



Unusual Popping Sound as an Indicator of Missed Root Canal: A Case Report

Mohsen Aminsobhani^a , Mohammad Marvi^b , Reza MahjourianQomi^{b*}

^a Department of Endodontics, Faculty of Dentistry/Dental Research Center, AJA and Tehran University of Medical Sciences, Tehran, Iran; ^b Department of Endodontics, School of Dentistry, Tehran University of Medical Sciences, Tehran, Iran

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*Corresponding author: Reza Mahjourian Qomi. Department of Endodontics, School of Dentistry, Tehran University of Medical Sciences, Tehran, Iran.

E-mail: rezamahjourianqomi@gmail.com

The patients with unusual symptoms present a diagnostic challenge for clinicians and may lead to misdiagnoses and inappropriate or unnecessary treatments. Endodontic diseases can present with a variety of symptoms, and it is possible for odontogenic pain to resemble non-odontogenic pain, which can complicate treatment due to the distinct management plans of the two conditions. This report details the successful management of vague pain, and popping sensations in the left maxilla triggered by cold exposure. Previous clinicians were unable to identify the pain's origin, leading to unnecessary treatments. A clinical examination, and cone-beam computed tomography evaluation revealed the presence of a missed second mesiobuccal root canal. The canal was located using an operating microscope and ultrasonics. Non-surgical endodontic retreatment was completed in two visits, successfully. This report highlights the critical importance of identifying the diverse symptoms that may arise from endodontic origin, as these can complicate clinical diagnosis.

Keywords: Diagnostic Error; Misdiagnosis; Endodontic Inflammation; Endodontically Treated Tooth; Pain Management; Root Canal Therapy

Introduction

A correct diagnosis based on the patient's signs and symptoms is essential for successful treatment. Inadequate treatment may still lead to healing, but a wrong diagnosis will not succeed. Odontogenic pain may often be confused with non-odontogenic pain, making it difficult to differentiate between the two, which need completely distinct treatment approaches [1-3]. One common cause of post-treatment endodontic disease is a missed root canal, leading to periapical lesions in 98% of cases [4]. The maxillary first molar is particularly susceptible, with the second mesiobuccal canal often missed [5]. Various methods have reported a range of 69.6%-87% prevalence of this canal [6-8], and cone-beam computed tomography (CBCT) examinations suggest up to a 92% prevalence [9]. Missed canals can lead to typical or atypical symptoms, sometimes misleading clinicians [2, 10, 11]. A case is presented in this report that involves a missed root canal and a previously unreported symptom that was resolved through non-surgical endodontic retreatment.

Case Presentation

A 52-year-old female suffered from constant dull pain, and also a popping sound sensation in the left quadrant of the maxilla triggered by exposure to cold. Medical history showed controlled hypertension and glaucoma. Dental history showed the endodontically treated maxillary left first molar that was carried out six years ago; three years after the root canal treatment, the dull pain and popping sound sensation started. Six months prior to her initial visit to our dental clinic, her clinician diagnosed the pain as being related to the maxillary left second premolar, so root canal treatment was performed, but the symptom was not resolved. In the first visit, pulp sensibility tests (cold, heat, and electric pulp test) were performed (Table 1), and the patient reported a popping or clicking sound during the cold test (Cold spray, Luber cool, Iran) on the maxillary left first molar. The teeth responded normally to percussion and palpation tests. No caries, fractures, periodontal disease, or sinus tract were present.



The maxillary left first molar had been restored with a suitable bonded composite resin (Figure 1A). The periapical radiograph revealed that the endodontic treatment was under-obtured in the mesiobuccal and distobuccal root canals (Figure 1B). However, there was no periapical lesion, only a widened periodontal ligament was observed. For further evaluation, a CBCT scan was ordered. In the axial and coronal views, the eccentric location of the mesiobuccal canal suggested the presence of a second mesiobuccal canal (Figure 1C and 1D).

Based on the clinical and radiographic findings, the primary diagnosis was that the symptoms might be related to a missed second mesiobuccal canal in the left maxillary first molar. According to the CBCT results, the prognosis for treating the uninstrumented second mesiobuccal canal was expected to be favorable; however, the resolution of the popping sound symptom was unpredictable. The results were discussed with the patient, and informed consent was obtained before proceeding with the treatment plan for non-surgical endodontic retreatment. In the first visit, local anesthesia was administered, and the tooth was isolated with a rubber dam; gutta-percha was removed using D1-D3 rotary retreatment files (Denco, Shenzhen Denco Medical, China) and chloroform (NikDarman, Tehran, Iran) as a solvent. The second mesiobuccal canal was negotiated after troughing with an ultrasonic E6D tip (Varios, NSK, Japan) and use of C-pilot files size #8 and #10 (VDW, Munchen, Germany) (Figures 1E to 1G).

