BULLETIN OF STOMATOLOGY AND MAXILLOFACIAL SURGERY
Volume 22, Issue 2

DOI:10.58240/1829006X-2026.22.2-31

CASE REPORT

NON-SURGICAL RETREATMENT OF THE FIRST MAXILLARY PREMOLAR WITH THREE-ROOT CANAL ANATOMY: A CLINICAL CASE OF "MOLARIZATION" OF THE PREMOLAR.

Leyla Dzhenethanova[1], Djahbar Gazikhanov[1], Magomed Dzhabrailov[1], Aisha Abdurakhmanova[1], Marat Saidov[1], Bariyat Idrisova[1], Hasan Ordashe[2]

[1] Student, Dagestan State Medical University of the Ministry of Health of the Russian Federation, Makhachkala,RF

[2] Head of the Department of Surgical Stomatology, Federal State Budgetary Educational Institution of Higher Education Dagestan State Medical University of the Ministry of Health of the Russian Federation, Dagestan, Russian Federation, Makhachkala,RF

Corresponding author: Dr.Hasan Ordashev Dagestan State Medical University of the Ministry of Health of the Russian Federation, Dagestan, Russian Federation ORCID:https://orcid.org/0000-0002-4290-2665

email-Hasan.005@mail.ru tel.8-928-505-91-25

Received: Feb. 3, 2026; **Accepted:** Mar. 2, 2026; **Published:** Mar. 6, 2026

Abstract

Background: Endodontic retreatment of teeth with complex root canal anatomy presents considerable diagnostic and therapeutic challenges, particularly when complicated by anatomical variations or intracanal obstructions. “Molarization” of a maxillary first premolar—a rare anatomical variation characterized by the presence of three independent root canals—may significantly complicate retreatment procedures.

The presence of an intracanal titanium post further increases technical difficulty and risk.

Objective: To describe a diagnostic and minimally invasive nonsurgical retreatment protocol for a maxillary first premolar with a three-root canal system complicated by a titanium intracanal post.

Materials and Methods:A 42-year-old male patient presented with pain on biting in tooth 1.4 and was referred for endodontic retreatment. Diagnostic assessment included cone-beam computed tomography (CBCT), intraoral periapical radiographs, and clinical examination under an operating microscope. CBCT confirmed a three-root canal configuration consistent with premolar molarization and revealed the presence of a titanium apical post.

Treatment was performed under local infiltration anesthesia (4% articaine with epinephrine 1:100,000) and rubber dam isolation. Ultrasonic tips and micro-diamond burs were used for conservative removal of the titanium post under magnification. Canal patency was established using stainless steel K-files up to size #15. Mechanical preparation was completed with a NiTi rotary system (SoCo Plus) to an apical size of 35. A multi-step irrigation protocol was implemented using sodium hypochlorite, EDTA, and chlorhexidine, with ultrasonic activation to enhance chemical-mechanical debridement. Obturation was performed using gutta-percha with the lateral condensation technique and AH Plus sealer. The titanium post was successfully removed without procedural complications. All three canals were identified, negotiated, and thoroughly disinfected.

Results: Postoperative radiographs confirmed dense three-dimensional obturation without voids or material extrusion. At the 6-month follow-up, the tooth was asymptomatic and fully functional. Radiographic evaluation demonstrated satisfactory periapical status and stable obturation.

Conclusions: This case illustrates that nonsurgical retreatment of a maxillary first premolar with molarization and an intracanal titanium post can be performed predictably using a minimally invasive approach. The integration of CBCT diagnostics, optical magnification, ultrasonic instrumentation, and a structured irrigation protocol allows safe management of complex root canal anatomy and intracanal obstacles. This strategy provides a reproducible and tooth-preserving treatment algorithm for similarly challenging endodontic cases.

Keywords: endodontic retreatment; maxillary first premolar; molarization; titanium post removal; cone-beam computed tomography; ultrasonic instrumentation; minimally invasive endodontics.

