**STEPS IN CARVING AMALGAM**
**class 2 cavity**
**2004-2005**

**Word to the wise:** Study of the occlusion, together with the remaining tooth contour and position of the adjacent tooth, **before starting** a cavity preparation, guides the placement of occlusal contacts and marginal ridge height in your restoration.

**Prior** to placement of the rubber dam and the cavity preparation:

**a-** Use articulating paper to locate the existing occlusal contacts with the opposing teeth.
**b-** Determine the level of the defective marginal ridge(s) in relation to the adjacent tooth (teeth).

## Carving Instruments

**Explorer** (EXD2A- cowhorn) (item # 2)
**Discoid and Cleoid: large and small -** (use the size that corresponds to the size of the prepared cavity) (items # 26 &27)
**Hollenback** (item # 24)
**Proximal carver** (CVWI 8) (Item # 25)
**Large spoon excavator** (item # 20)

**1-** First step- **Immediately** after completing condensation, use the **explorer** to:

**a-** separate the newly condensed amalgam from the matrix band. Rest the tip of the explorer against the matrix band and move the explorer from the bucco-proximal margin toward lingual, stopping at the center of the box (Fig. 1). Repeat the procedure again, this time starting from the linguo-proximal margin. (WHY)

**b-** define the contact area and marginal ridge. Note the height of the adjacent marginal ridge --- they should be at the **SAME** level (Fig. 2 & 3).

**c-** define the occlusal embrasure. Give special attention to the angulation of the explorer in relation to the matrix band (Fig. 2 & 3).

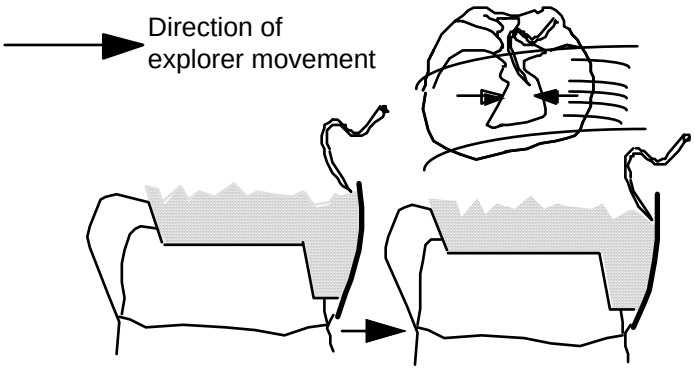



**Fig 1**

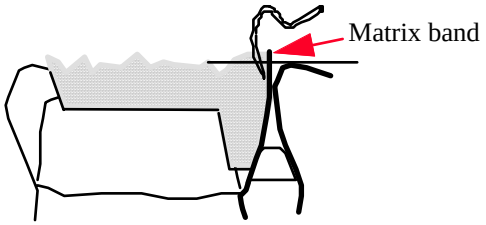



**Fig 2**

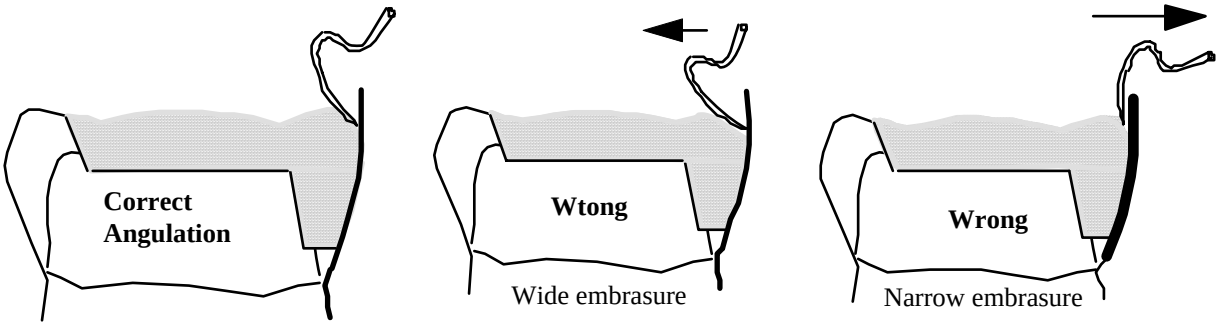



**Fig 3**

**2-** Use **Discoid and cleoid** (discoid side) (Item # 26/27 depending on the size of the restoration) to remove **excess amalgam** from the **occlusal surface** (exercise care **NOT** to come too close to the occlusal cavity cavo-surface margin **at this time**).

