

Two-stage approach for class II mandibular furcation defect with insufficient keratinized mucosa: a case report with 3 years' follow-up

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Abstract

Periodontal regenerative treatment is useful for intrabony defects and furcation involvement, but is difficult when there is insufficient keratinized mucosa to cover and maintain the regenerative material, particularly in the mandibular molar region. We report the case of a 27-year-old woman who underwent a two-stage surgical approach for a class II furcation defect with gingival recession and insufficient keratinized mucosal width (KMW) and vestibular depth at the mandibular left first molar. We first improved the KMW and keratinized mucosal thickness using an epithelial embossed connective tissue graft with enamel matrix derivative, and then focused on periodontal regeneration at the furcation defect using an enamel matrix derivative and a bovine-derived xenograft. Probing depth reduction, clinical attachment gain, horizontal probing depth reduction, KMW gain, and gingival recession reduction were observed 3 years postoperatively. This case report suggests that this novel staged approach may be effective for treating furcation defects with insufficient keratinized mucosa, thus providing useful insights into periodontal regeneration therapy.

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Introduction

Periodontal regenerative treatment is a standard option for prolonging tooth survival in patients with severe periodontitis.¹⁻³ Evaluation of the treatment site in relation to the hard tissue, such as the bone defect configuration, and the soft tissue around the defect is important to achieve good results.^{4,5} In particular, an adequate keratinized mucosal width (KMW) with thick gingival tissue contributes to the regeneration outcomes.^{6,7}

Zucchelli et al.⁸ demonstrated that periodontal regenerative treatment combined with a connective tissue graft (CTG) and coronally advanced flap (CAF) enhanced the clinical and esthetic outcomes in the anterior and premolar regions when treating a non-contained defect with gingival recession (GR). The CTG was used as a membrane to improve the three-dimensional morphology of the infrabony defect, alter the gingival biotype, and stabilize the graft material.⁸ However, insufficient KMW, keratinized mucosa thickness (KMT), and vestibular depth (VD) are frequently encountered during periodontal regenerative treatment, particularly in the mandibular molar region. Such cases may not be suitable for the procedure proposed by Zucchelli et al. because performing periodontal regenerative treatment with CAF is difficult. Rasperini et al.⁹ recently recommended a staged approach for periodontal regenerative treatment for cases with furcation involvement and a KMW < 1 mm and a shallow VD. They recommended initial

surgery using a free gingival graft (FGG) to obtain sufficient KMW, KMT, and VD. We report good results using a staged approach for periodontal regenerative treatment in a patient with a furcation defect with insufficient KMW and VD, using an epithelial embossed CTG (eCTG) instead of an FGG.

Case report

A 27-year-old woman presented with pain and discomfort in her left mandible when brushing her teeth. She was systemically healthy, taking no medications, and was a non-smoker, with no financial issues or cultural beliefs that prevented her from receiving the reported treatments. She had received no previous periodontal treatment. Despite good plaque control, severe periodontitis was observed around the mandibular left first molar. There was positive bleeding on probing (BOP), a probing depth (PD) of 5 mm, clinical attachment level (CAL) of 7 mm, horizontal probing depth (HPD) of 5 mm, KMW of 0.5 mm, GR of 2 mm at the mid-buccal site, and KMW of 0 mm at the mesio-buccal site due to abnormalities in the buccal frenulum and enamel projection (Figure 1a). BOP using controlled insertion pressure is diagnostic of an inflammatory lesion.¹⁰ The clinical parameters used in this case were based on Becker et al.¹¹ The BOP score was 5.2% and the patient was diagnosed with localized stage III grade B periodontitis.¹² Radiographic examination revealed a

