**Dr. Ala’a**

**Amalgam Treatment options:**

1. Pin retained amalgam

2. Slot retained amalgam

3. Amalgam foundations

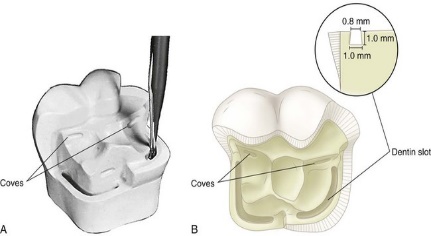
4. Bonded Amalgam

***Slot retained amalgam***

* Slots; grooves placed in the dentine horizontal position, used with or without pins.
* Locks; grooves placed in a vertical position
* Indications;

1. short clinical crowns
2. Cusps reduced 2-3 mm

|  |  |  |
| --- | --- | --- |
|  | Conservation | Complication |
| slot | Less conservative | Less micro fractures , perforation and penetration the pulp. |
| pin | More conservative | More micro fractures, Perforation and penetration the pulp. |

* You should rely on clinical scenario and your clinical skills to determine what you’re supposed to use.
* The position of the slot could at any aspect of the cavity (facial, lingual, mesial, distal) depending on the caries, and the only way to make slot horizontal is to place it in the gingival floor of the cavity.
*  In this picture, slot placed in mesio-lingual , horizontally on the gingival floor of the cavity.
* Continuous or segmented depending on the amount of tooth structure missing and whether pins are to be used or not.
* It should be at least 0.5mm in depth from the occlusal plane and 1mm long.
* The width of occlusal part is SMALLER than the width of gingival part due to CONVERSION walls (0.8 mm, 1 mm, respectively)

***Amalgam foundations***

* The initial restoration of a severely involved tooth.
* Amalgam restoration replaces missing tooth structure and provides retention and resistance forms for the placement of the definitive indirect restoration.
* Indirect restorations are used when pins or a slots cannot be used.
* When a large amount of the tooth is missing a foundation (restoration that replaces part of the missing tooth) is applied before indirect restoration.
* Functions of amalgam foundation:

1. Resist fracture of remaining tooth structure.
2. Replace part of the tooth structure at will cover by indirect restoration later on.

* The technique for tooth preparation depends on the type of retentive mean to be used: pins, slots or chamber retention
* DEFINTIVE TREATMENT; Pins and slots as amalgam tx options are alternative treatment for patient and are not covered by indirect restorations.
* NON- DEFINITIVE TREATMENT; Pin and slot (in amalgam foundation) used for retention, and use under the indirect restoration.

1. **Pin retained foundation**

* Used in severely broken teeth with few or no vertical walls where an indirect restoration is indicated.
* Slot/pin for retention in amalgam foundation should be placed MORE AXIAL compared to pin/slot that used as a definitive treatment otherwise it will be lost.
* Main difference from using pins for definitive restorations is the distance of pin holes from the external surface of the tooth, and more bending of the pins may be necessary.

1. **Slot retained foundation**

* Foundation slots are placed slightly more axial.
* They are usually 0.5-1mm in depth and width, and 2-4mm in length.

1. **Chamber retention**

* Used in multi-rooted endodontically treated teeth.
* Pulp chamber (for a non vital tooth) when its dimension is adequate to provide retention, and the thickness of dentine in the area is enough.
* Molars and premolars have very good amount of pulp chamber (long chamber), so you can rely on chamber for retention and condensate the amalgam inside access cavity.
* Condensation of the amalgam inside the access cavity will not break the tooth if this tooth has enough tooth structure.
* The root trunk of pulp chamber + the pulp chamber in the crown will give the retention.
* If the height of the pulp chamber is less than 2mm extension into the root canal (2-4mm), the use of prefabricated post, cast post & core, pins and slots should be considered.

**Bonded Amalgam**

1. Reduce the need for mechanical retention features and resistance form.
2. Improvement of the marginal seal with potentially less sensitivity.
3. Self or dual cured bonding agent or resin cement placed on conditioned tooth structure, then Amalgam is condensed immediately.
4. Micromechanical bond.

* Clinical steps:

1. Acid etching
2. Applying bonding agent for all the walls of the cavity, then self or dual cure (self is better than dual cure), we can’t use light cure for amalgam.
3. MICROMECHANICHAL RETENTION is achieved when dentine bonding agent sets.

