



INNOVATIVE APPROACH IN POST-ENDODONTIC RESTORATION: PRESERVING TOOTH STRUCTURE AND FUNCTION: A CASE REPORT.

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ABSTRACT Root canal treated tooth often necessitates placement of crown to ensure long term success and functionality of tooth from external forces such as biting and chewing. Conventional crown, although used commonly as a post endodontic restoration, has certain setbacks. Full coverage crowns requires extensive removal of tooth structure which may compromise structural integrity of tooth ultimately leading to failure. The concept of minimal preparation and conservation has led to various innovative designs to preserve dentin and maintain the integrity of tooth. In this case report, crown was designed taking into consideration peri cervical dentin, forces acting on functional and non functional cusp and Deeman's criteria of crown preparation

KEYWORDS : Minimal preparation, innovative design, peri- cervical Dentin, Deeman's criteria

INTRODUCTION

Dentistry has evolved in the last 30 years, and a new age of restorative dentistry has begun. Endodontically treated teeth are at higher risk of fracture when compared to vital teeth as root canal treatment leads to changes in root architecture, dentin properties and sense of proprioception [1]. The prognosis of endodontically treated teeth not only depends on successful root canal treatment but also on the conservation of remaining dentin. For each case the quality and quantity of tooth structure should be considered before going ahead with any kind of post endodontic restoration [2]. Peri cervical dentin which is found 4mm above and below the crestal bone is considered as a critical region for structural integrity of the teeth and so preserving it is of utmost importance [3].

In case of anterior teeth with adequate amount of tooth structure and limited endodontic access cavity, direct restoration can be an alternate treatment option without the need for full coverage crown. Whereas posterior teeth requires cuspal coverage because of the anatomical features and high stress they endure [4]. Although posterior teeth requires full coverage crown, it has detrimental effect on the remaining tooth structure as there is excessive removal of sound tooth for crown placement [5].

Many conservative approaches have been tried for restoring endodontically treated teeth, veneers, onlays, overlays and veneerlays to name a few. Veneerlay is an indirect bonded partial restoration, preferentially used in case of maxillary premolars. It can be used as an alternative to full coverage crown as a less invasive approach for post endodontic rehabilitation [1]. Endo crown is another form of post endodontic restoration, which has an added advantage of macro retention from anchoring the restoration from within the pulp chamber's internal portion and to the margins of cavity [5]. In this case report, a new design with minimally invasive aspect of veneerlay and macro retention of endocrown were combined, taking peri cervical dentin also into consideration.

CASE REPORT

A 38 year old female patient reported to the out patient department of Conservative Dentistry and Endodontics, with a complaint of pain in the upper right tooth region since two weeks. On clinical examination, proximal caries involving the distal side of the tooth #14 was seen. Radiographically, radiolucency was seen in the proximal side involving enamel, dentin and pulp. Tooth was tender on percussion, vitality of pulp was checked using cold test, patient responded with an exaggerated response that lingered after the removal of stimulus,

suggestive of acute irreversible pulpitis with symptomatic apical periodontitis. The tooth was treated endodontically (Figure.1). Prosthetic decision was to restore the tooth with a conservative crown, combining advantages of endocrown and veneers.



Figure 1- Pre-operative image after endodontic treatment



Figure 2 – Crown preparation. (A) Occlusal reduction done. (B) Primary flare of proximal preparation with palatal cusp capping. (C) Veneer preparation with reduction of 1.5mm in the buccal surface

Crown Preparation:

A conservative approach for crown preparation was undertaken in this case. Shade selection was done prior to the preparation using vita 3D shade guide. Occlusal reduction of 2mm (Figure 2A) was prepared using tapered diamond bur. Undercuts in the access cavity was removed using the same bur, to provide a occlusal convergence of 7 degree. Access cavity was continued as a class 2 cavity removing all the caries, primary flaring of proximal preparation was done, palatally

continued as cusp capping (Figure 2B) and buccally as a continuation of veneer preparation with a reduction of 1.5 mm on the buccal surface (Figure 2C), prepared using a tapered diamond bur. Supra gingival chamfer finish line was given on the buccal side using a round end tapered bur. Final finishing of preparation was done by using fine grit diamond bur (Figure 3). Diagrammatic representation of tooth preparation and design of prosthesis is shown in (Figure 4)



