TOOTH COLORED INLAYs
AND ONLAYs - II

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**Posterior Bonded Porcelain Restorations**

Ceramic inlays were introduced in 1913 but did not become popular →

- **Difficulties in fabrication**
- **High failure rate**

**In 1980s**
Development of compatible refractory materials made fabrication easier

Development of abrasive resin cements greatly improved clinical success rates
Advantages

Porcelain is an excellent replacement material for unaesthetic tooth substance for some of the following reasons:

- **Color**: Most porcelain systems use well-established techniques of effectively blending in with the adjacent natural dentition.
**Advantages**

- **Periodontal health:** A porcelain restoration may accumulate less plaque on its surface than will other systems.

- **Resistance to abrasion:** The wear-and-abrasion-resistance of these restorations is high, although they have the potential to create wear in the opposing arch.
Advantages

- **Radio density:** On radiographs, the radio density of porcelain resembles that of normal tooth structure, quite often allowing for radiographic access to areas that were previously shielded by radiopaque restorations.
Advantages

The marginal integrity:
when ceramic restorations are combined with resin bonding and a composite resin luting agent, is excellent with the result that microleakage is decreased to an absolute minimum.
Disadvantages

- The amount of time and attention to detail required when these restorations are fabricated and placed (**technique-sensitivity**) makes them of necessity an expensive alternative to other modalities.

- **Moisture contamination** and placement procedures are all potentially **problematic**.
Disadvantages

- The **strength** of the individual unbonded restoration is relatively nominal, so that the try-in procedures can result in **fracture** of the porcelain.

- The **laboratory fee** for this type of restoration is an added factor when a treatment plan is developed.
### Disadvantages

- The potential **wear** of the teeth in the opposing arch, particularly during Para functional habits, is a contraindication.

A new generation of **low-fusing porcelains**

→ **less wear of enamel**

  e.g.: *Empress 2 pressable ceramics* → **almost no wear**
Disadvantages

- In cast-glass or ceramic restorations with superficical surface stain, occlusal adjustment results in the loss of the surface colorants. This obviously results in a less attractive restoration, when esthetics may well have been the reason the patient sought treatment in the first place.
Indication

- When one cusp of posterior tooth is being covered with an esthetic bonded onlay
- In the restoration of a molar with a short occlusogingival dimension (require 2mm occlusal reduction. No axial reduction)
- All margin should be on enamel
Indication

- Should be amenable to rubber dam placement
- Patient should exhibit *no* sign of a Para functional habits
Contraindications:

1. Bruxism patient

2. Excessive tooth destruction with very little *dentin* remaining
Failure

- **Bulk fracture**
  - Area of cuspal coverage (↓ 2mm thick)
  - At the **isthmus** adjacent to marginal ridges
    (porcelain poorly supported by tooth structure)

- **Marginal breakdown** because resin cement not be heavily filled → **wear** more quickly than the adjacent restorations or tooth structure.
Ceramic Inlay vs. Resin Composite Inlay

- Leak less
- Fit better
- Adhesion of luting resin is more reliable and durable to etched ceramic material

Porcelain inlay is quite fragile subject to fracture during the try-in

Removed proximal contact can be replaced by time-consuming
Porcelain Onlays vs. Resin Composite Onlay

Has **same** disadvantages as porcelain inlay.

It is a cuspal coverage restoration cause **wear of opposing enamel**

But provide **long-term occlusal stability**
Ceramic Materials that can be used for Posterior Inlays and Onlays

1. Conventional ceramics

2. Glass ceramics
   a. *Castable glass ceramic*
   b. *Injection molded glass ceramics*
   c. *CAD-CAM and Copy milled materials*
A. **Conventional Ceramic**

The concept of a ceramic inlay dates back to the end of the last century, when the first restorations of this type were fabricated. The problems inherent with porcelain, such as:

- Material weakness
- Lack of Marginal integrity
- Lack of an adequate cementing medium

Initially made this an unsuccessful restoration.
Conventional Ceramic

Advantage

Ceramic restoration provide:

• Color stability
• Stain resistance
• Marginal integrity (resin bonding and composite resin luting agent)
• Microleakage to absolute minimum
Conventional Ceramic

Disadvantage

- ↑ time
- Tend to fracture during porcelain try-in
- Expensive
- Wear of opposing teeth
- Difficult to adjust
B. Glass Ceramics

1. Castable glass ceramics (Dicor)

2. Injection molded glass ceramic

3. CAD-CAM and copy milled material
1. **Castable Glass Ceramics (Dicor)**

Over the years castable glass-ceramic systems have proved to be a viable alternative ceramic system.

