of particles (60 - 100°C, 6 – 8 hours)

Particle size: 60 – 120 μm in length
10 – 70 μm in width
10 – 35 μm in thickness

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Production of irregular particles

Molten alloy is spraying into water under

high pressue

Irregulary shaped high-copper particles

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Production of spherical particles

Molten alloy is spraying under

high pressue of inert gas through a fine

crack in a crucible into a large chamber

Diameter of the spheres: 2 – 43μm

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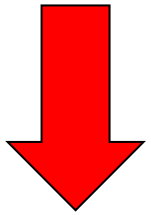
Amalgamation processes

alloy is mixed with pure mercury



Trituration

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Types of amalgam restorative materials

Low – Copper Amalgam (5% or less copper) conventional amalgam

Composition – wt%

Silver	63 - 70 %
Tin	26 – 28 %
Copper	2 - 5%
Zinc	0 - 2%

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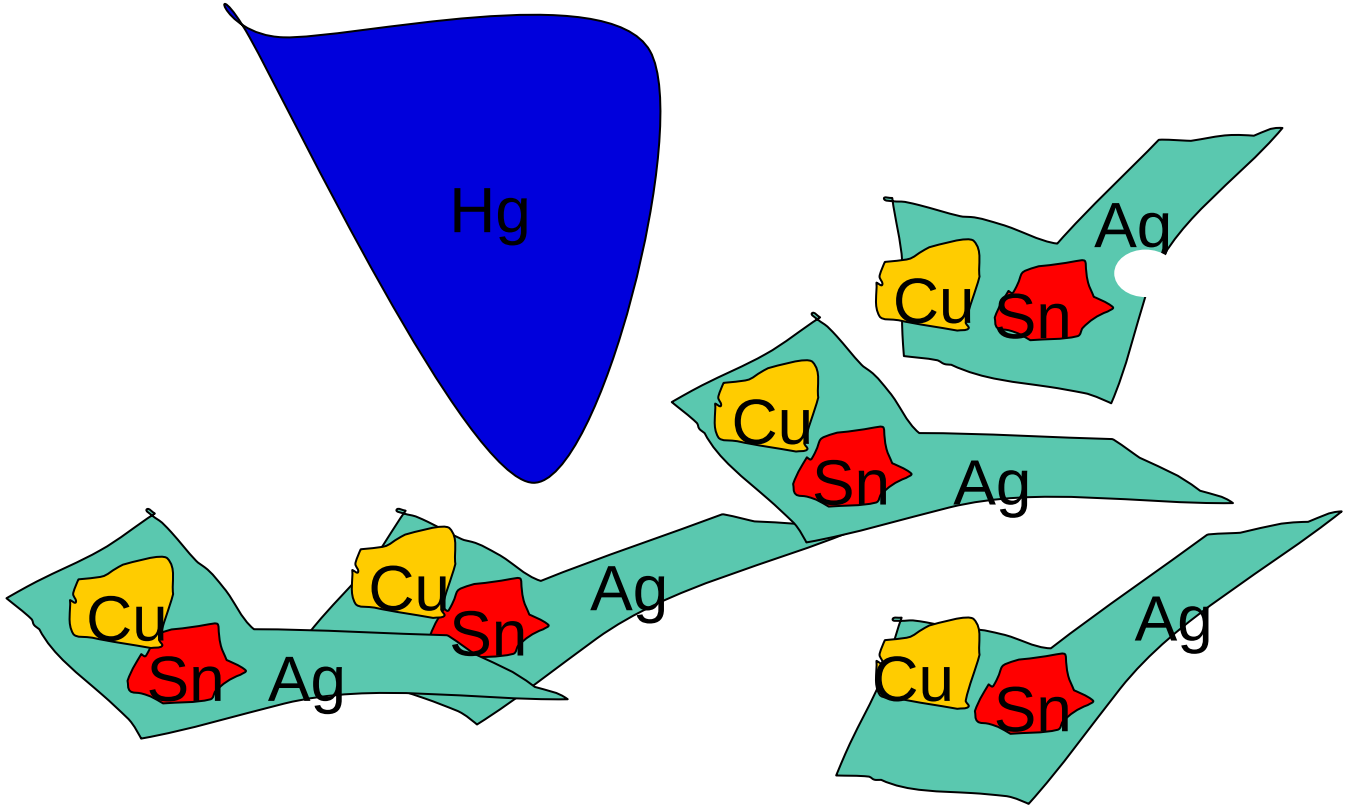
Amalgamation processes

