**Manipulation of dental amalgam**

1- Proportioning and Dispersing
Alloy-mercury ratios vary between 5:8 and 10:8. Those mixes containing greater quantities of mercury are wetter and are generally used with hand mixing which requires the removal of excess mercury following trituratration and during condensation. For optimum properties, the final set amalgam should contain less than 50% mercury. require the removal of excess mercury following trituratration and during condensation. This ratio depends on: alloy type, particles size, and shape; therefore manufacturer instruction should be followed.

**Proportioning of Hg and alloy:**
This done by the use of:
1- Volumetric proportioning for Hg and alloy.
2- By weight with the aid of balance
3- The use of pre-weighted alloy tablets with the use of volumetric Hg dispense
4- The most accurate methods is the using of capsule containing both alloy particles and Hg in separated compartments. these capsules supplied in 400,600 and 800 mg of alloy and appropriate amount of Hg

**Mixing(trituration)**
The object of trituratation is to provide proper amalgamation of the mercury and alloy. The alloy particles are coated with a film oxide that is difficult for the mercury to penetrate. This film must be rubbed off so that a clean surface of alloy can come in contact with mercury. The oxide layer is removed by abrasion during trituratation. The duration and speed of trituratation should be just enough to coat all alloy particles with mercury, produce the amalgam matrix, and provide a plastic mix. The normally mixed mass is homogenous, shiny in appearance, it can be managed easily during condensation. A good (normally) mix of amalgam is plastic enough to condense well. Excessive trituratation should be avoided because it generates heat and creates excess matrix in the microstructure of the resulting set material. In addition, an over triturated mix of amalgam will set prematurely after trituratation, and this will prevent adequate condensation and adaptation to the walls of the preparation, resulting in a weakened product. The over mixed amalgam is difficult to remove from the capsule and has soupy appearance and difficult in handling. If the mix is too hard, brittle, or hot, reduction of the mixing time and/or the mixing speed is indicated. Under mixed mass is crumbly, dull in appearance and has low strength. Originally, the mixing done by hand with mortar and pestle today the amalgamators produce faster, less Hg content and standardized products.

**Mulling process**
It is the continuation of the amalgamation process it is an effective way of collection

**Condensation**
The objectives of condensation are:
1- to secure adaptation of the amalgam to the walls and the margins.
2- to get compactness and homogeneity of the amalgam in the restoration with minimal voids which is an influential parameter in the reduction of the strength.
3- To further remove excess Hg while gaining the adaptation When amalgam is condensed, mercury tends to be brought to the surface, creating a mercury-rich amalgam on the surface. To reduce the amount of mercury left in the restoration (residual mercury), the preparation is
overfilled (Fig 1) and the mercury-rich excess is carved off. The lower the residual mercury in
the carved restoration, the greater its strength and the better the expected longevity of the
restoration.
In general if more Hg is left in the amalgam during condensation the restoration will have:
1-more dimensional change during setting with higher creep
2-excessive amount of gamma2
With irregular shaped alloys, in which a higher percentage of Hg is used initially, the operator
should remove as much Hg as possible during condensation by using as great force as possible
on the condenser with small condenser head for condensation of the increments Amalgam
should be condensed both vertically and horizontally or laterally (toward the walls of the
preparation). This will promote a close adaptation of the amalgam to the walls as well as to the
floor of the preparation.
With spherical alloys, the initial Hg is lower and its not necessary to remove as much as Hg
for the irregularly shaped alloys. spherical alloys produce an amalgam that requires a lower Hg-
alloy ratio ,less condensation force and lateral condensation force is more important because
dey do not adapt to the cavity wall as well as the lath-cut or admixed amalgam. In addition, the
spherical materials generally have a shorter working time and demonstrate a faster set than the
admixtures. the condensation force required for spherical amalgams will be considerably
less,161'162 because heavy forces with the condenser tend to push the spherical particles to the
side and cause the condenser to "punch through" the amalgam mass Larger condensers should
be used for spherical amalgam, rather than for admixtures, to allow adequate force to be applied
without displacement of the spherical amalgam to the side.
After the mix is made, condensation of the amalgam should be promptly initiated. The longer
the time laps between mixing and condensation the weaker is the amalgam in addition the Hg
content and creep will increase.
Condensation of partially set material probably fractures. Also when the alloy has lost a certain
amount of plasticity, it is difficult to condense without producing internal voids.
The field of operation should be kept absolutely dry during condensation.
The amalgam should be carried to the cavity with amalgam carrier incrementally; immediate
condensation done after each increment with sufficient pressure in vertical and horizontal
direction.(fig-1)
The procedure of adding an increment and condensing it, adding another increment is
continued until the cavity is overfilled (about 1mm) and the filling is over packed with larger
condenser. The incremental method is used to ensure maximum condensation effectiveness. fig 2
Many mechanical devices are available for condensation, they are more popular and more
useful for condensing irregularly shaped alloy when high condensation forces are required.
With the development of spherical alloys, the need for mechanical condenser was eliminated.
Overfilling : to put an excess of amalgam above the occlusal surface in order to:
1- cover the cavo-surface margin completely to avoid exposure of those margins.
2- To be able to do proper carving.
3- To further remove excess Hg.
Condensation when Amalgam Bonding Resins Are Used

The polymerization of amalgam bonding resins is chemically initiated, the amalgam must be ready to place when the two parts of the bonding resin are mixed to initiate polymerization. Although all walls of the cavity preparation should be coated, caution should be exercised to minimize the amount of bonding resin placed on the walls. One problem resulting from excess bonding resin is the reduction of the amalgam strength by incorporation of large amounts of resin into the bulk of the amalgam.