This systems have been used for a variety of different clinical situations as:

- **Core for ceramic crowns**
- **Inlays and onlays**
1. **Castable glass ceramics (Dicor)**

   - The immediate advantage of this type of ceramic process over the conventional is that
     →
   a. It utilizes the conventional **waxing on a die**.
   b. Casting techniques similar to the conventional **lost wax technique** used for cast-metal restorations.

**Indication:**

**For single unit**
Advantages

- The **fit** of cast-glass restorations reportedly supersedes that of conventional porcelain. This decreases the amount of resin luting agent at the margins, in turn **decreasing** the potential for **ditching**.

- The **wear** on the opposing occlusion is predicted to be less than that of conventional porcelains.
Advantages

- The **thermal cycling** properties of cast glass approximate those of enamel.

- **Flexural strengths** is reportedly greater than it is for conventional porcelain.
Disadvantages

- The **colorant** is a surface stain, hence any grinding on the restoration leaves an unaesthetic opaque white area.

- An **additional chairside** visit is necessary to fit and adjust the contacts, anatomic form, and occlusion prior to staining. Once stained, the surface cannot be adjusted without compromising the esthetics.
Disadvantages

- The whole process is **technique-sensitive**, from the casting of the inlays through the staining of the cerammed restorations.
2. Injection molded glass ceramic – pressed-ceramic system (IPS Empress)

A newer material of the all-ceramic type, which is not cast but injection molded, is **IPS Empress**.

- This system uses **high-temperature** pressing of a pre-cerammed glass ceramic with **hydrostatic pressure** in a vacuum unit.
**IPS Empress II**

- Utilizes veneering technique
- The core is a glass ceramic
- Veneer contains fluoroapatite crystals
- Higher volume of crystals
- Stronger than the original IPS Empress
Advantages of Pressed-Ceramic Systems

- The pressed-ceramic system involves relatively *simple* processing procedures that accurately reproduce the waxed pattern.

- The cerammed restorations have a high degree of *stability* during subsequent shading or layering techniques.
Advantages of Pressed-Ceramic Systems

- The precerammed porcelain has a high degree of flexural tensile strength (exceeding 200 MPa).
Advantages of Pressed-Ceramic Systems

- The versatility of the process allows for the development of very *esthetic* restorations ranging from *inlays* and *onlays* to *full crowns* and *laminate veneers*, even in very thin sections of only *1mm*
Advantages of Pressed-Ceramic Systems

- The *lost-wax technique* and *ceramic injection molding* allow for *accurate fit*.

- The preshaded base ingots with two different characterization techniques allow achievement of *excellent harmony* and blending with adjacent teeth.
3- **CAD-CAM Systems**

The introduction of computer-aided design/computer-aided manufacturer (**CAD/CAM**) systems to restorative dentistry represents a major technological breakthrough.
CAD-CAM Systems

New fabrication method in which the restoration is milled out of a piece of ceramic that is pre-manufactured.

- Elimination of laboratory techniques variables
- Improvement in the properties of the ceramic material
- Less porosity
- Extremely expensive
Component of the System

1. Three dimensional video camera
2. Electronic image processor
3. Three access-of rotating-milling machine
4. Computer component and screen of the cerec system
Material

1. Dicor ceramic material
2. Vita porcelain (Vita Mark II)
Advantages of the Cerec System

Ceramic-bonded restorations offer a wide range of advantages over conventional restorative materials.

