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***Sheet no. 7***

***Refer to slide no. : 7***

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**h**

Extra notes are coded with a dotted line & a pink color ..

**p**

first I have a bad news & a good news for you “sheet reader” ^^
The Bad one .. the two parts of this title supposed to be given in 3 lectures not two .. but a lecture was dropped with the sweet snow vacation. :’) so these 2 lectures are gonna be a bit condensed

The Good one .. you Don’t need to refer to the slides of this lecture except to see the pictures :D

Thank you .. & now I will leave you with the..

Treatment of Grossly Carious Teeth

part-1

Till now we managed to classify any teeth that need restorations, i.e.“class I , II , III … etc, but in some cases the tooth can be extensively destructed & can’t be classified … So what kind of treatment can we do in such situations ??

\*\* “Complex Restoration” or “4-Surface Restoration”\*\*

It is the type of Restoration we use when most of the tooth is destructed

 The destruction could be due to :

1. Fracture.
2. Extensive caries.
3. Existing defected restorative material :

leaky margins can cause new carious lesions around filling , in this case we have to remove the old restoration along with the new caries leaving an extensively destructed tooth.

**Problems with very large posterior restorations:**

1. Most of the occlusal contacts will be restored by the restorative material. 🡪no sound tooth structure opposing occlusal contact
2. The extensions might be on the root surface 🡪 part of the cavity would be on the root’s surface which leads to more complications
3. The area will be probably difficult to isolate 🡪 as we know teeth isolation with rubber dam needs adaptation of clamps so if the tooth is extensively destructed you want be able to adapt the clamp correctly.

**Differences between ordinary class II and extensive cavities:**

Class II 🡪has sound tooth structure around the restoration

Whereas complex restoration as here with amalgam 🡪 all the tooth is made from amalgam

\*\* just so you know ,, such restorations are not easy to be achieved ; if carving of class two amalgam needed a lot of effort from as to be acceptable !! then how about a whole tooth :D

\*\*& if you ask .. “why don’t we just use a crown (an indirect restoration)?!

Then the answer is that such restorations (indirect) are more expensive! **:/**

1. Some or all the cusps may need to be capped
2. Extensions in all directions need to be greater
3. More secondary retentive features will be needed 🡪 if class I & II with their sound tooth margins need good retention, then how about such teeth with extensive destruction !! \*.\*
4. More resistance form features will be used

**Stages for restoring posterior large cavities:**

1. **Preoperative assessment** 🡪 to decide if complex restoration is the best choice

**Clinical examination**

* Extent of the caries or the existing restoration and its relation with the gingival margin (perio surgery?) 🡪 sometimes you may take a Radiograph of a tooth and find out that the carious lesion is extended to the bone level ! & it’s hard to be restored because ;
1. the cavity would be sub-gingival .. I can’t take an impression or even isolate the tooth .
2. violation of the “*Biologic Width*” ; the distance from the Alveolar bone to the margin of the cavity which should be at least 2mm, so an extended cavity’s margins will be closer that 2mm to the Alveolar bon , here “*Perio-Surgery”* must be done to cut from the bone & restore that distance. Or else Non-existing Biologic width is an indication for EXTRACTION..
* Assessment of the pulp (vitality testing) 🡪 Vital tooth needs a certain treatment & non-vital needs endo-treatment
* Examination of occlusion in centric and lateral excurions. 🡪malocclusion or the need for an extensive occlusal treatment can affect my restoration & we might not be able to use amalgam restoration ! .. here I will need to make a crown as a better choice for stabilization of the occlusion

**Radiographs (bitewing, periapical**).

 For each patient I have to

1. Take a bitewing, which is a radiograph that only show the crowns of upper and lower teeth to make sure that there is no proximal caries .
2. Make sure that there is no bone resorption
3. Periapical🡪 if the patient complains from pain on percussion so I suspected a periapical lesion
4. **Caries removal**
5. Old restorations should be removed
6. Access to carious dentine.
7. Cleaning dentino-enamel junction.
8. Removal of undermined enamel.
9. Removal of caries from the pulpal wall.
10. Direct pulp capping or protection (mechanical, carious exposure).
11. Indirect pulp capping with calcium hydroxide if the cavity is deep & close to the pulp
12. RCT 🡪 Root Canal Treatment .. if pulp was exposed
13. **Designing the restoration**

Design is initially indicated by the previously existing restoration or the extent of carious lesion.

