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Ceramic Inlay - A New Boon for Restorative Dentistry: Case Reports

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Abstract

Increasing interest in tooth-colored non-metallic posterior restorations has stimulated the development of new materials. This escalating demand has been attributed to an increasing interest in esthetic dentistry and the growing concern over the use of metallic alloys. This has urged for the search of newer tooth coloured restorative materials that provide good aesthetics, marginal adaptation and durable restoration that can harbour a large diameter cavity with compromised marginal ridge and wide diameter isthmus better than composite adhesive restorations. All ceramics with high strength are better alternative to composite, amalgam and gold for posterior tooth restoration. Bonded ceramic inlays can eliminate the need for conventional means of retention and allow the restoration of lost tooth structure. Ceramics have excellent biocompatibility, inertness, improved physical bonding, and natural appearance. Hence, these case reports describe the reconstruction of carious posterior teeth with porcelain ceramic inlays fabricated through CAD/CAM (computer aided design/computer-assisted manufacturing) systems.

Keywords: All Ceramic, Inlay, Feldspathic Porcelain

Introduction:

In recent years dentists have learned that the metal fillings in the mouth act much like metal does outside the mouth. The demand for tooth-colored restorations has grown considerably during the last decade.1 New materials wedded to precise techniques have emerged to blur the interface between biologic and artificial structures.2 The most commonly used restorative materials are silver amalgam fillings, gold alloy, glass ionomer cements, composite resins, ceramics, etc. Mercury toxicity has become a compelling rationale for replacing amalgam restorations with tooth-colored materials. In contrast to

amalgam restorations, composite resin restorations are currently being used in 50% of all anterior/posterior direct/indirect restorations. Ceramic restorations have demystified the concept of indirect tooth colored restorations. Ceramics have become popular in recent years, due to aesthetics, biocompatibility, high wear resistance, etc. Ceramic inlays are an esthetic substitute for large amalgam and other metallic restorations through indirect means.

Indirect restorations are one of the most rapidly growing treatment modality for teeth requiring esthetic restorations. Teeth can be restored using indirect techniques, in which restorations are fabricated outside the mouth. Most indirect restorations are made on a replica of the prepared tooth in a dental laboratory by a trained technician.3 several systems and techniques are available today for tooth-colored inlays using both resin composite and all-ceramic materials.4

All ceramic based inlays provide aesthetics and durability as restoration. It maintains a better anatomic forms, exhibits a better marginal integrity, and colour stability in oral cavity. All Ceramic-based inlays also reinforce the remaining dental hard tissue as they bond to the tooth with adhesive cement.5 All ceramic material with high strength is a better alternative to composite, amalgam and gold.6

The adhesive ceramic category includes both fine-grained feldspathic porcelain and leucite-reinforced porcelain. These materials contain a significant glass component resulting in increased translucency allowing them to have an improved “chameleon” effect. The chameleon effect may be described as the ability to reflect the color of the surrounding tooth structure and thus blend into the existing tooth shade. These materials have a moderate flexural strength on the order of 125 to 175 megapascals (MPa). The glass component of these materials allows them to be etched with hydrofluoric acid for micromechanical adhesive bonding.7 Significant developments in all-ceramic materials have created wonderful opportunities for the fabrication of lifelike restorations that provide reliable, long-term results.

Case Report 1

A 23-year old male patient reported to the Department of Conservative Dentistry and Endodontics with the chief complaint of food lodgement in right upper back teeth region since 2 months. The medical history of the patient was non-contributory. On clinical examination, a carious lesion was present on the disto-occlusal aspect of 15 and mesio-occlusal aspect of 16. (Fig.no.1:A) . The teeth were asymptomatic and no pain could be elicited. Both the teeth (i.e. 15 and 16) responded positively to the thermal and electric pulp testing. The involved teeth showed no signs of mobility. His radiographic examination revealed the presence of a carious lesion involving enamel and dentin only but not involving the pulp with no signs of periapical involvement (Fig.no.1:B) . Patient was interested in aesthetical durable restoration; it was decided to give all ceramic inlays as restoration

Clinical Procedure 1

Cavity preparation was done with the principle of cavity preparation for both #15 and #16. The affected dentin in case of tooth #16 was not removed and left untouched (Fig.no.1:C). After the cavity preparation impressions were made using both light body and heavy body putty material using the two step technique and send to laboratory, where feldspathic porcelain inlay was prepared. In laboratory –Image was scanned from the cast and dye cut was prepared by firing dental porcelains on refractory dies. After the inlays were received from the laboratory (Fig.no.1:D), both tooth surface and internal surface of inlay were prepared for bonding.

