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CASE REPORT

Cemental Tear on Maxillary Anterior Incisors: A Description of Clinical, Radiographic, and Histopathological Features of Two Clinical Cases

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ABSTRACT

In this case report, three teeth with complete or incomplete cemental tear in two patients were presented. Even though periapical radiograph could detect cemental tear in these three teeth, the cone-beam computed tomography scanning clearly revealed the pattern of the cemental tear, which was later confirmed by histopathological examination. Therefore, this case report shows the benefits of incorporating both cone-beam computed tomography and histopathological examination to diagnose cemental tear.

Keywords: Cemental tear, cementodentinal tear, cementum, cone-beam computed tomography, periradicular radiolucency

HIGHLIGHTS

- Cemental tear is rare, and many clinicians including endodontists may not encounter it in their practice.
- With the highlights of the clinical, radiographic, and histopathological findings of cemental tear in this case report, the readers will be aware of its presentation, clinical diagnosis and decision-making.

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INTRODUCTION

Cemental tear is defined as a "complete separation along the dentino-cemental junction or a partial split within the cemental tissues along the incremental line" (1). The detachment of cementum from root surface may cause periodontal with or without periapical (PA) breakdown (2). The pathogenesis of cemental tear is not fully elucidated, but gender, age, tooth type, attrition, vital tooth, and occlusal and dental trauma were found to be the predisposing factors (3). Due to the scarcity of data on cemental tear, it is a challenge to address questions related to cemental tear, such as its prevalence, incidence, exact etiology, mechanism of its development, and the outcome of the treatment rendered.

There are a few commonly associated clinical characteristics of cemental tear, including abscess, sinus tract, positive vitality test, localized deep pocket, periodontal/periapical bony destruction, and detection of thin radiopaque fracture-like fragment on the root surface in the PA radiograph (3). Diagnostic accuracy of cone-beam computed tomography (CBCT) is better than that of the PA radiograph. Therefore, compared with the radiograph, the incorporation of CBCT should yield a better diagnostic value for cemental tear. To the best of knowledge, there is no study that incorporates the CBCT to diagnose cemental tear. It is worth noting that, the definitive diagnosis of detached root fragment can only be confirmed by histopathological examination.

This case report aims to illustrate two clinical cases regarding their clinical features, radiographic findings from both PA radiograph and CBCT imaging, and histopathological presentation.

CASE PRESENTATION

Case 1:

A 67-year-old Asian woman complained of dull aching pain on maxillary anterior tooth. The patient had root canal treatment (RCT) and crown placed on the maxillary right permanent central incisor for more than 15 years. She experienced intermittent discomfort related to that tooth since two years, with a few episodes of gingival swelling. Patient denied history of dental trauma.

Clinical examination revealed the maxillary right permanent central incisor with a porcelain fused to metal crown (PFM) with acceptable crown margin. The tooth was slightly tender to palpation

and percussion. No obvious gingival swelling was observed, but multiple sinus tracts were detected on the buccal gingivae with pus drainage upon gingival palpation. A 5-mm periodontal pocket was detected on the labial surface of the tooth, and 4-mm periodontal pockets were detected on the mesial and distal aspects. The periodontal pocket on the palatal aspect was found within normal limit. A Miller grade II mobility was evident on this tooth.

The PA radiographic view (Fig. 1a) showed casted post crown with previous RCT of a sufficient length and density. A periradicular radiolucency was detected on maxillary right permanent central incisor. A long thin discontinued radiopaque fragment was detected on the distal aspect of the root, where it was found "floating" in the radiolucent lesion. Another irregular radiopaque fragment was found partially detached from the mesial part of the root. Three gutta-percha size #30/02 (Dentsply Maillefer, Ballaigues, Switzerland) were used to trace the sinus tract on different sites on the buccal gingivae. One gutta-percha traced the sinus tract to the apical region of the root. The other two gutta perchas traced the sinus tract to the cervical region at buccal aspect. CBCT views (Veraviewepocs 3D R100, J. Morita, Osaka, Japan) (Fig. 2) showed extensive bone loss on apical, mesial, distal, and buccal aspects of the root, leaving the coronal part of the palatal bone intact. Two radiopaque fragments were found at the disto-buccal and bucco-mesio-palatal aspects of the root with complete and incomplete detachment from the root surface, respectively.