* Good isolation is a condition for amalgam bonding.
* It’s of increased cost
* Dentin bonding agent is considered a varnish for the amalgam and provides better isolation

**Restorative technique**

* Same as any restorative technique for amalgam, but we should attention to the matrix, we can use:

1. Universal matrix; insure that it replaces the contour of the tooth.

2. Automatrix; Retainer of the automatrix is bounded to the matrix itself. So, it small in size, can surround the tooth from all sides, also you can modulate its size by using special instrument.

3. Compound supported copper band:

1. Place the matrix around the tooth.
2. Heat compound martial.
3. Inject the compound around the matrix in order to fix the matrix during procedure.

* Indications for the use of composite:

1. Use the composite for grossly caries lesions because; the mechanical properties of the composite are good enough where it has the Ability to strengthen weakened tooth structure
2. An interim restoration (control restoration)\* while waiting to determine pulpal response

*\* used to make sure there’s no signs and symptom for the patient and can be used as definitive treatment if there weren’t any and if it was of good quality and good carving.*

1. As a foundation for indirect restorations

* Problems:

1. Wear resistance
2. Polymerization shrinkage

* Secondary retention is usually required in very large composite restorations due to:

1. The increased amount of missing tooth structure (decreased amount available for bonding).
2. Bonding strength for enamel is better than dentine, but in case of grossly caries lesion most of the tooth structure is lost, therefore, most of the bonding will be to the dentine.
3. Since most of the bonding to the dentine surface (which is not enough if the cavity is large) we need extra retention for retaining the composite in the tooth.

* Retentive means include

1. Grooves
2. Slots
3. Locks
4. Pins (not as esthetic as previous options).
5. Wider bevels in or flares on accessible enamel margins (on the non-stress area) to increase the surface available for bonding
6. Using the root canals.

#SAME clinical technique are used for class 3, 4 and 5 composite restoration.

1. **Conventional class I preparation:**

* *Indication:* large preparations of restorations subjected to heavy occlusal forces(no root)
* *Design:* box like amalgam and some flat walls ┴ occlusal forces.
* Uniform depth.
* Pulpal floor is usually flat and follows the DEJ.
* Preserve the strength of the cuspal and marginal ridge areas as much as possible.
* Extensions into marginal ridges should result in 1.6mm thickness of remaining tooth structure in premolars and 2mm in molars.
* If extension is required toward the cusp tips, the same approximate 1.5mm thickness is maintained.
* No attempt is made to place bevels on the occlusal margin because

1. It may result in thin composite in areas with heavy occlusal forces
2. The enamel rod are exposed to aced etch(as shown in the figure)
3. **Beveled Conventional class I preparation**

* *Indication:* large Class I with groove extension (buckle extension, lingual extension) (it is the only indication for use Beveled Conventional class I preparation)
* rarely used
* You should take the **occlusal load** in consideration; Functional cusps are palatal cusp in the upper teeth, buccal cusps of the lower teeth (if you prepare lingual extension for upper tooth, you should check the occlusion; if the occlusion on the occlusal part of groove extension, don’t place bevel on the occlusal part, place the bevel in the gingival part only).
* *Design:* box like form and beveled walls on the groove extension walls.
* Uniform depth.
* Pulpal floor is usually flat and follows the DEJ.

1. **Modified class I tooth preparation**

* *Indications:* minimally involved class I or faults.
* *Design:* less specific in form/ scooped out appearance.
* The initial depth is 1.5mm or .0.2 mm inside dentine, but the pulpal floor may not be uniform.
* *Modified:* there’s no specific shape for the cavity, just remove the caries and place the composite. However, the posterior teeth have a heavy occlusion so the THICKNESS of the cavity at least should be 2.5mm or .2mm in the dentin.

