
Persistent endodontic lesion due to complex cementodentinal tears in a maxillary central incisor—a case report

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The cementodentinal tear is rarely detected by noninvasive procedures owing to its clinical picture simulating a root fracture or a periodontal or endodontic lesion. We present a case of complex cementodentinal tears in a 79-year-old woman who presented a repeated swelling at the labial mucosa of the left maxillary central incisor for 6 months. Periapical radiographs demonstrated a vertical radiolucent fracture line extending from the root apex along the mesial aspect of the root to near the middle portion of the root of the left maxillary central incisor. Because endodontic re-treatment failed to cure the disease, periapical surgery was performed, and 2 fractured U-shaped root fragments around the apical root surface were removed. Histologic examination showed that the 2 fractured root fragments were composed mainly of the dentin covered by a thin layer of the cementum and overlying periodontal ligament tissue, suggesting cementodentinal tears. A swelling recurred 8 months after the initial operation. Therefore, a second periapical surgery was performed. Although no obvious fracture line was observed around the root surface, the second surgery did not cure the disease, either. A persistent small swelling was noted at the alveolar mucosa of the affected tooth during the follow-up. We conclude that although a cementodentinal tear can be detected by a careful radiographic examination, its clinical outcome is not predictable by surgical removal only. (**Oral Surg Oral Med Oral Pathol Oral Radiol Endod 2007;103:e55-e60**)

Gingival or alveolar mucosal swelling with a sinus tract is frequently encountered in the dental practice. The cause of this disease is mainly periodontal or root canal infection, but some other root structure abnormalities, such as palatoradicular groove, root fracture, and cemental tears, are also associated with it.¹⁻⁶ Clinically, the differential diagnosis of most periodontal or endodontic lesions is generally not difficult. However, the diagnosis of an unexpected lesion such as a cemental or cementodentinal tear might be challenging even after a proper history taking and comprehensive clinical and radiographic examinations.⁷

Vertical root fractures (VRFs) occur primarily in the facial-lingual plane. They may involve either 1 or 2 sides of the root. The VRF probably begins from the canal wall and extends outward to the root surface. It might extend from the root apex to the whole root length or to a particular section of the root.⁸ The prevalence of VRFs ranges from 2% to 5%, and they usually occur in end-

odontically treated teeth.⁹ Cemental or cementodentinal tears are specific types of root fractures, which are difficult for both clinical diagnosis and treatment. These VRFs may be observed in exposed and unexposed cementum as well as in vital and nonvital teeth.¹⁰ Cemental tear is defined as a complete separation of a cemental fragment along the cementodentinal junction or a partial split in the cementum along an incremental line.¹¹ The cemental detachment is often related to occlusal overloading, aging, or a previous trauma. The prevalence of cemental tears is still not known; this is possibly owing to difficult diagnoses of cemental tears leading to limited cases reported in the literature.¹⁰

The purpose of the present article is to report the diagnosis and treatment of a left maxillary central incisor with 2 complex U-shaped cementodentinal tears which surrounded almost the apical half of the tooth root. Although the 2 fractured root fragments were removed by a periapical surgery, it did not result in the healing of the lesion.

CASE REPORT

A 79-year-old woman had experienced discomfort in the left maxillary central incisor for 6 months. After about 3 months, she visited a local dentist for treatment of a swelling at the labial alveolar mucosa of that tooth. Periapical radiography was performed (Fig. 1A), and root canal therapy of the left maxillary central incisor was done by the local dentist. Because a sinus tract was still present at the alveolar mucosa