Intermetallic compounds

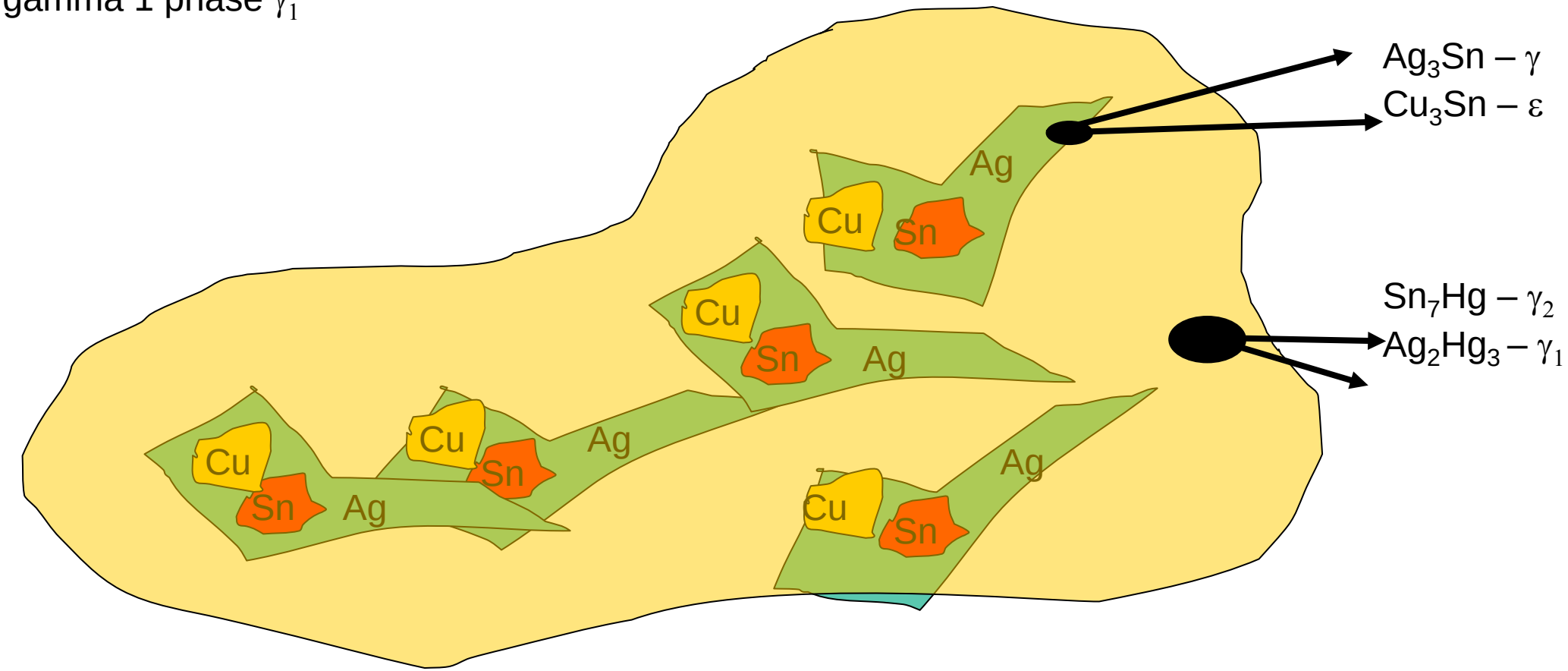


Ag_3Sn – γ

Cu_3Sn – ε

Amalgamation processes low copper amalgam

The mercury disolves the particles of the alloy
Sn – Hg: gamma 2 phase γ_2
Ag-Hg: gamma 1 phase γ_1



Setting of low copper (conventional) amalgam

Principle of setting is crystallization

Structure of the amalgam filling

Ag-Hg: gamma 1

Sn-Hg: gamma 2

} These phases crystallized – become hard

Gamma phase (Ag-Sn) that did not dissolve completely – remains in the structure

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Risks of the gamma 2 phase

- Non stable
- Tin is released due to electrogalvanism in oral cavity and mercury from this phase reacts with remaining gamma phase.
- This is external electrochemical corrosion.

Low copper amalgam has worse mechanical and corrosion resistance than high copper amalgam

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High copper amalgam

- Content of copper increased: 12 – 13%

(Less tin)

- Or up to 25% up to 40% (Less tin and silver)

Better mechanical and corrosion resistance

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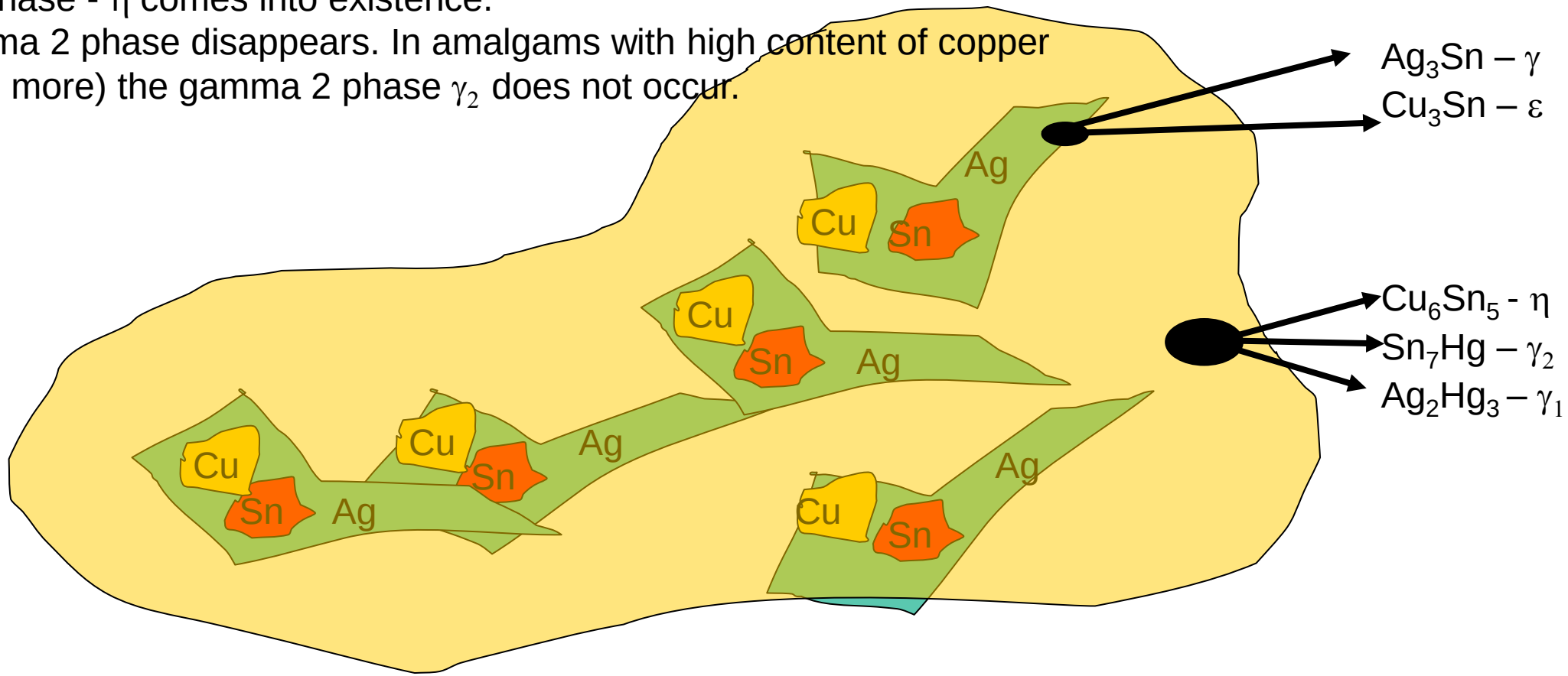
Amalgamation processes – high copper amalgam