1. **Proximal composite restorations**

* You can either preserve the marginal ridge or remove it.
* Access through the marginal ridge (remove it, as class2 amalgam cavity preparation. (MO, DO, box only(on the proximal surface), MOD).
* Marginal ridge is preserved.
* Access through the marginal ridge.
* Access to carious dentine is by removal of enamel over the marginal ridge(remove the caries from occlusal part or buccal part and use the marginal ridge for seal).
* Cleaning of the dentino-enamel junction using a low speed round bur
* Excavation of caries over the pulp.
* Unsupported enamel is left in the cavity.(unsupported enamel should remove in case of heavy occlusion, if there’s no heavy occlusion unsupported enamel left).
* No need to place bevel (except in case of buccal or lingual extension you can place bevel).
* Marginal ridge is preserved
* It could be of an occlusal approach or a buccal approach (suitable for teeth that are tilted lingually where the bur is placed perpendicular to the long axis of the tooth).
* Placing the matrix and restoration;
* Matrix band should be used especially with class2.
* The best choice is the SECTIONAL MATRIX BAND.
* Universal matrix band is thick so, it leads to over contact.
* milar strip can be used and fixed by wedges.
* Diagnosis: it is a mental resting place on the way to intervention.
* Treatment depends on the diagnosis.
* Caries: is a minute of PH fluctuation as a result of metabolic activity in the biofilm.

Mineral loss PH Mineral Deposition (Gain)

* We don’t see the white chalky appearance unless mineral loss exceeds mineral gain and reach the clinical detection, and not seeing them doesn’t necessarily mean that there is no demineralization and re-mineralization.
* Then dental caries are episodes of demineralization and re-mineralization rather than unidirectional demineralization (reversible).
* If we alter the biofilm (modify it ) by improving the patient’s oral hygiene instructions we can stop the process and the symptoms and specially carious lesion
* Modern clinical caries management concept:

1. Caries detection: whether have caries or not, whether I have lesion or not.
2. Assess the process: the lesion measurement whether it is :
3. In the first part of the enamel (E1)
4. Deep in the enamel (E2) (reached the amilo-dentinal junction without lateral spread)
5. Lateral spread that reached the first third of the dentine (D1)
6. In the second third of the dentine (D2)
7. In the third third of the dentine and reached the pulp (D3)
8. Lesion monitoring: give the patient oral hygiene instructions and take x-ray every 6 months, and every recall assess it, whether it is increasing or it became arrested. If it is increasing that means that my measurements were wrong, so I have to intervene. If it stops that means we are in the right track.
9. Caries activity measures: it allows us to know whether the lesion is active or arrested;

a. totally arrested.

b. totally active .

c. partially active partially arrested .

1. Diagnosis: to intervene or not.
2. Prognosis: predict the result of the treatment, whether the tooth of poor prognosis, good prognosis or fair.
3. My clinical decision :
4. To intervene or not
5. Operative treatment (OT) or non operative treatment
6. The outcome on long term after 6 months, one year … etc
7. Sub clinical initial lesion: I can’t see any lesion so I can’t do anything for the patient.
8. Lesion detectable only with traditional diagnostic aids : we see by special methods
9. Intact lesion: white chalky surface (intact enamel but it’s a detection that there is a beginning of demineralization.
10. Caries cavity
11. A deep cavity that reached the dentine
12. A cavity that reached the pulp

* In b, c, d the treatment is preventive non operative (not in Jordan).
* e is treated by preventive care and operative intervention.
* *How to know if there discolored lesion are arrested or active?*

We depend on 2 factors:

1. Age of the patients; if the patients is 60 years old then most likely its arrested caries (discoloration, pigmentation), if it’s a teenager we suspect it to be active caries.
2. Oral hygiene: if the patient is of poor oral hygiene then most probably it is carries

After assess these two factors you take your decision.

* How to evaluate the tooth surface?

1. Sound; we don’t intervene
2. Filled or lesion; the lesion either active or inactive

* Any very dark smooth shiny surface without any cavity its arrested lesion
* Rough matte surface with cavities is an active lesion.
* If the filling is defected we either remove it or remove parts of it.

**Diagnostic tool**

* Diagnostic tool requirements :

1. Valid: the degree to which the measurements measure what it is purposed to measure.
2. Reliable: gives the same result every time (as a standardization in the world).
3. Accurate.
4. Sensitive: true positive (# lesions detected = # lesions present).
5. Specific: true negative (it shouldn’t detect any carious lesion if they aren’t present).

* Specificity low: there is no carious lesion and the tool gives me carious lesion.
* Sensitivity low: there is a carious lesion and the tool doesn’t detect any.