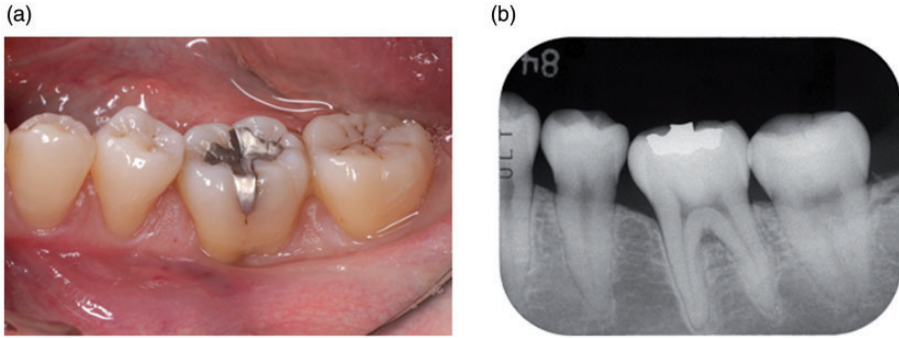


Figure 1. Baseline presentation. (a) Pre-treatment intraoral view of the buccal aspect of the mandibular left molar region. Abnormalities of the buccal frenulum were observed at the mandibular left first molar area. (b) Periapical radiograph of the right mandibular molar region. Furcation bone resorption was observed.

radiolucent lesion in the furcation area at the mandibular left first molar (Figure 1b). There was no periodontitis in the anterior and pre-molar areas, and mild periodontitis was detected in relation to other molars.

At 6 weeks after non-surgical treatment, BOP and class II furcation involvement persisted at the mandibular left first molar with a PD of 4 mm, CAL of 7 mm, and HPD of 5 mm. This was because the patient had difficulty cleaning the buccal side of the mandibular left first molar owing to an insufficient KMW and VD and buccal frenulum abnormalities. The degree of furcation involvement was graded according to the classification system proposed by Hamp et al.¹³ The vertical furcation involvement was classified as grade A according to the criteria proposed by Tarnow and Fletcher.¹⁴

An eCTG with a 2-mm band of epithelium with enamel matrix derivative (EMD) gel (Straumann Emdogain, Straumann, Basel, Switzerland) was planned using a bilaminar technique to improve the GR, KMW, KMT, and VD. After local anesthesia, a combination flap (full thickness in the coronal area and partial thickness in the apical area) with vertical incisions was elevated on the buccal side (Figure 2a). The granulation tissue and enamel

projections were removed, and planing of the exposed root was performed (Figure 2b). An eCTG was harvested from the left palate at the first molar using a single-incision technique. The donor site was sutured using 4-0 silk (MANI Sutures Silk; Mani Inc., Tochigi, Japan) cross mattress sutures (Figure 2c). The root surfaces were conditioned with 24% ethylenediamine tetraacetic acid gel (PrefGel; Institut Straumann AG, Basel, Switzerland) for 2 minutes to remove the smear layer. After a saline rinse, EMD gel was applied to the root surfaces (Figure 2d). The eCTG, with a 2-mm band of epithelium, was placed at the level of the cemento-enamel junction of the recipient tooth and secured with 6-0 absorbable polyglactin (Vicryl; Johnson & Johnson, Sint-Stevens-Woluwe, Belgium) cross mattress and simple sutures (Figure 2e). The flap was repositioned at the original level to prevent the decrease of VD and to completely cover the CTG, except for the 2-mm band of epithelium. The flap was then sutured with 6-0 absorbable polyglactin simple sutures (Figure 2f). The patient was recalled 7 and 14 days later for suture removal and infection control using irrigation with 0.05% chlorhexidine gluconate (Concool F; Weltec, Osaka,