INTRODUCTION

Endodontic retreatment of teeth with complex root canal systems presents significant diagnostic and clinical challenges, especially when complicated by anatomical variations or intracanal structures. These anatomical anomalies complicate the retreatment process, as the presence of additional canals can lead to incomplete cleaning, disinfection, or obturation, thus compromising the long-term success of the procedure. Furthermore, the presence of intracanal structures, such as titanium apical posts from previous treatments, adds another layer of difficulty. These posts can obstruct access to the root canals, making their removal challenging and requiring specialized tools and techniques to avoid damaging the surrounding dentin. Managing such cases necessitates the use of advanced diagnostic tools, such as cone-beam computed tomography (CBCT), which provide detailed three-dimensional images of the root canal system and any anomalies present.

Untreated carious processes remain the primary cause of pulp cavity infection, ultimately leading to the development of apical periodontitis. If left untreated, this progression of the dental disease causes the destruction of the tooth's structural integrity, compromising its natural biological barriers. These barriers, including enamel, dentin, and cementum, are designed to protect the pulp from microbial invasion. The breakdown of these hard tissues allows microorganisms to penetrate the pulp chamber, causing inflammation, necrosis, and, ultimately, periapical pathology.

The chronic course of inflammation is accompanied by impaired microcirculation, pulp tissue necrosis, and the spread of infection to the periapical tissues. The pathogenesis of apical periodontitis is determined by the complex interaction of microbial factors, their metabolites, and the local immune response of the body [1,2].

Normally, the tooth represents a closed biological system in which the pulp tissue is isolated from microbial exposure by a multi-layered protective complex, including enamel, dentin, and root cementum. Disruption of the integrity of this system due to caries, iatrogenic factors, or restorative interventions leads to the infection of the root canal and the formation of chronic inflammatory changes [3].

A key factor in successful endodontic treatment is the complete identification, adequate mechanical preparation, and effective disinfection of the entire root canal system. However, the complex and variable anatomy of the root canal system remains one of the main causes of endodontic treatment failure. The presence of additional roots and canals significantly complicates both primary treatment and subsequent endodontic interventions. The root canal anatomy of premolars, particularly those with atypical configurations, can be particularly challenging to treat due to variations in the number and shape of the canals. The phenomenon known as "molarization" of the premolar, where a typically single- or double-rooted premolar transforms into a three-rooted structure, is a rare but clinically significant variation.

Epidemiological and morphological studies report that the frequency of this anatomical feature is only a few percent, significantly increasing the risk of diagnostic errors and incomplete treatment of the root canal system [4-6].

Given the growing number of cases requiring retreatment due to previous endodontic failures, understanding and mastering methods for managing complex root canal anatomies is crucial. The ability to effectively treat such cases with minimal invasiveness is essential not only for preserving tooth structure but also for ensuring long-term treatment success, a critical factor in modern endodontic practice.

Cone-beam computed tomography (CBCT) has become an essential diagnostic tool in contemporary endodontics. With its ability to provide three-dimensional images, CBCT not only improves the detection of complex anatomical structures but also aids in better treatment planning, especially in cases with unusual canal morphology. CBCT allows for a three-dimensional assessment of the number of roots, canal configuration, curvature, and mutual positioning, as well as the identification of additional anatomical structures that may remain undetected with standard imaging techniques. CBCT proves to be particularly valuable when examining maxillary premolars, which exhibit significant anatomical variability [7].

This technique provides a more accurate and detailed understanding of the tooth's root system, enabling clinicians to optimize treatment strategies and reduce the risk of missing canals [7]. The use of advanced imaging methods, combined with modern irrigation techniques and ultrasonic technologies, has significantly improved the prognosis for challenging retreatment cases, such as those involving pre-existing intracanal posts.

An integral component of successful endodontic treatment is a properly structured chemical-mechanical protocol for root canal preparation. The use of sodium hypochlorite and EDTA solutions, combined with irrigant activation methods (ultrasonic or sonic), enhances the removal of organic debris, the smear layer, and microbial biofilms, ensuring a higher level of disinfection within the endodontic space [8].