S1 to F2 rotary files (Perfect Dental Company, Shenzhen, China) were used for shaping root canals, and 5.25% sodium hypochlorite (NikDarman, Tehran, Iran) was used as an irrigant. To monitor the patient's symptoms, it was decided to postpone the completion of the treatment to the next visit. So, calcium hydroxide powder mixed with chlorhexidine 2% (NikDarman, Tehran, Iran) was prepared in a creamy consistency as an intracanal dressing.

The patient's symptoms completely resolved two weeks later on the second visit. Intracanal medicament was removed using irrigation with 17% EDTA (Morvabon, Tehran, Iran). The irrigant was activated with an Ultrasonic U-file size #15 (NSK, Japan). Root canals were obturated by the EndoPlus sealer (President Dental, Duisburg, Germany) and ISO-standard gutta-percha, using the cold lateral compaction technique. The access cavity was temporarily sealed with Zonalin (Kemdent, United Kingdom).

At the 6-month follow-up, the patient was asymptomatic and radiographic examination revealed no periradicular radiolucency or widening of the periodontal ligament (Figure 2B).

Discussion

The most crucial step in disease management is accurate diagnosis. In the cases where the patient shows atypical symptoms, it is difficult to diagnose the origin of pain, and if the treatment is planned based on a wrong diagnosis, the treatment will not be successful. In some cases, since odontogenic pain and non-odontogenic pain require entirely different treatment approaches, distinguishing between the two is essential. Odontogenic pain may mimic non-odontogenic pain symptoms [12].

Mascarell *et al.* reported a case of sharp, electric-shock-like pain triggered by friction between the lips and teeth. The patient met the criteria for trigeminal neuralgia (TN), and treatment began after a TN diagnosis was made. However, the symptoms were not completely resolved. A comprehensive analysis of the CBCT revealed pulpitis related to a dens in dent in the patient's maxillary lateral incisor on the same side. Following root canal therapy, the patient's symptoms were completely resolved [3]. Conversely, non-odontogenic pain can sometimes mimic the symptoms of odontogenic pain. For instance, Yoon *et al.* described a case of malignant lymphoma in the maxillary sinus that misled the clinician, leading to a misdiagnosis and resulting in several unnecessary extractions or root canal treatments [11]. If the source of the patient's pain is not accurately diagnosed, the patient may endure pain for years, or, as illustrated by the lymphoma case, face life-threatening delays. One of the main reasons for endodontic treatment failure is the missing root canals, which can manifest with different signs and symptoms. Previous reports have highlighted unusual symptoms, such as paresthesia in the chin area or sensitivity to cold and heat, attributed to missed root canals. These issues were resolved through non-surgical endodontic re-treatment [2]. Furthermore, Sanner [13] reported a rare case of severe pain resulting from the simultaneous occurrence of atypical trigeminal neuralgia and apical periodontitis. The condition was resolved through the initiation of neuralgia treatments and non-surgical endodontic re-treatment of the mandibular second molar, which had a missed mid-mesial canal.

Table 1. Results of pulpal and periodontal examination

| Tooth Number | Cold | Heat | EPT* | Percussion | Palpation | Probing depth |
|---|----------------------|-------|------|------------|-----------|---------------|
| Left maxillary 2 nd molar | +(3s) | +(2s) | 5 | normal | normal | WNL |
| Left maxillary 1 st molar | ^+++ (popping sound) | - | - | normal | normal | WNL |
| Left maxillary 2 nd premolar | - | - | - | normal | normal | WNL |

