

All Ceramic Inlays: Coming of Age and a Case Report

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Abstract

In the past decade and a half there has been an explosion in the introduction of restorative materials and techniques for the restoration of posterior teeth. The primary impetus for this explosion has been society's fascination with aesthetics in general, and a concomitant desire to eliminate metallic restorations. **Case report:** - A young male patient reported to the department with complains of food lodgement in distal aspect of mandibular first molars. On examination a composite restoration was seen in relation to 46 (DO) having inadequate contact with adjacent tooth, and a cement filling with 36 (DO) which had been dislodged partially. After a radiographic evaluation and patient's needs were assessed, it was agreed to replace the restorations with all ceramic press able inlays (CERGO press able ceramic). **Conclusion:** - A main indication for the use of ceramic restoration in cases requiring a high level of wear resistance.

Keywords: Ceramic; Inlays; Pressable inlays.

Introduction

In the past decade and a half there has been an explosion in the introduction of restorative materials and techniques for the restoration of posterior teeth. The primary impetus for this explosion has been society's fascination with aesthetics in general, and a concomitant desire to eliminate metallic restorations¹. Esthetics alternatives to the cast gold inlays and amalgam fillings include glass ionomer cements, hybrid ionomers, direct composites, composite inlays and ceramic inlays.

The first attempt to use esthetic inlays was described at the end of nineteenth century. This trend achieved larger acceptance with the introduction of restorative materials bonded to natural teeth substrate. An indirect esthetic adhesive restoration, that is ceramic

inlays have become clinically acceptable restorations for posterior teeth with extended coronal destruction.

In 1988 a survey in USA showed that more than 50% of those individuals questioned with regard to their attitude to tooth colored restorations were not aware that such materials could be used for posterior tooth². Although the appearance of posterior teeth was judged to be either somewhat (51%) or very (37%) important, only a small percentage (17%) indicated that they would have their posterior restorations replaced with resin. When patients who had previously received posterior composite restorations, were surveyed, 75% were satisfied with the result and 96% stated that they would request a tooth colored posterior restoration if required in the future, even though 18% disliked the procedure because of increased time taken³.

The possibilities of innovative uses of esthetic materials are existing and almost unlimited.

Esthetic restorative systems and materials

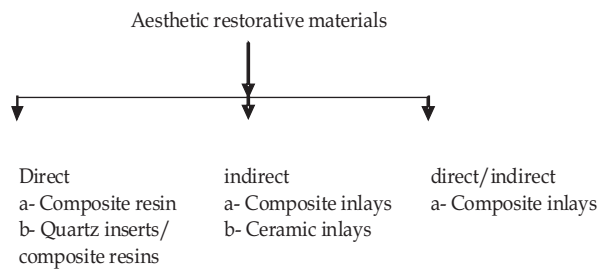
Currently there are several tooth colored restorative systems available for the restoration

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of cavities in the posterior teeth. They are summarized as follows



Direct restorations

A- Composite resins

The introduction of this filled resin material in 1962 became the basis for the restorations that are generally termed composites. Composites are presently most popular tooth colored restorative material, having completely replaced silicate cement and partially silver amalgam. Composites and acid etch technique represent two major advances. Adhesive materials that have stronger bonds to enamel and dentin further simplify restorative technique.

Composites can be indicated to be use on any part of the tooth structure, with considerations towards isolation, occlusion and operative factors. The primary contraindications for use of composites as restorative material relate to the same three factors. If operating site cannot be isolated from contamination by oral fluids, composites should not be used. If all of the occlusal points will be on the restoration, composites may again not be the material of choice. If the operator is not confident of the manner of use of composites, it again is a contraindication.

B- Quartz inserts / composite resin

In theory, the properties of the inserts are close to the tooth than that of composite. Using this knowledge, first considered in the mid 1980, beta quartz inserts made of lithium aluminosilicate glass combined with modified oxides and treated with silane coupling agent, which are placed within composite restorations.