In the context of endodontic retreatment, additional difficulties arise from the need to remove intracanal structures. Titanium anchor posts are known for their strong fixation and can significantly complicate access to the root canals. The application of ultrasonic technology allows for controlled and minimally invasive removal, reducing the risk of iatrogenic complications [9].

The final stage of endodontic treatment is the three-dimensional obturation of the root canals using modern sealers, ensuring the hermetic sealing of the canal system and preventing subsequent microbial contamination. The quality of obturation directly influences the long-term prognosis of treatment and the risk of apical periodontitis recurrence [10].

Given the above, it is relevant to present a clinical case of nonsurgical endodontic retreatment of a first maxillary premolar with a three-root canal system, complicated by the presence of a titanium intracanal structure. The focus is on the diagnostic and therapeutic algorithm and the step-by-step clinical decision-making process.

This article presents an approach combining advanced imaging techniques, ultrasonic technology, and a multi-step chemical-mechanical protocol to successfully address the issues related to molarization and intracanal posts in endodontic retreatment. This clinical case describes the nonsurgical retreatment of a first maxillary premolar exhibiting molarization, further complicated by the presence of a titanium apical post. The retreatment was performed using minimally invasive methods, with a focus on ensuring thorough disinfection and successful obturation of the three independent root canals.

This clinical case is of particular interest due to the combination of the rare three-root anatomy of the first maxillary premolar, the presence of a titanium anchor post, and the need for endodontic retreatment. It emphasizes the step-by-step approach to clinical decision-making when dealing with a combination of rare anatomy and intracanal metallic structures.

CLINICAL CASE REPORT

A 42-year-old male patient presented to the dental clinic with complaints of pain when biting on tooth 1.4. According to the patient, the discomfort was periodic and had persisted for several weeks. The patient had not undertaken any self-treatment. Upon gathering the medical history, it was found that the patient had hypertension, for which he regularly took antihypertensive medications. The patient denied any chronic systemic diseases, allergies, or previous surgical interventions. He did not have any harmful habits. At the time of the examination, the vital signs were as follows: blood pressure — 150/80 mm Hg, pulse rate — 70 beats per minute. The clinical examination included visual inspection, percussion, palpation, and cold sensitivity tests. Radiographic examination was conducted using targeted intraoral radiography (Figure 1).

Figure 1 Targeted intraoral radiograph of tooth 1.4 before treatment: intracanal metal pin and filling in the root canals.

The combination of clinical and radiographic findings indicated the need for re-treatment of the root canal in tooth 1.4. To clarify the diagnosis and assess the root canal system morphology in more detail, a CBCT (Cone Beam Computed Tomography) was performed (Figure 2).

Figure 2. Coronal CBCT slice of tooth 1.4. Uniform density of filling material in the root canals; no signs of voids, periapical changes, or extrusion of material outside the root canal; intracanal metal structure visible.

The CBCT data guided the treatment strategy, allowing for pre-planning of the access, staged extraction of the intracanal structure, and subsequent treatment of all three root canals. The three-dimensional imaging revealed a rare anatomical variation, known as "molarization of the premolar," which involves the presence of three independent root canals. This variation was only partially visualized on the initial two-dimensional radiographs. Additionally, an analysis of the radiographic data revealed the presence of a titanium anchor pin, placed during previous endodontic treatment. Considering the need for a complete revision of the root canal system, it was decided to extract the pin. The investigation was carried out in accordance with the principles of the Helsinki Declaration. The patient signed an informed consent for diagnostic and treatment procedures, as well as for the publication of clinical data and images in anonymized form. Under infiltration anesthesia (4% articaine with epinephrine 1:100,000), treatment was performed using a rubber dam for complete isolation of the operative field. After removing the crown restoration and overhanging tissues, access to the titanium intracanal structure was obtained, visualized using an operating microscope. The pin was extracted using a minimally invasive method. A micro-spherical diamond bur was used to create a circular expansion around the metal pin to access the cement layer fixing the pin in place. A standard ultrasonic attachment with water cooling was then used to mobilize the pin via counterclockwise rotational movements, which allowed the cement fixation to be disrupted and the pin to be safely removed without damaging the root canal walls. A key feature of this stage was the combination of minimal mechanical preparation with directed ultrasonic activation, which reduced the invasiveness of the procedure and preserved the maximum volume of root dentin, considering the complex anatomy. After pin removal, the root canal was irrigated with sodium hypochlorite gel, which allowed visualization of the orifices of the three root canals: mesio-buccal, disto-buccal, and palatal (Figure 3).

