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CBCT-Assisted Endodontic Management of a Mandibular Anterior Teeth with Two Canals: A Unique Case Report

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1. INTRODUCTION

The primary cause of endodontic treatment failure is an insufficient understanding of root canal anatomical variations. In some cases, clinicians may leave a canal untreated due to limited knowledge of complex root canal morphology or a lack of experience and skill in identifying and navigating challenging canal anatomy.(1)The complete root canal anatomy must be thoroughly examined, cleaned, and obturated to achieve a successful outcome in root canal therapy. Therefore, it is crucial for practitioners to be familiar with the various root canal configurations.(2)

Failure to detect and treat all canals can result in complications such as pain, sinus tract formation, and swelling, which may require further intervention through surgical or non-surgical retreatment. In more severe cases, these issues could ultimately lead to the need for tooth extraction.

Root canal variations with an elongated oval cross-section were observed in 25% of the sample studied. Vertucci's assessment of 300 extracted teeth revealed that 27.5% of mandibular teeth had two root canals. Similarly, Al-Qudah and Awawdeh found that 26.2% of mandibular incisors in a Jordanian population exhibited two canals. Ezoddini et al. reported a higher incidence of 55.9%, while Miyashita et al. found only a 15% occurrence of two root canals in mandibular incisors in their study.(3)

Hence Various methods have been employed to analyze root canals, including radiographic examination, root sectioning, staining and clearing techniques, direct observation under a microscope, sectioning with macroscopic examination, stereomicroscopy, spiral computed tomography, and cone beam computed tomography.

Vertucci studied root canal morphology in extracted mandibular anterior teeth using the clearing technique. It has been noted that staining and clearing allow for the visualization of intricate details within the root canal system. This method also eliminates the need for instrument negotiation, preserving the canal's original shape and relationships while providing a three-dimensional view of the canals.(2)

In this case report, we utilized advanced imaging technology, specifically CBCT, rather than traditional 2D X-rays to ensure precise diagnosis and validate the accuracy of the root canal treatment performed on the patient.

2. MATERIALS AND METHODS:

A 35-year-old female patient presented to the Department of Conservative Dentistry and Endodontics with expressing concerns about spacing between their lower anterior teeth, particularly noticeable when speaking.

Upon examination, the patient was found to have a high upper lip and an anterior open bite. To develop an appropriate treatment plan, CBCT was recommended for teeth 41, 42, 31, and 32. The radiograph revealed insufficient bone level, and the patient expressed a desire for immediate results. Given these factors, along with the patient's financial constraints that ruled out orthodontic treatment and implant placement, the proposed treatment plan was intentional root canal treatment.

followed by bridge placement for teeth 41, 42, 31, and 32.

A CBCT scan was taken to obtain a complete three-dimensional view of the root canal morphology in the lower anteriors. The scan revealed that tooth 41 had a Type I (1-1) canal configuration, while tooth 42 exhibited a Type III (1-2-1) canal configuration with a thin layer of dentin separating the two canals in the middle third, where the canals bifurcated, and an additional lateral canal in the apical third. Teeth 31 and 32 showed a Type II (2-1) canal configuration in the buccolingual direction.

Patient consent was obtained, and treatment was scheduled. After isolating the area with a rubber dam, access was opened. Tooth 41

showed evidence of previous root canal treatment, which the patient confirmed, although they were unsure of the exact reason. Rubber dam isolation and access was then created for teeth 42, 31, and 32. The working length was established using the (Coltene CanalPro CL2i) Endomotor with an integrated apex locator and verified by radiographic imaging (RVG). Biomechanical preparation was carried out with the Coltene HyFlex CM rotary file system,and the canal was enlarged upto 4%25.(4) Alongside biomechanical preparation, ample and copious irrigation was performed using 3% NaOCl (Pime Dental Pvt). During preparation, the thin dentin between the two canals in tooth 42 was carefully removed, resulting in a single, larger canal configuration.

After verifying the master cone with radiographs (Figure 1), AH Plus sealer was selected, and obturation was successfully completed. Subsequently, composite access restoration was performed, and a postoperative CBCT scan was taken to assess and confirm the quality of the obturation.

