Cons sheet #19

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Why do not restorations last forever?

As you know lots of our works are of placing or replacing restorations.

Some researchers estimated that around 60% more or less of time is spent to restore failed or correct previous restorations we don’t like.

* Is this replacement the correct procedure or not? This what we will talk about today.

So lots of our time and effort are spent replacing old restorations.

Until recently amalgam was the material of choice for posterior teeth restorations, unless esthetics is of prime concern. This is because amalgam lasts the longest and it’s the cheapest.

At this point of time, amalgam is being phased out of dentistry, by 2020 amalgam will be out of dentistry.

* The main cause of that is:
* health of population, as people might think, and its effect on environment, and because composite is being developing fast providing best competition than amalgam (composite is getting better and better), also risk of mercury using on environment. That’s why amalgam is being phased out gradually from dentistry.

Before 5 years or 10 years, most of students work were amalgam because of conservative concerns, and the bulk of the work was replacing amalgam. While today, composite takes the bulk of the work.

* Dr said that he restored an amalgam filling the day before (class II), and that’s was the first time since 6 months, and the reason of that: inability to isolate the cavity because of excessive saliva, metal crown (impossible to use rubber dam) and the already restored old amalgam that’s required to be replaced. It was impossible to isolate just by cotton rolls and saliva ejector.
* What are the factors influence successful of restorations?

Hey are 3 factors: (factors related to the patient, dentist, and material itself)

Dentist factor is the most important, providing that you have used the proper material approved by national and international standards.

* **Patients factors:**
1. Personal oral hygiene:

 (the most important related to patients, or one of the most important that’s why we concentrate on patients oral hygiene. You should satisfy certain level of oral hygiene before applying restorations or even treatment).

* Don’t treat patients who don’t brush their teeth, unless it is an emergency. I don’t say to leave patients in pain, but I’m saying to educate and motivate your patients oral hygiene. It’s your job.
1. Preventive factors
2. Oral habits
3. Site of restoration
4. Cooperation at time of placement

(special needs are less cooperative, and this affects quality of restoration).

1. General health of patient affects quality of treatment and also affects oral hygiene.
* **2nd is the dentist factor:**
1. Clinical skills
2. Knowledge of material properties
3. Design of cavity
4. Size of preparation

Some students tend to be extremely conservative, and others to over prepare, this is inside of selves. You have to educate yourself to have accepted type of behavior and work, and to motivate yourself.

* **3rd is the material factor:**
1. Durability
2. Wear
3. Technical sensitivity

One of the most important factors related to materials used.

* It affects: 1. Quality and morphology 2. Shape of restoration 3.Acceptance of material.
* Other factors influence restorations: design of preparation, intraoral preparation and location, some say posteriors are more difficult than anteriors, other say mandibulars are more difficult than maxillaries.

Recall: the operator is the most important (60% of the influence related to dentistry). Material factors are the least important, provided the material recognized nationally and internationally (it will perform well with cooperation).

a study done by doctor Tenmay !( I have tried to collect the graph or anything else, but I couldn’t) he collected 12 studies that were done in dentin bonding agent (spot bonding), in these studies they used the same material and same technique but different operators ,,he took the result and compared them and put the results of these studies in a curve on one graph, he took the mean of readings of shear bond strength of composite to dentin with one standard deviation.

What do you see ?

There is a high variability in result ,, means are different, standard deviation is one)

in one study the maximum number is the minimum in other study. ,,although they use the same material and the same technique (under similar situation).

 What is the difference between the studies? The OPERATOR. (the variable)

* What to consider using a material:
1. Initial physical properties
2. Longevity
3. consistency

What are the values that we need for? around 20 mega Pascal.

Is the strength alone enough? or there is another thing you look for in any bonding situation or adhesive material?

If I have 3 materials the bond strength in one is 20 and others are 40 , 5mpa

…. 5 mpa is very low so we will discard it.

Does it necessary mean that 40 is better than 20 ? NO. I have to look at the other factors.

What is the other factor ? CONSISTENCY ( similar result all the time) and LONGEVITY.

Consistency ,,,It is better for me as a dentist to get 20 mpa every time than to get 50 at time and 10 in other time !. if the material of 20 after 10 years becomes 100, and the 40 becomes 5, I will choose the 20, it has better longevity.

When I see the material of 20 gives a 19mpa in the 2nd specimen and 21 in the 3rd specimen, and the one of 40 gives 5 and 100, I will choose the first one because it has better consistency.

So consistency and longevity are the other 2 factors we need in addition to bond strength for estimation, estimation is an important factor, but strength is related to many other thing.

longevity means the material will stay for a long time.

