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Digital Guided Therapy– A Treatment Strategy For Management Of Pulp Canal Obliteration: A Case Report

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Abstract

Injuries to the tooth, whether low-grade and repetitively sustained over a period of time or a one-time force causing catastrophic changes in the homeostasis of the tooth and its environment, lead to either deposition or resorption of hard tissue. Hard tissue formation in the pulp canal space leads to calcification and closure of the pulp space, which is often referred to as pulp canal calcification (PCC) or pulp canal obliteration (PCO). For endodontist, any of these root canal calcifications impede negotiation of canal, debridement, and shaping of the canal system. Additionally, locating the root canal orifice and the canals could lead to gouging and stripping of the hard tissue and weakening of an infected but structurally intact tooth if treated conventionally. These challenges have led to the development of guided endodontic therapy (GET). Its a technique used by the alignment of cone beam computed tomography (CBCT) imaging and intra-oral surface scans to design and fabricate a three-dimensional (3D) printed stent. This case report show cases endodontic management of right maxillary central incisor with pulp canal obliteration using static guided endodontic treatment and ultrasonics under magnification which was already treated with conventional approach which had led to cervical perforation. This case report followed the PRICE 2020 (Preferred Reporting Items for Case reports in Endodontics) guidelines.

Keywords: Static Guided Endodontic Therapy,Pulp Canal Calcification (PCC),Cone Beam Computed Tomography (CBCT), 3D Printed Endodontic Stent, Ultrasonics in Endodontics, Dental Trauma

Introduction

A 23-year-old female patient reported to the Department of Conservative dentistry and Endodontics with a chief complaint of on and off episodes of pain in her upper front teeth region for past few months and a breach on her upper right front tooth. Patient's past dental history revealed that patient had undergone root canal treatment which was incomplete and also had a labial perforation in her upper right front tooth. Patient also gives a history of orthodontic treatment done before 6years and treatment was incomplete. Patient's medical history was non contributory. On hard tissue examination, labial perforation was seen in relation to #11 with temporary restoration. After clinical examination , pulp sensibility testing was done using endoice (Endo-Frost Coltene) which had showed a negative response on both 11,21 . IOPA revealed previously root canal treatment attempted #11 and #12, with pulp canal obliteration from coronal to middle third with labial perforation, PDL widening and periapical radiolucency in the peri-radicular area. #12 also showed the presence of PDL widening and periapical radiolucency in the peri-radicular area. Inorder to confirm the extent of the pulp canal obliteration and location of labial perforation, a CBCT was adviced. CBCT on sagittal section revealed the presence of labial perforation near the cervical region of #11 along with pulp canal space obliteration in the coronal third of the root. Canal was evident 10mm from the incisal tip of #11. On comparing clinical and radiographic findings, the diagnosis was given as Iatrogenically induced non-vital 11 with pulp canal calcification and symptomatic apical periodontitis. For 12, diagnosis was given as non vital tooth with symptomatic apical periodontitis. Non surgical root canal treatment with Static Guided Endodontic Therapy was planned for # and 11conventional non- surgical root canal treatment was planned for tooth #12.

FIGURE 1: Pre-operative photograph and radiographic examination. (a) Tooth 11

(b) The 2D radiograph of tooth 11 and 12 with associated periapical radiolucency.