The maxillary right permanent central incisor was diagnosed as chronic periradicular abscess with the presence of cemental tear. The suggested treatment options were:

1. Surgical debridement of the cemental tear and apicoectomy with retrograde filling on maxillary right permanent central incisor.

2. Extraction of maxillary right permanent central incisor and replacement of missing tooth with implant, bridge, or denture.

Patient opted and consented for the surgical debridement and apicoectomy on maxillary right permanent central incisor after the risks and benefits, the procedures involved, the cost, and the probable prognosis of the treatment were explained to her. During the surgery, extensive granulation tissue and a few prickle-like hard tissues were found, curetted, and collected for biopsy before apicoectomy with retrograde filling (Fig. 1b).

The histopathological examination of the hard tissue fragments revealed cellular cementum (Fig. 3) consistent with the radiographic findings of a torn cementum. The cementum demonstrated incremental lines and areas of resorption. A thin layer of fibrous connective tissue representing periodontal ligament was attached on the cementum surface. The diagnosis of cemental tear was confirmed. Histological evaluation of the soft tissue lesion (Fig. 4) obtained from the periradicular region showed a cystic lesion lined by non-keratinized stratified squamous epithelium and backed by chronically inflamed fibrous cyst wall, supporting a diagnosis of radicular cyst.

Figure 1. (a) Pre-operative PA radiograph. Three gutta-percha traced three different sinus tracts to the periradicular radiolucency. (b) The PA radiograph taken immediately after surgical removal of detached cementum and apicoectomy where MTA was used as retrograde filling

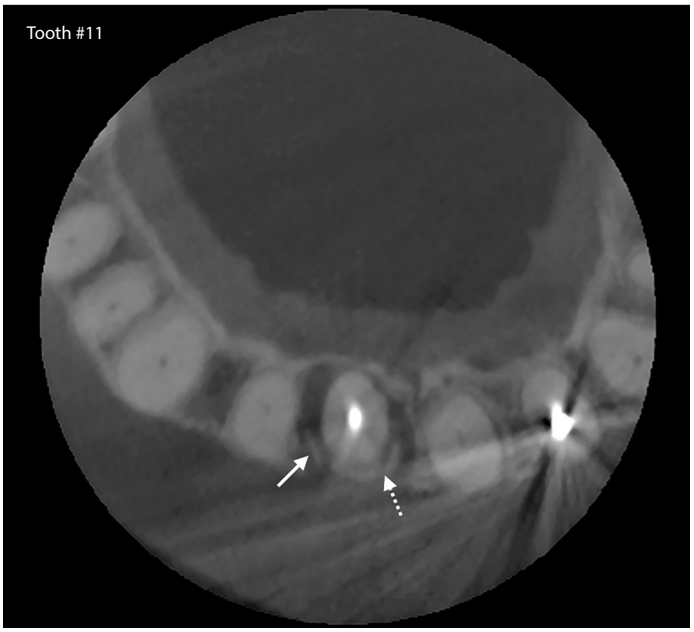

Figure 2. Axial image of CBCT. Arrow indicates complete cemental tear. Dotted arrow: Incomplete cemental tear where the cementum detaches from the root surface