The relation of the floor of the cavity to the gingival margin 🡪 the biological width

1. **Choosing the restorative material.**

Depends on the amount of the remaining tooth structure after I remove all the caries & old restorations .. is sufficient to use composite with binding agent for example, or can I use pins to retain composite or amalgam.

**Our options are :**

1. **Direct restorations**

They don’t need much time & I can finish the work in one appointment .

* Amalgam (bonded, pin retained, core)
1. Bounded Amalgam 🡪 not widely used , the same concept of bounded composite (Resin) but we have to use the self-cure type to bind dentin and amalgam
* Composite (restorative material or foundation under indirect restorations). 🡪 with some new addition it can withstand high occlusal load.
1. **Indirect restorations**

Where I prepare the cavity with convergent walls , take an impression, send to the lab .. and there they will make the restoration & just need to adapt it.

Such restorations need more work and more time (not in the same day)

* Indirect composite
* Inlays
* Onlays
* ¾ crowns
* Crowns

**(1)**

**THE USE OF AMALGAM**

Properties of amalgam

**Advantages**

* Easy to use
* Has high compressive strength.
* Excellent wear resistance.
* Proven long term clinical performance.

**Disadvantages**

* Unaesthetic. 🡪 in esthetic areas of posterior teeth like the lowe & upper premolars
* Requires a retentive tooth preparation.
* Doesn’t seal or strengthen tooth structure.

Amalgam may be used as:

1. Control restorations in teeth that have questionable pulpal and or periodontal prognosis. 🡪 temporary restoration for a certain period until I make sure of the prognosis of the tooth

 This will help in:

* Protection of the pulp from the oral cavity. 🡪by restoring the tooth
* Provide anatomic contour which provides gingival health. 🡪by repositioning the tooth on its proper position under occlusion
* Facilitate control of caries and plaque.
* Provide some resistance against tooth fracture.

2. Control restorations in teeth with acute and severe caries.

3. Definitive final restorations. 🡪 final treatment when there is no signs & symptoms & the tooth doesn’t need follow up

4. Foundations. 🡪 as a core under an indirect restoration i.e I fill the tooth with amalgam & the next visit I prepare the tooth for a crown or any other indirect restoration

\*Contraindications:

In some situations I can’t use amalgam restoration for a Grossly Carious Teeth ..

* If the tooth cannot be properly restored with a direct restoration because of anatomical or functional considerations. 🡪 like when the tooth need a lot of occlusal modifications and I have to use indirect restoration rather than amalgam
* The patient has significant occlusal problems.
* If the area to be restored is esthetically important for the patient. 🡪 ex: upper & lower Premolars.

**Amalgam Treatment options**

1. Pin retained amalgam
2. Slot retained amalgam
3. Amalgam foundations
4. Bonded Amalgam
5. **Pin retained Amalgam restoration**

Amalgam restorations requiring the placement of one or more pins in dentin to provide adequate retention and / or resistance form.

“**Pins**” are like small screws in which holes must be first made for it, in the tooth structure, with a proper shape & diminutions then we adapt it to be bounded to / as a part of Dentin.

A part of it will be retained in the restoration & the other in dentin

This way it will increase retention & some times resistance form as well.

**“Generally pins are placed whenever satisfactory retention and resistance forms cannot be established with other means of Retention such as undercuts, grooves, slots…”**

**Types of pins**



Usually people use the last discovered type of anything , so

 *Self-threading*

Is the most widely used nowadays

1. **Cemented pins**
2. **Friction locked pins**
3. **Self-threading pins**
4. **Cemented pins**

As the name indicates .. it will be cemented inside the dentin,

* First described by Markley 1958.
* Threaded or serrated SS pins cemented into pinholes prepared 0.001 (0.025mm) to 0.002 inch larger than the diameter of the pin. So the pin will enter the hole easily
* The depth of the pinhole is between (3-4mm) 🡪 inside the dentin
* Cement used Zn-Ph, poly carboxylate, etc.
* It does not cause stress or craze lines in dentin 🡪 because the hole is larger than the pin so it will enter without engaging with dentin
* Least retentive of the 3 types.
1. **Friction locked pins**
* Described by Goldstein 1966.
* Diameter of the pinholes prepared 0.001 inch (0.025mm) smaller than the diameter of the pin.
* The pins are tapped into place and retained by the resiliency of dentin. 🡪 tapping (by a special hammer) is a disadvantage
* They are 2-3 times more retentive than the cemented pins. 🡪because the hole is smaller than the pin
1. **Self-threading pins**
* Described by Going 1966.
* Diameter of the pinholes prepared 0.0015 to 0.004 inch (0.038-0.1mm) smaller than the diameter of the pin.
* The depth of the pin-hole varies from 1.3 to 2.0mm.
* The pin is retained by threads engaging the resilient dentin as it is inserted 🡪instead of tapping into place .. it will work just like real screws with threads you turn it clockwise to adapt into the hole , & because dentin is resilient it will engage easily
* It is the most retentive of the three types.& no need for tapping :D
* It is 5-6 times more retentive than the cemented pin.
* Lateral and apical stresses can be generated in the dentin when the pin is inserted. 🡪 this is a disadvantage & can damage the pulp if the cavity is deep (close to the pulp) or it might perforate the tooth or penetrate the pulp
* The Thread Mate System (TMS) is the most widely used self-threading