Carving:

Initial carving consists of removal of the bulk excess using a large spoon excavator with the remaining tooth structure contour being employed as a guide.

Precarving burnishing is a form of condensation to ensure dense amalgam at the margins and it aids in shaping the restoration, this done by using heavy stroke with large burnisher moving from the center of the restoration outwards beyond the margins.

Carving:

As crystallization of amalgam occurs, its consistency becomes much stiffer, it is suitable for carving.

Carving instruments:

1. blunt probe.
2. cleoid-discoid.
3. excavator.
4. carver.
5. ash no.6.

1. All carving should be done with the margins (in the direction of the margins or parallel to the margins).
2. Some of the blade edge of the carving instrument should rest on or over the external tooth surface adjacent to the cavity margins in of the surface contour across the margins. (fig-3,4)
3. Occlusal anatomy should be kept reasonably (shallow) to preserve a bulk of amalgam at the margin. Deep grooves produce stress areas that are susceptible to fracture and areas for food collection. When the grooves are deep it means the amalgam is thin.
4. Under carving leaves thin portions of amalgam an the external tooth surface that will break away, giving the appearance that the amalgam has grown out of the preparation.
5. Mesial and distal pit areas should be carved slightly deeper than the proximal marginal ridge.
Post carve burnishing: it is a light rubbing of the carved surface with the burnisher to improve smoothness and produce a shiny appearance and produce a denser amalgam with more compaction, adaptation and sealing of amalgam at the margins.

Occlusion: light closer is made and the surface checked for the heavier burnished areas, lateral slide is used to develop the desired eccentric occlusion. Articulating paper may be used to check the occlusion.

Finally, the grooves are enhanced with "conical amalgam burnisher" and the amalgam is smoothened by a small damp ball of cotton.

Finishing and polishing: this is necessary to complete the carving, to refine the anatomy, contours, and marginal integrity and enhance the surface finishing of the restoration, they are not done within 24hr. of insertion, since the crystallization of amalgam is not completed. They reduce the surface roughness of the restoration with less prone to tarnish and corrosion. Finishing is done with stone bur and the polishing can be done with rubber point at low speed rotating handpiece; avoiding generation of high temperature which affect on the pulp and cause releasing of Hg.
**Fig-6**: Polishing the amalgam. A, When necessary, use fine-grit carborundum tone to develop continuity of surface from tooth to restoration. B, Surface the restoration with round finishing bur. C, Initiate polishing with coarse, rubber abrasive point at low speed. D, Point should produce smooth, satiny appearance. E, Obtain high polish with medium- and fine-grit abrasive points. F, Polished restoration.

**Cervical cavity**: Place the alloy into the preparation in small increments and condense first into the retentive areas with an properly size condenser. As the surface of the restoration becomes more convex, condensation becomes increasingly difficult. The operator must guard against the amalgam's "land sliding or displacing" during over packing. Often a large condenser or plastic instrument held against the amalgam may help to offer resistance from pressure applied elsewhere on the restoration.

The most difficult gingival cavity preparation to condense is the one with an axial wall that is very convex mesiodistally. Two alternate methods for insertion may be considered. First, the cavity may be prepared and filled in sections. Each new section of the preparation should be extended slightly into the previously condensed portion.

Second, is the application of a matrix to confine the amalgam in the mesial and distal portions of the preparation. Short lengths of stainless steel matrix, one each for the mesial and distal surfaces, are passed through the proximal contacts, guided into the gingival crevice, and wedged. The strips must be wide enough to extend occlusally through the respective contacts and long enough to extend slightly past the facial (lingual) line angles. The strip may require
compound for stability. (Often it is helpful to apply a small amount of softened compound on the tip of the wedge before wedge insertion.)

Carving may begin immediately following insertion of the amalgam. All carving should be done "with" the margins (i.e., parallel to the margin) Fig-8.

the edge of the carving instrument should rest on external tooth structure or surface to prevent "Over carving" (use a carver and a probe) which result in food stagnation area at the restoration. Also under carving should be avoided which produce food stagnation area below the restoration. The food should be directed on to the gingiva but not into the gingiva for without damaging effect of food impaction and gingivitis

Fig-7- Using of proximal matrix fixed by impression compound for proximal extended Class V amalgam application

Fig-8-Carving of cervical amalgam restoration

Fig-9-extended cervical amalgam restoration