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(CASE REPORT)

COMPREHENSIVE CLINICAL MANAGEMENT AND ANATOMICAL EXPLORATION OF A RADIX ENTOMOLARIS IN A PERMANENT MANDIBULAR FIRST MOLAR: A DETAILED CASE REPORT

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ABSTRACT

The ultimate success of endodontic therapy relies heavily upon the clinician's ability to thoroughly locate, mechanically shape, chemically debride, and completely seal the intricate three-dimensional network of the root canal system. A profound and comprehensive understanding of internal dental anatomy is absolutely essential for achieving this objective, as the failure to identify and treat all existing root canals is a primary etiology for persistent periapical infection and subsequent treatment failure. While standard anatomical configurations are well-documented in dental literature, developmental anomalies such as the *radix entomolaris* (an accessory root located on the distolingual aspect) and the *radix paramolaris* (an accessory root situated on the mesiobuccal aspect) introduce significant clinical challenges that can easily compromise the long-term prognosis of the tooth. This manuscript presents a highly detailed case report illustrating the successful clinical management of a radix entomolaris encountered in a permanent mandibular first molar. Furthermore, it emphasizes the critical importance of meticulous preoperative radiographic interpretation utilizing varied angulations, the strategic application of modified access cavity designs, and the careful visual inspection of the pulpal floor dentinal map to ensure the predictable identification and negotiation of these complex anatomical variations.

Keywords: Radix Entomolaris, Mandibular First Molar, Anatomical Variation, Endodontic Therapy, Cone-Beam Computed Tomography, Aberrant Root Anatomy.

1 INTRODUCTION

The foundational objective of modern endodontic therapy is grounded in the thorough mechanical and chemical debridement of the entire endodontic space, which is subsequently followed by a dense, three-dimensional obturation. This rigorous clinical protocol is designed to prevent the onset of periapical pathosis and to facilitate the biological healing of any pre-existing inflammatory lesions within the periradicular tissues [1]. Consequently, operating clinicians

must possess a deep familiarity with both standard root morphology and unusual canal anatomies to navigate the endodontic triad of cleaning, shaping, and sealing successfully.

The mandibular first molar, often considered the primary workhorse of the human dentition, is particularly well known for displaying a wide array of morphological variations. In the majority of clinical presentations, the mesial root houses two distinct canals that may either end in separate apical foramina or merge in the apical third to exit as a single entity [2]. The distal root typically demonstrates a wide, kidney-shaped canal configuration that tapers down to a singular, round apical foramen. However, the unexpected presence of a supplementary third root requires a fundamental shift in the clinician's approach, demanding strategic modifications to standard access preparations, customized shaping protocols, and enhanced disinfection techniques to prevent catastrophic treatment failure.

2 CASE PRESENTATION

A 21-year-old male patient presented to the outpatient clinic of the Department of Conservative Dentistry and Endodontics, reporting a chief complaint of severe, relentless pain localized to the right side of his mandible that had persisted for the previous seven days. Upon obtaining a comprehensive dental and medical history, the patient described the pain as continuous and throbbing in nature, frequently radiating toward the temporal and auricular regions on the ipsilateral side. The patient noted that the discomfort was intensely exacerbated by the consumption of hot and sweet foods, leading to prolonged lingering pain that significantly disrupted his normal sleep patterns over the preceding week.

A thorough intraoral examination revealed the presence of a deep, cavitated occlusal carious lesion affecting the right mandibular first molar (FDI tooth 46). The offending tooth demonstrated acute tenderness upon vertical percussion, indicating the spread of inflammation into the periodontal ligament space. There were no visible signs of a draining sinus tract, vestibular swelling, or generalized soft tissue erythema. Both tooth mobility and periodontal probing depths were recorded and found to be well within normal physiological limits, ruling out a primary periodontal etiology.

Radiographic assessment utilizing standard intraoral periapical views revealed a large radiolucent lesion penetrating the pulp chamber, accompanied by a noticeable widening of the periodontal ligament space at the periapical regions of both the mesial and distal roots. Based on the clinical and radiographic findings, a definitive diagnosis of symptomatic irreversible pulpitis with acute apical periodontitis was established, and the patient was scheduled for immediate endodontic intervention.

Profound local anesthesia was achieved via an inferior alveolar nerve block utilizing 1.8 ml of 2% lignocaine hydrochloride containing a 1:80,000 concentration of epinephrine. Following the application of rubber dam isolation to ensure a sterile operating field, all carious biomass was excavated, and a conventional triangular access cavity was prepared using high-speed diamond burs.