High copper amalgam – copper dissolved in mercury has high reaction afinity to tin that is also dissolved in mercury. It reacts with tin in gamma2 phase γ_2 and eta phase - η comes into existence.
The gamma 2 phase disappears. In amalgams with high content of copper (25% and more) the gamma 2 phase γ_2 does not occur.



Types of amalgam restorative materials

High – Copper Amalgam (13% - 40%)

Admixed regular: Irregular particles: Ag 40 - 70
Sn 26 – 30
Cu 2-30
Zn 0-2

Spherical particles Ag 46 – 65
Sn 0 – 30
Cu 20 - 40

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Types of amalgam restorative materials

High – Copper Amalgam (13% - 30%)
Copper
Admixed unicompositional: Ag 52 - 53
Sn 17 - 18
Cu 29-30
Zn 0
Spherical particles Ag 46 – 65
Sn 0 – 30
Cu 20 – 40

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Types of amalgam restorative materials

Unicompositional - Spherical
Ag 40 – 60
Sn 22 – 30
Cu 13 – 30

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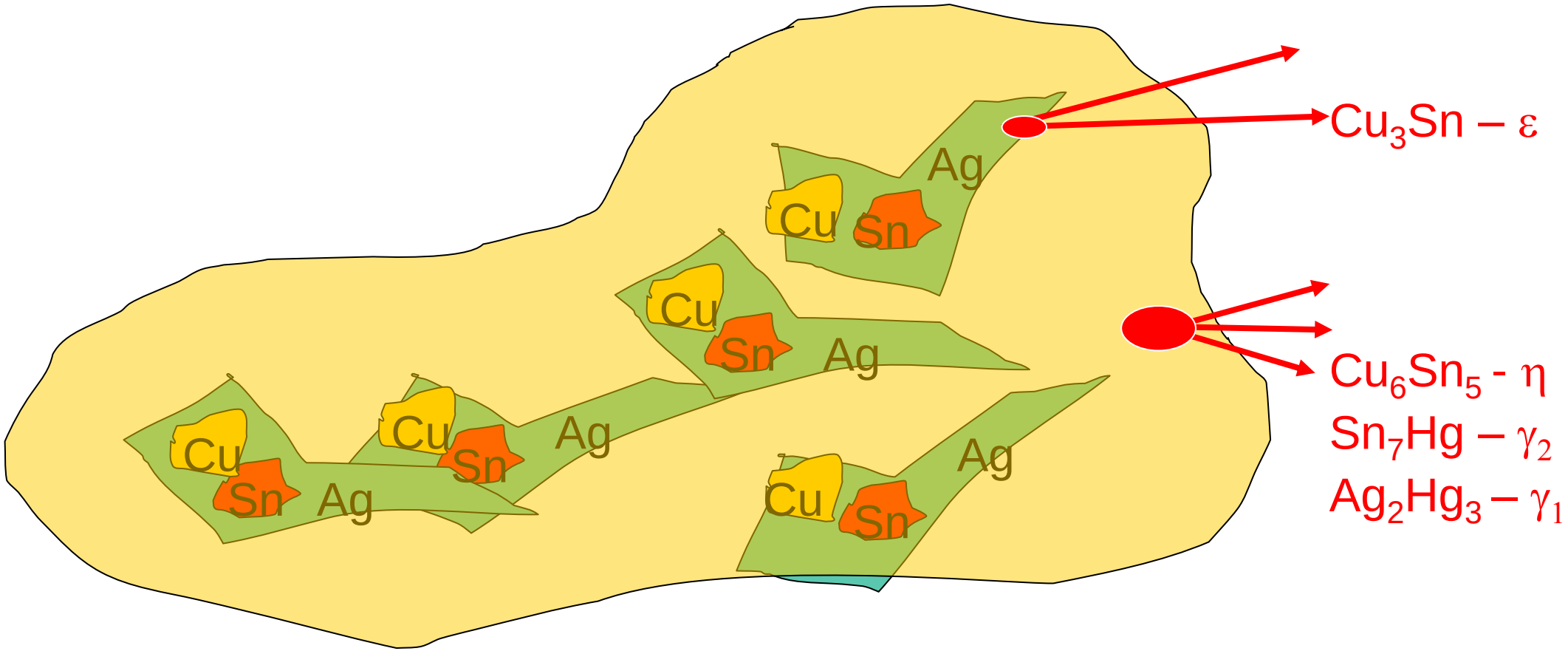
Amalgamation processes



Gamma two disapears or it does not occur when content of copper is high

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Amalgam - properties

Amalgam

- **Wear and pressure resistance (2mm thickness ast least**)- brittleness
- **Easy handling**
- **Low price**
- **Thermal and electrical conductivity**
- **Corrosion**
- **Bad aesthetics**
- **Flow (deformation of not completely set amalgam if the filling is loaded)**
- **Creep – completely set amalgam can be deformed due to bite forces. The filing is principly hammered.**

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Biocompatibility

- More than 160 years, more than 200 milions Ag fillings every year in USA.
- Allergy rare
- Precautions in children and in pregnancy.

