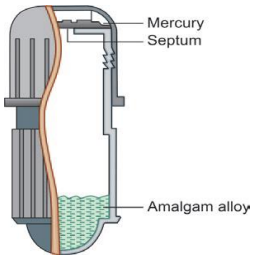
Dental Amalgam



Alloy:
Alloy is a union of two or more metals.

Amalgam:
Amalgam is an alloy of mercury with any other metal.

Dental Amalgam:
Dental amalgam is an alloy of mercury with silver, tin, and varying amounts of copper, zinc and other minor constituents.

Dental Amalgam Alloys:
Dental amalgam alloys are silver tin alloys with varying amounts of copper, zinc and other metals.

Advantages:

1. Ease of use.
2. High compressive strength.
3. Excellent wear resistance.
4. Favorable long-term clinical research results.
5. Inexpensive compared to composite restorations.
6. Biocompatible.

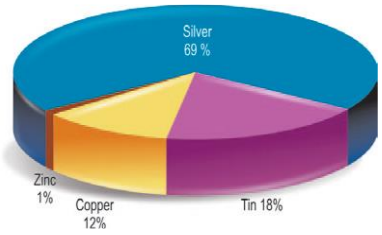
Disadvantage:

1. Non-esthetic.
2. Non-insulating.
3. Less conservative tooth preparation than for composite restorations.
4. Dental amalgam does not adhere to tooth structure, so mechanical retention means are needed (undercuts, grooves).
5. Initial marginal leakage.
6. Subject to corrosion and galvanic action.

Indication:
Amalgam may be used for Class I, II, V, and VI restorations; for foundations; and for caries-control restorations. Occasionally amalgam may be utilized for Class III areas if isolation problems exist. Likewise, Class V amalgam restorations may be indicated in anterior areas where esthetics is not an important consideration and the patient has high caries risk.

Contraindication:
Amalgams are contraindicated in patients who are allergic to alloy components. Amalgam should not be used when composite resin would offer more conservation of tooth structure, better esthetic and equal clinical performance.

Composition:



Amalgam consists of amalgam alloy (powder) and mercury (liquid). Amalgam alloy is composed of silver-tin alloy with varying amounts of copper, zinc, indium and palladium. Dental amalgam alloys are mainly of two types, low copper and high copper alloys. Low copper alloys contain copper upto 6% by weight and high copper alloys contain copper between 6 to 30%.

Types:

A. Based on shape of particles:

1. Lathe-cut: is made of irregular particles shape of the alloy.

2. Spherical (spheroidal) alloy: Alloy particles have spherical shape.

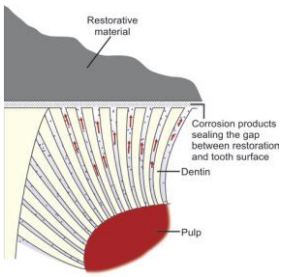
3. Admixed alloy: is that when different size or shape of amalgam powder is mixed together to increase filling efficiency.

B. Based on copper content:

1. Low copper alloy: Copper is in range of 2 to 6%. The material is subjected to corrosion.

2. High copper alloy: Copper is in the range of 6 to 30%. It reduces the formation of corrosion on the restoration. However, enough corrosion occurs at the amalgam–tooth interface to result in the sealing of the restoration, which reduces microleakage. High-copper amalgams exhibit no clinically relevant creep they are available with admixed or spherical alloy structure.

Effects of Constituent Metals on Properties of Amalgam:



Silver: It has the following effects on the properties of amalgam.

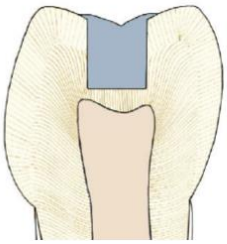
1. Increases strength.
2. Increases setting expansion.
3. Reduces setting time.
4. Resists tarnish and corrosion.

Tin: Tin helps in formation of a silver/tin compound (Ag/Sn). This is the gamma phase which readily undergoes an amalgamation reaction with mercury. Tin causes following effects:

1. Increases setting time.
2. Retards the reaction.
3. Reduces strength, hardness, and setting expansion.

Copper: It has the following effects on the properties of amalgam.

