Acta Scientific Dental Sciences

Volume 10 Issue 5 May 2026

Case Report

# Guided Root Canal Treatment of an Obliterated Maxillary Central Incisor: A Case Report

**Hassan T Shawli***

*Department of Restorative Dental Science, Faculty of Dentistry, Taif University, Taif, Saudi Arabia*

***Corresponding Author:** Hassan T Shawli, Department of Restorative Dental Science, Faculty of Dentistry, Taif University, Taif, Saudi Arabia.

**DOI:** 10.31080/ASDS.2026.10.2109

**Received:** April 06, 2026

**Published:** April 15, 2026



## Abstract

Pulp canal obliteration (PCO) is a recognized sequela of traumatic dental injury and may complicate endodontic treatment by making canal location difficult and increasing the risk of excessive dentin removal and iatrogenic errors. Guided endodontics has been recognized as a conservative and predictable approach for managing such cases. This report describes the use of static guided endodontics for the treatment of an obliterated maxillary right central incisor. A 25-year-old female presented with pain on biting associated with maxillary right central incisor and reported a history of dental trauma. Clinical examination showed crown discoloration, a facial crack line, tenderness to percussion, negative palpation, and no cold or electric pulp testing response. Cone-beam computed tomography (CBCT) demonstrated complete canal obliteration with no visible canal lumen and no periradicular lesion. A diagnosis of pulp necrosis with symptomatic apical periodontitis was established. A static guided endodontic approach was planned by merging CBCT data with an intraoral scan in Blue Sky Plan software. A sleeveless guide was fabricated, and guided access was performed using a Munce bur to a planned depth of 15 mm. Canal negotiation, working length determination, chemomechanical preparation, and obturation were completed successfully. At the 1-month follow-up, the patient showed complete pain resolution, and clinical and radiographic findings were stable. Static-guided endodontics enabled safe, conservative management of a severely obliterated central incisor and may reduce the risk of clinical errors in similar cases.

**Keywords:** Guided Endodontics; Static Guided Endodontics; Pulp Canal Obliteration; Calcific Metamorphosis; Maxillary Central Incisor; Cone-Beam Computed Tomography; Traumatic Dental Injury; Case Report

## Introduction

Pulp canal obliteration (PCO), also termed calcific metamorphosis, is a recognized late sequela of traumatic dental injury (TDI), characterized by progressive hard tissue deposition within the pulp space that may partially or completely reduce the canal lumen [1]. A current systematic review and meta-analysis reported an estimated prevalence of PCO of 27.6% in permanent teeth following TDI [1]. Clinically, PCO may be associated with reduced or absent responses to pulp sensibility testing and a yellowish tooth discoloration [1].

Pulp canal obliteration (PCO) is frequently observed during follow-up after traumatic dental injuries and usually indicates the presence of viable pulp tissue within the canal space [2]. Management is commonly based on scheduled clinical and radiographic follow-up, including documentation of symptoms and pulp sensibility testing, rather than routine prophylactic intervention [2]. Contemporary evidence synthesis supports this conservative approach: for discolored but asymptomatic teeth with PCO, external bleaching is advocated, and root canal treatment

should not be implemented as a preventive strategy, whereas symptomatic teeth must follow conventional endodontic treatment pathways [3]. Overall, decision-making should integrate patient-reported symptoms with clinical and radiographic signs over time, initiating endodontic treatment when findings are consistent with pulpal necrosis and/or apical disease rather than on PCO alone [2,3].

Endodontic diagnosis in teeth with a history of trauma and suspected calcific change can be challenging because commonly used pulp tests (cold and electric pulp testing) assess sensibility (neural response) rather than true pulpal blood supply, and false results can occur [4,5]. Therefore, diagnosis should be established by combining the trauma history, symptom pattern, percussion/palpation findings, and imaging, rather than relying on a single test result [2,3]. With respect to apical diagnosis, the American Association of Endodontists (AAE) diagnostic terminology defines symptomatic apical periodontitis by pain on biting and/or percussion/palpation and explicitly notes that it "might or might not be associated with an apical radiolucent area" [6]. Likewise, AAE diagnostic guidance emphasizes that radiographic changes can depend on disease stage and that the periodontal ligament space may appear normal in symptomatic cases [7].

Conventional access in teeth with PCO carries an increased risk of excessive dentin removal and iatrogenic errors due to the difficulty of locating a narrowed canal. Static-guided endodontics (template-based guided access) has been introduced to improve predictability by combining cone-beam computed tomography (CBCT) data in combination with surface scans to plan a drill path and fabricate a guide, facilitating conservative, targeted access to the canal [8,9]. Experimental and clinical evidence support the feasibility and accuracy of this approach in calcified/obliterated canals [8-10].

