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RESEARCH ARTICLE

ENDOCROWN BRIDGE: A UNIQUE DENTAL PROSTHESIS. A CASE REPORT

***Vandana Gade, Aparajita Gangrade, Jaykumar Gade, Sanjay Patil and Priyatama Meshram**

Swargiya Dadasaheb Kalmegh Smruti Dental College and Hospital, Wanadongari - Wadhamna road, Hingna, Dist Nagpur – 441110

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ABSTRACT

Objective: Endocrown restorations are single unit prostheses fabricated from reinforced ceramics. These restorations are indicated for endodontically treated teeth, molars especially, that have significant loss of coronal structure. Endocrowns gain their retention from the coronal portion integrated into the apical projection that fills the pulp chamber space, and possibly the root canal entrances.

Clinical Consideration: In this case report a new style Fixed Partial Denture is introduced. Here mandibular second molar had compromised tooth structure and hence Endocrown was planned with the tooth. For replacement of missing first molar a three unit fixed partial prosthesis was planned. This unique three unit prosthesis had Endocrown on mandibular second molar and a full veneer crown on mandibular second premolar as an abutment fabricated in Zirconia with CAD-CAM technology.

Conclusion: This innovative design of Fixed Partial Denture is better suited in cases where there is compromised tooth structure and the tooth is strategically important and has to be retained.

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INTRODUCTION

Endodontically treated teeth (ETT) are different from vital teeth both structurally and physically. Major changes that occur in ETT include, loss of tooth structure either due to caries or trauma and then biomechanical alterations. Hence they are more prone to fracture (Gislaine Rosa Biacchi *et al.,* 2013; Giovanni Tommaso Rocca *et al.,* 2013). Post endodontic restoration should preserve and protect the existing tooth structure. It should also provide adequate coronal seal and aesthetics (Gislaine Rosa Biacchi *et al.,* 2013; Giovanni Tommaso Rocca *et al.,* 2013; Roopak Bose Carlos *et al.,* 2013). Traditionally, for ETT with extensive coronal loss of tooth structure, fabrication of total crowns supported on dowels cores (metal/fiber) was done (Gislaine Rosa Biacchi *et al.,* 2013). In the current era, restoration of ETT is rather based on the principles of the minimally invasive dentistry. These principles attempt to conserve sound tooth structure and pericervical dentine (Giovanni Tommaso Rocca *et al.,* 2013). To mechanically stabilize the tooth-restoration interface and increase surface for adhesion minimal intervention can be helpful (Roopak Bose Carlos *et al.,* 2013). Minimally invasive conservative dentistry is accomplished by using adhesive techniques because adhesion assures sufficient material retention without the need of aggressive macro retentive techniques (Giovanni Tommaso Rocca *et al.,* 2013). Endocrowns are considered as a better alternative to full crowns for restoration of nonvital posterior teeth. They are especially indicated inthose with minimal crown height but sufficient tooth structure available for stable and durable adhesive cementation (Roopak Bose Carlos *et al.,* 2013). This article introduces a new style fixed partial denture with Endocrown as an abutment. As per the knowledge of the author, no clinical report has yet been published addressing rehabilitation of missing tooth and adjacent severe coronally damaged tooth requiring endodontic intervention, using a fixed partial denture with Endocrown as an abutment.

Corresponding author:* **Vandana Gade,
Swargiya Dadasaheb Kalmegh Smruti Dental College and Hospital, Wanadongari - Wadhamna road, Hingna, Dist Nagpur – 441110.

CASE REPORT

A 28 year old male patient reported to the Department of Conservative Dentistry and Endodontics with a chief complaint of food lodgement in lower left back region of jaw. His past dental history showed extraction with the first molar on lower left side 3 years back. On clinical examination, lower left first molar was missing. Lower left second molar was grossly carious with carious pulpal involvement and it was tender on vertical percussion. Radiographic examination revealed PDL widening and no periapical rarefaction suggestive of apical periodontitis. Endodontic therapy was initiated with lower left second molar. With completion of biomechanical preparation, intracanal calcium hydroxide dressing was placed and patient was recalled after 7 days.

