Type – Case Report
Open Access

Check for updates

International Journal of Medical Science and Dental Health (ISSN: 2454-4191)
Volume 11, Issue 12, December 2025
Doi: https://doi.org/10.55640/ijmsdh-11-12-08

Single-Visit Endodontic Treatment and Digital Restorative Workflow for a Mandibular First Molar with Radix Entomolaris

Siti Muthi'atun Naila
Resident of Endodontic and Conservative Dentistry Specialist Program, Faculty of Dentistry, Universitas Sumatera Utara, 20155, Medan, Indonesia

Widi Prasetia
Lecture of Endodontic and Conservative Dentistry Specialist Program, Faculty of Dentistry, Universitas Sumatera Utara, 20155, Medan, Indonesia

***Corresponding Author:** drg. Widi Prasetia, Sp.KG., Subsp.KE(K)
Lecture of Endodontic and Conservative Dentistry Specialist Program, Faculty of Dentistry, Universitas Sumatera Utara, Medan, Indonesia. Jalan Alumni No. 2, Kampus USU Medan, Sumatera Utara, Indonesia 20155

Received: 15 November 2025, **accepted:** 02 December 2025, **Published Date:** 22 December 2025

Abstract

Diagnosing **complex root canal anatomy** in mandibular molars is often challenging, particularly in cases with radix entomolaris, which may be overlooked on conventional radiographs. Failure to recognize such variations can compromise treatment success. Cone-beam computed tomography (CBCT) enables accurate three-dimensional assessment, improving diagnostic confidence and clinical outcomes. Likewise, extensive coronal destruction following endodontic therapy requires a reliable restorative approach. Digital impressions obtained with intraoral scanners allow precise, efficient, and accurate fabrication of indirect restorations. A 17-year-old female patient presented with chief complaint spontaneous nocturnal pain in the mandibular left first molar. Clinical and pulp sensibility tests confirmed symptomatic irreversible pulpitis as a diagnosis. Radiograph examination showed radiolucency into the pulp without periapical lesion and the additional root in the middle between mesial and distal root. CBCT confirmed the presence of a radix entomolaris. Single-visit root canal treatment was performed with thorough chemomechanical preparation, irrigation activation, and single-cone technique obturation with a bioceramic sealer. The coronal structure was immediately reinforced with EverX Posterior composite to provide internal support. The definitive restoration was achieved through a fully digital workflow: an intraoral scanner was used for impression taking, and zirconia onlay was fabricated with CAD/CAM technology and luted with adhesive resin cement. This case highlights the importance of CBCT in diagnosing complex root canal anatomy and demonstrates how the integration of intraoral scanning with CAD/CAM-fabricated zirconia onlays can provide predictable functional and esthetic outcomes in endodontic treatment.

Keywords: Radix entomolaris; Cone-beam computed tomography; Intraoral scanner; Single-visit endodontics; Zirconia onlay

1. INTRODUCTION

Complex root canal anatomy is a major factor affecting the success of endodontic treatment. One such anatomical variation is **radix entomolaris (RE)**, an additional root located distolingually in mandibular molars, which may be overlooked on conventional two-dimensional radiographs. Failure to detect RE can lead to inadequate cleaning, shaping, and obturation of root canals, thereby increasing the risk of treatment failure [1,2].

Cone-beam computed tomography (CBCT) has emerged as a valuable imaging modality that offers three-dimensional visualization of root and canal morphology, allowing clinicians to identify additional roots, canal curvatures, and other anatomical complexities with greater accuracy than conventional radiographs [3–5]. The use of CBCT in endodontics has improved diagnostic confidence and clinical outcomes in cases involving complex root canal anatomies such as RE.

Beyond diagnosis, restorative considerations after endodontic treatment are equally important. Teeth with extensive coronal destruction require reinforcement to ensure long-term success. Digital dentistry tools — including intraoral scanners for impression taking, CAD/CAM technology, and monolithic zirconia materials — have gained popularity due to their improved precision, marginal adaptation, reduced fabrication times, and superior aesthetic outcomes compared to conventional techniques [6–9].