## Case Report

### Case presentation

A 25-year-old female presented with pain on biting associated with the maxillary right central incisor (FDI 11). The patient reported a history of dental trauma approximately 7 years earlier, and the type of injury was unknown. The past medical history was negative for systemic disease and chronic conditions. At the time of presentation, the patient was not pregnant, was not taking any medications, and had no known drug or environmental allergies. Written informed consent was acquired for publication of clinical data and images.

Clinical examination revealed crown discoloration of tooth #11 and a clinically visible facial crack line that did not cross the marginal ridge (Figure 1). The crack line was evaluated under an operating microscope.

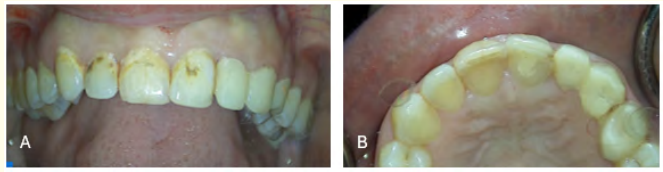


**Figure 1:** Preoperative frontal view (A) and occlusal view (B) showing discoloration of #11 and showing the crack line.

Periodontal probing demonstrated no isolated deep periodontal pocketing; the periodontal chart was within physiologic limits. No parafunctional signs were noted. Tooth 11 was tender to percussion and palpation was negative. Cold testing and electric pulp testing elicited no response from tooth #11, while adjacent control teeth responded normally. Periapical radiography demonstrated an intact lamina dura and a uniform periodontal ligament space with no localized widening and no periradicular radiolucency (Figure 2).

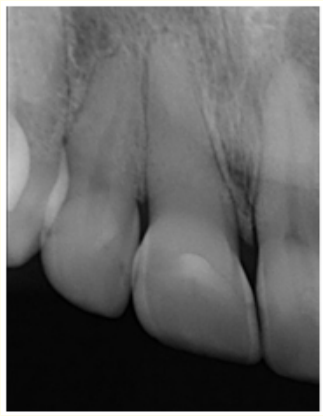

**Figure 2:** Periapical radiography showed an intact lamina dura with no localized widening and no periradicular radiolucency.

Cone-beam computed tomography (FOV 8 × 8 cm; voxel size 0.150 mm) showed no periradicular low-density area, no resorption, and no fracture line; canal visibility was not evident (Figure 3). A diagnosis of pulp necrosis with symptomatic apical periodontitis was established.

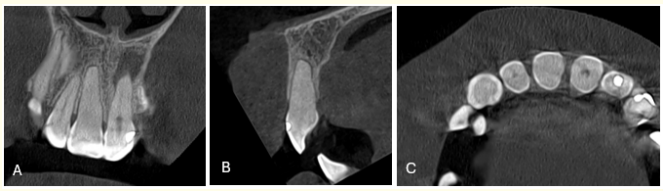


**Figure 3:** CBCT slices coronal (A), sagittal (B) and axial (C), showed no periradicular radiolucency, no resorption, and no fracture line; canal visibility was not evident.

## Digital planning and static guide design

Because the canal lumen was not visible on CBCT and freehand access was considered high risk for deviation and excessive dentin removal, a static-guided endodontic approach was selected. CBCT imaging of tooth 11 was obtained with a field of view of 8 × 8 cm and a voxel size of 0.150 mm. The CBCT dataset was combined with an intraoral surface scan obtained with the iTero Element 5D Plus scanner and imported into Blue Sky Plan (Blue Sky Bio) for digital planning. A sleeveless guide design was selected and fabricated using an Anycubic Photon Mono SE 3D printer with clear LODDEN Surgical Guide Resin. The drill trajectory was planned centrally within the root along the presumed canal path while maintaining safety clearance from the external root surface. The access pathway was planned to a drilling depth of 15 mm. The guide was designed with posterior tooth support to improve stability and incorporated inspection windows in the premolar regions to verify complete seating before drilling. Complete seating was confirmed clinically by visual inspection through the windows, together with tactile confirmation of guide stability on the supporting teeth (Figures 4 and 5).

## Clinical procedure

Local anesthesia was administered using 2% lidocaine with 1:100,000 epinephrine. A conservative access was initiated prior to guide placement. The guide was then seated and clinically verified as described. Guided access was performed under copious irrigation using Munce burs sizes #1/4 and #1/2 to the planned depth of 15 mm (Figure 6).