1. Potential negative aspect must be evaluated

The first thing that’s come up to minds is radiographs and its negative impacts.

1. Cost effectiveness.

* There is no diagnostic tool that has the perfect requirements.
* No single diagnostic modality can be used on all surfaces under all circumstances for caries detection. Therefore, theclinician must decide which tooth surface with benefits.
* **Detecting methods :**

1. ***Visual /tactile****:* we dry the tooth surface and examine it with probe and mirror under light and this is the traditional way.

* Visual 🡪 by the naked eye
* Tactile 🡪 by the probe
* Dry the tooth and use good light not to miss composites, buccal and occlusal caries.
* Opacity with or without air drying is an indication of caries initiation.
* Chalky matte and rough enamel surface indicate active lesion
* Shiny and smooth surface doesn’t indicate any problem
* Problems of this technique:

1. Subjective: it depends on the person use it (unreliable).
2. Visual sensitivity is very low (0.2-0.5) ,tactile sensitivity is better with (0.5-0.6) , but it has high specificity.

* It is the best detecting method for occlusal carries. There is no unnecessary over treatment in low caries risk population.
* Probing shouldn’t be used forcefully on the occlusal surface, otherwise it could produce cavities.

1. ***Radiographs*:** it helps us assess the proximal caries we either have:
2. R0 🡪 no radiolucency
3. R1 🡪 in the enamel
4. R2 🡪 in the enamel but not exceeding the amilo dentinal junction (without lateral spread)
5. R3 🡪 reached the amilo dentinal junction with or without breaking it
6. R4 🡪 in the inner half of the dentine

* Intervene when the radiolucency reach the inner half of the dentine and the pulp.
* Restore surgically only when a lesion is seen clearly penetrate the amilo dentinal junction, but as long as it is in the amilo dentinal junction without lateral spread we don’t intervene.
* Clinical examination is the best diagnostic method for occlusal caries with (75-82%) efficiency, while in detecting caries on proximal surfaces it has (22-32%) efficiency.
* Since the occlusal surfaces are highly mineralized, detection the carious lesion by radiograph is very hard even if it reached the dentine.
* Radiographs have high sensitivity and specificity.
* Problems of this method:

1. It can’t be used for pregnant ladies
2. It can’t be used for monitoring
3. It can’t be used as a preventive measure, because it needs a very high demineralization level to appear in the radiograph. (The lesion doesn’t appear radio graphically except after it extended to the dentine).

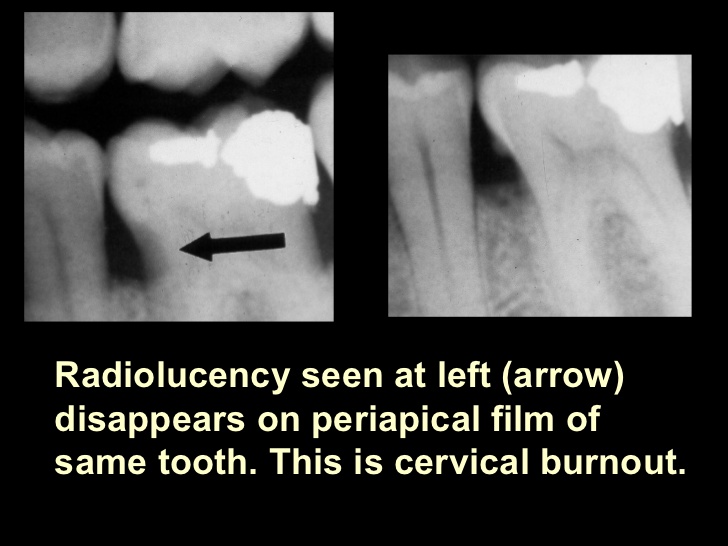
* Radiographs quality :

1. Proximal caries can’t be detected if the cone beam direction is wrong.
2. The radiograph must have enough contrast and you must be able to see the colors as it is.
3. It has Low sensitivity
4. It has limited precision: the tooth may have hypocalcification lesion or any non carious lesion but we think it a carious lesion.