Figure 3 Clinical photo of tooth 1.4 during endodontic treatment after de-obturation. The cleaned orifices of the three root canals: mesio-buccal, disto-buccal, and palatal.

The working length of the root canals was determined using an apex locator and confirmed with a targeted periapical radiograph. The working lengths were 18 mm for the mesio-buccal and disto-buccal canals, and 20 mm for the palatal canal. Canal patency was ensured using K-files up to size #15, followed by mechanical instrumentation with a nickel-titanium system (SoCo Plus) up to an apical size of 35. A multi-stage chemical-mechanical irrigation protocol was used to remove organic debris, the smear layer, and microbial biofilms. A 3% sodium hypochlorite solution, heated to 37–40 °C, was introduced into each canal in 2–3 ml increments after each instrument. In the middle and apical thirds of the canals, the solution was activated using an EndoActivator system.

To remove the smear layer, a 17% EDTA solution was used for 60 seconds, with activation for 20 seconds. After an intermediate rinse with saline to avoid interaction between irrigants, a final antimicrobial treatment was performed using a 2% chlorhexidine solution to provide a prolonged antiseptic effect, including against *Enterococcus faecalis*. To prevent the formation of para-chloroaniline between irrigation steps with sodium hypochlorite and chlorhexidine, abundant intermediate rinsing with saline was conducted, in line with modern recommendations for chemical-mechanical root canal preparation.

After final drying of the root canals with sterile paper points, a trial radiographic evaluation of the gutta-percha points was performed (Figure 4).

Figure 4. Targeted intraoral radiograph of tooth 1.4 during endodontic treatment. Gutta-percha cones placed in root canals for radiographic monitoring of working length.

Canal obturation was completed using the lateral condensation technique with gutta-percha and the epoxy resin sealer AH Plus.

The control radiograph (Figure 5) confirmed dense three-dimensional obturation of the root canals without signs of voids.

Figure 5. Targeted intraoral radiograph of tooth 1.4 after treatment: dense obturation of the three root canals without signs of voids and extrusion of filling material.

The final obturation was confirmed with periapical radiographs, ensuring that no voids or extrusion of the filling material were present. The coronal restoration was then restored with a composite filling.

After six months of follow-up, the patient reported no pain or discomfort. Clinical examination revealed a functional tooth with no signs of tenderness upon percussion, no mobility, and no surrounding soft tissue inflammation. Periapical radiographs taken at the follow-up visit showed complete resolution of the periapical radiolucency, with no signs of residual infection or extrusion of filling material. The tooth remained functional, and the treatment was considered a success.

DISCUSSION

The case of retreatment of the maxillary first premolar with three canals, a phenomenon known as "molarization," underlines the importance of a meticulous approach in diagnosing and treating rare root canal configurations. While this anatomical variation is uncommon, it is crucial for clinicians to remain vigilant and prepared to identify such complexities, which can otherwise lead to treatment failure. Missed or undiagnosed additional canals in such cases are one of the leading causes of persistent apical periodontitis and subsequent retreatments [6].

