ORIGINAL RESEARCH PAPER

Volume-8 | Issue-4 | April-2019 | PRINT ISSN No 2277 - 8179

INTERNATIONAL JOURNAL OF SCIENTIFIC RESEARCH

POST ENDODONTIC MONOBLOCK RESTORATION WITH NOVEL CAD/CAM ENDOCROWN APPROACH: A CASE SERIES

Dental Science

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ABSTRACT

Background: To determine the performance of endocrown in badly broken carious teeth. Two patients with badly carious tooth in posterior region of mouth came to the dental college for treatment. Both patients were interested in conservative and permanent treatment of posterior teeth. As the crown height and occlusion were not permissible to do conventional crown, so decision was taken to do endocrown for both patients, in case-1 tooth no.46 and in case -2 tooth no.46. Both crowns were made with high strength CAD/CAM material i.e LAVA Ultimate a resin nanoceramic material and cemented with variolink resin cement. After cementation of endocrown clinical observation was done after one week, one month, three months, six months and eighteen months for retention, color changes, marginal ditching and partial or complete fracture and debonding of endocrown. According to observational parameter of clinical study both endocrowns were intact after every observation, retained properly, there is no color changes, marginal ditching, partial or complete fracture and has no complain about its function. Endocrown is alternate treatment plan in restorative dentistry after root canal treatment where badly broken teeth are present.

KEYWORDS

All ceramic Restoration, CAD/CAM, Endocrown, Lava Ultimate, Monoblock, Resin Cement

INTRODUCTION

Restoration of endodontically treated teeth remains a challenge because they represent a stark biomechanical difference compared with their vital counterparts, representing a multifactorial dissimilarity that includes changes in tissue composition and dentin microstructure and macrostructure as well as the evident loss of tooth structure. Postendodontic restoration should preserve and protect the existing tooth structure, while restoring satisfactory esthetics, form, and function.

The goal is to achieve minimally invasive preparations with maximal tissue conservation for restoring endodontically treated teeth. This will help to mechanically stabilize the tooth-restoration complex and increase surfaces available for adhesion. Many different compensatory treatment strategies have been proposed, including intracoronal post systems,[1] directly placed complex restorations, and adhesive considerations in every clinical situation. The choice depends on the structural integrity of the tooth, esthetic, and protective requirements. In this perspective, endocrowns can be considered as a feasible alternative to full crowns for restoration of nonvital posterior teeth, especially those with minimal crown height but sufficient tissue available for stable and durable adhesive cementation.

"Pissis[2]" was the forerunner of the endocrown technique, described that it as the "mono-block porcelain technique". In 1999 Bindl and Mormann[3] had described nomenclature endocrown for the first time. These crowns would be anchored to the internal portion of the pulp chamber and on the cavity margins, thus obtaining macromechanical retention provided by the pulpal walls, and micro mechanical retention would be attained with the use of adhesive cementation.[4]These type of endocrown are indicated where excessive loss of hard tissues of the crown, interproximal space is limited so inadequate ceramic thickness, a short clinical crown, and traditional rehabilitation with post and crown is not possible because of calcified or curved canal, or short root canals that make it impossible to use posts.[3]

The evolution of ceramic technology especially dental CAD/CAM systems have enhanced the options to produce single all ceramic endocrowns with high biocompatibility and optimal mechanical properties.

The purpose of the present paper is to present a clinical cases, in which an esthetic and conservative posterior CAD/CAM endocrown was used to restore a mandibular molar that presented endodontic treatment and extensive coronal destruction and follow up is done up to 18 months.

Case 1

A 26-year-old male patient reported with a chief complaint of pain in the lower right back region teeth since one month. On radiographic examination radiolucency approximating pulp of tooth 46 was seen. Based on the clinical and radiographic examination tooth 46 was diagnosed with acute irreversible pulpitis (Fig 1,2,3). Root canal treatment was performed. Based on the remaining tooth structure, that is, approximately 3mm, occlusal evaluation, and patient's esthetic demands, a conservative approach of restoring the tooth with an endocrown was decided as the treatment option. On additional request by the patient for an advanced and a prompt restoration, CAD/CAM processed LAVA Ultimate endocrown was decided as the treatment option. After removal of the provisional restoration, preparation for endocrown was initiated. Flowable bulk-fill resin composite (Tetric EvoFlow,Ivoclar Vivadent,USA) was used to achieve a flat pulpal floor and to block the undercuts. The preparation was done using diamond bur and consisted of a circular equigingival buttjoint margin and central retention cavity into the entire pulp chamber constructing both the crown and the core as a single unit. The appropriate reduction of the buccal and lingual walls was done (Fig 4,5). Interocclusal space was carefully evaluated and occlusal reduction done to achieve a clearance of 2 mm. Shade-A1 was selected (VITAPAN Zahnfabrik, Germany). Retraction cord was placed and impressions made with polyvinyl siloxane impression material (Aquasil LV, Putty/Light Body, Dentsply

DeTrey, Germany) using putty wash technique. Die stone model was fabricated.

