

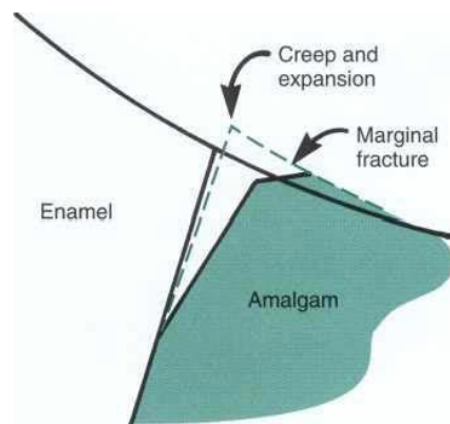
## Dental Amalgam

### Properties of dental amalgam:

**1- Compressive strength:** amalgam has high compressive strength for high copper alloy and less for low copper alloy. Because amalgam is brittle material therefore a sudden application of excessive forces to amalgam tend to fracture of amalgam restoration.

**2- Tensile strength:** Because amalgam is strongest in compression and much weaker in tension and shear, the prepared cavity design should maximize the compression forces in service and minimize tensile and shear stresses resulted from bite forces.

**3- Creep:** Is permanent deformation under static loads. Under a continued application of force in compression, an amalgam shows a continued deformation, even after the mass has completely set. The maximum allowable creep value for dental amalgam should not exceed 3%. After aging of the amalgam restoration at oral temperature for 6 months the creep value will be reduced. High copper alloys have lower creep values in compared with low copper alloys. So low copper alloys may have high incidence of marginal fracture (ditching of the margin as in figure 1) in compared with high copper alloys.



**Figure (1) Schematic view of Class I amalgam restoration with expanded margin due to creep that lead to marginal fracture and ditching**

**4- Dimensional changes:** The amalgam undergo shrinkage at the first time after setting (first 20 min.) and after this period the expansion will occur, although, the total change remain negative, and the dimension become constant within 24 hours.

If a contamination of the amalgam with moisture will occur during mixing or condensation, the zinc in the amalgam will decompose water into H<sub>2</sub> and O<sub>2</sub> gases which will lead to excessive delay expansion of the amalgam restoration and this may cause; marginal discrepancy, pitting of the surface of the restoration, compression on the surrounding tooth surface, post- operative pain, fracture of the restoration, and recurrent caries.

**5- Corrosion:** It is a progressive destruction of the metal by chemical or electrochemical reaction with its environment. Excessive corrosion can lead to increase porosity, reduce marginal integrity (ditching of the restoration margins), loss of strength, and release of metallic products into the oral environment.

Tarnish of the amalgam is black discoloration of the surface due to chemical corrosion with the sulfide.

**Three types of mixing may be resulted with different appearance and properties:**

**1- Undermixed (undertriturated) amalgam:** which appear dull and crumbly. The mercury does not completely wet the outer surfaces of the particles, so the mass remains soft for a longer period of time, producing an amalgam with a longer working time. Such an amalgam mass contains excessive amounts of porosity, has lower strength, and possesses poorer corrosion resistance.

**2- Normal mix:** which appear shiny and separated in one mass from the capsule.

**3- Overmixed (overtriturated) amalgam:** which appear soupy and tend to stick to the inside of the capsule. Over-trituration reduces working time, causing the reaction rate to increase because the amalgamated

mass becomes hot. The resulted amalgam has low compressive strength and high creep.

### **Amalgam condensation:**

Condensation of the amalgam inside the cavity is important for:

- 1- Good adaptation of amalgam to cavity walls and margins.
- 2- To get compact and homogeneity amalgam restoration and minimal voids, this can effect on the strength of filling.
- 3- To remove excess of mercury and this reduce the dimensional changes, creep and increase compressive strength of filling.

After mixing, the amalgam must be used immediately without prolonging the time between mixing and condensation because this will lead to condensation of partially set amalgam and that may lead to break and fractures in the matrix that has been formed in the mixed amalgam.

Cavity to be filled should be kept completely dry during amalgam condensation.

### **A-Hand condensation:**

- 1- There are many hand instruments with many tip shapes and with different sizes.
- 2- Lateral and vertical direction of the condensation provides better adaptation of the amalgam to the cavity walls and floor.
- 3- Amalgam should never be touched with hands to eliminate contaminations.
- 4- The amalgam carried to the cavity in small amount by using of amalgam carrier and condensation should be done immediately to each small increment, because if large amount of the amalgam is putted in the cavity, the condensation will be ineffective to have a properly condensed restoration with low amount of mercury.

**5-** Condensation is continued till we have over-filled cavity, this mean put amount of amalgam above the occlusal surface and this overfilling is important for:

- a- To ensure that the cavo-surface margins are completely covered to avoid exposure of that margins.
- b- To be able to do good carving.
- c- Get rid of excess mercury.

### **B- Mechanical condensation:**

Many mechanical devices are available for condensing amalgam. These devices are more popular and more useful for condensing irregularly shaped alloys when high condensation forces are required.

### **Amalgam carving:**

The main aim of carving the amalgam is for removal of the excess material and maintains the structure of the tooth. There are many instruments that can be used for carving such as carver and spoon excavator.

after ending of the condensation, the surface of the overfilled amalgam should be burnished by using of a large burnisher with high force moving from the center of the restoration to the margins, this will produce denser amalgam at the margins of the cavity.

All carving should be done with the edge of the blade perpendicular to the margins as the instrument is moved parallel to the margins. Part of the edge of the carving blade should rest on the unprepared tooth surface adjacent to the preparation margin. Using this surface as a guide helps to produce a continuity of surface contour across the margins.

