

Indirect Restorations: Crowns, Inlays, Onlays, Bridges

Dental Materials Lecture #3

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Direct vs. Indirect Restorations

Direct Restorations:

- Constructed Inside the Mouth
- Includes Simple Fillings (Resin Composites, Glass Ionomers, Amalgams)
- Less Strong than Indirect Restorations
- Indicated when substantial tooth structure remains

Indirect Restorations:

- Fabricated outside the Mouth
- Includes inlays, onlays, crowns, bridges, Veneers
- Stronger than direct Restorations
- Must be cemented onto teeth
- Indicated when significant missing tooth structure

Dental Materials Lecture #3 Outline

- Indirect Restorations (Inlay, Onlay, Veneer, Crown, Bridge)
- Indirect Restorative Materials
- Core Buildups
- Fabricating Indirect Restorations
- Temporary Restorations
- Cementation of Indirect Restorations
- Clinical Detection and Management of Dental Restorative Materials

Learning Objectives

- Learn about Indirect Restorations
- Understand differences between Indirect Restorative Materials
- Understand How Indirect Restorations are Made
- Review Temporary Crowns/Indirect Restorations
- Review Cementation of Indirect Restorations
- Review Clinical Recommendations for Maintenance of Indirect restorations during hygiene visits

Indirect Restorations

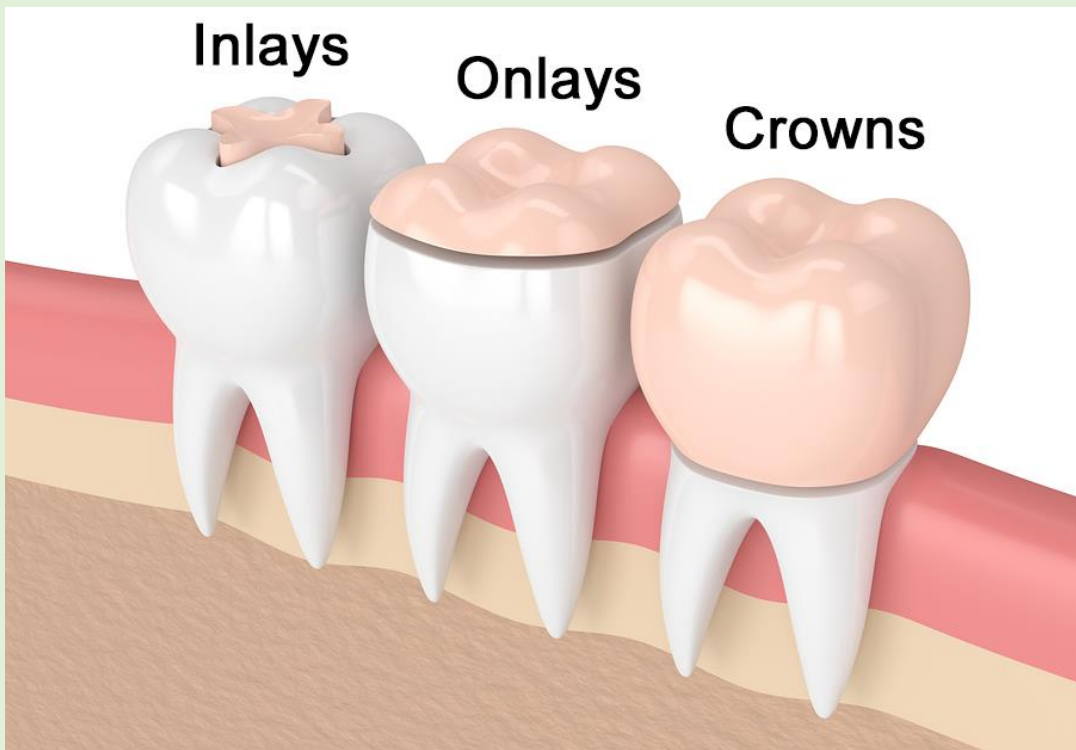
- Inlays, Onlays, Crowns, and Bridges are all used to replace missing or damaged tooth structure.
- **Inlay:** Very Similar to a Simple Filling. Does not include Any cusps
- **Onlay:** Larger than an Inlay, includes 1 or more cusps
- **Crown:** Covers the entire clinical crown
- **Bridge:** Used to replace a missing tooth. Crown connected to a pontic connected to a crown: (Crown)—(Pontic)—(Crown)

In the case of a bridge, it is not just replacing missing tooth structure, but replacing an entire missing tooth

