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Multislice computed tomography demonstrating mental nerve paresthesia caused by periapical infection: A case report

Yong-Min Kim[1], Ho-Keun Choi[1], Jo-Eun Kim[1], Jeong-Joon Han[2], Kyung-Hoe Huh[1,*]

[1]*Department of Oral and Maxillofacial Radiology and Dental Research Institute, School of Dentistry, Seoul National University, Seoul, Korea*

[2]*Department of Oral and Maxillofacial Surgery, Dental Research Institute, School of Dentistry, Seoul National University, Seoul, Korea*

ABSTRACT

Components derived from an infected lesion within the bone can spread through various passages in the mandible, particularly via the mental foramen. Radiologically, the spread of infection is typically nonspecific and challenging to characterize; however, multislice computed tomography (MSCT) can effectively detect pathological changes in soft tissues and the bone marrow space. This report describes the case of a 55-year-old woman who experienced mental nerve paresthesia due to a periapical infection of the right mandibular second premolar. MSCT imaging revealed increased attenuation around the periapical lesion extending into the mandibular canal and loss of the juxta-mental foraminal fat pad. Following endodontic treatment of the tooth suspected to be the source of the infection, the patient's symptoms resolved, and the previous MSCT imaging findings were no longer present. Increased bone marrow attenuation and obliteration of the fat plane in the buccal aspect of the mental foramen may serve as radiologic indicators of inflammation spreading from the bone marrow space. ***(Imaging Sci Dent 2024; 54: 115-20)***

KEY WORDS: Multidetector Computed Tomography; Mental Foramen; Mandibular Nerve; Paresthesia; Periapical Disease

Paresthesia is characterized by abnormal sensations such as partial numbness, prickling, burning, tingling, or itching, and it is often accompanied by altered sensitivity to heat, cold, and pain in sensory neural tissue.[1,2] Various factors can contribute to endodontic-related neural complications, including: 1) pre-endodontic conditions or procedures, such as a predisposing periapical lesion affecting the nerve or trauma from direct needle contact with the nerve;[3,4] 2) events during endodontic treatment, such as nerve damage from over-instrumentation or an irrigation needle;[5] and 3) post-endodontic processes, such as inflammation and/or necrosis due to extruded obturation materials extending beyond the apical foramen.[6] Additionally, neural tissue can be compromised by the release of inflammatory mediators such as prostaglandin, histamine, interleukin 1, tumor necrosis factor, and nitric oxide. These substances can also lead to pathological changes in the peripheral soft tissues and may be triggered by endodontic-related infections.[7]

Components originating from an infected lesion within the bone can disseminate through various passages of the mandible, particularly via the mental foramen. Such a lesion may also impact the adjacent vital soft tissues, leading to numbness in the lip and mandible.[8] Radiologically, the spread of infection may be indicated by alterations in the density and configuration of nearby anatomical structures; however, these signs are typically non-specific and challenging to characterize. Limited research has documented changes in the adjacent tissues associated with paresthesia in the paramental region.[9]

Panoramic and periapical radiographs cannot accurately visualize the 3-dimensional relationship between an infected lesion and the adjacent anatomical structures.[10] A multiplanar imaging method, such as cone-beam computed tomography (CBCT), is better suited for accurately determining the relationship with and/or proximity to anatomic struc-

Yong-Min Kim and Ho-Keun Choi contributed equally to this work as first authors.

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*Correspondence to : Prof. Kyung-Hoe Huh
Department of Oral and Maxillofacial Radiology and Dental Research Institute, School of Dentistry, Seoul National University, 101, Daehak-ro, Jongno-gu, Box 03080, Seoul, Korea
Tel) 82-2-6256-3053, E-mail) future3@snu.ac.kr

tures, such as the inferior alveolar nerve and the floor of the maxillary sinus.[11] However, CBCT is limited in its capacity to clearly identify soft tissue changes due to the high level of image noise, which stems from x-ray beam inhomogeneity and low detector sensitivity, even though it exposes patients to relatively low levels of radiation.[12,13] In contrast, multislice CT (MSCT) is more effective in detecting pathological changes in soft tissues, including those within the bone marrow space.[9,11,14]

Although multiple instances of mental nerve paresthesia have been documented, no publication has yet elucidated the radiologic characteristics associated with this condition.[15,16] This report presents a case of mental nerve paresthesia induced by a periapical lesion, with a focus on soft tissue changes adjacent to the mental foramen as observed on MSCT.