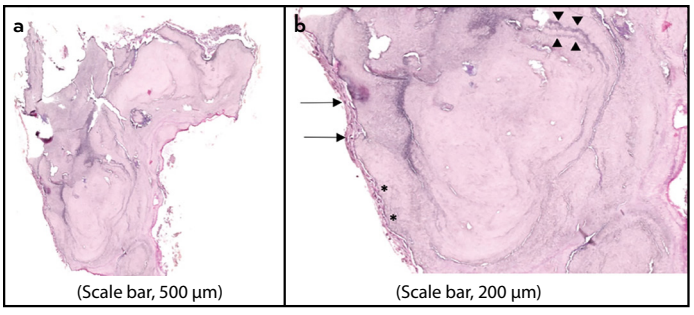

Figure 3. Photomicrographs of cemental tear. (a) A fragment of cellular cementum with presence of lacunae and cementocytes. (b) Remnants of periodontal ligament (arrows) were attached on the surface of the cementum. Incremental lines (arrowheads) in the cementum fragment. Asterisks: Areas of resorption

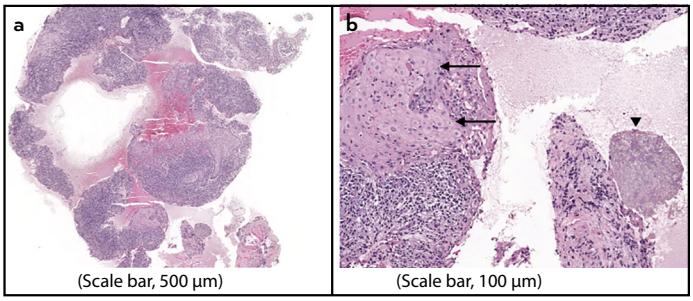

Figure 4. Photomicrographs of periapical lesion. (a) A cystic lesion. (b) Inflamed fibrous cyst wall lined by epithelium. Arrows: Non-keratinized stratified squamous epithelium. Arrowhead: Microbial colony. (A: Scale bar, 500 µm. B: Scale bar, 100 µm)

Patient returned for a follow-up after 3 months. The tooth appeared to be asymptomatic, and no deep pocket and sinus tract detected. However, patient did not return for 1 year follow-up.

Case 2:

A 38-year-old Asian woman was referred to the clinic with the chief complaint of sinus tract on maxillary left permanent central incisor and unpleasant aesthetics of her maxillary anterior crowns. Patient had crowns performed on both maxillary permanent central incisors about five years ago. The patient reported no history of dental pain or swelling. She had RCT completed on maxillary left permanent central incisor a month ago by her dentist, but the sinus tract did not resolve after the RCT. Both teeth were asymptomatic. Patient denied history of dental trauma.

Clinical examination revealed that both teeth presented with marginal discrepancy of PFMs. They were not tender to percussion and palpation, and had no gingival swelling. However, a sinus tract was detected on the buccal gingivae, and a palatal accessed cavity was observed on the PFM crown of maxillary left permanent central incisor. Maxillary right permanent central incisor did not respond to the cold test. A deep pocket more than 10 mm was observed on the mesial aspect, and 5 mm was observed on the distal aspect of maxillary left permanent central incisor. A deep pocket more than 6 mm was observed on the mesial aspect of maxillary right permanent central incisor. Maxillary right and left permanent central incisors presented with Miller grade I and II mobility, respectively.

The PA radiograph (Fig. 5) showed previous RCT on maxillary left permanent central incisor with acceptable length and density. A halo-shaped periradicular radiolucency was observed, and the gutta-percha size #30/02 (Dentsply Maillefer, Ballaigues, Switzerland) traced the sinus tract to the periradicular radiolucency associated to this tooth. Besides, a few radiopaque hard-tissue-like materials were also observed around the apical half of the root. In regards with maxillary right permanent central incisor, no RCT was performed, and a periradicular radiolucency was observed. Vertical bone loss was detected on the mesial aspect of the tooth. An irregular radiopaque mass was attached on the mesial aspect of the root of maxillary right permanent central incisor at mid-root region, suggesting possible calculus deposition. A partially detached radiopaque material was observed at the