Single-visit endodontic treatment, when feasible, reduces chair time, patient discomfort, and the risk of inter-appointment contamination. The integration of CBCT for diagnosis, single-visit root canal therapy, and digital workflows for final restoration offers a promising approach for delivering predictable, functional, and aesthetic outcomes. The case report describes management of mandibular left first molar with RE using CBCT, single-visit endodontics, and a fully digital workflow culminating in a CAD/CAM-fabricated zirconia restoration.

2. CASE REPORT

A 17-year-old female patient presented to the Dental Hospital Universitas Sumatera Utara, with the chief complaint of pain in the mandibular left posterior region for approximately two weeks. The patient reported that the pain was spontaneous, more intense at night, and partially relieved by over-the-counter analgesics. Medical history of the patient was not contributory, with **no history of systemic disease or drug allergies**.

Clinical examination revealed deep caries involving the pulp chamber in the mandibular left first molar (tooth 36). The tooth responded positively to pulp sensibility testing, while percussion, palpation, and mobility tests were negative. Radiographic examination (periapical radiograph) demonstrated radiolucency extending into the pulp chamber, with the periapical tissues appearing normal. Interestingly, an additional root was suspected on the distal aspect using the **same lingual, opposite buccal (SLOB) technique** on 2-dimensional radiographs.

To confirm the unusual anatomy, CBCT imaging was performed. The CBCT scan confirmed the presence of a **radix entomolaris**, located distolingually, with a distinct and separate root canal extending from the chamber floor to the apex. According to the **Carlsen and Alexandersen classification**, the radix entomolaris was categorized as **Type A** (radix located lingually to the distal root complex). Based on the **De Moor classification**, it corresponded to **Type III**, characterized by an independent root and canal extending from the coronal third to the apex. The mesial roots showed two separate canals (mesiobuccal and mesiolingual), while the distal root presented with two distinct canals: a main distobuccal canal and the additional distolingual canal corresponding to the radix entomolaris. The surrounding periapical tissues appeared within normal limits, with no evidence of periapical radiolucency. These findings established the diagnosis of **symptomatic irreversible pulpitis; normal apical tissue in mandibular left first molar with radix entomolaris**.

