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# Static Guided Approach for Obliterated Canal -A Case Report of Maxillary Central Incisor

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**Abstract:- In recent decades, significant technological advances have deeply influenced our daily lives. Notably, innovations such as 3D printers and 3D cone-beam computed tomography have become valuable tools in clinical dentistry. Diagnosing and treating teeth with pulp canal obliteration presents unique challenge in endodontic procedures. These challenges include the risk of breaking root canal instruments during treatment, preparing overly extended access cavities, and misaligning the access cavity, which could potentially lead to root perforation. Recently, guided endodontics has gained popularity as a method to address these issues. This case report explores the use of guided endodontics in treating a maxillary central incisor with pulp canal obliteration. This approach is advantageous as it reduces the time patients spend undergoing treatment and, more critically, minimizes the risk of inadvertent damage to the tooth structure.**

***Keywords***:- *Pulp Canal Obliteration, 3D Printers, 3D Cone Beam Computed Tomography, Guided Endodontics.*

## I. INTRODUCTION

In permanent teeth, partial or complete pulp canal obliteration (PCO) is frequently observed and is linked to traumatic injuries, age, caries, and systemic illnesses. As a result of the pulp repair process, tertiary dentin is deposited in response to injury (such as traumatic injuries, caries, orthodontic treatment, etc.), obliterating the pulp chamber and the root canal space. PCO could develop as a whole or in part. PCO is common in young permanent teeth following luxation injuries, despite variations in its frequency reported in the clinical literature from 3.7% to 40% after traumatic dental injuries (TDI) and from 29.4% to 95.2% after root fracture.[1,2] Usually this teeth are asymptomatic, the calcification process is detected either by chance during a radiological examination or by a yellowish discoloration of the tooth.

Dentine deposition is regarded as an indirect indicator of pulp vitality, even though sensitivity testing typically yields a negative result. It is generally agreed that root canal therapy is not necessary until there is clinical and radiographic confirmation of pulpal or periapical pathosis.[3,4] On the other hand, calcified teeth may eventually require root canal therapy due to apical periodontitis. After a longer observation period, this is expected in up to 27% of the studied teeth with PCO.[4]

Treating such scenarios endodontically is a major challenge. Even when done with the use of magnification devices, it can still take a lot of time and effort and become more difficult due to major hard tissue loss, perforation, or challenge in gaining access to the cavity.[3]

"Guided endodontics" was invented for safer, less invasive intervention of difficult calcified root canals with the combined use of intraoral optical scanning and CBCT. This approach lessened the chance of technical errors and shortened treatment times.[3,5]

There are two methods to approach the preparation of a guided endodontic access: dynamic navigation uses a camera system and markers placed in the patient's mouth, while static guiding involves the use of a template. This case report aims to explain the application of guided endodontics technique as a minimally invasive approach to treating calcified maxillary central incisor.

## II. CASE DESCRIPTION

A 35-year-old female patient was referred to the Department of Conservative Dentistry and Endodontics, with the chief complaint of pain in the upper front area of her jaw. She had experienced trauma to the upper anterior region seven years prior. The patient had no general or chronic illnesses and was in good health. During the clinical examination, we discovered a slightly discolored upper right

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central incisor (Fig. 1). Both cold and electric pulp tests revealed a negative result, and the tooth was painful to the percussion. A largely obliterated pulp chamber and pulp canal were visible on the periapical radiograph (Fig. 2). To get a closer look at the periapical region, a CBCT was done. Clear indications of apical periodontitis and widening of the periodontal ligament were seen on the CBCT. (Fig. 3)

The decision was made to execute endodontic treatment with guided access due to the potential risk of increased tooth material loss and perforation during access opening.