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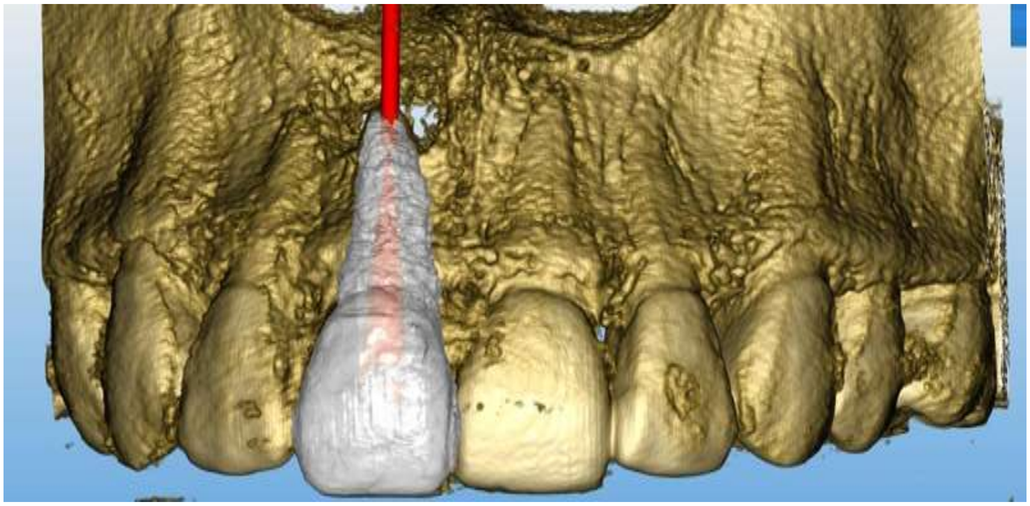
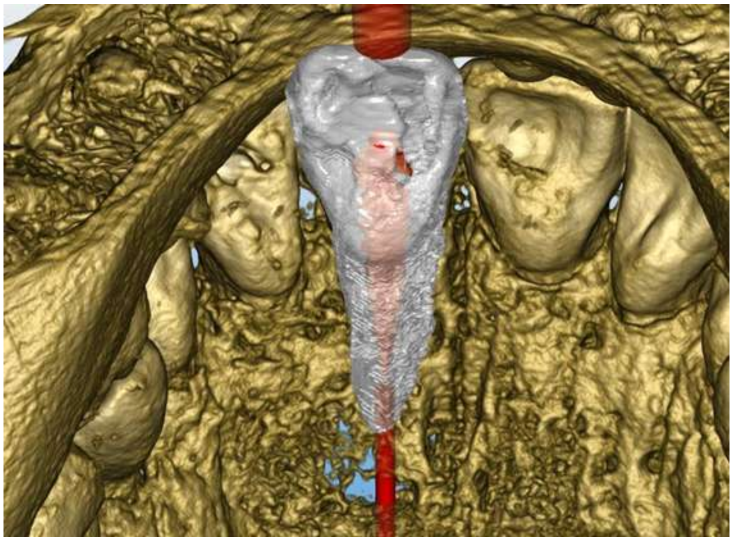
Tooth #11- calcified pulp chamber space seen along the long axis of the tooth; also seen are widening of periodontal ligament space and loss of lamina dura. Well defined moderately sized periapical radiolucency is seen associated with both teeth. (c-f) Pre-operative CBCT images.

Note in the sagittal section (f) the calcification of the pulp chamber space.

Treatment planning phase

For fabrication of static guide, intra oral scans was taken using an (3Shape intra oral scanner (TRIOS™, 3Shape, Copenhagen, Denmark),in STL files. Computer-aided designing (CAD) of the template was performed using the implant studio software (3Shape Implant Suite™), CBCT DICOM images and STL files of intra-oral scans were superimposed to fabricate the static guide. (Figure 4).





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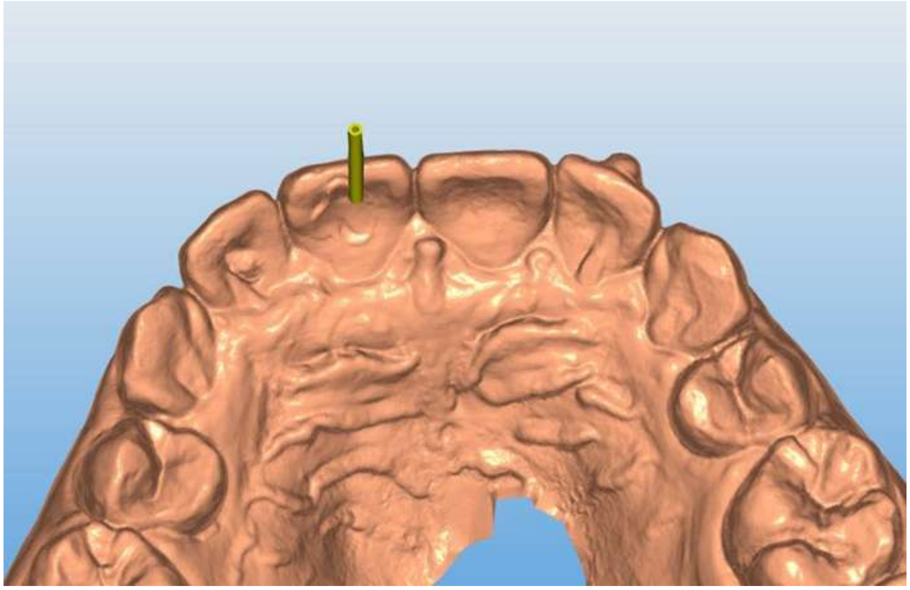
The stent/template was materialized through 3D printing or milling processes.



