

Digital precision meets dentin preservation: PriciGuide™ system for guided access opening

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Abstract

Traumatic injuries to maxillary central incisors often necessitate root canal treatment (RCT). However, traditional access cavity preparation can remove significant dentin, compromising tooth strength and long-term prognosis. This article explores the use of the PriciGuide™ system for minimally invasive access cavity preparation in such cases. PriciGuide™ system is a novel, patented system that utilizes a sleeveless guide technique to enhance accuracy and control during access procedures. This article presents a clinical case demonstrating the application of PriciGuide™ system for access cavity preparation in traumatized necrotic maxillary central incisors. The focus is on preserving dentin while achieving optimal access for successful RCT. By showcasing the effectiveness of PriciGuide™ system in this case, this article contributes to the growing body of evidence supporting its role in minimally invasive endodontics. The approach presented has the potential to improve long-term outcomes for patients with not only traumatized necrotic maxillary central incisors but also in teeth having prosthesis that requires RCT and in teeth with calcifications.

Keywords: Digital dentistry; guided endodontics; minimally invasive dentistry; PriciGuide™ system

INTRODUCTION

Traumatic injuries to the maxillary central incisors, a common occurrence, particularly among young patients, often result in pulp necrosis, necessitating root canal treatment (RCT).^[1,2] Traditional methods of access cavity preparation typically involve the removal of significant dentin, which is vital for tooth strength and long-term prognosis.^[3] However, newer approaches to access cavity design, such as conservative access, truss access, and ninja access, have emerged in recent years.^[4]

These innovative designs aim to minimize dentin removal while providing adequate access to the root canal system. However, their successful implementation often depends on the skill and experience of the treating dentist.^[5] To

address this challenge, the concept of guided endodontics has emerged, utilizing 3D-printed templates generated from cone-beam computed tomography (CBCT) and intraoral scans majorly used in cases of calcified canals.^[6]

These templates facilitate precise access cavity preparation, regardless of the dentist's experience level while preserving as much tooth structure as possible.^[7] This advancement represents a significant step forward in endodontic practice, offering enhanced precision and efficiency in RCTs.

The major drawback of the existing guide with a sleeve lies in its propensity for deviation, limited visibility, inadequate coolant reaching the bur, and consequent bur overheating.^[8] To address these challenges, Roots to Cusps™ Private Limited, based in Bengaluru, India, developed the PriciGuide™ system. Unlike traditional guides, the PriciGuide™ system employs a sleeveless design, utilizing guide rails to orient the bur, thereby eliminating the need for a sleeve. This innovative approach not only enhances

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visibility but also reduces deviation and ensures proper coolant flow to prevent bur overheating.

Fortunately, advancements in endodontic technology now offer minimally invasive solutions for such situations. This article delves into the utilization of the PriciGuide™ system, a novel patented technology by Roots to Cusps™ Private Limited, for access cavity preparation in traumatized necrotic maxillary central incisors to help preserve the dentin. By examining how this innovative system enables dentists to achieve optimal access for RCT while prioritizing the preservation of valuable dentin structure, this article aims to contribute to the evolving landscape of minimally invasive endodontics. Ultimately, the goal is to improve long-term outcomes for patients with such dental injuries.

CASE REPORT

A 22-year-old male patient presented to the Department of Conservative Dentistry and Endodontics with fractured upper front teeth, diagnosed clinically and radiographically as Ellis Class 2 fractures. A cold test indicated no response, warranting RCT. The patient consented to undergo RCT using the PriciGuide™ system for minimally invasive access.

The patient underwent CBCT (CS 9300, Carestream Health) [Figure 1a and b] to obtain the Digital Imaging and Communications in Medicine file, and a diagnostic impression was taken to assist in crafting a patient-specific guide for the minimally invasive access opening procedure.

The CBCT data and impression were sent to Roots to Cusps™ Private Limited for the fabrication of a customized guide [Figure 1c] to be used with the PriciGuide™ system [Figure 1d].