AMALGAM IS STILL A MATERIAL OF CHOICE

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Toxicity and environmental risks

- Organic compounds

Vapours, aerosol

Precautions

- Ventilation
- Rests of amalgam in water
- Amalgam separators
- Dangerous waste (180 110)

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Amalgam indications

- Posterior area
- I. a II. class : moderate or large cavities,
- V. class

Other factores for consideration

When oral hygiene is not excellent

When patient wants low cost filling.

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Indications and contraindications of amalgam

Indications

- Moderate and large cavities in posterior area (class I., II. V)

Contraindications

Fillings in frontal area

Pregnancy, children till the age of 15

Allergy

Other factores for consideration

When oral hygiene is not excellent

When patient wants low cost filling.

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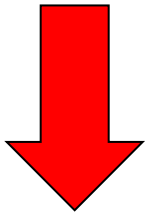
Mixing of amalgam

- **Hand mixing (obsolete)**

- **Power driven trituration**



Amalgamators

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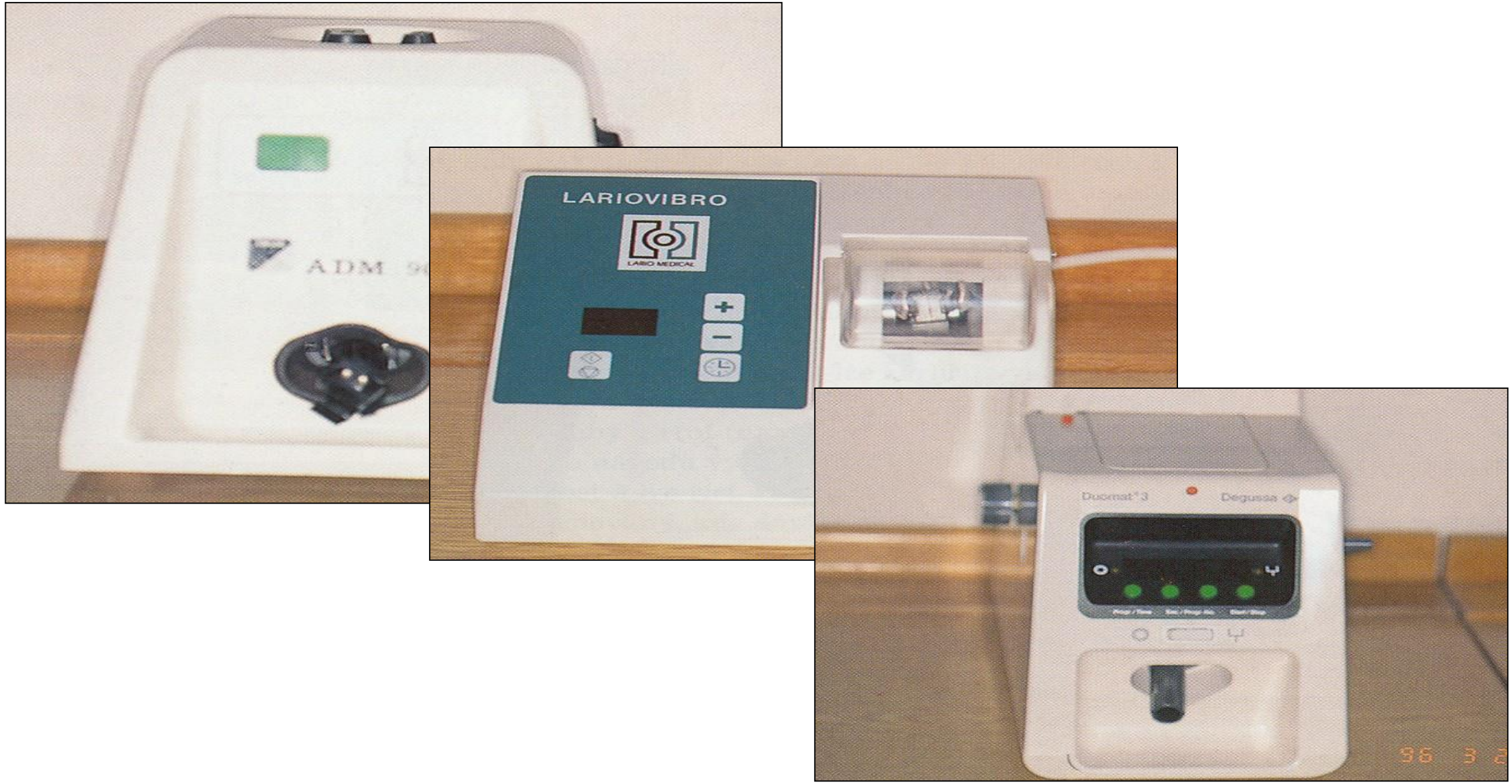
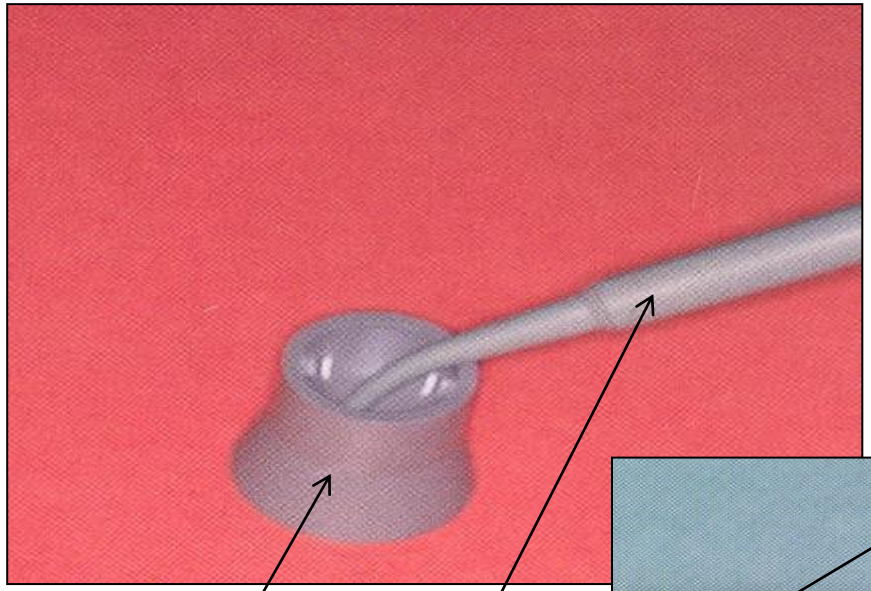
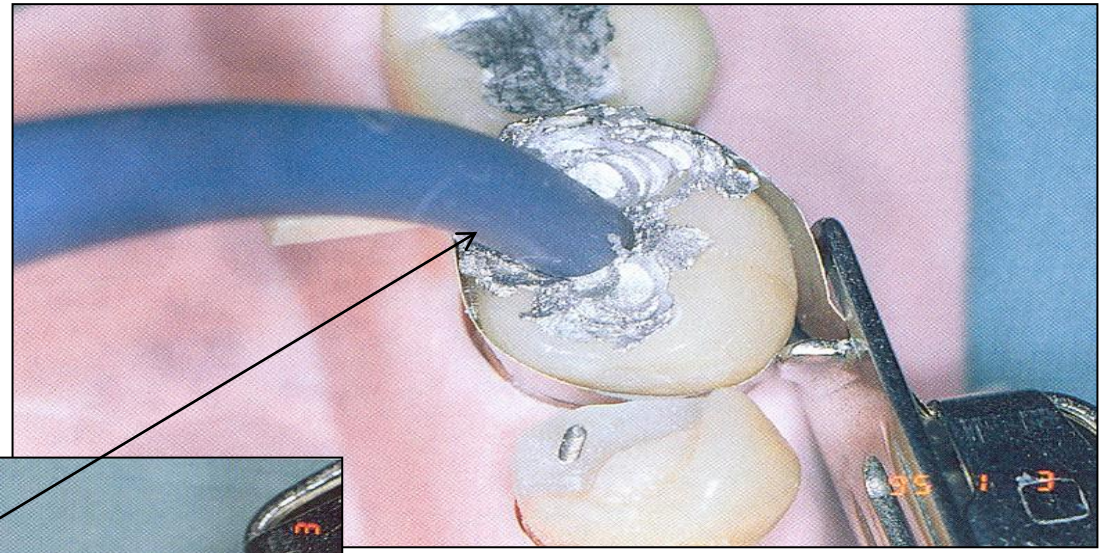
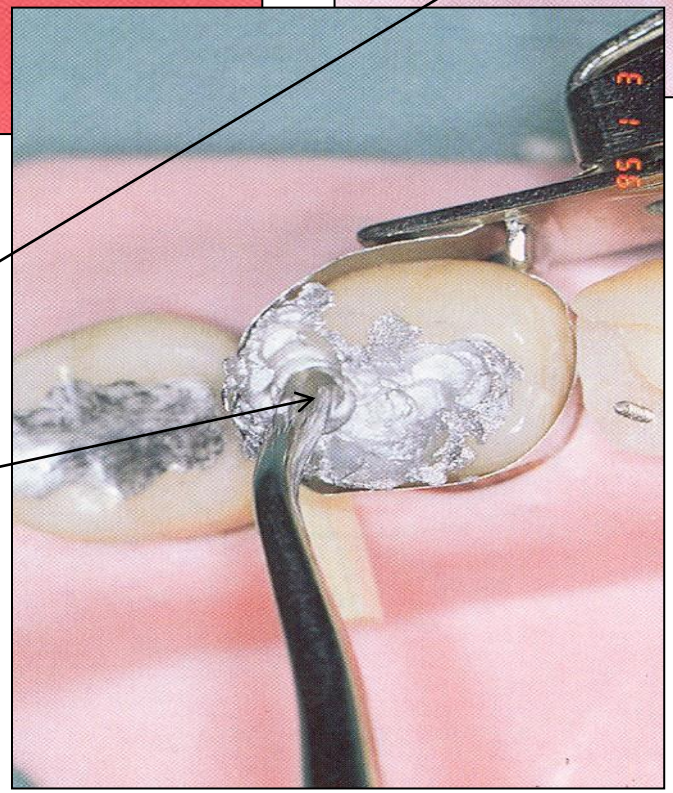

