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Review Article

Restoring non-restorable with the help of customized digital solutions: A review

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ABSTRACT

This article aims to provide a comprehensive literate review on endocrown / customized digital restoration and how they might be a better option for hopeless decayed tooth. Dentist might be hesitant to apply such a successful treatment option for grossly decayed /fractured /traumatic teeth in their clinical practice because it's not as widely used as other conventional methods. Here we review about innovative treatment approach for endodontically treated teeth, using a digital workflow with IOS and computer-aided design/computer-assisted manufacturing (CAD/CAM) fabrication of restoration. Endocrowns/ customized digital restoration constitutes a reliable approach for restoring severely damaged tooth as they are more precise, aesthetic and time saving.

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1. Introduction

Restoration of endodontically treated teeth that are grossly destructed has been a challenge for many clinicians over years. Endodontically treated teeth exhibit various physiological alterations in dentin composition and microstructure which predispose tooth to multiple risk factors such as reduced retention/stability, increased tooth fragility, compromised substrate adhesion and eventually leading to failure of prosthesis.¹ Further studies reported and linked access preparation with decreased structural integrity which led to a higher occurrence of fractures in endodontically treated teeth compared with vital teeth.²

Need for replacement of crown /bridge /implant in grossly mutilated endodontically treated tooth is

challenging task for all clinical practitioners. This might be attributed to various physiological alterations in root canal treated tooth.³ Most commonly recommended treatment option for such cases associated with significant loss of two or more dentin walls is the placement of conventional post and core followed by a crown.⁴

However, there is need for definite core filling, particularly in cases of posterior teeth where masticatory forces are directed parallel to long axis of tooth. This is due to fact that use of intraradicular posts alone might not contribute to an increased retention of restoration, as stated in various studies.⁵ Yet, endocrowns/ customized restorations can replace need for post and core retention.⁶

Moreover, systematic review showed 94%–100% success rate of endocrowns/ customized restoration and higher fracture strength than with conventional treatments.⁷

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Authors suggested that endocrowns/customized restoration may perform similarly or better than conventional treatments that use intraarticular posts, direct composite resin, or inlay/onlay restorations.

Endocrown/customized restoration is made from zirconia blocks material which is applied with resin cement to post endodontic teeth. This restoration is full occlusal coverage and takes advantage of pulp chamber to increase adhesive surface area. Materials used for manufacture of endocrown are feldspathic and glass-ceramic, hybrid composite resins, and computer-aided design and computer-aided manufacturing (CAD/CAM) zirconia.^{8,9} Computer-aided design (CAD) and computer-aided manufacturing (CAM) are digital technologies used to design, plan and ultimately create dental prosthodontics with 3D printing technology. With CAD/CAM, dentists can efficiently create dental crowns, teeth bridges, veneers, onlays, inlays, dentures, and dental implant-supported prostheses.

Endocrown/ customized restoration indications include loss of extensive tooth structure, small intermaxillary spaces where rehabilitation using pegs and crowns is not possible because of insufficient thickness of ceramic material, and cases where post use is contraindicated because there are anatomic variations of the roots.^{10,11}

In this article, we review for an innovative approach for treating endodontic treated tooth using a digital workflow with IOS and computer-aided design/computer-assisted manufacturing (CAD/CAM) fabrication of restoration.

2. Discussion

In today's adhesive dentistry era, endocrown/customized restoration can be considered as viable, conservative, and feasible alternative to conventional post and core restorations. It is fixed to a depulped posterior tooth, which is anchored to the internal portion of the pulp chamber and to cavity margins, thus obtaining micromechanical retention (provided by the pulpal walls), and micro retention (by adhesive cementation).^{12,13}

In addition, its easier technique, less clinical time, and better acceptance make it a superior option among the various treatment alternatives.¹⁴ The overall success rate of the endocrowns/customized restoration is very good, and clinical concept also appears to be simple and feasible, as stated by Bindl et al. In another 2-year evaluation clinical study, Bernhart et al¹⁵ concluded that endocrowns represent very promising treatment alternative for endodontically treated teeth.¹⁶ The endocrown/customized restoration fits perfectly with concept of biointegration and can be preferred choice for restoring posterior endodontically treated and badly destructed teeth. Endocrowns are especially indicated in cases of tooth with short, obliterated, dilacerated, fragile roots, and severely mutilated tooth.¹⁷

CAD-CAM system, with an estimated success of 90.5% for molars and 75% for premolars in 55 patients^{16,18}. According to Belleflamme et al., even in 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 teeth.¹⁹

2.1. An overview of dental CAD/CAM

All CAD/CAM systems have three functional components: data capture or scanning to capture and record data about oral environment (tooth preparation, adjacent teeth and occluding tooth geometry); CAD to design restoration to fit preparation and to perform according to conventional dental requirements; and CAM to fabricate restoration. The first and so far, only, commercially available in-office system is CEREC system (SIRONA). With this system, all three steps involved in automated production of restorations can be accomplished in a dental office. The dentist can prepare a tooth and, by selecting appropriate materials, can fabricate restoration (in house manufacturing) and seat it within single appointment all done chairside.²⁰ In a matter of less than 45 minutes, compliant, enjoyable, and acceptable results are achieved.