* When they have done studies on bond strength or other properties, they do:
1. thermocycling
2. mechanical loading
* **Thermocycling**: put specimen in certain device, at a temperature for example of 55° for 30 seconds, then at 35° temperature for 30 seconds, for a number of cycles.

Why? To transfer it to test the material (weaken it) and record it under variability that occurs in the oral cavity, will it reduce its properties or not.

* **Mechanical loading**: we put the specimen in a device and apply load on it with a quantity of less than what’s enough for breaking it. Not to destroy it, but putting it under stress and load that’s not enough for breaking it, 100,000 times or 200,000 repeatedly to see what will happen to it.
* The doctor represented a study from ((مؤسسة الأبحاث العلمية \, in which of standards are controlled, and the procedures are controlled (temperature, humidity, exact technique) are controlled, although we have variability in results.

What do u think will happen in a clinical situation? if in places under control, we get variability, what will happen in dental clinics and with dental students?

variability will be very high, tendency will be to the lower curve not towards the upper curve.

When u take dentine bonding agent and place it in the bench, the solvent is active so it will evaporate and leave it as a resin only.

* two types of restorations failure:

1. mechanical

2. biological

3. and in tooth colored restoration: esthetic failure or failure for esthetic reason.

* **Mechanical failure** is often related to incorrect use of material, lack of understanding of dentist during cavity preparation, and mechanical deficiency of the material itself.

according to lack of understanding: every step during cavity preparation of amalgam: resistance - retention forms / depth of cavity/ line angles/ flat gingival floor.

all of these are needed to be considered to have a comfortable successful restoration.

every material will have mechanical deficiency, we are all as dentists can explain this deficiency existence by the technique or the procedure used.

instead of using material with weakness points, put it under stress or unfavorable conditions.

when doing amalgam restoration, let the gingival floor to be as no gingival floor or flat one/ slope, then put the material in unfavorable condition, because it will be subjected to tensile stresses and compression.

I know amalgam has deficiency, weakness under tension, so if I do that, I will enhance or exaggerate the deficiency.

* **Biological failures**:

Often start as micro leakage around restorations, leading to 2ry caries, distorting the supporting dentine.

What do u think will be the more important? mechanical or biological?

….mechanical for amalgam, but for other materials, biological factor is more important causing the most commonly found cause of failure.

In class II restorations, you will always find recurrent caries at cervical margins starting from there.

There is a study says that 6 different restorations were sectioned on autograph,

what are the difference?

they show an example of grading criteria for marginal defects.

the restoration takes grade 0 if it does not contain a marginal defect.

grades 1,2,3,4,5 according to amount of defect, the worst is 5.

In all cases, u will see at gingival floor or areas nearby it, where defects are considered to be there.

* so to detect defects, always look for gingival margins, where you will find the defect (2ry caries).

Clinical judgment of 2ry caries is remarkable and accurate, several studies say that some dentists frequently tend to replace old restorations done by other dentists, this is a tendency, they like to replace others work, and this could be a financial challenge to do work, or they don’t like restorations done by others.

so weather to replace a defective restoration or not? decide according advantages and disadvantages of replacing

If you decide to replace a restoration that is imperfect, but doesn't have any scientific criteria, in most of cases u will end up with inferior restoration to what was before.

When you evaluate a restoration that has to be replaced, the replacement depends on material quality.

dentists who don't follow scientific criteria or knowledge for replacement, often end with inferior restoration to what was before.

If u are in doubt, when you look morphologically at imperfect restoration, weather to restore or not?

* it’s better to keep it and monitor over time, unless one of these criteria exist:

1. You find caries and you demonstrate dentine around restoration

2. tooth is symptomatic

3. impairment of function/ fracture of the tooth or the restoration

4. esthetic reasons

If a patient with amalgam restoration on a posterior tooth, asked u to replace it, is that a reliable criteria to replace? he doesn’t like it, so u don’t have to convince him,

It is if esthetic. esthetics is one of the criteria for replacement.

If a patient with amalgam restoration and marginal breakage, it is not a reason. marginal breakage of amalgam is not a reliable scientific criteria for replacement.

If this marginal breakage is with 2ry caries or impairment of function or pain or esthetically unacceptable, then it’s a reliable reason.

If a patient with multiple overhanging restorations and upon taking radiographs, u didn’t find 2ry caries, u have to replace it because it’s a defect, and a reliable reason.

If it’s symptomatic (bleeding, overhanging, gingivitis, pain), then replace.

a student asked: why not to replace an open margin?

the dr answered: I did not say open margin , I said broken amalgam margin( as an imperfect margin) is not a reliable criteria, because all amalgam on occlusal surfaces will develop imperfect margins because of corrosion and ditching and degradation.