Advantages of such inserts include

- a) Reduction in polymerization shrinkage
- b) Increased dimensional stability
- c) Chemical and mechanical bonding to composite resin

Disadvantages include cost of material and time consumed.

Indirect placement restorations

In an attempt to overcome some of the problems associated with direct placement posterior composite techniques, in particular polymerization shrinkage and control of anatomic form, esthetic inlay systems utilizing composite resins or porcelain have been developed and are continuing to be refined.

Indications and contraindication of esthetic inlays include

Indications

1. Esthetics: - indirect tooth colored restorations located in areas of esthetic importance for the patient.
2. Large defects or previous restorations: - large class I and class II defects or replacement of large existing compromised restorations, especially those that are wide faciolingually and require cuspal coverage.
3. Economic factors: - some patients desire best dental treatment available, regardless of the cost. Indirect tooth colored restorations may be indicated, not only for large defects, but also for moderate sized restorations that might otherwise be restored with direct restorative material.

Contraindications

1. *Heavy occlusal forces*: ceramic restorations may fracture when they lack bulk or are subjected to excessive occlusal stress, as in patients who have bruxing or clenching habits.
2. *Inability to maintain dry field*: adhesive techniques for indirect restorations require

near perfect moisture control to ensure successful long term clinical results.

3. *Deep sub gingival preparation*: not an absolute contraindication, but be avoided. These margins are difficult to record with an impression and are difficult to finish⁴.

Types of esthetic inlays

a) Composite inlays

The physical properties of composite restorations are improved when the composite is free of voids, and the resin matrix is maximally polymerized. Generating dense, well cured restorations is best accomplished in the dental laboratory using devices that polymerise the composite under pressure, vacuum, inert gas, intense light, heat and combination of these conditions.

b) Ceramic inlays

Ceramic inlays have become popular not only because of patients demand for esthetics, durable restorative materials, but also because of recent improvements in the materials, fabrication techniques, and bonding systems.

Among the ceramic materials used are

i) Feldspathic porcelain inlays

Dental porcelains are partially crystalline minerals (feldspar, silica, alumina) dispersed in a glass matrix⁵. Porcelain restorations are made from finely ground ceramic powders that are mixed with distilled water or a special liquid, shaped into a desired form, then fired and fused together to form a translucent material that looks like tooth structure.

ii) Hot pressed glass ceramics

In 1968, it was discovered that certain glasses could be modified with nucleating agents and upon heat treatment, be changed into ceramics with organized crystalline forms. Such "glass ceramics" were stronger, had a higher melting point than non crystalline glass, and had variable coefficient of thermal expansion.

iii) Machinable or CAD CAM

Rapid improvements in technology, have spurned several computerized devices that can fabricate ceramic inlays and onlays from high quality ceramics in matter of minutes. Some CAD CAM systems are very expensive laboratory based units requiring the submission of impression or working cast of a prepared tooth. The CEREC system was the first commercially available CAD CAM system developed for the rapid chair side design and fabrication of ceramic restorations.

Results

A young male patient reported to the department with complains of food lodgment in distal aspect of mandibular first molars. On examination a composite restoration was seen in relation to 46 (DO) having inadequate contact with adjacent tooth, and a cement filling with 36 (DO) which had been dislodged partially. (Fig 1)

After a radiographic evaluation and patient's needs were assessed, it was agreed to replace the restorations with all ceramic pressable inlays (CERGO pressable ceramic). (Fig 2 & Fig 3)

Tooth preparation was done keeping in mind the depth and restorations to be replaced were completely removed. (Fig 4)

After the impression and cast preparation, die cutting and scoring was done to adequately adapt the wax pattern to the margins.

Then the patterns were sprued and investment was poured. (Fig 5 & Fig 6)

Multimat touch and press systems accomplished the further procedure to process the ceramic inlays. (Fig 7)

Cast ceramic were then cleared of the investment with air abrasion.

Sprues were cut and the inlays trial fitted onto the cast and after necessary correction stains and gloss was fired on the occlusal surface.