Local anesthesia was administered to anaesthetize the teeth 11 and 21, and rubber dam isolation was achieved [Figure 1e]. The guide was positioned [Figure 1f], and the PriciGuide™ system [Figure 1g] was employed to perform the access opening [Figure 1h]. Working length determination was done using an electronic apex locator [Figure 1i] and confirmed radiographically [Figure 1j].

Reciprocating files (Neoendo Reciprocation File 25 mm #25) were utilized for canal instrumentation [Figure 1k], with irrigation performed using Twin Kleen and saline, enhanced by passive ultrasonic activation [Figure 1l]. Platelet-rich fibrin (PRF) [Figure 2a] barrier was employed to contain Biodentine within the root canal for apexification [Figure 2b].

Following apexification [Figure 2c], the canals were obturated using a thermoplasticized obturation technique [Figure 2d]. Access openings were sealed with composite resin after 1 week. The orthodontic correction was deemed necessary due to the patient's deep bite, presenting a challenge for the planned placement of full-coverage crown.

Blu-bite, a light-cure radiopaque composite for precise posterior bite elevation material, was affixed to the

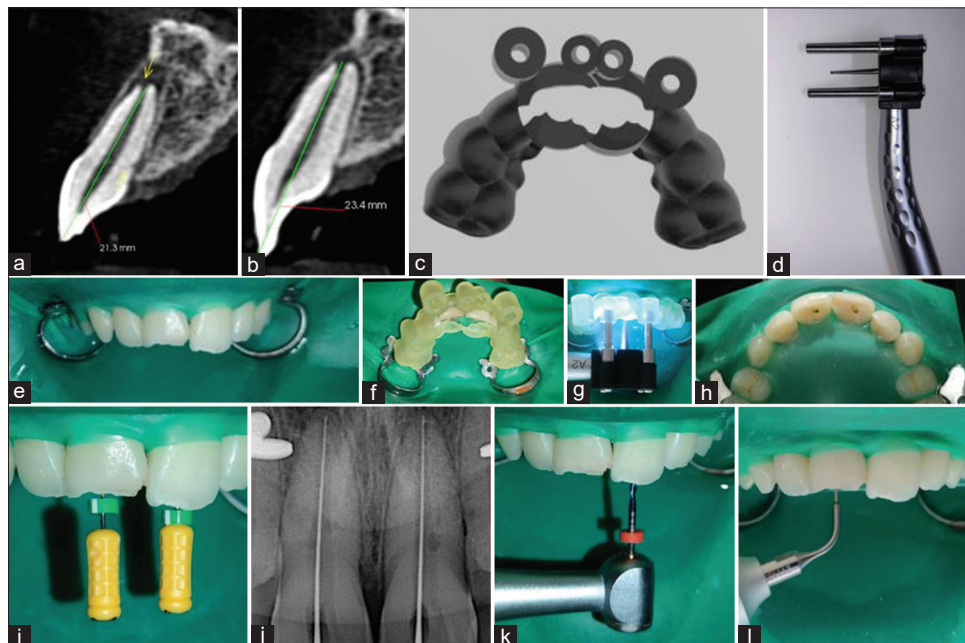


Figure 1: (a) Preoperative cone-beam computed tomography (CBCT) showing open apex to 11, (b) Preoperative CBCT showing open apex to 21, (c) Customised sleeveless guide, (d) PriciGuide™ system, (e) Isolation under rubber dam, (f) Guide placed on the teeth, (g) PriciGuide™ system used to perform access opening, (h) Guided access opening, (i and j) Working length determination, (k) Cleaning and shaping using reciprocating files, (l) Passive ultrasonic activation using UltraX

