Amalgam
Technical Aspect

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Silver colored restorative material.

Dental amalgam is a metal like restorative material composed of a mixture of silver/tin/copper alloy and mercury.

ANSI/ADA Specification No. 1
The basic setting reaction of amalgam is --

Alloy Particles for Amalgam + Mercury

Dental Amalgam + Nonreacted Alloy Powder Particles

Mercury is liquid at room temperature so it is easily alloyed with solid metal.

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SUCCESSFUL AMALGAM RESTORATION

- Selection of alloy
- Proportioning
- Trituration
- Mulling
- Matricing
- Condensation
- Carving
- Burnishing
- Finishing & polishing

- Composition of alloy
- Size and shape of alloy
- Heat treatment of alloy
- Surface treatment of alloy
- Mode of supply
**Low Cu alloy**  
(5% or less)

(\(\beta + \gamma\)) + Hg

(\(\gamma_1 + \gamma_2\)) + 
unused(\(\beta + \gamma\))

\(\gamma_2\)- weakest phase

**Least stable and corrosive**

**High Creep**  
(1%–8%)

**High Cu alloy**  
(13%–30%)

(Ag-Sn-Cu) + Hg

(\(\gamma_1 + \eta\)) + 
Unused alloy

\(\eta\)- Corrosion resistant phase

**High compressive strength**

**Better marginal adaptation**

**Low creep** (0.1%–1%)

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ZINC

Zn Containing (>0.01%)

Non Zinc Containing (<0.01%)
MODE OF SUPPLY

- Alloy powder & mercury.
- Disposable capsules with pre proportioned alloy powder & mercury.
- Preweighted pellets or tablets & mercury in sachets.
- Self activating Capsules.
DISPOSABLE CAPSULES

- Disposable capsules contain preproportioned alloy particles and mercury separated by a membrane.

- Before use the membrane is ruptured by compressing the capsule.

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PREWEIGHED PELLETS

- Conventional method of correctly dispensing alloy.
- Uniform in weight.
- Proper handling to avoid chipping of pellet.
- An accurate mercury dispenser is required.
Dispensers are based on volumetric proportioning.
SELF ACTIVATING CAPSULES

• Automatically releases mercury into alloy chamber during first few oscillations of amalgamator.
• Eliminates chances of Hg spills during proportioning.
A high copper spherical single compositional or admixed type of alloy is mostly preferred in 90% of cases.
PROPORTIONING

Signifies the parts by weight of Hg and of alloy to be used for particular technique.

- alloy composition
- particle size and shape
- heat treatment
- manipulation
- condensation technique
MERCURY/ALLOY RATIO

Amount of alloy powder and Hg in wt% that is required for trituration.

High mercury technique

Historically

So manipulative procedures to remove excess mercury-

- Squeezing mixed amalgam before insertion of increments.
- Removal of Hg rich amalgam during condensation of each increment.

Deleterious effect on physical and chemical properties of amalgam.

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MINIMAL MERCURY TECHNIQUE

EAMES TECHNIQUE

Recommended Hg/alloy ratio -
Lathe cut Alloys - 1:1 or 50%

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TRITURATION

The process of grinding powder, especially within a liquid.

In dentistry, used to describe the process of mixing the amalgam alloy particles with mercury.
OBJECTIVES OF TRITURATION

Remove oxide film on the surface of the alloy particles. for proper wetting by Hg.

Provide proper amalgamation & achieve a workable mix giving more working time.

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Using mortar & pestle.
2–3 psi triturative pressure is required.
Excessive force can lead to weakening of matrix.
Takes more than 45 seconds.

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MECHANICAL TRITURATION

➢ Trituration of amalgam alloy and Hg is done with a mechanical mixing device called AMALGAMATOR.
➢ Time ranges from 3 to 30 seconds.
ADVANTAGES OF MECHANICAL TRITURATION

- No need to squeeze excess of mercury, since alloy / mercury ratio is proportioned by manufacturer.
- Standardizes the procedure.
- Uniform mix can be attained.
CONSISTENCY OF MIX

Undertriturated
Rough and grainy.
More porous. Low in strength. Less corrosion resistance.

Normal
Shiny, smooth surface and consistency.
Separates as a single mass from capsule.

Overtriturated
Soupy
Difficult to remove from capsule.
Too plastic to manipulate.

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EFFECTS OF OVER & UNDER TRITURATION

- Working time decreases
- Dimensional changes
- Creep increases
- Compressive and tensile strength decreases

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MULLING

• Continuation of trituration

• Improves the homogeneity of the mass, improves texture.