Initial exploration of the pulpal floor yielded three standard canal orifices (mesiobuccal, mesiolingual, and a single distal canal). However, meticulous inspection of the dentinal map revealed a notable structural anomaly: a severe dentinal overhang was present on the distolingual aspect of the chamber. Furthermore, the primary distal canal orifice was positioned much further to the buccal side than is traditionally expected. Governed by the established laws of pulpal floor anatomy and orifice location, this distinct asymmetry strongly indicated the hidden presence of an additional distolingual root canal.

To facilitate unimpeded straight-line access to this suspected anatomical variant, the standard triangular access cavity design was strategically modified and extended distolingually, transforming the outline form into a trapezoidal shape. Subsequent exploration with a DG-16 endodontic explorer successfully engaged a fourth canal orifice located in the far distolingual corner of the pulpal floor. To definitively confirm this finding radiographically, a second periapical radiograph was captured utilizing a 25-degree mesial tube shift, which clearly outlined the distinct morphology of a radix entomolaris. The entire root canal system—comprising the mesiobuccal, mesiolingual, distobuccal, and the newly identified distolingual canals—was then systematically negotiated, mechanically prepared using rotary instrumentation, chemically disinfected with sodium hypochlorite, and hermetically sealed using gutta-percha and an epoxy resin-based sealer. Informed consent was obtained from the patient prior to the initiation of thearpy and thoroughly briefed on the procedure and formally consented to the publication of this case report, including the use of their de-identified clinical data, intraoral findings, and radiographic images for academic and scientific purposes.

3 DISCUSSION

3.1 Prevalence and Anthropological Significance

The occurrence of a radix entomolaris in mandibular first molars is not evenly distributed across the global population; rather, it is strongly tied to specific genetic lineages and ethnic backgrounds. Anthropological and dental studies have consistently shown that populations expressing Mongoloid traits—such as those of Chinese, Eskimo, and Native American descent—exhibit a remarkably high prevalence of this anomaly, ranging anywhere from 5% to 30% [1,3]. Conversely, in Eurasian and Indian demographics, the incidence drops significantly to less than 5% [3], and it remains an exceptionally rare finding in African populations at less than 3% [1]. While the RE is most commonly associated with the first mandibular molar, it can occasionally manifest in the third molar, and is seen least frequently in the second molar. Notably, when this anatomical variant is present, literature suggests it occurs bilaterally in 50% to 67% of individuals [4].

3.2 Etiological Factors

The precise embryological mechanisms driving the formation of an accessory root remain a subject of ongoing investigation. However, researchers suggest that the anomaly is likely the result of external environmental stimuli influencing the developing Hertwig's epithelial root sheath during odontogenesis [1]. Furthermore, the profound phenotypic expression of this extra root is heavily dictated by racial and genetic factors, which explains the high degree of penetrance seen in specific global populations and highlights the genetic complexity of dental morphogenesis.

3.3 Advanced Radiographic Interpretation

Standard diagnostic imaging frequently fails to capture complex three-dimensional anatomy. As documented by Walker and Quackenbush [5], clinicians relying solely on standard parallel panoramic radiographs only achieve a 90% accuracy rate when attempting to diagnose three-rooted mandibular molars. The inherent limitation of conventional two-dimensional radiography is the compression of complex structures, resulting in the superimposition of the distolingual root directly behind the more prominent distobuccal root.

To circumvent this limitation, clinicians must employ additional radiographic exposures utilizing altered horizontal angulations. Research conducted by Wang et al. [6] clearly demonstrated that utilizing a 25-degree mesially angulated radiograph provides vastly superior visibility for diagnosing a radix entomolaris compared to distal angulations. This phenomenon is explained by the SLOB rule (Same Lingual, Opposite Buccal). When the x-ray tube head is shifted mesially, the lingually positioned object (the radix entomolaris) will appear to move in the same mesial direction on the resulting film, effectively separating its radiographic shadow from the distobuccal root.

In contemporary practice, Cone-Beam Computed Tomography (CBCT) has emerged as an indispensable diagnostic instrument. By providing a non-invasive, multiplanar reconstruction of the maxillofacial region, CBCT completely eliminates anatomical superimposition. This allows the practitioner to precisely visualize the acute curvatures typically associated with radix canals, thereby drastically reducing the risk of iatrogenic complications such as procedural ledging, apical transportation, or the catastrophic separation of rotary instruments [6].

3.4 Clinical Diagnosis and Access Cavity Modification

The diagnostic process must extend beyond radiography and incorporate a rigorous physical examination of the tooth crown and the surrounding periodontal architecture. Careful periodontal probing can often trace the cervical morphology of the roots, offering vital clues. The presence of an accessory cusp (such as a tuberculum paramolare), an unusually prominent distolingual developmental lobe, or a distinct cervical convexity at the cementoenamel junction should immediately raise clinical suspicion regarding the presence of a supplementary root [1].