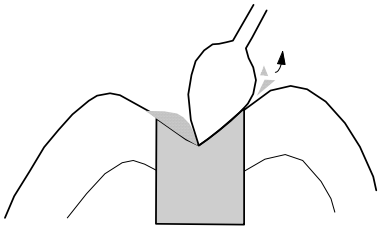
**Start occlusal carving when the dental amalgam shows some resistance to the carving instrument**
(Use explorer or Discoid/cleoid to test the amalgam for resistance to the carving instrument)

**Amalgam shouldn't be**
## too plastic or too set

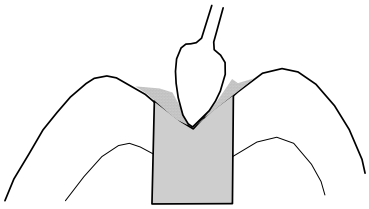
**3-** Use **Discoid/cleoid** (cleoid side) to develop a continuous (smooth) surface from the enamel to the restoration (not a "step down"). Occlusal carving is done with "pull stroke", however, the "push stroke" can also be suitable in developing occlusal anatomy (grooves). Occlusal margins are carved so that no feathered over-extension remains. Knowledge of the external outline of the prepared cavity, the morphologic anatomy, the prior functional contacts and the remaining tooth anatomy all serves to guide in the development of the occlusal anatomy.

Occlusal grooves are formed to coincide with the remaining tooth anatomy. These are developed **as distinct** but not **necessarily deep** grooves.
The occlusal amalgam should be carved with two strokes:

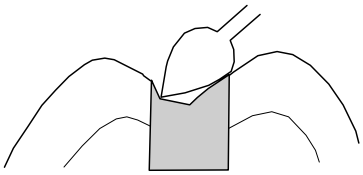
**a-** The carver is pulled (or pushed) as the cleoid **edge** is placed parallel to the cavity margin as part of the cleoid edge rests on the enamel adjacent to the restoration (fig 4 & 5). The tip of the instrument should not pass the **center** of the prepared cavity (fig. 6).



**CORRECT**
**Fig. 4**



**WRONG**
**Fig .5**



**WRONG**
**Fig. 6**

**b-** The carver is pulled from enamel toward the restoration as it is held 90$^{o}$ to the margin of preparation (a large spoon excavator or discoid is more suitable for this stroke than the cleoid side of the instrument (Fig. 7).

Thin fins (acute angles) are formed and fractured easily when the:

**b1-** carver is pulled from the restoration toward the enamel. This will cause a "step down," rather than a continuous (smooth) surface from the enamel to the restoration. (Fig. 8)

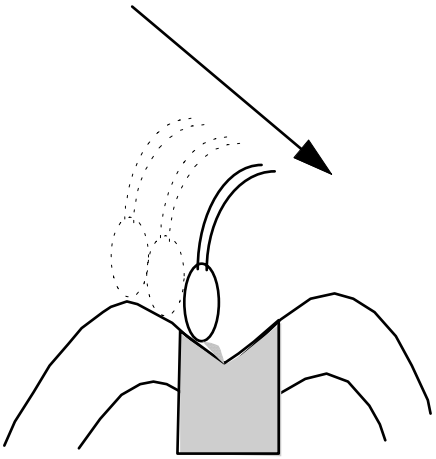


**Fig. 7**

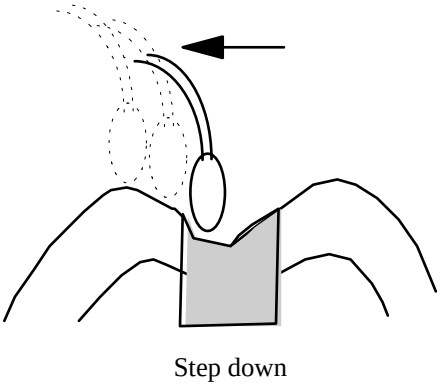



**Fig. 8**

**b2-** amalgam is over-carved to develop deep grooves (Fig. 9).

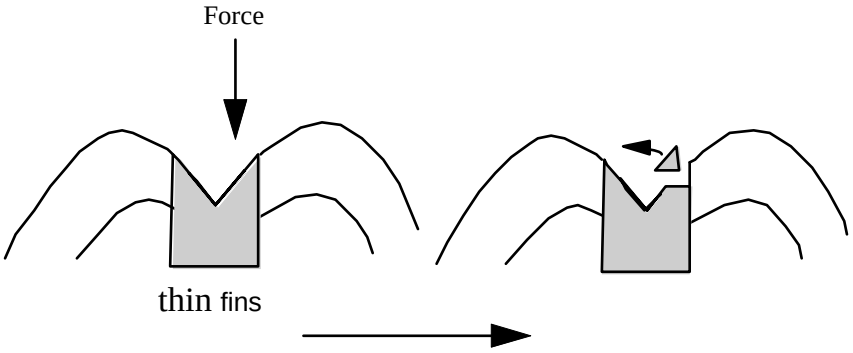



**Fig. 9**

**b3 -** When the occlusal grooves needs to be deepened, the side of the carver should not make contact with the amalgam adjacent to the preparation margins (Fig. 10).

