**Sheet no: 14**

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***Cosmetics onlays and inlays***

Last year we learned how to prepare metallic onlays/inlays in the lab (mainly gold), today we will talk about cosmetic ones (high demand for tooth colored materials which is higher in aesthetic).

* Cosmetics onlays and inlays >> are treatment option for simple calss I and class II restoration
* We called them cosmetics because they are fabricated from a tooth colored material. Either:
1. Resin composite
2. Ceramic material
* Retention and resistance form for onlays/inlays >> mainly obtained from adhesion to tooth structure.
	+ - * **Note:** metallic or gold inlays/onlays dosen’t bond to tooth structure as ceramics or composite so when we prepare the cavity we make sure that we have retention and resistance form; mesial and distal boxes, occlusal shoulder.
* We will talk about guidelines for preparation, but in real life you will never prepare similar cavities, because it depends on your case (the extension of caries). But you should know the guidelines.
* Onlays is the stage before doing a full crown(we have a tooth structure, The tooth is vital and I wanna preserve tooth structure as much as I can so I decide to do onlay rather than full coverage crown)
* **Indications** are similar to class I & class II cavity, but also you should have:
* Adequate remaining tooth structure
* Patient with low caries risk
* **Contraindications:**
* Patients with heavy occlusal loading (it’s not a complete contraindication) >> I can do it for a patient with bruxism but I should give him an occlusal splint (but in these cases the Dr prefer to use **gold,** because gold has the same wear resistance of enamel so no abrasion to opposing teeth and it has more stable occlusion).
* Extensive caries and extensive loss of tooth structure.
* Large MOD cavities (because of wedging effect) >> SO in these cases we prefer to cover the functional cusps (**onlay**)
* Remember : if you have MO or DO we go for >> inlay
* But if you have MOD we go for >> onlay (to cover up the functional cusps)
* **Advantages:**
* durable compared to direct composite restorations (the longevity of ceramics are more)
* lower marginal deterioration and leakage
* high esthetics
* cusp support (in case of onlays)
* **disadvantages:**
* less conservative than a direct restoration. Why?
* We have a preparation
* Divergent boxes by 6 degree
* We can’t leave undermined tooth structure
* Occlusal adjustments can only be made after cementation (I can do a little occlusal adjustment but I will be afraid because If I did while the prosthesis not set well it will fracture
* It takes its final strength when it’s cemented with tooth structure.
* Abrasion of the opposing teeth
* Time consuming (in comparison with direct ones)
* **Preparation guidelines:**
* **Inlay’s preparation:**
* Penetrate central groove to minimum depth of 1.5mm with round or tapered carbide bur held in the path of insertion.
* Extend the occlusal outline conservatively through the central groove to the marginal ridge
* avoid occlusal contact with the cavosurface margin because it is the weakest link (you have to stay 0.5mm away from the contact of the opposing )
* then do the box, the box is slightly divergent by 6 degrees.
* the width of the gingival floor should be at least 1mm>> for ceramics not to break
* at least 0.6 mm clearance with the adjacent tooth), and positioned supragingival >> easier to take an impression and easier to do cementation
* Sometimes when I finish the outline I notice presence of caries on the axial wall. In this case I can excavate caries and then block it by glass ionomer in order not penetrate or prepare it more and maintain the geometry.
* All caries should be removed and undercuts should be blocked.
* All internal angles should be rounded >>
* Stress concentrating area
* When pouring your impression all your sharp angles won’t be clear.
* Inlays are much less indicated than onlays.
* **Metallic inlays are differed in:**
* Ceramic inlay preparation differs from a metallic inlay preparation in:
1. **No grooves**. We do them in gold to increase retention (mainly) and resistance because we gonna cement it with conventional cement.
2. **No bevel or flare**. We do beveling for gold because u can burnish it inside the patient mouth and this will give u the most accurate margin ever. don’t do bevel for ceramic, because it will fracture in thin sections ( has low tensile strength)
3. **amount of reduction >>** greater amount of reduction in ceramics.
4. **round angles are more important in ceramics than metal**



This pic is from the book for metal preparation, but it has many similarities with cosmetic ones. We have dovetail and a box .