**“Usually pins come with different sizes (widths) large sizes are used with amalgam & small sizes with composite”**

**Problems associated with pin placement**

Main problems are :

* difficulty of placement in posterior teeth, 🡪 cause the tooth is already destructed & small amount of tooth structure is remained , so perforations or penetrations can happen easily making extraction as the only choice, also the posterior position of the tooth will make insertion in a certain tilt really difficult .
* patient apprehension during placement.
* Stresses are created in dentin causing lateral cracks perpendicular to the long axis of the pin and shearing forces apical to the leading edge of the pin.

**When determining the appropriateness of pin retained amalgam restorations the following should be considered:**

* Resistance and retention forms.
* Status and prognosis of the tooth
* Role of the tooth in the overall treatment plan.
* Occlusion, esthetics and economics.
* Age of the patient.

**Retention and resistance form**

Mainly obtained from the pins

* The number of pins is dictated by the amount of tooth structure remaining and missing, as a general rule 1 pin for each missing cusp is adequate. 🡪& is inserted in the previous cusp location
* In selected cases pins placed before placement of amalgam can function to improve the resistance form.

**The location of the pin hole from the external surface depends on:**

1. External morphology of the tooth. 🡪like mesial or distal depressions on the roots of some teeth so I should be very careful & always remember teeth anatomy
2. The type of restoration to be placed (amount of reduction required).
3. The type of margin to be prepared. 🡪amalgam or composite , direct or indirect restoration

For example in premolar we can insert 2 pins one mesial & one distal

**Preferred locations for pin placement.** Slide#28

* **(dotted areas)** The most preferred locations, at the line angles in at the cusps place ,away from the external margins
* **(white areas)** areas to avoid because of concavities, furcations, or thin dentin
* **(lined areas on the molars)** areas where pins may be placed with added caution 🡪by holding a probe parallel to the external surface inside the gingiva and holding the bur parallel to it to avoid perforations

**Status and prognosis of the tooth**

* Teeth that are sensitive or symptomatic should be treated first before pin placement.
* The placement of non-cemented pins in RCT teeth should be avoided because they are already weak, RCT teeth could be better restored used the appropriated “posts” they are large pins inside the root canals which takes advantage of the endo access in retention instead of using ordinary pins
* Pins are contra indicated in teeth were the gingival margins are so deep that the application of a matrix band is difficult or impossible.

**The role of the tooth in the overall treatment plan**

* Pin-retained amalgam restoration is not the treatment of choice for teeth that must serve as an abutment for a removable partial denture. 🡪 cause they’re already under the stress of the RPD & adding more stress with damage the teeth
* Pins are contraindicated in teeth that require elaborate occlusal alteration

 **Esthetic**

When esthetics are of prime concern pin-retained amalgam could be contra-indicated.

**Cost**

When cost is a major factor, the pin retained amalgam is appropriate provided that an acceptable restoration could be achieved

* because it’s the cheapest one. but just if have the ability to carve the tooth in a very good anatomical way that resist fraction in occlusal assessment

**Age of the patient**

* For some geriatric or debilitated patients, this could be the treatment of choice over the more expensive and time-consuming cast restorations also pulp is smaller in older patients so pins are can be inserted easily
* Young patients, the placement of pins could provide a risk as the pulp chambers are large and it might be easy to penetrate into it.

**Advantages**

* Tooth preparation is more conservative than alternative restorations. 🡪 amalgam usually is not conservative but in this situation in comparison with the other choices of indirect restoration & crowns it is more conservative.
* Gingival margins could be healthier than indirect restorations because margins of an indirect restorations don’t fit very well especially ceramic there will always be marginal discrepancy between the tooth structure & the restoration leading to many gingival problems
* Less time consuming, could be finished in shorter duration and in one visit.
* Relatively economical compared with other materials and techniques.
* Retentive form is significantly improved by the use of pin or pins.
* In selected cases, the resistance form is significantly improved by the use of pin or pins.