ADM
LARIOVIBRO
LARIO MEDICAL
Duomat 3
Degussa
98 3 2



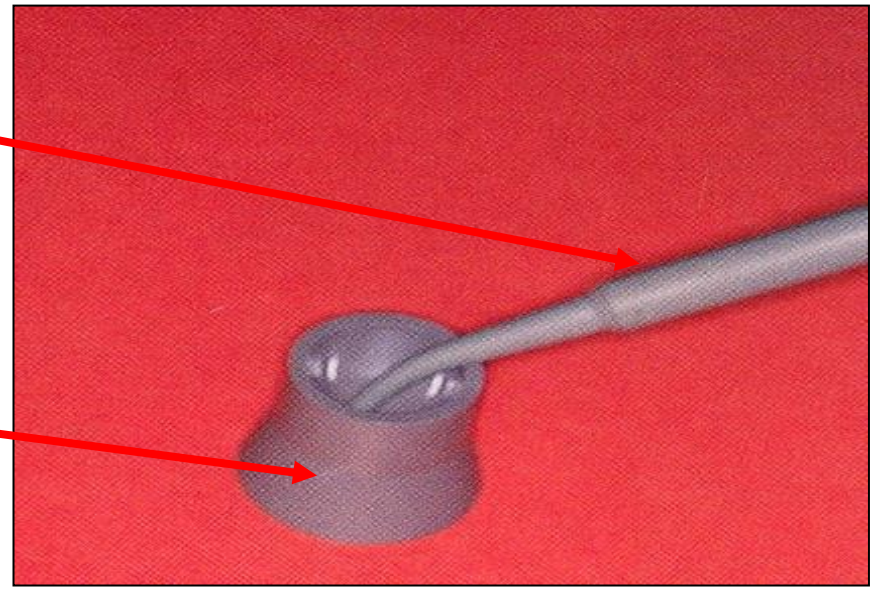


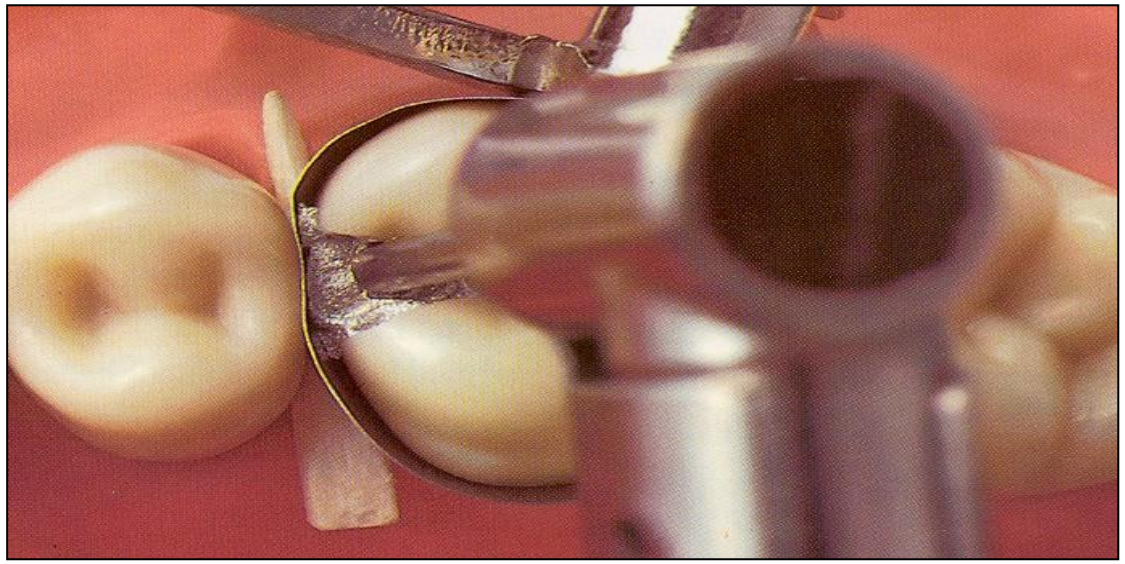


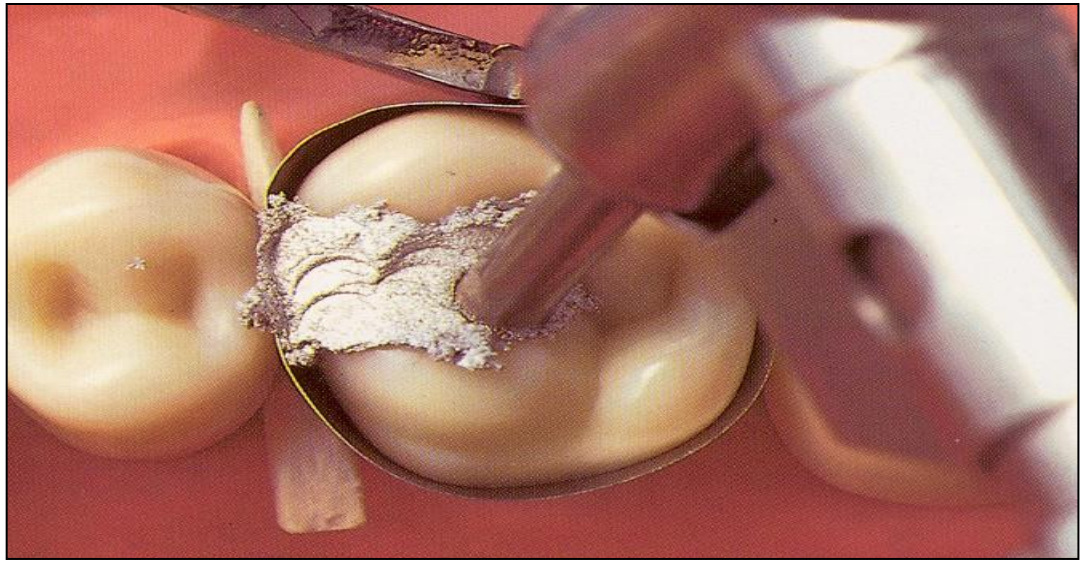
Cup
Amalgam gun
Condensor

Amalgam gun

Crucible (cup)







Power driven condensation

handpiece
condensor

Instruments

- **Preparation instruments**
- **Filling instruments**
- **Carvers**
- **Burnishers**