Using the CBCT images, the estimated position of the accessible pulp space in the cervical one-third was identified, and the minimum length required to reach the target site (10mm) was identified.

The below image show 3D-printed stent/template fabricated for static guided treatment

Treatment phase

1. 3D-printed model was checked for fit in the patient's mouth

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2. The tooth was anaesthetised with 1.8 mL of 2% lignocaine containing 1:80,000 adrenaline. To check and confirm the path of insertion of the bur, the tip of a graduated periodontal probe was dipped in methylene blue dye material and inserted into the entry point. The marked dye impression of the graduated probe was counter-checked with the insertion of the bur through the entry point. A long shank bur (length/diameter: 34/0.6 mm) was selected for access opening, and the dimensions of the selected bur were noted to design the combined inner and outer access dimensions of the static guide. The access opening was performed in a pecking motion using a low-speed handpiece using Long shank bur with intermittent water spraying as a coolant as shown in the figure[1]. In between assessment radiographs were taken to confirm the path of insertion and angulation of the bur.

Since the calcification was 10mm away from the incisal tip, negotiation was impeded with LN bur. Once the path was confirmed with LN bur, ultrasonic tip (ACTEON TIP-ET 25) was used under operating microscope in order to negotiate the canal.

Consequently radiographs were taken to assess the progress. At 10mm the canal was negotiated with #10 D finder file.

Continuous irrigation with Twin Kleen(HEBP+NaOCl) was carried out and canal was negotiated till the apex. Working length was determined and glide path preparation was done with GenEndo- glide path files. Cleaning and shaping was done using GenEndo files(by Micro Mega, Coltene India). Continuous irrigation was carried out using Twin Kleen(HEBP+NaOCl)Maarc Dental Innovationsendo, India) and it was used as the final irrigant.

The canal was dried with sterile absorbent paper points, and calcium hydroxide dressing was given for seven days. In the second appointment, the canals were irrigated with normal saline and dried with sterile absorbent paper points. The canal was obturated using Gutta-percha (25/0.4) and bioceramic sealer. Permanent restoration was done using composite resin.

Discussion

Traumatic injuries to the permanent dentition have deleterious sequelae if not treated adequately. In case of any kind of dental trauma, treatment planning depends on the type of dentition, location of the tooth, and the extent of tooth tissue that is lost due to trauma. PCO, also referred to as pulp canal obliteration, calcific metamorphosis, or dystrophic calcification, is commonly associated with trauma, but other etiological factors such as caries, deep restorations, trauma from occlusion, physiologic change, and orthodontic movement have also been observed. It is a radiographical finding, which normally presents clinically with a tooth associated with a history of trauma. Calcified tooth are more commonly asymptomatic and discoloured. Presence of radiographic changes or radiolucency in the periapical

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region dictates the need for endodontic intervention. In this case long term orthodontic treatment could be the reason for pulp canal obliteration .

Calcification at any levels, in an unexperienced hand leads to iatrogenic errors such as perforations, loss of sound tooth structure, and peri-cervical dentin, which reduces prognosis of the tooth. Advancements in the field of digital dentistry led to the recent development of guided endodontic therapy. They are divided into static navigation (SN) and dynamic navigation (DN). The guided endodontic approach uses advanced imaging, and CAD-CAM technologies used in guided implant dentistry to design and fabricate a digital stent to provide the clinician with a straight path to follow while attempting minimally invasive endodontic access to the targeted tissue site.

The sleeveless guide system was used in this study because it requires less space above the occlusal surface and provide better visibility than sleeve template[2]. Sleeve guide system will constrain the bur movement which may lead to perforation. A periodontal probe was used to help identify the clinical crown's profile and the root canal's alignment.

0.85mm diameter bur was used to ensure a minimally invasive approach considering the size of the tooth treated. Also long-shank smaller diameter burs (0.85 mm) when compared to larger diameter burs (1.5 mm) generate lesser heat as suggested by Neil V Lewis et al [3]

Ultrasonic tips are used in digital guided therapy to treat pulp canal obliteration (PCO) in combination with other tools, such as dental operating microscopy (DOM) and cone-beam computed tomography (CBCT). Ultrasonic instrumentation enables safe negotiation of the canal at greater depths within the pulp chamber. The combination of dental operating microscopy (DOM) and ultrasonic tips (US) may help in identifying obliterated canals. DOM offers magnification and lighting, while ultrasonic tips allow working at greater depth within the pulp chamber safely, with a low risk of iatrogenic injury. [7]

D Finder file(Mani) was used to negotiate the root canal since it has a unique blend of non-cutting and cutting features and 1.5 times more fracture resistance than other penetration files according to Rich Mounce et al. Therefore it is effective for root canals that are narrowed by calcification because it resists but penetrates easily in the canal. D Finder files are stainless steel hand files with D-shaped cross section, which increases stiffness by up to 50%used.

