A right lower central incisor with a sinus tract at the labial gingiva that required periodontal treatment, but not endodontic treatment: Prodigious amount of periodontal regeneration of the severe labial bone loss due to a cemental tear after treatment

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Abstract

Cone-beam computed tomography and clinical examinations including pulp vital testing and pocket probing depth showed a cemental tear with a severe labial alveolar bony defect, but no endodontic lesions in #25, which had a sinus tract at the labial site, in a 75-year-old woman.

A right lower central incisor with a sinus tract at the labial gingiva that required periodontal treatment, but not endodontic treatment: Prodigious amount of periodontal regeneration of the severe labial bone loss due to a cemental tear after treatment

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Conflict of interest

The authors have no conflicts of interest to disclose.

Ethical approval

None.

Consent

The patient has consented to the submission of the case. Written informed consent was obtained from the patient to publish this report in accordance with the journal's patient consent policy.

Author contribution

TN, KT, SI, KW and HS: drafted the manuscript and contributed to treatment of the patient. All authors have read and approved the final manuscript.

A Key Clinical Message

The clinical management of a cemental tear with severe periodontal tissue destruction based on the new classification and treatment decision-making (*Lee et al., 2021*) includes complete removal of the torn fragments and periodontal regenerative treatment of the novel therapy using recombinant human fibroblast growth factor-2**.**

Abstract

Cone-beam computed tomography and clinical examinations including pulp vital testing and pocket probing depth showed a cemental tear with a severe labial alveolar bony defect, but no endodontic lesions in #25, which had a sinus tract at the labial site, in a 75-year-old woman. This cemental tear was diagnosed as Class 3/Stage C based on the classification by Lee et al., 2021. Recombinant human fibroblast growth factor-2 as a regenerative agent was then applied into the bone defect after removing cemental fragments and inflamed granulomatous tissue containing bacterial colonies. The labial bone defect was regenerated to the position of the crest of lingual bone, showing successful clinical and radiographic outcomes at 2-year follow-up.

Keywords: cemental tear; recombinant human fibroblast growth factor-2; periodontal regeneration therapy

Introduction

A cemental tear, the detachment of cementum from the root surface, may cause periodontal breakdown, although its pathogenesis has not been fully elucidated (1-3). A cemental tear often mimics periapical periodontitis, vertical root fracture, or an endodontic-periodontal lesion (2, 4-8). Therefore, interpretation of the images of dental X-rays and cone-beam computed tomography (CBCT) and clinical examinations including pulp vital testing and measurement of periodontal pocket depth need to be carefully conducted to distinguish a cemental tear from the other lesions (2, 4-6, 9-12).

Our previous case involved a mandibular right central incisor affected by a perforation into a labial site and cemental tear that underwent an endodontic approach to perforation repair and periodontal treatment including periodontal regenerative therapy using recombinant human fibroblast growth factor-2 (rhFGF-2) to the labial bone defect (13). These treatments decreased pocket depth (PD), with a 5-mm gain in the clinical attachment level (CAL) and proximal bone regeneration (13). However, sufficient reconstruction of the labial bone was not observed on cone-beam computed tomography (13).

Lee et al. (2) have recently reported a new classification for cemental tears and recommendations for treatment strategies. This case report shows that removal of torn cemental fractions and granulation tissues and the application of rhFGF-2 in a mandibular right central lower incisor with a sinus tract, cemental tear, and severe localized periodontal destruction, which had been diagnosed as Class 3/Stage C based on the classification by Lee et al., led to significant clinical improvement (PD reduction, CAL gain, and bone regeneration).