Inlays

Onlays

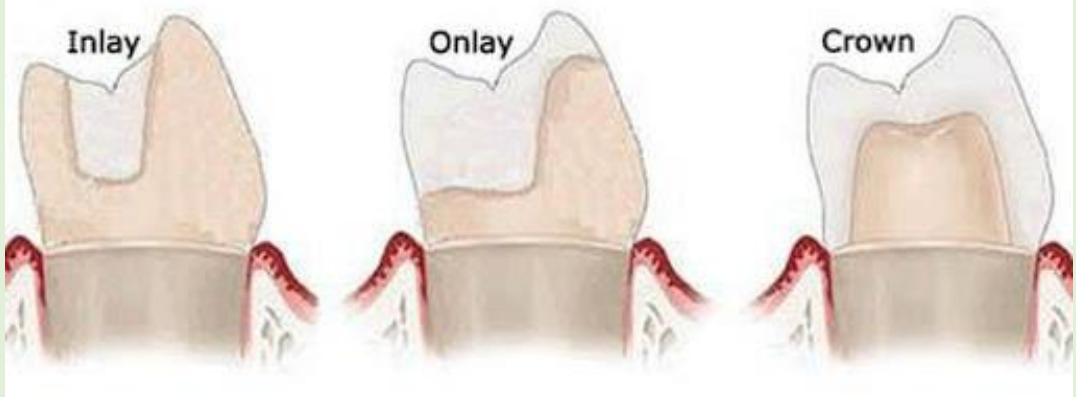
Crowns



Inlay

Onlay

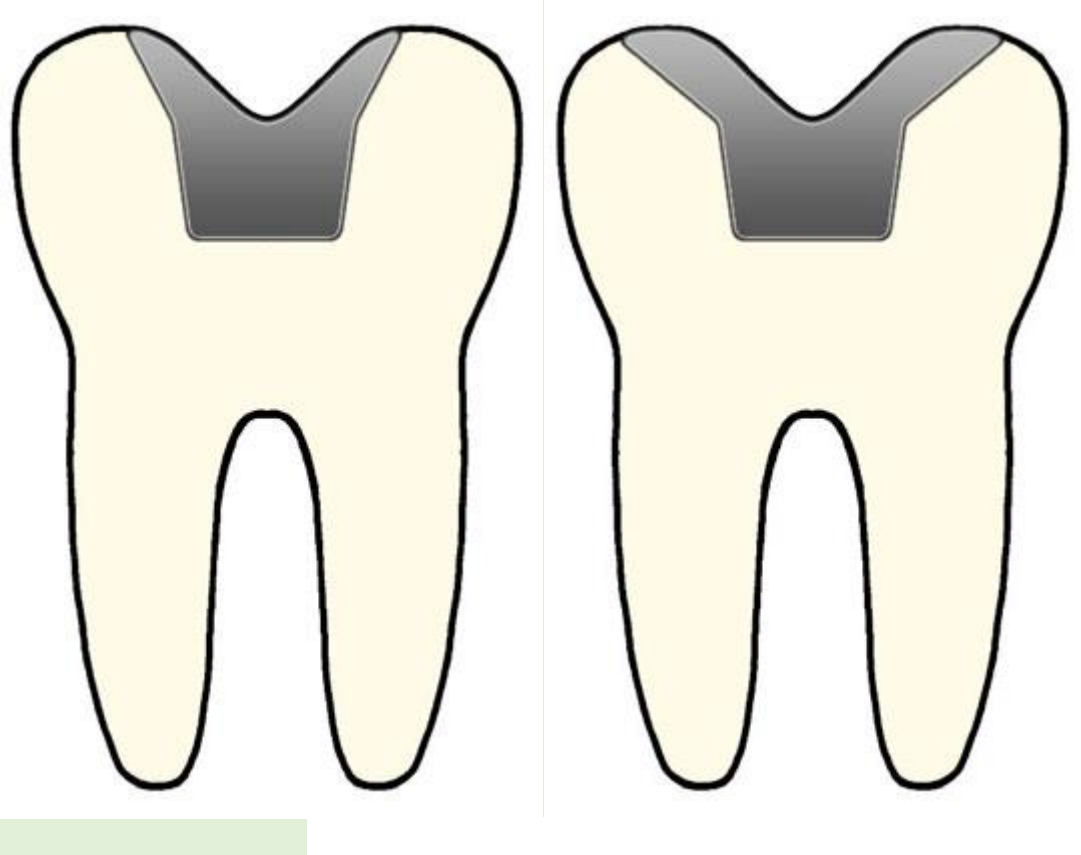
Crown



Indirect Restorations

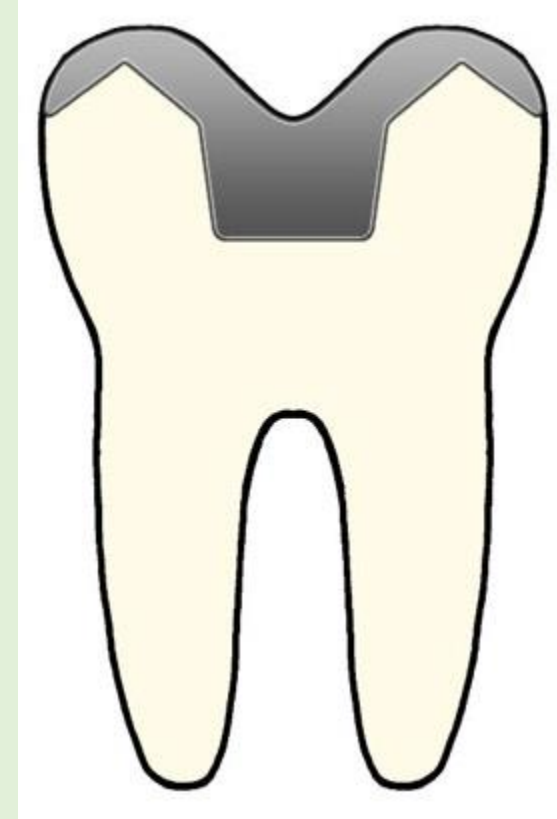


Inlay vs. Onlay



inlay

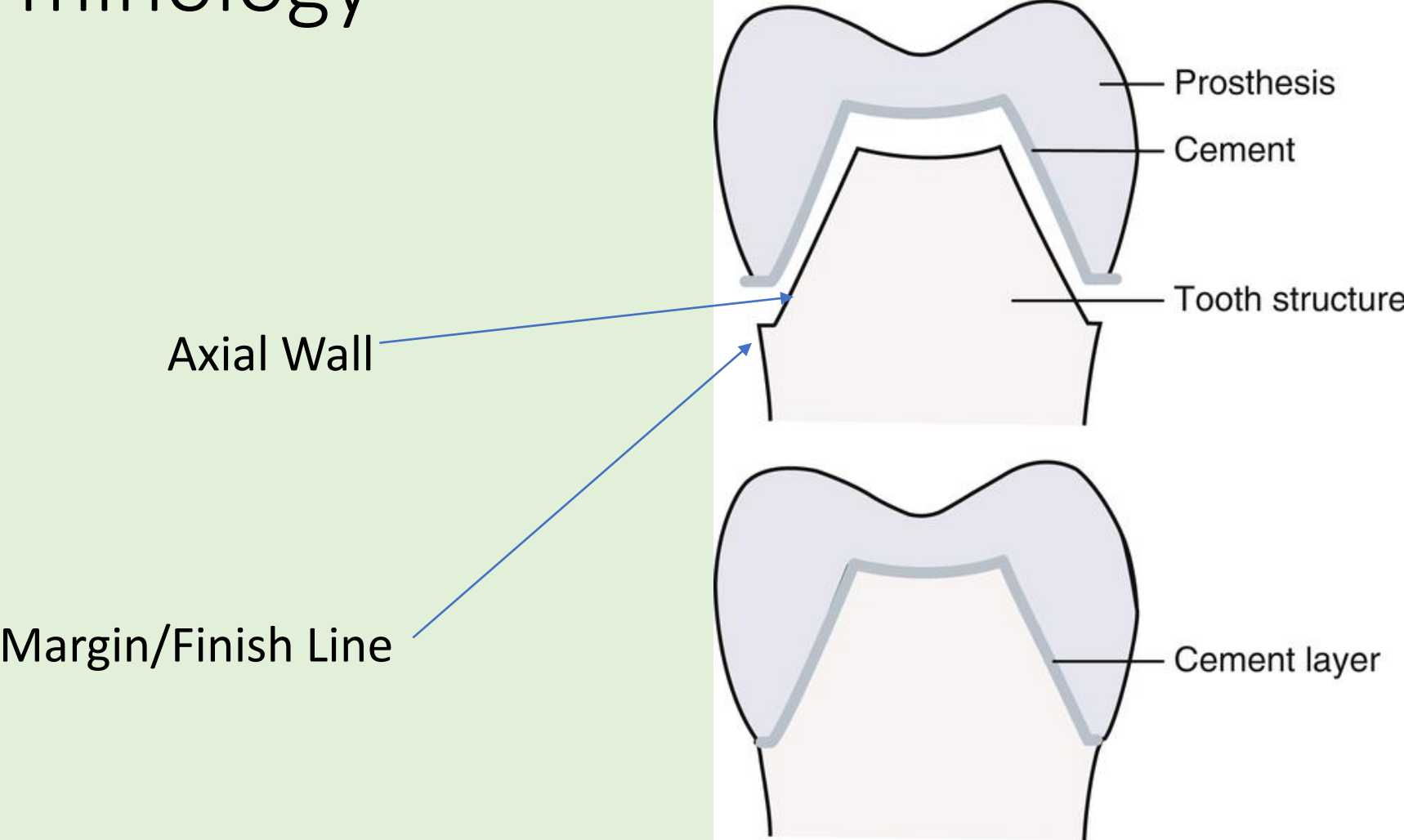
Does Not Include Any Cusps



onlay

Includes One or More Cusps

Crown Terminology



Dental Crown: Terminology Review



Dental Bridge: Terminology Review



Crown

- **Crowns** are used to restore teeth that have lost a significant amount of tooth structure. They are used when the tooth needs to be surrounded and held together by the restoration.