Case Report

A 55-year-old woman visited the Department of Oral and Maxillofacial Surgery at a dental hospital. The patient's chief report was numbness involving the right side of the lower lip and the lower right premolar region. She noted that these sensory disturbances began approximately 3-4 days before her visit to the clinic. Her medical history was unremarkable except for rheumatism.

Upon oral examination, advanced dental caries were observed in the right mandibular second premolar, and pulpal infection was suspected. The tooth exhibited tenderness upon percussion and palpation. Panoramic and periapical radiographs revealed apical rarefaction of the tooth (Fig. 1). The periapical lesion was suspected to be located near the anterior loop of the inferior alveolar canal. MSCT (SOMATOM Definition Edge, Siemens Healthineers, Erlangen, Germany; imaging protocol: 140 mA, 120 kV, 0.6-mm slice collimation) was performed to assess pathological changes in both bone and soft tissues, including the bone marrow. Under the bone window setting, the MSCT images displayed no apparent pathological bone changes, aside from the periapical lesion on the right mandibular second premolar (Fig. 2). However, when viewed with a soft tissue window, the MSCT images revealed increased attenuation within the bone marrow space beneath the same tooth (Fig. 3). Furthermore, MSCT images with a soft tissue window showed increased attenuation and obliteration of the fat plane on the buccal side of the right mental foramen, suggesting that the inflammation had spread from the bone marrow space to the mental foramen.

Extraoral examination revealed no facial swelling or changes in skin and mucosal color. Neurosensory evaluation, in the form of a directional discrimination test, identified an anesthetized zone extending from the right side of the anterior lower lip to the mandibular midline. The patient reported a 60% decrease in sensation relative to normal levels. In contrast, sensory responses in the buccal gingiva and tongue were normal when stimulated with a dental probe. Clinical and radiological evaluations led to a diagnosis of mental nerve paresthesia, attributed to a periapical lesion associated with the right mandibular second premolar. Consequently, the patient was referred to an endodontist for