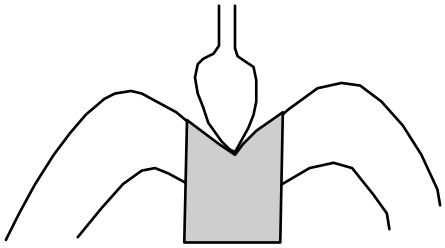


**Fig. 10**

**c- Development of Mesial and Distal Pits:** The triangular fossa is important for correct carving of the occlusal anatomy. The crest of the marginal ridge represents the "base" of the triangle, and continuation of facial and lingual supplemental grooves in amalgam restoration form the two sides of the triangular fossa that meet in the mesial or distal pit.

When carving the triangular ridges (slopes of the cusp), keep the blade of the carving instrument angled in "harmony' with the slop of the cusp.

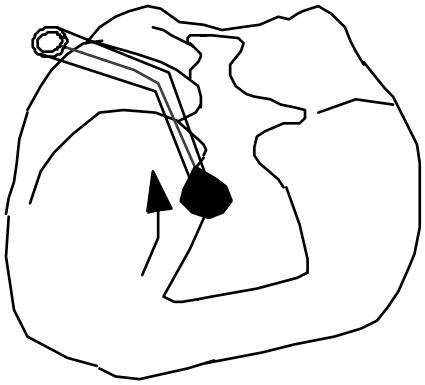
**4-** Remove the matrix **retainer** but leave the matrix **band** in place and supported by wedge.

**5-** Use the **HOLLENBACK** (Item #24)- pull the instrument (with series of shaving strokes) occlusally from the cavity proximal corners (gingivo proximal line angle). Place the Hollenback carver obliquely across the cavity margins with its **tip resting** against the adjacent tooth (matrix band) and its blade resting on the enamel adjacent to the proximal cavity margins. The proximal contour of the adjacent tooth is used as a guide to develop the restoration's proximal contour.

**5a- Use** the **proximal carver CVW18** (Item # 25) in areas of difficult access. This instrument **should be used** with **special care** because of its sharp tip and sharp blade- - - Use with **MINIMAL** pressure and a series of **SHAVING STROKES.** Use with the same method as explained above for the Hollenback carver.

**6-** Use a discoid or large spoon excavator to remove excess amalgam and/or blend the proximal cavosurface margin into the occlusal CSM. Part of the blade rests on the adjacent enamel.

**NOTICE:** These instruments can also be used for adjusting the height and shape of the marginal ridges, occlusal embrasures and rounding the marginal ridge.



**7-** Remove the wedge and matrix band. To remove the matrix band, tilt the band obliquely and withdraw it linguo-occlusally or bucco-occlusally. Support the restored marginal ridge with a cotton pledget. For an MO or DO restoration, the band is removed first from the non-involved proximal side. The band is then laid back toward adjacent tooth and away from the newly condensed amalgam.

**8-** Use a Hollenback, proximal carver (CVW18) or explorer to remove excess amalgam from the cervical area, if any.

**Remember**: The more difficult areas to access are approached first, e.g. in an MOD cavity begin carving the distal linguo-cervical, then the distal bucco-cervical, and finally the mesial linguo-cervical and mesial bucco-cervical areas (WHY).

**Check the cavo-surface margins with a cowhorn explorer, with its tip held 90 degrees to the interface of tooth/restoration.**

## No catches should be present

**9-** Use **direct vision** to ensure that no light passes through the contact (hold your mirror in the lingual and look from the buccal, change the angulation of the mirror). Then, check the contact area with a piece of dental floss. Dental floss should **snap** in. Take special care not to injure the gums. Remove the dental floss buccally.

**NOTICE:** At this time if there is light contact or no contact with the adjacent tooth (teeth), **REPEAT THE RESTORATION**.

**10-** Before removing the rubber dam, the patient should be informed that his/her lips **only** may close together, but that teeth may not touch.

**11-** After the rubber dam is removed, the dentist's finger lies on the incisal surface as instructions are given for the patient to **"bring the teeth lightly together**, with **TLC."**

**12-** The patient is allowed to close. A shiny area on the restoration is indicative of premature contact.

**13-** The hyper-occluded area is removed using a spoon excavator or discoid. Light closure is permitted again and the restoration is rechecked.