Types of Crowns:

Gold



Porcelain



Porcelain fused to Metal



Zirconia



Lithium Disilicate



Indirect Restorative Materials

Gold Restorations

- Gold indirect restorations are made by a casting procedure. Casting involves melting the metal and then pouring or forcing the liquid metal into a mold.
- Not Cosmetic
- Requires Minimal tooth preparation
- Malleability, biocompatibility, and resistance to corrosion.
- Similar wear properties to tooth structure. Will not wear down opposing dentition
- **Closest modulus of elasticity to tooth structure.**
- Radiopaque on X-Ray
- Gold restorations fit the tooth very intimately and thus are inherently very retentive. They do not depend on high bond strength.
- Very Expensive \$\$\$

Porcelain Restorations

- Can be made by “heat pressing” in a laboratory or “machined” from a block. The machine is called a “Mill”
- Highly Cosmetic
- Closest esthetics to a natural tooth
- Translucent (can see the color of the underlying tooth shine through)
- Very Weak
- **Mostly used on front teeth, especially for veneers**
- High Bond Strength
- More Radiolucent on X-Ray

PFM Crowns and Bridges

- Porcelain Fused to Metal restorations are only used for crowns and bridges. It is not used for inlays, onlays, nor veneers
- PFMs have a metal substructure (coping) with porcelain on top
- The metal substructure is made in the same process (casting) used for Gold crowns, and then porcelain is baked on top to provide a natural look.
- PFMs combine the strength of the metal casting with the esthetics of the porcelain
- Potential complication is porcelain fracture and seeing a grey line at the margin
- Can look natural, but not as natural as Porcelain or Lithium Disilicate Crowns
- Just like gold crowns, has intimate fit with tooth. Retention does not depend on bond strength
- Metal casting is radiopaque, porcelain is more radiolucent on X-Ray

Zirconia Restorations

- Made on a machine that mills the crown from a block. The machine is called a “Mill”
- Very strong material
- Good for patients with Bruxism
- Can wear out opposing dentition
- Poor bond Strength (less than Porcelain or Lithium Disilicate)
- Better esthetics than gold, but less than Porcelain and Lithium Disilicate
- No Translucency
- Much stronger than Porcelain and Lithium Disilicate, but less esthetic
- Radiopaque on X-Ray
- Commonly referred to as Bruxzir crowns.
- Generally only used for crowns and bridges
- Not used for Inlays, Onlays due to poor bond strength
- Not used for veneers due to poor bond strength and lack of “natural” esthetics

Lithium Disilicate Restorations

- Can be “heat-pressed” in laboratory or machined from a block, just like Zirconia crowns. The machine is called a “Mill”
- Highly Esthetic
- Translucent
- High Bond Strength
- More Radiolucent on X-Ray
- Stronger than Porcelain, but weaker than PFM/Gold/Zirconia
- Sometimes will fracture if used for posterior crowns/bridges
- Commonly referred to as Emax crowns.

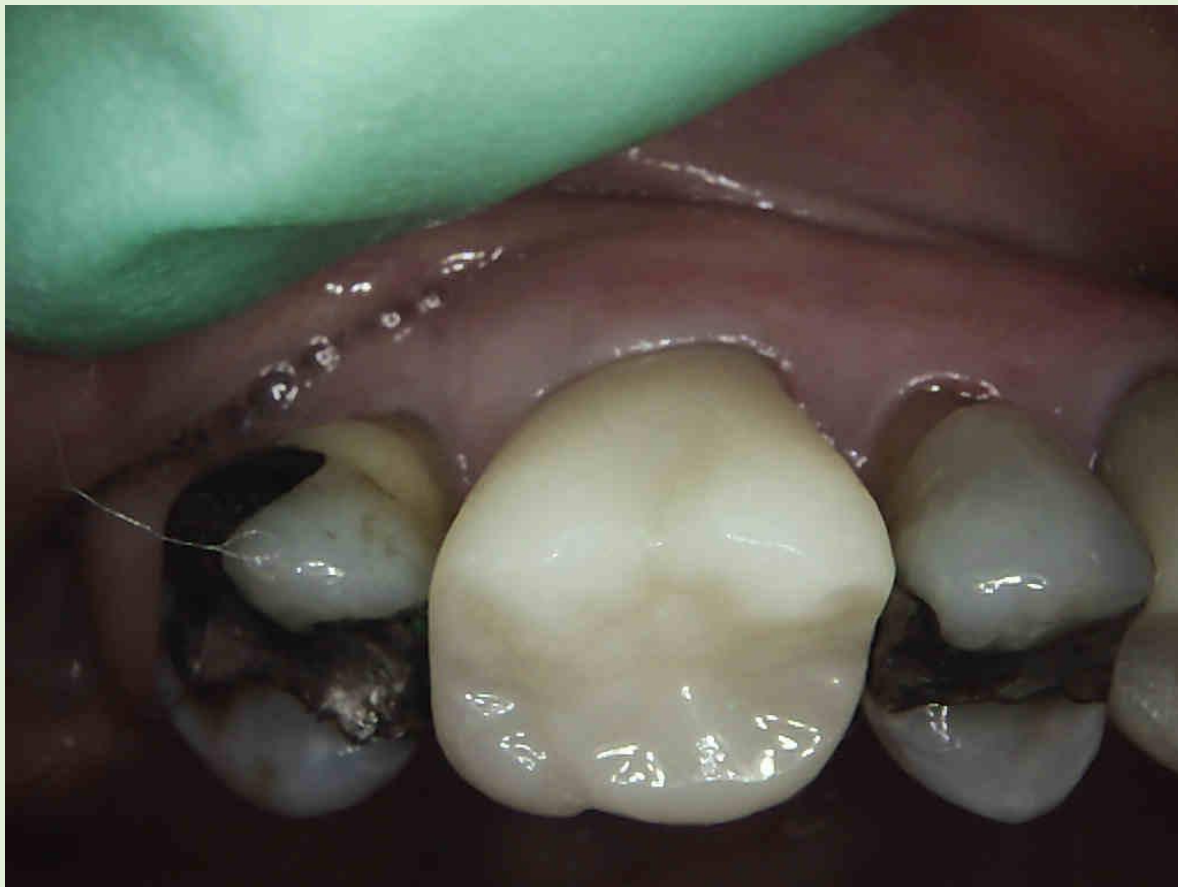
Materials Review

- Gold has the Closest Modulus of Elasticity to natural teeth
- Porcelain and Lithium Disilicate have the best esthetics
- Porcelain is the weakest
- Zirconia is the strongest
- Gold and Lithium Disilicate most common for Onlays and Inlays
- PFM and Zirconia only used for Crowns and Bridges (not inlays, onlays, veneers)
- Zirconia poor bond strength
- Porcelain and Lithium Disilicate high bond strength
- Gold and PFM don't depend on bond strength to stay on, but retention comes through intimacy of fit with preparation
- Gold, PFM, Zirconia are radiopaque on X-Ray
- Porcelain and Lithium Disilicate are more radiolucent on X-Ray

