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Fully Digital Direct Technique for CAD-CAM post and core restorations - a case report

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Abstract

Restoring the endodontically treated teeth is highly problematic without residual hard tooth tissues and destruction at the gingiva level -no ferrule effect. One possibility is to make post and core restoration. Aim. This article aims to establish the time needed to produce post and core restoration and temporary crown by the fully digital direct method. Materials and Method. A patient visited for restoration of a fractured tooth 34. We decided to make CAD-CAM post and core restoration and temporary crown by fully digital direct methods. Results. The total time estimated was three clinical visits or 180 minutes, with a standard time for one clinical visit of 60 minutes. Conclusion. Within this clinical case, we found that three clinical visits or 180 minutes were required for the fully digital production of computer-assisted posts and cores of chromium cobalt and a temporary 3D-printed crown. The accuracy of the recovery is acceptable. Further research is needed in this direction.

Keywords: post and core restorations; digital dentistry; 3D printing.

Introduction

The strength of the hard tooth tissues is impaired after the removal of the dental pulp for endodontic treatment. In opening the pulp chamber, a significant part of the tissues is removed, which is unfavorable from a biomechanical point of view. Therefore, preserving the maximum amount of hard tooth tissues is desirable. Still, sufficient access to the tooth's root canal system is also necessary to ensure a good result from the endodontic treatment. Restoring these teeth is highly problematic without residual hard tooth tissues and destruction at the gingiva level -no ferrule effect[1]. Studies by various authors show that the placement of the post and core construction of the destroyed teeth does not strengthen them but weakens the tissues[2]. The results are expressed in fractures of the treated roots. Post and core restoration is a challenging and complex clinical procedure. It requires consideration of many factors, such as the thickness of the root of the tooth, root length, and the presence of remaining dental and enamel walls above the gingiva, to ensure the strength of the construction through the ferrule effect and others. In addition, taking a standard impression is complicated, as it is necessary to print the intracanal features of the tooth and others accurately. Different types of materials for post-construction also place additional requirements[1].

For making post and core restorations, there are different options. The types of posts and core building materials are steel, zirconia, and fibber. A restoration method indicated direct constructions with different types of posts and core build-up with composite materials[3]. Indirect post and core restorations are conventional and also by digital methods. Conventional indirect restorations are labor-intensive and complex laboratory artistry, which is why the result is not always predictable. On the other hand, digital posts and core restorations are relatively new, with facilitated methodology and excellent results[3].

It remains an open question of which method of restoration and type of materials is to be applied to protect the remaining tissues and restore affected tooth structures in the long term
This article aims to establish the time needed to produce post and core restoration and temporary crown by the fully digital direct method.

Material And Methods

A 59-year-old DW patient visited to restore a fractured tooth 34. The clinical examination found an endodontically treated tooth without periapical changes with destruction almost at the gingiva level (Figure 1 A) and a previous post and core restoration with a crown. Analysis of adjacent teeth found that distally located teeth were implants. Therefore, if extraction of tooth 34 is needed, the subsequent treatment would also be with an implant. A decision was made to produce a post and core restoration. The patient signed informed consent by legal requirements. The first clinical visit is for examination and preparation of the treatment plan.

Second clinical visit. The root canal and gingiva-level tissues were formed with suitable burs. A scan body (3Shape, Copenhagen, Denmark) for post restoration is fitted with dimensions 1.7 mm thick and 12 mm long. With an intraoral scanner, a Trios 3 footprint (3Shape Dental System. 3Shape, Copenhagen, Denmark) (figure 1 B, C, D) was taken and submitted to a laboratory to fabricate post and core restoration from chromium-cobalt alloy and a temporary crown.