The GenENDO files were used in this study since it has an asymmetrical cross-section which helps in recapitulating and smoothening of the canal walls. The T wire treated Coronal flare file gives the much required coronal enlargement with much ease, on the other hand, the special Glide Path file ensures a smooth path in extremely difficult cases with severe curvatures and thinner canals. The C wire treated Preparation File and the Universal Finishing File represent the amalgamation of strength and flexibility[4].

Twin Kleen, which consists of 9% HEBP was freshly mixed with 3%NaOCl and was used as a one-step final rinse. It is safe to use with NaOCl and has been suggested for the continuous soft chelation of the root canals and also designed for efficient root canal irrigation. This combination effectively eliminates debris impaction in anatomical irregularities, ensuring thorough cleaning of the root canal system. Hence with continuous irrigation, the irrigant is continuously flowing to irrigate the root canal simultaneously and better lubrication is achieved throughout the procedure[5].

Limitations

Digital planning is time-consuming, and there is significant skill involved in designing the digital stent. There are also few drawbacks or concerns while performing guided endodontic treatment such as micro-crack formation that originates from the root surface during access opening and the heat generated on the external root surface that may result in injury to periodontal ligament and surrounding bone tissue. The skill of the clinician is also a factor as any deviation or error may result in the fracture of the drill itself.

Conclusions

Guided endodontics employs a minimally invasive endodontic approach to successively treat teeth with pulp and periapical disease. In the treatment of PCO, bypassing the laws of access cavity using a digital stent provides clinicians with a straight path to follow, which makes it easier to treat. Digital planning is time consuming and crucial as it contributes to the ease of treatment, thus reducing the patient-chair time. Using guided access cavity allows rapid and accurate

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treatment while conserving tooth structure and is a viable treatment modality in cases of compromised tooth anatomy.

References

1. 1.2023 Jul 24;15(7):e42379. doi: 10.7759/cureus.42379. Static Guided Endodontic Approach for Pulp Canal Obliteration: A Case Report. Neil V Lewis 1, Shalini Aggarwal 1,
2. April 2023, 104466, In vitro study on the accuracy of sleeveless guided endodontics and treatment of a complex upper lateral incisor. Torres a b, M. Dierickx b, W. Coucke d, MS. Pedano b, P. Lambrechts b, R. Jacobs. https://doi.org/10.1016/j.jdent.2023.104466
3. 2023 Jul 24;15(7):e42379. doi: 10.7759/cureus.42379. Static Guided Endodontic Approach for Pulp Canal Obliteration: A Case Report. Neil V Lewis 1, Shalini Aggarwal 1.
4. Redefining the new generation endodonticsGenEndo Files: cases reports and review. Harpreet Singh. 2022;13(1):21-23. DOI: 10.15406/jdhodt.2022.13.00564
5. J Conserv Dent 2012 Apr-Jun;15(2):170–173. doi: 10.4103/0972-0707.94587. Effect of ethylene diamine tetra-acetic acid, MTAD™, and HEBP as a final rinse on the microhardness of root dentin. Mukura Kulasekaran Dineshkumar 1, Thilla Sekar Vinothkumar 1,✉, Ganesh Arathi 1, Partheeban Shanthisree 1, Deivanayagam Kandaswamy PMCID: PMC3339014.
6. Dent. J. 2024, 12(6), 166; https://doi.org/10.3390/dj12060166. Management of Calcified Canals with a New Type of Endodontic Static Guide: A Case Report by Roberto Fornara,Massimo Pisano,Giovanni Salvati,Giulia Malvicini, Alfredo Iandolo,Carlo Gaeta
7. Iran Endod J. 2017 Fall;12(4):527–533. doi: 10.22037/iej.v12i4.18006. Clinical Approach to Pulp Canal Obliteration: A Case Series. Kenia Maria Soares de Toubes a, Patrícia Alves Drummond de Oliveira b, Stephanie Nicácio Machado a, Vânia Pelosi a, Eduardo Nunes c, Frank Ferreira Silveira.

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