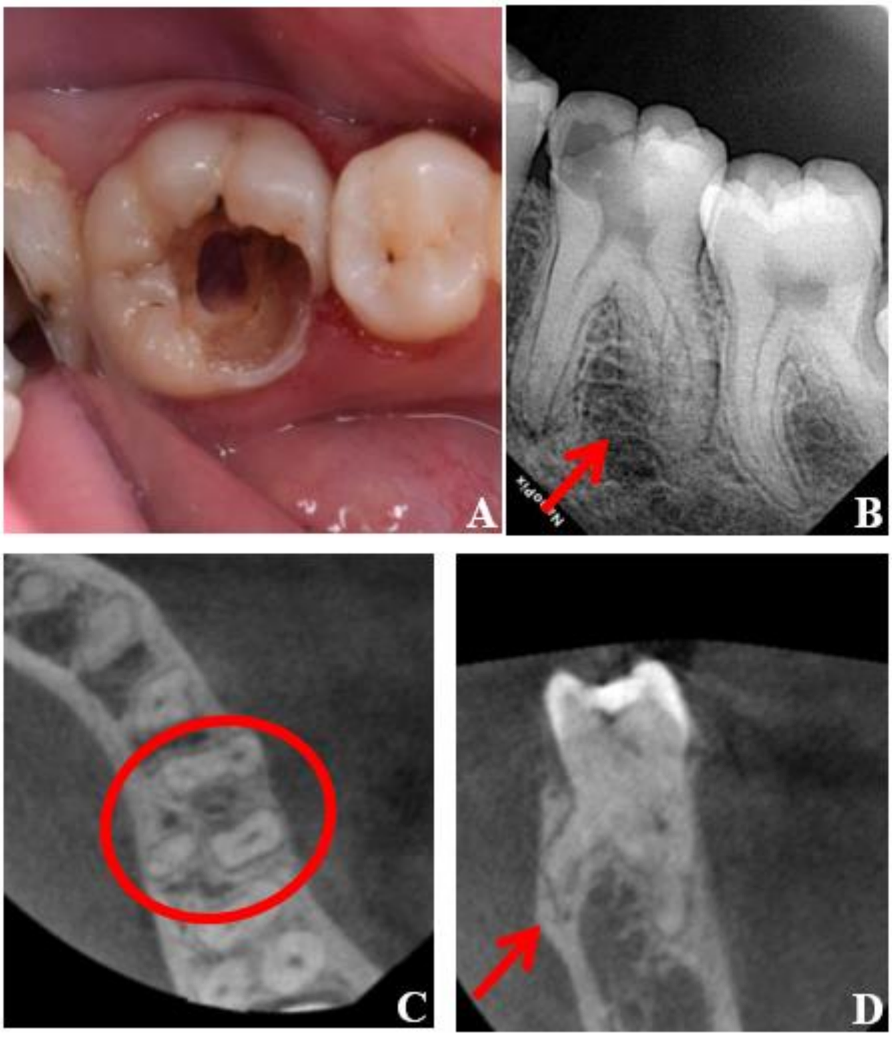

Figure 1. (A) Initial clinical photograph of tooth 36 showing extensive carious lesion involving the pulp chamber. (B) Periapical radiograph of tooth 36 demonstrating radiolucency reaching the pulp and suspected additional root (red arrow). (C) CBCT axial view confirming the presence of a radix entomolaris (red circle). (D) CBCT sagittal view showing the independent distolingual root canal corresponding to the radix entomolaris (red arrow).

3. CASE MANAGEMENT

Local anesthesia was achieved with **articaine hydrochloride 4%** combined with **epinephrine 1:100,000**, administered via infiltration technique. Due to persistent sensitivity related to symptomatic irreversible pulpitis, an **intrapulpal injection** was additionally performed, resulting in profound anesthesia.

The tooth was isolated with a rubber dam. **Access cavity preparation** was performed using a **round diamond bur in a high-speed handpiece** to gain entry, followed by an **Endo-Z bur** to refine the cavity walls and ensure straight-line access to the canals. Four canal orifices were identified: mesiobuccal, mesiolingual, distobuccal, and distolingual (radix entomolaris).

Pulp extirpation was carefully performed under magnification using a barbed broach and precurved #10 K-files to remove inflamed pulp tissue from all canals. Copious irrigation with 2.5% sodium hypochlorite was used throughout to aid tissue dissolution and initial disinfection prior to establishing working length.

Working length determination was established after scouting the canals with a **#10 K-file (M-Access, Dentsply Maillefer, Switzerland)**. The file was gently advanced until a glide path was achieved, and the approximate working length was first assessed radiographically (Figure 2A). This measurement was then confirmed and refined with an **electronic apex locator (Findpex V, Eighteeth, China)** to ensure accuracy. The working length were 24mm for mesiobuccal canal, 23mm for mesiolingual, 26mm distobuccal, and 20mm for distolingual canal (radix entomolaris). Establishing a precise working length was considered essential for effective cleaning and shaping, while minimizing the risk of over-instrumentation or under-preparation, both of which could compromise apical sealing and treatment outcome.

Cleaning and shaping were performed using the **Orodeka Plex-V rotary file system (Orodeka, China)** with a finishing file size #25.06. This system, made of heat-treated nickel–titanium alloy, provides high **flexibility and cyclic fatigue resistance**, making it particularly suitable for negotiating curved canals such as those found in the radix entomolaris, while reducing the risk of canal transportation and instrument separation.

Irrigation was performed with **2.5% sodium hypochlorite** throughout instrumentation, alternated with **17% EDTA** to remove the smear layer. To enhance irrigant activation and penetration into complex canal anatomy, **passive ultrasonic irrigation (PUI)** was performed using the **Ultra-X system (Eighteeth, China)**. A final rinse with sterile saline completed the irrigation protocol.

