



ERA OF ACCURACY BY DIGITALIZATION AND 3D-PRINTING: A SERIES OF 3 CASE REPORTS

Dental Science

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ABSTRACT

Dentistry along with digitalization is doing wonders in improving the form, function and esthetics for the patients. One such advancement is direct metal laser sintering technology for casting metal crowns and posts. Laser sintering is easy to use, produces accurate restorations, simplifies post processing procedures, free of porosity unlike conventional castings and possesses improved electromechanical characteristics. Moreover, introduction of digitalization eliminates steps such as choosing a tray, preparation of the impression materials, disinfection of the impressions, and transferring the impression to the laboratory making this computerized technique more cost effective.

KEYWORDS

Post and core, 3D printing, direct metal laser sintered, digitalization in dentistry

INTRODUCTION

Present era of dentistry is focusing on conservation of natural tooth and since old ages endodontic dentistry is playing major role in restoring tooth function and after which prosthetic dentistry brings its function and esthetics back. Present era of dentistry is focusing on conservation of natural tooth and since old ages endodontic dentistry is playing major role in restoring tooth function and after which prosthetic dentistry brings its function and esthetics back. Endodontic dentistry has been playing a major role in the restoration of teeth form, function and esthetics and aims at conserving maximum tooth structure¹. The restoration to be done depends on factors like amount of remaining tooth structure, functional demand of the tooth, need of tooth as an abutment. Tooth with minimal remaining structure presents an increased risk for fracture and decreased retention. A vertical support is needed to prevent dislodgement/fracture of the restoration and therefore, to restore such teeth a post and core may be indicated.²

Post functions to provide maximum retention to the core, evenly distribute the functional stress along the root surface and to provide esthetic compatibility with definitive restoration and surrounding tissue³. Posts can be either prefabricated or customized posts.

Prefabricated posts may include metal posts, fibre posts, carbon fibre posts, etc. Cast metal posts, are customized posts, fabricated by either a direct or an indirect technique. Indirect impression is made with an elastomeric material, while in the direct technique, the pattern of the post and core is formed with acrylic resin or wax. The indirect technique encompassing digital scanning can be used as a part of the procedure with either a half-digital or full-digital technique.⁴

The digital workflow provides the advantages of simplicity, patient comfort, rapid access to 3-dimensional (3D) diagnostic information, easy transfer of data, reduced chairside time, costs and also eliminates steps and use of materials involved in conventional impression making.

CASE 1

A 23-year-old male patient reported to the Department of Conservative Dentistry and Endodontics with a chief complaint of broken and unaesthetic tooth in the upper front teeth region of jaw since 2 weeks. Patient gave history of root canal treatment (RCT) in the same tooth about 4-5 months back. Clinical examination revealed deep bite, insufficient tooth structure, to support a restoration (Fig1). Radiographical examination revealed proper RCT in #21 with very limited remaining dentin on the walls, no sign of periapical pathology and an intact periodontium. Based on the clinical and radiographic observations, the case was diagnosed as Ellis class VIII fracture in #21.

After discussion of all treatment modality, Richmond crown was opted as the treatment plan.

Periodontal Intervention

Gingivectomy was done followed by osteotomy by giving an internal bevel incision on the labial and palatal aspect of #21 for the maintenance of the biological width. After which, flap was placed back and simple interrupted suture was given using 3-0 suture.

Prosthetic Intervention

After 2 weeks, post-surgery, shade selection was done for the patient using VITA classical shade guide and post space preparation was done followed by impression of the canal with elastomeric impression material.

Laboratory Intervention

The impression was sent to the lab for extra oral scanning (Medit Identica blue scanner) and an STL file was generated (Exocad software) for designing and 3D printing of Richmond crown using DMLS technology.

The Richmond crown was tried for the fit in the patient's mouth clinically and radiographically and luted using glass ionomer cement.