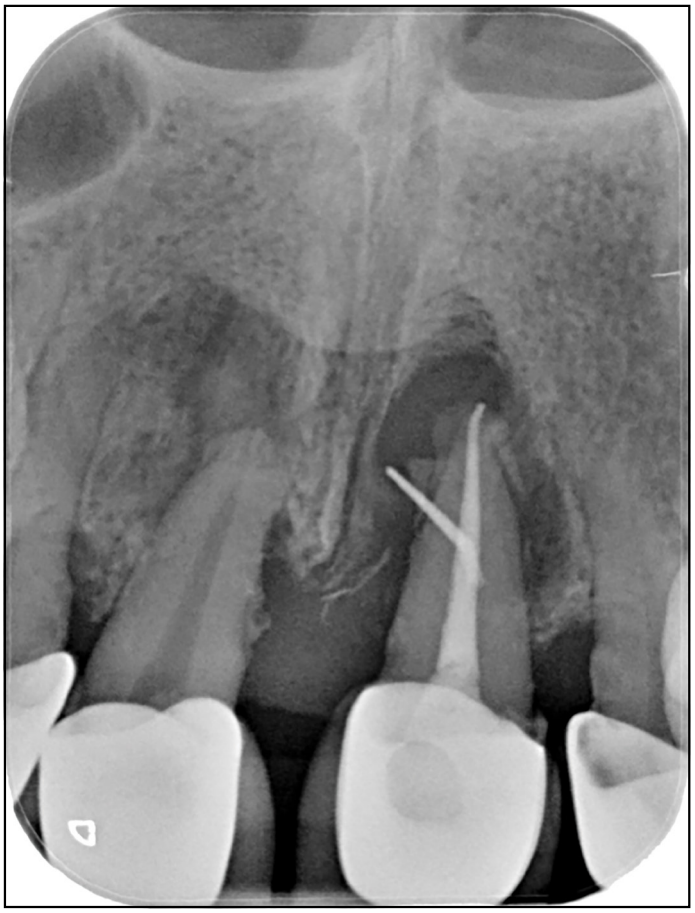

Figure 5. Pre-operative PA radiograph. A gutta-percha traced the buccal sinus tract to the periradicular lesion on maxillary left permanent central incisor

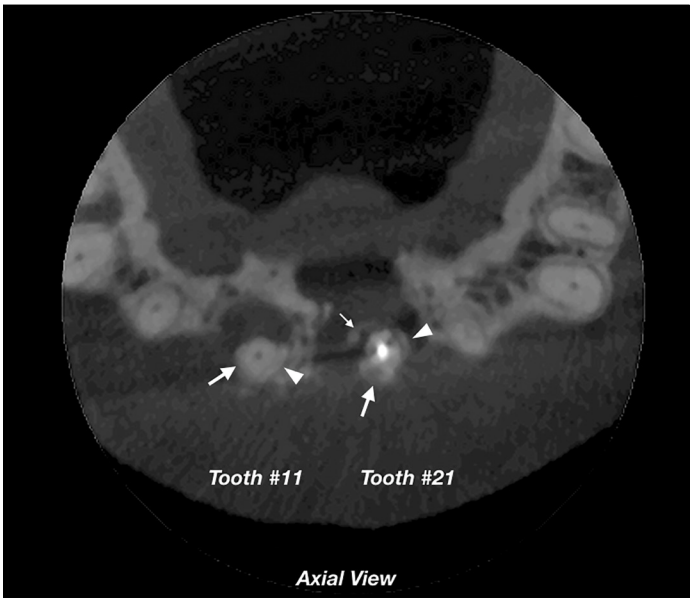

Figure 6. Axial view of CBCT on maxillary right and left permanent central incisor. Arrowheads: Partial cemental tear. Thin arrow: Complete cemental tear. Thick arrows: The cementum remained attached on the root

distal aspect of the root at the apical third. CBCT views (Veraviewepocs 3D R100, J. Morita, Osaka, Japan) (Fig. 6) showed extensive periradicular bone loss around both teeth. The radiopaque fragments were found partially detached on the

root surface of maxillary right permanent central incisor at apical third and at the mesial surface of the mid-root region. A radiopaque fragment was also found completely detached from the root of maxillary left permanent central incisor at mesio-palatal part of apical part of the root. A partially detached radiopaque fragment was also found on the disto-buccal aspect of the root at apical half of maxillary left permanent central incisor.