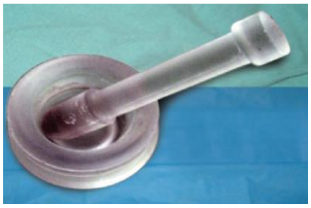
1. Reduces tarnish and corrosion.
2. Reduces creep.
3. Strengthening the set amalgam.



Zinc: Its presence is not essential. It may vary from 0 to 2 percent by weight. It has the following effects on the properties of amalgam:
1. Scavengers the oxygen to impede oxidization during manufacturing.
2. If contaminated with moisture, Zn gives rise to delayed or secondary expansion.

Palladium (0 to 1% by weight): Improves the corrosion resistance and the mechanical properties.

Indium (0 to 4% by weight): It decreases the evaporation of mercury and the amount of mercury required to wet the alloy particles.

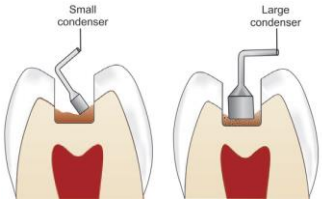


Trituration: It is a process of mixing the alloy powder with mercury liquid. It can be done by hand (by using mortar and pestle) or mechanical means (by using amalgamator) for a proper time mentioned by the manufacturer. Over-trituration causes increase in contraction, creep, and decreases the tensile and compressive strengths; mix is 'warm', sticks to the capsule, shiny wet and soft. While under-trituration looks dry, crumbly mix which very weak with low tensile and compressive strength, and increase in creep. Normal trituration mixtures look shiny mix, convenient to handle, mix is plastic in consistency and homogeneous.

Under **Normal** **Over**

Mulling:
It is continuation of trituration. Mulling of the amalgam can be done manually or mechanically. By hand, it can be done by squeezing the freshly mixed amalgam collected in the chamois skin. Mechanical mulling is done in the amalgamator by triturating it for one to two seconds.

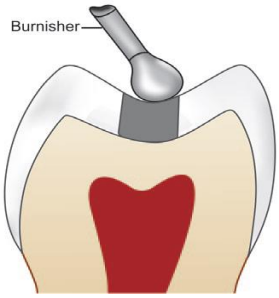
Insertion of Amalgam:
Use amalgam carrier to carry amalgam alloy into the preparation. Place first increment of amalgam in the deepest proximal part of preparation and condense it with flat surface of condenser. After it, add next increment and again condense it.



Condensation:
Different shapes and sizes of condensers are used for amalgam condensation. Working end of a condenser is serrated. Start condensation within three minutes of trituration. It condenses, eliminating voids and adapts amalgam to the preparation walls and floors.

Burnishing:

Burnishing is the process of rubbing of amalgam surface to make it shiny. Precarve burnishing is done after condensation when amalgam is overfilled. It is burnished immediately to improve marginal adaptability of restoration and remove excess mercury from over-packed amalgam. While postcarve burnishing it helps in decreasing rate of corrosion and reducing the surface roughness produced by carving.



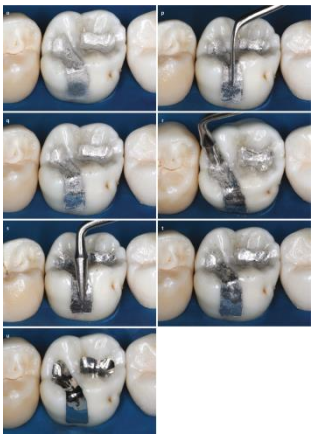
Carving:

Carving is anatomic sculpturing of amalgam restoration. It is done by carver instrument to produce anatomical contours and functional occlusion for the restoration. Amalgam should not be carved until it is sufficiently firm. For adequate carving, it is preferable to over-pack the preparation and then carve it to the margins. It provides no over and under hangs amalgam, good proximal contact and adequate marginal ridges.

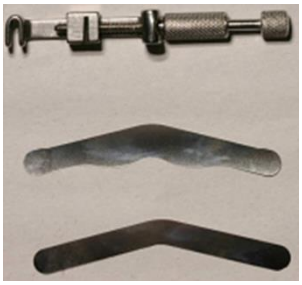
Finishing and Polishing

Finishing amalgam restorations involves removal of marginal irregularities, defining anatomical contours, and smoothening the restoration. They should be done after 24 hours of placement of amalgam restoration using abrasive stone.

