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RESEARCH ARTICLE

PROSTHETIC REHABILITATION OF ENDODONTICALLY TREATED TEETH USING ENDOCROWN : A MODERN CONSERVATIVE APPROACH - TWO CASE REPORTS

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Abstract

Endocrowns are a potential alternative for endodontically treated posterior teeth that have been severely damaged. Endocrowns are indirect monoblock restorations that are held in place by the pulp chamber of endodontically treated teeth (ETT). The major goal is to establish a bonded biomimetic repair with minimal root canal invasiveness. When compared to traditional crowns with post and core, the clinical technique including endocrown creation may be deemed less difficult, more practical, and easier to accomplish. With a 6-month follow-up period, this article covers two case reports of endodontically treated teeth successfully managed by PFM based Endocrown.

Introduction:-

A tooth that requires root canal treatment often exhibits extensive loss of tooth structure because of caries, tooth surface loss, or iatrogenic reasons. The failure rate of 28.6%–35.9% in endodontically treated teeth (ETT) with three intact tooth walls has been widely reported [1]. ETT requires cuspal coverage, particularly for the posterior tooth, which is subjected to strong masticatory stress [2].For all clinical practitioners, replacing the crown in a substantially disfigured endodontically treated tooth is a difficult undertaking [3].The philosophy of minimally invasive dentistry is adhered to with the development of endocrown, which preserves the maximal coronal tooth structure [4].Pissis was the first to introduce the heatpressed ceramic Monoblock technology in 1995, which took advantage of the pulp chamber to improve the crown's macromechanical retention [5]. Bindl and Mörmann expanded on Pissis' proposal in 1999, coining the term "endocrown" to describe a CAD/CAM all-ceramic crown that is macromechanically anchored to the internal portion of the pulp chamber and adhesively cemented to the remaining tooth structure to achieve micromechanical retention [6].

Endocrown-type restorations are defined as a monolithic (one-piece) ceramic-bonded construction with a supracervical butt junction that keeps as much enamel as possible to increase adhesion [3]. Initially, alumina or spinell reinforced non-silica-based ceramics and silica-based feldspar ceramics [6] were used to fabricate an endocrown, with either a heat-pressed process or subsequently CAD/CAM technology. Later, glass ceramics became the preferred material because they allow for surface modification, such as using hydrofluoric acid or air abrasion, which improves their adhesion to the tooth tissues.

CASE 1

A 23-year-old male reported to our department with a chief complaint of decayed teeth in relation to both lower right and left back tooth region. Patient's medical history was noncontributory. Clinical examination revealed

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grossly decayed lower right first molar (46) and deep occlusal caries on lower left first molar (36) with extensive destruction of 50% of tooth structure. However, the patient was asymptomatic and an Intraoral Periapical (IOPA) Radiograph in relation to 36 revealed a radiolucency involving the pulp with periapical rarefaction(Figure 1 A) . Prognosis for tooth number 46 was very poor and hence was advised for extraction. The patient was informed about the treatment procedure, success rate and scope of saving the tooth(36). Conventional endodontic therapy was initiated after obtaining patient's informed consent. The canals were enlarged till F1 in the mesio buccal and mesio lingual canals and F2 on the distal canal. Canals were irrigated with 2% sodium hypochloride followedby placement of calcium hydroxide as intracanal medicament on the first visit. On the second visit IOPAR showed slight reduction in the periapical rarefarction so completion of the endodontic procedure was done with obturation. Due to the economic status of the patient various post-endodontic treatment options were considered and proposed according to the patient's request for minimal treatment cost. Due to the presence of only half the residual tooth structure, a conservative postendodontic management with an Endocrown was suggested and the treatment was executed following the patient's informed consent.