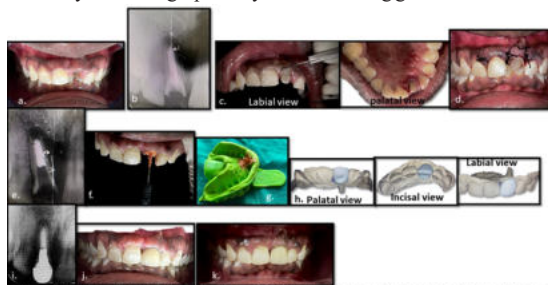


Fig 1. a) Pre-op Clinical Picture wrt #21 b) Pre Op Radiograph c) Internal bevel incision wrt #21 on the labial aspect and palatal aspect d) Suture placement e) Confirmatory Radiograph after post space preparation of 10mm f) Light body impression with number 80 k-file after even spreading of the material within the canal with lentulo spiral g) Final Impression made using elastomeric impression material h) Virtually designed Richmond Crown using Exocad Software i) Radiographic Evaluation j) Clinical Evaluation and luting k) 1 month follow up.

CASE 2

A 22-year-old female patient reported to the department with a chief complaint of broken tooth because of trauma in the lower front teeth region of jaw since few years. The patient gave history of RCT in the same tooth about 5 months ago which on clinical examination revealed insufficient tooth structure to support a restoration (Fig2). Radiographic examination revealed previously root-canal treated #31, #41 with no signs of periapical pathology and an intact periodontium which was diagnosed as Ellis class VIII fracture in #31, #41.

Custom post and core was planned as a treatment modality. Prosthetic

and laboratory intervention was carried out in a similar manner as in case 1

On obtaining a good fit of the post in the patient's mouth, it was luted using glass ionomer cement. Tooth preparation was then carried out over which a porcelain fused to metal (PFM) crown was given.

CASE 3

A 32-year-old male patient reported to the department with a chief complain of broken tooth because of trauma in upper front teeth region of jaw since few years. The patient gave history of RCT in the same tooth about 6-7 months back. Clinical examination revealed extremely scarce tooth structure to support a restoration (Fig3). Radiographical examination revealed previously root canal treated #11 with no sign of periapical pathology and an intact periodontium. The case was diagnosed as Ellis class VIII fracture with respect to #11.

Custom post and core was planned followed by shade section and the treatment was proceeded similarly as case 2

For all the above mentioned cases, consent form was signed by the patients prior to the initiation of treatment.



DISCUSSION

Irrespective of the approach opted for the management of badly mutilated endodontically treated teeth post and core serves to be one of the best treatment option in saving the tooth structure. Thus, aiding in rehabilitation of a beautiful smile especially in case of anterior teeth.⁵ For management of case 1, an interdisciplinary approach was opted in which gingivectomy was done for gingiva #21 to contour lost shape of inflamed gingiva. Following which osteotomy was done to maintain the biological width.⁶

The indirect post and core fabrication technique has been found to be comparable⁵ or superior to direct technique. Pitigoi-Aron et al (2012) found that the indirect fabrication of post and showed better accuracy than direct technique, which can be attributed to the continuing shrinkage of the resin pattern in direct group.⁷

One of the key elements in assessing the success of a restoration has always been the accuracy of the fit of the restoration. The internal wall adaptation and adequate apical extension of the metallic post will help in superior stress distribution within the root canal space. In this case series, direct metal laser sintering (DMLS) technology has been used to fabricate metallic post and core in conjunction with semi-digital workflow.

Direct Metal Laser Sintering (DMLS) is a laser-based additive manufacturing technology which produces three-dimensional complex shapes from the powder material in a layer by layer fashion directly from the metal powder (Co-Cr powder) having a particle size of 3–14 μm .⁸

The marginal gap and internal adaptation of DMLS technique was better compared to conventional casting.⁹ This combined with very fine point laser (0.1 mm) results in a density of 99.9 %, resulting in stronger copings with high accuracy and well detailed restorations.

Laser sintering is a computer-controlled, precise process that ensures consistent work quality. The use of automated scanning and CAD software results in full control over the framework design. Hence it can be stated to be a clean alternative to casting. Though, further studies are recommended to compare the outcomes of this technique with conventional techniques.

CONCLUSION

Digitalization in the field of dentistry, which includes use of scanner and CAD/CAM, which proves to be an alternative to the conventional technique with better accuracy and reduced chair time. Although these post and core restorations offer good fracture resistance, bond strength, adaptation, stress distribution and superior aesthetics, more long term in vitro and in-vivo studies required to substantiate the results of this clinical reports

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