* Quality control:

1. High density
2. Good contrast
3. Viewing environment
4. Processing artifacts

* **Cervical burnout:** is an area of apparently increased radiolucency in the mesial and distal cervical (neck) regions of the tooth.  Such regions are often mistaken for interproximal caries when in fact they only appear radiolucent because they have neither the radiopaque enamel of the region immediately above nor the bone tissue below. (it is due to angulations differences)



* **Black match:** the enamel is highly mineralized while the dentine is less mineralized so when they unite they give contrast.

\*\* amilo dentinal junction is hypomineralized in comparisons with the enamel and dentine.

1. ***Diagnodent*:** it is a German invention from Kavo corporation

* It is used on
  1. Occlusal surfaces
  2. Smooth proximal surfaces
  3. For enamel and dentine
* Properities of diagnodent:

1. Not invasive
2. High reliability
3. Valid
4. Accurate
5. High reducibility
6. High co-relation with histological lesions
7. Reliable with both occlusal and proximal surfaces
8. Reliable with both dentine and enamel .
9. ***Quantitative light fluorescence (QLF):***

* It depends on the tooth auto fluorescence
* The lesion appears black
* Used for smooth surfaces mainly class 5
* Enamel caries only
* High sensitivity and specificity
* High reliability
* Diagnodent and QLF depend on minerals not on bacteria, histology or collagen.
* If they detect a lesion it might be fluorosis or hypocalcification flakes.

1. ***Digital fiber optic transmission image*:**

* For dental caries only
* Not for occlusal surfaces because of their complex anatomy
* It has low sensitivity in proximal surfaces but better than the naked eye
* Radiograph > digital fiber optic > clinical diagnosis
* No co-relation with histological lesion depth

### [*Dental electrical conductance measure*](http://scholar.google.com/scholar?q=dental+electrical+conductance+measure&hl=ar&as_sdt=0&as_vis=1&oi=scholart&sa=X&ei=UBE0VcHNCYrPaLSJgYgB&ved=0CB4QgQMwAA) *(ECM):*

### It depends on the electrical conductivity of the tooth, which depends on minerals

Mineral content electrical conductivity

* So if we have a high electrical conductivity then there is a lesion
* It has:

1. High sensitivity and specificity
2. Accurate
3. Can be used for enamel or dentine
4. Fissure caries in recently erupted molars
5. Good for monitoring , non operative treatment

* QLF , ECM and Diagnodent early caries detecting tools.
* Not all methods can detect early lesion accurately such as radiograph .

**Dr. Ibrahim**

* Post treatment failure and post treatment apical periodontitis can be regarded as a microbiology problem “caused by bacteria”.
* **Apical periodontitis**: disease caused by bacterial infection in root canal.
* **The enemy zone:** is the zone of infection or the zone of necrosis which contains the bacteria, the abundance of bacteria is generally greater apically than coronally, and the middle part tends to have less bacteria

|  |  |
| --- | --- |
| Coronally | More actinobacteria |
| Apically | More taxa and diversity  More obligate anaerobes  More proteobacteria |

* Not all dentinal tubules around the canal are invaded by bacteria, because the infection tends to be localized within the canal (simply, because the nutrition in the tooth is localized within the pulp and root canal system).
* BUT only if cementum is eroded, bacteria tend to penetrate all the way through; the whole thickness of root canal in this case could be invaded by bacteria, and this is the case of chronic apical periodontitis where there is resorption in the tooth surface in the apical area.
* In a previously filled tooth, this DEPENDS ON the quality and length of filling.
* The condition of root canal is a guide to the condition of periapical tissue; that means **when bacteria is present** *lesion and infection is present in the apical portion of root canal system.*
* When the lesion is large the diversity of infection is much greater and this will affect the outcomes of treatment.

Bacteria

Release substances

Induce immune response

Mobile molecular phagocytes

Mediators

Prevent bacteria to gain access to bone & avoid osteomylitis and systemic effects