Clinical Procedure For Tooth Preparation For Pfm Based Endo Crown

The tooth preparation was done according to the technique recommended by Bindl and Mörmann[6]. The cervical margins were leveled in the shape of a chamfer with a diamond bur Sf-21 (Dia-Burs, Mani) at high speed and under constant cooling system throughout the procedure ensuring that a uniform thickness of 2 mm was maintained with the remaining coronal tooth structure. The bur was oriented along the long axis of the tooth and maximum efforts were attempted to maintain an occlusal convergence of 7 to 10° to ensure a continuous flow of the prepared coronal pulp chamber and the access cavity. Following opening of the root canal, the gutta-percha was removed up to 2 mm below the level of each orifice, followed by complete sealing of the coronal orifices and the pulp chamber (2 mm thick) with glass ionomer (Type II) restorative cement (GC corporation Tokyo, Japan). The chamfered walls and margins were then smoothed with a finishing bur TR21EF. Retentive grooves (1 mm deep) were placed on the buccal and lingual axial surfaces of the external aspect of the tooth, so as to aid in mechanical retention and stability of the endocrown. Gingival retraction cord 00 (Ultracord, Dent One Inc, USA) was applied along the gingival crevice and an impression was made with poly (vinyl siloxane) material (Aquasil LV, Dentsply DeTrey, Germany) using a putty wash technique and shade selection was done and the impressions were sent to the laboratory for further processing. On the next appointment after checking for the fit and highpoints, sandblasting of the fabricated PFM endocrown was done to enhance the retention of this conservative single piece restoration followed by luting of the final finished PFM based endocrown with glass ionomer cement (GIC Type II, GC corporation Tokyo, Japan) under proper isolation. Post cementation instruction were given and patient was recalled for a revisit after 6 months.

CASE 2

A 25-year-old female reported to our department with a chief complaint of incomplete root canal treatment. Patient gave a history of initiation of root canal treatment one year back in a private clinic and her medical history was noncontributory. Clinical examination revealed temporary restoration in relation to the lower left second molar (37). However, the patient was asymptomatic and an IOPA radiograph in relation to 37 revealed radio opacity involving the pulp chamber with evidence of periapical lesion. The case 2 was similar to that of case 1, so continuation of endodontic therapy was initiated followed by placement of calcium hydroxide intracanal dressing in the first visit. On the second visit IOPAR showed reduction in Periapical lesion so completion of the endodontic procedure was done with obturation. Due to patient's economic constraint and based on her demands, a conservative post endodontic management with a metal ceramic-based endocrown (PFM) was suggested and the treatment was carried out after obtaining an informed consent from the patient. The preparation design for the endocrown in the present case was similar to that of case 1. On the next appointment endocrownwas luted with glass ionomer cement (GIC Type II, GC corporation Tokyo, Japan) under proper isolation. Post cementation instruction were given and patient was recalled for a revisit after 6 months.