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Instruments

Preparation instruments - power driven

Burs

Diamonds

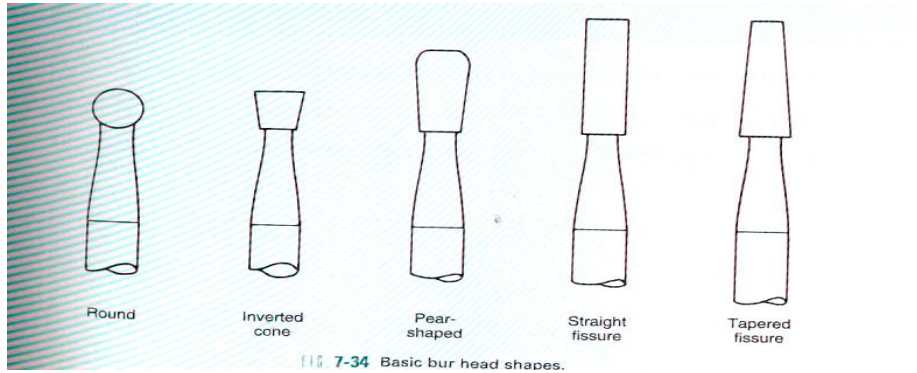

FIG 7-34 Basic bur head shapes.

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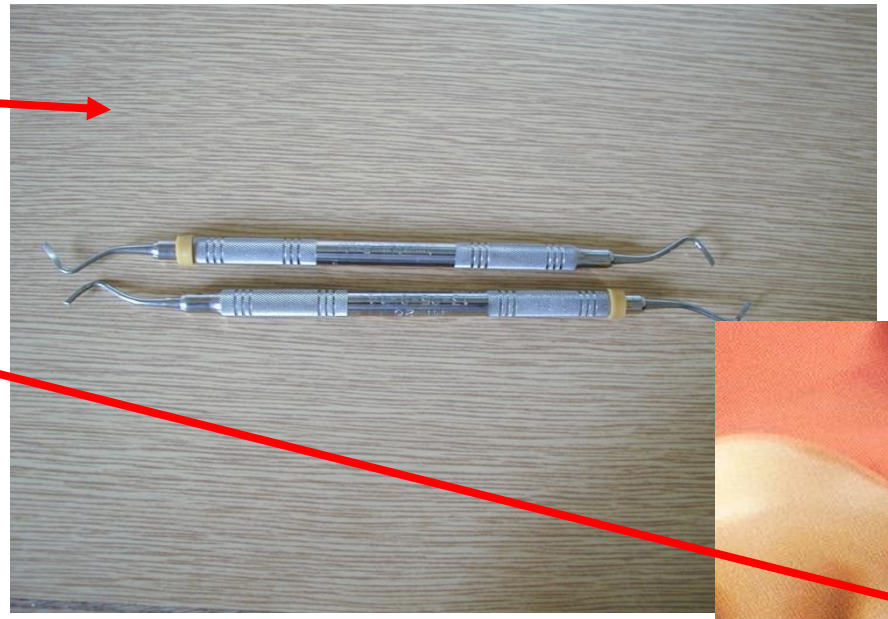
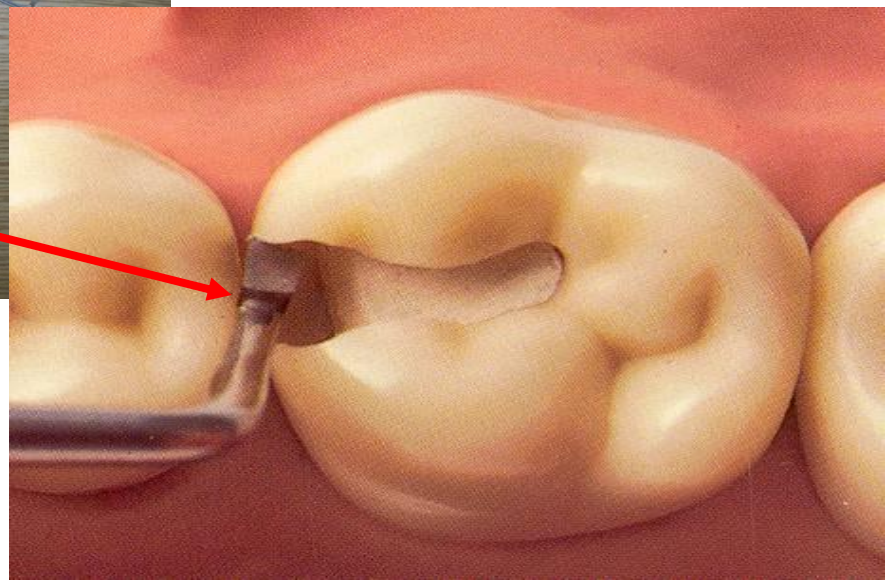
Instruments

- **Preparation instruments - hand**

Chisel



Excavator



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Amalgam carrier

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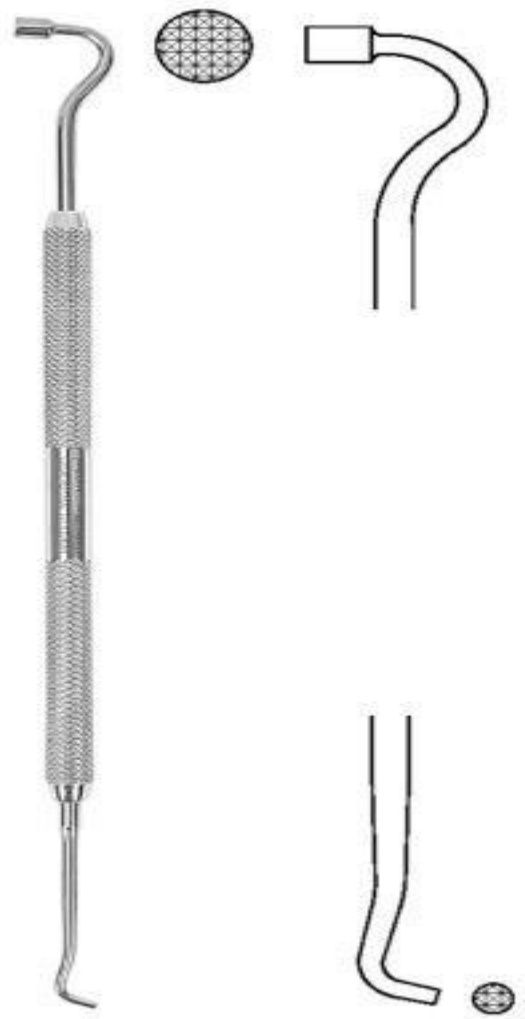
Amalgam carrier