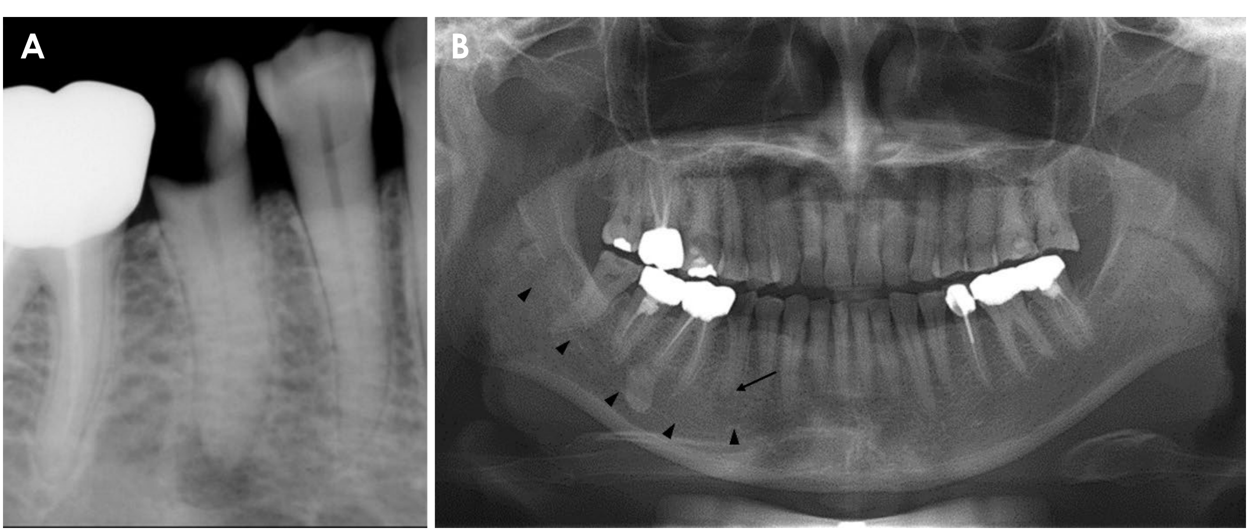

Fig. 1. A. A periapical radiograph reveals severe dental caries and periapical rarefaction of the right mandibular second premolar. B. A panoramic radiograph displays a suspected close relationship between the periapical lesion (indicated by the arrow) and the anterior loop of the inferior alveolar nerve (marked by arrowheads).

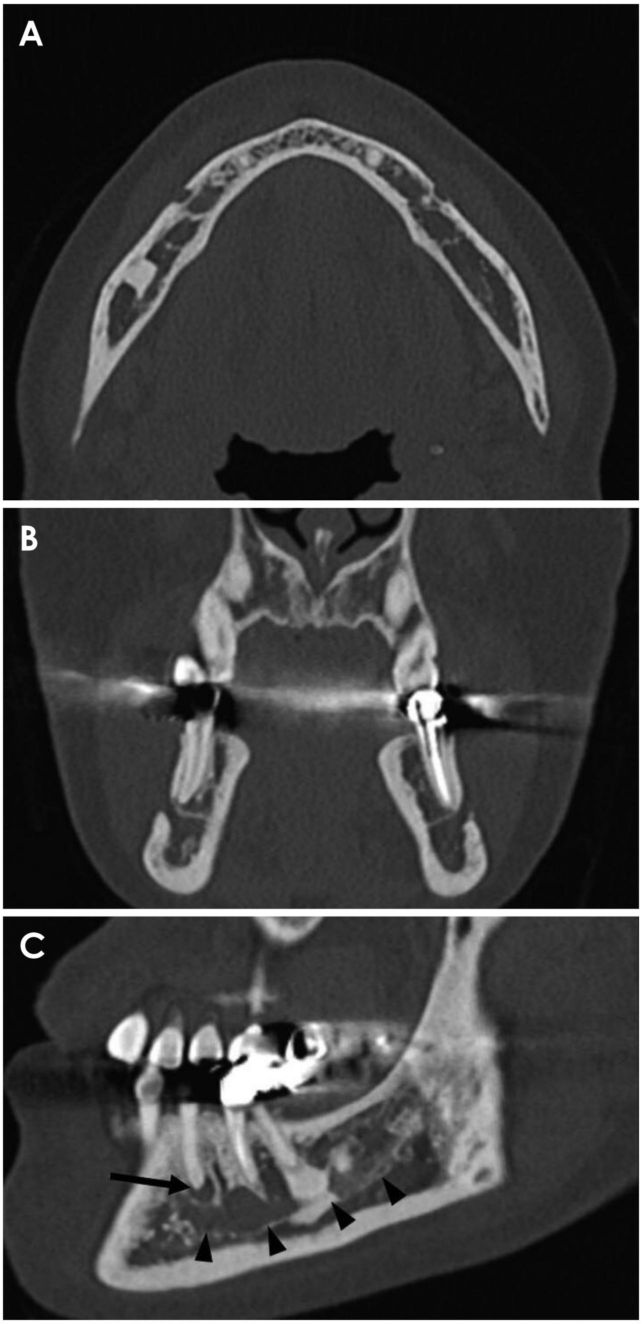

Fig. 2. A and B. No apparent pathological bone changes are evident on bone window multislice computed tomography (MSCT) images. C. Parasagittal MSCT image under the bone window setting demonstrates a close relationship between the periapical lesion (indicated by the arrow) and the inferior alveolar canal (indicated by the arrowheads).

root canal treatment.