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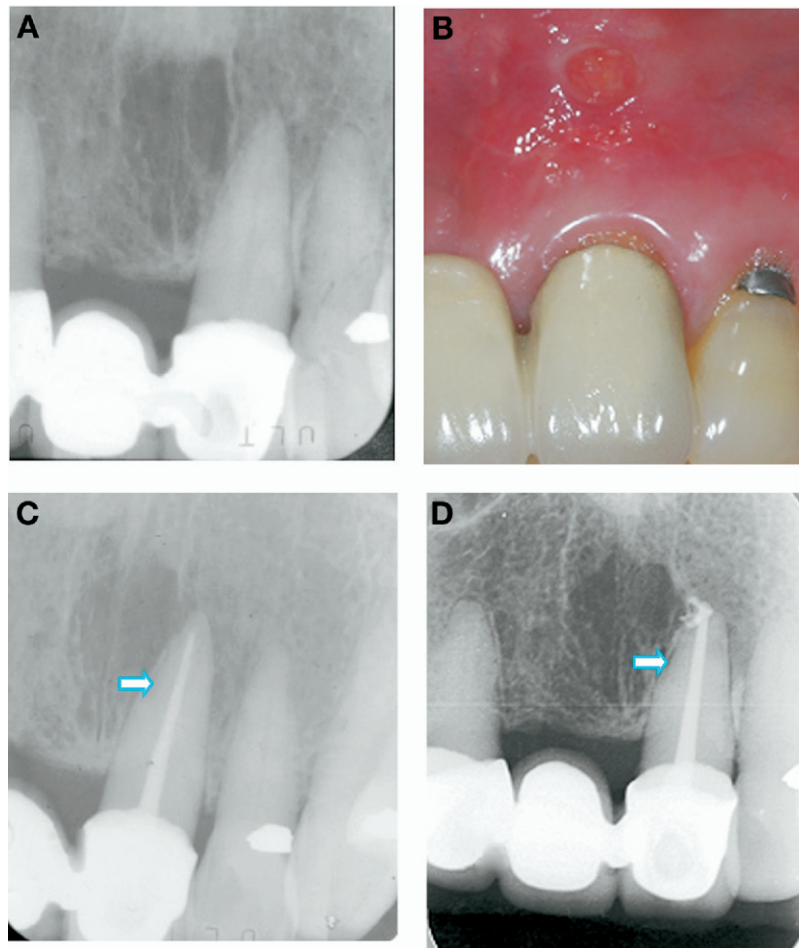


Fig. 1. **A**, Periapical radiograph taken by a local dentist before treatment, showing no obvious radiolucent lesion at the periapical area of the left maxillary central incisor. **B**, Clinical photograph exhibiting a soft tissue swelling at the labial alveolar mucosa of the left maxillary central incisor. **C**, Periapical radiograph revealing a vertical radiolucent fracture line (*arrow*) extending from the root apex along the mesial aspect of the root to near the middle portion of the root of the left maxillary central incisor. **D**, Periapical radiograph showing a filled root canal, overfilled material at the root apex, and a persistent radiolucent line (*arrow*) at the apical and mesial aspect of the root of the left maxillary central incisor.

after the endodontic treatment, she was referred to the Department of Endodontics, National Taiwan University Hospital, for further treatment. The patient had received a 3-unit porcelain-fused-to-metal bridge from the right upper lateral incisor to the left upper central incisor more than 10 years before. She could not remember whether the left maxillary central incisor had a trauma history or not.

Intraoral examination revealed a swelling with a sinus tract at the labial alveolar mucosa of the left maxillary central incisor (Fig. 1B). The periapical radiograph taken after placing a tracing gutta-percha point showed that the sinus tract originated from a radiolucent lesion located at the apical and mesial aspect of the left maxillary central incisor (radiograph not shown). Clinical probing around the tooth revealed that the probing depth was within the normal limit (<3 mm), and no obvious tooth mobility and fremitus were observed. Root canal obturation with an acceptable quality was found from

the periapical radiograph. Careful examination of the periapical radiograph detected a vertical radiolucent line at the apical and mesial aspect of the left maxillary central incisor. The radiolucent line extended from the root apex to near the middle portion of the root (Fig. 1C). Based on the radiographic findings, a tentative diagnosis of a cementum tear or root fracture was made. Because the presence of accessory canals, insufficient root canal debridement, or a root canal filled with paste only could not be excluded completely, we decided to re-treat the root canal. After 3 appointments of nonsurgical endodontic treatment, the swelling and the sinus tract were still present without a significant improvement. Therefore, the tooth was filled with gutta-percha points and canals (Showa Shizai Kako Co., Tokyo, Japan) and arranged for periapical surgery to check the possible presence of root fracture (Fig. 1D).