Obturation was carried out using the **single cone technique** with size-matched gutta-percha cones and **CeraSeal bioceramic sealer (Meta Biomed, Korea)**. This calcium silicate–based sealer provides **excellent biocompatibility, dimensional stability, and bioactivity** that promote biomineralization and long-term apical healing. Following obturation, an **orifice barrier** was placed using **Ionoseal (VOCO, Germany), a light-cured resin-modified glass ionomer cement (RMGIC)**, to seal the canal orifices and reduce the risk of coronal leakage. The pulp chamber was then reinforced with **EverX Posterior composite resin (GC, Tokyo, Japan)** as a fiber-reinforced core build-up material to mimic dentin and and enhances fracture resistance in endodontically treated teeth.

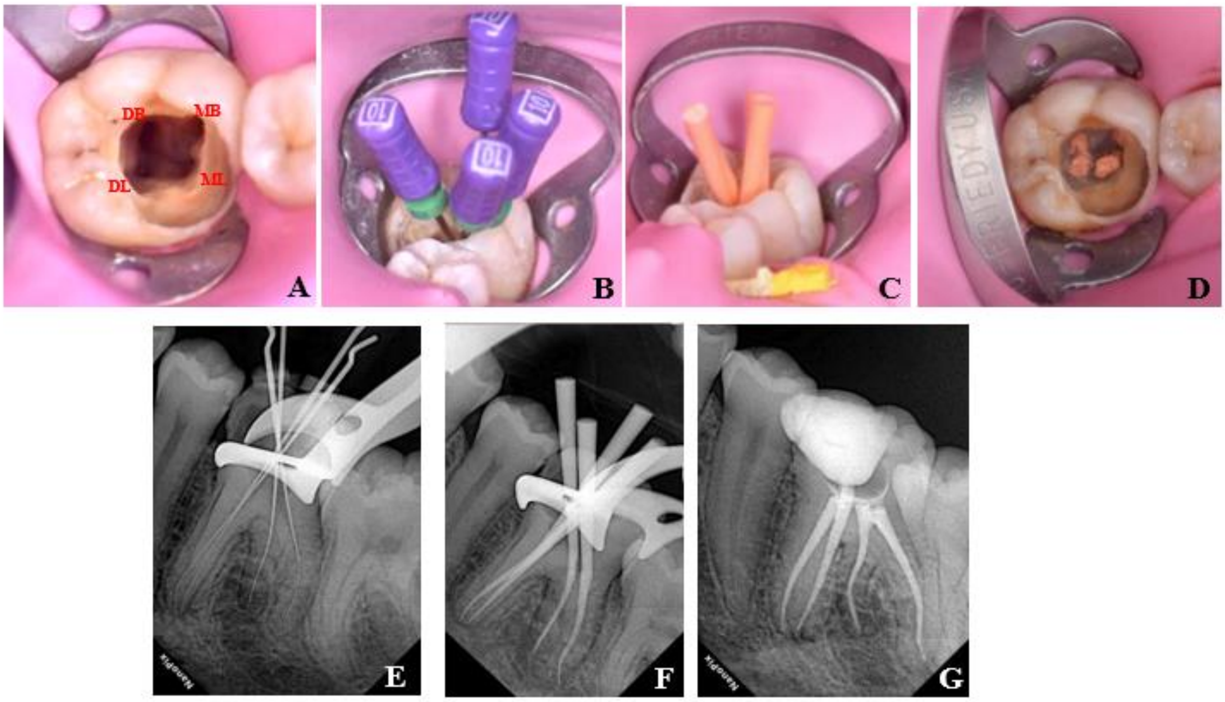

Figure 2. (A) Access cavity preparation of mandibular left first molar (tooth 36) showing four canal orifices: mesiobuccal (MB), mesiolingual (ML), distobuccal (DB), and distolingual (DL) corresponding to radix entomolaris; (B) Working length determination using #10 K-files in all canals; (C) Master cone trial with gutta-percha cones adapted to the prepared canals; (D) Obturation for all canals; (E) Radiograph confirming working length determination; (F) Radiograph confirming master cone adaptation before obturation; (G)Radiograph showing obturation of all four canal

In the next visit, subsequently, **onlay preparation** was carried out. Occlusal reduction of 1.5–2.0 mm was performed with a **round-end tapered diamond bur**, with functional cusps reduced around 1.5 mm compared to non-functional cusps (≈1.0 mm). Axial reduction of 1.0–1.5 mm was achieved with a slight divergence of 6–10°, ensuring a clear path of insertion. Margins were prepared as **full bevel (≈1 mm)**, placed supragingivally where possible to preserve enamel for adhesive bonding. All internal line angles were rounded to minimize stress concentration on the zirconia restoration.