*CAD/CAM Processing.*The three-dimensional reconstruction of the preparation was done using the DENTAL WINGS 3SERIES SCANNER (GERMANY) and milled from VHF milling machine using resin nanoceramic block material-LAVA Ultimate. The 3D scanning of the individual die and the antagonist arch for occlusal function (virtual articulation) were done. The milling was then initiated on a monolithic solid resin nanoceramic block (Fig 6,7,8,9,10). The finished endocrown was checked for shade, fit, and occlusion in the patient's mouth and then cemented using dual cure resin luting agent (Variolink, Ivoclar/Vivadent, Schaan/ Liechtenstein). Clinical and radiographic evaluation was done and follow up after 18 months showed no secondary caries, fracture, discoloration or loosening/decementation of the crown (Fig 11,12,13).

Case 1-
CAD/CAM Endocrown Restoration irt 46
Pre-op clinical examination
Pre-op Radiographic examination

Fig-1,2,3

Fig – 4: Occlusal view after post-obturation

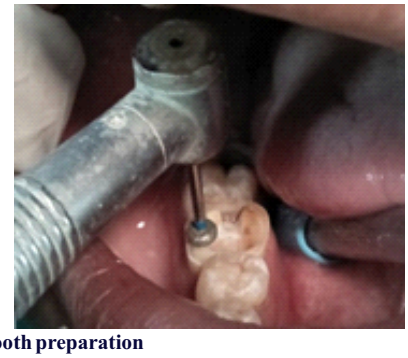

Fig - 5: Tooth preparation

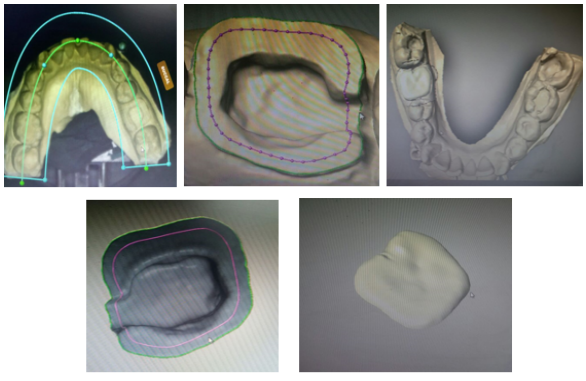

Fig – 6,7,8,9,10: Processing all ceramic endocrown restoration Using CAD- CAM technology

Fig – 11,12,13: Cementation and Follow up images

Case 2
A 32-year-old female patient reported with dislodged restoration in lower right first molar. On clinical examination tooth number 46 was root canal treated one month back,it was asymptomatic and the occlusogingival height of the remaining crown structure was approximately 4 mm. The radiographic findings revealed well obturated canals with no periapical changes (Fig 14,15). A conservative approach of restoring the tooth with an endocrown was decided as the treatment option, as more than half the residual tooth structure was remaining and there were no occlusal wear facets. The endocrown preparation and the impression technique were performed as described in the previous case and fabricated a CAD/CAM processed LAVA Ultimate endocrown. The finished endocrown was checked for fit and occlusion in the patient's mouth and then cemented using dual cure resin luting agent (Variolink, Ivoclar/Vivadent, Schaan/Liechtenstein).Clinical and radiographic evaluation was done and a 18-month follow-up showed no secondary caries, fracture, discoloration or loosening/decementation of the crown (Fig16,17).

Case 2-
CAD/CAM Endocrown Restoration irt 46

Fig 14,15: PRE-OP clinical and radiographic images

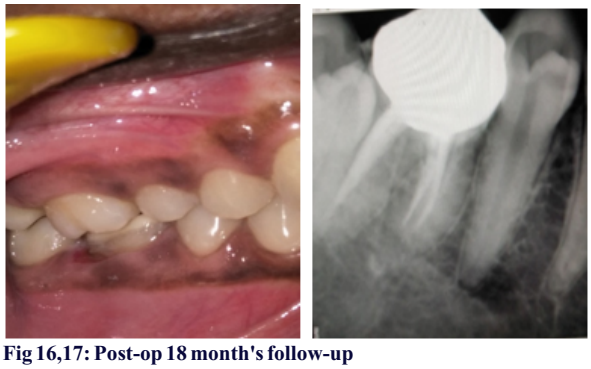

Fig 16,17: Post-op 18 month's follow-up

DISCUSSION
A Change Occurring in Endodontically Treated Teeth (ETT) is due to many reasons. Reduction in stiffness and fracture resistance of ETT is because of loss of structural integrity associated with caries, trauma and extensive cavity preparation, rather than dehydration or physical changes in dentin. Type of restorative materials used and an appropriate restoration that conserves tooth structure are the factors affecting the longevity of endodontic treatment. Quality and integrity of the remaining tooth structure should be preserved carefully in terms of providing a solid base required for restoration and increasing the structural strength of the restored tooth. Two different cases are usually seen in clinical practice where either minimal loss of coronal structure