The gingival margin is then checked for any over hanged margin of amalgam using sharp probe and also carving of the gingival embrasure if needed.



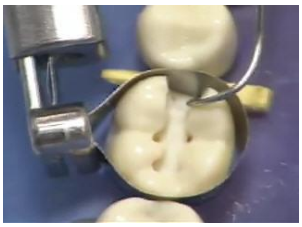
Matrix band and retainer:



The function of the matrix band:-

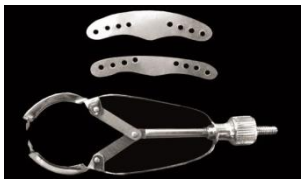
1. To retain the amalgam in the cavity during condensation.
2. To permit close adaptation of the amalgam to cervical and axial margins.
3. To help to restore the contact area and external contour of the crown.

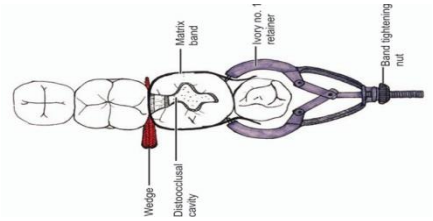
Matrices are of 3 types:-



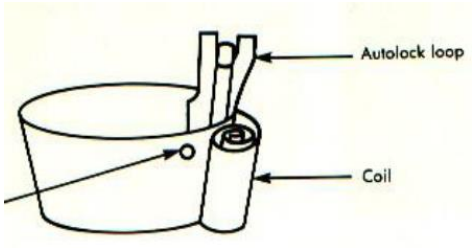
1. Universal Tofflemire matrix: The band encircles the tooth and is secured by a retainer indicated when we have 3 surfaces (MOD), 2 surfaces class II, it positioned from buccal. Band has different shapes: straight, curved, and contoured. The chief advantage of this type is that it can be firmly adapted to the tooth.

2. Ivory no.1The band encircles ¾ (three- quarters) of the crown and is retained by a retainer into the free embrasure. Indicated when the contact points are so tight that it is difficult to place the other types.



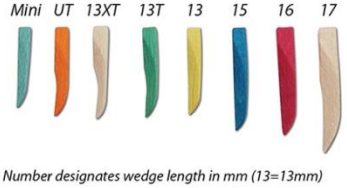


3. Automatrix retainerless system: In the third type only a matrix band is used without a retainer such as; Circumferential matrix system. It is indicated in badly broken teeth or patient with gagging reflex.



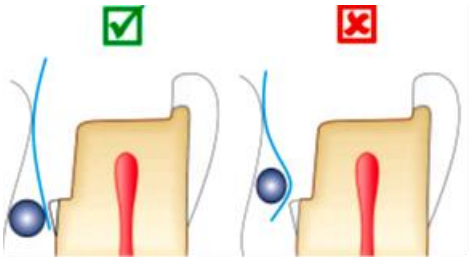
4. sectional matrix system: Only one tooth proximal surface is covered by a short band.

Wedges: They are wooden or plastic devices which are usually located interproximaly to provide a rapid tooth separation. They are either having a triangular or circular cross section.



Advantages:

1. Help in rapid separation of teeth.
2. Prevent gingival overhang of restoration.
3. Provide space to compensate for thickness of matrix band.
4. Help in stabilization of retainer and matrix during restorative procedures.
5 Help in retracting and depressing the interproximal gingival area.



The wedge should be positioned as near as possible to the gingival margin (just beneath to the gingival margin).

If the wedge is located occlusal to gingival margin, the band will be pressed into the preparation creating an abnormal concavity.

If the wedge is located as far as apical to margin, the band will not be held tightly against the gingival margin result in gingival excess (over-hanging restoration).

The triangular wedge is recommended for the deep gingival margin, because the base of the wedge will engage to the tooth gingival margin without causing excessive soft tissue displacement. While the round wedge is recommended to be used with conservative proximal boxes because it's wedging action is more occlusal (near the gingival margin) without impinging the soft tissue.

Reference:

1. Sturdevant's art & science of operative dentistry. Seventh edition (2015).
2. Textbook of operative dentistry. Nisha Garg and Amit Garg. (2015).