• Should not be done with bare hands.

• ADVANTAGES – helps to uniformly coat the alloy particles with Hg
Mechanical mulling –
After mechanical trituration pestle is removed from capsule mix is triturated at low speed for 2 to 3 seconds.

Hand mulling – Mix is placed in dry piece of rubber dam or glove and vigorously rubbed between first finger and thumb.
Excess Mercury is squeezed out as fine droplets from a muslin cloth.

Thick condensable plastic paste

Squeezed amalgam is collected in well of dappen dish and loaded in amalgam carrier.
• Cavity preparation involving more than one surfaces, in order to have the required four surrounding walls and a floor for amalgam condensation into a cavity, a matrix should be adapted to tooth.
CONденSATION

The method of packing amalgam mix in its plastic state into the prepared cavity so as to achieve the greatest possible density of the material when set.
OBJECTIVES

To adapt the plastic amalgam mix to cavity walls and margins.

To remove unreacted Hg out of increments during building up restoration.

To reduce the number of voids.
Started with small increment at the centre of cavity

Condensor point stepped 45° at line and point angles

Subsequent condensation at 90° to prevent displacement of previous one

Presence of sufficient Hg for diffusion and bonding to increment

Shiny appearance after condensation

Each portion condensed from centre to periphery

Process continues till restoration is overfilled

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**PRINCIPLES OF HAND CONDENSATION**

- **Field of operation** – moisture free to avoid delayed expansion
- **Smaller increments to avoid voids and adapt alloy to cavity walls**
- **Condensed immediately within 3-4 minutes**
  - Time increased, Amalgam prone to fracture & Creep
  - Modern amalgam, rapid hardening so rapid condensation done
- **Never touched with bare hands**
  - Chances of contamination
  - Harmful for clinician

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DOUBLE ENDED CONDENSOR

- Contra angled with serrated and smooth ends.
- Serration make surface rough aiding mechanical bonding between increments.

CONDENSATION PRESSURE
- Condensation force 13.3 - 17.8N (3 to 4lb).

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MECHANICAL CONDENSOIRS

- Use rapid vibration
- Used where high condensation forces are required.

ULTRASONIC CONDENSOIRS

- Not recommended because of increased mercury levels in dental office.
PRE CARVE BURNISHING

- Continuation of condensation.
- Strokes are from restoration towards cavosurface margin.
- A large round burnisher with light strokes is used.
• Burnishing is defined as the plastic deformation of a surface due to rubbing/sliding contact with another object.

• Burnishing is accomplished with a ball burnisher.
• To Improve marginal adaptation

• To bring any excess Hg to the surface
Carving

Anatomical sculpturing of the amalgam material

Amalgam should hard enough to offer resistance to carving instrument.

So a scraping sound of AMALGAM CRYING should be heard

While carving the edge of carver should always rest on cuspal inclines.

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• To produce proper physiological contours.

• A restoration with adequate, compatible marginal ridges.
Amalgam scrap in clinics can be managed by
1. By mixing it with fixer because it has unreacted silver particles with which mercury can bind.
2. By mixing it with glycerine because it has very high viscosity.
3. By mixing excess scrap in 14 litres of water as liquid mercury is 14 times denser than water.
OCCLUSAL ADJUSTMENTS

To remove excessive occlusal contacts during centric loading and excursive mandibular movement.

1. Patient is asked to occlude; if any burnished (shiny) points or heavy centric stops are visible, it indicates high points and needs to be removed.

2. Articulating paper is commonly used to determine high points.

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POST CARVE BURNISHING

To remove scratches and irregularities on the amalgam surface

Done by ball burnisher with gentle strokes from the amalgam to the tooth surface

Rubbing the surface with a moist cotton pellet.

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FINISHING

removes surface irregularities

POLISHING

The process that removes the scratches & irregularities from the surface of the restoration leaving a smooth, highly glazed surface that is corrosion resistant.

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FINISHING

Removal of gross overhangs and flashes

Removal of unwanted shiny contacts

Removal of Superficial scratches and irregularities

• Finishing Burs

• Finer finishing burs and disc

• Finer rubber cups

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• Finishing strips for proximal surfaces

• Rubber cup with flour of pumice

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I. Do not eat for an hour.

II. Do not bite together hard or eat on new amalgam fillings for 2 to 3 hours

III. Do not eat hard or very crunchy foods for 24 hours.

IV. Avoid hot and cold drinks or foods for 4 – 5 hours