Over-carving or deep occlusal grooves carving should not be done on the restoration, because these may thin the amalgam at the margins, invite chipping, and weaken the restoration.

Under-carving leaves thin portions of amalgam (subject to fracture) on the unprepared tooth surface. Such margins give the appearance that the amalgam has expanded beyond the preparation.

After end of carving, post carving burnishing is done by lightly rubbing the carved surface with a burnisher of suitable size and shape to improve smoothness and produce a satin (not shiny) appearance.

Finally; the grooves are enhanced with conical amalgam burnisher and the restoration smoothed by small damp ball of cotton.

### **Filling cavities using matrix band:**

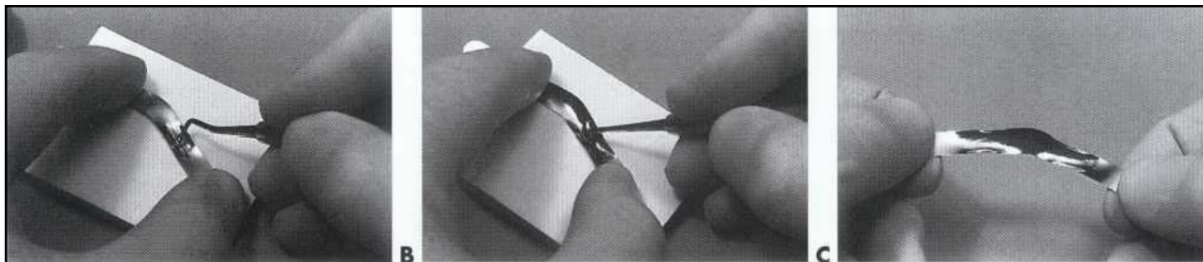
The matrix-bands are used in compound or complex cavities to have the desired contour of the restoration.

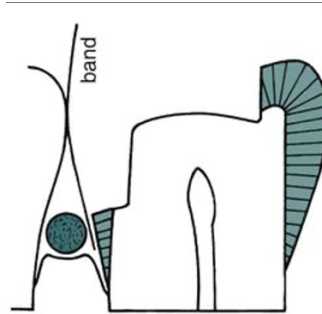
**Matrix bands:** its position must be 2 mm above the marginal ridge.

**Matrix retainer:** It's a mechanical device retained the band in its selected position.

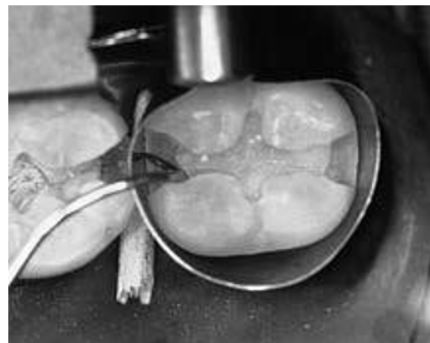
**Tofflemire retainer:** The conrangle-tofflemire can be placed at the lingual side. When there is one missing wall of the tooth circumferential retainer can be used. Attention must be given to have the proper contour of matrix band bucco-lingual and occluso-gingival direction, otherwise the restoration will have defects in its contour. Contouring occurs by burnishing the band in the areas corresponding to the proximal surface or surfaces to be restored once the band is positioned around the tooth.

Burnishing means that the metal band has been deformed occluso-gingivally with a suitable burnisher to produce a rounded or convex surface that (when in place around the tooth) will produce a restoration that is symmetric in contour with the adjacent proximal surface.





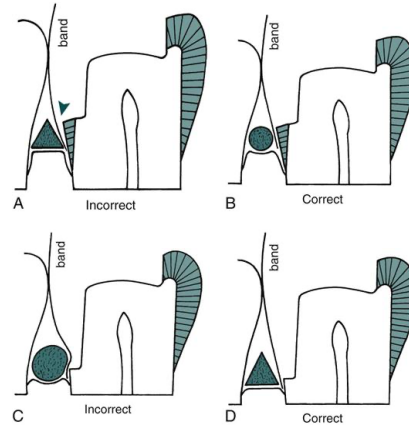
Use of the explorer tip to ensure proper adaptation of the band to the gingival margin. In addition, the tip is pressed and dragged along the gingival margin in both directions to ensure the removal of any friable enamel.



**Wedge:** It's a triangular or circular cross section wooden or plastic piece located interproximally to:

- 1- Hold the band tightly against the gingival margin of the cavity.
- 2- Prevent an over hanged filling.
- 3- Provide sufficient separation of teeth to compensate the thickness of band.

The wedge is placed in the gingival embrasure, from the lingual or facial embrasure (whichever is larger), slightly gingival to the gingival margin of the cavity, however the lingual embrasures are larger than the buccal in the posterior teeth. Wedge the band tightly against the tooth and margin, if the wedge is placed occlusal to the gingival margin, the band will be pressed into the preparation, creating an abnormal concavity in the proximal surface of the restoration. See fig 4

**Figure (4) A- wedge B- correct wedge position.****Finishing and polishing:** it is done for:

- 1- Well finished and polished restoration this will keep the surface smooth and clean so less tarnish and corrosion occur.
- 2- Rough surface may cause accumulation of food particles leading to secondary caries.
- 3- Polished surface gives better response to the surrounding soft tissues.
- 4- We can have more ideal carving and contouring.
- 5- A small feather edges of amalgam excess left beyond the margins may fractured under stress leaving rough surface and that can be removed during polishing.

For finishing and polishing we use the following:

- 1- Tapered stone bur.
- 2- Round or flamed finishing bur with deferent sizes.
- 3- Rubber cup and pumice with water.
- 4- Thin zinc-oxide with soft cup brush for final shine.