**14-** At this time use articulating paper (place it in an articulating paper holder) to check the occlusion. The restoration must be adjusted until any contacts on the restoration occur simultaneously with other centric contacts on the tooth and adjacent teeth. Place shim stock (0.0005") and instruct the patient to close in centric. Shim should be held firmly in place by the restored tooth. Repeat the same test with the adjacent teeth, and it should again be held firmly in place (assuming that those teeth held shim prior to the restoration). If the adjacent teeth do not hold the shim stock, your restoration is likely high. The same is true for the restored tooth but this time the restoration is low. Check the occlusion in different sitting positions.

**15-** Ask the patient to make lateral and protrusive movements to look for interferences.

**16-** The interproximal area is checked AGAIN and AGAIN to ensure the absence of any amalgam debris or rubber dam septa. If debris is noticed, remove debris carefully.

**17-** Bring the back of the chair up **very slowly.**

**18-** Tell the patient:

- To restrict chewing on the restoration for two hours.

- to be careful not to bite their lips or cheek if a local anesthesia was given.
- they may experience some sensitivity to cold and heat for few days (WHY!!). This should disappear gradually in few days or a week. If it does not decrease or disappear to contact you.
- if they feel a hyper occlusion after losing local anesthesia to contact you immediately.
- come back in 24 hours for finishing and polishing procedure

**19-** Let the patient to sit upright for a period of time before helping the patient step out of the dental chair.

**Post-carve burnishing: Burnishing** is the process of rubbing, usually performed to make a surface shiny or lustrous. In the context of the condensation procedure, burnishing is the further adaptation and compaction of the amalgam mass at the margins and surface of the restoration. Burnishing **does not** replace proper use of condensing and carving instruments. If burnishing is done too early, it can cause thinning of margins and if it is done too late there is a danger of fracturing a segment from newly placed restorations.

At this stage of your education, we would like to teach you the proper use of your condensation and carving instruments to develop proper tooth anatomy. You can smooth the surface of a restoration by wiping over the amalgam with a cotton ball or cotton roll saturated with water (assuming the amalgam is partially set).

**P.S.:** **Newly placed** amalgam restorations may fracture at the marginal ridge because of the following reasons:

- Failure to separate amalgam from the matrix band during carving.
- Improper matrix band placement (e.g. the occlusal margin of the matrix band is placed below occlusal CSM or marginal ridge of the adjacent tooth)
- The marginal ridge of the newly place restoration is not at the same level of the adjacent marginal ridge (if higher-it will fracture with the first bite)
- Lack of proper condensation
- Unstable matrix (loose matrix band)

## NOTICE: A failing grade is assigned if:

**1-** Contacts are open or light (tactually and visually).
**2-** There is a discrepancy between adjacent marginal ridges (higher or lower).
**3-** Open margins.
**4-** Anatomy is lacking or rough after carving (you must be graded for carving **BEFORE** starting the finishing and polishing**).**
**5-** There is overhang.

Check the above **diligently** before asking for a grade. If not satisfactory, discuss the mistakes with your instructor and repeat the procedure.

## Questions and Answers

**Q** What can cause obvious pitting on the surface of an amalgam restoration that cannot be removed with routine polishing procedures 24 hours after insertion?

**ANSWER:** Poor condensation - it is usually present in localized areas where it is difficult to gain access with condensers. Surface pits will act as small corrosion cells and result in surface deterioration with time. The possible causes for inadequate condensation are:

a. Use of an alloy with too short a working time. The Hg/alloy reacts partially, and this causes insufficient plasticity needed to remove air voids and excess mercury.

b. Delay in the condensation of amalgam will also produce entrapment of voids in a mix with insufficient plasticity. An amalgam should not be utilized once it has progressed beyond the usable range of plasticity, and fresh material should be made immediately.

c. Insufficient pressure on the condensing instrument. A large faced condenser requires a greater force than one with a smaller face to deliver adequate pressure to the surface of the amalgam (WHY).

Other steps required for good condensation:

d. The condensation should be done in an orderly, uniform, stepwise fashion, with each step on the condenser overlapping the previous one to ensure complete coverage of all areas.

e. The active condensing pressure must be exerted directly on the amalgam surface beneath condenser's face. The addition of large increments of material with a carrier will lead to air entrapment and difficulty in condensing.

f. The size of the condenser face should be selected carefully. Too large a condenser will make access difficult and encourage incorporation of voids. Likewise a very small condenser will prolong the procedure and create similar problems.

g. The final layer on occlusal surfaces should be sufficiently bulky and heavily condensed to bring mercury rich amalgam to the surface. Removal of this mercury rich amalgam during carving permits a more homogeneous Hg/alloy ratio on the amalgam surface. A large condenser should be used, with heavy force applied in the direction of inclined planes.