**Disadvantages**

* Proper contours and occlusal contacts are sometimes difficult to achieve. 🡪 needs high skills to reproduce the occlusal table
* Drilling of pin-holes and placement of pins could create internal stresses in dentin.
* Micro-leakage around all types of pins has been demonstrated, however it is no greater than micro-leakage occurring at the tooth restoration interface.

**“**Pins do not reinforce the amalgam therefore do not increase the strength of the restoration. No increase in compressive strength, significant decrease of tensile strength”

🡪They just increase resistance & retention

“Increase the risk of perforation into the pulp or the external tooth surface, unless the procedure is knowledgeably and skillfully done”

**Factors affecting the retention of the pin in dentin and amalgam**

1. Type of pin, self-threading > friction locked > cemented.
2. Surface characteristics of the pin (depending on its shape), retention of the amalgam onto the pin: self-threading > cemented > friction locked. No bonding between the amalgam and the pin, pure mechanical retention.
3. Orientation of the pin(s): putting the pins not parallel to each other enhance retention of amalgam, severe bending of the pins should be avoided parallel pins will make the dislodgment of the restoration easier.
4. Number of pins: Within limits increasing the number of pins increase the retention in dentin and somewhat in amalgam (the benefits should be weighed against the risks of increasing the number of pins).
5. Diameter of the pin: within limits, as the diameter increase retention in amalgam and dentin increase. 🡪 but the risk of perforation will increase so be carful !
6. Length of pin into dentin and restorative material: with the cemented pins, retention increase linearly with increasing the pinhole depth, with friction-locked and cemented pins there is no real benefit in increasing the pinhole depth beyond 2mm. increasing the length will just increase the risk of perforation

**Failure of pin retained restorations**

Slide# 40

*Failure could happen at any of five different locations:*

1. Within the restoration (fracture).
2. At the interface between the pin and the restorative material (the material could pull off the pin).
3. Within the pin (the pin can fracture when stressed beyond its limit).
4. At the interface between the pin and the dentin (the pin can pull out of the dentin).
5. Within the dentin (the dentin can fracture).

***With the exception of friction locked pins, failure is more likely to occur at the pin/dentin interface rather than pin/restorative material interface.***

**Potential problems of pin retained amalgam restorations**

**Broken drills and broken pins**

* If stressed laterally or allowed to stop before removed from the hole.
* Removal of the broken piece is difficult and should not be attempted.
* Prevention is the best solution.
* Solution: Choose a safe location at least 1.5mm away from the broken piece. 🡪 never remove the broken part , only cut it if it was long & leave in its place & it won’t affect the tooth except if I tried to remove it, because it’s now bounded to tooth.

**Loose pins**

* Usually because the pin doesn’t properly engage dentin or the pin hole is too large.
* Pins could be loosened when attempts to shorten them with a bur.
* Solution: The pin should be removed and one of the following procedures done:
* The pinhole is prepared with the next largest size drill.
* The depth is increased to 3-4mm using the next largest drill and the same pin cemented in position

**Penetration or Perforation**

* Penetration into the pulp or perforation of the external tooth surface:
* Hemorrhage in the pinhole following removal of the drill.
* Usually operators can tell through their tactile sensation (you feel a sudden drop!). Or if the pin continue to thread beyond the 2mm depth(this means that perforation has occurred ).
* Observation of the angulations of the drill should indicate whether a pulpal or external penetration has occurred.
* Radiographs can verify if **pulpal penetration** has not occurred
* if there is sound dentine between the pulp and the pin however, any view projecting the pin in the same region as the pulp does not necessarily mean pulpal penetration, it might be an overlap as a result of angulations.
* Any radiograph showing the pin projecting outside the tooth confirms **external penetration.**
* However any radiograph showing the pin inside the projected outline of the tooth does not exclude the possibility of perforation.
* In an asymptomatic tooth, a pulpal penetration is treated as any other mechanical exposure.
* Perforation into the external wall of the tooth, examine clinically by probing and by radiographs to determine the location of perforation.
* Perforations located occlusal to the gingival attachment:
* Cut the pin flush with the tooth surface.
* The pin removed and the pin hole restored.
* The pin cut and the tooth prepared beyond the perforation.

**Perforations located apical to the gingival attachment:**

* Reflect the gingival surgically, expose the pin hole, enlarge and restore.
* Perform a crown lengthening and place the margins of the restoration gingival to the perforation.

