CONSERVATIVE DENTISTRY
DB 213

RESTORATIVE MATERIALS

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DENTAL AMALGAM

INTRODUCTION

Dental amalgam is the most widely used restorative material. It has been in use for over 150 years. Dental amalgam is a mixture of a silver alloy with mercury. The silver alloy is a fine powder that is composed mostly of silver, tin and copper, and sometimes zinc, palladium or indium. When the silver alloy and mercury are mixed, a chemical reaction occurs that forms dental amalgam. This reaction between alloy and mercury is termed as amalgamation reaction. Although some forms of mercury are hazardous, the mercury in amalgam is chemically bound to the other metals to make it stable and therefore safe for use in dental applications.

Dental amalgam is used in all surfaces of posterior teeth and occasionally in the lingual pits of anterior teeth. Amalgam restorations account for a significant portion of all dental restorations. However, because of its silvery-gray appearance, restorations are limited to posterior teeth. The popularity of dental amalgam results from its cost-effectiveness, durability and the ease of use.

Furthermore, surveys have shown that the percentage of failures among amalgam restorations is smaller than that with any other restorative material. However, the failures that do occur are more frequently due to improper design of the cavity preparation and faulty manipulation of the material. Therefore, every step, from the time the alloy is selected until the restoration is polished has a definite effect on the physical properties and potentially on the success or failures of the restoration. (Philips Moore: 1994).

TYPE OF MATERIAL

CLASSIFICATION

Dental amalgam is classified into 2:

1. Low-copper dental amalgam
2. High-copper dental amalgam

LOW-COPPER AMALGAM

These are also known as 'traditional', 'conventional' amalgam. Low-copper amalgams were used earlier on. Now low-copper amalgam has been replaced by high-copper amalgams. (JF McCabe, AG Walls: 1998)

HIGH-COPPER AMALGAM

This is the product that is used in the SOH clinic. High-copper amalgam was developed in1962 by the addition of silver-copper eutectic particles to low-copper silver-tin lathe-cut particles. Compared to low-copper amalgam counterparts, high-copper alloys exhibit the following properties: greater strength, less tarnish and corrosion, less creep and less sensitive to handling variables and produce better long-term clinical results. High-copper amalgam restorations also have a much lower incidence of marginal failure compared to low-copper amalgam. The copper content may vary from one brand to another. There are 2 basic types of high-copper alloys: admixed and single-composition. (JF McCabe, AG Walls: 1998)

Admixed Alloys

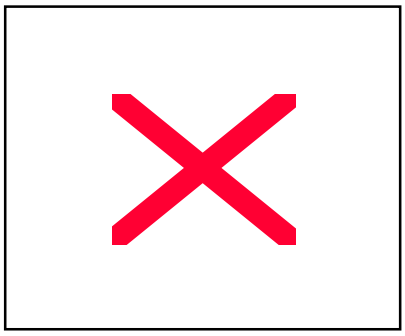
This is the oldest type of high-copper alloy. The alloy powder purchased from the manufacturer is a mixture of powders of 2 alloys. One is traditional low-copper alloy. The other is a powder – often a silver-copper eutectic. Addition of these two increases the overall copper content. The total copper content of commercial admixed alloys ranges from about 9-20%. The alloy particles are either spheres or lathe-cut.
(JF McCabe, AG Walls: 1998)

Single-composition

This type of amalgam has an increased amount of copper in the silver-tin-copper alloy particles. It contains powder particles of only one composition. The copper content varies ranging from about 13-30%. Some single-composition alloys contain small amounts of indium and palladium. (JF McCabe, AG Walls: 1998)

Alloy Particles:
The shape and size of the alloy powder particles vary. There are 2 types of alloy particles: Lathe-cut alloys and spherical alloys.

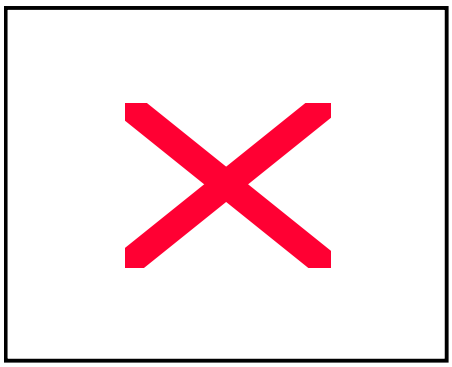
1. Lathe-cut alloys – are irregular in shape, they may be fine-grain or coarse-grain. They are heat-treated to produce a uniform composition and regulate properties. The alloy may be dispensed in the form of preweighed tablets or pellets.



