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Diagnosis Of Root Canal Obturation Failure (Tooth 24) Due To Post-Endodontic Treatment Flare-Up With Cone Beam Computed Tomography (CBCT) Radiography

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Abstract

Post-obduration flare-up is a rare acute complication characterized by severe pain occurring within a few days following endodontic treatment. In a treated tooth, acute pain triggered by masticatory forces often leads to the initial clinical suspicion of a Vertical Root Fracture (VRF). This case report aims to demonstrate the crucial role of CBCT in diagnosing the etiology of flare-up in tooth 24. An 18-year-old male patient experienced severe pain on tooth 24, 1-3 days post-obduration, exacerbated after consuming satay. Initial periapical radiography (2D) failed to show a VRF or clear periapical lesions. Subsequent CBCT examination (3D) ruled out VRF and instead revealed a non-hermetic root canal filling defect (intraradicular void) in the mid-root section. CBCT proved essential for the definitive diagnosis, guiding the treatment plan toward retreatment and providing a better prognosis compared to VRF.

Keywords: Post-Obturation Flare-Up, Vertical Root Fracture (Vrf), Cbct Diagnosis, Endodontic Retreatment, Intraradicular Void, Case Report.

INTRODUCTION

Root Canal Treatment (RCT) is a fundamental dental procedure aimed at preserving teeth that have undergone irreversible pulp damage or necrosis. The success of RCT relies on maximum microbial cleaning and the hermetic sealing of the root canal system through obturation. An ideal obturation must fill the entire volume of the root canal, prevent microleakage, and isolate any remaining microorganisms.

In clinical practice, the quality of obturation plays a decisive role in determining long-term treatment outcomes. Inadequate compaction, poor adaptation of filling materials, or the presence of voids within the obturation mass may compromise the apical and coronal seal, allowing bacterial ingress or persistence of intracanal infection. Such technical shortcomings can undermine otherwise well-executed cleaning and shaping procedures and may lead to post-treatment complications.

Furthermore, obturation-related errors are often difficult to detect using routine clinical examination alone. Patients may present with nonspecific symptoms, while the tooth may appear clinically intact. As a result, obturation defects may remain undiagnosed until they manifest as postoperative pain, delayed healing, or acute exacerbation of periapical inflammation.

Despite modern protocols significantly improving success rates, acute post-treatment complications—known as endodontic flare-ups—remain a clinical challenge. A flare-up is a manifestation of acute periapical inflammation, generally caused by an imbalance between irritants (debris, bacteria, toxins, or chemicals) and the host's defense mechanisms. Flare-ups can be triggered by the extrusion of infected debris into the periapical tissue during instrumentation or by obturation failures that create pathways for recontamination.

The incidence of flare-ups has been reported to vary widely in the literature, reflecting differences in case selection, canal anatomy, microbial status, and procedural techniques. Clinically, flare-ups not only cause patient discomfort but may also negatively affect patient confidence and compliance with further dental treatment. Therefore, identifying the underlying cause of post-obturation pain is essential for appropriate management and prognosis.

Clinically, flare-ups may significantly affect patient quality of life and confidence in dental care, particularly when pain occurs shortly after treatment that was expected to relieve symptoms. Therefore, understanding the mechanisms and predisposing factors of post-obturation flare-ups is crucial for both prevention and management.

Additionally, occlusal trauma following obturation, especially from hard or fibrous food, can exacerbate existing periapical inflammation or magnify pain perception. This mechanical factor may further complicate the diagnostic process, as it may mimic structural failure of the root rather than a biologically driven inflammatory response.

This case presents a unique diagnostic challenge as severe pain in the maxillary first premolar (tooth 24) emerged immediately following obturation and was exacerbated by intense occlusal pressure while the patient was consuming mutton satay. Clinically, this combination is highly suspicious of a Vertical Root Fracture (VRF), a diagnosis associated with a poor prognosis. Maxillary premolars, particularly tooth 24, often possess complex anatomy (two roots or two canals) and are highly susceptible to VRF due to mechanical stress post-RCT.

Vertical root fracture is a critical condition in endodontics because it often necessitates tooth extraction and is frequently difficult to diagnose at an early stage. The clinical signs of VRF may overlap with those of apical periodontitis or post-treatment flare-ups, making differential diagnosis particularly challenging when pain is the primary symptom. As a result, clinicians must rely on a combination of clinical findings and advanced imaging to avoid misdiagnosis and unnecessary invasive procedures.

Periapical radiography (2D) is the mandatory initial diagnostic step. However, 2D imaging has significant limitations, particularly in detecting early-stage VRF aligned with the X-ray beam or identifying filling defects in the bucco-lingual plane. To rule out VRF and evaluate the quality of the filling in 3D, the use of Cone Beam Computed Tomography (CBCT) is essential and indicated. This case report aims to demonstrate how CBCT successfully ruled out VRF and revealed the actual etiology of the flare-up: technical failure of the obturation.

