ISSN: 2581-5989
PubMed - National Library of Medicine - ID: 101738774

International Journal of Dental Science and Innovative Research (IJDSIR)

IJDSIR : Dental Publication Service

Available Online at: www.ijdsir.com

Volume – 5, Issue – 3, June - 2022, Page No. : 235 - 243

Endocrown- A novel approach in restoring endodontically treated teeth

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Citation of this Article: Dr. Giftlin Denny Xavier, Dr. George Thomas, Dr. Sunil Jose, Dr. Adarsh V J, Dr. Saron R Nair, "Endocrown- A novel approach in restoring endodontically treated teeth", IJDSIR- June - 2022, Vol. – 5, Issue - 3, P. No. 235 – 243.

Type of Publication: Case Report

Conflicts of Interest: Nil

Abstract

Endodontic treatment is considered a success only when the said tooth is brought back to its form and function. A tooth which is already weakened by caries, fracture or root canal treatment itself will not survive the demanding masticatory loads in the oral cavity. The resistance form of such a tooth is enhanced by giving a good post endodontic restoration in the form of post and core followed by crown. Among the various techniques of restoring badly broken-down teeth, the newest approach is that of an Endocrown. Endocrown full fills the idea of a monoblock effect in root canal treatment, as the entire core and crown is built as one unit. This novel concept strengthens the remaining tooth structure and improves resistance forms. This paper represents a series of clinical cases managed with Endocrown.

Introduction

Dental caries, if left untreated results in loss of integrity of tooth leading to fracture of remaining tooth structure. This is true even in the case of an endodontically treated tooth. Restoring such a tooth is a challenge clinically. Additional retentive methods such as posts and clinical

crown lengthening procedures are the most common methods employed to restore badly mutilated teeth with loss of clinical crown structure.

Restoring endodontically treated teeth with posts poses extra challenges in the form of resistance to fracture. Since posts are placed in root dentin there is risk of micro fractures along the root surface thereby leading to the loss of tooth itself. One of the alternative methods to replace traditional post and core restoration was suggested by Biodl and Mormann in 1999. This novel method was called as Endocrown.

The concept of Endocrown utilizes the mono block concept where in the entire core acts as a single unit. Here the retention form is achieved form the pulp chamber space itself rather than the root dentin. Additional retention is achieved though micromechanical bonding of the core to pulp chamber dentin. This combination of micromechanical and macro mechanical procedures ensures adequate fracture resistance and long-term retention of the tooth in oral cavity.

Endocrown are usually made with Esthetically superior ceramic monobloc as described by PSs is. Other material such as indirect composites can also be used to make endocrons. Endocrown are gaining popularity as alternatives to traditional posts and cores. There are many advantages including less chair side time, better esthetics and less iatrogenic error.

This article highlights the clinical steps in making Endocrown through a series of case presentations.

Keywords: Endocrown, endodontically treated tooth, minimally invasive dentistry, crown preparation, post and core, bonded indirect restoration

Case report 1

A 27-year-old female patient reported to the Department of Conservative Dentistry and Endodontics with a chief complaint of pain in the upper right back tooth region. Based on clinical and radiographical examination, a diagnosis of tooth with mutilated crown structure and symptomatic irreversible pulpitis was made [fig1,2]. Root canal therapy was initiated. On completion of the endodontic therapy [fig 3], an interocclusal clearance of 2.2 mm, a pulp chamber depth of 4 mm, and a cervical margin of 2 mm were seen. Based on this amount of remaining tooth structure and thickness of the walls, a post endodontic restoration with lithium disilicate ceramic Endocrown was decided. Two millimeters of gutta-percha was removed from the canal orifices [fig 4], and the orifices were sealed using resin-modified glass-ionomer cement (Vitrebond, 3M ESPE) [fig 5]. Preparation included a butt joint margin and a central retentive cavity using a coarse grit diamond-coated bur, which had a depth of 4 mm from the pulp chamber roof to the intracoronal Cavo surface margin. Appropriate reduction of the buccal and lingual walls was done with a WR-13 bur so as to achieve an interocclusal clearance of 2 mm. Extra coronally, the finish lines were placed supragingival Ly. The undercuts in the cavity were blocked using conventional resin composites [fig 6]. Before any intervention, selection of shade was done which led to A3 shade selection. An impression was made using polyvinyl siloxane impression using the putty wash technique [fig 7], which was sent to the laboratory for the fabrication of prosthesis. A provisional acrylic resin restoration was made and cemented using temporary cement. On receiving the prosthesis [fig 8], try-in was done where the marginal integrity and the shade of the restoration were checked before cementation. The intaglio surface of the prosthesis was etched with 10% hydrofluoric acid for 10s [fig 9], rinsed with water, and dried with oil-free air [fig 10]. Next, a coat of silane application was done [fig 11] for a minute