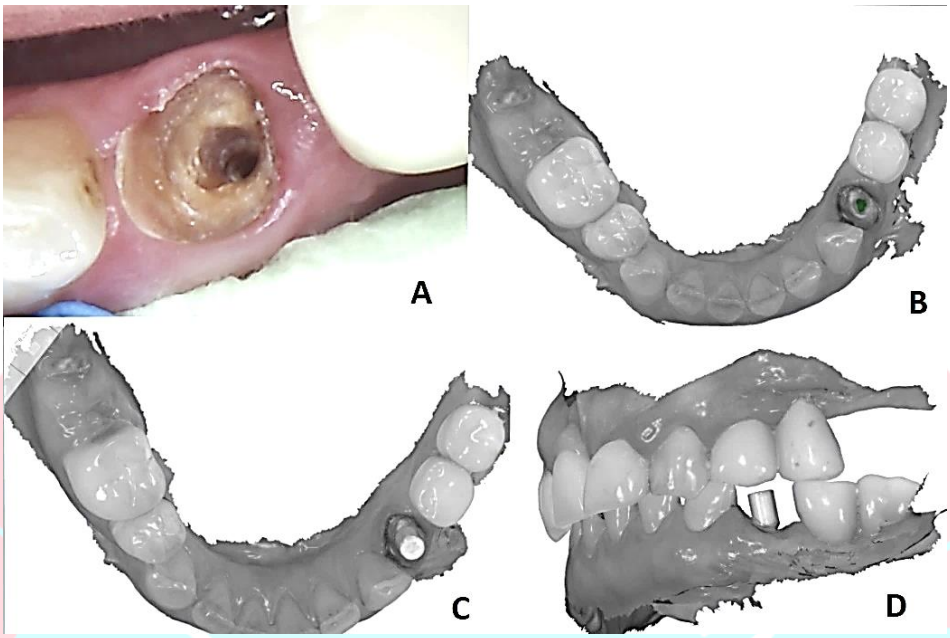

Figure 1. A. Tooth root prepared for digital impression; B. Impression of the tooth root after application of a retraction cord; C. Digital impression with placed scan-body; D. The bite impression taken, ready for sending to the laboratory.

The time for preparing the tooth tissues and the root canal and taking the digital impression is established in the number of visits.

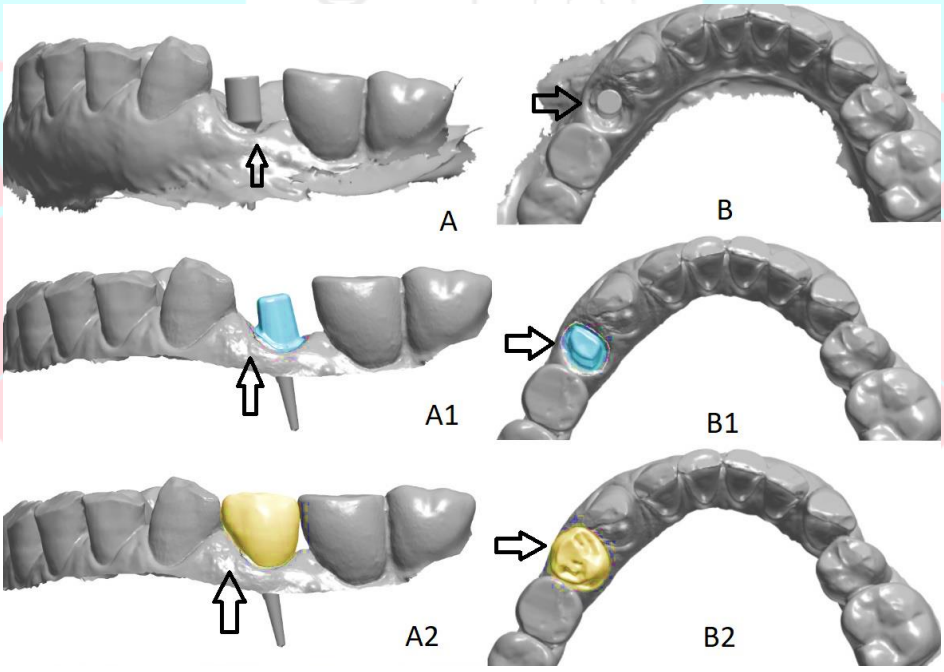

Figure 2. A, B. The finished model with scan-body; A1, B1. The model with the prepared virtual post and core; A2, B2.The model with the prepared virtual temporary crown.