Maxillary right permanent central incisor was diagnosed as pulp necrosis with asymptomatic periradicular periodontitis. Maxillary left permanent central incisor was diagnosed chronic periradicular abscess with a secondary periodontal affection. Both teeth presented with the cemental tear. The suggested treatment plan and options were:

1. RCT on maxillary right permanent central incisor prior to surgical debridement of cemental tear and apicoectomy with retrograde filling on both teeth.

2. Extraction of maxillary right permanent central incisor and replacement of the missing tooth with implant, bridge, or denture.

After discussing with the patient the risks and benefits, the procedures involved, the cost, and the possible prognosis of the treatment, the patient decided to have both the teeth extracted. The extraction was performed by the patient's dentist, and the extracted teeth, curetted granulation soft tissue, and prickle-like hard tissue were sent for biopsy.

Calculus and plaque were observed especially on the mesial mid-root region of the extracted maxillary right permanent central incisor (Fig. 7). A cemental line could be seen on the root surface, which indicated of the history of cemental tear.

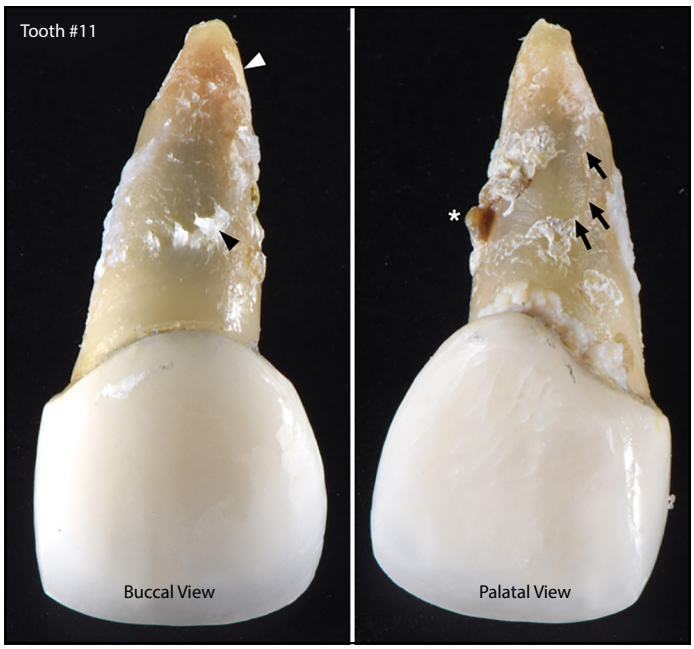

Figure 7. Photographic view showing the extracted maxillary right permanent central incisor. White arrowhead: Partial cemental tear. Black arrows: Cemental line. Asterisks: Calculus deposited on the root surface. Black arrowhead: The soft tissue attached on the root surface