Under local anesthesia, a semilunar flap was lifted up and the root of the left maxillary central incisor was exposed.

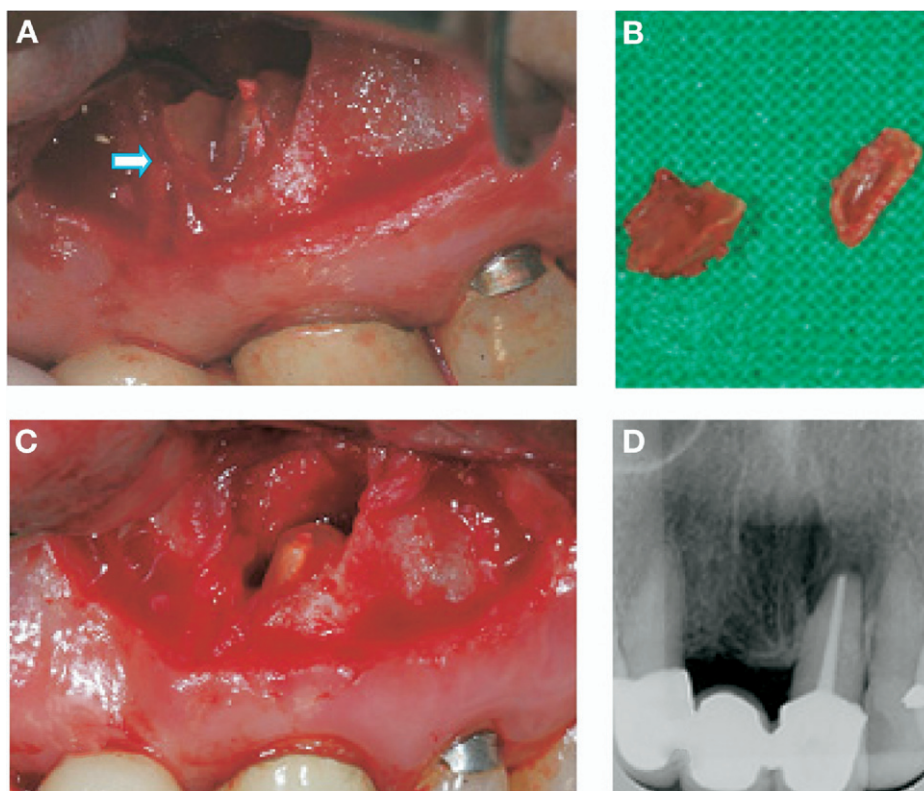


Fig. 2. **A**, A U-shaped root fragment (*arrow*) was separated from the apical root after insertion of an explorer into the crack line. **B**, The fresh specimens of the 2 fractured U-shaped root fragments. **C**, Clinical photograph of the root of the left maxillary central incisor after removal of granulation tissue, apicoectomy, and root planing. **D**, Postoperative periapical radiograph confirming the complete removal of the fractured root fragments.

After removal of granulation tissue and the overfilled gutta-percha points, a crack line was found on the root surface. Insertion of an explorer into the crack line resulted in the detachment of a fractured U-shaped root fragment (Fig. 2A). Further exploration separated another fractured U-shaped root fragment, both extending up to the middle third of the root trunk as observed under magnification with micromirror and a Zeiss surgical microscope. The 2 fractured U-shaped root fragments surrounded nearly the apical half of the root but interestingly without offending the root canal (Fig. 2B). To clarify whether the fracture surface was in the cementum or in the dentin, the 2 fractured root fragments were fixed in formalin and sent for histopathologic examination. Because there was enough root dentin left, apicoectomy and root planing were performed on the remaining root (Fig. 2C). Postoperative periapical radiography confirmed the removal of fractured root fragments (Fig. 2D).