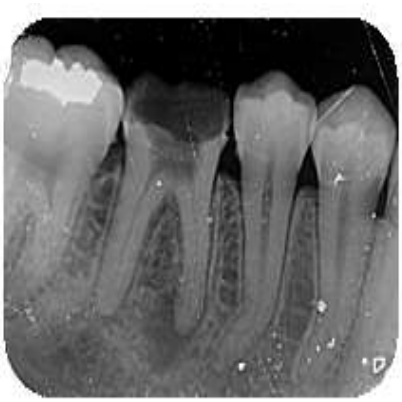


Figure 1A

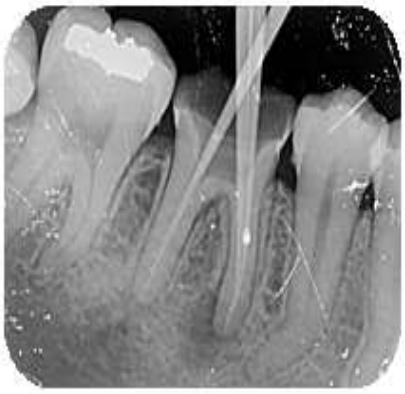


Figure 1B

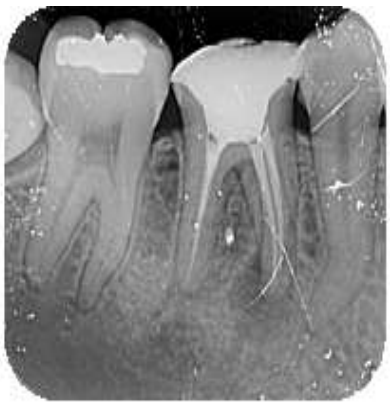
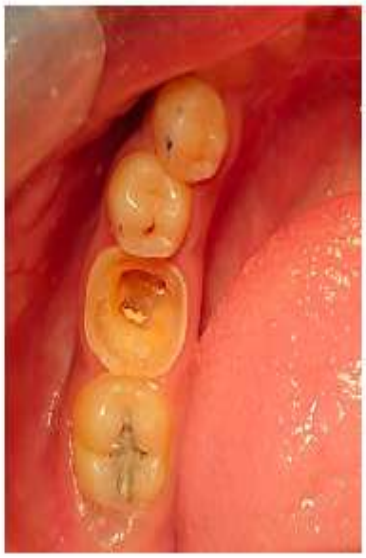


Figure 1C



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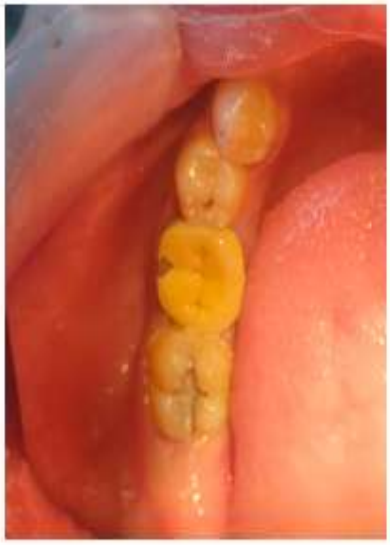

Figure 1E

Figure 1A to 1E : CASE 1 –(A)Pre operative IOPA radiograph of 36 (B) Master cone placement (C) Postoperative IOPA radiograph of 36 with cemented PFM endocrown in place (D) Tooth preparation for PFM based Endocrown in 36 (E) Postoperative review following 6 months