Pre operative images

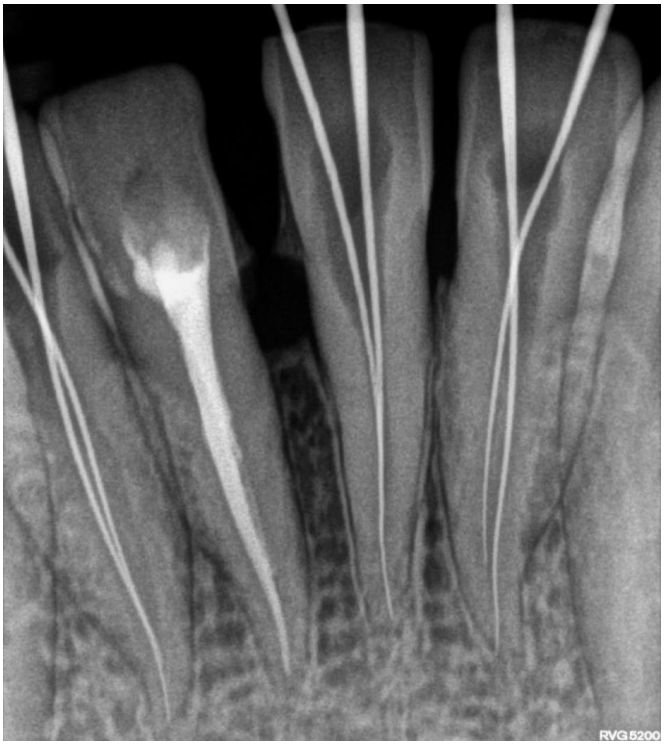


Fig: Working length determination