Fig 1. Preoperative clinical photograph

Fig. 2. Tooth preparation done to receive Endocrown with lower left second molar

Fig 3 : Occlusal clearance after tooth preparation for Endocrown is checked

Fig. 4. Tooth preparation done for full cermaicveneer with lower left second premolar and Endocrown with lower left second molar

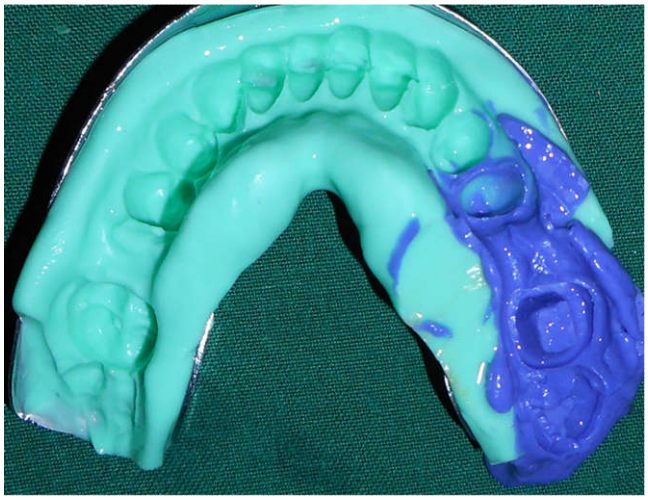

Fig. 5. Elastomeric impression

Fig. 6. Fabricated Endocrown Bridge

Fig. 7. Final Prosthesis (Occlusal View)

Fig. 8. Final Prosthesis (Buccal View)

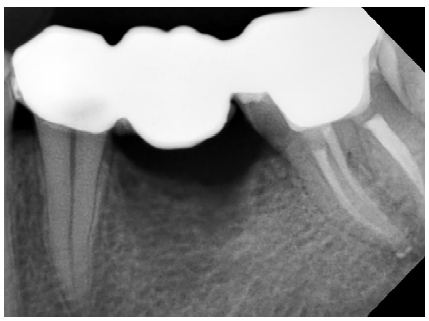

Fig. 9. Post cementation radiograph

Endodontic therapy was completed in second sitting. After complete endodontic therapy, options for post endodontic restorations and restoration of missing tooth were discussed with the patient. Due to patient's urgent need for prosthesis, a new style of Fixed Partial Denture (FPD) involving lower left second premolar, first and second molar was proposed, which would consist of Endocrown restoration as an abutment on lower left second molar. After patient's consent for the new technique of FPD, a three unit bridge was planned involving lower left second premolar, lower left first and second molar with lower left second premolar as full veneer crown, lower left second molar as Endocrown. The preparation for Endocrown with lower left second molar was adapted from the technique recommended by Bindl *et al.,* 1999 A WR-13diamond point (125 µm grain size diamond-coated, MANI DIA-BURS, Mani Inc. Japan) was used for preparation of the circular cervical butt margin with width of 1.0 to 1.2 mm. The preparation was finished using EX-18F diamond point (63 µm grain size diamond-coated, MANI DIA-BURS, Mani Inc. Japan). The depth of the central retention inlay cavity