Figure 3 – After crown preparation

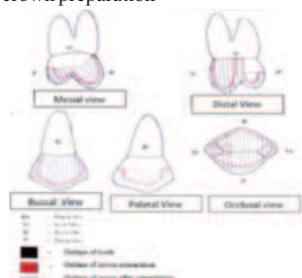


Figure 4– Design and preparation of tooth for the prosthesis

After tooth preparation impression was made using polyvinyl siloxane impression material of light and putty consistency using a double-mix single-stage technique. Lithium disilicate based prosthesis was prepared using computer-aided design (CAD) / computer-aided manufacturing (CAM) milling technique (figure 5A). In this case sand blasting of the inside surface of the crown was already done in the lab, and so requires only wiping the inside of the crown using 5% sodium hypochloride solution, followed by rinsing with water and air dried. Resin cement was applied on the inner surface and cement the crown (figure 6), then tac cure for 2 seconds followed by removal of excess cement. Follow it up with complete cure for 20 seconds.

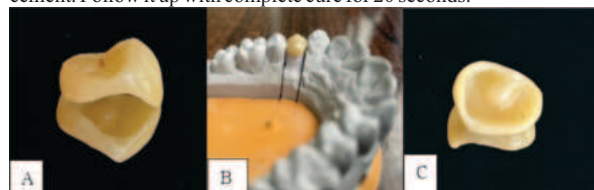


Figure 5A - Lithium Disilicate based prosthesis using computer-aided design (CAD) / computer-aided manufacturing (CAM) milling technique. (A) External view. (B) Palatal view of the prosthesis. (C) Interior surface of the prosthesis.



Figure 6– Occlusal view after cementation.



Figure 7– Six months follow up images. (A) Buccal view. (B) Occlusal view. (C) Radiographic image



Figure 8– One year follow up. (A) Buccal view. (B) Occlusal view. (C) Radiographic image

DISCUSSION

Preserving natural tooth structure during and following root canal treatment is an important aspect for predictable clinical outcome [6]. In the recent years, minimalistic strategy is employed in an attempt to preserve dentin. This biominimalism helps in preserving the pericervical dentin which in turn supports the remaining coronal tooth structure from occlusal stress and thereby prevent cuspal flexure during mastication [7]. Different types of post endodontic restoration are available based on amount of tooth structure remaining or been prepared. According to study done by Nadig RR et al, stress seen with indirect onlay and vonlay as post endodontic restoration were relatively less compared to conventional crown for restoring endodontically treated teeth [8]. Onlays are not a frequent restorative option for endodontically treated teeth especially in case of heavily compromised tooth [8]. Advancement in adhesive technique and growing emphasis on minimally invasive procedure has led to development of endocrown as an option for restoring endodontically treated teeth [9]. Endocrowns are mainly indicated for molar teeth, however some recent studies have suggested, endocrown for premolars to exhibit clinical performance similar to that for molars [10].

Premolar which is relatively smaller and narrower compared to molars are at relatively higher risk of failure due to difficulty in achieving adequate retention and resistance form during crown preparation, and in case of endocrown, reduced bonding surface area due to smaller pulp chamber when compared to molars, makes prosthetic restoration of premolar difficult [16]. These features are very crucial for the stability of the crown, and so incorporation of macro retention from endocrown and microretention from the resin cement along with preservation of dentin forms the basis for designing this crown.