The above image shows lathe-cut alloy particles.
(source: google image)

The lathe-cut alloy particles are packed into capsules
(source: google image)

2. Spherical alloys – alloy particles are made in the form of small spheres. One method of preparing this is known as atomizing procedure. Spherical alloys amalgamate very readily. Amalgamation can be accomplished with smaller amount of mercury than that required for lathe-cut alloys.



The image shows spherical particles of Spherical alloys.
(source: google images)

PRODUCT USED IN THE SOH CLINIC

- Brand – Contour Amalgam Regular
- Trade-name – Contour Amalgam Regular
- Company – 'Kerr'
- Supplier – South Austral
- 2 spill product
- $5200 per annum

(Information from Narayan; SOH staff)

Contour

Contour is a dispersed phase (admix) alloy that features a firm pack with smooth carving. It has 70% spherical and 30% lathe-cut particles. This gives a better contact in an easy-to-condense formulation. Contour helps avoid chipping and flaking of marginal ridges. These are self-activating, re-sealable capsules, traditional color-coding system and works with any amalgamator.

Benefits:

- Fast and easy, no activation step
- Reliable and consistent
- No tool required
- Efficient and compliant disposal

NOTE

Tytin is another product but this is not used in the SOH clinic. It is not spherical, not admix. It is hybrid amalgam. It has all the features and benefits of Contour product. It has good and firm condensation resistance, has smooth finishing characteristics and provides excellent mechanical properties.

(http://www.kerrdental.com/products/aToZList/index.cfm)

STORAGE REQUIREMENTS

Amalgam capsules should be stored at a temperature no higher than 25°C.
(source: Narayan; SOH Clinic staff)

CHEMISTRY AND REACTION

LOW-COPPER DENTAL AMALGAM

COMPOSITION:

The composition of low-copper, 'traditional', 'conventional' amalgam alloy is based on G V Black's composition of approximately 65% silver, 25% tin, less than 6% copper and sometimes 1% zinc.

SETTING REACTION:

Excess Ag_3Sn + Hg $\dashrightarrow$ unreacted Ag Sn + Ag Hg + Sn Hg

1. When the liquid mercury is mixed with the amalgam alloy, the mercury is both absorbed by the particles and dissolves the surface of the particles.
2. Silver and tin continue to dissolve in the liquid mercury, which becomes saturated with silver and tin.
3. The gamma-1 (Ag-Hg) and gamma-2 (Sn-Hg) phases begin to precipitate. Precipitation is a process in which a solid is formed from material dissolved in a liquid.
4. Precipitation of the gamma-1 and gamma-2 phases continues until the mercury is consumed and a solid mass results. The setting reaction may take as long as **24hours** to complete, when strength reaches a maximum.

(L Williams, Wilkins: 2004)

HIGH-COPPER DENTAL AMALGAMS

COMPOSITION:

High-copper amalgam contains 40-60% silver, 27-30% tin and 13-30% copper and 1% zinc. Sometimes it also contains Indium and Palladium.

- Ø Silver causes setting expansion and increases strength and corrosion resistance.
- Ø Tin causes setting contraction and decreases strength and corrosion resistance.
- Ø Copper increases strength, reduces tarnish and corrosion, reduces creep, and lowers cases of marginal leakage.
- Ø Zinc reduces oxidation of the other metals in the alloy. Recently, clinical research has shown that zinc – containing dental amalgams have a longer clinical life expectancy than nonzinc amalgams.
- Ø Indium reduces creep and increases strength.
- Ø Palladium reduces tarnish and corrosion.

(source: http://www.dentalindia.com/ccamal/htm)

SETTING REACTION:

The setting reaction of high-copper amalgams is a little more complex than in low-copper amalgams. Its notable feature is the lack of a gamma-2 (Sn-Hg) product.

Excess AgSnCu (the alloy) + Hg ------> unreacted alloy + Ag Hg + Cu Sn

1. The alloy contains 10% to 30% copper.
2. Silver reacts in the same manner as a low-copper amalgam, forming a gamma-1 (Ag-Hg) product.
3. Tin reacts with copper to form several Cu-Sn reaction products. No Sn-Hg reaction product is formed as occurs in the low-copper amalgam reaction.