Condensor with flat front

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Condensor and burnisher - spatula combined

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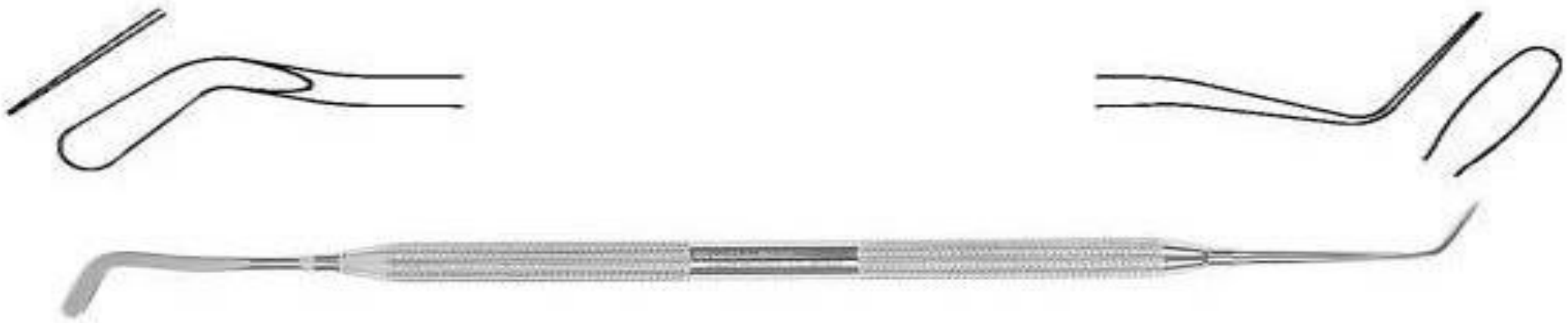
Burnisher - spatula
Angular- trough edge trough face



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Carver - Frahm

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Carver - Sapin

Carver - Sapin

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Carver discoid-cleoid

Carver Discoid-cleoid

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Burnisher – spatula, angular three face

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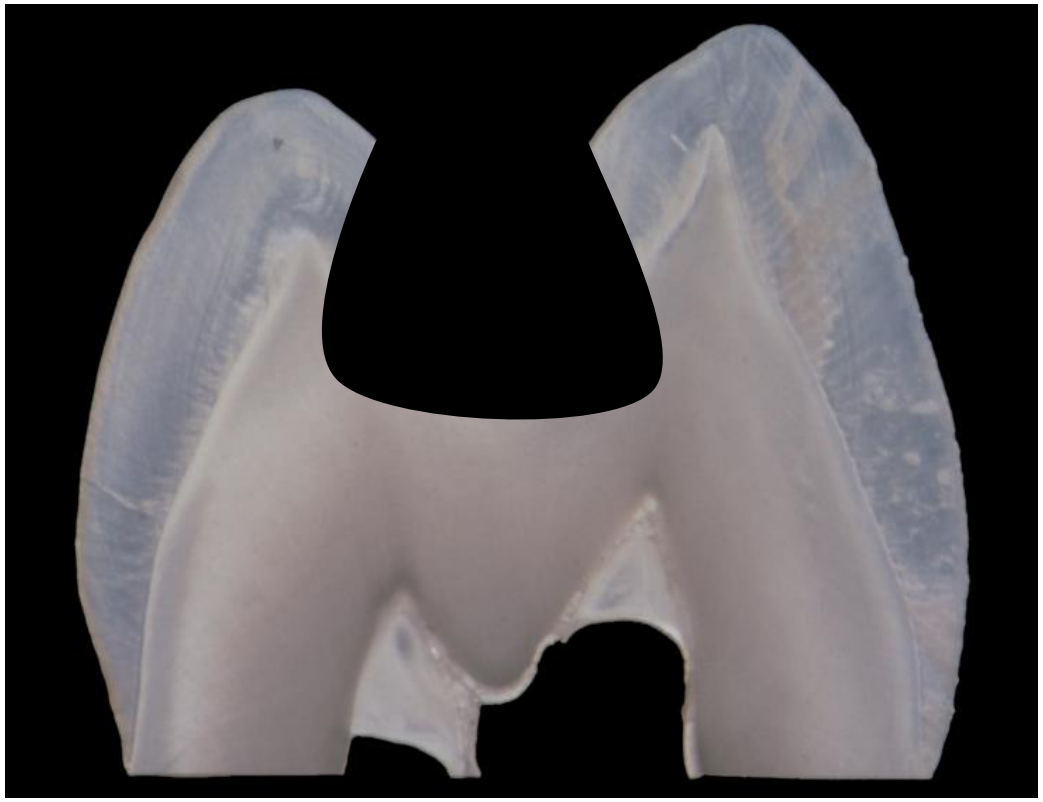
Ball condensor – used as a burnisher at most

Principle of the retention of amalgam

- Macromechanical retention
  - Undercuts
  - Grooves
  - Cavities for retention

Undercut



Amalgam step by step procedure

- Preparation of the cavity
- Base – protection of dentin wound
- Mixing
- Application portion by portion, condensation
- Carving
- Burnishing
- Finishing and polishing