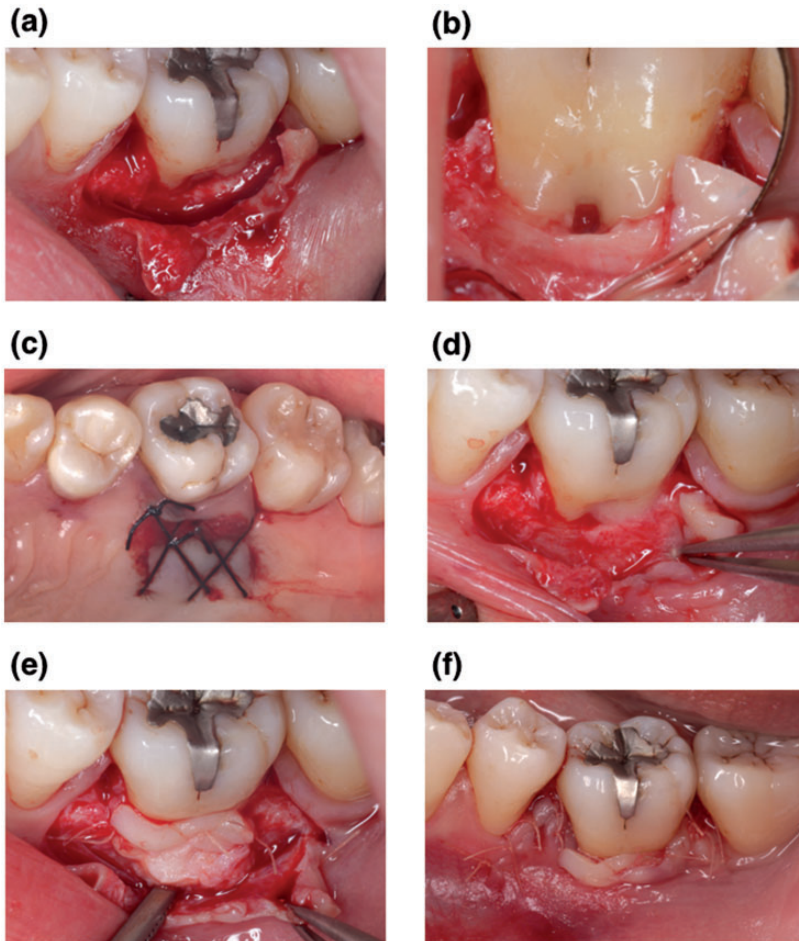


Figure 2. Intraoral view of the buccal aspect of the mandibular left molar, which received initial surgery with a subepithelial connective tissue graft and enamel matrix derivative. (a) Bony defect after elevating the combination flap. (b) Close-up of the furcation defect. (c) The donor site was stabilized with cross-suturing. (d) Application of an enamel matrix derivative to the root surface. (e) The donor subepithelial connective tissue graft (CTG) (size: 17×15 mm, thickness: 1.5 mm) was stabilized with simple and cross-suturing. (f) The buccal flap was repositioned to its original position. A subepithelial CTG was intentionally partially exposed.

Japan). Postoperative care included amoxicillin 750 mg/day for 3 days and 0.05% chlorhexidine gluconate rinses twice a day for 14 days. The patient was advised to refrain from mechanical oral hygiene measures in the treated areas for the first 2 postoperative weeks. The patient also returned for professional teeth cleaning every 3 months.

Approximately 6 months after the first surgery, a sufficient KMW (1.5 mm), KMT (1 mm), and VD were observed at the mesio-buccal site (Figure 3a). A second surgical treatment was then performed by applying an EMD gel combined with a bovine-derived xenograft (BDX) (Bio-Oss; Geistlich Biomaterials, Wolhusen, Switzerland). After the administration of

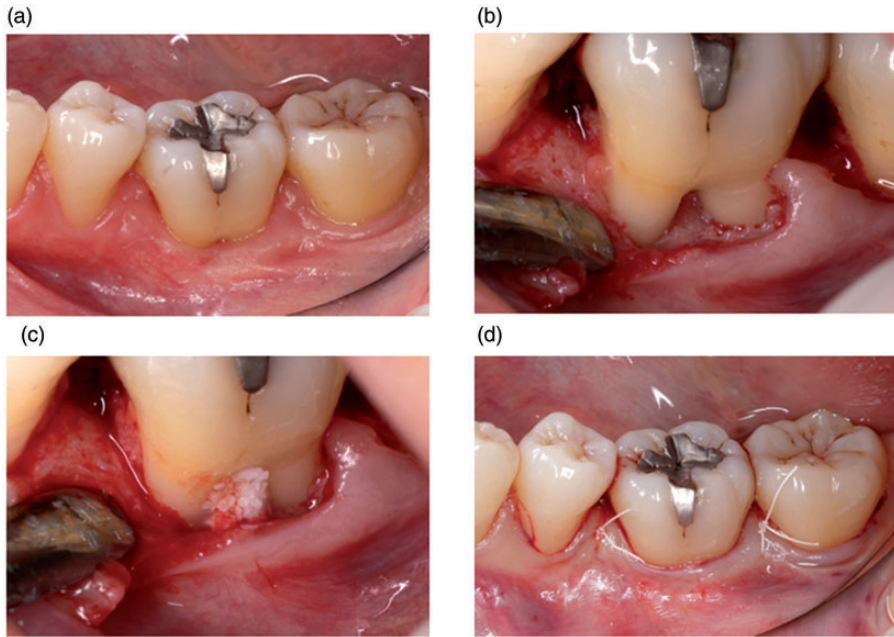


Figure 3. Intraoral view of the buccal aspect of the mandibular left molar, which received second surgery with enamel matrix derivative and bone-derived xenograft (a) Intraoral view of the buccal aspect of the mandibular left molar area at approximately 6 months after the first surgery. The buccal frenulum abnormalities had improved. (b) Bony defect after elevating the full-thickness flap. (c) Application of an enamel matrix derivative to the root surface and bone-derived xenograft around the bone defect. (d) The buccal flap was repositioned to a slightly coronally advanced position.