For the final restoration, a **fully digital workflow** was adopted. A digital impression was obtained using the **Helios 600 intraoral scanner (Eighteeth, China)**. This scanner was chosen for its **high-resolution optical system, rapid scanning speed, lightweight ergonomic design, and ability to capture full-color images with precise marginal detail**. Compared with conventional impressions, the EIOS E600 provided greater patient comfort, eliminated the risk of impression material distortion, and ensured an accurate digital model for CAD/CAM fabrication.

The definitive restoration was designed using CAD software and fabricated from a **monolithic zirconia block** via a CAD/CAM milling system. Zirconia was selected for its high fracture toughness, wear resistance, and esthetic translucency. The restoration was cemented with **adhesive resin cement (RelyX Ultimate, 3M ESPE, USA)** under rubber dam isolation, following the manufacturer's adhesive protocols.

At short-term recall, the patient reported no postoperative discomfort, and the tooth demonstrated satisfactory function and esthetics.

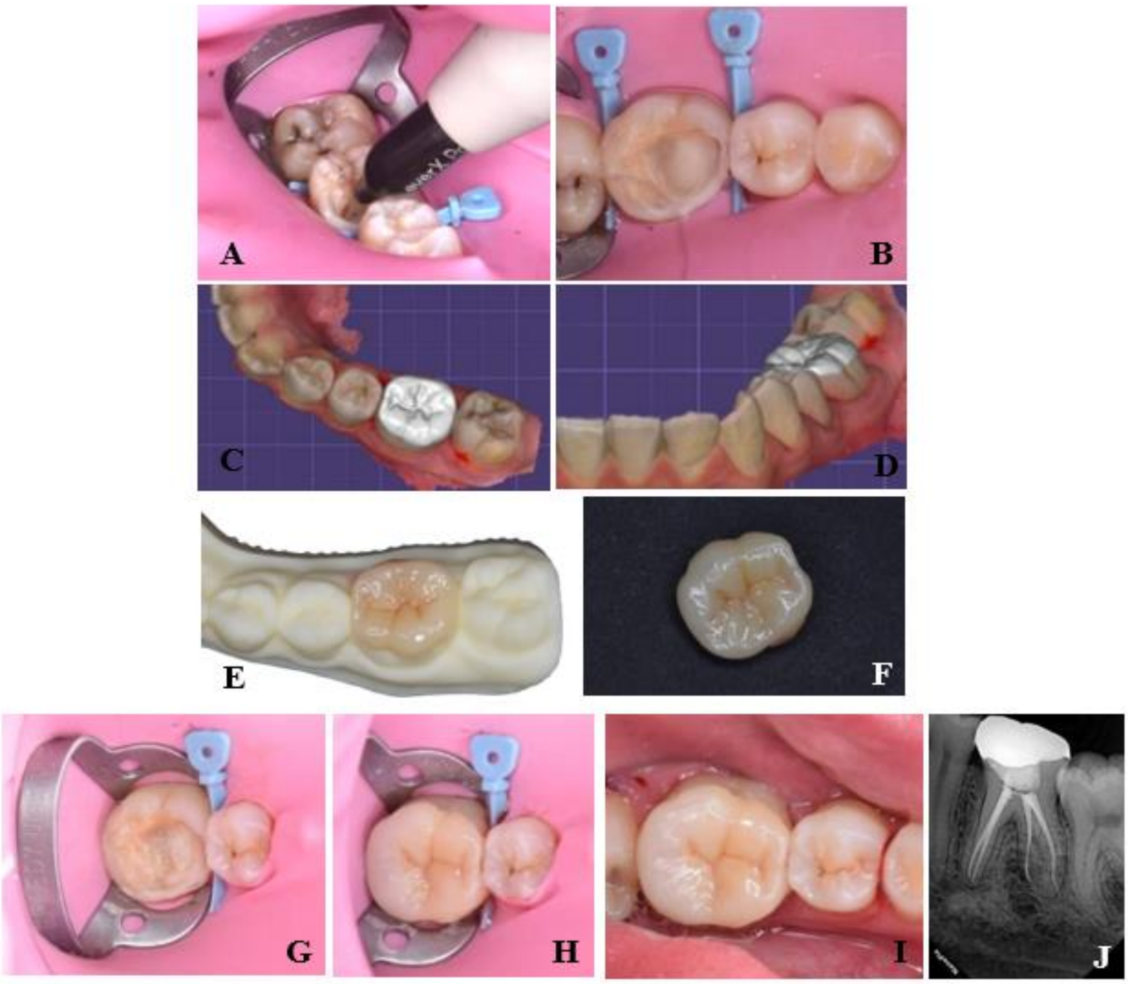

Figure 3. (A) EverX Posterior placement; (B) Onlay preparation; (C and D) Onlay design using CAD software; (E and F) Onlay Zirconia; (G) Tooth preparation for cementation; (H) Onlay cementation; (I) Clinical view after cementation; (J) Radiographic view after final restoration placement.

4. DISCUSSION

Accurate identification of root canal morphology is one of the most critical determinants of endodontic success. Conventional two-dimensional periapical radiographs, although widely used, are limited in detecting complex root canal anatomies such as radix entomolaris, C-shaped canals, or accessory canals, due to superimposition of anatomical structures. CBCT provides three-dimensional visualization and has been shown to significantly improve the detection of additional roots, root canal curvatures, and variations that are otherwise difficult to interpret radiographically [11,12].