depended upon the remaining coronal tooth structure. The inlay cavity wall angles were 90° ± 4° according to the preparation rules as defined by Mörmann and Brandestini. In this case, the depth of the central retention cavity was 3.5 - 4 mm. Orifices of the root canals were sealed with flowable resin composite (Tetric Flow, Ivoclar Vivadent, Liechtenstein, Schaan, Germany). The lateral retention areas of undercuts of the pulp chamber walls were filled with composite (Tetric Flow, Ivoclar Vivadent, Liechtenstein, Schaan, Germany). Tooth preparation with lower left second premolar wasdone to receive a full ceramic crown was adapted from H. Shillingberg (Shillingburg *et al.,* 1997). Occlusal reduction was done with RS-21 diamond point (125 µm grain size diamond-coated, MANI DIA-BURS, Mani Inc. Japan). Overall reduction of 1.5 mm was performed. On the functional cusp 2 mm reduction was done. An overall shoulder preparation was achieved by SF-12 diamond point (125 µm grain size diamond-coated, MANI DIA-BURS, Mani Inc. Japan). Tooth preparation was done meticulously, keeping a single path of insertion for FPD. Elastomeric impression was madeusing light and heavy consistency (Aquasil, Dentsply, Tulsa, USA). A simultaneous moulding technique was used to make the impression. The impression of the antagonist arch was taken with heavy consistency (Aquasil, Dentsply, Tulsa, USA). Provisional restoration was done. The casts were poured and sent to the laboratory. The "Endocrown Bridge" was fabricated from zirconiain shade A3. In the next sitting, the provisional restoration was removed, and the pulp cavity and cavity margins were cleaned with pumice-water slurry. The Endocrown Bridge was tried-in, and small proximal adjustments were made. After proper reduction of highpoints cementation was carried out as follows:

The internal surface of the bridge was sandblasted for 30 seconds for each tooth followed by treatment with 10%hydrofluoric acid (Ultradent Products, Inc. South Jordan, USA) on the internal surface for 20 seconds, washing with water/air for 30 seconds, application of Monobond Plus (silane agent, Multilink, Ivoclar Vivadent, Liechtenstein, Schaan, Germany) for 1 minute. The tooth was etched with 37% phosphoric acid (Multilink, Ivoclar Vivadent, Liechtenstein, Schaan, Germany) for 15 seconds. Afterwards, the tooth was washed with abundant water and allowed to dry for 20 seconds, keeping the dentin moist. Primer A and B were mixed and applied. Dual cure resin cement (Multilink Automix, Ivoclar Vivadent) was mixed and was applied on the internal surface of Endocrown Bridge and tooth surface. Endocrown Bridge was placed in position and pressed. Excess cement was removed using explorer and floss, and light activation was performed for 60 seconds on the lingual, buccal and occlusal faces (Gislaine Rosa Biacchi *et al.,* 2013).

DISCUSSION

The choice of the therapeutic options for restoring a devitalized tooth are based on various factors. Factors such as the geometry of the access cavity, the tooth localization in the mouth, as well as aesthetics are essential in establishing objective and simple guidelines. Other factors like the presence of parafunction in the occlusal scheme, the age of the tooth, its endodontic/periodontal prognosis and the financial aspects are also important factors but should be considered secondarily (Giovanni Tommaso Rocca *et al.,* 2013). The loss of pulpal vitality is accompanied by a slight change in tooth moisture content and it is attributed to a change in free water. According to the biomechanical principles the structural strength of a tooth depends on the integrity of the anatomic form of the tooth, the quantity of the remaining hard tissue and its intrinsic strength. Tooth integrity can be drastically altered by caries, access cavity preparation, canal enlargement and chemo mechanical preparation and presence of pericervical dentine. There is manifold increase in the fracture resistance of tooth by virtue of residual tissue present in the pericervical area (Cohen's Pathways of the Pulp). And hence the remaining coronal tooth structure and functional requirements of the tooth should be pivotal in deciding the treatment modality (Cohen's Pathways of the Pulp; Erika Lander *et al.* 2008; Gaye Sevimli *et al.,* 2015). Teeth with minimal remaining coronal tooth structure are at a higher risk of clinical complications namely: root fracture, coronal-apical leakage, recurrent caries, dislodgement or loss of the core/prosthesis, periodontal injury from biologic width invasion (Cohen's Pathways of the Pulp) Therefore the amount and quality of remaining tooth substrate are far more important for the long-term prognosis of ETT than the properties of the restorative material (Cohen's Pathways of the Pulp). Literature asserts that when most of the coronal tooth structure is missing dowel core restoration represents the least favourable biomechanical situation and such treatment cannot have a satisfactory longevity (Erika Lander, 2008).