In conservative dentistry, the concept of inflection plane becomes relevant primarily in the context of restorative dentistry. Inflection plane can be understood as a point or region on tooth where noticeable change in curvature or angle is seen. The inflection plane is that point at which the applied force on a tooth shifts direction during chewing or clenching motions [17,18]. By placing a crown above this plane, the compressive and tensile forces are more evenly distributed across the tooth surface. In this case as the upper first premolar has palatal cusp as the functional cusp, the forces acting on palatal cusp will be more than that acting on the buccal cusp. This necessitates the usage of palatal cusp capping above the inflection plane instead of full coverage on the palatal side, and veneer preparation on the buccal side taking Deeman's criteria of conservative dentistry into consideration.

Conservative post endodontic treatments like inlays, onlays, direct composite restorations and other minimally invasive procedure offers several advantages over traditional full-coverage crowns, like preservation of tooth structure. Conservative restorations minimizes the removal of healthy tooth structure, preserving the biomechanical integrity of the remaining tissues, it also helps in maintaining peri cervical dentin, which acts as a stress transmitting conduit that increases tooth strength [19]. Inlay, onlays and other conservative post endodontic restoration has also shown to have better esthetics, reduced clinical time and visit, better sealing ability, and comparable survival rate to conventional full coverage crown [20].

Onlays are generally indicated in cases where one marginal ridge is

lost and adjacent cusps are compromised⁹. In this case report, distal marginal ridge of upper first premolar was lost due to caries and conservative access opening was done for root canal treatment. Concept of minimal preparation, preservation of peri cervical dentin, micro- retention and macro retention were incorporated in this case to achieve best possible result. Preservation of peri cervical dentin was done by restricting the preparation of crown by incorporating veneer preparation on the buccal side and cusp capping without involving the cervical third of the tooth on the palatal side. Micro retention of prosthesis was obtained by using resin cement for cementation. In this case self cure resin cement was used to simplify the procedure and to eliminate the need for surface treatment [11]. Macro retention property of endocrown was also incorporated in this prosthesis by extension of the crown into the pulp chamber taking retention from the tooth itself.

Studies has shown lithium disilicate-reinforced ceramic had lower risk of catastrophic failure when compared to composite restoration [21]. In finite element model, lithium disilicate occlusal onlay showed better load bearing capacity when compared to zirconia onlays [22]. Thus, lithium disilicate reinforced ceramic was used as a material of choice for this case, as stanadardized by literature. Non- metallic restoration like lithium disilicate requires color stable cement that can match the shade and translucency of the crown, which is provided by resin cement. An adhesive dual-cure luting resin (3M™ RelyX™ Unicem 2 Automix) was used for cementation. This cement provides high adhesion, resist discoloration, long-term stability, and minimal postoperative sensitivity [23].

A Minimally destructed endodontically treated tooth with sufficient tooth structure can be managed with intra coronal composite restoration without the need for cuspal coverage [12,13]. In case of moderately destructed tooth, as in this case requires cuspal coverage. This could be managed through the use of mechanically retained indirect restoration like partial coverage crown or full coverage crown [14,15]. It can also be managed by adhesively retained restorations like onlays or overlays, or modification of overlay to include the buccal surface of the teeth as veneer and a pulpal extension to add macro retention to the prosthesis as shown in this case.

Follow up of 6 months (Figure 7A-7C) and 1 year (Figure 8A-8C) showed no distinct differences and was in a perfect state, which represent fully functional clinical situation.

CONCLUSIONS

With growing demand in minimally invasive dentistry, clinicians are trying to innovate methods to reduce the amount of tooth structure removal while incorporating necessary principle design features needed for clinical success of prosthesis. Type of prosthesis used may also depend on remaining tooth structure, functional and esthetic requirement. Overall success of any dental clinical procedure requires proper planning, innovative idea and clinical experience, and as de Vans statement goes “Perpetual preservation of what remains is more important than meticulous replacement of what is missing [17].

Conflict Of Interest: NIL

Acknowledgement: NIL

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