One of the major advantages of cone-beam computed tomography (CBCT) in endodontics is its ability not only to detect the presence of an additional root such as the radix entomolaris (RE), but also to accurately determine its **classification and morphology**. Two-dimensional radiographs often fail to reveal the full curvature and spatial orientation of RE due to superimposition of surrounding structures. In contrast, CBCT allows three-dimensional visualization in axial, sagittal, and coronal planes, enabling clinicians to analyze the root curvature, orientation, and length precisely. This facilitates the application of established classification systems, such as those proposed by **Carlsen and Alexandersen** and **De Moor**, to describe the RE configuration more accurately [13,14].

In the present case, CBCT imaging enabled classification of the RE as **Type A** (Carlsen and Alexandersen) and **Type III** (De Moor), characterized by an independent distolingual root extending from the coronal third to the apex with marked curvature. This detailed assessment guided the choice of instrumentation system, taper, and irrigation activation method, minimizing the risk of procedural errors and improving the quality of cleaning and shaping.

Recent CBCT-based studies have highlighted this diagnostic advantage. **Steinfort et al.[15]** analyzed 200 mandibular molars and demonstrated that CBCT allows reproducible classification of RE curvature using De Moor's system, improving preoperative planning and reducing instrumentation complications. Similarly, **Alam et al.[16]** confirmed that CBCT enhances the reliability of RE detection and classification compared to conventional radiography, providing valuable information for case-specific endodontic management. Thus, CBCT serves not only as a diagnostic tool but also as a **morphological mapping system**, offering the three-dimensional data necessary for individualized treatment of complex root canal anatomies such as radix entomolaris.

Several studies have demonstrated that CBCT imaging offers superior accuracy when compared to conventional radiography in identifying additional roots and variations in root canal anatomy, thereby reducing the risk of missed canals and subsequent endodontic failure [3,10]. Furthermore, CBCT can aid in treatment planning by providing valuable information regarding canal curvature, diameter, and proximity to anatomical structures. In the present case, CBCT confirmed the presence of a radix entomolaris initially suspected on two-dimensional radiographs, allowing appropriate modifications in cleaning, shaping, and obturation protocols to ensure thorough canal debridement.