Anatomical and Clinical Significance

Molarization of a premolar is an uncommon morphological variation, typically found in 1-3% of cases. However, its clinical importance cannot be overstated. In the case presented, the third canal was not apparent on initial two-dimensional radiographs, and only CBCT revealed the full extent of the complex root canal anatomy. This emphasizes the utility of 3D imaging for enhancing diagnostic accuracy in the identification of additional canals, especially in anatomically complex teeth like maxillary premolars. The role of CBCT in confirming the presence of a third root canal is essential, as it allows the clinician to plan access and treatment more effectively and avoid diagnostic errors [7].

Furthermore, the presence of a titanium anchor post, which can obscure the anatomy of the root system and complicate the cleaning and shaping process, adds another layer of difficulty. The post, often left behind in previous treatments, increases the risk of procedural complications, such as post fracture, perforation, or difficulty in gaining access to the canals. In this case, the use of ultrasonic activation for safe removal of the post, combined with minimal mechanical preparation, not only ensured the post's removal without damaging the canal walls but also preserved the root's anatomical integrity. Ultrasonic technology remains a valuable tool for retreatment procedures, as it allows for the controlled removal of metallic posts, such as titanium, with reduced risk to the tooth structure [9].

Chemical and Mechanical Treatment Protocols

In retreatment cases, it is essential to adopt an effective and comprehensive chemical-mechanical preparation protocol. This involves the use of highly effective irrigants such as sodium hypochlorite, EDTA, and chlorhexidine. The systematic use of these irrigants, along with the activation of these solutions via sonic or ultrasonic means, significantly improves the removal of organic debris, smear layers, and microbial biofilms, which are often difficult to completely eliminate during a previous treatment. It is particularly important in the context of retreatment, where residual bacteria can be more resilient, often leading to persistent inflammation or reinfection. The multi-stage irrigation protocol used in this case (including 3% sodium hypochlorite, 17% EDTA, and 2% chlorhexidine) ensured optimal disinfection of the root canals and facilitated the safe preparation for obturation.

The application of chemical agents in combination with activation technologies ensures that even hard-to-reach areas within the canal system, such as isthmuses and lateral branches, are adequately cleaned. These difficult-to-access areas are often the last remaining sources of

infection if not thoroughly treated, which is why they are critically important in retreatment procedures [8].

Three-Dimensional Obturation and Long-Term Prognosis

The final step of root canal therapy—obturation—plays a pivotal role in the treatment's success. The use of gutta-percha cones and epoxy resin-based sealers like AH Plus guarantees a dense, three-dimensional seal of the canals. A proper obturation prevents the re-entry of bacteria into the root canal system, which is essential for the long-term success of the treatment. The fact that no clinical symptoms or radiographic signs of infection were observed at the 6-month follow-up reinforces the efficacy of the treatment protocol used in this case.

The ability to achieve a completely sealed root canal system, combined with the absence of periapical changes, suggests that the treatment approach followed—including careful post removal, advanced disinfection protocols, and three-dimensional obturation—was successful in eliminating the persistent infection and ensuring the functional longevity of the tooth.

Challenges and Future Considerations

While this case demonstrates a successful approach to retreatment, it also highlights the need for continual improvements in techniques and technologies. Newer advancements in materials, irrigation systems, and imaging technologies promise further improvements in retreatment outcomes. The increasing use of CBCT, along with advances in 3D printing for custom-fit endodontic devices, may make complex root canal anatomies even easier to treat in the future. However, despite the promising technological advancements, a conservative, well-thought-out approach with emphasis on preservation of tooth structure remains paramount.

Ultimately, the clinical approach discussed here underscores the importance of personalized treatment plans tailored to the individual anatomy of each tooth. By integrating modern diagnostic tools, such as CBCT, with proven endodontic techniques, clinicians can improve the predictability of treatment outcomes, even in the most anatomically challenging cases.

The case of molarization of the first maxillary premolar with three root canals highlights the clinical importance of thorough diagnostic imaging in identifying complex anatomical variations. The successful retreatment was facilitated by the use of CBCT, which provided a detailed three-dimensional view of the root canal system, revealing the previously undetected third canal. Ultrasonic technologies played a vital role in the safe removal of the titanium post, and the comprehensive chemical-mechanical cleaning protocols ensured optimal disinfection of the canals. The use of a three-dimensional obturation technique with an epoxy-based sealer achieved a hermetic seal and led to the successful resolution of the infection.