Conventional impression technique requires full mouth impression whereas, in digital impression, we need to take an impression of the particular arch /segment /quadrant we need to treat. The use of the digital intraoral impression technique eliminates need for conventional alginate impression. Conventional impressions are considered an unpleasant experience because they cause gagging due to which impression has to be repeated to get accurate result, thus switching to digital impression procedure, have long-term positive impact on patient perceptions of dental procedures.²¹ (Figure 1a,b,c,d,e)

It has been shown that endocrowns/customized restoration made of lithium disilicate-based zirconia are considered among the best restorative materials because of their adhesive properties also, they promoted micromechanical interlocking with resin cement^{22,23}. (Figure 2)

Customized digital approach is preparation of restoration uses minimally invasive technique only occlusal preparation is required with no labio-lingual and mesio-distal extensions. Customized digital restoration perfectly fit on endodontically treated tooth and occlusion is achieved with no adjustments required to be done on antagonist tooth.

2.2. Advantages and disadvantages of CAD CAM

CAD CAM restorations are on top if we compare CAD CAM restorations over conventional one. Because CAD CAM a) provide us quality restorations with quick and

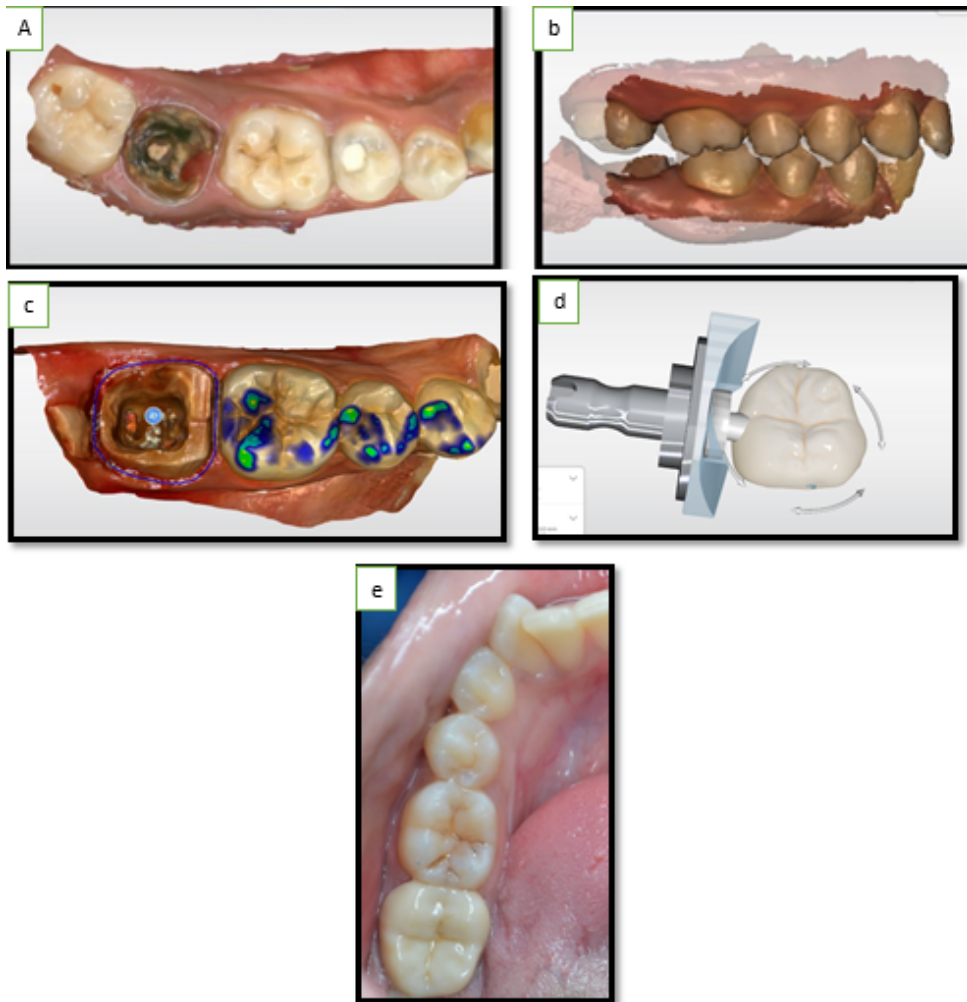


Fig. 1: a,b: Digital scanning of prepared tooth and bite scanning; c: Designing of restoration; d: Manufacturing; e: Final cemented restoration on molar



Fig. 2: Customized zirconium restoration

easy fabrication b) Scanning of intra oral tissues takes less time than conventional impression c) if chair side system is available, patients can get their restorations in one appointment.

CAD CAM has changed concept of modern world dentistry. Different specialties of dentistry are being successfully because of CAD CAM. Either orthodontics or endodontics, quality treatment is possible with accuracy and effectiveness. But cost of these treatments is still a problem for the patients and the dentists, especially in the developing countries. We are hopeful that in the near future, CAD CAM will be started using widely in the developing countries as well.²⁴

3. Conclusion

Endocrowns have been used as an alternative to conventional post-core and fixed partial dentures in restoration of ETT (endodontically treated teeth) with

extensive coronal tissue loss. Compared to traditional methods, better aesthetics and mechanical performance, and short clinical times, less tooth reduction, highly précised are the advantages of endocrowns/ customized restorations. CAD/CAM systems have evolved dentistry by providing high-quality restorations. With introduction of new systems demonstrate increasing user friendliness, expanded capabilities, and improved quality, and range in complexity and application.

4. Conflict of Interest

The authors declare no relevant conflicts of interest.

5. Source of Funding

None.

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