that is up to one-half of the coronal tooth structure missing, more than half of the coronal tooth structure is missing and most of the coronal tooth structure is missing.[5]

When extensive loss of tooth structure is there after endodontic treatment different treatment modality like inlay, onlay, overlay, post and core, Richmond crown, sharonlay is used for restorations to achieve long term success of treatment. But all these restoration will support the tooth from outside so there is a chance with horizontal forces tooth get fracture at cervical line and if intracanal support is taken than fracture of root is common. These root canal posts are designed for the retention of the coronal restoration but not for root reinforcement.[6,7] Where as for full cast crown, crown height needs to be reduced excessively which ultimately leads to retention issues.[8]

The idea of developing single unit restorations has remained in the minds of researcher that eventually lead to development of new strategies of restoration.

This type of crown is specially indicated in

1. When excessive loss of hard tissues of the crown,
2. Inter proximal space is limited,
3. Traditional rehabilitation with post and crown is not possible because of inadequate ceramic thickness or curved root or calcified and narrow canal.[1]

The endocrown preparation consists of a circumferential 1.0-1.2 mm depth butt margin and a central retention cavity inside the pulp chamber, constructs both the crown and core as a single unit monoblock structure, and does not take support from the root canals[3,4]. The suggested dimensions are a 3 mm diameter cylindrical pivot and a 5 mm depth for the first maxillary premolars and a 5 mm diameter and a 5 mm depth for molars, but the precise dimensions for the preparation of central retention cavity were not clearly determined[9]. The thickness of the ceramic occlusal portion of endocrowns is usually 3-7 mm.

The development of reinforced ceramic materials is increasing in recent years like CAD CAM ceramics, which has reduced the brittleness of ceramic and increased their clinical performance in different applications. Especially dental CAD-CAM (computer-aided design and manufacturing) systems increase the possibility to produce single-unit restorations in short period of time with high strength. Carlos RB et al. in 2013 done different cases with All-ceramic endocrown and concluded that endocrowns fabricated using CAD/CAM and pressable ceramic technology can be considered as a reliable option for the restoration of moderately mutilated endodontically treated posterior teeth.[10]

Mahesh BA et al. in 2015 also published a case report study on endocrown and came to the conclusion that, endocrown fits perfectly with the concept of bio-integration and can serve as the most conservative and esthetic option for restoration of non-vital posterior tooth.[11]

Compared to conventional crowns, endocrowns are easy to apply and require a short clinical time. Low cost (compared to costly zirconias), short preparation time, ease of application, minimal chair time and aesthetic properties are the advantages of endocrowns.[12]

In 2018, Tribst et al. evaluated the influence of a restorative material type on the biomechanical behavior of endocrown restorations and concluded that Leucite presents a better stress distribution and it can be a promising alternative to lithium disilicate for the manufacture of endocrown restorations.[13]

An investigation made by Darwish et al. showed that endodontically treated maxillary premolars restored with resin nanoceramic endocrowns presented better internal adaptation compared to those restored with lithium disilicate endocrowns and that endocrown preparation with smaller axial wall divergence (“6”degree) provided better internal fit.[14]

According to Belleflamme et al., even in the presence of extensive coronal tissue loss or occlusal risk factors, such as bruxism or unfavorable occlusal relationships, endocrowns could be a reliable approach to restore severely damaged molars and premolars.[15]

Dogui H also published a case report study on endocrowns and concluded that, it is a conservative approach for mechanical and aesthetic restoration of nonvital posterior teeth.[16]

CONCLUSION

The endocrown represents a very hopeful treatment alternative in restorative dentistry where badly broken teeth are present after root canal treatment.It allows maintaining of tooth structure, it is compatible with goal of minimally invasive dentistry, and it is adequate for the concept of biointegration. Endocrowns have opened up new horizons in the adhesive and conservative dentistry thus sparing the need of full cast crowns in badly broken teeth and it is a conservative approach for mechanical and aesthetic restoration of non-vital posterior teeth. This type of reconstruction, which is still uncommon, should be more widely known and practised.

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