Navigating the internal anatomy presents its own set of unique challenges. High-resolution micro-computed tomography studies [7] have confirmed that the orifice of the radix entomolaris is notoriously difficult to locate because it is frequently masked by a rigid dentinal protrusion extending from the pulpal roof. When managing a suspected RE, the clinician must proactively extend the standard triangular access preparation toward the distolingual aspect, shaping it into a rectangle or trapezoid to gain adequate visual and physical access.

The utilization of visual magnification adjuncts—ranging from simple operating loupes to high-powered dental operating microscopes—is practically mandatory for identifying the subtle color variations on the pulpal floor. Clinicians should meticulously trace the dark developmental fusion lines using an angled endodontic explorer to safely uncover the hidden orifice beneath the dentinal overhang, ensuring that no anatomy is left untreated.

Figure 1: Pre Operative Radiograph

Figure 2: Intraorifice Photograph

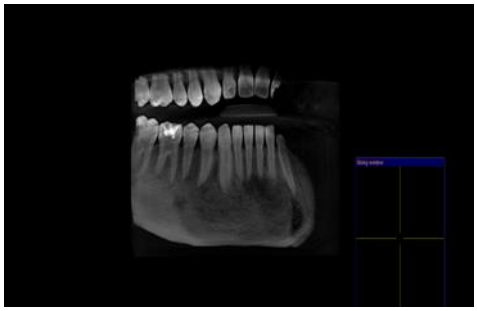

Figure 3: CBCT evaluation panoromic view

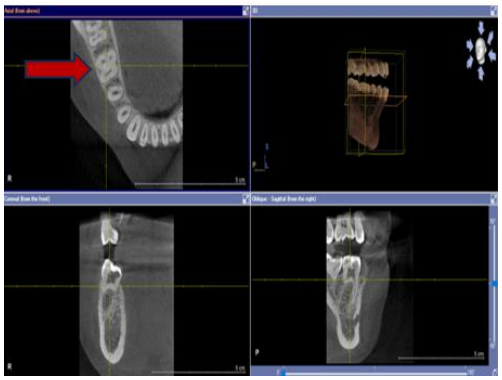

Figure 4: CBCT evaluation – cross section view (coronal third)

Figure 5: CBCT evaluation – cross section view (2MM below CEJ)

Figure 6: CBCT evaluation – cross section view (middle third)

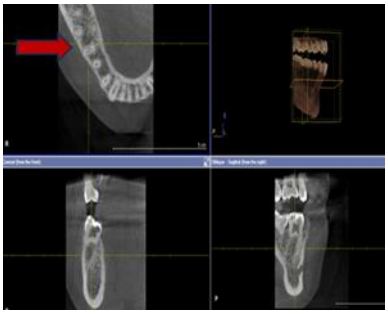

Figure 7: CBCT evaluation – cross section view (apical third)

Figure 8: Working Length Determination Radiograph

Figure 9: Working Length Determination Photograph

Figure 10: Master Cone Radiograph

Figure 11: Master Cone Photograph

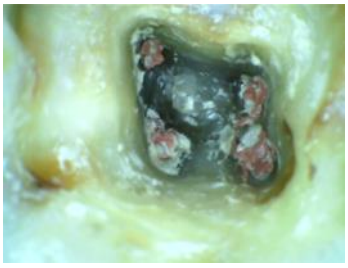

Figure 12: Obturation Photograph

Figure 13: Post Operative Radiograph

Figure 14: 2 months follow up

4 CONCLUSION

Although the incidence of a radix entomolaris in the Indian demographic is relatively low when compared to populations of Mongoloid descent, endodontic practitioners must constantly maintain a high index of suspicion for this specific anatomical variation. The long-term survivability of a root canal-treated mandibular molar is entirely dependent upon the early detection, meticulous chemical debridement, and complete three-dimensional obturation of all existing canal spaces, including those hidden within an extra distolingual root. Failure to locate and manage a radix entomolaris remains a leading cause of persistent periapical pathology and post-treatment endodontic disease. Furthermore, identifying this supplementary root morphology early in the diagnostic phase helps the clinician anticipate procedural difficulties, formulate a more accurate prognosis for endodontic retreatment scenarios, and proactively prevent complicated root fractures in the event that exodontia is ultimately required.

STATEMENTS ON COMPLIANCE WITH ETHICAL STANDARDS

Disclosure of conflict of interest

The authors declare no conflicts of interest regarding this manuscript

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