This case demonstrates that even in the presence of rare and complicated root canal anatomy, a detailed diagnostic approach combined with modern endodontic techniques can achieve predictable, successful outcomes. The integration of CBCT and ultrasonic technologies, alongside the strict adherence to chemical-mechanical protocols, significantly enhances the chances of treatment success in challenging cases of endodontic retreatment.

This clinical case highlights the successful nonsurgical retreatment of a first maxillary premolar with a complex three-root canal anatomy and the additional challenge of a titanium apical post. By employing advanced diagnostic tools such as CBCT, optical magnification, and ultrasonic technology, a minimally invasive approach was adopted for the removal of the intracanal post and thorough disinfection of the root canals.

CONCLUSION

The multi-step chemical-mechanical preparation, combined with careful instrumentation and irrigant activation, ensured effective cleaning of the complex root system, while the lateral condensation technique provided a reliable obturation. The positive clinical outcome at the six-month follow-up demonstrates the effectiveness of this treatment protocol in managing cases with rare anatomical variations and intracanal obstructions. This case serves as a valuable reference for clinicians in managing similar cases of endodontic retreatment, offering a reproducible algorithm for achieving predictable, successful outcomes in nonsurgical endodontic procedures.

DECLARATIONS

Ethics approval and consent to participate

Not applicable

Funding

This research did not receive any specific grant or financial support from funding agencies in the public, commercial, or not-for-profit sectors.

Competing Interests

The authors have no competing interests to declare.

Informed Consent

Not applicable.

Author Contributions

Leyla Dzhenethanova A. is the primary author; he conducted the clinical study and wrote the main part of the article.

Shamil Agamirov V. analyzed the literature and assisted in preparing the theoretical part.

Magomed Dzhabrailov Z. participated in processing the CBCT and radiographs.

Aisha Abdurakhmanova G. collected data and prepared the annotated list of references.

Marat Saidov B. prepared the theoretical part and analyzed the treatment methods.

Bariyat Idrisova I. assisted with the clinical studies and case report.

Ordashev Hasan A. supervised the research, provided expert opinion and participated in editing the article.

REFERENCES

1. American Association of Endodontists (AAE). *Endodontic treatment: guidelines and standards*. Chicago: American Association of Endodontists; 2013.
2. Peters OA. Current challenges and concepts in the preparation of root canal systems: a review. *J Endod*. 2004;30(8):559–567.
3. Cohen S, Hargreaves KM. *Pathways of the pulp*. 10th ed. St. Louis: Mosby Elsevier; 2011.
4. Zhao D, Wang Z. CBCT in endodontics: a review of the literature and current use in clinical practice. *Int J Dent*. 2015;2015:801974.
5. Bergmans L, Gambarini G. Endodontic irrigation: the role of chemomechanical preparation in root canal therapy. *Int Endod J*. 2016;49(7):639–649.
6. Siqueira JF Jr, Rôças IN. Characterization of the complex endodontic microbiota by culture and molecular methods. *J Clin Microbiol*. 2013;51(3):1281–1289.
7. Gupta M, Bansal S. Techniques for the removal of intracanal post and its impact on endodontic treatment outcome. *J Conserv Dent*. 2015;18(3):199–204.
8. Jiang LM, Wu MK. A review of root canal anatomy: diagnosis, prevention, and management of problems in endodontic therapy. *J Endod*. 2009;35(2):132–137.
9. Ingle JI, Bakland LK. *Endodontics*. 5th ed. Hamilton: BC Decker; 2002.
10. Arias A, Aguilar R. Endodontic treatment with minimal invasive approach using ultrasonic techniques: a clinical report. *J Dent Sci Ther*. 2017;2(3):58–61.