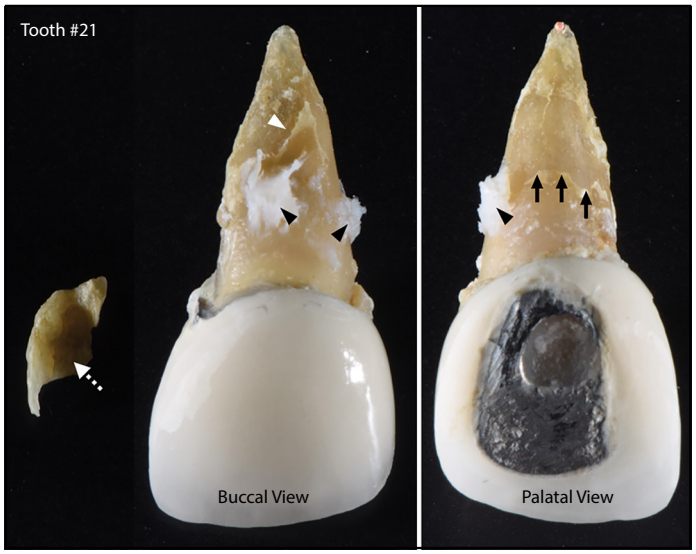

Figure 8. Photographic view showing the extracted maxillary left permanent central incisor. White arrowhead: Partial cemental tear. Black arrows: Cemental line. White dotted arrow: Complete cemental tear obtained from the socket after removal of maxillary left permanent central incisor. Black arrowheads: Soft tissue attached on the root surface

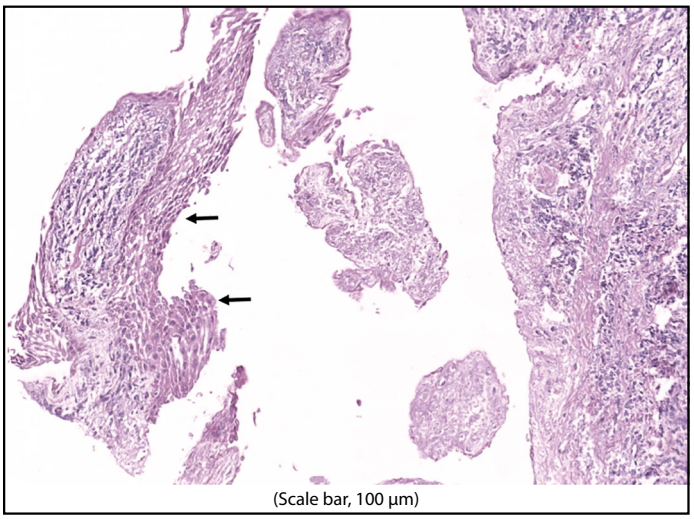

Figure 9. Photomicrograph of periapical lesion showing inflamed cystic lesion with evidence of epithelial lining. Arrows: Non-keratinized stratified squamous epithelium. (Scale bar, 100 µm)

A prickle-like hard tissue was observed on extraction of maxillary left permanent central incisor (Fig. 8). A partially detached hard tissue was observed on the buccal surface of the maxillary left permanent central incisor, and a few cemental lines were observed on the root surface suggesting that cementum was detached from the root surfaces.

The histopathological examination of the soft tissue lesion (Fig. 9) showed inflamed fibrous connective tissue wall lined by non-keratinized stratified squamous epithelium, confirming a diagnosis of radicular cyst. The decalcified section of the hard tissue fragment that was detached from the tooth root consisted of dentine with attached cementum (Fig. 10). Whereas, the decalcified section of the extracted teeth showed cemental tear involving multiple sites along the root

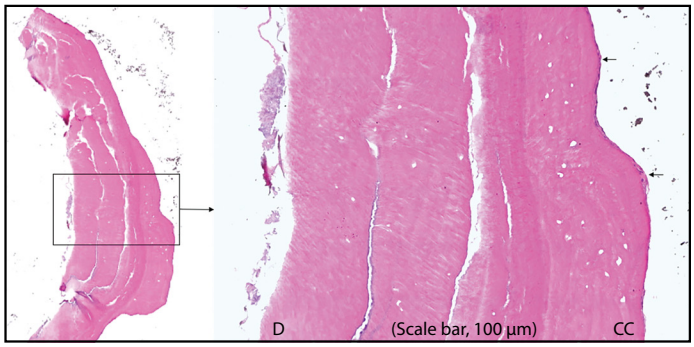

Figure 10. Photomicrograph of a dentin fragment with attached cementum. A thin layer of fibrous connective tissue representing periodontal ligament was adhered to the cemental surface (arrows). D: Dentine, CC: Cellular Cementum [Scale bar (inset), 100 µm]