(L Williams, Wilkins: 2004)

PROPERTIES

MECHANICAL PROPERTIES

1. STRENGTH
   The strength of an amalgam restoration must be high enough to resist the biting forces of occlusion. The strength of the amalgam depends on the phases that are present. Having more of the stronger phases results in a stronger material. The two types of strength are compressive strength and tensile strength. Dental amalgam has high compressive strength (380MPa for low-copper amalgam and 414MPa for high-copper amalgams). However, the tensile and shear strengths are comparatively low. Therefore, amalgam should be supported by tooth structures for clinical success in the long term.

   The rate at which an amalgam develops strength is an important clinical characteristic. Spherical particle alloys and copper-enriched alloys develop strength more rapidly than conventional lathe-cut materials. Fine-grain, lathe-cut products develop strength more rapidly than coarse-grain products. If the amalgam restoration is subjected to chewing or other oral forces before sufficient strength develops, it is at risk for fracture.

2. CREEP
   Creep is a slow change in shape caused by compression due to dynamic intra-oral stresses. Creep causes amalgam to flow, such that unsupported amalgam protrudes from the margin of the cavity. These unsupported edges are weak and may be further weakened by corrosion. Fracture causes the formation of a 'ditch' around the margins of the amalgam restoration. Creep also creates overhangs on fillings leading to food trapping & secondary decay. The gamma-2 phase of amalgam is primarily responsible for the relatively high values of creep exhibited by some materials.

Values for static creep for amalgam:

Material type	**Creep (%)**
Conventional lathe-cut	2.5
Dispersion-modified, copper-enriched	0.2
Copper-enriched, containing 0.5% palladium	0.06

3. DIMENSIONAL CHANGE:

The net contraction or expansion of an amalgam is called its dimensional change. Dimensional change is negative if the amalgam contracts and positive if it expands during setting. In general, most amalgams expand or contract only slightly overall during setting, but the ANSI/ ADA specification No.1 requires that the dimensional change be an expansion or a contraction of no more than 20micrometres/cm. Expansion could result in post-placement sensitivity or protrusion from the cavity, whereas contraction would leave gaps prone to leakage between the restoration and the tooth.

Dimensional change is affected by many factors, such as the mercury/alloy ratio as well as trituration and condensation techniques. During amalgamation reaction, expansion and contraction occur simultaneously. The dissolution of gamma particles generally leads to contraction, whereas the formation of gamma-1 causes expansion. The overall dimensional change is therefore the sum of these two processes. Improper manipulation that alters the ratio of gamma to gamma-1 and η in the set amalgam therefore also will alter its dimensional change.

CHEMICAL PROPERTIES

1. CHEMICAL CORROSION (TARNISH)
   Tarnishing simply involves the loss of luster from the surface of a metal or alloy due to formation of a surface coating. The integrity of the alloy is not affected and so no change in mechanical properties is expected. Amalgam readily tarnishes due to the formation of a sulphide layer on the surface.

   Reaction:
   Ag+1 + S-2 -------> Ag2S (black film)

2. ELECTROCHEMICAL CORROSION
   Galvanic corrosion occurs when two dissimilar metals exist in a wet environment. Electrical current flows between the two metals, corrosion (oxidation) of one of the metals occurs. The likelihood of galvanic corrosion increases if two metallic phases are present in a metal. Corrosion occurs both on the surface and in the interior of the restoration. Surface corrosion discolors an amalgam restoration and may even lead to pitting. Surface corrosion also fills the tooth/amalgam interface with corrosion products, reducing microleakage. Internal corrosion will lead to marginal breakdown and fracture. An acidic environment promotes galvanic corrosion.

The above image is of an amalgam restoration that has undergone galvanism.
(source: google image)

THERMAL PROPERTIES

1. THERMAL DIFFUSIVITY
   Amalgam has a relatively high value of thermal diffusivity. Thus, in constructing an amalgam restoration, an insulating material, dentine is replaced by a good thermal conductor. In large cavities it is necessary to line the base of the cavity with an insulating, cavity lining material prior to condensing the amalgam. This reduces the harmful effects of thermal stimuli on the pulp.

2. COEFFICIENT OF THERMAL EXPANSION
   This value for amalgam is about three times grater than that for dentine. This coupled with the grater diffusivity of amalgam, results in considerably more expansion and contraction in the restoration than in the surrounding tooth when a patient takes hot or cold food or drink. Such a behavior may cause micro leakage around the filling since there is no adhesion between amalgam and tooth substance.