Nonetheless, CBCT is not without limitations, including relatively higher radiation exposure compared with periapical radiography, cost, and possible voxel size limitations in detecting fine structures. Therefore, its use should be justified based on case complexity and diagnostic necessity [17].

The long-term success of endodontic therapy depends not only on adequate disinfection and obturation of the root canal system but also on the quality of the coronal restoration. Recent advances in digital dentistry have enabled intraoral scanners (IOS) to replace conventional impression techniques, providing enhanced accuracy, efficiency, and patient comfort. In particular, IOS generate highly accurate digital models without the distortions inherent to traditional impression materials [18].

The use of intraoral scanners has been shown to improve marginal fit and trueness of CAD/CAM restorations, reducing the risk of microleakage and secondary caries [19,20]. Moreover, digital impressions are time-efficient, more comfortable for patients with gag reflexes, and enable immediate data transfer to CAD/CAM systems, expediting the fabrication process [21]. The Helios 600 (Eighteeth, China), as used in this case, provides high-resolution full-color scanning with rapid image acquisition, facilitating precise capture of preparation margins and occlusal anatomy. This significantly contributed to the accuracy and clinical success of the monolithic zirconia onlay restoration placed in this patient.

The decision to restore the tooth with a **monolithic zirconia onlay** rather than a full coverage crown was based on the principle of minimally invasive dentistry. Endodontically treated teeth often suffer significant loss of structural integrity, but preserving sound tooth structure is crucial to improve long-term survival. Onlay restorations provide cuspal coverage and reinforcement comparable to full crowns, while requiring less axial reduction and preserving peri-cervical dentin, which is essential for fracture resistance [22,23]. Monolithic zirconia was selected due to its **high flexural strength, wear resistance, and favorable esthetics**, ensuring functional longevity and optimal patient satisfaction. Moreover, when adhesively bonded, onlays have shown survival rates similar to or higher than traditional crowns, making them a conservative yet reliable option for restoring posterior teeth following root canal therapy.

Integration of intraoral scanners into a fully digital workflow enhances not only restorative accuracy but also clinical efficiency, making them particularly advantageous in single-visit endodontic-restorative protocols.

5. CONCLUSION

This case demonstrates how CBCT facilitated accurate diagnosis of a radix entomolaris, allowing appropriate endodontic management. Thorough cleaning, shaping, irrigation activation, and obturation with bioceramic sealer ensured effective canal sealing. Immediate reinforcement and a fully digital workflow with intraoral scanning and CAD/CAM zirconia onlay provided a conservative, precise, and durable restoration. The integration of CBCT and intraoral scanners supports predictable outcomes in complex endodontic-restorative cases.