After the trial seating, fit and contact point were evaluated and finally the cementation of the inlays was done with Rely X U 100 self adhesive universal resin cement, the

advantage of which excludes the primary steps of etching and use of primer and/or bonding as pretreatment of tooth substrate. (Fig 8 & Fig 9)

Fig 1: Pre op photograph of 36 and 46



Fig 2: Radiograph showing defects in distal region of 36

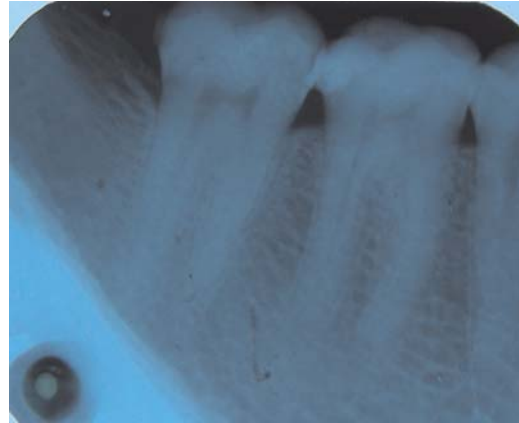


Fig 3: Radiograph showing defects in distal region of 46



Fig 4: Tooth preparation with 36 (DO) and 46 (DO)



Fig 5: Die preparation



Fig 6: Wax pattern

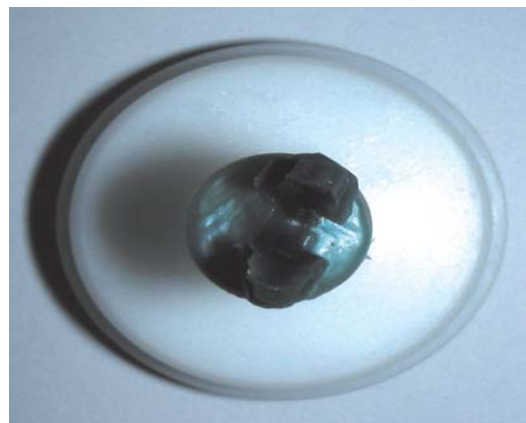


Fig 7: Multimat 2 touch + press (Dentsply)

Discussion

Marginal integrity is one of the most important criterions when restoration success is evaluated. Ceramic inlays superior marginal integrity is confirmed in an in vitro study by Mehl A in 1996. Because adhesive inlays are inserted into cavities with a resin cement, the luting gap is always susceptible to increased wear as mechanical properties of the resin cement is inferior compared with highly wear resistant ceramic inlays.

Loss of marginal integrity can be caused at baseline polymerization shrinkage or removing of cement flashes with blunt instruments. Premolars usually offer more favorable conditions for adhesive inlays than molars. Cavities are usually smaller, the effect of chewing forces is less intense, and access for the dental treatment is easier. Dental treatment also plays an important role, because the adhesive insertion technique is sensitive to the handling of materials and the dentist's

Fig 8: Inlay cementation with 46**Fig 9: Inlay cementation with 36**

technique⁶. Hence taking all this into consideration, the least technique sensitive with accepted bond strength luting cement was selected (Rely X U 100 self adhesive universal resin cement). Etching and use of primer and/or bonding as pretreatment of tooth substrate are not necessary.

Only a few systems have been successful for the restoration of molars, and additional factors such as adequate preparation depth and cementation can outweigh material considerations.

It has been proven that ceramic inlays have 94% survival probability after 57 months of clinical service⁷.

Conclusion

With the ceramic and composite material showing diverse physical properties, many

aspects of their associated techniques show common features, for example, cavity preparation, indication for use and luting procedure. However, a main indication for the use of ceramic restoration in cases requiring a high level of wear resistance. While composite inlays are generally considered to be more user friendly and thereby less costlier than ceramic inlays.

Nevertheless, it may be anticipated that future trends will show increasing demand for techniques, such as esthetic inlays, alongside the refinement of new techniques such as those provided by computer aided design and manufacture.

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