BIOLOGICAL PROPERTIES

1. MERCURY TOXICITY
   It is a concern in dentistry because mercury and its chemical compounds are toxic to the kidneys and the CNS. Mercury has a high vapor pressure and evaporates at room temperature. The lungs absorb most of the mercury vapor in air when inhaled. Proper handling and storage along with prompt cleaning of all mercury spills will minimize risk of toxicity.

2. AMALGAM TATTOO
   This may occur during amalgam removal when a rubber dam is not used and the particles of amalgam are flung by the bur into the gingival tissues where they remain embedded, become fibrous tissue encapsulated, and corrode to form black corrosion products. There are no known adverse reactions but it is esthetically unpleasing.

(source: google images)

ADVANTAGES OF DENTAL AMALGAM

- It is durable.
- Least technique sensitive of all restorative materials.
- Applicable to a broad range of clinical situations.
- Newer formulations have grater long-term resistance to surface corrosion.
- It has good long-term clinical performance.
- Ease of manipulation by dentist.
- Minimal placement time compared to other materials.
- Corrosion products seal the tooth restoration interface and prevent bacterial leakage.
- It is a one-appointment placement (direct material).
- Long lasting if placed under ideal conditions.
- Very economical.
- Self sealing
- Biocompatible

DISADVANTAGES OF DENTAL AMALGAM

- Some destruction of sound tooth tissue.
- Poor esthetic qualities.
- Long-term corrosion at tooth-restoration interface may result in 'ditching' leading to replacement.
- Galvanic response potential exists.
- Local allergic potential.
- Concern about possible mercury toxicity that affects the CNS, kidneys and stomach.
- Marginal breakdown.
- Bulk fracture
- Secondary caries
- Sometimes excess Hg within the restoration may seep through the dentinal tubules, discolor dentin and result in blackish or grayish staining of teeth. Since enamel is semi-translucent, this discoloration is not inconspicuous.

ESTIMATED COST FOR ONE STANDARD APPLICATION

A bottle of 600 amalgam capsules costs around $1000 Aus therefore since one amalgam restoration mostly uses one amalgam capsule, the cost per standard application would approximately be $2.07 FJ.

(source: Narayan, FSM clinic staff)

CLINICAL APPLICATIONS

Dental amalgam is used in the following situations:

- In individuals of all ages.
- In stress-bearing areas and in small-to-moderate sized cavities in the posterior teeth.
- Especially used in large MOD cavities.
- When there is severe destruction of tooth structure and cost is an overriding consideration.
- As a foundation for cost-metal, metal-ceramic and ceramic restorations.
- When patient commitment to personal oral hygiene is poor.
- When moisture control is problematic with patients.
- When cost is an overriding patient concern.

Dental amalgam is not used when:

- Esthetics is important, such as in the anterior teeth and in lingual endodontic-access restorations of the anterior teeth.
- Patients have a history of allergy to mercury or other amalgam components.
- A large restoration is needed and the cost of other restorative materials is not a significant factor in the treatment decision.
- When a women is breast feeding because mercury can be passed to the baby through breast milk.

MANIPULATION OF DENTAL AMALGAM

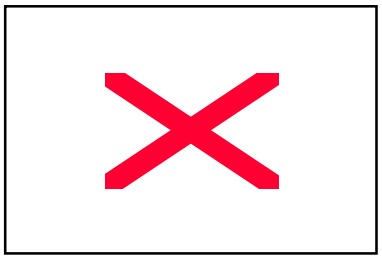
The manipulation of amalgam involves five major steps:

1. Proportioning and dispensing
2. Trituration
3. Condensation
4. Carving
5. Polishing

Proportioning and dispensing

Alloy/ mercury ratios vary between 5:8 and 10:8. Those mixes containing grater quantities of mercury are 'wetter' and are used with hand mixing. Those containing smaller quantities of mercury are 'drier' and are used with mechanical mixing. For any given alloy/mercury ratio, the nature of the mix may vary depending upon the size and shape of the alloy particles.