followed by application of bonding agent (G-Premio bond, GC America), air dried and cured for 10 seconds [fig 12]. Rubber dam isolation was done on the prepared tooth surface and was etched with 37% phosphoric acid for 20 s and rinsed with water and dried with cotton. A dual-cure resin luting cement (G-CEM Link Force, GC America) was applied on the intaglio surface of the Endocrown and was adhesively cemented onto the prepared tooth surface. Light curing was done for 3s which facilitated any excess cement removal, followed by curing for 40 s on all the surfaces. No occlusal discrepancy was noted [fig 13]. Radiographic examination revealed proper marginal adaption [fig 14]

Case report 2

A 30-year-old male patient reported to the Department of Conservative Dentistry and Endodontics with a chief complaint of swelling in the upper left back tooth region. On clinical and radiographical examination, a diagnosis of symptomatic irreversible pulpitis was made and root canal therapy was initiated [fig 15,16]. Based on the amount of remaining tooth structure and thickness of the walls, a post endodontic restoration of lithium disilicate ceramic Endocrown was decided. A2 shade was chosen, and the preparation and cementation procedure were performed similar to the first case report [fig- 17- fig 23]

Case report 3

A 26-year-old male patient reported to the Department of Conservative Dentistry and Endodontics with a chief complaint of pain in the left lower back tooth region. On clinical and radiographical examination [fig 24], a diagnosis of symptomatic irreversible pulpitis was made and root canal therapy was initiated. Based on the amount of remaining tooth structure and thickness of the walls, a post endodontic restoration of lithium disilicate ceramic Endocrown was decided. A2 shade was chosen, and the preparation and cementation procedure was performed similar to the earlier case report. [fig 25- fig 28]

Discussion

Adhesive dentistry plays a vital role in modern dental practice. Many newer treatment modalities have evolved due to better dentin bonding principles. One of the novel approaches centered around this thought is the use of Endocrown for restoring badly mutilated teeth. This concept utilizes a combination of monoblock and micro mechanical bonding to dentin.

Researches in Adhesion of composite with ceramic led to the invention of newer bonding agents which are effective in bonding with ceramics. This bonding has a core advantage as they are minimally invasive and less time consuming in preparation. In these clinical cases G Premio bond was used which is an 8th generation bonding agent. Its unique combination of three functional monomers (4-MET, MDP and MDTP), notably excluding HEMA. It ensures excellent stability and exceptional bond strengths not just to tooth tissue but also to precious and nonprecious materials.[2]

The combination of two polymerization mechanisms, light and chemical, guarantees polymerization under no light conditions. This material has adequate mechanical and sufficient adhesive properties, and is easily applied with double-bodied syringes with provided

mixing tips, which prevent air bubbles formation.[3] Prepolymerization of the cement may result in easy removal of excess material from the edges of the restoration and teeth. Mechanical reduction of excess cement can cause trauma to the marginal gingival tissue and cause gingival recession.

Endo crowns presented several advantages over posts and cores and crowns, as the tooth preparation requires lesser clinical time and visits. Esthetic properties are also superb [3]. Also, adhesive restorations can decrease the

infiltration of microorganisms from the coronal to the apical part thus improve the clinical success of endodontic treatment [6]. Moreover, they show a great advantage in cases where posts are contraindicated due to short or narrow and dilaceration.

Endo crowns are indicated in Endo treated teeth with suitable pulp chamber depth. Nevertheless, Endocrown is contraindicated in cases with parafunctional habits, pulpal depth less than 3 mm, cervical margin less than 2 mm, and subgingival margins, and also in cases where isolation cannot be properly achieved.[12]

Even though there are studies in which Endocrown are made of metal ceramic, PEEK and zirconia, Lithium disilicate is the material of choice as many studies have proven their ability to bond with the tooth there by creating a monoblock effect thereby reducing the amount of microleakage along with other added advantages like esthetics and mechanical interlocking of resin composite [1,9]

The central retainer design was following the on the anatomical form of the pulp chamber.[5] Several modifications in Endocrown preparation had been studied one among them is the addition of grooves and extension into pulp chamber space. But in spite of it showing a higher fracture resistance compared with conventional Endocrown preparation design the fractures were catastrophic. [6] So a butt margin preparation was adopted here.