local anesthesia, a buccal full-thickness flap was raised, granulation tissue was removed, and the exposed root was planed (Figure 3b). The root surfaces were conditioned and the EMD gel was applied in the same manner as in the first surgery. The BDX was placed in the furcation defect (Figure 3c). Finally, the flap was sutured in place with 5-0 non-resorbable expanded polytetrafluoroethylene modified vertical mattress sutures (Figure 3d). Amoxicillin was prescribed (750 mg/day for 3 days) postoperatively.

No periodontal or functional problems were observed at the mid-buccal site at the 6-month and 3-year follow-up visits. The clinical parameter scores were the same at both follow-up visits (PD: 2 mm,

CAL: 2 mm, CAL gain: 5 mm, HPD: 1 mm, KMW gain: 1.5 mm, GR reduction: 2 mm) (Figure 4a–d). Additionally, radiographic bone fill was observed in the furcation area at the 6-month and 3-year follow-up visits. An amalgam filling was replaced with composite resin at the 1.5-year-follow-up visit. The patient was satisfied with the results of the treatment. Patient adherence was high throughout the treatment period.

We obtained written informed consent from the patient for treatment, but not for the publication of this case report. However, because we de-identified the patient, we did not require ethical approval and signed consent to publish this report. CARE guidelines were followed in the reporting of this case.¹⁵

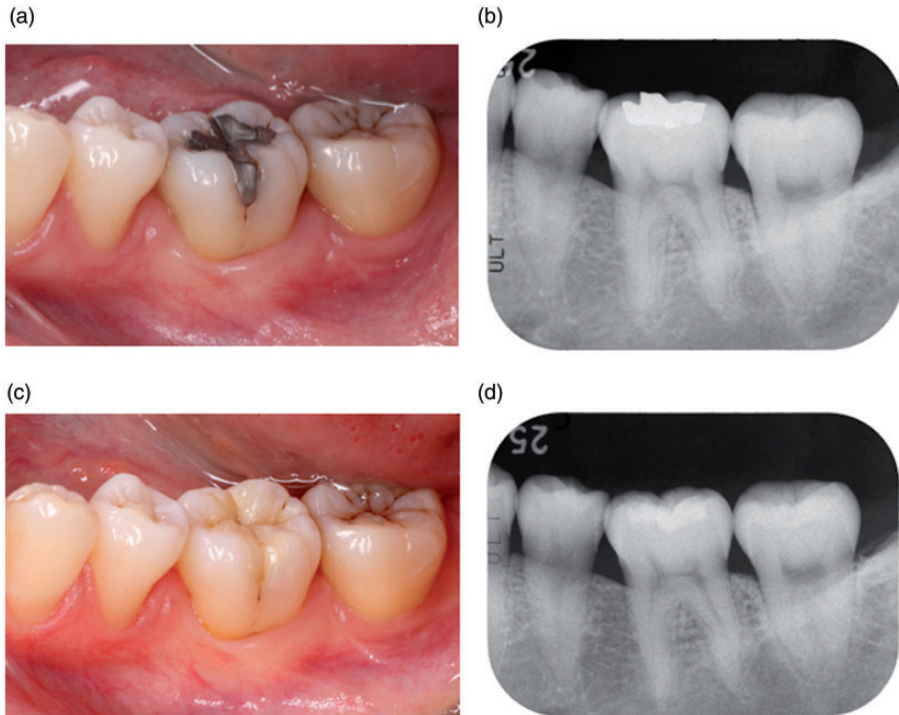


Figure 4. Intraoral view and radiograph of the mandibular left molar area 6 months and 3 years after surgical treatment. (a) Intraoral view of the buccal aspect of the mandibular left molar region 6 months after surgical treatment. An adequate keratinized mucosa width and vestibular depth and improvements in gingival recession and the buccal frenulum were observed. Oral hygiene was well-maintained by the patient. The patient was reviewed every 3 months and remained satisfied with the results. (b) Periapical radiograph of the mandibular left molar after surgical treatment. Bone resorption was observed in the furcation area 6 months after surgical treatment. (c) Intraoral view of the buccal aspect of the mandibular left molar region 3 years after surgical treatment. (d) Periapical radiograph of the mandibular left molar 3 years after surgical treatment.