Various methods of dispensation are available. The most accurate method to weigh the mercury and alloy components is using a balance. Volume dispensers are also common. Another method of dispensation for the alloy is preproportioned as a powder in a small sachet or envelope or as a tablet in which the powder particles are compressed together. Another convenient method involves the use of encapsulated materials. Each capsule contains both alloy and mercury in proportions that have been determined by the manufacturer. The two components are separated by an impermeable membrane that is shattered using a purpose-built capsule press or on starting to vibrate the capsule in a mechanical mixer. Capsules which do not require the use of a press are called self-activating capsules.



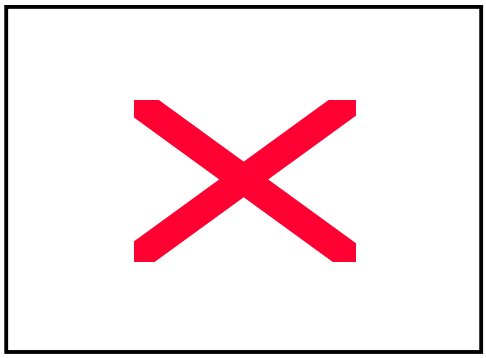
Proportioning plays a very important role in the success of an amalgam restoration.

Trituration

Trituration is the mixing of amalgam. AKA amalgamation reaction. Mixing can be done with hands, using a mortar and pestle or in an electrically powered machine, which vibrates a capsule containing the mercury and alloy. The trituration time may have an effect on the properties of the final set amalgam. Some products require at least 40 seconds trituration in order to achieve full 'wetting' of alloy particles by mercury and optimal properties in amalgam.

Trituration by hand is not extensively practiced. Instead mixing is far more widely used. Mechanical trituration is also used in FSM teaching clinic. The advantages of mechanical trituration are as follows:

1. A uniform reproducible mix is produced.
2. A shorter trituration time can be used.
3. A grater alloy/ mercury ratio can be used.



Condensation

Following trituration, the material is packed or condensed into the prepared cavity.
The material is carried into the mouth by amalgam carriers. A variety of methods have been suggested to condense amalgam including ultrasonic vibration and mechanical condensing tools. The most widely used method of condensation is with a hand instrument called an amalgam condenser. These are flat-ended and come in a variety of styles. The shape and size of the condenser should be chosen with the size of the cavity in mind. The condenser must be able to fit within the cavity outline and should be able to get reasonably close to the peripheral margin of the restoration. It is better to use a smaller diameter round condenser or an ovoid instrument to facilitate the first stage of packing. The amalgam is packed in increments, each increment being equivalent to the volume of material which can be carried in an amalgam 'gun'. This is the device used to transfer the material from the mixing vessel to the prepared cavity. During condensation, a fluid, mercury-rich layer is formed on the surface of each

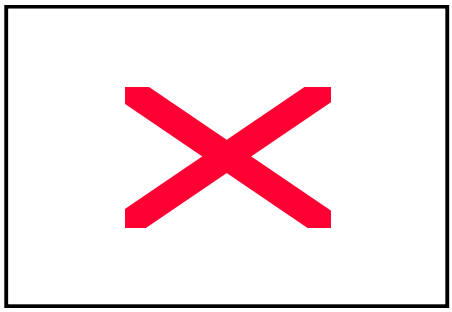
incremental layer. The cavity is overfilled and the mercury-rich layer carved away from the surface. This effectively reduces the mercury content of the filling thus improving its mechanical properties.

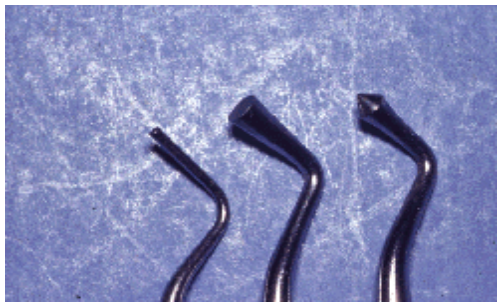
The technique chosen for condensation must ensure the following:

1. Adequate adaptation of the material to all parts of the cavity base and walls.
2. Good bonding between the incremental layers of amalgam.
3. Optimal mechanical properties in the set amalgam by minimizing porosity and achieving final mercury content of 44-48%.