The 2 detached root fragments measured up to $5 \times 4 \times 2$ mm in size, which involved nearly an area of 40 mm^2 of the root surface. Microscopically, the 2 fractured root fragments were composed mainly of the dentin covered by a thin layer of the cementum and the overlying inflamed periodontal ligament tissue (Fig. 3). Histologic examination con-

firmed that the fracture surface was within the dentin, and the 2 fractured root fragments were actually cementodentinal tears.

After 7-month follow-up, the surgical site healed uneventfully (Fig. 4A). However, a swelling recurred at the previous lesion site 8 months after surgery. To rule out the possible presence of a new root fracture, a second periapical surgery was performed with the patient's informed consent. Besides granulation tissue, no obvious vertical root fracture was found during the second operation. In addition to the apical curettage, a retrograde filling with MTA was done (Fig. 4B). However, 3 months after the second operation, the apical lesion is still present (Fig. 4C), and a swelling about 1×1 mm in diameter recurred at the labial alveolar mucosa of the left maxillary central incisor (Fig. 4D). We suggested to the patient that we remove the tooth and put a dental implant in the tooth-missing area. Because the patient still wanted to preserve the tooth, she refused any further surgical intervention.

DISCUSSION

Vertical root fractures often extend longitudinally down the long axis of the root and through the root