The access cavity was prepared under local anesthesia using 2% lidocaine with 1 : 100,000 epinephrine (Huons lidocaine-epinephrine; Huons, Seoul, Korea), followed by isolation with a rubber dam (medium, 5″ × 5″, plain blue; Sanc-

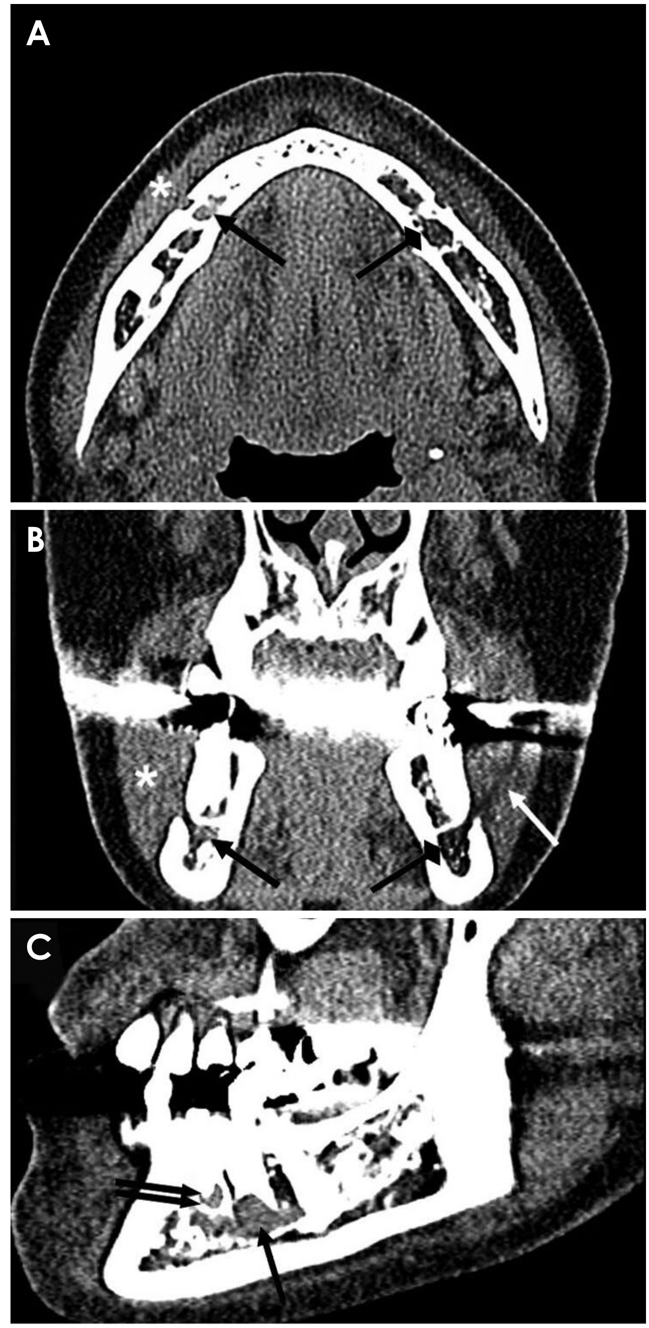

Fig. 3. A and B. Soft tissue window multislice computed tomography (MSCT) images reveal increased attenuation (arrow) in the bone marrow space beneath the right mandibular second premolar. The normal bone marrow space below the left mandibular premolar exhibits fatty attenuation (diamond arrow). Note the increased attenuation and obliteration of the fat plane (asterisks) on the buccal side of the right mental foramen, suggesting the spread of inflammation from the bone marrow space. The fat plane (white arrow) between the buccal facial muscles is preserved on the buccal side of the left mental foramen. C. A parasagittal MSCT image with a soft tissue window shows the periapical lesion (double arrow) and increased attenuation (arrow), indicative of inflammatory changes, in the bone marrow space beneath the right mandibular second premolar.