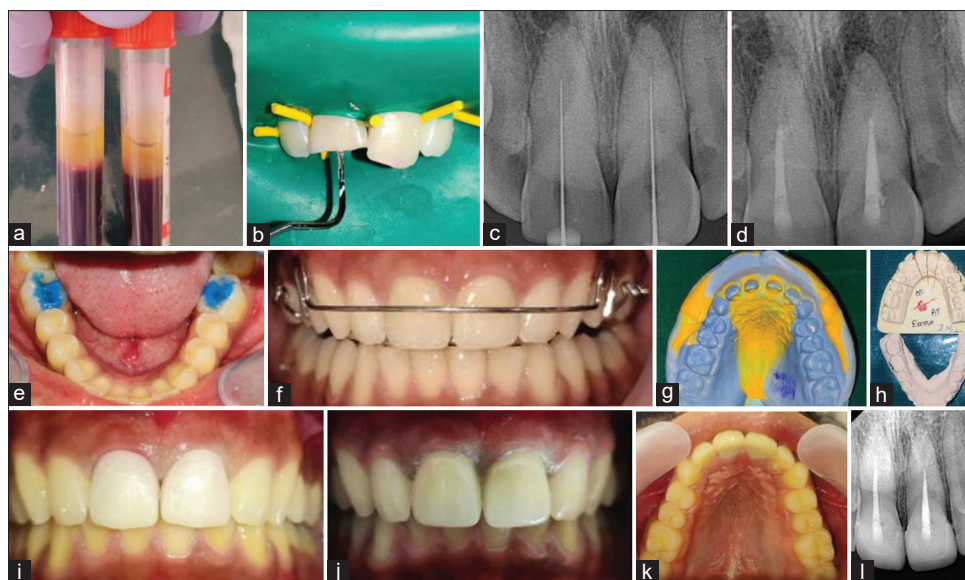


Figure 2: (a) Platelet-rich fibrin, (b and c) Biodentine apexification, (d) thermoplasticized obturation, (e) Blu-bite placed on 36 and 46, (f) correction of deep bite using orthodontic appliance, (g) Impression recorded using rubber base impression material, (h) cast, (i) Bisque trial, (j and k) final cementation of crowns, (l) 1-year follow-up

occlusal surfaces of teeth 36 and 46 for correcting the deep bite [Figure 2e]. The removable appliance design incorporated two Z springs targeted at the upper lateral incisors to address rotation and retroclination, a labial bow to deter proclination, Adams clasps on the molars for retention, and an acrylic base plate with an anterior bite plane measuring 2.5 mm [Figure 2f].

Follow-up appointments scheduled necessary modifications were made. The patient's feedback regarding any discomfort and pain was evaluated during follow-up appointments.

Once the bite opening of around 2 mm was obtained, impressions were recorded [Figure 2g], and the cast was poured [Figure 2h] to fabricate full-coverage crowns. A bisque trial was performed [Figure 2i], and upon confirming fit, final crowns were fabricated and cemented [Figure 2j and k]. The patient underwent regular recall examinations at 3, 6, and 12 months, remaining asymptomatic after 1 year [Figure 2l], indicating successful treatment.

DISCUSSION

Trauma to the maxillary anterior teeth is a prevalent occurrence, often resulting in pulp necrosis and potential calcification.^[9] Utilizing cold testing aids in distinguishing between vital and nonvital teeth.^[10] A comprehensive assessment with CBCT is imperative for accurate diagnosis, particularly in cases of open apices, as conventional periapical radiography provides limited information due to its two-dimensional nature.^[11]

In the present case, RCT followed by apexification was chosen due to time constraints and the patient's inability to adhere to frequent follow-ups to undergo apexogenesis.

Preservation of dentin has become a paramount consideration in contemporary dentistry, aligning with the principles of minimally invasive dentistry.^[12] Among the techniques for minimally invasive access opening, guided endodontics stands out for its simplicity and effectiveness, particularly in cases where experience may be limited.^[6] Traditional guided systems, however, suffer from several drawbacks, such as limited visibility, coolant obstruction, and difficulty in posterior application.^[8]

To address these challenges, Roots to Cusps™ Private Limited introduced the innovative PriciGuide™ system, which eliminates the need for a sleeve, thereby improving visibility, coolant access, and overall maneuverability, even in posterior regions or cases with restricted mouth opening.