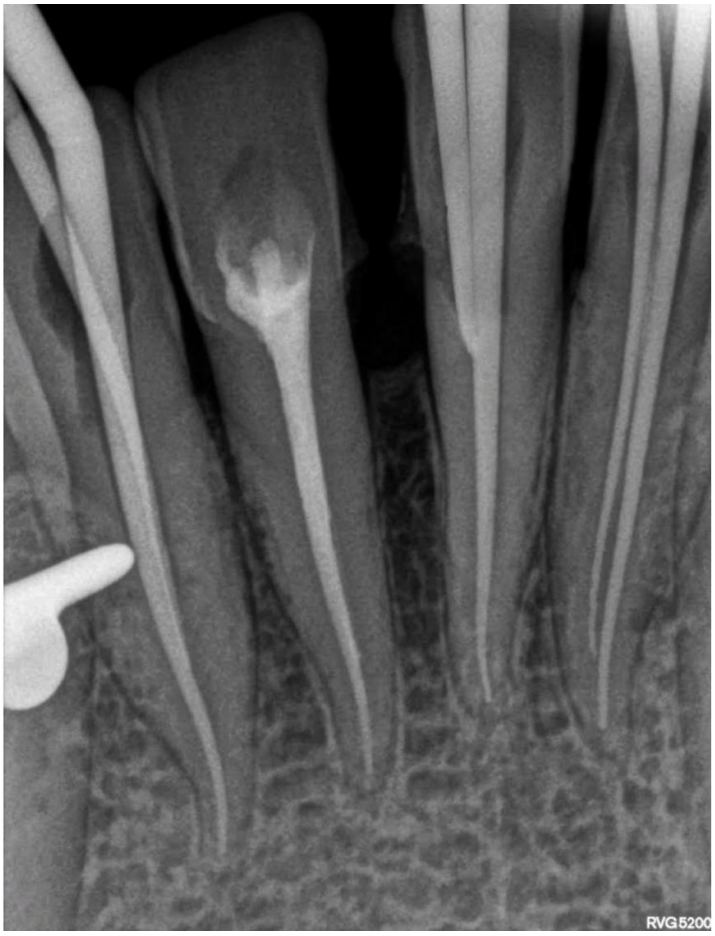
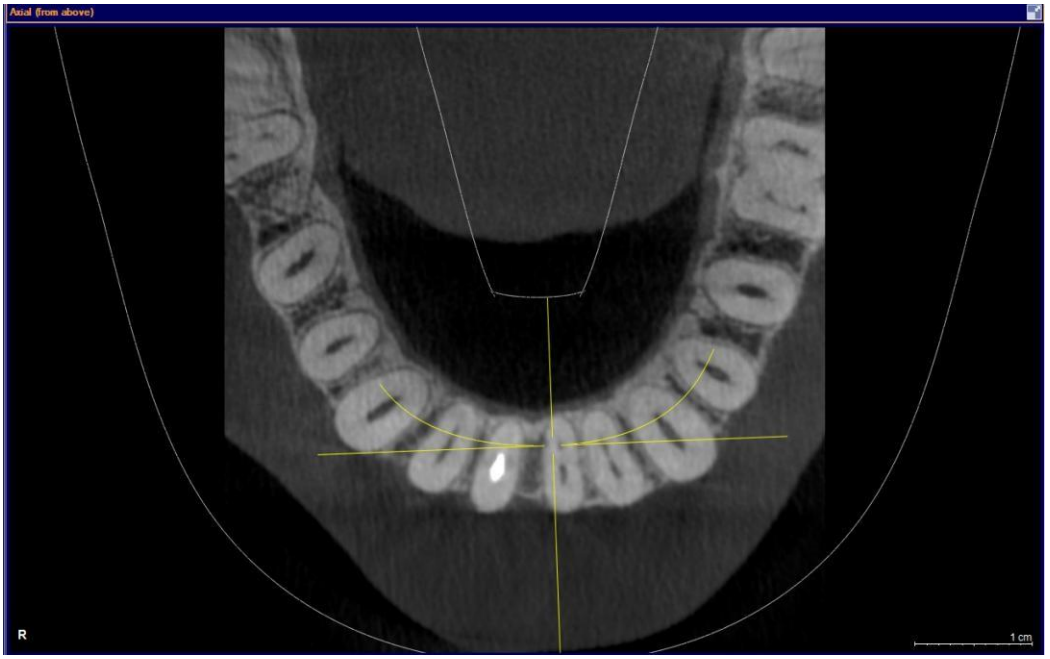
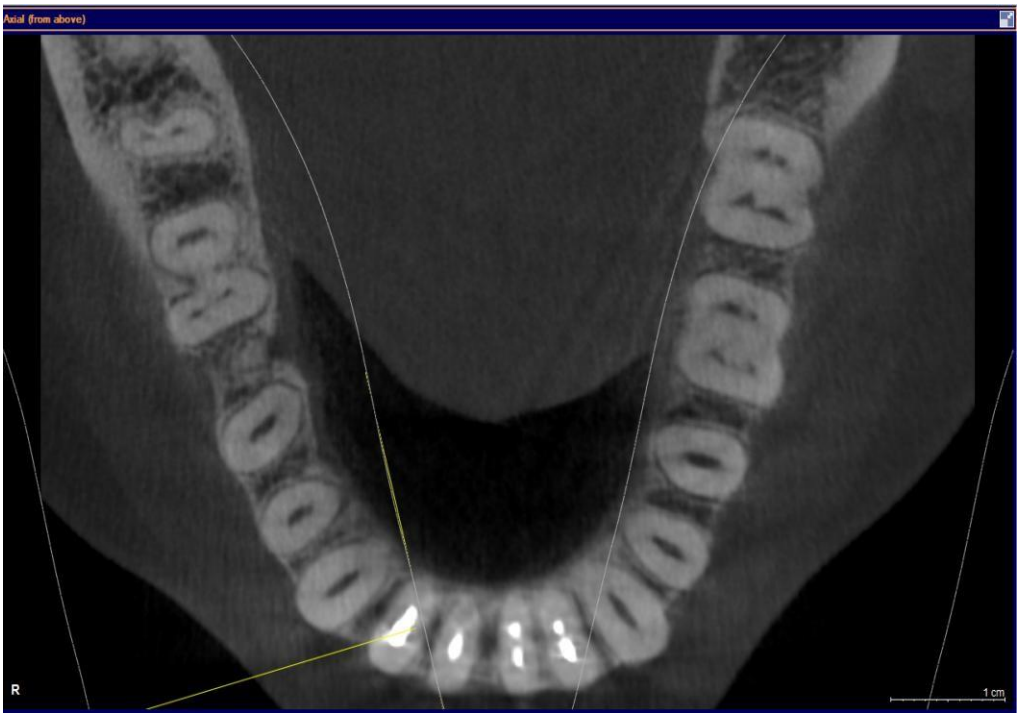