Break Slide



Zirconia Crown

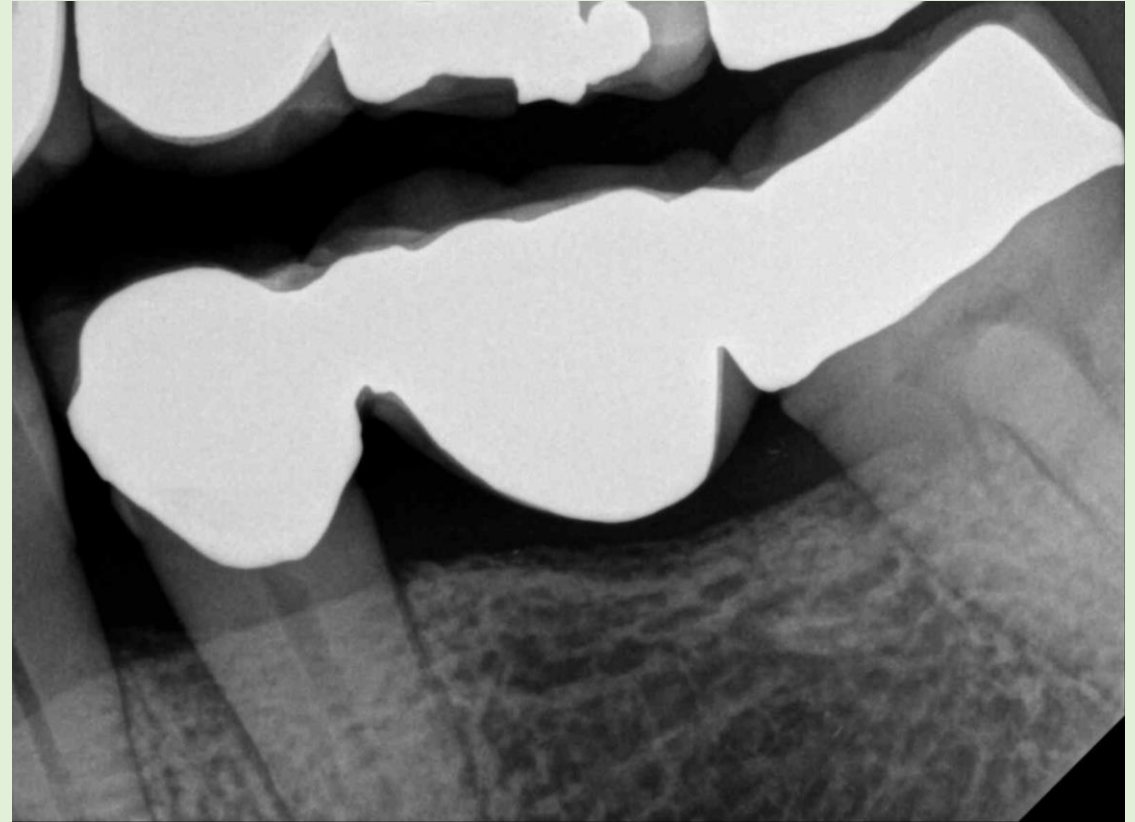


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PFM Crowns

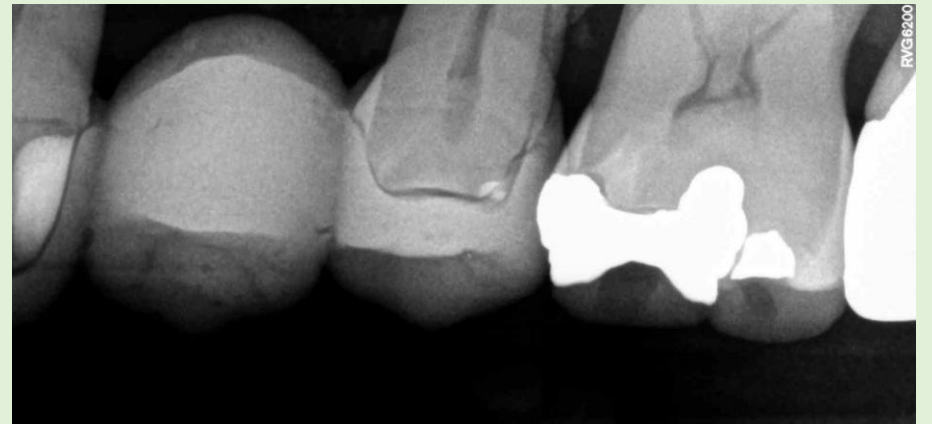


PFM Bridge #29-X-31



Lithium Disilicate Bridge

#11-X-13

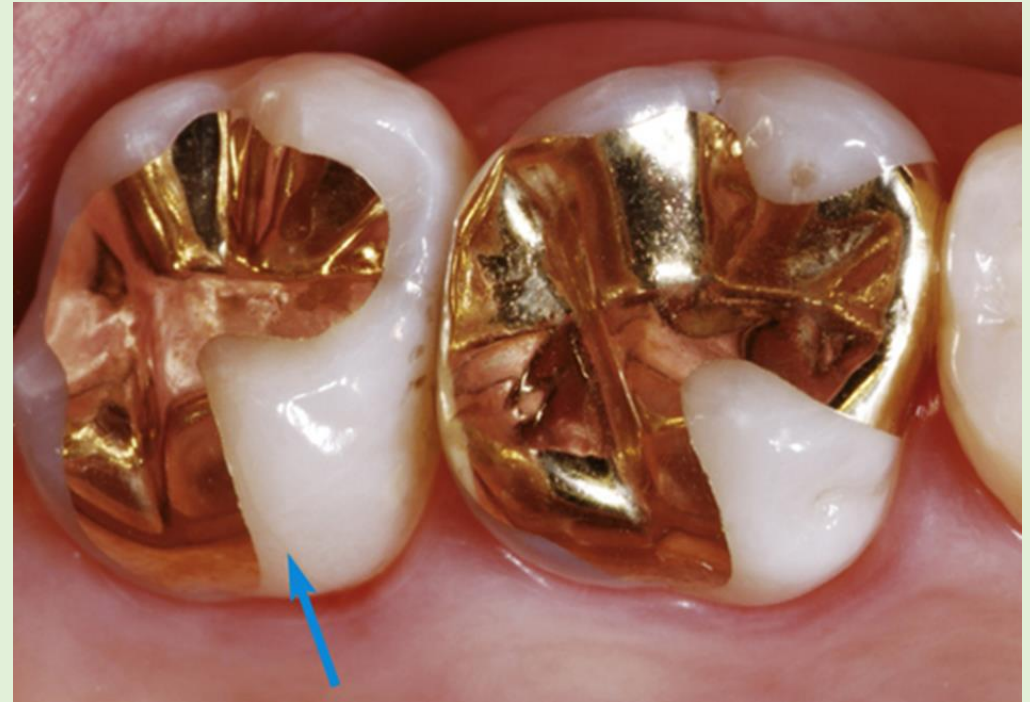


Inlays & Onlays

Lithium Disilicate (Emax)