For a durable adhesive interface, optimal dry field conditions are required. A clean surface and careful

execution of the bonding procedure according to the manufacturer's instructions are also prerequisites for success. Therefore, the inlays were etched with 5% hydrofluoric acid (IPS Ceramic etching gel, Ivoclar Vivadent) and silanated with Relyx ceramic primer (3M ESPE USA) and cemented with RelyXTMU100 self-adhesive Universal Resin Cement. (3M ESPE USA).

After the removal of interim restorative material, the preparation surfaces of the tooth were cleaned. The total-etching technique was used to condition the tooth surfaces with 37% phosphoric acid gel (Ivoclar Vivadent) for 30 seconds per manufacturer's instructions. One Coat Bond SL (Coltene) was used as a bonding agent. After the bonding agent was air thinned, the cementation was performed immediately (Fig.1:E)with resin cement (RelyXTMU100 self-adhesive Universal Resin Cement). Excess cement was removed with a dental probe and dental floss. Light polymerization was performed for 40 seconds from each side. The occlusion and the articulation were checked carefully after the inlay was luted and a post cementation radiograph was obtained (Fig.1:F).

Case Report 2

A 31-year old male patient reported to the Department of Conservative Dentistry and Endodontics with the chief complaint of blackish discoloration in the lower left back tooth region since the past 3-4 months. Patient was asymptomatic 4 months back until when he started noticing the blackish discoloration in a specific tooth in the lower left back tooth region. He gave no history of pain in the same tooth. The medical history of the patient was noncontributory. On clinical examination, a carious lesion was present on the distobuccal cusp of tooth #36 along with a deep carious buccal pit on the same tooth (Fig.2:A). The tooth was asymptomatic and no pain could be elicited. The tooth responded positively to the thermal and electric pulp testing. The involved tooth showed no signs of mobility. His radiographic examination revealed the presence of a carious lesion involving enamel and dentin only but not involving the pulp with no signs of periapical involvement (Fig.2:B).

Clinical Procedure 2

Cavity preparation was done with the principle of cavity preparation for tooth #36. The affected GIC was used as a base material to block the undercuts (Fig.2:C) and a peri-operative radiograph was obtained for the same procedure to check for the proximity of the base restoration to the pulp. After inspecting all the margins of the prepared cavity, an impression was made using both light body and heavy body putty material using the two step technique and send to laboratory, where feldspathic porcelain inlay was prepared (Fig.2:D).

Similar lab procedures and luting procedures were followed as elaborated in Case report 1.

Case Report 3

A 36-year old male patient reported to the Department of Conservative Dentistry and Endodontics with the chief complaint of dislodged restoration in the upper left back tooth region since the past 6-7 months. He gave no history of pain in the same tooth. The medical history of the patient was noncontributory. On clinical examination, a carious lesion was present on the distopalatal cusp of tooth #26 (Fig.3:A). The tooth was asymptomatic and no pain could be elicited. The tooth responded positively to the thermal and electric pulp testing. The involved tooth showed no signs of mobility. His radiographic examination revealed the presence of a carious lesion involving enamel and dentin only but not involving the pulp with no signs of periapical involvement (Fig.3:B).

Clinical Procedure 3

Cavity preparation was done with the principle of cavity preparation for tooth #36. The affected dentin in case of tooth #26 was not removed from the axial wall and left

untouched. After the cavity preparation, GIC was used as a base material at the axial wall site (Fig.3:C). After inspecting all the margins of the prepared cavity, an impression was made using both light body and heavy body putty material using the two step technique and send to laboratory, where feldspathic porcelain inlay was prepared (Fig.3:D).