6. REFERENCE

1. Şendişçi Gök R, Tercanlı H, Ekinci A. Evaluation of root and canal morphology of mandibular molar teeth by cone beam computed tomography: cross-sectional study. BMC Oral Health. 2025;25:798.
2. Javed MQ, Al-Humaid J, Aldahmash M, Alenazy MS, Alahmari A, Khan S. A cone beam computed tomography-based investigation of the frequency and distribution of radix entomolaris in mandibular first molars of a Saudi Arabian population. Diagnostics (Basel). 2023;13(16):2685.
3. Oliveira YM de Araújo, Mendes Gomes MC, Nascimento MFS, Machado R, Moreira DM, Paiva HC, et al. Prevalence of radix molaris in mandibular molars of a subpopulation of Brazil's Northeast region: a cross-sectional CBCT study. Sci Rep. 2025;15:22651.
4. Hatipoğlu FP, Kalender A, Orhan EO, Arslan D. Assessment of the prevalence of radix entomolaris and distolingual canal in mandibular first molars: a CBCT study. J Endod. 2023;49(8):1016-22.
5. Chamani A, Javanmardi M, Alimoradi F. Management of radix entomolaris of mandibular first molar: case series with complex root curvatures. Clin Case Rep. 2025;13(5):e7010.
6. Leven R, Schmidt A, Binder R, Kampschulte M, Vogler J, Wöstmann B, et al. Accuracy of digital impression taking with intraoral scanners and fabrication of CAD/CAM posts and cores in a fully digital workflow. Materials (Basel). 2022;15(12):4199.
7. Ashtiani RE, Salari M, Mohammadi M, Torkaman S. Clinical assessment of monolithic zirconia crowns fabricated using an intraoral scanner and CAD/CAM. BMC Oral Health. 2024;24:512.
8. Doan TM, Nguyen TN, Pham VK, Chotprasert N, Vu CTB, et al. Comparative analysis of the fit quality of monolithic zirconia veneers produced through traditional and digital workflows using silicone replica technique: an in vitro study. BMC Oral Health. 2024;24:1566.
9. Guncu MB, Cakan U, Yildirim YD, Eser A. Performance of high-translucent zirconia CAD/CAM fixed dental prostheses: digital workflow evaluation. J Dent Sci. 2023;18(2):452-8.
10. Biswas M, Jayalakshmi NS, Kumar NS. Cone-beam computed tomographic evaluation of prevalence and internal dental morphology of radix entomolaris and paramolaris in mandibular first and second molars — a retrospective study. J Indian Acad Oral Med Radiol. 2024;36(4):392-6.
11. Spring C, Patel S, Dawood A, Davies J, Newton T, Wilson R. Diagnostic value of cone beam computed tomography for root canal anatomy: comparison with micro-CT gold standard. Clin Oral Investig. 2023;27:3817-26.
12. Al Yahya RS, Al Attas MH, Javed MQ, Khan KI, Atique S, Abulhamael AM, et al. Root canal configuration and its relationship with endodontic technical

errors and periapical status in premolar teeth of a Saudi sub-population: a CBCT study. Int J Environ Res Public Health. 2023;20(2):1142.

13. Carlsen O, Alexandersen V. Radix entomolaris: identification and morphology. Scand J Dent Res. 1990;98(5):363–73.

14. De Moor RJ, Deroose CA, Calberson FL. The radix entomolaris in mandibular first molars: an endodontic challenge. Int Endod J. 2004;37(11):789–99.

15. Steinfort K, Martinho FC, Baratto-Filho F, Soares AJ, Silva-Sousa YT, Sousa-Neto MD. Evaluation of radix entomolaris morphology and curvature using CBCT imaging and De Moor classification: a cross-sectional study. Int J Morphol. 2024;42(4):426–33.

16. Alam MK, Karamoy J, Wahyudi IA, Sujono H, Satria A. Prevalence and classification of radix entomolaris in mandibular molars using cone-beam computed tomography: a Southeast Asian population study. BMC Oral Health. 2023;23:1179.

17. Patel S, Brown J, Semper M, Abella F, Mannocci F. European Society of Endodontology position statement: use of CBCT in Endodontics. Int Endod J. 2019;52(12):1675-8.

18. Dhull KS, Garg Y, Singh S, Verma A. Intraoral scanners: mechanism, applications, and advantages. J Prosthodont Biol Sci. 2024;13(3):e16003.

19. Fratila AM, Ionescu A, Ghergic DL, Ionescu E, Moldovan M, Sarosi C. Enhancing intraoral scanning accuracy: clinical considerations. J Clin Med. 2025;14(10):3562.

20. Zaki MS, Mohamed M, Omar E, Hassan R. Trueness and depth discrepancy of post-space scans using intraoral scanners compared to conventional methods. BMC Oral Health. 2025;25:602.

21. Jardim JS, Costa A, Aguiar F, Lins D, et al. The role of intraoral scanning in the fully digital workflow for oral rehabilitation. J Prosthet Dent. 2024;132(4):537-45.

22. Rocca GT, Daher R, Saratti CM, Sedlacek R, Suchy T, Feilzer AJ, et al. Restoration of endodontically treated teeth: minimally invasive approaches with endocrowns and onlays. J Dent. 2018;68:25-34.

23. Skupien JA, Opdam NJ, Kreulen CM, Huysmans MC, Pereira-Cenci T. Crown vs. onlay survival of posterior teeth after endodontic treatment: a systematic review and meta-analysis. J Dent. 2016;54:1-7.