Gold



Inlays and Onlays are made from either Gold or Lithium Disilicate

Inlay vs Amalgam



Veneers

Veneers are restorations that are placed on the facial surface of anterior teeth to treat an esthetic problem, such as discolorations, rotations, or spaces (diastemata).

Veneers are made from Porcelain or Lithium Disilicate.



Indirect Restoration Workflow

- 1) Prepare Tooth
- 2) Take Impression of prepared tooth
Place Temporary Restoration between visits
- 3) Fabricate Indirect Restoration (usually in the dental lab)
- 4) Cement permanent indirect restoration

Some offices can mill Emax or Zirconia crowns and cement them in permanently on the same day as the preparation. These can be done in one visit and therefore the temporary is unnecessary.

#3 Zirconia Crown



Remove Old Fillings and Decay



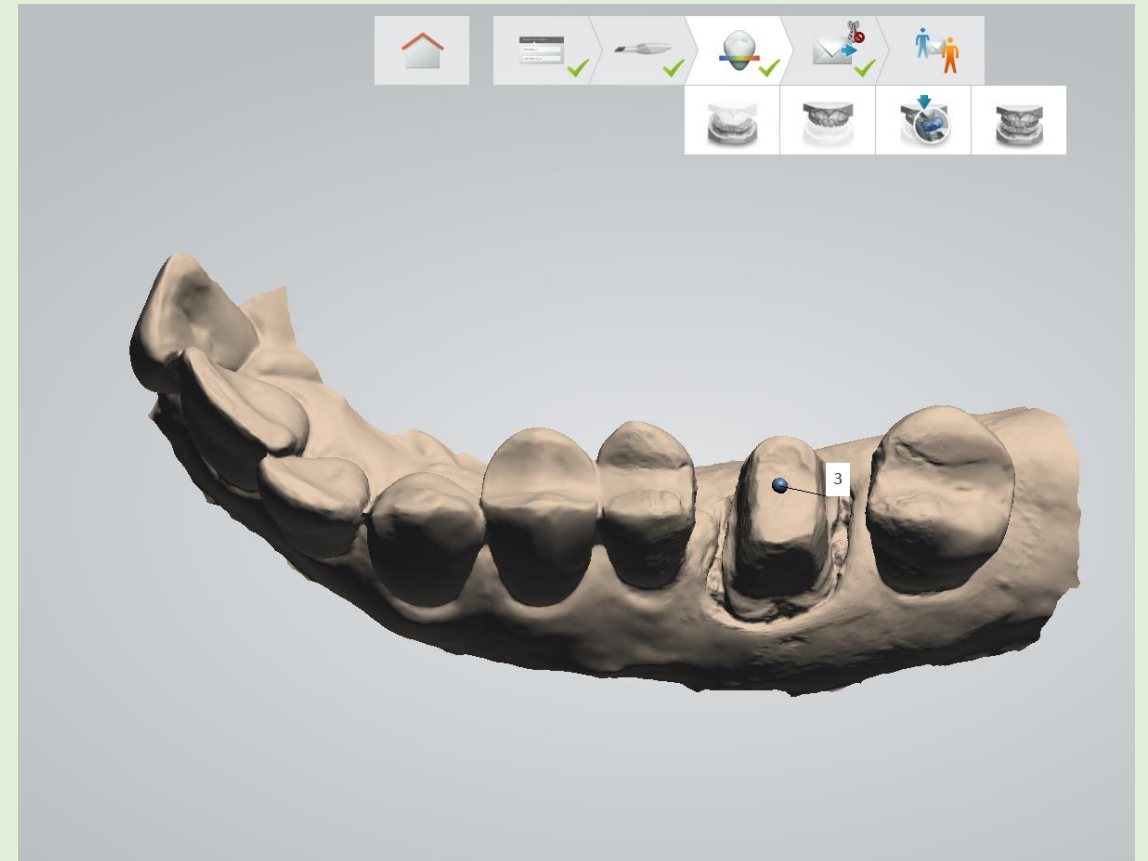
Core Buildup and Finish Preparation



Retraction Cord Placed. Astringent Paste Used.



Digital Impression & Digital Stone Model



Cementation of Zirconia Crown



Break Slide



Principles of Cementation

- Isolation
- Cement Selection
 - Light Cure/Self Cure/Dual Cure?
 - What shade cement?
 - What type of Cement?
 - Cleanup?
- Pre-cementation tooth conditioning
- Pre-cementation conditioning of restoration

Dental Cements for Indirect Restorations

- Zinc Phosphate
- Glass Ionomer
- Resin Modified Glass Ionomer
- Resin Cement

Zinc Phosphate

- Luting Cement, it does not depend on bond strength
- Used for metal restorations (Gold and PFM)
- Mix powder and Liquid on a Glass Slab
- Mixing is technique sensitive
- Initially very acidic, but becomes neutral within 24 hours
- Low pH can cause pulp sensitivity
- Easy Cleanup
- Self Cure
- Only used for Gold or PFM crowns

Glass Ionomer

- Decent Bond Strength
- Less frequently used for indirect restorations
- Fluoride Release
- Self-cure
- Easier cleanup
- Dispensed via click gun after triturating capsule



Resin Modified Glass Ionomer (RMGI/Compomer)

- Better Bond Strength than traditional GI
- Fluoride Release
- Dual cure
- Properties in between GI and Resin
- Dispensed via click dispenser or via automix dispenser
- Can be used for all restorations



Resin Cement

- **Strongest Bond**
- Most sensitive to moisture contamination
- Usually dual cure or light cure
- Most difficult to clean after cementation
- Least soluble
- No fluoride release
- Thinnest film thickness
- Dispensed via click dispenser or via automix dispenser
- Can be used for all restorations



Excess Cement Removal

- Done with a dental scalers
- Very often cement removal starts when cement is semi-set
- Most Dental Cements are radiopaque
- Take post-cementation Bitewing radiograph when suspicious of remaining cement

Excess Cement Removal



Loading a Crown with Cement



Temporary Crowns

- Used to protect tooth between visits
- We use a temporary cement so that we can easily remove the temporary crown during the second visit
- Temporary restorations are usually made from either Acrylic or Bisacryl
- Patients are informed to only chew very soft foods on the side with the temporary crown. They can chew their normal diet on the opposite side.***
- When flossing a temporary crown, floss down like normal in between the teeth, but then pull through the side.***
- If the temporary restoration comes off between appointments, the tooth may be very sensitive. The patient will usually have to come in an additional time before the permanent cementation to have the temporary re-cemented.