In the recent past studies have been done conducted to find the wide application of Endocrown.

The second was a preliminary in vivo study advocating Endocrown on permanent molars after pulpotomy. And they found that the treatment is successful both clinically and radiographically after 12 months follow up.

In a recent study comparing Endocrown, fibre post and cast post, When the dentin ferrule is incomplete, the stress distribution of the Endocrown is more excellent than post-core-crown.[10]. In a study of 3D Finite Element Analysis of molars restored with Endocrown and posts during masticatory simulation, teeth restored by Endocrown were potentially more resistant to failure than those with fiber reinforced posts (11).

Conclusion

Endocrown is a viable alternative to full coverage restorations in teeth with badly broken down and compromised cown structure. The added advantage of esthetics make this treatment option a good choice among dentists to adopt.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent for publishing. The patient(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal.

The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

Suggestion

Long-term evaluation of composite Endocrown restorations is needed as long-term temporary restoration

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and posts during masticatory simulation. Dent Mater 2013;29(12): e309-317.

Legend Figures

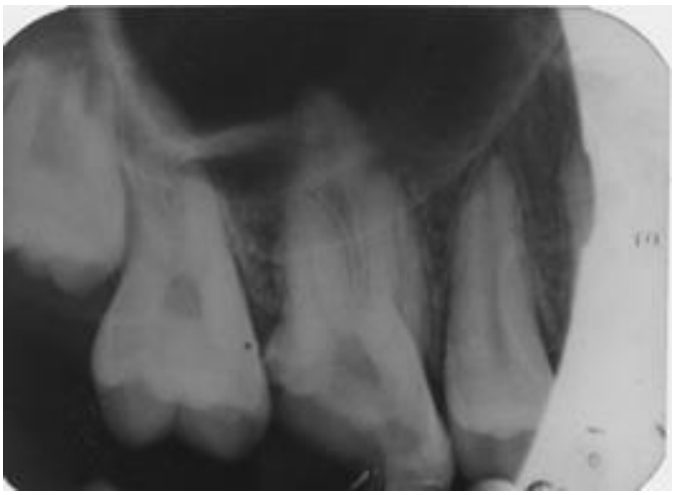

Fig 1: Pre-op iopa

Fig 2: post obturation iopa

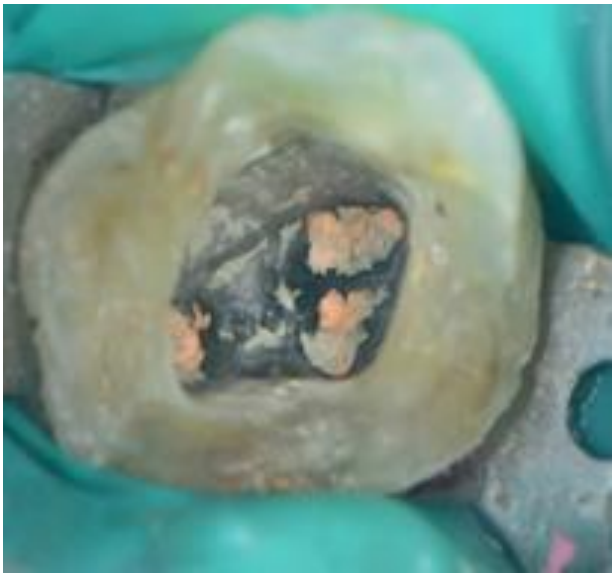

Fig 3: clinical picture after obturation

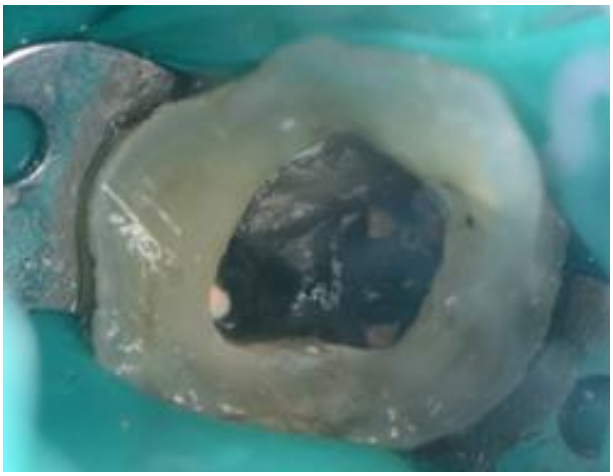

Fig 4: Coronal GP is Removed 2mm

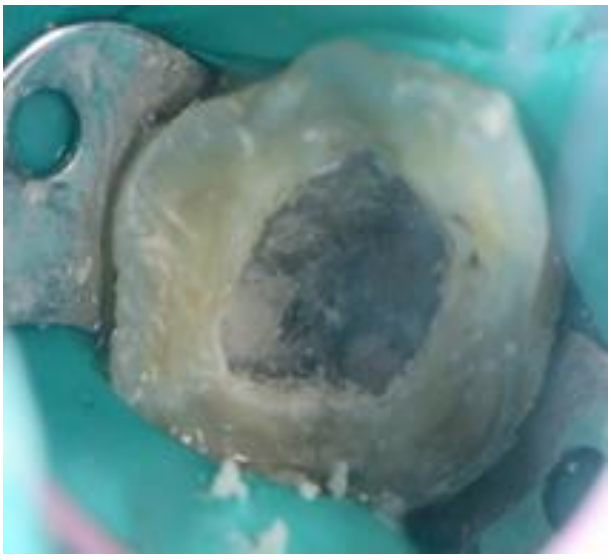

Fig 5: canal orifice are sealed using resin modified gic

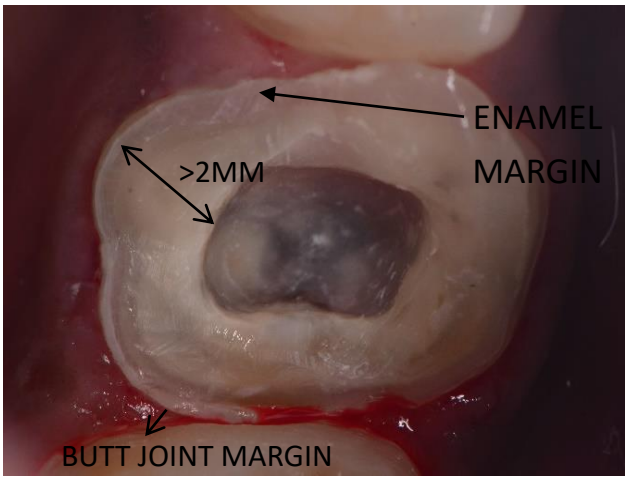

Fig 6: final preparation

Fig 7: impression

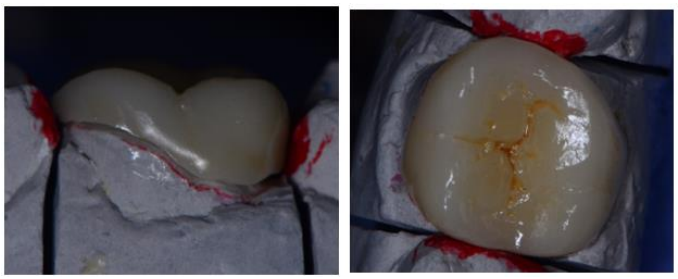

Fig 8: fabricated Endocrown

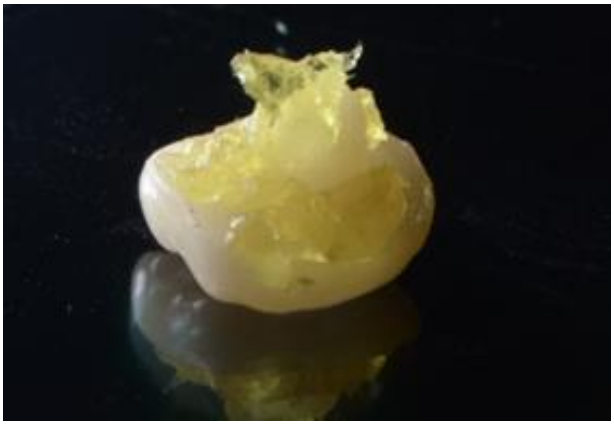

Fig 9: etching with 10% hf

Fig 10: air dried.