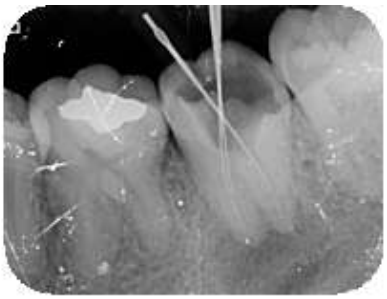

Figure 2A

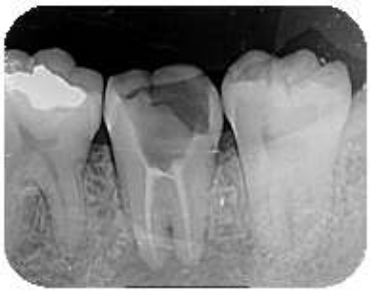

Figure 2B

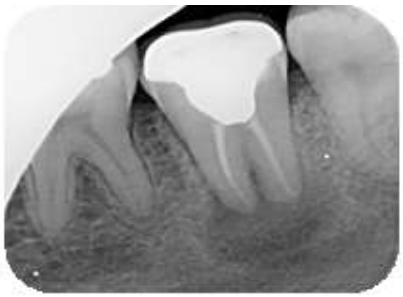

Figure 2C

Figure 2D

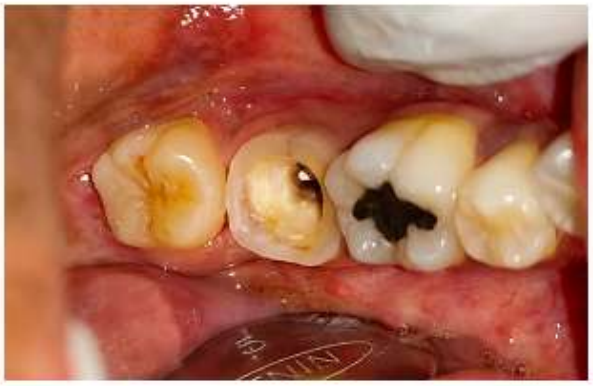

Figure 2E

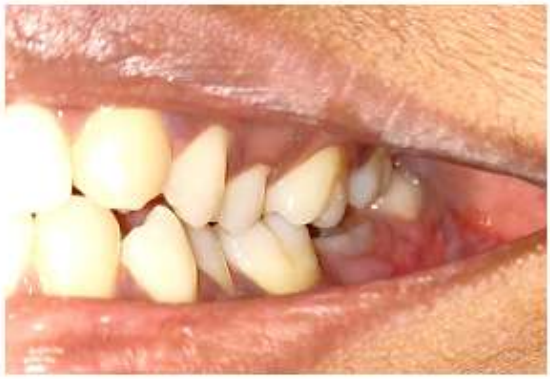

Figure 2F

Figure 2A to 2F : CASE 2 – (A) Working lenth determination IOPA radiograph of 37 (B) Post obturation radiograph of 37 (C) Postoperative IOPA radiograph of 37 with cemented PFM endocrown in place (D) Fabricated PFM Endocrown (E) Tooth preparation for PFM based Endocrown in 37 (F) 2 mm clearence after tooth preparation for PFM Endocrown in 37

Discussion:-

Endodontically treated teeth with significant coronal tooth structure loss may be difficult to recover, and the task may be made more difficult by the lack of interocclusal space [4]. Endocrown can be considered a practical, conservative, and feasible alternative to traditional post and core restorations in today's adhesive dentistry era. The

endocrown is anchored to the internal portion of the pulp chamber and the cavity edges of a repulpedz posterior tooth, resulting in macromechanical (given by the pulpal walls) and microretention (by adhesive cementation). Furthermore, it is a preferable option among the many treatment options because of its simpler technique, shorter clinical time, and higher acceptance [7]. According to Bindl et al. [8], the overall success rate of the endocrowns is very high, and the therapeutic concept appears to be straightforward and practicable. Bernhart et al[9] found in another 2-year clinical research that endocrowns are a very good therapeutic option for endodontically treated molars[10]. The endocrown is well-suited to the notion of biointegration and may be the best option for recovering posterior teeth that have been endodontically treated or have been significantly damaged. Endocrowns are particularly useful in molars with short, obliterated, dilacerated, fragile roots and severely mutilated teeth, as well as in cases where there is extensive loss of coronal tooth structure (i.e., 1/2 residual tooth structure) and limited interocclusal space, and it is impossible to achieve an adequate thickness of the ceramic covering on the metal or ceramic substructures [10].

Specific preparatory requirements are recommended for the manufacture of endocrowns. It is feasible to change the design of the endocrown to improve the final restoration's aesthetics and physiomechanical qualities. The restorative material, among other things, effects the preparation design in terms of overall occlusal surface height decrease. When using a monoblock ceramic material, Fages et al. [11] suggested an axial reduction of at least 2 mm, whereas Rocca et al. [12] suggested an overall reduction of 1 to 1.5 mm from the occlusal plane when using a resin composite, taking advantage of the material's elastic modulus and stress-absorbing properties similar to those of dentin [13].

The tooth preparation for an endocrown, like any other restoration, should follow certain rules. A total height reduction of 2 mm is required. Although a butt joint margin of 1–1.2 mm is recommended, it is not always necessary. All cervical margins should be set as high as feasible above the gingiva. In order for the coronal pulp chamber and the endodontic access cavity to be continuous, an occlusal divergence of 5–7° is also required[9]. Modifications are possible, however, for aesthetic, biomechanical, and material reasons. A smaller decrease in the axial height of the cusps, especially when resin composite is used [13], the use of the immediate dentin sealing technique for increased bond strength [14], and the presence of a uniform or non-uniform ferrule in the restoration for increased fracture resistance [15,16] are all examples of these deviations. Despite the fact that the insertion of a ferrule increases fracture resistance [17], ferrule design is incompatible with minimally invasive dentistry.