CBCT provides enhanced diagnostic accuracy by allowing three-dimensional assessment of root canal fillings, root morphology, and periapical tissues without anatomical superimposition. Its use is especially valuable in cases with persistent symptoms and inconclusive conventional radiographs. When applied judiciously, CBCT facilitates precise diagnosis, guides appropriate treatment planning, and contributes to a more favorable clinical outcome.

RESEARCH METHODS

This study is a clinical case report documenting a diagnostic and therapeutic approach to a post-endodontic complication in an 18-year-old male patient. The research methodology began with a comprehensive clinical assessment, including a review of the patient's dental history, particularly the recent multi-visit root canal treatment on tooth 24. Intraoral examinations were conducted through percussion, palpation, and mobility tests to evaluate the severity of the periapical inflammation. For the radiographic investigation, a comparative approach was used between two-dimensional (2D) periapical radiography and three-dimensional (3D) imaging. While periapical radiographs served as the mandatory initial step, Cone Beam Computed Tomography (CBCT) was subsequently utilized to eliminate structural superimposition and definitively rule out a vertical root fracture (VRF). The diagnosis was established by correlating clinical symptoms with three-dimensional findings of intraradicular voids. Finally, the treatment plan followed a non-surgical endodontic retreatment protocol, adhering to the ALARA principle to ensure clinical justification and a favorable prognosis.

This case report followed a stepwise clinical procedure. First, diagnosis was established through anamnesis, clinical examination, and sequential radiographic evaluation using periapical radiography and CBCT. Second, etiology was determined by correlating clinical findings with three-dimensional radiographic evidence, particularly the presence of intraradicular voids within the

obturation material. Third, treatment planning and intervention were performed based on the definitive diagnosis, consisting of non-surgical endodontic retreatment. Finally, outcome evaluation was conducted through clinical follow-up to assess symptom resolution and treatment success.

RESULTS AND DISCUSSION

The results of this case report are presented in a descriptive manner, encompassing the patient's clinical presentation, diagnostic findings, radiographic evaluation, etiological analysis, treatment procedure, and clinical outcome. The findings are reported sequentially to illustrate the diagnostic process and therapeutic management of the post-endodontic complication observed in this patient.

CASE REPORT

An 18-year-old male patient presented to the Department of Conservative Dentistry with a chief complaint of severe pain in the maxillary left first premolar (tooth 24). the pain occurred suddenly and intensified sharply approximately 1–3 days after tooth 24 underwent a root canal obturation procedure. The patient reported that the pain peaked after consuming hard and chewy food, specifically mutton satay. The pain was described as a throbbing sensation and was painful upon biting. Tooth 24 had previously been diagnosed with pulp necrosis and had undergone multi-visit root canal treatment, concluding with an obturation procedure using the lateral condensation technique with gutta-percha and sealer.

DIAGNOSIS AND ETIOLOGY

Extraoral examination showed normal conditions, with no signs of facial swelling, asymmetry, or palpable cervical lymphadenopathy, ruling out spreading odontogenic infection. Intraoral examination of tooth 24 revealed that the tooth had been restored with an adequate temporary filling. The surrounding gingival tissues appeared healthy, without localized redness or swelling.

Percussion tests elicited a strong positive response (sharp pain), indicating active inflammation. Palpation tests were negative, and mobility tests for tooth 24 showed no increased mobility (Grade 0), which does not support a diagnosis of advanced Vertical Root Fracture (VRF). Based on the post-obturation pain triggered by occlusal pressure, the primary differential diagnoses were Vertical Root Fracture (VRF) or Acute Exacerbation of Apical Periodontitis due to post-obturation irritants.

A supplementary periapical radiographic examination was performed to evaluate the quality of the obturation and to look for signs of VRF. The periapical radiograph showed gutta-percha obturation extending nearly to the apex. In the 2D view, the obturation appeared sufficiently dense, and no radiolucent fracture lines were visible. Minimal widening of the PDL space was observed around the apex. Since the periapical radiograph was inconclusive in ruling out VRF and failed to explain the etiology of the severe pain, a CBCT scan was required.

Cone Beam Computed Tomography (CBCT) was indicated to eliminate superimposition and to visualize the root integrity and root canal filling details in 3D. CBCT scans in axial and coronal sections definitively ruled out VRF, as the root structure of tooth 24 appeared intact with no fracture lines. However, the CBCT revealed a distinct area of hypodensity (intraradicular void) within the filling material mass, located in the mid-root section of tooth 24. This hypodense area indicates a void and a non-hermetic obturation failure. Consequently, the definitive diagnosis was established as Post-obturation Flare-up due to non-hermetic obturation failure (with Intraradicular Void) on Tooth 24.