Case report

A 75-year-old woman with osteoporosis visited Nippon Kokan Fukuyama Hospital with a chief complaint of a gingival abscess and swelling around #9. Her gingiva in all areas of the mouth except #9 and #25 was healthy (Figure 1A) and she had good oral hygiene (plaque control record: 13.8%). Her #9 was found to have received trauma two years earlier and to have a vertical root fracture. Therefore, #9 was extracted with her informed consent. In contrast, the patient had no subjective symptoms related to #25. A sinus tract was observed on the labial side of the gingiva around #25 (Figure 1A); #25 responded positively to thermal and electric pulp vital tests by PULPER® (GC, Tokyo, Japan) and Digitest® (Parkell, Farmingdale, NY, USA). Pocket probing depth (PPD) on #25 was 3 mm in all areas except the labial center, whose PPD was 9 mm. Probing of the labial center resulted in bleeding. Clinical attachment loss at #25 of the labial center was 16 mm; #25 was inclined labially and showed tooth attrition (Figure 1B). A gutta-percha point (size 40/02; GC Dental Industrial Corp., Tokyo, Japan) was used to trace the periodontal pocket of the labial center (Figure 1B). Radiography showed that the tip of the gutta-percha point inserted into the sinus tract reached the mesial site at one-fourth of the root length from the root apex of #25 (Figure 1C). Radiolucent areas were not observed around the tip of the inserted gutta-percha point (Figure 1C). Dental radiographs in the orthoradial projection and the eccentric projection of #25 showed no radiopaque fragments at the root (Figure 1D). The patient's oral hygiene was good, and her gingiva and bone levels in all areas of the mouth except #25 were healthy, suggesting that #25 should be classified as a periodontal abscess in a non-periodontitis patient (14, 15).

Cone-beam computed tomography (CBCT) images (3DX Multi-Image Micro CT FPD8; J Morita, Tokyo, Japan) of #25 showed an extensive bone defect on the labial aspect and narrow-range defects on the mesial and distal aspects at the buccal side (Figure 2A and B). Three-dimensional reconstruction of CBCT images showed narrow shallow vertical bone defects from the existing marginal bone in the three sites (Figure 2C). Radiopaque thin fragments, which were completely and incompletely detached from the root surface, were observed at the distal-labial and mesial-labial aspects of the root (Figure 2A and B). This was diagnosed as a case of cemental tear accompanied by severe periodontitis. According to the new three-dimensional classification of cemental tears (2), this case was classified as Class 3 (clinically inaccessible, *infrabony* and/or dehiscence, no apical involvement)/Stage C (cemental tear and the associated bony defect involves 3 surfaces of the root). The clinical symptoms and the results of the examinations suggested that whileendodontic treatment was not necessary, periodontal treatment (surgical removal of cemental fragments and granulomatous tissue, biopsy of removed tissues, and periodontal regenerative therapy with rhFGF-2) was. Informed consent was obtained from the patient after explanation of the risks, benefits, and costs of the proposed treatments.

Occlusal adjustment was conducted at the anterior tooth to improve occlusal function after extraction of #9. After scaling and root planing had been carried out, the periodontal pocket (PPD of the labial center: 9 mm) remained, although the swelling, abscess, and sinus tract had disappeared (Figure 3A). Under disinfection with povidone iodine and local anesthetic administration with Xylocaine®(DENTSPLY-Sankin Co., Tochigi, Japan) in the right mandibular region, a full-thickness mucoperiosteal flap with a single-flap approach to the labial access was raised (Figure 3B). After granulomatous tissue was partially removed (Figure 3C), cemental fragments on the root were stained with methylene blue dye (MORIMURA DENTAL Co., Tokyo, Japan) (Figure 3D). After the removal of cemental fragments and the remaining granulomatous tissue with hand curettes under the dental operating microscope, the range of the bone defect was found on the proximal and labial aspects (Figure 3E and F). Subsequently, root planing was conducted. A thin dentin

defect that did not extend to the wedge-shaped defect occurred on the labial-site root. For this, rhFGF-2 (Kaken Pharmaceutical Co., Tokyo, Japan) was applied into the bone defect (Figure 3G). The flap was then repositioned without tension and sutured with 7-0 nylon (Mani, Tochigi, Japan) (Figure 3H). During surgery, the cemental fragments (Figure 3I) and granulomatous tissues (Figure 3J) were collected for biopsy.