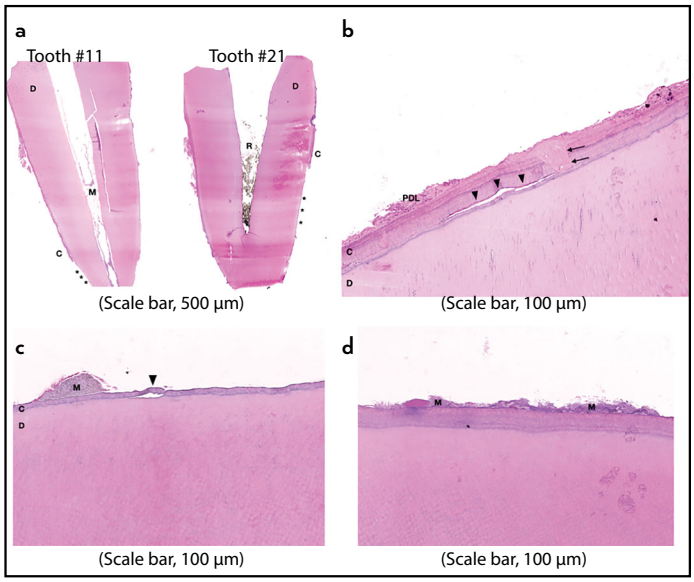

Figure 11. (a) Histological section of tooth root. (b–d) Histological findings along the root surface. C: Cementum, D: Dentine, M: Microbial colonies, R: Remnant of root filling material, PDL: Periodontal ligament. Arrowheads: Detachment of cementum from root dentine. Arrows: Deposition of cellular cementum indicative of cemental repair. Asterisks: Denuded root surface

surface (Fig. 11), corroborating a diagnosis of combined cemental and cementodentinal tears. Deep periodontal pocket was reflected by the presence of microbial deposits along the root surface (Fig. 11d).

DISCUSSION

Cemental tear is a unique form of root fracture where the cementum detaches from of the root surface, and subsequently results in periodontal and/or periapical tissue breakdown (4, 5). Literature on cemental tear is scarce, and it is usually misdiagnosed, especially with inexperienced clinicians. There are few common clinical features that could suggest the presence of cemental tear: extensive periradicular radiolucency detected in the PA radiograph, presence of sinus tract, gingival abscess, and deep periodontal pockets (3, 6, 7, 8). However, these clinical features could mimic the clinical presentation of vertical root fracture, endodontic infection, periodontal infection, or the combination of both endodontic-periodontal infection (3, 6, 9). Therefore, the aforementioned features are not pathognomonic for cemental tear. The radiographic presentation of thin radiopaque fragment(s) detached from the root surface could support the presence of cemental tear. Nevertheless, this manifestation could be undetected in a two-dimension PA radiograph especially if the location of the cemental detachment is at a bucco-lingual/palatal dimension of the root (6, 10). Therefore, the use of CBCT could help in prevailing the shortcoming of PA radiograph.

Other than accurately determining the location of the cemental tear, the CBCT images could potentially detect the nature and the pattern of the cemental detachment. For example, the irregular thickness of the root outline provides the information with possible previous cemental detachment. Also, the presence of small gap at the cementodentinal junction suggests that the cementum detaches from the root surface. This information is important because all detached or detaching cementum should be removed as the detaching cementum is most likely to detach further and hinder the periradicular healing. Thus, knowing and understanding the pattern of the cemental detachment through three-dimensional imaging influences the treatment approach and modality, and potentially affects the treatment outcome.

Chou et al. presented a case report in which the detachment of the root fragment was within the root dentine, and not at the cementodentinal junction, and thus indicating cementodentinal tear (11). The histopathological finding of the detached hard tissue on maxillary left permanent central incisor in Case 2 showed a fragment of dentine, and this confirmed cementodentinal tear. However, no study has listed out the contributing factors of cementodentinal tear. Most studies speculated that it shared the same causative factors as in cemental tear (3, 12, 13). However, because both of them are fundamentally distinct in their anatomy and histopathology, further studies are needed to investigate and differentiate them. Besides, it is important to assert the benefit of histopathological examination, as it is impossible to obtain the definitive diagnosis through clinical and radiographic examination (12, 14). Without the histopathological examination, the authors would have misdiagnosed the detached fragment in Case 2 (maxillary left permanent central incisor) as cemental tear. And this could play a vital role in determining the management or the outcome of the tooth if the predisposing or contributing factors for cemental tear and cementodentinal tear are different.