- Single appointment
- No impression
Advantages of the Cerec System

- Reduced marginal gap
- Wear hardness similar to enamel
- Less fracture of the inlay, because it is milled from a solid, homogeneous block
- Excellent polishing characteristics
- Improved esthetics
- Less reduction to tooth structure, hence better periodontal health
Advantages of the Cerec System

- Bonded restorations enhance tooth strength
- Preparation, fabrication, cementation, and polishing normally accomplished in 1 to 1½ hours
4- Copy Milling Celay

An innovative system, the celay technique is a variation on the direct-indirect restoration concept but without the need for a laboratory technician.

This system duplicate the hard composite resin patterns of the restoration from the improved material mentioned in the CAD-CAM
Advantages of the Celay System

- A precisely **fitting** ceramic restoration can be developed

- **In one patient session.**

- Without the need for a laboratory technician.

- **In factory-fired high-grade porcelain.**
Advantages of the Celay System

- The processing time required is very short. A **small inlay** can be milled in **3 minutes**, a **mesio-occluso-distal inlay** in less than **8 minutes**, and a complete **onlay** in **12 to 13 minutes**.
The preparation should incorporate the following features:

- A **1.5 to 2.0mm** reduction in vertical height of the cusps and all occluding areas
- Preparation finish lines on any supporting cusps that are **hollow-ground chamfers**, generally with **no bevel**
Well-rounded angles on the cuspal preparation, to prevent propagation of porcelain fracture from these sharp stress points.
The specifically developed instrument with a newly designed tip results in the following:

- A **flat** pulpal floor with the calculated divergent axial walls
- A **rounded** line angle between the pulpal and axial wall
Highly retentive axial walls because of the hybrid diamond on the shank, which increases the surface area for bonding and develops mechanical retention.

A well-defined cavosurface margin at the occlusal surface on which the hollow-ground chamfer can be developed Fine-grit round instrument
The most common method of fabrication of porcelain inlays and onlays → **refractory die**

- After a master die is poured in die stone
  1. **Refractory die is made by:**
     - Duplicating the master die or
     - Repouring the impression in refractory material
  2. The porcelain is backed on the refractory die, recovered, and fit to the master die
The newer generation of pressed ceramic is fabricated much differently.

1. The restoration is **waxed on a stone die in the traditional manner and invested in a special investment.**

2. The invested wax pattern is burned out as in the traditional **lost-wax technique.**
3. An ingot of the pressed ceramic material is **heated** and **pressed** into the lost-wax pattern space.

4. After **cooling**, the investment is removed and the ceramic restoration is retrieved and finished in the same manner as a feldspathic porcelain restoration.
Prior to final luting of the porcelain inlays, it is important to follow the four-stage try-in. The restorations need to be evaluated for the following criteria:

- **Marginal integrity**
  The intimate adaptation of all porcelain margins to the prepared tooth surface must be checked.
The Four-Stage Try-In

- **Proximal relations.** The collective fit and relationship of one restoration to the other or the adjacent tooth must be evaluated.
- **Occlusal relations.** The contact relations, with the opposing arch in centric occlusion and lateral excursive movements of the mandible, are best evaluated after inlay placement.
The Four-Stage Try-In

- **Color:** Posterior restorations, their basic shade should blend with the surrounding teeth. The need for individual characterization, such as fissure staining or other such color high-lights, must also be ascertained.
Inlay/Onlay Placement Procedure

The porcelain restoration bonds to the tooth in a series of individual links:

- **At the tooth interface**, etched enamel **micromechanically** bonds with dental bonding agent.

- **At the restoration interface**, etched porcelain is made reactive via a **silane**, which **mechanically and chemically** bonds to an unfilled resin layer.
These two reactive interfaces are joined by an optimized dual-cure hybrid composite resin luting agent.
THANK YOU
Conventional Ceramic

- The recent development of reinforcing systems for porcelain, however, coupled with the ability to etch and bond the porcelain to the underlying etched tooth structure.
Advantages of Pressed-Ceramic Systems

- The precerammed porcelain has a high degree of flexural tensile strength (exceeding 200 MPa).

- This makes the material adequate for most normal restorations, let alone those bonded to the underlying tooth structure.