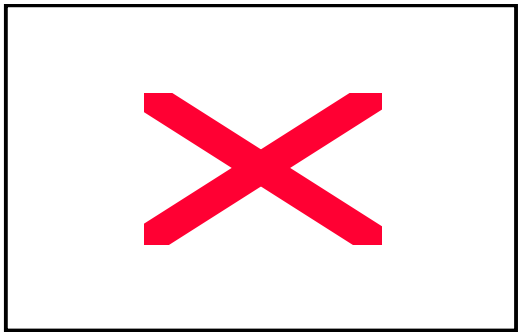
There should be a minimal time delay between trituration and condensation. If condensation is commenced too late, the amalgam will have achieved a certain degree of set and adaptation, bonding of increments and final mechanical properties are all affected.

Below are the pictures of some amalgam condensers





The picture below shows amalgam being condensed into the cavity.



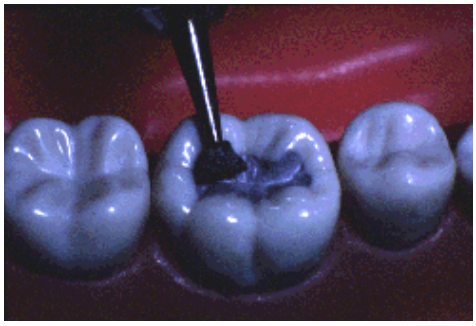
Carving

The purpose of carving an amalgam restoration is to remove the mercury-rich layer on the amalgam surface and to rebuild the anatomy of the tooth, re-establishing contact with the opposing dentition. Carving should be carried out when the material has reached a certain degree of set. If attempts are made to carve too soon there is a danger of 'dragging out' significant amounts of material from the surface. If carving is delayed there is a danger of chipping at the margins. It will be necessary to check the pattern of occlusal contacts whilst carving a restoration. When the amalgam is still soft, rubbing the surface with cotton wool produces a matt finish, if the subject gently taps their teeth together or moves from side to side, any areas of contact will show up.

Polishing

Polishing is carried out in order to achieve a lustrous surface having a more acceptable appearance and better corrosion resistance. The fillings should not be polished until the material has achieved a certain level of mechanical strength; otherwise there is a danger of fracture at the margins. Many products require a delay of 24 hours between placing and polishing.

Gross irregularities in the surface can be reduced using multi-bladed steel burs in a slow hand piece. This stage results in a smooth surface contour. Fine polishing to produce a luster is then undertaken using graded abrasives. Pastes are applied using a rubber cap or brush.



The above picture shows amalgam restoration being polished using a brush.

CLINICAL HINTS AND THINGS THAT MIGHT LEAD TO FAILURES

CAVITY DESIGN

- Amalgam has no intrinsic ability to bond to enamel and dentine, hence cavities have to be used which are undercut, i.e., the cavity is wider within the structure of the tooth than at the surface. This is done to retain the material mechanically. All internal line angles should be rounded to minimize internal stresses within the restoration and to facilitate adaptation of the material to the cavity walls. The floor of the cavity, both that overlying the pulp and at the gingival extent should be flat to permit condensation of amalgam.

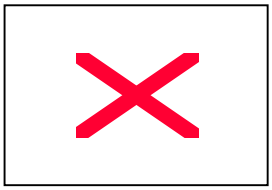
- It is always necessary to remove unsupported enamel once any carious dentine has been removed. This is easy to achieve on a clearly visible cavity surface. Failure to remove unsupported enamel will result in an intrinsic weakness at the margins of the restoration. The unsupported tissue could fail either during function or under the pressure applied by a steel matrix band whilst the restoration is being packed. It could cause marginal ditch formation and failure of the restoration.

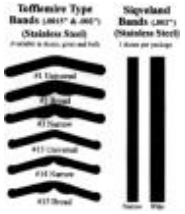
- An alternative form of amalgam retention is to prepare pits and grooves in the remaining dentine. These act as retentive features if positioned correctly in relation to the remaining tooth tissues. Alternatively dentine pins can be used. Nowadays, the most common form of pin is self-threading pin. Pins which have a shoulder which engages the tooth tissue before the threaded shaft of the pin contacts the base of the pin hole cause less damage to the tooth. Pins need to be placed with care to avoid the pulp and the periodontium. Also adequate space needs to be available between the pin and the location of the surface of the restoration. Finally pins should not be placed too close together. All dentine pins weaken the restoration therefore should be used sparingly.