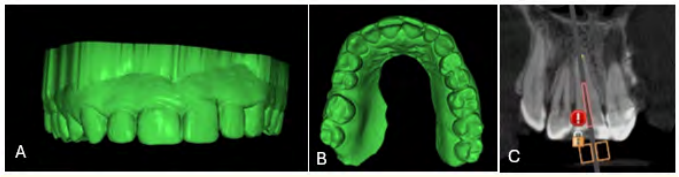


**Figure 4:** Digital planning workflow in Blue Sky Plan. CBCT data were merged with the intraoral scan to create a guided access pathway (A and B). The drill trajectory was planned centrally within the root (C).

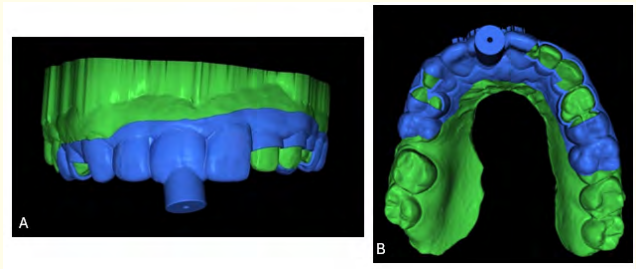


**Figure 5:** Virtual design of the static sleeveless guide. (A) Frontal view of the guide design. (B) Occlusal view of the guide design with premolar inspection windows incorporated into the guide design to allow verification of complete seating before guided drilling.

Rubber dam isolation was achieved using a #9 clamp. Canal location was confirmed under operating microscope visualization and by file insertion. Working length was obtained using an electronic apex locator (Root ZX Mini) and verified radiographically. Canal negotiation was initiated with a #6 C-file, followed by stainless-steel K-files to working length while maintaining apical patency. Shaping was completed using the WaveOne Gold reciprocating system to size 35/06 (Medium) according to the manufacturer's instructions. Irrigation was performed with 5.25% sodium hypochlorite throughout instrumentation. Chelation was performed using 17% EDTA, activated with passive ultrasonic irrigation for 20 seconds per cycle, for 3 cycles. Paper points were

used to dry the canal, and obturation was performed using a single-cone technique with a WaveOne Gold Conform Fit gutta-percha point size 35/06 and EndoSequence BC Sealer (Brasseler USA) (Figure 7). The access cavity was temporarily sealed with Cavit, and the patient was referred for definitive restorative management with a full-coverage crown planned for coronal seal and structural reinforcement.

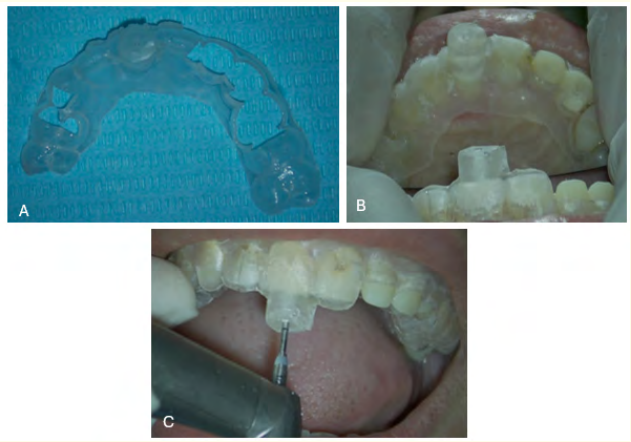


**Figure 6:** Clinical use of the static guide. (A) Printed guide seated extraorally. (B) Printed guide seated intraorally with visual confirmation of complete seating through the premolar inspection windows. (C) Guided access performed under copious irrigation using Munce burs sizes #1/4 and #1/2 to the planned depth of 15 mm.

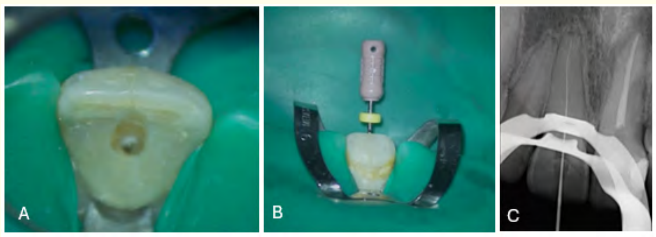


**Figure 7:** (A) Microscopic view after guided access showing the canal location. (B) Initial file insertion confirming canal negotiation. (C) Working length radiograph after determination with an electronic apex locator and radiographic verification.