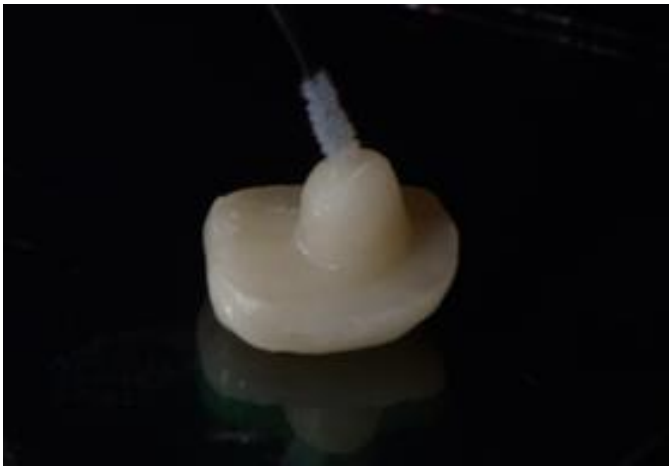

Fig 11: silane coupling agent application

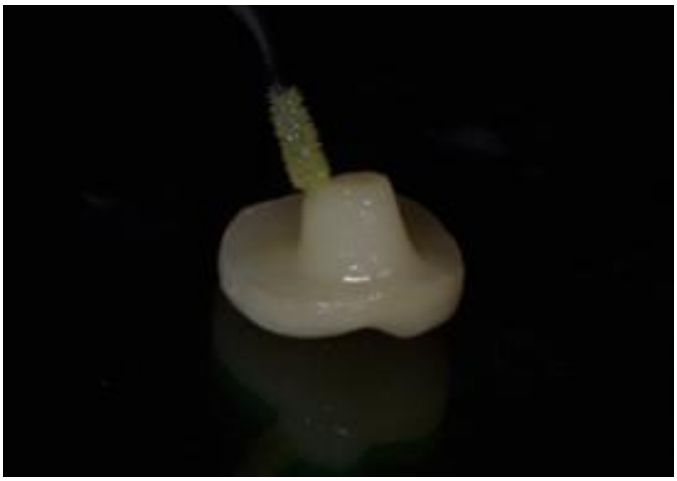

Fig 12: bonding agent application

Fig 13: intraoral image of cemented Endocrown

Fig 14: post cementation iopa

Fig 15: pre-op clinical picture

Fig 16: pre-op radiograph

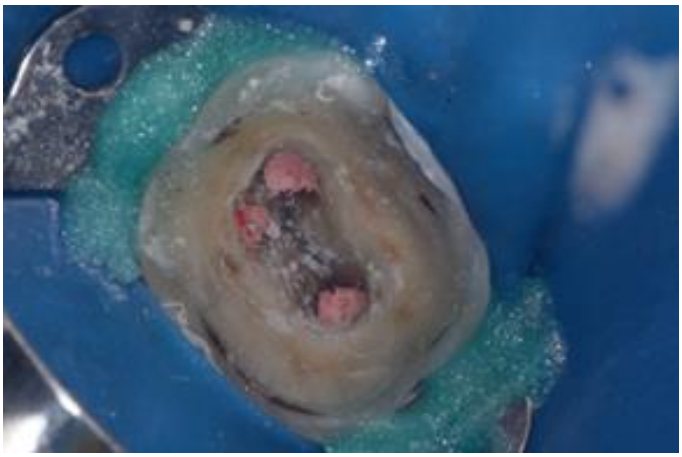

Fig 17: post obturation

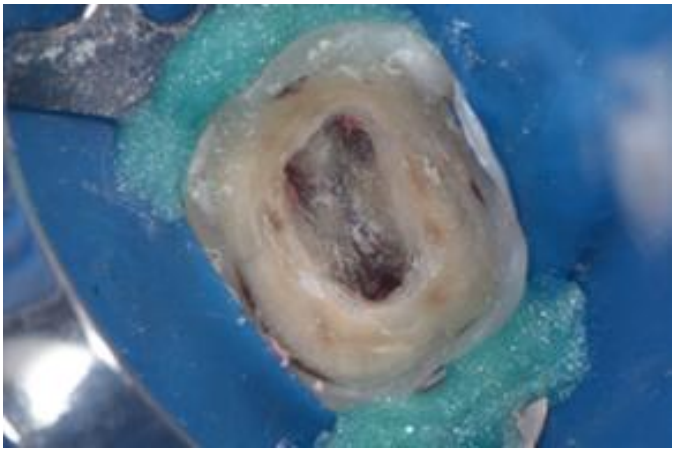

Fig 18: 2mm coronal Gp removed