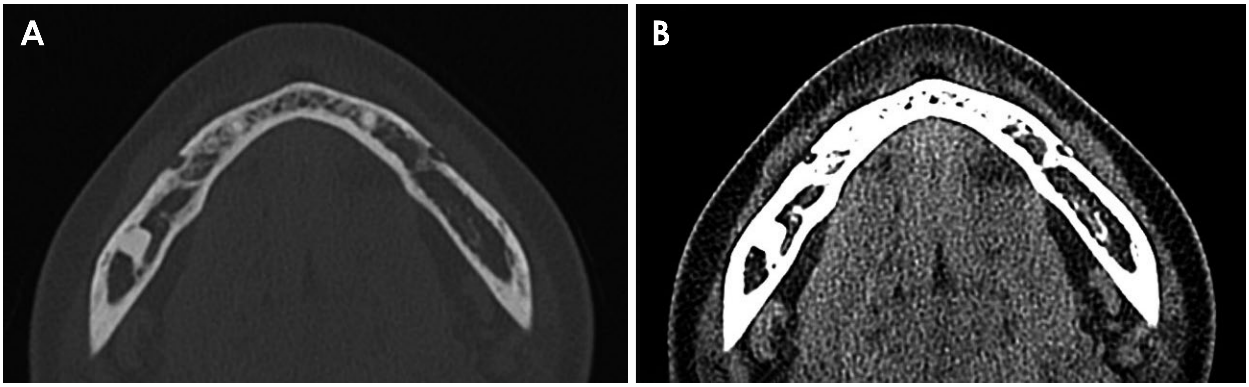

Fig. 4. A. An axial multislice computed tomography (MSCT) image under the bone window setting, captured 6 months following the initiation of endodontic treatment, demonstrates recovery of the periapical lesion. B. MSCT image with the soft tissue window setting, taken concurrently with image A. This image reveals the normal appearance of the facial muscle and the restoration of the fat plane in the buccal aspect of the right mental foramen.

tuary Dental Dam, Perak, Malaysia). Over the course of 4 months, the canal was irrigated several times, which substantially reduced the numbness on the right side. At this stage, the tooth was no longer tender to percussion. Subsequently, the root canal was prepared to a final size of a #40.04 taper, and obturation was carried out using a gutta-percha point (DiaDent, Seoul, Korea) and an endodontic sealer (EndoSeal MTA; Maruchi, Wonju, Korea). The tooth was restored with a glass fiber post (ParaPost Fiber Lux; Coltène/Whaledent, Altstatten, Switzerland) and a resin core (3M ESPE, St. Paul, MN, USA).

At the 6-month follow-up appointment after the initiation of endodontic treatment, the numbness in the patient's right lower lip had completely resolved, and the patient was asymptomatic. Given the potential for recurrence,[17] MSCT images were obtained during the follow-up visit. These images revealed no increased attenuation in the adjacent soft tissue and demonstrated the restoration of the fat plane on the buccal aspect of the right mental foramen (Fig. 4B), indicating complete resolution of the previous inflammation.

Discussion

This report details the pathological changes in the soft tissue of the paramental region resulting from a periapical lesion, as visualized through MSCT images. To these authors' knowledge, this is the first report of mental nerve paresthesia exhibiting soft tissue changes around the mental foramen, as demonstrated by MSCT imaging. While numerous reports have documented cases of paresthesia associated with periapical lesions,[15,16,18,19] these accounts have predominantly relied on 2-dimensional imaging data, such as panoramic and periapical radiographs, and have not illustrated the imaging manifestations associated with the paresthesia. In a recent case report involving a 42-year-old woman, Ricucci et al. described the use of 3-dimensional imaging, specifically CBCT, to examine paresthesia affecting the left chin and lip; this condition was attributed to a large periapical lesion impinging on the inferior alveolar nerve.[19] However, the authors presented only images of the hard tissue around the periapical lesion and did not include images of the soft tissue changes in the paramental region, which may have been directly associated with the numbness.

It is well recognized that CBCT utilizes low kilovoltage and milliamperage, resulting in images that often contain relatively high noise. Consequently, identifying changes in bone marrow or soft tissues using CBCT can be challenging.[14] In the present case, the patient did not simply report a toothache caused by deep caries with an accompanying periapical lesion; she also experienced numbness of the lower lip. Therefore, MSCT was chosen over CBCT to evaluate the bone marrow space and the soft tissues around the mental foramen. This approach aligns with the American Association of Endodontists' recommendations for CBCT indications and the SEDENTEXCT 2012 statements, which suggest that MSCT or magnetic resonance imaging (MRI) is more appropriate than CBCT for evaluating soft tissue damage and diagnosing maxillofacial infection.[20,21] However, the use of MRI is often limited due to severe image artifacts caused by metal restorations and prosthodontics in the oral cavity.[22] Clinically, when mental nerve paresthesia is present, other conditions such as a neurogenic tumor involving the relevant nerve, perineural spread of malignancy, or traumatic injury should be considered in the differential diagnosis. MSCT may represent an effective imaging modality for evaluating mental nerve paresthesia.