Acrylic Temporary Material

- Provisional Material
- Acrylic Resins
- Consists of PMMA (Poly Methyl Methacrylate)
- Chemical Set (Self Curing resin)
- Exothermic polymerization
- High polymerization shrinkage
- Low wear resistance
- Mix Powder and Liquid



Bis-acryl Composite Temporary Material

- Provisional Material
- Introduced to overcome the negatives of the PMMA
- Chemical Set (Self Curing resin)
- Low polymerization shrinkage
- Low exothermic reaction
- Good wear resistance and strength
- Cartridge with automixing tips
- Expensive
- Brittle



Temporary Cements

- Tempbond
- Tempbond NE (NE = Non-Eugenol)
- Tempbond Clear with Triclosan

Tempbond

- Zinc Oxide/Eugenol (ZOE)- Used as a:
 - temporary cement
 - base- to provide thermal insulation
 - perio pak- to protect surgical sites
 - impression material (inelastic).
- **ZOE *Contains eugenol- will inhibit the polymerization of permanent resin cements and acrylic temporaries.**
- Self-cure
- Available in automix syringe, tube delivery and Unidose
- Weak Cement
- Strong enough to withstand the stresses of mastication, yet permits easy removal of the restoration when this is desired



Tempbond NE

- Zinc Oxide/Non-Eugenol Cement
- Temp-Bond NE is a non-eugenol temporary dental cement that will not inhibit the polymerization of permanent resin cements and acrylic temporaries.
- Self cure
- Available in automix syringe, tube delivery and Unidose
- Weak Cement.
- Strong enough to withstand the stresses of mastication, yet permits easy removal of the restoration when this is desired



Temp-Bond™ Clear with Triclosan

- Dual Curable Transparent Resin Cement with Triclosan
- Tempbond Clear is a non-eugenol temporary dental cement that will not inhibit the polymerization of permanent resin cements and acrylic temporaries.
- Self Cure
- Available in automix syringe.
- Weak Cement
- Strong enough to withstand the stresses of mastication, yet permits easy removal of the restoration when this is desired



Fabricating Temporary Crown

- 1) Take a pre-op impression (before you prepare the tooth for a crown)
- 2) Reseat the impression once the crown preparation is completed to make sure that it fits
- 3) Place temporary material in the negative of the tooth that was just prepared and reseat in the mouth until material fully sets
- 4) Remove impression + temporary crown.
- 5) Trim temporary accordingly. Check proximal contacts, check occlusion
- 6) Cement with temporary cement

1) Pre-operative Impression



- 2) Reseat the impression once the crown preparation is completed to make sure that it fits
- 3) Place temporary material in the negative of the tooth that was just prepared and reseat in the mouth until material fully sets
- 4) Remove impression + temporary crown
- 5) Trim temporary accordingly. Check proximal contacts, check occlusion
- 6) Cement with temporary cement and remove excess cement



Cementing Temporary Crowns

- DO NOT OVERFILL THE CROWN.
 - 1) Isolate the tooth
 - 2) Put a thin layer of cement around the intaglio surface (inner walls) of the temporary crown
 - 3) Seat the with firm finger pressure
 - 4) Have patient bite on a guaze or cotton roll while cement is setting
 - 5) Remove excess cement.
 - 6) **Review homecare instructions with patient including diet and how to floss.**

Recementing Temporary Crowns

- 1) Thoroughly remove existing temporary cement
- 2) Clean tooth
sometimes prepped teeth are very sensitive and must be anesthetized
- 3) Check to make sure existing crown still fits (margins sealed, occlusion and contacts good).
- 4) Repeat Temporary Crown Cementation Protocol.

If the crown has a loose fit or if there is a short tooth with poor retention, consider a stronger temporary cement (ie- Durelon instead of Tempbond) or fabricating a new, more retentive temporary crown.