The digital post and core preparation sequence are shown through the software of 3Shape (3Shape, Copenhagen, Denmark). Then, the finished post and core computer models and the temporary crown are submitted for fabrication to computer-assisted machines. Finally, the post and core, and temporary crown are made according to the proposed models by printing with different types of machines. The post and core are made by laser sintering from chrome-cobalt alloy(TRUPRINT 1000, 3D FUSION). The temporary crown is from photopolymerizing composite resin on a NextDent printer 5100 (3D systems, Rock Hill, South Carolina, USA).

Results

For the first and second clinical visits, a time of 2 visits was recorded. The standard time for one clinical visit is 60 minutes.
Second clinical visit. After receiving the finished post and core (Figure 3C), it is adjusted (Figure 3D) and cemented (Figure 3E) with i-Cem(Pulpdent Corp. 80 Oakland Street, Watertown, MA, USA). The adjusted and cemented temporary composite resin crown (XtraLute, MEDICEPT UK LTD) is shown in Figure 3 F.

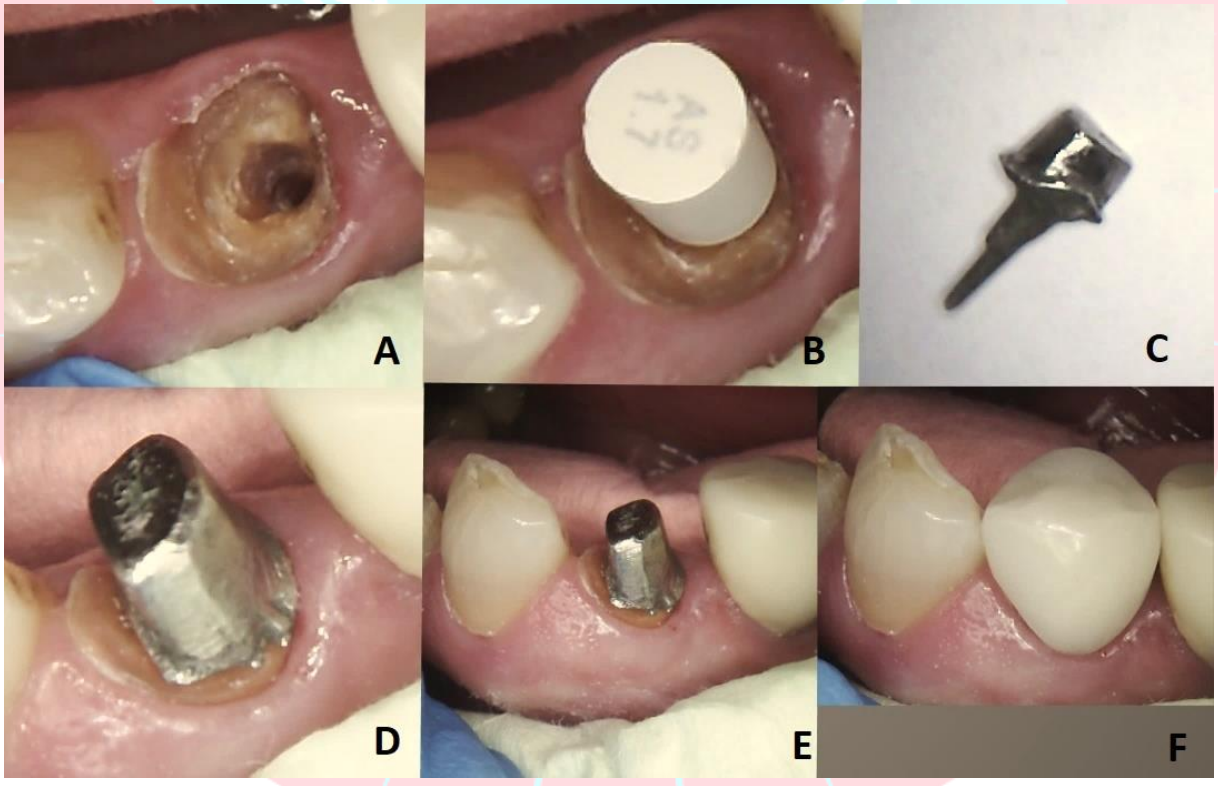

Figure 3. A. The prepared tooth for post and core restortion; C. The tooth with the placed Scan-Body; C. The finished post and core restoration; D. The post and core placed on the tooth; E.The cemented post and core; F.The cemented temporary crown.