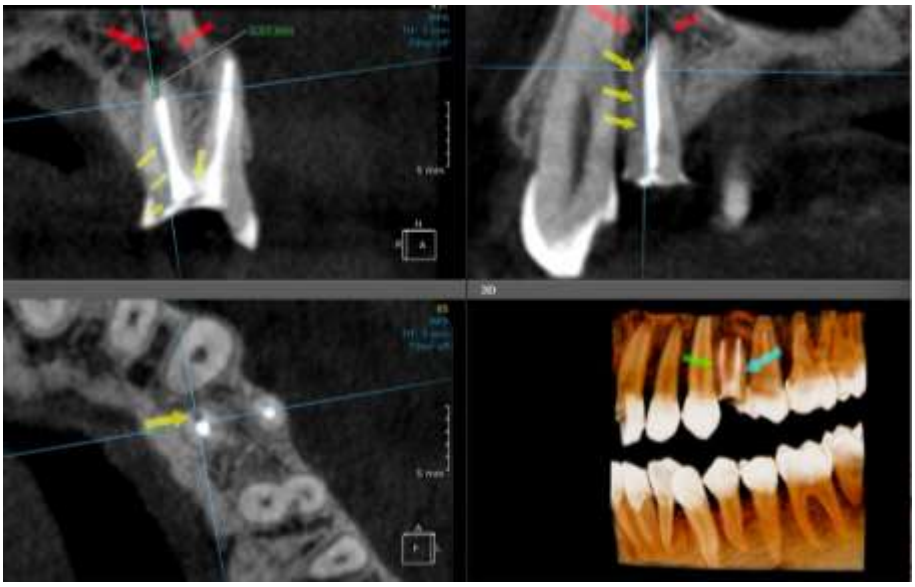

Figure 1. In the part marked with a yellow arrow, a radiolucent image is visible, indicating that the root canal space has not been filled with PSA filling material.

ETIOLOGY

The etiology of the flare-up in this patient was a technical failure of the obturation, which resulted in the formation of a mid-root void. This void created a discontinuity in the hermetic seal, allowing residual microorganisms or toxins within the root canal system to diffuse into the periapical tissues. Occlusal trauma from chewing mutton satay then acted as a mechanical triggering factor, where the intense pressure increased stress on the already inflamed periodontal ligament (PDL), leading to acute pain and a flare-up.

PROGNOSIS

The prognosis for tooth 24 is considered good after the diagnosis of post-obturation flare-up due to non-hermetic obturation failure successfully ruled out a Vertical Root Fracture (VRF). Obturation failure is a manageable complication through an appropriate root canal retreatment procedure, which carries a high success rate.

TREATMENT AND OUTCOME

The primary goal of the treatment was to eliminate the etiology of the flare-up—specifically the non-hermetic obturation failure—by resolving the acute pain and inflammation, performing thorough disinfection of the root canal system, and achieving a dense, 3D hermetic re-obturation.

The selected treatment plan was non-surgical endodontic retreatment. The procedure involved the removal of the old restoration and obturation material, followed by re-cleaning and shaping with intensive irrigation (e.g., using Sodium Hypochlorite and EDTA) to eliminate bacteria and debris trapped within the void. Re-obturation was performed using a condensation technique that ensures optimal 3D sealing (e.g., warm vertical compaction) to prevent further voids. Finally, an adequate permanent coronal restoration was placed to prevent future microbial leakage. At the follow-up visit after retreatment and re-obturation, the patient was reported to be asymptomatic with a negative percussion test.

DISCUSSION

Periapical radiography (2D) was initially used as it is the standard for evaluating periapical status and working length. While the parallel technique ensures minimal geometric distortion, the primary limitation remains the 2D projection, which causes the superimposition of structures (such as the alveolar bone and the buccal and palatal roots of tooth 24), potentially masking a VRF or obturation voids in the bucco-lingual plane.

CBCT is indicated when 3D information is required for a definitive diagnosis that will alter the treatment plan, adhering to the "As Low As Reasonably Achievable" (ALARA) principle and clinical justification. In this case, CBCT was necessary to rule out VRF and evaluate obturation failures not visible in 2D imaging. The CBCT finding of an intraradicular void at the mid-root was the diagnostic key. Maxillary premolars (tooth 24) commonly have two root canals , and a mid-root void indicates a total failure of the root canal obturation. This failure creates an ideal environment for *E. faecalis* or other residual bacteria to survive.

The occlusal trauma experienced while chewing mutton satay acted as a triggering factor. This pressure hydrodynamically transmitted force to the tissue fluids around the void, increasing the diffusion of toxins into the PDL and resulting in a severe acute inflammatory response (flare-up). This diagnosis differs from VRF, which typically shows localized PDL widening on one root surface and is often accompanied by a periodontal pocket. This report demonstrates the appropriate application of CBCT in endodontic differential diagnosis while adhering to the ALARA principle. An accurate diagnosis shifted the prognosis from poor (VRF) to good (retreatment) and successfully linked function-triggered clinical symptoms with specific radiographic findings.

CONCLUSION

The post-obturation flare-up experienced by the 18-year-old male patient on tooth 24 was caused by a non-hermetic root canal obturation failure, as evidenced by an intraradicular void in the mid-root section. Cone Beam Computed Tomography (CBCT) examination proved to be a crucial diagnostic modality that successfully ruled out suspected VRF and established the correct diagnosis to guide the appropriate retreatment plan, ultimately providing a favorable prognosis for the tooth.

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