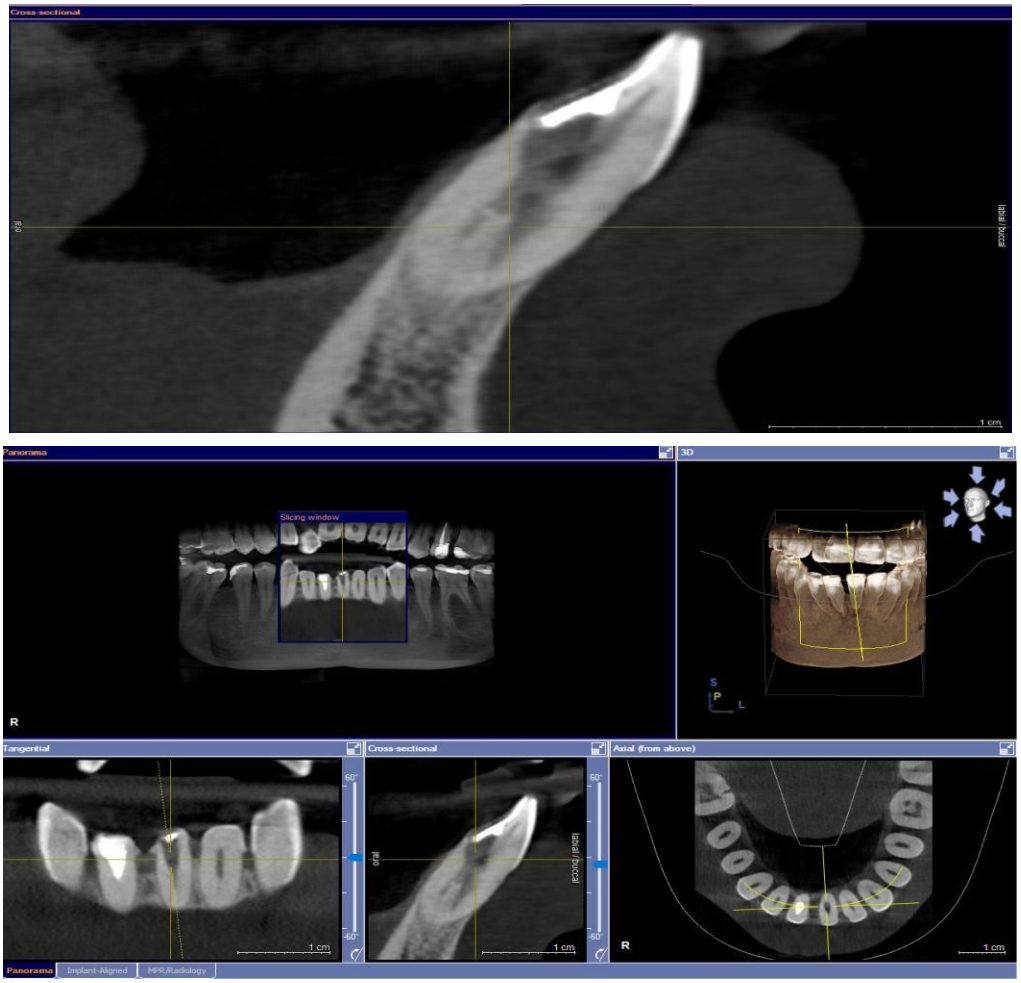
Fig:Master Cone X ray



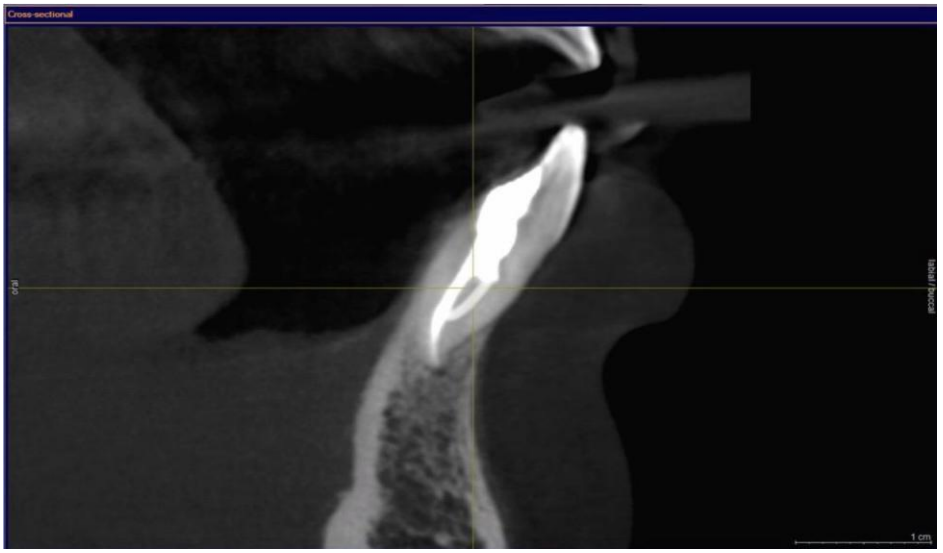
Pre-operative CBCT

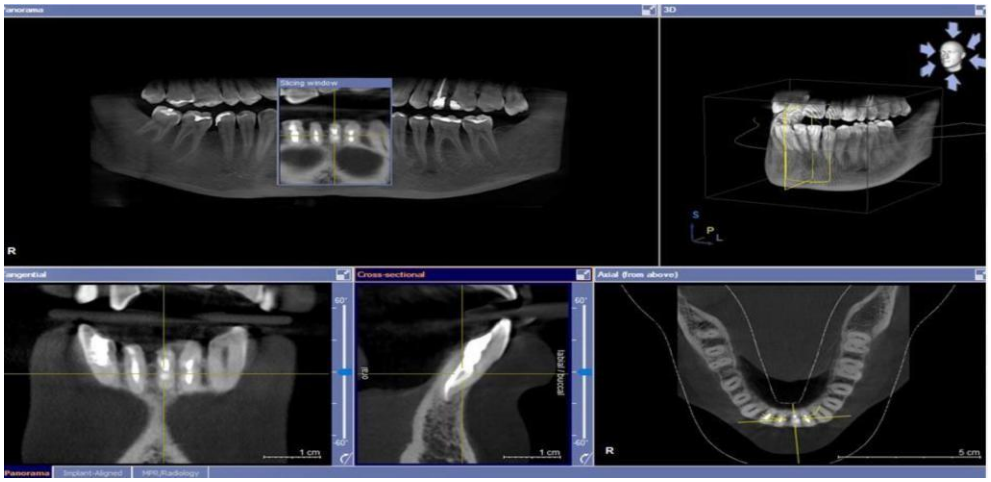


Post operative CBCT

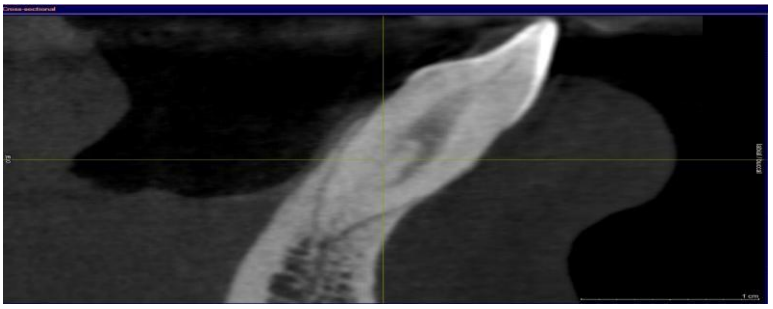


31-PREOPERATIVE CBCT

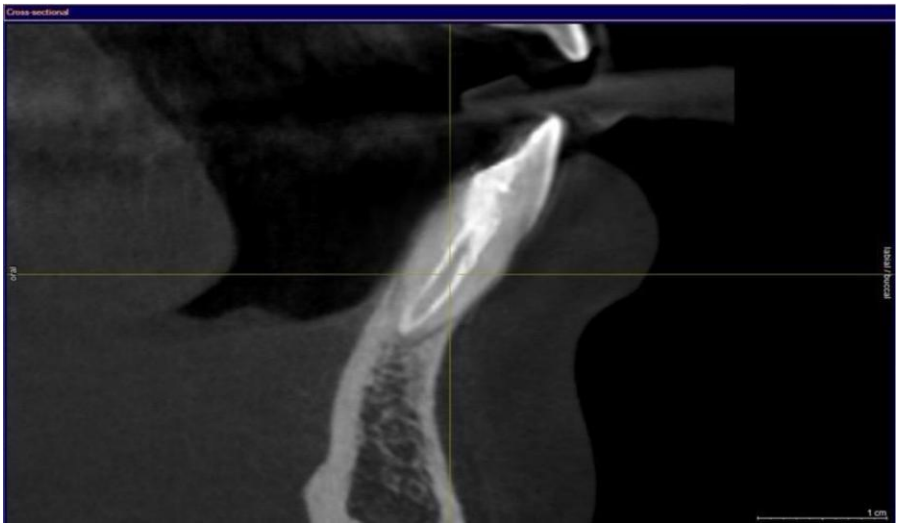




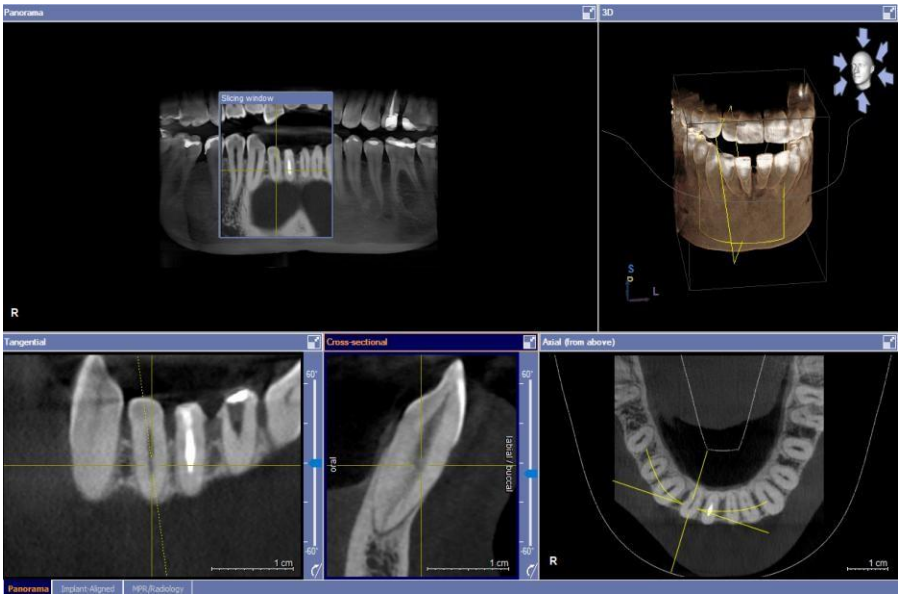
31-POST OPERATIVE CBCT



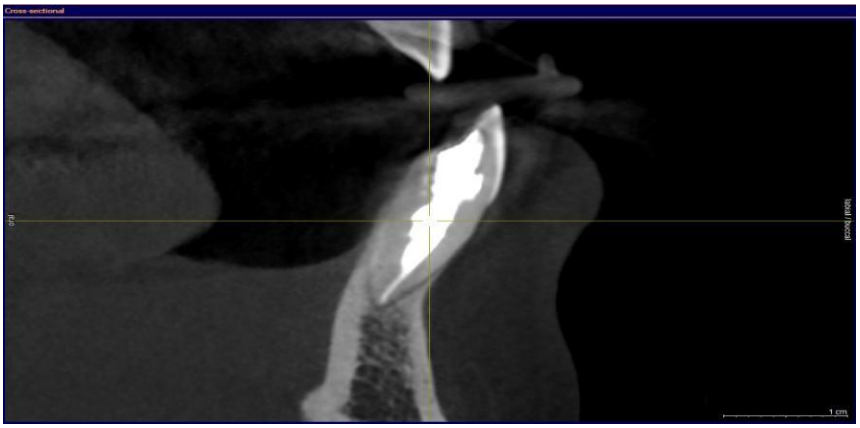
32-PRE OPERATIVE CBCT

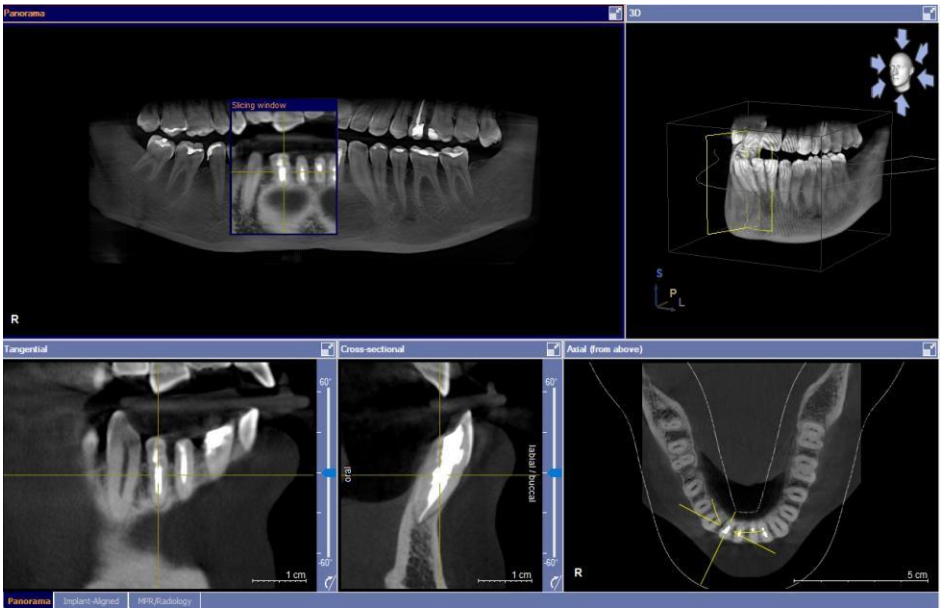


32-POST OPERATIVE CBCT



42-PRE OPERATIVE





42-POST OPERATIVE

3. DISCUSSION:

The goal of root canal treatment is to achieve thorough debridement of the entire pulp system and ensure complete obturation with an inert material. Diagnostic radiographs revealing abrupt changes in canal radio density, narrowing of the canal space, or sudden loss of canal continuity are critical indicators that suggest the possibility of an additional root or canal. In such cases, obtaining an angulated radiograph is essential for accurate diagnosis and treatment planning(5).