In a study of 153 cases of osteomyelitis, An et al. found that the most common imaging feature of infection spreading from nerve tissue to adjacent vital tissues was an increase in the attenuation of subcutaneous adipose tissue and muscle.[9] The authors also noted the obliteration of the interfascial fat space. These findings align with the radiologic evidence presented in the present report. In this case, increased attenuation was observed along with obliteration of the fat plane on the buccal aspect of the right mental foramen, which indicated the spread of inflammation from the bone marrow space. Furthermore, 6-month follow-up MSCT images depicted recovery of the fat plane in the same region, reflecting the resolution of inflammation. This was consistent with the patient's symptomatic improvement.

Previous studies have examined the proximity of the mandibular posterior teeth to the inferior alveolar canal.[23,24] A recent retrospective study utilized 1000 CBCT scans to assess the mean distance between the apices of mandibular posterior teeth and the superior cortical bone of the inferior alveolar canal, including the mental foramen.[24] The results indicated that the mean distance from the root apex of the right second premolar to the inferior alveolar canal was only 3.93 mm in female participants. Furthermore, the smallest recorded distance between the inferior alveolar canal (or the mental foramen) and the right second premolar was −0.22 mm, indicating contact between the tooth apex and the canal. This finding underscores the potential for periapical lesions to readily inflict damage on the neighboring inferior alveolar nerve tissues.

The inferior alveolar artery, along with numerous vacuoles in the mandible, can serve as a pathway to nerve tissues, thereby facilitating the spread of pathological irritants.[1,25,26] Consequently, when diagnosing relevant conditions, careful consideration of the proximity between the mandibular premolar and the mental foramen is essential. Poveda et al. have identified 5 potential routes for the spread of endodontic infections: through nerve bundles, lymphatic vessels, veins, bone, and the mucosal membrane.[8] As demonstrated in the present case, when the source of infection is located near the mental foramen, it can readily spread through the vacuole-rich cancellous trabecular bone of the mandible. This increases the risk of the infection spreading to the surrounding vital tissues. In the present case, although the cortical plate beneath the periapical lesion was intact and in direct contact with the nerve bundle, the lesion could still mechanically and/or chemically impact the nerve tissue.[27] These effects may result from mechanical pressure due to edematous inflammatory changes, as well as from toxic chemical substances present in inflammatory exudates.

The patient in this report fully regained normal sensation in the affected area by 6 months following initial endodontic treatment. The disinfection of the root canal led to the resolution of the periapical lesion and the healing of the affected tissues. This process likely reduced the expanding pressure and levels of chemical mediators, contributing to a favorable prognosis.[28] Given that 6 months represents the benchmark for permanent paresthesia, a positive prognosis is more probable when sensation returns shortly after the removal of the pathogenic cause.[2,29] Factors such as the size of the lesion, its duration, the proximity of the root apex to the nerve, and the patient's immune response may all influence the development and resolution of endodontic-related paresthesia.[30,31] Further research is necessary to analyze CT images of various conditions associated with nerve function impairment.[32,33] Standardized criteria should be established for evaluating soft tissue changes around the mental nerve on CT images.

To date, no case report has illustrated the manifestation of mental nerve paresthesia due to a periapical lesion as observed on MSCT. In the present case, MSCT revealed heightened bone marrow attenuation and obliteration of the fat plane in the buccal aspect of the mental foramen, suggesting the spread of inflammation from the bone marrow space. MSCT appears to be a potentially effective imaging tool for assessing mental nerve paresthesia.

Conflicts of Interest: None

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