Histopathological examination of the removed cemental fragment with hematoxylin and eosin (HE) staining showed the acellular cementum (Figure 4A and B). A thin layer of fibrous connective tissue representing the periodontal ligament was attached to the cemental fragment (Figure 4B). Gram-positive bacteria (Figure 4C) and periodic acid-Schiff (PAS)-positive bacteria (Figure 4D) were observed on the cemental fragment. Small, scattered cemental fragments existed within the removed granulomatous tissue (Figure 5A and B). Gram-positive bacteria (Figure 5C) and PAS-positive bacteria (Figure 5D) were observed on the small, scattered cemental tears within the granulomatous tissue.

Two years after the surgery, no abnormal findings were seen radiographically (Figure 6A), and clinically healthy soft tissues were observed without severe gingival recession (Figure 6B). PPD of all sites was 2 mm. #25 had no bleeding on probing and no tooth mobility. The clinical attachment level of the labial center was improved from 16 mm to 9 mm (attachment gain: 7 mm). CBCT 2 years after the surgery showed reconstruction of the labial bone wall (Figure 7A, B and C) and proximal bone walls (Figure 7B). In particular, the regenerated labial bone had a similar height to the lingual bone (Figure 7A).

Discussion

In this case of a 75-year-old patient, pulp vital testing, measurement of periodontal pocket depth, and CBCT provided an accurate diagnosis of a cemental tear with severe periodontitis at #25, and a sinus tract at the labial gingiva was found to be caused by periodontal inflammation due to the cemental tear, but without endodontic disease. In addition, the patient had healthy periodontal tissue. These findings can support that cemental tear is one of the causes of periodontal abscess in non-periodontitis patients (14, 15).

According to the new classification that consists of Class (0 to 6), Stage (A, B, C, and D), and treatment decision-making and selection for cemental tears (2), this case was classified as Class 3/Stage C, and the regeneration approach with rhFGF-2, which can effectively regenerate periodontal tissue in patients who suffer from periodontal disease (16-18), was applied. Bacteria invade the concealed site of the fractured fragments of a cemental tear and scattered cemental fragments within the granulomatous tissues to colonize, proliferate, and survive (13). A dental operating microscope is essential to improve access to the operative field and to facilitate complete removal of torn cemental fragments and granulation tissue during the operation (2). Therefore, in this case, a surgical approach was adopted using a dental operating microscope.

In this case, the labial bone defect was regenerated to the position of the crest of lingual bone, showing successful clinical and radiographic outcomes. In our previous case of a cemental tear with root-canal perforation into the labial site, chronic apical periodontitis, a severe loss of labial bone, and a proximal bone defect at the middle third of the root in #25, significant PD reduction, CAL gain, and proximal bone regeneration were obtained after perforation repair, root canal treatment, and periodontal treatment including periodontal regeneration therapy, although bone regeneration at the labial site was not observed (13). The tooth-root states differed between our previous report (13) and the present report in periodontal regeneration therapy, as follows. In the previous case, #25 had an obturated root canal, perforation repair, and a large wedge-shaped defect at the labial site, and #25 in the present report had vital pulp, no perforation repair, and a thin dentin defect, unlike the wedge-shaped defect, implying endodontic treatment, perforation repair, and the size (area and depth) of the root-dentin defect might have caused the worse prognosis of the labial bone regeneration in the previous case. Clinical research is necessary so that the classification of the size (area and depth) of a root-dentin defect, healthy vital pulp or non-vital pulp, and the presence or absence of perforation repair may be considered in the treatment strategy for periodontal destruction with a cemental tear in addition to the classification of class and stage (2).