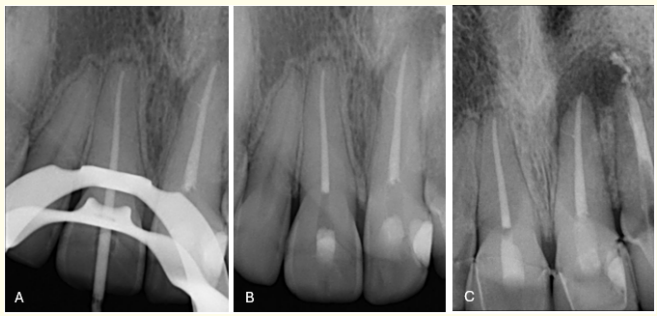


**Figure 8:** Master cone fit with a WaveOne Gold Conform Fit gutta-percha point size 35/06 (A). Immediate postoperative radiograph following obturation with EndoSequence BC Sealer using a single-cone technique (B). Follow-up radiograph obtained from the referring dentist (C).

## Follow-Up

At 1 month, the patient reported complete resolution of pain on biting. Clinical examination showed normal function with percussion and palpation negative. A follow-up radiograph from the referring dentist demonstrated stable periradicular structures with no periradicular radiolucency (Figure 8).

## Discussion

Pulp canal obliteration (PCO) is a well-recognized late sequela of dental trauma and may present years after the injury with canal narrowing/obliteration and crown discoloration. A current systematic review and meta-analysis reported a substantial prevalence of PCO following traumatic dental injuries (TDI) (reported pooled estimates in the low-to-high 20% range across included studies), underscoring how commonly clinicians encounter this entity in post-trauma anterior teeth [1].

Because most teeth with PCO remain asymptomatic and vital for long periods, contemporary recommendations emphasize monitoring rather than prophylactic root canal treatment, reserving intervention for cases that develop clinical/radiographic evidence of pulpal necrosis and/or apical disease [2,3]. Decision-making procedures proposed in systematic reviews similarly support a conservative strategy until clear endodontic indications arise [3,11]. In addition, trauma guidelines stress the requirement for ongoing follow-up of injured teeth due to the possibility of late complications (including PCO and pulp necrosis) [12].

Diagnosis of teeth with suspected PCO can be challenging because commonly used sensibility tests infer pulp status from neural response and may yield false results. Therefore, findings must be interpreted alongside history, symptoms, and comparative testing against control teeth [4,5]. The AAE diagnostic guidance explicitly notes that some teeth may be non-responsive to pulp testing because of calcification and/or a history of trauma, supporting the need for a multi-parameter diagnostic approach rather than dependence upon a single test [7]. In the present case, the combination of a trauma history, pain on biting and percussion tenderness (apical symptoms), together with persistent lack of response to cold/EPT, supported the diagnosis of pulp necrosis with symptomatic apical periodontitis [4,5,7].

Importantly, the absence of periradicular radiolucency on periapical radiography or CBCT does not exclude symptomatic apical periodontitis, particularly in early disease stages. The AAE diagnostic terminology describes symptomatic apical periodontitis as pain on biting/percussion that may or may not be accompanied by radiographic changes, and the AAE consensus terminology similarly recognizes variability in radiographic presentation [6,7]. CBCT was important in this case primarily to (1) assess the canal space and root anatomy when conventional imaging is limited by superimposition, and (2) support guided access planning. Professional guidance from the European Society of Endodontology (ESE) emphasizes case-by-case justification for CBCT and recommends using the smallest feasible field of view with high resolution when CBCT is indicated for endodontic purposes [13].

Static guided endodontics has been recognized as a predictable approach for negotiating calcified/obliterated canals via integrating CBCT data with a surface scan to design a 3D-printed guide that controls angulation and drilling depth. In an *in vitro* comparative study, guided access substantially improved canal location success while reducing dentin removal and procedure time compared with conventional access in simulated calcified canals [8]. A randomized controlled clinical trial further showed the high accuracy of static-guided access preparation in PCO cases, supporting its clinical feasibility when appropriate case selection and a controlled workflow are used [9]. These data are consistent with the rationale for choosing a static guide in the present tooth (#11), where CBCT slices demonstrated no visible canal lumen and where decreasing iatrogenic risk (e.g., perforation) and conserving tooth structure were key objectives [8,9,14].

The presence of a visible crack line and pain on biting required careful exclusion of more advanced fracture patterns. Guidance on cracked teeth and vertical root fractures draws attention to the diagnostic importance of periodontal probing patterns (including the presence of an isolated deep probing defect) and targeted biting tests, along with magnification/transillumination, to improve the differential diagnosis [15]. In this case, the lack of an isolated periodontal pocket reduced (but does not eliminate) suspicion of a root fracture, supporting an endodontic-restorative plan that included definitive coronal coverage after endodontic management [16].