From a rubber-based addition silicon impression, a gypsum cast of the maxillary arch was made. It was later scanned using an intraoral scanner. To design an endodontic guide, the STL file from the intraoral scan and the DICOM files from the CBCT was required. The software Blue Sky Plan (Blue Scan Bio) integrated these two files. The guide was created using a 3D printer, and the splints was designed using 3D implant planning software. In sagittal, axial, and coronal dimensions, the correctness of the merging was cross-checked (Fig. 4). In order to ensure straight-line access to the root canal, bur path was made. The guiding cylinder measured 5 mm in length and 1.2 mm in diameter, respectively was made. An endoguide bur (SS White) measuring 18 mm in length and 1 mm in bur head diameter was our choice. Based on the CBCT scans, we selected a milling depth of 18 mm.

Fig 1 Discoloration of Left Maxillary Central Incisor

Fig 2 Preoperative Radiograph


Fig 3 CBCT Showing Calcification in Cervical and Middle 3rd of Canal


Fig 4 CBCT Picture Displaying a Virtual Implant that is Scheduled: Endodontic access Path in (a) Sagittal View and (b) Coronal View.

Fig 5 Isolation and Fit of Guide was Checked

Before the insertion of the guide, multiple teeth were isolated using a rubber dam (Hygenic, Coltene Whaledent, USA). The fit of the 3D guide was verified once it was positioned on the maxillary teeth. (Fig. 5) On the tooth surface, the entrance point was marked. To do this, a drop of colored composite was applied to the tip of the pin, designating the tooth surface entry location (Fig. 6).

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The endodontic hand piece was used to guide the endoguide bur (EG bur) through the guide's sleeve at a speed of 250 revolutions per minute in order to prepare the drill path. (Fig. 7)