Guided access opening facilitates the preservation of pericervical and pericingulum dentin, enhancing the tooth's fracture resistance and long-term prognosis. Furthermore, the choice of reciprocating instrumentation minimized dentinal microcracks, which are associated with conventional rotary systems.^[13]

Passive ultrasonic irrigation was employed to enhance irrigant penetration, ensuring thorough disinfection of the root canal system.^[14] Biodentine was selected for apexification due to its favorable handling characteristics and rapid setting time, supplemented by a PRF barrier to prevent material extrusion beyond the apex.^[15]

Due to the presence of a deep bite, orthodontic correction was pursued to provide space for proper crown placement. Anterior bite planes represent orthodontic devices frequently employed to address dental malocclusions such as deep bite.^[16] Regular follow-up appointments and timely adjustments to these appliances play a critical role in ensuring their efficacy and enhancing patient comfort. These follow-up sessions are scheduled at predetermined intervals to track progress, make essential modifications, and manage any potential issues that may emerge during the course of treatment. After 7 months of follow-up, a bite opening of approximately 2 mm was attained.

Impressions were then recorded to fabricate full-coverage restorations. Lithium disilicate was chosen as the material of choice for the full-coverage restoration due to its esthetics and sufficient strength.^[17] The bisque trial was performed to confirm the fit of the prosthesis before the final glaze. Upon confirmation, the crowns were glazed and then cemented using self-adhesive cement (3M RelyX U200).

Taking inspiration from guided endodontic procedures that utilize guiding templates created through tomographic planning to access and locate root canals with severe calcification, the patented PriciGuide™ system was employed for access opening, aiming to preserve dentin. This technique demonstrates safety and clinical feasibility, reducing treatment time and enabling less experienced operators to perform the procedure. The authors unanimously acknowledge the accuracy of the technique and its relevance for the new possibility of negotiating severely calcified root canals, performing access opening through crowns, preparing post spaces, and retrieving broken posts. Consequently, guided endodontic treatment, even without the aid of an operating microscope, proves highly beneficial for professionals dealing with complex cases.

The guided endodontic procedure has limitations regarding its applicability, restricted to straight canals or until the curvature area. Isolating multiple teeth is necessary to place the guide. The small access opening presents challenges during apexification procedures, requiring modifications to existing equipment or the development of newer equipment for enhanced procedural ease. In addition, the procedure's duration is prolonged, and the cost of the guide increases the treatment expense.

Overall, the successful management of nonvital maxillary central incisors highlights the efficacy of guided endodontics, particularly with the innovative PriciGuide™ system, in achieving optimal treatment outcomes while preserving tooth structure and promoting long-term dental

health. At the 1-year follow-up, radiographic examination showed normal periapical structures, and the patient reported being pain free and able to use the teeth without any issues.

CONCLUSION

The utilization of guided endodontics, particularly with the PriciGuide™ system, represents a significant advancement in the field of minimally invasive dentistry. By combining innovative technology with traditional endodontic principles, clinicians can achieve optimal treatment outcomes while preserving valuable tooth structure and enhancing long-term prognosis.

The case presented herein demonstrates the effectiveness of the PriciGuide™ system in facilitating conservative access cavity preparation, even in complex clinical scenarios such as traumatic necrotic maxillary central incisors with open apices. Through meticulous treatment planning, interdisciplinary teamwork, and precise execution, dentists can successfully manage such cases while minimizing iatrogenic damage and maximizing patient comfort and satisfaction.

Moving forward, continued research and clinical validation of guided endodontic techniques, including the use of advanced technologies such as the PriciGuide™ system, will be paramount. In addition, ongoing advancements in materials and instrumentation will further refine and optimize treatment protocols, ultimately benefiting both patients and practitioners.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form, the patient has given his consent for his images and other clinical information to be reported in the journal. The patient understands that his name and initials will not be published and due efforts will be made to conceal his identity, but anonymity cannot be guaranteed.

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Conflicts of interest

Dr. Varun Prabhuji reports personal affiliation with Roots to Cusps™ Private Limited outside of the submitted work. The other authors have stated explicitly that there is no conflict of interest in connection with this article.

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