Finally, the limitation at this stage is the duration of the outcome: a 1-month review is helpful for early clinical assessment, but it is insufficient to confirm long-term endodontic success. ESE guidance on endodontic practice reinforces the need for structured, longitudinal outcome evaluation using both clinical findings and appropriate imaging. A longer follow-up is therefore necessary to document stability/healing in teeth treated for post-traumatic endodontic disease [17,18].

## Conclusion

This case emphasizes the value of static-guided endodontics as a predictable, minimally invasive strategy for treating pulp canal obliteration in anterior teeth. By combining CBCT-based planning with a guided access pathway, canal negotiation was achieved safely in a tooth with no visible canal lumen on imaging. Within the limitations of a single case and short follow-up, the outcome was favorable. A longer follow-up is required to confirm long-term periapical health and treatment success.

## Acknowledgements

The author extends his appreciation to Taif University, Saudi Arabia, for supporting this work.

## Conflict of Interest

The author declares no conflicts of interest.

## Bibliography

1. Abreu, Mariana Gouvêa Latini., *et al*. "Prevalence of Pulp Canal Obliteration After Traumatic Dental Injuries: A Systematic Review and Meta-analysis". *Brazilian Oral Research* 38 (2024): e092.

2. Krastl G., *et al*. "Endodontic management of traumatized permanent teeth: a comprehensive review". *International Endodontic Journal* 54 (2021): 1221-1245.

3. McCabe PS and Dummer PMH. "Pulp canal obliteration: an endodontic diagnosis and treatment challenge". *International Endodontic Journal* 45 (2012): 177-197.

4. Chen Eugene and Paul V Abbott. "Dental Pulp Testing: A Review". *International Journal of Dentistry* (2009): Article ID 365785.

5. Jafarzadeh H and PV Abbott. "Review of Pulp Sensibility Tests. Part II: Electric Pulp Tests and Test Cavities". *International Endodontic Journal* 43.11 (2010): 945-958.

6. American Association of Endodontists. "AAE Consensus Conference Recommended Diagnostic Terminology". *Journal Endodontics* 35.12 (2009): 1634.

7. American Association of Endodontists. "Endodontic Diagnosis. Endodontics: Colleagues for Excellence". Fall (2013).

8. Connert Thomas., *et al*. "Guided Endodontics versus Conventional Access Cavity Preparation: A Comparative Study on Substance Loss Using 3-Dimensional-printed Teeth". *Journal of Endodontics* 45.3 (2019): 327-331.

9. Li Jiayang., *et al*. "Accuracy of Static-guided Endodontics for Access Cavity Preparation with Pulp Canal Obliteration: A Randomized Controlled Clinical Trial". *BMC Oral Health* 25 (2025): Article 933.

10. Moreno-Rabié C., *et al*. "Clinical applications, accuracy and limitations of guided endodontics: a systematic review". *International Endodontic Journal* 53.2 (2020): 214-231.

11. Vinagre A., *et al*. "Management of Pulp Canal Obliteration—Systematic Review of Case Reports". *Medicina (Kaunas)* 57.11 (2021): 1237.

12. Levin L., *et al*. "International Association of Dental Traumatology guidelines for the management of traumatic dental injuries: General introduction". *Dental Traumatology* 36.4 (2020): 309-313.

13. Patel S., *et al*. "European Society of Endodontology position statement: Use of cone beam computed tomography in Endodontics". *International Endodontic Journal* 52 (2019): 1675-1678.

14. Connert T., *et al*. "Present status and future directions - Guided endodontics". *International Endodontic Journal* 55.4 (2022): 995-1002.

15. Mathew S., *et al*. "Diagnosis of cracked tooth syndrome". *Journal of Pharmacy and Bioallied Sciences* 4.2 (2012): S242-S244.

16. American Association of Endodontists. "Cracked Teeth and Vertical Root Fractures: A New Look at a Growing Problem (2022 Edition)". *Endodontics: Colleagues for Excellence* (2022).

17. Duncan HF., *et al*. "Treatment of pulpal and apical disease: the European Society of Endodontology (ESE) S3-level clinical practice guideline". *International Endodontic Journal* 56.3 (2023): 238-295.

18. European Society of Endodontology. "Quality guidelines for endodontic treatment: consensus report of the European Society of Endodontology". *International Endodontic Journal* 39 (2006): 921-930.