* if no sensitivity or pain or 2ry caries, then leave it and monitor over time.
* According to amalgam, many factors contribute to its failure:

creep, corrosion, ditching, marginal degradation. (here are the PRE-physical properties related to dental amalgam only).

creep: means plastic deformation over time under occlusal load, so it occurs over occlusal loading.

dr showed 10 sections of amalgam, and a fracture happened.

marginal degradation because of creep.

If u don’t have 2ry caries or sensitivity, leave it unless pain or esthetics are of concern.

corrosion contributes also.

\*Remember:

* All the factors that will affect creep are the same factors that will affect corrosion.
* Any amalgam that has a high creep value, will not perform well clinically (this is only laboratory measure characteristics that is directly related to the clinical performs).

\*What will increase creep value?

Mercury and presence in gamma phase

* Some of the problems that we face with amalgam:
1. Lack of adaptation
2. Postoperative sensitivity (can be related to lack of adequate condensation, especially lateral condensation ….. when you condense amalgam in a proximal box we concentrate on vertical condensation , but you have to condense on the walls “laterally”)
3. Lack of proper dentinal sealing with sealer or bonding system (before we place amalgam, we should place varnish or bonding agent)

Potential solution includes: proper condensation, proper dentinal sealing of the cavity.

1. Marginal voids
* Major cause: inadequate condensation
* Material pulling away or breaking from the marginal area when carving bonded amalgam

….. The doctor asked a question about a picture; what’s the material that used in the cavity?

It was gallium based alloy.

(in the earliest 90th, when mercury was a problem because of its effect on environment, they tried to find an alternative for conventional amalgam (amalgam consist of; mercury + powder “silver tin alloy”) if we remove mercury from the amalgam how we will make amalgamation? is there is another liquid metal in amalgam … gallium not liquid at room temperature, but it has a very low melting point (27°C) but it has a special characteristic that if we mix gallium with indium and tin, they will form a liquid & this liquid could be used with the same alloy as amalgam, but as an alternative to mercury, main problems of this material:

1. Material pulling away or breaking from the marginal ridge (this is the main problem of this material) … when you condense it because its sticky material that sticks to the condenser when you condense so the material will be left from the cavity when you left the condenser( the major problem is handling characteristic of the material … that’s why it was discarded and not used clinically any more ).
2. Corrosion resistance
3. Excessive setting expansion
4. Marginal ridge fractures (very common problem)
* Causes:
* a- marginal ridge left too high (very common)

b- occlusal embrasure form incorrect

c- marginal ridge is not in the right position

d- improper removal of matrix (very common)

you can avoid this by putting a condenser or burnisher on the marginal ridge rest down then you left the matrix, so any tensile force will have an opposite force of it.

e- overzealous carving (deep carving)

you will affect the strength of the amalgam when you carve deeply.

Q: if you want to strengthen an amalgam restoration at this weak area, would you make the cavity deeper or wider?/ If you want to strengthen the isthmus, would you large the cavity by increase the depth or width?

By increasing the depth

* Summary: amalgam is a very good restorative material. While there are some concerns about its use, it is safe & effective direct restorative material.

A successful amalgam restoration is still relatively easy to accomplish, and adherence to tooth preparation & material handling requirements will result in a successful restoration.

Indication for the use of amalgam in posterior restorations have decreased, but this is not because of problems with either amalgam as a material or as a restoration; it is because of the recognized benefits of bonded composite restorations.

* The decrease in use of dental amalgam is due to concerns related to mercury and may be because of environment and because of development of modern composite.
* Main composite problems before 20 years was;
1. Polymerization shrinkage … it is still present

We can overcome this by engineering down of this deficiency or by our clinical technique.

1. Wear characteristic (wear characteristic of composite is equivalent if not better than amalgam) … so wear is not a problem.

Q: if we want to produce microfilled composite, how much can I fill the resin with micro particles?

(same question in another way; if you have large and small particles, which one I can fill more?)

Larger particles (if I have a resin and tow containers one of large particles& one of small particles and I start mix the resin with each container “we want to have them in same consistency not liquid and not very rigid”, when you reach this consistency we will have been adding more from the smaller particles …. Fillers of the composite is not related to particles quantity but its related to the total surface area … when the particles are smaller, the surface area of it will be higher relative to its volume), that’s why with small particles you can fill the resin by 40%, while with larger particles we will add 60-65%

Q: how can I fill the same resin with the smaller particles that have 40% to reach 60 – 65%, without changing the consistency or particles size or the resin matrix?