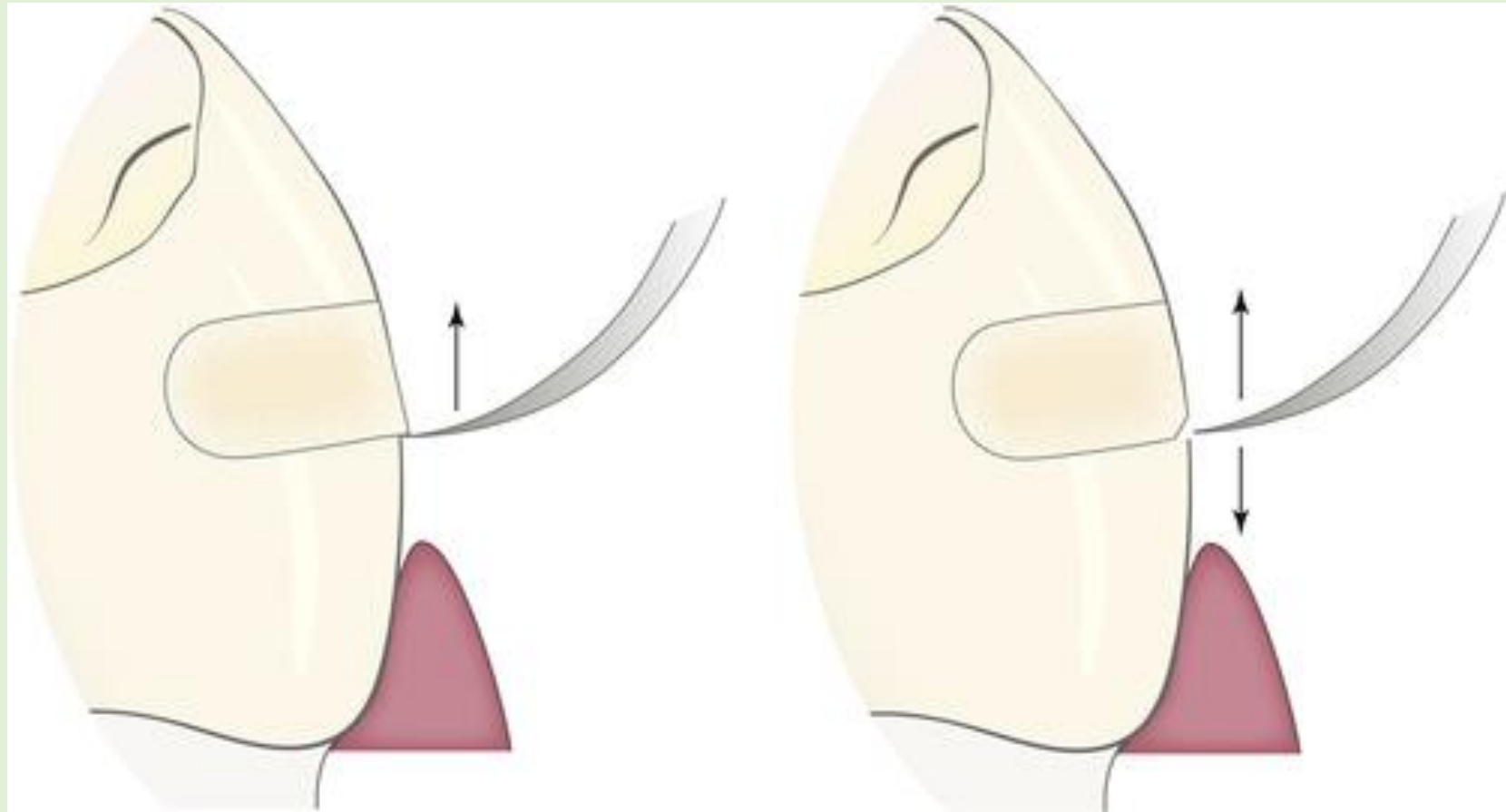
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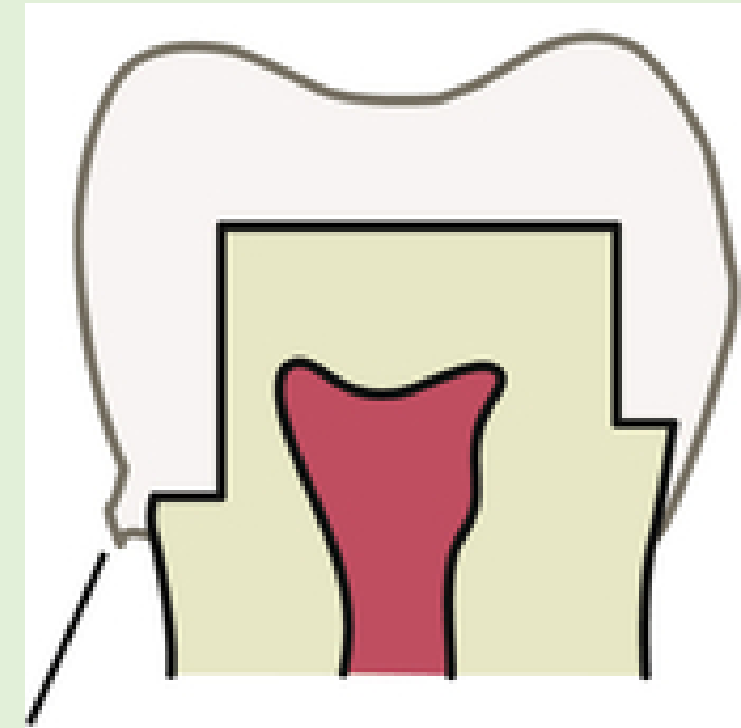
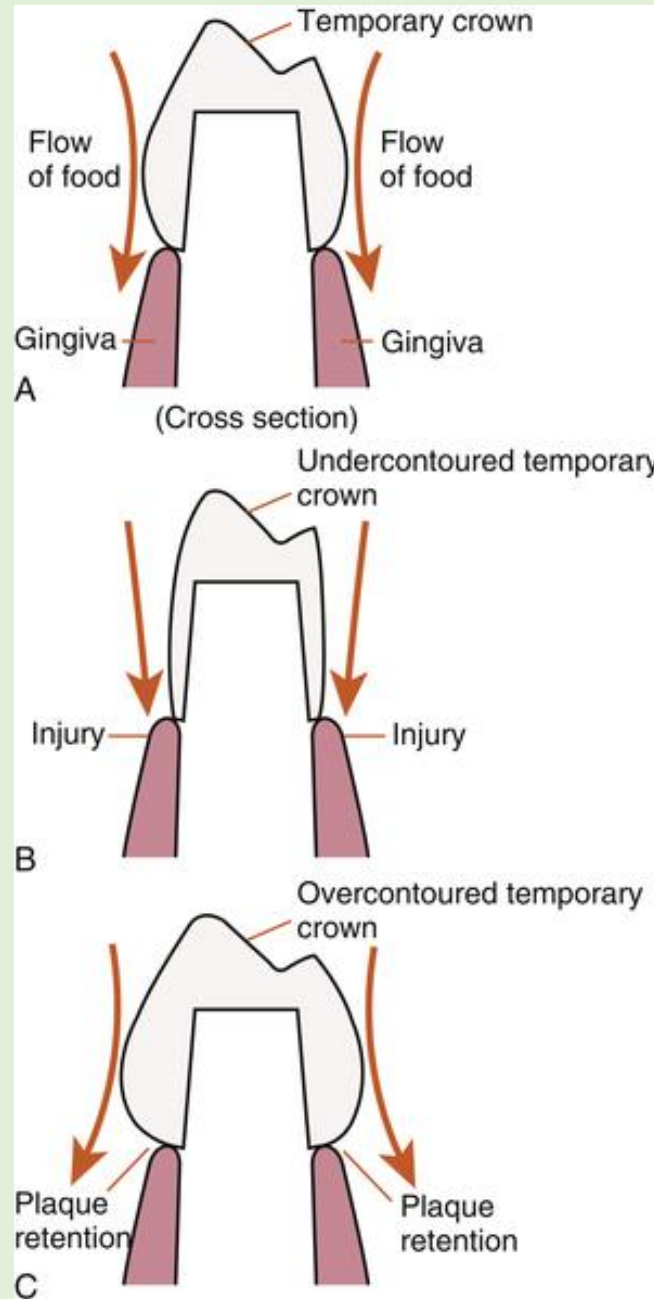
Clinical Detection and Management of Dental Restorative Materials during Scaling and Polishing

- Very often restorative materials (both direct and indirect restorations) will not be perfectly flush with the tooth.
- This can be due to:
 - overhangs or defective margins
 - crown margin that extend beyond the tooth margin
 - over-contoured (bulky) restorations
- This creates challenges to maintaining dental hygiene.
- Be cautious when scaling temporary restorations.
 - When in doubt, check with dentist
 - Use light pressure when instrumenting
 - When in doubt, skip it entirely (just check with the dentist first)

Overhang and Defect



Crown Margin Beyond Tooth and Over-contoured Restoration.