This advanced imaging technique enables clinicians to identify complex root canal configurations, additional canals, and other anatomical anomalies that may not be apparent on conventional radiographs. By offering three-dimensional visualization with minimal radiation exposure, CBCT enhances diagnostic accuracy, thereby improving the predictability and outcomes of endodontic treatments.(6)

In this study, CBCT proved invaluable in detecting the presence of two canals oriented bucco-lingually. Additionally, it provided critical information about the thickness of the dentin separating the canals. Notably, in relation to tooth 42, the dentin thickness was found to be minimal, alerting the clinician to the possibility of dentin perforation during rotary biomechanical preparation. This preoperative insight ensured that the clinician could proceed with heightened precision and caution.

However, Patients should only be exposed to higher doses of radiation when absolutely necessary, and its application should be confined to specific, limited areas.(7)

Mandibular incisors with two canals are often buccol ingually oriented, with the lingual canal frequently overlooked due to its position concealed beneath the lingual shoulder. To address this, complete removal of the lingual shoulder is essential, and the access cavity must be extended gingivally into the cingulum. This approach ensures that if a lingual canal is present, it can be effectively located directly beneath the extended access. While the buccal canal is generally more straightforward to locate due to its typically straight course, the lingual canal remains challenging, often obscured by the lingual shelf. In this

case, the previously undetected lingual canal was revealed only after the access was adequately extended lingually beneath the cingulum. This underscores the critical importance of carefully evaluating radiographic features from multiple angulations prior to initiating endodontic treatment, ensuring all canals are identified and treated effectively.(2)

4. CONCLUSION:

Comprehensive knowledge of root canal morphology is vital for the success of endodontic treatment. The use of advanced diagnostic tools like CBCT has revolutionized the field, allowing for precise identification of intricate root canal anatomy, including atypical configurations such as bucco lingually oriented canals and bifurcations. This case highlights the importance of leveraging three-dimensional imaging to ensure accurate diagnosis, informed decision-making, and meticulous treatment planning. By enabling the identification of hidden canals, such as the lingual canal in mandibular incisors, CBCT contributes significantly to reducing the risk of missed anatomy, thereby enhancing treatment outcomes.

Furthermore, this study emphasizes the necessity for clinicians to thoroughly assess radiographs from multiple angulations and to adapt access cavity designs to ensure comprehensive canal exploration and debridement. The judicious use of CBCT, complemented by a detailed understanding of canal morphology and thoughtful clinical execution, underscores the potential for optimal results in even the most complex endodontic cases..

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