Similar lab procedures and luting procedures were followed as elaborated in Case report 1.

Discussion

As the aesthetic aspect of dental care becomes important to patients, aesthetics is playing an increasingly important role in their choice for dental restorations. There are various options of aesthetic restoration for anterior teeth but aesthetic restoration for posterior teeth is challenges for dental practitioner.8 Various aesthetic materials for posterior teeth include direct composite restoration, indirect composite restoration, metal ceramic restoration, all ceramic restoration. Direct composite is generally used for small to medium size preparation and can be placed in one appointment but there are certain reasons like difficulty in placement, improper marginal adaptation, difficulty in finishing & in developing contour and contacts, chances of voids which leads to weakening of the restoration, chances for microleakage and post-operative sensitivity. So it becomes difficult to use in day to day practice. Indirect composite restorations provide good color match, easy to finish, intra oral repair is possible but there are chances of poor marginal fit, marginal failure, require laboratory support, technique sensitive, adhesion to tooth may be weak. Metal ceramic restorations for small to medium size carious lesion in posterior teeth are difficult to fabricate and do not provide good aesthetics. Metal ceramic is generally used for full coverage restoration. All ceramic material with high strength provide good restorative alternative to moderate to large size carious lesion. Cavity preparation is also simple for example the line angles and point angles are rounded, floor and gingival sheet area is smooth and flat, cavo-surface angle is 90 degree, walls are diverging, isthmus is wide, if any undercuts are present can be blocked with glass-ionomer cement, 0.5mm clearance from adjacent teeth and all cavity walls should have the same path to draw.6

In the present cases, laboratory ceramic inlay/onlay were made of feldpathic porcelain. Porcelain restorations are made from finely ground ceramic powders that are mixed with distilled water or a special liquid, shaped into the desired form, and then fired and fused together to form a translucent material that looks like tooth structure.

In the above cases after removing the old restoration and secondary decay we proceeded with indirect pulp capping with light cure GIC since the cavities were deep. After 1 week of temporary restoration when patient reported asymptomatic we proceeded with completion of inlay/onlay preparation in respective cases. This was followed by rubber base impression and shade selection was done. Cast was fabricated and send to the laboratory for indirect ceramic inlay fabrication. After receiving the ceramic inlay from the laboratory, try-in followed by cementation was done. Occlusion was also checked. In all the discussed cases, the patients were satisfied with the restoration.

Therefore, it can be inferred from the above case reports that ceramic inlay is a better alternative as esthetic restoration compared to direct and indirect composite resin restoration for medium to large size carious lesion. In large carious lesion or in replacement of failed restoration cavity preparations significantly weaken the remaining tooth structure. However, acid etching and adhesive technique do reinforce dental tooth structures in a manner that stiffness values of restored teeth become

equivalent to the values of sound teeth.9 The use of indirect ceramic partial coverage restorations provides a predictable restoration which is capable of restoring form, is conservative of structurally important dentine and will preserve the remaining tooth structure whilst satisfying patients' aesthetic requirements.10 However, there are certain limitations of ceramic inlay restoration like it requires multiple appointments, good laboratory support, difficult to repair and somewhat expensive as compared to other cheaper options available in the dental market.6

Conclusion

Advances in ceramic, polymer, and adhesive technologies have resulted in the development of a variety of tooth-colored indirect restorations. Ceramics offer an aesthetic long-lasting alternative with a predictable degree of clinical success. These restorations offer an excellent alternative to direct composite restorations, especially for large restorations, and are more conservative than full-coverage restorations. The physical properties of ceramics have improved dramatically in recent years, with improvements in CAD/CAM technologies. Because the clinical procedures are relatively technique-sensitive, however, proper case selection operator skill, and attention to detail are crucial to success.