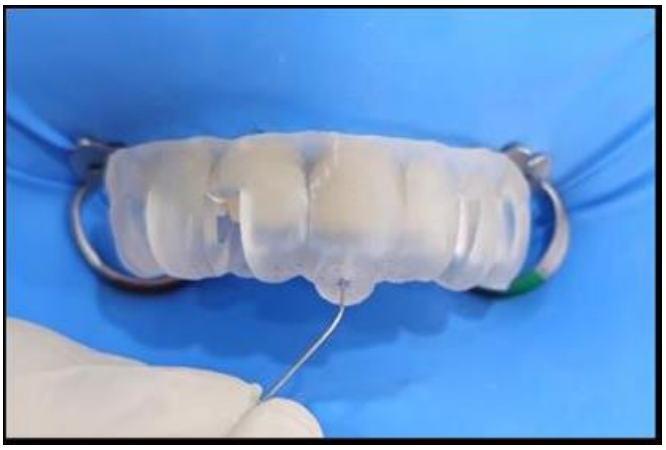

Fig 6 Entry Point was Marked using Pin

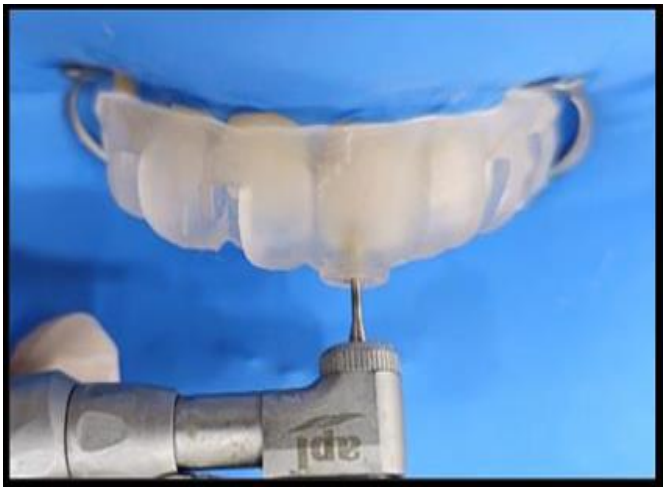

Fig 7 Drill Path was Created using Endoguide

Fig 8 Picture of the Conservative Endodontic Access Opening

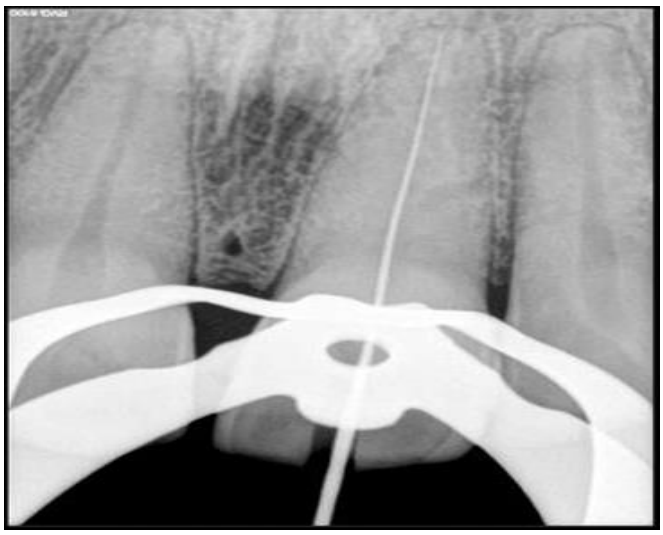

Fig 9 Working Length Radiograph

Fig 10 Mastercone RVG

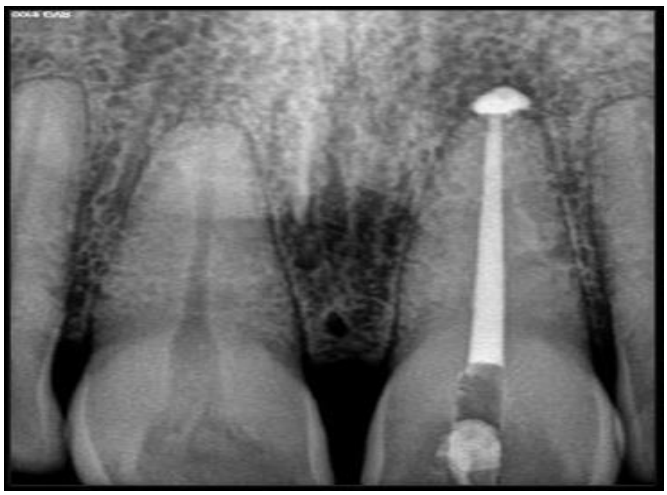

Fig 11 Postobturation RVG

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After the access opening (Fig. 8), an 8-no-K file (Mani, Inc., Japan) was used to negotiate the canal. The apex locator was used to establish the working length, which radiographically validated. (Fig. 9) Cleaning and shaping was performed with rotary files (Neoendo flex, orikam) upto #30(6%), iriagation was performed with 0.9% saline, 3.25% NaOCl and EDTA alternatively. The last rinsing solution was 0.9% saline. Mastercone RVG was taken. Before obturation, the canal was dried with absorbent paper points (Fig. 10). Using a single cone method and a bioceramic sealer (safe endo-bioactive RCS), obturation was carried out (Fig. 11).

## III. DISCUSSION

In teeth with calcified canals, root canal therapy should be carried out prior to prosthetic and surgical treatment if the tooth exhibits radiological evidence of periapical illness or if the patient reports symptoms.[2] With the rapid advancement of digital dentistry, patients now have reliable, quick, and simple solutions for a variety of difficult procedures.

Variety of methods can be used for diagnosis of teeth with pulp calcification, periapical radiograph is the first choice examination for endodontic pathology mainly for exposing patients to low radiation doses, but because they are only two-dimensional depictions of three-dimensional structures, they provide only a limited amount of information. Furthermore, the presence of superimpositions, undesired shadows, and geometric distortions might complicate interpretation. By offering exact, higher-resolution three-dimensional views, CBCT gets beyond these restrictions. With the help of CBCT, root canal morphology and degree of calcification can be detected and mapped much more effectively, potentially leading to better root canal therapy outcomes.[6,7] So the CBCT examination was performed in the present case.