Discussion

An adequate KMW with thick gingival tissue contributes to the success of periodontal regenerative treatment.^{4,5,9} In cases with a deficient KMW, KMT, and VD, insufficient keratinized mucosa has commonly been reported to induce gingival necrosis and collagen membrane exposure, often leading to failure of periodontal regeneration.^{16–18}

The connective tissue wall technique and soft tissue wall technique involve the placement of CTG and EMD, respectively, with

a simultaneous CAF for a non-contained defect with GR.^{8,19} These techniques are highly effective, but require a sufficient KMW and VD, because the CAF may result in a reduction in the VD.²⁰ However, KMW and VD are frequently insufficient, particularly in the mandibular posterior region. The aim of the first proposed surgery in the current case was to treat the malformed buccal frenulum and GR, and increase the KMW, KMT, and VD. The flap was repositioned to its original level using a partially modified Langer and Langer technique, exposing part of the

eCTG.²¹ This improved the GR, KMW, and KMT without requiring a CAF.²¹ Rasperini et al.⁹ reported that an FGG can increase the KMW, KMT, and VD prior to periodontal regenerative treatment in cases with furcation involvement associated with a KMW < 1 mm and a shallow VD. However, simultaneous CTG or bone graft substitutes and biologic agents are recommended when the KMW is 1 to 2 mm or when there is an adequate KMW (≥ 2 mm) with a KMT ≤ 1 mm, regardless of whether GR is present.⁹ The FGG retains the original appearance of the palatal soft tissue at the recipient site²² and may result in a scar tissue-like texture and poor esthetic integration. An FGG can increase the KMW and KMT,²³ whereas a CTG can increase the soft tissue with a harmonious gingival margin.²⁴ In our case, GR was present and the KMW was 0.5 mm and 0 mm at the midpoint and mesio-buccal site of the mandibular left first molar, respectively. The proposed first surgery may thus not only improve the GR, KMW, KMT, and VD, but also the furcation involvement, as a result of debridement of the root surface and use of an EMD. In addition, the combination of an EMD and a CTG has been reported to result in better root coverage and KMW outcomes than CTG alone.²⁵ Therefore, we applied EMD with CTG in the first surgery in the current case, to treat the furcation involvement with an insufficient KMW and GR.

A previous systematic review revealed that EMD could result in signs of clinical improvement as early as 6 months after treatment.²⁶ Therefore, we set 6 months as the period between the first and second surgeries in this case. Nemoto et al.²⁷ reported good results with EMD and BDX in regenerative therapy for class II mandibular furcation involvement. BDX has shown highly biocompatibility and osteoconductive properties and can be successfully used as a bone substitute.^{28,29} Therefore, we performed the

second surgery for the regenerative treatment of furcation involvement according to the method proposed by Nemoto et al.²⁷ Karimi et al.³⁰ treated class II mandibular furcation defects using BDX alone, and reported a PD reduction and CAL gain of 0.85 ± 0.43 mm and 0.11 ± 0.64 mm, respectively, between baseline and 6 months. Jentsch et al.³¹ reported the outcomes of EMD alone for class II mandibular furcation defects, and showed a PD reduction and CAL gain of 1.55 ± 0.90 mm and 0.97 ± 0.92 mm, respectively, between baseline and 12 months.³¹ The present results were thus considered favorable, despite the difficult nature of the case in terms of periodontal regenerative therapy.

This single case demonstrated the efficacy of a novel staged approach for the treatment of mandibular periodontitis with GR, insufficient KMW, KMT, and VD, and a class II furcation defect. Despite the weak nature of the evidence, this case suggests that this staged approach may be particularly useful for the treatment of mandibular molar areas, where regenerating the periodontal tissue using conventional methods is difficult.

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Declaration of conflicting interest

The authors declare that there is no conflict of interest.

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