* If boxes are extended beyond the transition line angle , preparation will lose retention and resistance , you should switch to onlay instead of inlay.
* Why I didn’t do completely parallel walls?
1. Eye can’t see the parallelism except if there is 6-degree divergence or more
2. The cement will escape from parallel walls
3. If I have parallel walls it’s almost impossible for inlay to be inserted >> so this 6 degree makes the insertion easier.
* **Onlay’s preparation:**

**It will cover functional cusps with an occlusal shoulder with minimal at least 1 mm**

* Penetrate groove to minimum depth of 1.5mm
* Occlusal shoulder width is 1mm minimum, without any bevel, and its height depends on the opposing (0.5 to 1 mm away from the occlusal contact)
* Margins are 90 degree butt joint
* Everything should be smooth and uniform
* all internal angles are rounded.
* Divergence from 6-10, above 20 u will lose your retention dramatically.
* Bur>> flat end or wide chamfer



* **Provisional restoration:**
* **Inlays:** temporary filling
* **Onlays:** bisacryl, light cure composite, polymethyl methacrylate >> then we cement it using polycarboxylate **(it’s a long term provisional cement, we don’t use a temporary cement we prefer to use polycarboxylate)**
* **Note:** we avoid using Zneg cement as a temporary cement because eugenol inhibit setting of resin cement.
* **Cementation:**
* We always use **resin cement**
* **Types of resin cement that we use:**
1. **Conventional resin cement:** either;
2. **Dual cure:** some studies say that if we light cure the dual cure we will have better results (**mainly we use dual cure or chemical cure**),, If we use dual cure still we have to light cure it to ensure maximum polymerization especially on the margins.

Light cure is used to seal the margins while a polymerization process of the chemical cure is taking place in the deep parts under the restoration.

1. **Light cure:** we don’t use it because we can’t make sure that light will reach cement.
2. **Self-adhesive resin cement:** we don’t need to etch the surface, but some studies Sayed that if you etch your surface will get better results, mainly we use it with posts
* **The standard cement that we use is the conventional cement.**
* We use resin cement because:
1. it bonds to enamel, dentine and to the restorative material
2. it limits microleakage and enhances the strength of the restoration and the tooth structure.
* Cosmetic inlays and onlays are always bonded to the tooth structure.
* The bonding mechanism relies on the acid etching of tooth structure and etching of porcelain and then binding them together.
* Two steps are required prior to cementation:
1. preparation of the restoration
2. preparation of the tooth
* ***Preparation of the restoration:***
* For ceramic inlays and onlays, the internal surface is first etched using Hydrofluoric acid conc. 9%-10% for a certain time depending on the type of ceramic that you use (more glass means more time for etching)
* Types of ceramic that you use:
1. **Feldspathic:** which you see every day over your metal prosthesis which has the highest aesthetic >> we can etch it up to **90 sec**
2. **leucite reinforced** >> etching **60 sec**
3. **Lithium disilicate >>** etching **20 sec**
* Then you wash for 20 sec
* Then you apply saline coupling agent
* Dry and evaporate
* **preparation of the tooth :** acid etching and bonding as you know before
* Rubber dam isolation
* Enamel and dentine etching using phosphoric acid.
* Bonding agent is applied, light curing is a must.
* mix the resin cement and then apply a thin layer on the tooth preparation and on the fitting surface of the restoration
* Slowly seat the restoration and remove excess while holding it in place
* To remove the excess easily, cure it for a short time (10 sec) and then remove it. (This process is technique sensitive; you have to hold the restoration in place while removing the excess)
* Apply glycerin or a separating medium on the margins to allow full polymerization for the margins of the resin cement and to prevent formation of air inhibited layer. Remember, resin cement is like composite; if it is exposed to air, the outermost layer is not polymerized.
* Margins are finished with micro-fine diamond burs (finishing burs), the restoration is then polished
* occlusion is checked.
* **differences between indirect composite and ceramics:**
* in indirect composite bonding of inlay/onlay is more difficult than bonding ceramics or direct composite, because:
* indirect composite is highly mineralized (it was made in the lab and left for more than one hour, polymerized by pressure and light>> so there is no more unreacted monomer which can bond to the resin cement)
* In composite, I can’t do etching by hydrofluoric or phosphoric acid rather I air abrade it, to create micro porosities then I use saline coupling agent.
* **Materials used for cosmetics inlays/onlays:**
* Composite
* Ceramics
* **Advantages of resin composite:**
* Can be fabricated directly inside the patient mouth **(rarely used)** or indirectly on the lab
* We have a new generation of composite “optimized composite”, which has better esthetics and better physical properties. Trade names ( . Artglass, Sculpture, and Targis). This composite is a special type for the lab it’s a laboratory composite.
* **The direct method for fabricating composite inlay or onlay:**
1. Prepare the cavity.
2. Put rubber dam and matrix band.
3. Apply separating medium.
4. Apply composite and cure it.
5. Remove the composite out of the cavity.
6. Cement it back in the cavity.
* **The indirect method:**
1. Prepare the cavity.
2. Put a retraction cord if the margins are low in height.
3. Make impression using any of the elastomers
4. Fabricate a cast (they didn’t do too much ditching and didn’t separate it as a die to maintain the accuracy of proximal contact)
5. Composite is made in the lab
6. Cement it.
* **Advantages of indirect composite over direct composite:**
1. Better proximal contour and contact.
2. No polymerization shrinkage stresses except for the minor shrinkage that happens in the cement which is almost negligible.