Using the guided endodontic approach, one can more easily align an instrument along a desired path, Without use of a dental operating microscope and withot any documented procedural errors to date, the 3D guides guide the drill to the proper location. It is more precise and secure than traditional endodontics, doesn't depend on the experience of the practitioner, and takes less time for the patient to go through treatment.[8]

Another advantage of guided access technique is minimally invasive access & which can preserve pericervical dentin . Preserving the pericervical dentin functions as a stress distributor. The pericervical dentin may strengthen the tooth's resilience to fracture and raise the likelihood that a prosthetic restoration will be successful in the future.[2]

Applications of endoguides include not only endodontic cavity access and canal location with pulp obliteration, but also osteotomy, apicoectomy, retrograde fillings, fiberglass post removal, and the treatment of teeth with morphological asymmetries. [2]

In the present case, the access opening with the help of engoguide was done. After the thorough examination, impression was taken with addition silicon impression which yielded great precision. Silicon impression is readily available, easy to use, and less costly than the optical impression which was used in most previously reported cases of guided endodontics.[8]

Coming to guide specifications, it has been suggested in previous articles that the sleeves should have a minimum height of 5 mm. Thus, in this instance, a 5 mm sleeve length guidance was used. Higher sleeve height appear to increase the amount of contact area between the sleeve and the drill, allowing for more accurate guiding.[9]

During the treatment multiple teeth were isolated at once with a rubber dam to achieve guide stability. While performing access opening, incisal-shifted approach was selected in this study to address some of the drawbacks of the cingulum access frequently employed in anteriors. Because of the enhanced straight-line access to the apical third with higher instrumentation ability, this could be advantageous for pulp canal calcification negotiation.[10]

**Zehnder et al. and Connert et al**. evaluated stent guided access preparations in ex vivo investigations by superimposing a postaccess CBCT over preoperative planned access. At the bur's tip, they revealed minor deviations from the planned access (0.12–0.34 mm), with a mean angular deviation of less than 2°.[11,12]

Bioceramic sealers exhibit exceptional fluidity, chemical stability, and biocompatibility. Since the single-cone approach and the combination of bioceramic sealers have produced outstanding results, it was used in this instance. Since it is not suitable for bioceramic sealers to come into contact with heat, they were only suggested for use in conjunction with single-cone techniques when they originally introduced to the market. If not, they may quickly harden.[13,14]

Initially this approach was developed for root canal treatment of anterior teeth, due to their easy accessibility to guiding template. However, the approach to multirooted teeth is also possible but patients with limited mouth opening might be a contraindication for the technique.[6] Static guidance is limited to straight roots or straight sections of curved roots, which is another limitation of the technique. Additionally, because the CBCT is required, planning takes more time, and the radiation dose is higher. Because of the extra work, the patient's expenses also go up (CBCT, template).[4] On the other hand, a perforation was avoided and the chair time for the root canal procedure was significantly decreased. These benefits may justify the additional cost. Compared to further therapy costs needed if conventional endodontic treatment fails and leads to tooth loss, the presented approach may be regarded as a cost-effective intervention. Due to the high accuracy of printed templates and extended flexibility, this technology seems very promising.[3]

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Tooth substance loss may be much greater if the root canal has to be located without guidance even when performed under the operating microscope.[3] Guided access technique is new in endodontology and traumatology. But this technique is still not commonly employed in routine practice. To achieve minimally invasive access cavity and to preserve as much tooth structure as possible, further studies and cases are needed to be conducted.

## IV. CONCLUSION

With the use of guided endodontics, practitioners can manage teeth with pulp calcifications more precisely and predictably while avoiding iatrogenic error and over preparation.

One can shorten the time required to find canals.

Additional investigation could expand the range of applications for guided dental procedures and further develop digital dentistry.

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