The prepared digital post restoration did not require the removal of pearls on the casting. It is probably due to the laser sintering. There were no pores on it. The prepared temporary crown adheres precisely to the

operative field. The placement and adjustment of the digital post and core with a temporary crown are made in one clinical visit - 60 minutes.
The total time reported was three clinical visits or 180 minutes, with a standard time for one clinical visit of 60 minutes. The time is recorded according to the clinical visits -one hour in the schedule of the dental center.

Discussion

Direct digital technology significantly reduces the clinical time for the fabrication of chromium-cobalt alloy construction. Inaccuracies are avoided due to volumetric changes in impression materials and plaster for models and volume changes in wax and composite models[1,2]. The fully digital method simplifies and shortens clinical and laboratory procedures. Post and core restorations with aesthetic materials have been studied in the literature[4,5]. As a result, the accuracy of the fitment to the walls of the root canal and the endurance to chewing forces by various stimulators have been established. Still, the studies with chromium-cobalt alloy for CAD-CAM post and core are insufficient, as are the long-term clinical studies. The use of this type of alloy without a nickel in its composition is favorable, as it has been proven that nickel is one of the main allergenic components in alloys used for dental restorations[6].
According to research by Moustapha and co-authors, the mechanical properties of CAD-CAM post and core restoration are more favorable [7].
Studies by Leven R and co-authors on the accuracy of different types of scanners prove that there is no significant difference in the accuracy of the studied intraoral scanners regarding the fabrication of CAD/CAM zirconia posts and cores[8].

Conclusions

Within this clinical case, we found that three clinical visits or 180 minutes were required for the fully digital production of computer-assisted posts and cores of chromium cobalt and a temporary 3D-printed crown. The accuracy of the recovery is acceptable. Further research is needed in this direction.

References

1. Al-Qarni FD. Customized Post and Cores Fabricated with CAD/CAM Technology: A Literature Review. Int J Gen Med. 2022;15:4771-4779.
2. Kanduti D, Korat L, Kosec T, et al. Comparison between accuracy of posts fabricated using a digital CAD/CAM technique and a conventional direct technique. Int J Prosthodont. 2021;34(2):212–220.
3. Schmidt A, Binder R, et al. Accuracy of Digital Impression Taking with Intraoral Scanners and Fabrication of CAD/CAM Posts and Cores in a Fully Digital Workflow. Materials (Basel). 2022;15(12):4199.
4. Suzaki N, Yamaguchi S, Nambu E, Tanaka R, Imazato S, Hayashi M. Fabricated CAD/CAM Post-Core Using Glass Fiber-Reinforced Resin Shows Innovative Potential in Restoring Pulpless Teeth. Materials (Basel). 2021;14(20):6199.
5. Saisho H, Marcolina G, Perucelli F, Goulart da Costa R, Machado de Souza E, Rached RN. Fracture strength, pull-out bond strength, and volume of luting agent of tooth-colored CAD-CAM post-and-cores [published online ahead of prin.. J Prosthet Dent. 2022;S0022-3913(22)00419-X.

6. De Graaf NPJ, Roffel S, Gibbs S, et al. Nickel allergy is associated with a broad spectrum cytokine response. Contact Dermatitis. 2023;88(1):10-17.
7. Moustapha G, AlShwaimi E, Silwadi M, Ounsi H, Ferrari M, Salameh Z. Marginal and internal fit of CAD/CAM fiber post and cores. Int J Comput Dent. 2019;22(1):45-53.
8. Leven R, Schmidt A, Binder R, et al. Accuracy of Digital Impression Taking with Intraoral Scanners and Fabrication of CAD/CAM Posts and Cores in a Fully Digital Workflow. Materials (Basel). 2022;15(12):4199. Published 2022 Jun 13. doi:10.3390/ma15124199

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