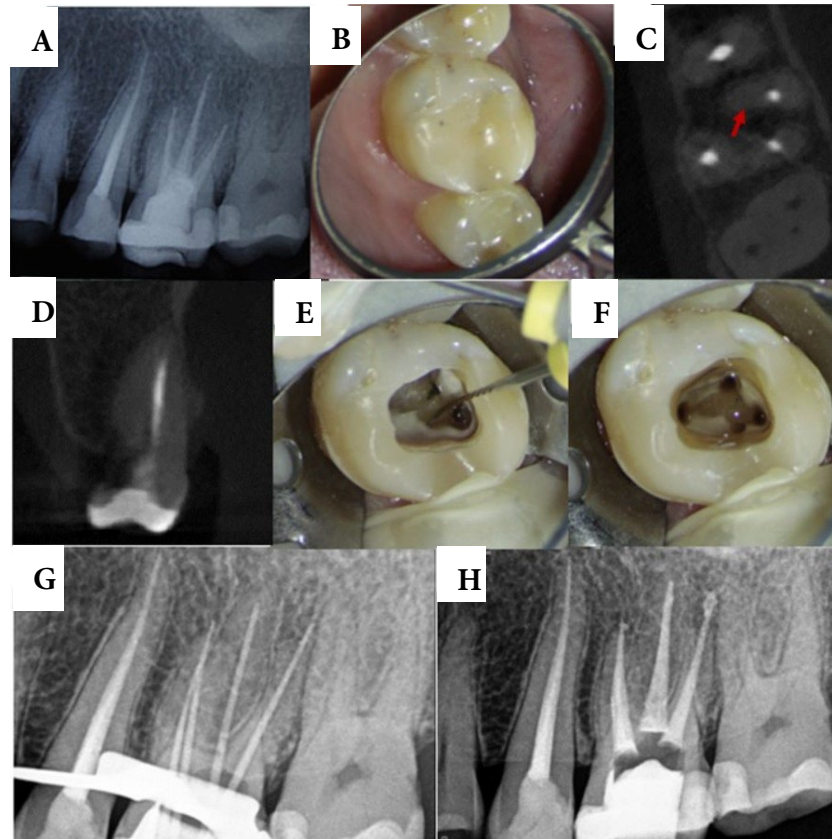


Figure 1. A) Periapical radiography; B) Left maxillary occlusal view; C) CBCT views Axial; D) CBCT views Coronal; E) Negotiation of the second mesiobuccal canal (MB2) with C-pilot file size #8; F) Occlusal view of 4-canal pulp chamber after cleaning and shaping; G) Periapical radiography of Cone fit; H) Periapical radiography after retreatment of left maxillary first molar

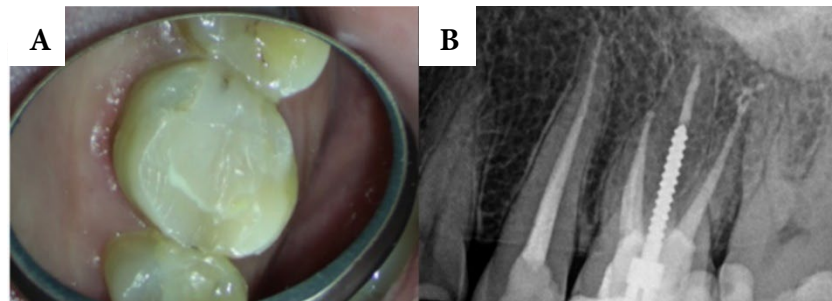


Figure 2. After six months recall A) occlusal view; B) Periapical radiograph

Since the prevalence of the second mesiobuccal canal in the maxillary first molar is so high, it will lead to apical periodontitis in many cases if it is not negotiated and cleaned as the main cause of endodontic treatment failure in maxillary first molars is missing the second mesiobuccal canal; a clinician's knowledge of root canal anatomy, paired with technical proficiency in locating and preparing these challenging mesiobuccal canals using appropriate instruments, is crucial especially in cases where the canals have severe curvature and complexity [5, 14-18]. Cone-beam computed tomography is an effective tool for detecting and locating the presence of a second mesiobuccal canal. The use of magnification, particularly with a

dental operating microscope, significantly increases the likelihood of identifying the second mesiobuccal canal [5, 15, 19].

In the present case, the patient experienced an atypical sensation when her tooth was exposed to cold, which she described as a popping or clicking sound. During a previous visit, the clinician misdiagnosed the issue, leading to an unnecessary root canal treatment on the maxillary second premolar; however, her symptoms persisted. After a thorough examination and CBCT evaluation, the presence of a second mesiobuccal canal was identified. Consequently, non-surgical endodontic retreatment was performed, and the missing root canal was located with the

assistance of an operating microscope. To monitor the patient's symptoms, the treatment was performed over two visits. The American Association of Endodontists recommends using calcium hydroxide as an inter-appointment intracanal medicament to prevent microorganism recurrence [20].

After the treatment, the patient's symptoms were completely resolved. The popping sound sensation when the tooth was exposed to cold may be attributed to the sudden contraction of gases inside the root canal and rapid expansion afterward. However, further investigations are suggested.

Accurate differentiation between odontogenic and non-odontogenic pain is a crucial step in endodontics. A missed root canal can lead to various common and uncommon symptoms. This report emphasizes the importance of recognizing atypical symptoms associated with odontogenic and non-odontogenic conditions and highlights the need to differentiate between these two categories.

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Conflict of interest

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Author contributions

MA: Conceptualization, Writing Original Draft, MM: Clinical procedure and clinical assessment, RM: Writing Review & Editing, Overall supervision, manuscript preparation, and final approval. All authors contributed to the study and approved the final manuscript.

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