Crown Margin Extended Beyond the Tooth Margin

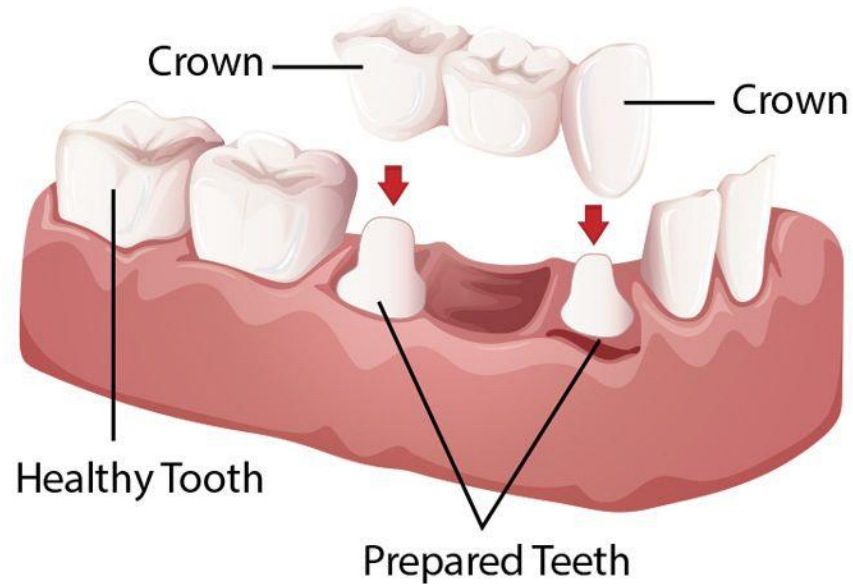
Clinical Recommendations for Scaling around Restorations

- 1) Evaluate Radiographs Prior to Scaling
- 2) Use 11/12 Explorer to determine if irregularity is calculus or irregular restorative margin
- 3) Scalers cannot “smooth out” a restorative overhang. If too much force is used it can cause discomfort to patient, dull instrument or break instrument
- 4) Occasionally cavitation use around margins will cause sensitivity.
 - First lower power settings and see if discomfort improves
 - Hand scale if still sensitive

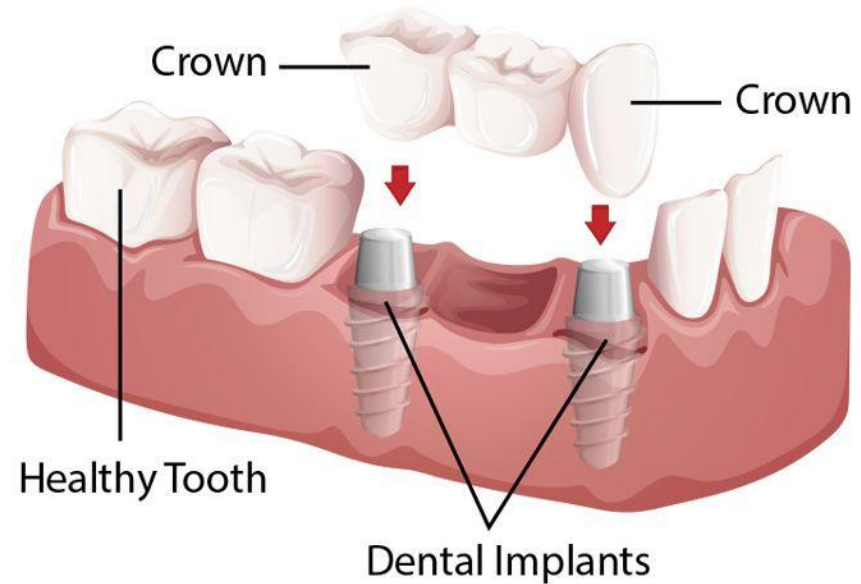
Fixed Partial Denture/Bridge

Fixed Partial Denture (Bridge)

Traditional Bridge



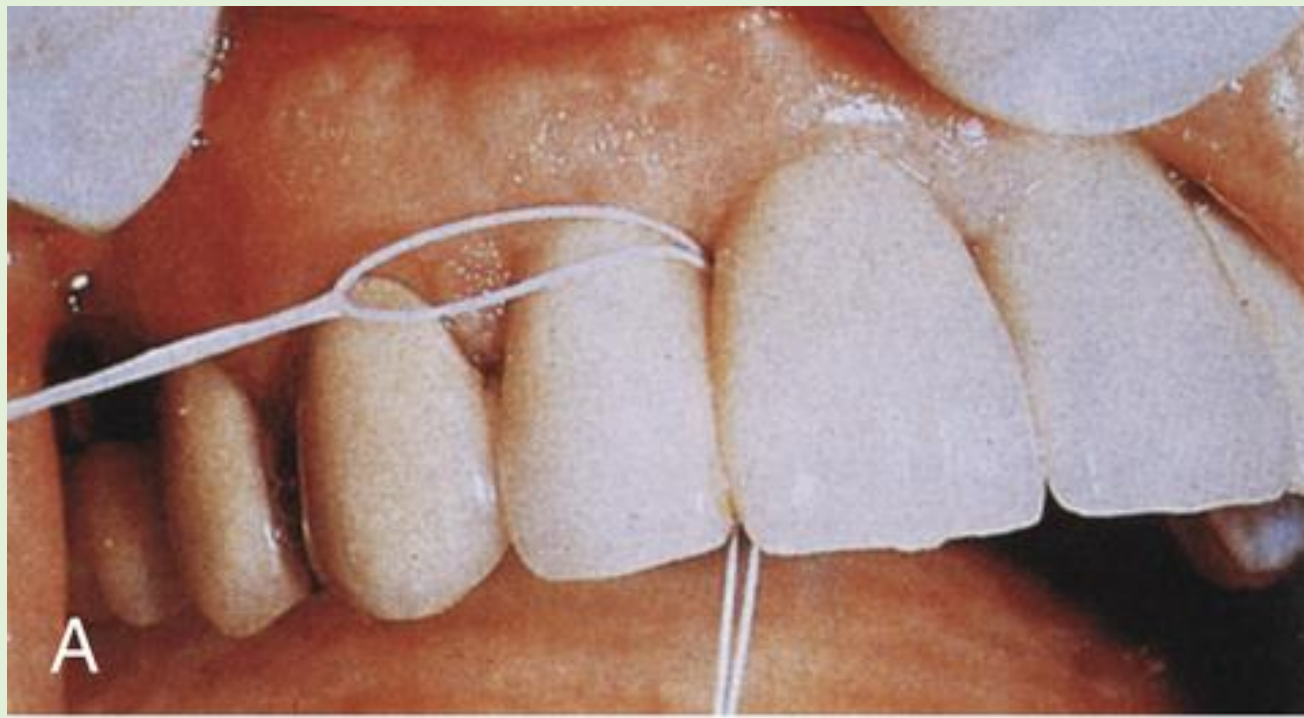
Implant-Supported Bridge



Fixed Partial Denture Oral Hygiene Instruction

- When discussing OHI, review with patient different tools/methods for cleaning under a bridge:
 - Proxy Brush
 - Super Floss
 - Floss Threader with regular Floss
 - Water Pic
- This applies for both a traditional Bridge as well as an implant supported Bridge.

Bridge Hygiene



Waterpik and other aids



THE END