Endocrowns appear to be a valuable prosthetic option for posterior ETT with sizable loss of coronal structure (Gislaine Rosa Biacchi *et al.* 2013). When half or more than half of the coronal tooth structure is missing, complete occlusal coverage is achieved conservatively using Endocrown (Cohen's Pathways of the Pulp Cohen's Pathways of the Pulp; Roopak Bose Carlos *et al.,* 2013; Andreas Bindl *et al.,* 1999). The notion of a conservative restoration and reconstruction for posterior ETT is not new. Amalcore, inlays and onlays are grounds to this principle. Amalcore utilizes the retentive large lineation of the root canal orifices and the pulp chamber to proffer a monoblock endowment. Inlays and Onlays promote the opinion of a supragingival finish line. The Endocrown is a conservative and an aesthetic supplement to this perpetuity (Bose Carlos *et al.,* 2013). Pissis was the forerunner of the "Endocrown" technique, describing it as the ''mono-block porcelain technique.'' The nomenclature "Endocrown" was given by Bindle and Mörmann in 1999 to adhesive endodontic crowns. It was characterized as total porcelain crowns fixed to pulpless posterior teeth. Endocrowns are partial crowns made out of ceramic, (lithium disilicate) or composite resin that are bonded by resin cements to the devitalized teeth. They offer a full occlusal coverage and they take advantage of the pulp chamber to increase the available adhesive surface. Fabrication of Endocrown can be done with feldsphatic and glass-ceramic, hybrid composite resin and the newest computer aided design/computer aided manufacturing (CAD/CAM) ceramic and composite resin blocks (Giovanni Tommaso Rocca *et al.,* 2013). Endocrowns are indicated in cases with excessive loss of coronal hard tissue, limited interproximal space and inadequate ferrule for full coverage crown. and for molars with short, obliterated, dilacerated, or fragile roots (Gislaine Rosa Biacchi *et al.,* 2013; Roopak Bose Carlos *et al.,* 2013; Gaye Sevimli *et al.,* 2015; Biacchi, 2012). Endocrowns have several advantages over conventional crowns as there are less number of interfaces in the restorative unit to give a monoblock effect, there is less stress concentration due to homogenized material. The preparation design is conservative as compared to the traditional dowel-core supported crown. There is no involvement of the biological width and there is increased

bonding surface offered by the pulpal chamber (Roopak Bose Carlos *et al.,* 2013). Lithium disilicate is indicated for the use endocrown due to its etchable property. However in the present case Zirconia was used for the fabrication of the new style FPD Endocrown Bridge. It is well-documented that zirconia has higher fracture toughness as compared to lithium disilicate. Primarily because maximal masticatory forces are experienced in the posterior region. The unilateral posterior bite force measured is around 878 N (Leila Perea *et al.,* 2014). Core ceramics and the newer monolithic ceramic systems possess significantly higher strength and elastic moduli. The fracture toughness of Enamel, Dentine and Zirconia are 84,100MPa, 18,600MPa, 200,000MPa respectively (Thompson *et al.,* 2011). Capacity of ceramics to bear loads is determined by their limited strength, low fracture toughness and high Young's Modulus. [16]Significant survival rates of Zirconia-ceramic FPD have been found in the studies done by Grohmann [2015]. In general, highly favourable results were seen with zirconia framework with no or very few fracture rates of a zirconia FPD (Philipp Grohmann *et al.,* 2015). Dynamic loading is the major cause of failures of FPD. Hence in this case, high strength zirconia was used instead of lithium disilicate. The basis for using zirconia as a material of choice is hence validated. The mechanical properties including flexural strength and fracture toughness of the zirconia blocks are surpassing other ceramic materials including lithium disilicate (Thompson *et al.,* 2012). In this article, strengths and weaknesses of Endocrown were weighed and a new abutment style FPD was introduced. Within 18 months of follow-up the patient reported no discomfort and dislodgement. However, to verify the longevity of such treatment alternative, other mechanical tests and further studies need to be performed.

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