1- Induce of destruction of canal tissue

2- induce clinical signs and symptoms

3- lead to environmental changes that provide nature for **bacteria**

* If the pt shows acute or severe clinical signs and symptoms (pyrexia, trismus, facial swelling, etc) of disease should be covered by antibiotics.
* Focal infection theory; the idea that a local infection affecting a small area of the body can lead to subsequent infections or symptoms in other parts of the body due either to the spread of the infectious agent itself or toxins produced from it. However, relatively recently current consensus in the dental community changed. It now suggests that FIT is not a valid reason to remove teeth or to avoid root canals.
* Inflammatory exudate is rich in proteins and glycoproteins and this will provide nutrition to the bacteria in the apical part of the canal.
* Spread of infection is possible if treatment is delayed or if treatment is performed unsuccessfully. Even in case of infection and lesion, the life expectancy for the tooth is fairly good, but;
* if you want the tooth to die  leave it or extract it.
* if you want the tooth to live  do proper RCT
* Root canal infection is caused by mixture of facultative anaerobes gram positive strains dominating by obligate anaerobes.
* Apical periodontitis is a biofilm induced disease.
* We can find the bacteria in the canal suspended, and they called planktonic bacteria (bacteria in free form). In term of treatment they are not significant because instrumentation and irrigation have a direct access to planktonic bacteria (free form bacteria can be physically blocked by the irrigant).
* The most important are the bacteria that adhere to the canal walls forming sessile state and they called biofilms.

In acute situation we can find a thick layer of biofilm inside the root canal system.

* Inside the biofilm, bacteria act as single large multicellular organism that has a great intelligence; it is not an inert structure that can simply kill. So, there are a differences between bacteria in the biofilm and bacteria in free form.
* **Endodontic biofilm categories:**
* Intracanal biofilm
* Extracanal biofilm (calcified mass on the root surface), they are responsible for delayed healing after treatment.
* periapical biofilm (isolated in the periapical region)
* Foreign body centered biofilm: (aggregation of actinomyces cells); it is a major complication associated with prosthesis and also in an implant supported prosthesis. And it is related to periapical disease in endodontics.
* The large majority of teeth we are dealing with biofilms. And in the apical periodontitis we have a great chance to deal with biofilm in the apical part of the canal.
* ***The prevalence of biofilms is larger in cysts and large lesions:***
* 69.5% in granulomas
* 95% in cysts
* 85% in abscesses
* These have lower success rate because the cause of large lesion is more complex and very difficult to eradicate.
* Extrardicular biofilms can present even after successful eradication of intraradicular biofilms.
* Bacteria in the biofilm will produce virulent soup and cause direct and indirect damage to the host.
* *Biofilms are a challenge to chemomechanical preparation* because the matrix of biofilm (structural dense organization of the biofilm within the polymeric matrix) restrict the penetration of any agent (amoxicillin, doxycycline, metronidazole) into biofilm. They are more one thousand times more resistant to phagocytosis and antibody than non-biofilm producing bacteria.
* Mechanical removal by instruments is only effective in some areas on the root, what we need is dissolution by sodium hypochlorite and detachment by ultrasonic energy.
* Biofilm needs a surface to hang on, so we need agitation to move the debris and detached biofilm and its break up matrix in the solution, then eliminated from endodontic space.
* **Best method to deal with biofilm is scraping.** Also, Instead of traditional approaches with single active component irrigant (smear irrigant), we need an **organized multiple attack strategies and multi agent approach that will attack different aspect of bacterial cell membrane.**

**Dr. Mohammed Rabab’a**

* Biomimetics in dentistry aims to enable us to restore the biomechanical, structural and aesthetic integrity of the tooth.
* Any restoration material causes a load or pressure on the other remaining teeth, especially the **amalgam and the non bondable restoration,** so it’s all about: Minimally invasive dentistry
  1. Early detection ( with degree of certainty )
  2. Minimal surgical invasion
  3. Repairing defective restorations
* Radiography:   
  1 - Conventional   
  2- Digital enhancement: computer image (not a real image )  
  3- Subtraction radiology: Comparison between 2 radiographies one before 6 months and the other is after 6 months) to know if there is secondary caries.
* Preventive phase:
* Caries > need four things : time , food , tooth , microorganism
* So we need to have:
* Diet control
* Fluoride application
* Fissure sealant
* Plaque control
* Restorative phase : (in descending order)

1. Preventive resin restorations.
2. Composite/GIC/Compomer.
3. Amalgam restorations.
4. Endo Tx
5. Extra coronal restorations

* G.V. Black : father of modern dentistry
* **TECHNIQUES**

1. ***Fissure Sealing***

* Flowable resin material (resin without filler) placed on newly erupted molars for the prevention of dental caries on pits and fissures.