MATRICES

If an external wall of a tooth is breached by a cavity a steel matrix band needs to be applied to the tooth to provide a surface against which the amalgam can be condensed. In addition the matrix should adapt very closely to the gingival margin of the cavity to prevent the production of ledges of amalgam outside the cavity during packing. The use of matrix may affect the tooth. This problem can be overcome firstly by adapting the matrix to the tooth. It is burnished outward to try to achieve contact with the adjacent tooth. Secondly, a wooden or metal wedge should be inserted between the teeth if possible. This helps maintain adaptation of the band to the tooth surface cervically and separates teeth slightly. Once the wedge is in place the matrix can be loosened slightly to facilitate burnishing against the adjacent tooth. Removal of matrix

bands should be carried out during the carving process. The amalgam must be sufficiently set that removal of the band will not result in bulk failure of the restoration.

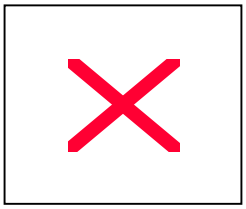




The images show the different types of matrix bands. There are many types but the one that is commonly used in the FSM dental clinic during amalgam restoration is tofflemire matrix band.

DISPOSAL

- All dental amalgam particles collected by any suction line configuration should be placed in an airtight container labeled ‘contact amalgam’.
- If the dental amalgam is removed by hand, the amalgam filling and teeth with filling should be placed in air tight container labeled ‘contact amalgam’.
- If excess dental amalgam is generated during the placement of a filling, collect the excess dental amalgam in an air tight container labeled ‘non-contact amalgam’.
- Where separation between contact and non-contact amalgam is not required by the approved waste carrier, all amalgam wastes may be placed in a single container labeled ‘scrap amalgam’.
- All amalgam waste must be released to an approved waste carrier for recycling or disposal.
- Broken and unused amalgam capsules should be placed in an air tight container labeled ‘non-contact amalgam’ and released to an approved waste carrier for recycling or disposal.
- Empty amalgam capsules should be recycled or disposed with regular garbage.



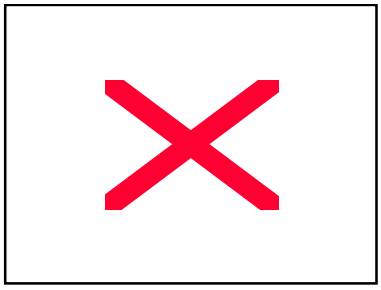
This is the image of a proper amalgam scrap disposal bin.
(source: google)

RUBBER DAM

A rubber shielding device called ‘rubber dam’ can be used during the application or removal of amalgam filling. It is a customized rubber sheet that fits over the teeth held by a clamp and frame and is used for most fillings procedures. It reduces the exposure to mercury and avoids solids and materials from being swallowed. It also overcomes obstacles like a tooth bathed in saliva, a tongue that insists on obstructing vision, and a bleeding gingival. Most importantly it creates a dry working area.

A dry, isolated work field means:

1. Bacteria from the saliva will not get inside the teeth. An easier time cleaning out the bacteria and decay from inside the tooth.
2. The restoration can be placed in a dry environment and stronger bonds will occur when moisture is controlled.
3. Protected from debris or tiny instruments being swallowed.
4. Tongue and other structures are protected from possible damage. Most patients like rubber dams and say they can feel more relaxed because they don't have to concentrate on staying open or positioning their tongue.



The diagram shows rubber dam being used during a restoration.

ARTICULATING PAPER

This can be used to determine the faults such as high spots so that the restoration can be carved properly for optimum function.

Other reasons for failure

- The manipulation of amalgam affects its strength. Inadequate condensation results in voids, which weaken the set mass. Mixing the amalgam for too long or too short a time also weakens the final strength by changing the ratio of unreacted gamma particles to the gamma-1 and gamma reaction products. In general, the manufacturer's instructions for manipulation should be followed precisely to ensure maximum strength.
- Over triturated amalgam tends to crumble and is difficult to condense. It exhibits a shortened working time. Under triturated amalgam has a mushy-grainy feel because not all particles are broken down. The mass is difficult to condense.

EXPERIENCE OF AN OPERATOR

Some operators discourage the use of dental amalgam because of the possibility of failures. Amalgam restoration requires proper manipulation of the material and a very thorough job on the part of the operator. Every step from the cavity design to the use of matrix band and rubber dam plays a very important role. Improper use of matrix bands can form overhangs. Amalgam requires proper finishing and polishing. Amalgam restorations are also prone to secondary caries and marginal breakdown. Furthermore, when patient bite they place a lot of force on the occlusion which may lead to periodontal problems.