Legends Figures

Case 1

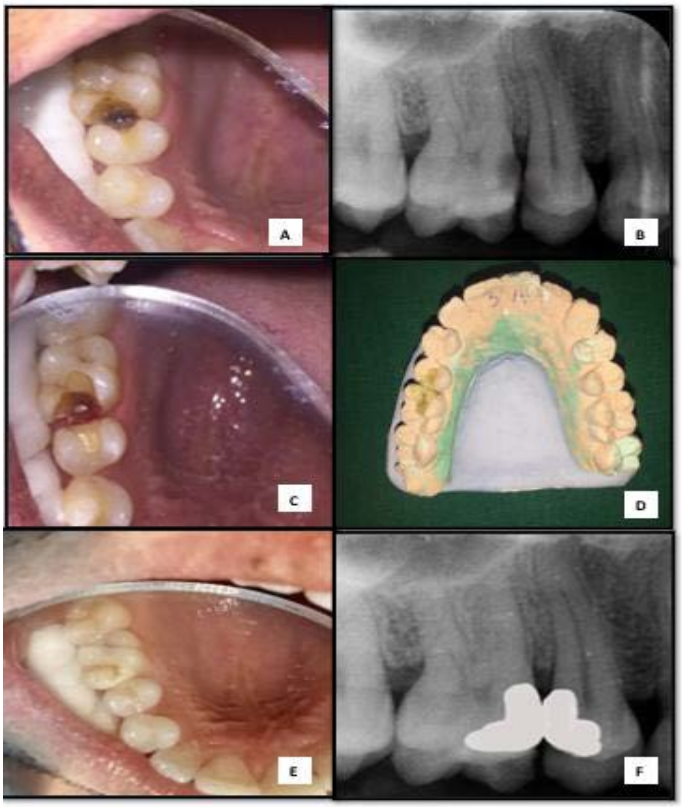

Figure 1: (Case 1)

A: Pre-Operative Picture of Tooth #15 And #16.

B: Pre-Operative Radiograph.

C: Cavity Preparation.

D: Inlay Obtained From the Lab.

E: Inlay Cemented On the Teeth.

F: Post -Cementation Radiograph.

Case 2

Figure 2: (Case 2)

A: Pre-Operative Picture of Tooth #36.

B: Pre-Operative Radiograph.

C: Cavity Preparation with GIC Base.

D: Inlay Obtained From the Lab.

E: Inlay Cemented On the Tooth.

F: Post -Cementation Radiograph.

Case 3

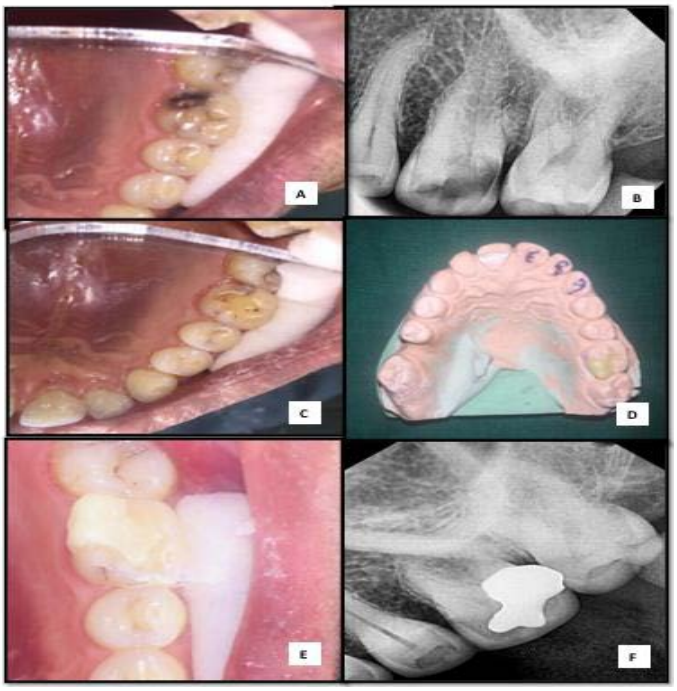

Figure 3: (Case 3)

A: Pre-Operative Picture of Tooth #26.

B: Pre-Operative Radiograph.

C: Cavity Preparation.

D: Inlay Obtained From The Lab.

E: Inlay Cemented on The Tooth.

F: Post -Cementation Radiograph.

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