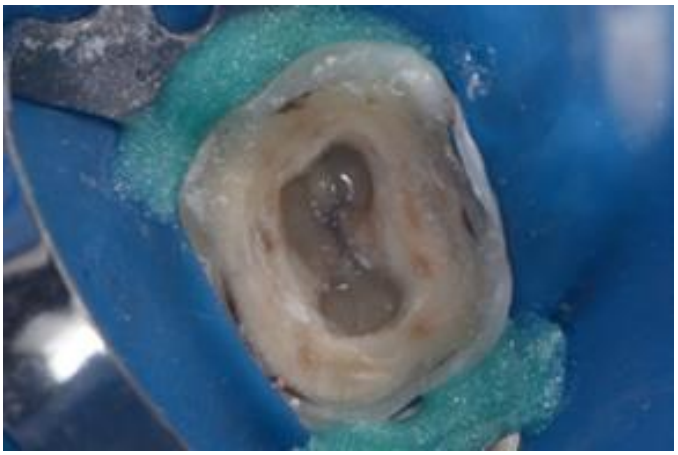

Fig 19: coronal seal done with gic

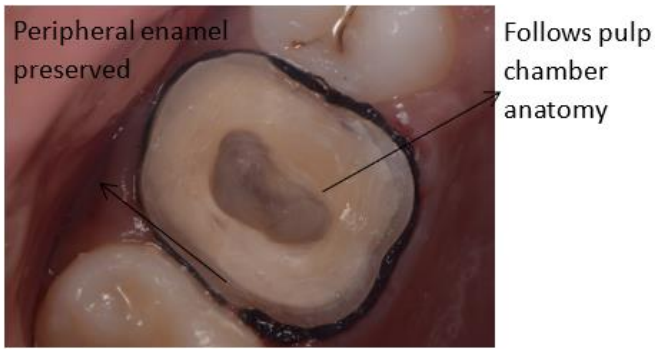

Fig 20: final preparation

Fig 21: final impression

Fig 22: Endocrown

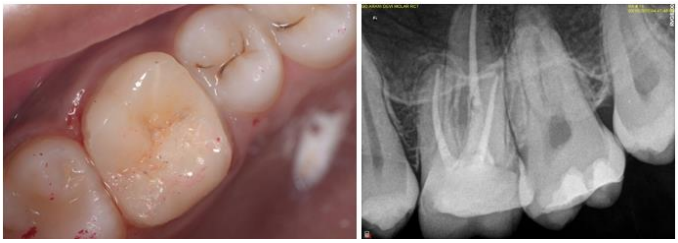

Fig 23: immediate post op

Fig 24: pre-op

Fig 25: preparation

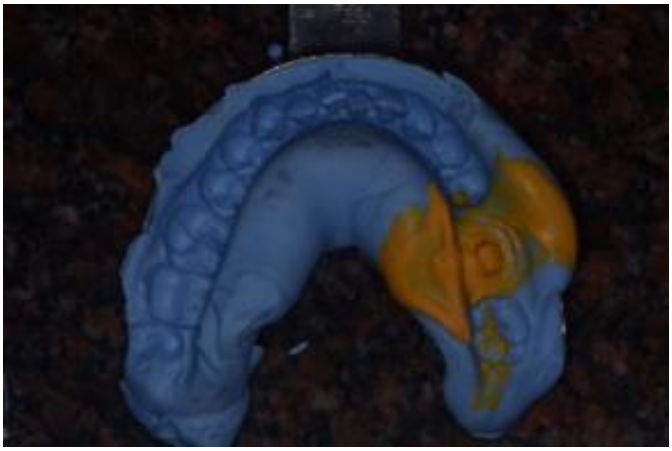

Fig 26: impression

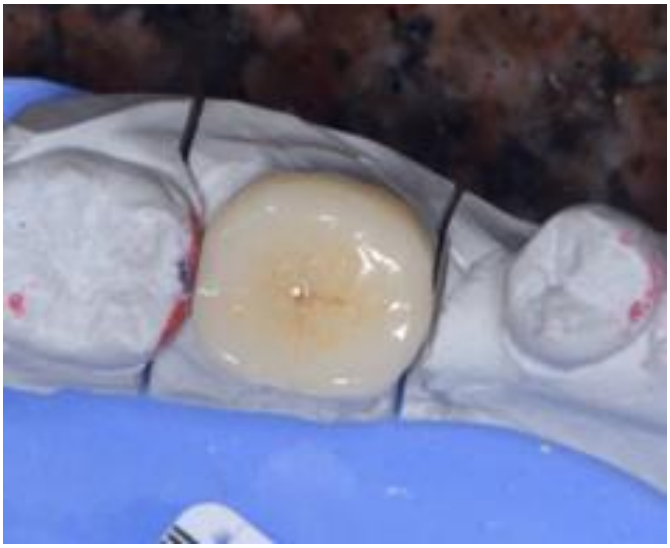

Fig 27: Endocrown

Fig 28: immediate post op