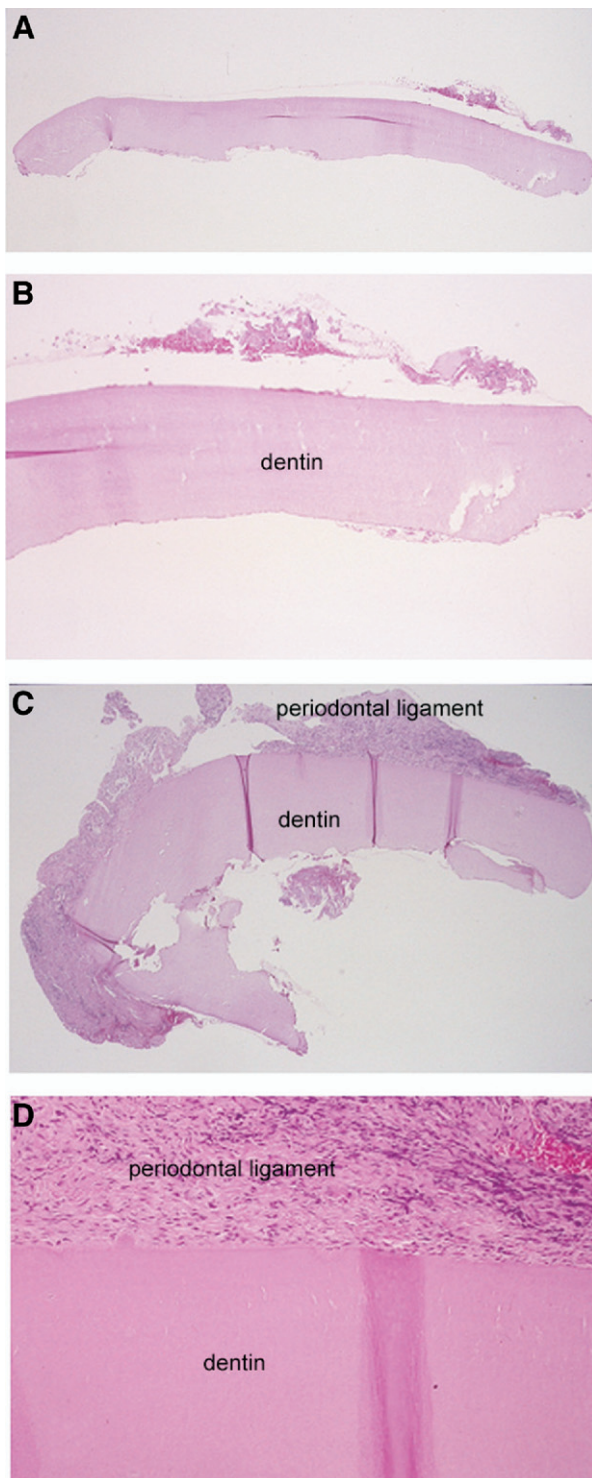


Fig. 3. **A**, Low-power, and **B**, medium-power histologic microphotographs of one fractured root fragment, showing that it was composed mainly of the dentin covered by a thin layer of the cementum and a small piece of the periodontal ligament tissue. (Original magnification: A, $\times 40$; B, $\times 200$.) **C**, Low-power, and **D**, high-power histologic microphotographs of the other fractured root fragment, showing that it was composed mainly of the dentin covered by a thin layer of the cementum and the overlying inflamed periodontal ligament tissue. (Original magnification: A, $\times 40$; B, $\times 400$.)

canal to the periodontium. They often involve either 1 or 2 sides of the root. On the other hand, cemental tears are often observed along the cementodentinal junction that represents a weak mechanical interconnection between the cementum and dentin.¹² In the present case, the 2 fractured U-shaped root fragments encircled nearly the apical half of the root, their long axis was generally vertical, and the fracture surface was located within the root dentin but not along the cementodentinal junction, indicating that they are actually complex cementodentinal tears.

Because cementodentinal tears are difficult to diagnose by noninvasive methods, the actual incidence of occurrence of cemental or cementodentinal tears in different teeth has not been known. From a limited number of case reports, central incisors and premolars seem to be the major affected teeth.¹² Fracture patterns of cemental and cementodentinal tears are different in various reports. The fracture surface has been reported to be located more frequently in the cementum^{6,13,14} than in the dentin^{12,15} of the root. More related case reports should be studied to confirm whether a U-shaped cementodentinal tear or a circular VRF is a specific disease entity.

Age-related tissue changes, heavy occlusal force, and increased thickness, mineralization and brittleness of cementum are suggested to be the major etiologic factors of cemental tears.^{6,16} The average age of patients with cemental tears is between 50 and 79,¹³ but cemental tears may occur in a person as young as 22 years of age.¹⁵ Because the present patient was a 79-year-old woman, the reduction in the fatigue strength of the dentin due to the age change may be one of the etiologic factors of the cementodentinal tears.¹⁶ Occlusal overloading may be the another etiologic factor responsible for the cementodentinal tears. Because the majority of our patient's posterior teeth were lost, the anterior teeth were frequently used to chew food. Therefore, excessive occlusal force might be added to the left maxillary central incisor. In addition, the endodontic treatment devitalized the dentin and removed the water supply from the dentin, resulting in a more brittle dentin which was easier to fracture than the cementum which could obtain its nutrition and water supply from the periodontal ligament.

Diagnosis of cemental and cementodentinal tears is difficult based only on history taking and clinical examination. Radiographic examination can be helpful in some cases when the displacement of the detached root fragment is evident. However, the location of the fracture lines and the axis of radiographic taking may leave some fracture lines invisible. Therefore, when a suspected fracture line is detected on an initial x-ray film, and when the swelling or the sinus tract persists even