1. ***Interproximal Lesions :***
2. ***Tunnel Prep***

* Indicated when the proximal lesion is 2.5mm below the contact point.
* Performed by accessing the carious dentine from the occlusal surface, while maintaining the **marginal ridge**.
* The proximal ridge is only broken if caries has broken into enamel, or it must be left as it is (Composite Resin).
* Adhesive material used to fill cavity.
* Sandwich technique is recommended

1. ***Slot Prep (mini-box)***

* These preps involve the removal of the marginal ridge, but do not include the occlusal pits and fissures, if caries removal in those areas is unnecessary.
* Cavities normally have a box or a saucer shape, and are restored with composite resin.

Study showed that tunnel preps had better results than a slot prep, in 3 years.

* **Repair Vs Replacement of Defective restorations :**
* More tooth structure is lost by replacement of restoration
* Replacement is common due to concerns:   
  Bond strength, residual caries, recurrent caries.
* **Ryge criteria (1973):**

1. ***Alpha:***
2. Excellent, fulfilling all quality criteria; tooth &/or surrounding tissues are adequately protected.
3. Highly acceptable
4. ***Bravo*:**

* Sufficiently acceptable but with minor shortcomings in areas where any instrumentation may result in damage to the tooth; no adverse effects are anticipated (ex: minimal caries on old restoration in highly aesthetic area).

1. ***Charlie:***

* Unacceptable but repairable (ex : caries on the margins of the old restoration in huge class 5)

1. ***Delta***:

* Unacceptable and must be replaced.
* **INNOVATIVE TOOLS USED:**1. ***Hand pieces :***
* High speed ( 400,000-600,000 ) round/ min
* Low speed hand pieces (10,000-40,000) round / min
* Main disadvantage of hand pieces with burs is heat generation which is painful.

**2. Air Abrasion (like sand plastic)**

* Pseudo-mechanical, non-rotary method of cavity cutting and removing dental hard tissue.
* The bonding of enamel and dentin surfaces prepared with air abrasion is much better than that with conventional carbide burs and acid etching.
* Kinetic energy is used to remove carious tooth.
* It’s a narrow stream of moving aluminum oxide particles directed against the surface to cut and as the particles touch the surface, they abrade it with force, without the use of heat, vibration or noise.
* These particles exit out of the tip of a hand piece, thus it is an end-cutting device.
* **The amount of structure cut can be adjusted by:-**

1. Changing the pressure
2. Changing the particle size
3. Amount of powder flow, Size of Tip
4. Tip Angles, and the distance of the tip from the tooth

* ***Advantages:***

1. Reduced Noise, Vibration and sensitivity
2. More rounded line angles

* ***Disadvanatages:***

1. Cannot be used in all patients; asthmatics, and patients with other pulmonary problems
2. Dust control.
3. Not efficient in removing large amalgam restorations
4. Does not remove gross caries well, as it doesn’t cut soft and resilient substances, a spoon excavator has to be used in conjunction with these
5. Depth of cavity cutting is hard to control   
     
    **3. Laser Cavity Preparation :**

* Laser stands for - **L**ight **A**mplification by **S**timulated **E**mission of **R**adiation.
* Device that generates a precise beam of concentrated light energy.
* Different wave-lengths are used for cutting different surfaces.
* Some good for soft tissue and some good for hard tissues.
* **Types used in dentistry include:**

1. Erbium:yttrium-aluminum garnet lasers
2. Chromium:yttrium-scandium-gallium-garnet

* Can remove caries selectively while maintaining healthy dentine and enamel.
* ***Does not produce smear layer* ( most important one , since there is no derbies so we can NOT use GI after laser since its bonding depends on free calcium in the debris).**
* Can be used without anaesthetics.
* Adhesive restorative materials are used with these preps.
* Laser is generated in machine, then guided by gold mirrors along the hand-piece to emit from the tip with a water-jet.
* Pressure of water does cutting, and guidance is achieved by red laser.
* **Advantages:**

1. No Vibration
2. Little noise
3. No Smell
4. No Numbness associated with anesthesia

* **Disadvantages**:

1. The lack of tactile sense
2. Cuts hard tissue more faster than soft demineralized dentin on cavity floor