However, some operators think otherwise. Some of them still recommend dental amalgam because according to them this is a very good material for large MOD cavities. This is because amalgam has high strength. It is very cost-effective and long-lasting. It being a one-appointment placement further makes dentists work easier. (Zeenat: BDS4, 2005)

MY EXPERIENCE AS AN OBSERVER

From my observation in the clinic I can conclude that amalgam can be a very good restorative material although it requires a lot of work. Amalgam needs to be manipulated properly. Even the trituration time makes a difference to the restoration. The cavity design has to be perfect. Matrix bands should be used properly to avoid overhangs.

Looking at the high cases of MOD cavities in our Pacific Region, I think amalgam filling would be the best option since amalgam has a long life-span (5-10 years) provided good oral hygiene is maintained and it can withstand force. However, if the cavity is not so large then other materials such as composites which have good esthetic qualities can be used.

CONCLUSION

With regards to the information given in the portfolio, understanding the chemical nature and physical properties of a material improves a clinician's ability to make good judgment. Historically, amalgam restorations have been among the most common of all dental restorations. The use of high-copper amalgams has improved dramatically the clinical longevity of amalgam (5-10 years under ideal conditions). Its major advantage has been the decline in the cases of microleakage. The use of precapsulated amalgam has reduced significantly the risk of exposure of dental personnel to mercury vapor. A successful amalgam restoration depends on the proper trituration, condensation, carving and finishing of amalgam. Improper placement can result in lost chair time and less than desirable results. Although small amounts of mercury release from amalgam is known to occur, it does not cause any major health problems. However, it might cause mild allergies in some patients. Although there are other alternatives to amalgam they can not match amalgam's longevity, ease of manipulation and versatility. Hence dental amalgam will be a part of dentistry for a long time to come.

RECOMMENDATION

It has been indicated in several literatures that the future restorative material of choice will no longer be dental amalgam. However the selection of the type of dental restorative material is dependent on numerous factors. The factors to consider include the extent of the lesion, the strength of remaining tooth structure, the preference of the dentist in using the material and the financial cost of the procedure.

Most people in Fiji and even those living in other Pacific Island countries are from low-socio economic background. Their diet includes high amount of carbohydrates such as dalo, cassava, taro and rice. With regards to their income they may not be able to afford proper dental care and therefore are at a high risk of having dental caries. They present to the clinic with large MOD cavities and then esthetics may not concern them much. There are no clinical scenarios of any severe medical problems associated with the use of amalgam although there might be some minor side effects in some patients. Dental amalgam is user friendly, suitable to all age groups, durable and very cost-effective and therefore very suitable to the Pacific Islanders as well as the dentists. Furthermore, it is stress bearing so it will remain in the market for the years to come. Keeping this in mind I would recommend the use of dental amalgam as a restorative material.

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APPENDIX

DHG 244
Metals in dentistry
Objectives

1. Define:
   a. alloy
   b. dental amalgam
   c. casting
   d. wroughting
   e. solder
   f. margination of the amalgam restoration
   g. finishing of an amalgam restoration
   h. recontouring of the amalgam restoration
   i. polishing of the amalgam restoration

2. State components of the amalgam restoration.
3. Identify advantages and disadvantages of the amalgam restoration.
4. Describe mercury and identify potential hazards associated with this metal.
5. Identify safety measures to be taken when working with mercury according to ADA and OSHA standards.
6. Describe properties that the following metals contribute to the dental amalgam:
   a. silver
   b. tin
   c. copper
   d. zinc

7. Define and describe the significance of mercury to ally ratio in the dental amalgam.
8. Define trituration and describe factors affecting a proper mix of the amalgam.
9. Describe condensation of the amalgam and the objectives for this step of the amalgam placement procedure.
10. Describe the setting of the amalgam including chemical process and time span.
11. Describe factors affecting dimensional changes in the amalgam restoration.
12. Define metal creep and explain the significance in the amalgam restoration.
13. Discuss factors affecting the resulting strength of the amalgam restoration.
14. List the classification of dental casting gold alloys and their recommended uses.
15. Identify various metals used in the manufacture of gold lloy and discuss the properties that each contribute to the resulting alloy.
16. Describe the steps followed in casting the gold alloy for restorative products.
17. Discuss uses of the gold alloy in dental restorations and the advantages and disadvantages of this
    metal.
18. Describe and demonstrate steps in polishing amalgams.