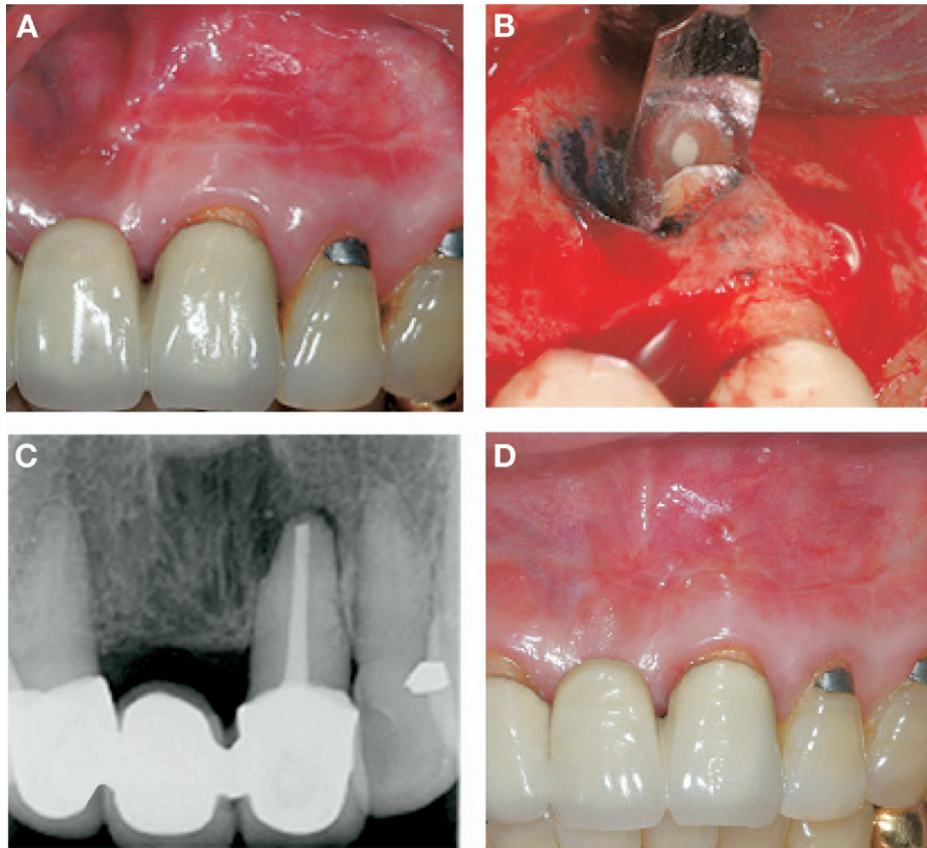


Fig. 4. **A**, Clinical photograph taken 7 months after surgery, showing the complete healing of the surgical site. **B**, Clinical photograph taken during the second operation, showing no obvious vertical root fracture line and detached root fragment after staining with methylene blue. Apical curettage and retrograde filling with white MTA were performed. **C**, Periapical radiograph, showing a persistent radiolucent lesion around the apical third of the root. **D**, A small sinus tract was still present in the labial alveolar mucosa of the left maxillary central incisor.

after a good-quality endodontic re-treatment, additional radiographs have to be taken to check for the presence of real root fracture or cemental tears.

In the present case, histologic examination indicated that the fracture surface was located within the root dentin but not the root canal. Most earlier case reports showed that the fracture surface was either in the cementum or along the cementodentinal junction. The findings from the present case and others indicate that the fracture may occur within the root dentin, producing a cementodentinal tear.^{12,13}

The long-term prognosis of teeth with cemental or cementodentinal tears is not predictable. Previous studies have shown that some teeth with cemental tears which receive different types of treatments are finally extracted.¹⁵ However, successful outcomes of teeth with cemental or cementodentinal tears can be achieved by removal of detached root fragments via surgical procedures and root planning with or without guided tissue regeneration.^{6,10,12-14,17,18} Stewart

and McClanahan¹⁵ described that the U-shaped cementodentinal tear can not be successfully treated by surgical removal only. In this case, although no obvious fracture line was observed around the root surface during the second surgery, the patient experienced repeated swelling at the alveolar mucosa of the affected tooth. We suggest that there may be some undetectable crack or fracture lines within the root, resulting in the unpredictable prognosis of this case. Further large series and epidemiologic studies are needed to evaluate the distribution and therapeutic efficacy of teeth with the specific U-shaped cementodentinal tears.

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