By using prefilled resin particles ( I bring a composite that have 80% filler, that will be very viscous that I can’t use, so I make a polymerization for it, then I grind it down to large particle size “ larger than the size of the fillers”, then I fill the resin with these fillers)

* How do we decrease the chances of failure in dental amalgam?
1. Whenever possible use micro- cavity size (smaller cavity), provided that we don’t deviate from the minimal requirement of amalgam cavity (don’t do 0.5 mm cavity then I say this is micro-cavity … amalgam require 1.5-2mm that I have stick to this but I don’t want to make it 3 or 4 you have to keep it small but provided all the requirements of material.
2. Finish all cavity to a butt joint, preferably at 90° to the cavosurface.
3. Avoid shallow isthmus and wide approximal embrasures, increase the depth of the preparation to allow bearing capacity of restorative material.
4. Use high copper alloys where ever possible, however there is no low copper alloy, all amalgam are high copper alloy.
5. Avoid contamination of saliva during packing
6. Manipulate the material properly according to manufacturer recommendations.

A picture of high copper spherical dental amalgam and its reaction zone

(you should be able to know the type of the amalgam depending on this picture … because its spherical it should be high copper alloy because there is no low copper spherical dental amalgam).

* What’s the difference between amalgam bond &dentine bond?
* Can we use dentinal bond for dental amalgam? Yes, we can put dentine bond underneath the amalgam, but it will not serve as a bond, but it will serve as a sealer for the dentinal tubules
* All bonds are mechanical, only the bonds that have a ‘… acid or gluma’ in its name, will be chemical.
* But if you want a bond what you use?
* The difference between amalgam bond and composite bond:
1. Amalgam bond should be chemically cured, we can’t have an amalgam that’s it light cure, why?because you have to place the amalgam before the bond is set.
2. Viscosity of amalgam bond is much more than dentine bond.

The idea is that the cavity I made have a surface irregularities and the amalgam that I condense it will have irregularities, so when you apply this thick chemically cured resin to the surface of the cavity it will interlock with the surface roughness, then you place the amalgam and condense it while the bond is not set… so the surface of the amalgam will mix with the resin and amalgam will interlock with the resin and the resin will interlock with the tooth …..so, we will have mechanical interlocking in between the amalgam and the tooth structure.

* The use of amalgam bonded restoration will be with superior quality than conventional restoration, but you should never relay on the bonding of amalgam as we rely on the bonding of composite, you still have to provide the form of mechanical interlocking that we need in amalgam.

\*\* Common problem that we face in composite restoration:

1. White line or Halo around the enamel margin
* Traumatic contouring or finishing technique (finish with excessive force and without water and remove thick layer so you interfere with the bond or enamel margin)
* Inadequate etching and bonding of that area
* High- intensity light curing, resulting in excessive/fast polymerization stresses.

--- potential solutions include :

* Re-etch, prime& bond area
* Conservatively remove the fault and re-restore
* Use atraumatic finishing techniques (e.g. light intermittent pressure)
* Use slow-start polymerization techniques
* Leave as it is
1. Voids

This voids will weaken the restoration, and if it’s in the margins of the restoration it will lead to micro leakage or secondary caries.

* Causes of voids:
* Mixing of self –cured composites.
* Spaces left between increments during insertion.
* Tacky composite pulling away from the preparation during insertion.
* Potential solution includes:
* Use more careful technique.
* Repair of marginal voids by preparing the area and rerestoring.
* We see voids more at interface between dentine and composite than the interface between enamel and composite.
1. Weak and missing proximal contacts (one of the major drawback of posterior composite)
* “difficult to establish contact, that its much easier with amalgam because of condensation force, on the other hand there is no condensation force in composite”
* There is something called condensable composite …..but in reality there is no condensable composite, because condensation means change the chemistry in the composition of the material (in amalgam we change its chemistry by taking mercury out …. Its adaptation)
* There is something in condensation of composite that will increase the flow ability of it and decrease viscosity.
* Causes:
* Inadequately contoured matrix band
* Inadequately wedging (most important factor)

Using a circumferential matrix band is a common mistake (using a universal matrix band to restore one proximal surface)

When I have miso-occlusal cavity for example, when I make condensation I have to compensate for thickness of two bands one in the mesial and one on the distal, …..so I should use sectional matrix.

---- if I don’t have sectional matrix, what can I use?

Burnish a matrix band then fix it OR matrix band two stage.

* Matrix band too thick…. So you have to choose the proper thickness of the matrix band.
1. Incorrect shade
* Causes:
* Inappropriate operator light ( you choose the shade while you are facing the light toward patient mouth)
* Selecting the shade after the tooth is dry (especially when you are using rubber dam)…. The first step in composite restoration is shade selection before you start.
* Sometimes shade tab not matching the actual composite shade.

When manufacturer produce the material, they produce it in form of patches… different patches will have different consistency or ….

* Wrong matching of shade (common wrong)
* Potential solution includes:
* Use natural light as much as possible
* Select the shade before isolating the teeth
* Take a small part of composite and cure it
* Use different shades