Another factor that affects the success of these restorations is the type of tooth that accepts them. Bindl et al. [9] observed in 2005 that endocrowns are insufficient for premolars, with a failure rate of 31%, and that the surface available for adhesion has a strong association. Endocrowns must also be limited to molars, according to numerous experts [18,19]. In contrast to the above assertion, Lin et al. [20] confirmed in 2010 that the use of endocrowns in maxillary premolars is possible using 3-dimensional finite element analysis (FEA). It should be noted, however, that the FEA is a computerised in vitro study in which the clinical situation may not be perfectly recreated [21]. However, Belleflamme et al. [14] concluded in 2017 that endocrown fabrication is a reliable procedure for repairing both molars and premolars, even in the presence of severe tooth structural loss or occlusal risk factors.

A PFM-based endocrown was planned and accomplished in both cases depending on the patient's economic factors. Despite the fact that microretention was compromised in the PFM endocrown case, meticulous care was taken to improve the restoration's retention by incorporating secondary retentive grooves in the axial walls, as well as sandblasting the metal surface before cementation, as stated in various studies [22]. By limiting the radius of rotation, these grooves aid in the retention of the metal surface onto the tooth, as well as the luting cement. Grooves improve retention by providing additional nearparallel sided walls to the preparation, as well as limiting the insertion path [23]. The antirotational shape of the preparation further improves the resistance feature [23]. According to Blair et al.,they are mostly employed for metal and metal-ceramic restorations, but are impracticable for all ceramic crowns [24] .In such circumstances, secondary retentive elements like pins, boxes, and slots[25] can be considered in a clinical context. Additionally, sandblasting was used to improve the bonding.

According to Biacchi et al., the cervical margins were also levelled in the shape of a chamfer across the whole extension of the crown and root remainders, while keeping the lingual face terminal in enamel, with the goal of providing better bond quality and retention. [26]. The pulp chamber preparation may have further aided the mechanical retention and stability of the endocrown. The gutta-percha was removed up to 2 mm in the pulp canal to take advantage of the saddle-like anatomy of the cavity floor, whereas GIC placement in the pulp chamber is a

biomimetic concept that fills internal undercuts to create adequate preparation geometry, resulting in improved marginal seal in the present cases [27].

Endocrowns are not recommended in the following situations: (1) where the pulp chamber depth is less than 3 mm or the cervical border is less than 2 mm wide, (2) if adhesion cannot be guaranteed, and (3) when there is only a little amount of tooth structure left [28]. Furthermore, discrepancies in the modulus of elasticity between the tougher ceramic and the dentin may cause root fracture and debonding. As a result, case selection is crucial to the long-term success of an endocrown-type restoration. Other aspects that influence the performance and lifespan of endocrowns include operator skill, proper preparation techniques, adequate selection of the best ceramic alternatives, and the bonding material used. Endocrown has been rejected as a treatment option in some cases due to a lack of adhesive bonding and the patients' financial constraints as the primary criteria. However, with proper implementation of retention and resistance elements in the tooth preparation, porcelain fused to metal-based endocrowns can be regarded a promising alternative in such circumstances.

The provisional coronal restoration is frequently used for diagnostic and therapeutic purposes, serving as a test structure for all essential functional, occlusal, and aesthetic changes before the permanent prosthesis is inserted. Coronal exposure of the root canal obturation to saliva for a reasonably long amount of time (30 days or more) could be deemed a clinical indication for retreatment [29,30]. The patients in the current case reports contacted us within 14 days of receiving endodontic treatment for the affected tooth in order to receive a definitive final restorative prosthesis. Furthermore, there were no clinical signs or symptoms linked with a decrease in periapical rarefaction (radiographically). As a result, a conservative postendodontic restoration operation was performed at a low cost.

Conclusion:-

Based on the patient's budget and cosmetic criteria, endodontically treated posterior teeth with severe loss of coronal tooth structure and minimal interocclusal space, Endocrown appear to be a promising treatment option. Metal ceramic-based endocrowns (PFM) may, however, be a viable treatment option, especially for patients with financial constraints. To get good results, all of the aforementioned clinically significant criteria should be examined before using PFM-based endocrown in clinical scenarios. This simple and effective idea is more in line with the philosophy of bio integrated prostheses, and as a result, this style of reconstruction, which is still relatively uncommon, should be more known and employed in restorative dentistry.

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