This means:

* Less gaps.
* Less cusp flexure.
* Less postoperative sensitivity.
1. Improved marginal adaptation and seal, hence, less microleakage.
2. Better physical properties than direct composite due to it’s highly polymerized. (first it’s polymerized on the cast then the lab takes it and put it in a polymerizing unit (curing unit) the temp is almost 100 for one hour)
* **Porcelain onlays and inlays**
* used when high esthetic are required
* **Ceramics inlay Vs. resin composite inlay:**
* Ceramic inlays Exhibit less microleakage as there is no shrinkage.
* Ceramic inlays Possesses better fit and marginal adaptation.
* Composite inlays tend to be more users friendly
* Composite inlays can be repaired.
* Ceramic inlays are fragile
* Ceramic inlays cause wear to the opposing
* **Inlay cases are better treated with composite material rather than ceramics.**
* **Ceramic onlay Vs. resin composite onlay:**
* Ceramic onlay exhibits a stronger bond, therefore more efficient transmission of forces**. (bonding of composite in the onlay is weaker than bonding in the direct composite and weaker than the bonding in the ceramic onlay)**
* For **onlay cases**, a ceramic type is preferred to the composite type.
* Ceramic inlays and onlays can be fabricated in the same way of ceramic crown:
* **Centering:** like Feldspathic ceramic
* **Milling:** it is milled, it comes as blocks (like CAD CAM)
* **Heat pressing:** this is the ceramics that is made by in the like similar to the loss wax technique**. Like;** Empress (empress has two generation materials: empress I >> **lucite reinforced,** empress II >> **Lithium disilicate (these are the fillers of ceramics reinforced the rest of types contain glass as a filler)**
* **Slip casting** (In-Ceram) is not used nowadays because it is very technique sensitive >> you have the powder and liquid of porcelain, you take the die and put it inside the mix, then you put it in the oven.
* **CAD CAM onlays:**
* It has many generations
* You could scan:
1. Your preparation (you scan the tooth) >> cerec system
2. The wax-up pattern >> celay system
3. The die >> procera system
* **Physical properties :**
* There is a significant difference in wear resistance between porcelain and composite.
* Feldspathic porcelain is highly abrasive.
* newer generations of low fusing porcelain (pressable like IPS Empress) Cause less wear than traditional ceramic
* Longevity
* Studies have shown that there is no significant difference between resin inlay and direct composite restoration in terms of longevity.

That’s why most of us as dentists tend to do direct composite restorations when there is simple class 1 or class 2.

* **Failures:**
* There are 2 types of failures:
1. **bulk fracture**:

 occurs specially in the **cusps** coverage due to inner tooth reduction and at **the isthmus** (between your dovetail and the box) because there is no support under the isthmus (No gingival floor or a small one)

1. **Marginal ditching:**

This occur in poorly adapted restoration because sometimes wear of luting resin occur so you have ditching on the margins.