**Q** When larger restorative procedures are being performed with amalgam, the amalgam is difficult to carve and seems to set before adequate carving can be completed. What could cause this problem, and can rotating burs be used to complete the carving when necessary?
**ANSWER:**

a. Choose an alloy with higher working time.

b. The two most frequent manipulative variables that could accelerate the reaction and make carving difficult are overtrituration and a decreased Hg/alloy ratio.

c. The increased reaction rate may be compensated for by making several smaller mixes as material is utilized. You should not try to complete large restorations from a single mix or continue to use a mix after it has exceeded its usable range of plasticity.

d. Technique should be evaluated; most carving problems can be remedied by obtaining assistance and improving operator speed.

e. Rotating burs and stones should **NOT** be used routinely on freshly condensed amalgam to complete carving. Early in the setting reaction, the matrix structure can be disrupted permanently by abrasive action and the surface properties altered. Setting amalgam is even more sensitive to thermal change in the environment, and heat developed by friction could produce harmful effects. The early strength of most setting amalgam is insufficient to withstand finishing procedures, and there is a danger of over finishing a softer surface as well as chipping the margins.

**Q** When trying a new alloy, one may note that some restorations appear dry and brittle at the carving stage and tend to fracture away in larger increments rather than carve smoothly. What could cause this problem?

**ANSWER:**

a. Prolonged condensation will involve working with material beyond its limits of plasticity, and the loss of cohesiveness between increments.

b. Delayed condensation in which there is a short unavoidable interruption during the procedure can also result in working with material after significant matrix has formed, causing the breakdown of structure. The result is a weak, friable surface that will not carve smoothly.

c. Lack of condensation force could result in a restoration with a large number of air voids or poor cohesion between increments. Frequently this will occur when the cavity preparation is not confining and an **unstable matrix band technique or when there is an between matrix band and gingival cavo surface margin** is used. It can also occur when **moisture contamination** interferes with cohesion between increments.

**Q** As amalgam restorations wear, the marginal integrity is usually the first area to show signs of failure. Small increments of either amalgam or unsupported enamel fracture and crevices develop, which leads to increased leakage, and eventually secondary caries. What factors contribute to marginal deterioration of this type?

**ANSWER:**

a. The cavosurface margin of the preparation should be examined for potential areas of enamel failure. Unsupported enamel rods and undercut walls are potential sites for fracture when subjected to occlusal forces. All cavosurface margins should be smooth, flowing curves and be free of unsupported enamel. Cavity walls should meet the external surface of the tooth at 90° angles to provide optimum support for the tooth and sufficient bulk of amalgam to resist fracture along the margin.

b. Carving of the amalgam should be continuous with existing tooth form and provide an accurate adaptation to the exposed cavity margin. An over-extension of amalgam beyond the margins and onto the enamel can fracture readily into the bulk of amalgam and leave a crevice.

c. Inadequate condensation of amalgam in areas adjacent to the margins, especially in areas of occlusal overpacking, will cause a high residual mercury level to remain at the margin interface. The excessive $\gamma_2$ phase in that area will lead to increased creep and corrosion and a decrease in strength that will predispose the restoration to fracture.

d. Alloys with high creep value will result in evidence of early marginal fractures when subjected to occlusal function. The high copper content alloys have less creep and demonstrate more durable marginal adaptation.

**Q** Small interproximal restorations often fail by fracturing across the occlusal isthmus. How can this type of failure be avoided?

**ANSWER:**

a. The major reason for this gross fracture is found in the design of the cavity preparation. Sufficient bulk of material must be provided to support occlusal forces. This can be done by keeping the isthmus narrow and **providing adequate cavity depth**. The axio-pulpal line angle should be rounded to reduce stress concentration in that area.

b. Occlusal contact should be adjusted to avoid **excessive contact on the marginal ridge**.

c. If the cavity requires the placement of a cement base, a **sufficiently rigid material** must be selected for use. Zinc phosphate cement is one of the materials with enough rigidity to support occlusal function. Other dental cements **tend to deflect** under stress and, without adequate support, failure is likely to occur in the amalgam.

**NOTE:**

1. Working time - starts at the end of trituration and is the period during which the amalgam has optimal plasticity to be properly condensed.

2. Carving time - starts at the end of trituration and extends through the period in which a condensed amalgam can be smoothly carved without crumbling.

3. Late setting - amalgam that has completely hardened. Follows carving stage.