Conclusion

CBCT and clinical examinations including pulp vital testing and PPD are very important tools for periodontitis and/or endodontic lesions with a cemental tear located at labial/buccal and lingual/palatal sites. Complete removal of cemental fragments and periodontal regenerative treatment are indispensable clinical treatments for cemental tears with severe periodontal tissue destruction, although the size of the defect on root dentin after removal of cemental fragments and root planing in addition to the categories of class and stage (Lee et al., 2021) might be key factors that affect periodontal tissue regeneration.

Figure legends

Fig. 1 Intraoral photographs and dental radiographs at the first visit.

(A) Intraoral photograph at the first visit. Redness and swelling are observed at the labial gingiva around #9 and #25. #25 has the sinus tract (black arrow). (B) Sinus tract tracing with a gutta-percha point. (C) Radiographic view showing the gutta-percha point from the sinus tract ending at one-fourth of the root length from the root apex of #25. White arrow; #25. (D) Dental radiographs of the orthoradial projection and eccentric projection. No cemental tear is observed at the root of #25. White arrow; #25.

Fig. 2 CBCT images of #25 at the first visit.

(A) Sagittal reconstructed CBCT images at the point of the distal, central, and mesial sides. Arrowhead: cemental tear. (B) Coronal reconstructed CBCT images at the point of a-f slice lines in Fig. 2A. Arrowhead: cemental tear. (C) Three-dimensional reconstruction of CBCT images.

Fig.3 Periodontal regenerative therapy with rhFGF-2.

(A) Presurgical view. (B) Single-flap approach with labial access. (C) After removal of granulomatous tissue. Cemental fragments (black arrows) are observed. (D) Methylene blue dye staining shows the cemental tear clearly. Then, granulomatous tissue is completely removed by the curette. (E) Labial view after the removal of the cemental fragment. (F) Occlusal view after the removal of the cemental fragment. (G) Application of rhFGF-2. (H) After suture. (I) Removed cemental fragments. (J) Removed granulomatous tissues.

Fig. 4 Histological examination of the removed cemental fragments.

(A) A low-power view of a cemental fragment shows the presence of mainly acellular cementum. HE staining. Scale bar: 500 μm. (B) Higher-power view of the open square (a) in Fig. 4A. Periodontal fibrous connective tissue (asterisk) is observed on the cemental fragment. HE staining. Scale bar: 50 μm. (C) Higher-power view of the open square (b) in Fig. 4A. Gram-positive bacterial colonies are observed (black arrows). Gram staining. Scale bar: 20 μm. (D) Higher-power view of the open square (b) in Fig. 4A. PAS-positive bacterial colonies are observed (black arrowheads). PAS staining. Scale bar: 20 μm.

Fig. 5 Histological examination of the removed granulomatous tissue.

(A) A low-power view of the granulomatous tissue. Dense fibrous tissue contains small, scattered cemental fragments (white arrows). HE staining. Scale bar: 500 μm. (B) Higher-power view of the open square in Fig. 5A. Cemental fragments within removed granulomatous tissue (white arrows). HE staining. Scale bar: 50 μm. (C) Higher-power view of the open square in Fig. 5A. Gram-positive bacterial colonies are observed within the cemental fragment (black arrows). Gram staining. Scale bar: 20 μm. (D) Higher-power view of the open square in Fig. 5A. PAS-positive bacterial colonies are observed within the cemental fragment (black arrowheads). PAS staining. Scale bar: 20 μm.

Fig. 6 Dental radiograph and intraoral photograph of #25 two years after the surgery.

(A) Dental radiograph. No abnormal findings. (B) Intraoral photograph. Clinically healthy soft tissue.

Fig. 7 CBCT images of #25 2 years after the surgery.

(A) Sagittal reconstructed CBCT images at the point of the distal, central, and mesial sides. Small arrows: bone regeneration. Arrowheads: labial bone level. Large arrows: lingual bone level. (B) Coronal recon-

structed CBCT images at the point of a-f slice lines in Fig. 7A. Small arrows: reconstruction of the proximal bone and the labial bone. (C) Three-dimensional reconstruction of CBCT images.

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