Direct inspection of the extracted tooth maxillary left permanent central incisor in Case 2 showed evidence of cemental line (Fig. 8) after the event of cemental or cementodentinal tear. It is important to acknowledge the detection of cemental line as it is a trace line at the junction between the denuded root dentine (after cemental detachment) and the normal root surface (with cementum). Therefore, even though no cemental fragment could be obtained during the extraction of maxillary right permanent central incisor (Case 2), we confidently hypothesize the event of cemental tear on this tooth as the cemental line could be clearly detected on the root surface. And this has been supported by histopathological findings where

no cementum was detected on the denuded root surface. One possible explanation for unfound detached cementum is its removal during the deep scaling or periodontal treatment performed by the patient's dentist. The presence of the calculus and plaque on the root surface of maxillary right permanent central incisor (Fig. 7) explained the periodontal status of the tooth, but it was unable to precisely identify the incidence of cemental tear and periodontal disease chronologically. However, based on patient's dental history and general periodontal condition, clinical and radiographic examination, and evaluation of the extracted tooth, the authors suspected the existing periodontal disease was made worse by the event of cemental tear.

Based on the history of the patients, clinical findings, and current literature, we speculated the age of the patient in Case 1 predisposed the patient to cemental tear. A previous study showed that patients aged more than 60 years contributed to more than 70% of the cases with cemental tear (3). This could be due to the changes on cementum and dentine during aging (1, 8). However, in Case 2, the patient was rather young, and we suspected occlusal trauma to be the reason for cemental tear on both central incisors (3, 7, 8). The patient had lost her mandibular posterior teeth more than eight years ago, and she mainly relied on her anterior teeth for chewing and biting. Also, the overly contoured crown on both central incisors would further increase the occlusal loading on the teeth. Therefore, excessive occlusal forces might contribute to cemental tear on the central incisors.

An outcome study reported that the apicocoronal location of the detached cementum affected the prognosis of the treatment. The success is higher if the detachment is found at the middle third (66.7%) or coronal third (60.0%), and significantly lower if the detachment is at the apical third (11.1%) (15). In addition, the study showed that surgical management (57.7%) of the cemental tear healed significantly higher than non-surgical management (28.6%) (15). However, the two cases included in this case report presented the cemental tear extending from the apical third to coronal third; and therefore long-term prognosis of the proposed treatment options is unknown. Furthermore, the recurrence rate if the remaining cementum would continue to detach from the root surface remains unclear. Therefore, there is a need for more well-organized clinical studies to provide and strengthen the lack of evidence in cemental tears as this helps in clinical decision-making for both clinicians and patients.

CONCLUSION

In conclusion, this case report described the clinical, radiographic, and histopathological features of cemental tear. It has shown the benefits of incorporating the CBCT to detect, diagnose, and understand the pattern of complete and incomplete cemental tear; and confirming with histopathological examination.

Disclosures

Conflict of interest: Teng Kai Ong, Nurharnani Harun, Tong Wah Lim declare that they have no conflict of interest.

Ethics Committee Approval: N/A.

Peer-review: Externally peer-reviewed.

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Authorship contributions: Concept – T.K.O.; Design – T.K.O.; Supervision – T.K.O.; Fundings - T.K.O., T.W.L., N.H.; Materials – T.K.O., T.W.L., N.H.; Data collection &/or processing – T.K.O.; Analysis and/or interpretation – T.K.O.; Literature search – T.K.O., T.W.L., N.H.; Writing – T.K.O., T.W.L., N.H.; Critical Review – T.K.O., T.W.L., N.H.

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