

CASE STUDY

Double-sided entire papilla preservation technique in the combination periodontal regenerative therapy: A case report

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Abstract

Background: With the entire papilla preservation (EPP) technique, it is possible to perform regenerative therapy without incisions in the interdental papilla and to reduce the risk of papillary rupture. However, one limitation of the EPP is the sole access from the buccal side. Here, we present a case of periodontitis treated by the combination regenerative therapy employing the Double-sided (buccal-palatal) EPP (DEPP) technique, which adds a palatal vertical incision to the EPP.

Methods: A patient with 1–2 wall intrabony defects received the regenerative therapy using recombinant human fibroblast growth factor (rhFGF)-2 and carbonate apatite (CO₃Ap). Using the DEPP technique, vertical incisions at buccal and palatal aspects were placed to gain adequate access to the 1–2 wall intrabony defects between #11 and #12 without incision in the interdental papilla. After debridement, rhFGF-2 and CO₃Ap were applied to the defect. Periodontal clinical parameters and radiographic images were evaluated at the first visit, following initial periodontal therapy (baseline), 6, 9, and 12 months postoperatively.

Results: Wound healing was uneventful. Scarring of the incision lines was minimal. At 12 months postoperatively, probing depth reduction was 4 mm, clinical attachment gain was 4 mm, and gingival recession was not observed. An improvement in radiopacity in the previous bone defect was observed.

Conclusion: The DEPP is an innovative technique that allows approaching from both the buccal and palatal sides while ensuring flap extensibility without compromising the interdental papilla. This report suggests that the combination of regenerative therapy with the DEPP may be promising in the treatment of intrabony defects.

KEYWORDS

bone grafts, growth factors, periodontal regeneration, periodontitis

Key points

Why is this case new information?

- The DEPP allows a direct visual approach to a 1–2 wall intrabony defect extending from the buccal to palatal sides, and increases flap extensibility, without compromising the papilla.

What are the keys to the successful management of this case?

- Assessment of three-dimensional bone defect morphology is required. Computed tomography images are very useful. The flap elevation just under the

interdental papilla should be carefully performed with a small excavator to avoid damage to the interdental papilla.

What are the primary limitations to success in this case?

- Despite the addition of a palatal incision, it was not possible to obtain complete flexibility of the palatal gingiva. Caution must be taken in a case in which the distance between the interdental papilla is narrow. Even if the interdental papilla is ruptured during the operation, recovery is possible by continuing the operation and suturing the rupture at the end.

INTRODUCTION

Regeneration of periodontal tissue is one of the goals of periodontal therapy. To date, different types of regenerative therapy, including bone grafting, guided tissue regeneration (GTR) using non-resorbable or resorbable membranes, and the use of biological agents such as enamel matrix derivative (EMD) and recombinant human fibroblast growth factor (rhFGF)—2 have been clinically used.^{1–4} The outcomes of regenerative therapy are influenced by various patient-, site-, and surgery-associated factors.^{5–8} Among the surgical factors, primary closure of the interdental space resulted in enhanced protection of the wound area from the intraoral environment, possibly reducing its microbial infection.⁹ To reduce the risk of early wound failure, various techniques such as papilla preservation techniques have been developed.^{10,11} In order to minimize the risk of soft tissue complications, minimally invasive surgical technique (MIST)¹² and modified MIST (M-MIST)¹³ have been introduced. These techniques were reported to improve postoperative soft tissue stability and clinical outcomes by minimizing soft tissue incision and dissection.^{12–14} Although they can significantly improve clinical attachment and reduce the risk of gingival rupture, they do not always prevent papilla atrophy because of the incision made at the papilla. To obtain better results, the entire papilla preservation (EPP) technique was introduced.¹⁵ EPP involves making a vertical incision away from the bone defect. Periodontal regenerative therapy using EPP has been shown to achieve clinical outcomes comparable to conventional therapy, with fewer esthetic problems.^{15–18} With the use of EPP, it has become possible to perform regenerative therapy without incisions in the interdental papilla of bone defects. However, with EPP, the defect is accessible only from the buccal side, which could limit its clinical application. In order to overcome this, we propose the ‘Double-sided (buccal-palatal) EPP’ (DEPP) technique. The DEPP utilizes vertical incisions in both the buccal and palatal sides. The DEPP enables the practitioner to approach bucco-palatally allowing adequate visualization and access to a bone defect. Here, we report a case of periodontal regenerative therapy using rhFGF-2 and carbonate apatite (CO₃Ap) with the DEPP technique for the treatment of 1–2 wall intrabony defects.

MATERIALS AND METHODS

Clinical presentation

A 62-year-old systemically healthy Japanese woman presented to our clinic (Ishikawa Dental Clinic, Hamamatsu, Shizuoka, Japan) for the treatment of periodontitis. Written informed consent was obtained from the patient for inclusion in this report. The clinical diagnosis was Stage IV Grade C periodontitis.¹⁹

Case management

Presurgical treatment

Non-surgical initial periodontal therapy including oral hygiene instructions, scaling and root planing was performed. The root canal treatments in premolars (#12, 13) were carried out under rubber dam isolation. Subsequent reevaluation revealed an improvement in the level of plaque control as assessed by the O’Leary plaque control record (PCR) (from 50% at the first visit to 19%). The distal palatal aspect of #11 showed a probing depth (PD) of 5 mm and the mesial palatal aspect of #12 showed 6 mm at baseline (Table 1 and Figure 1). The depth (4.8 mm) and width (3.4 mm) of the intrabony defect were measured on computed tomography images. The bone defect morphology was estimated to be a 1- to 2-wall intrabony defect extending bucco-palatally, which was confirmed during the surgery.

Surgical procedure

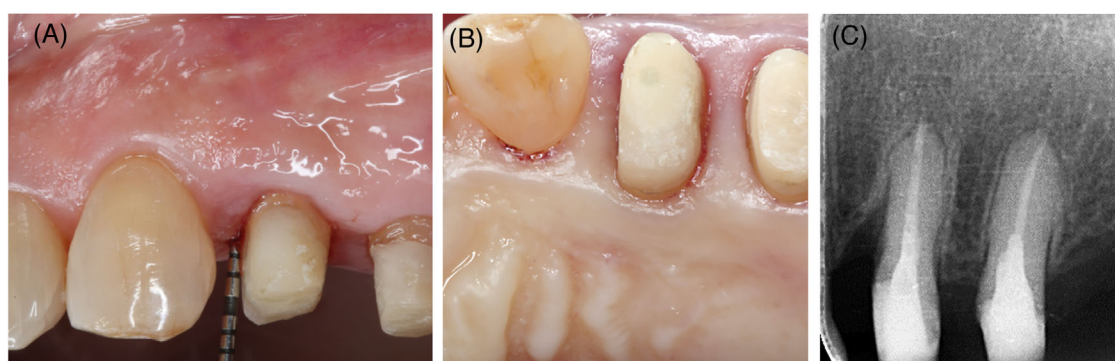
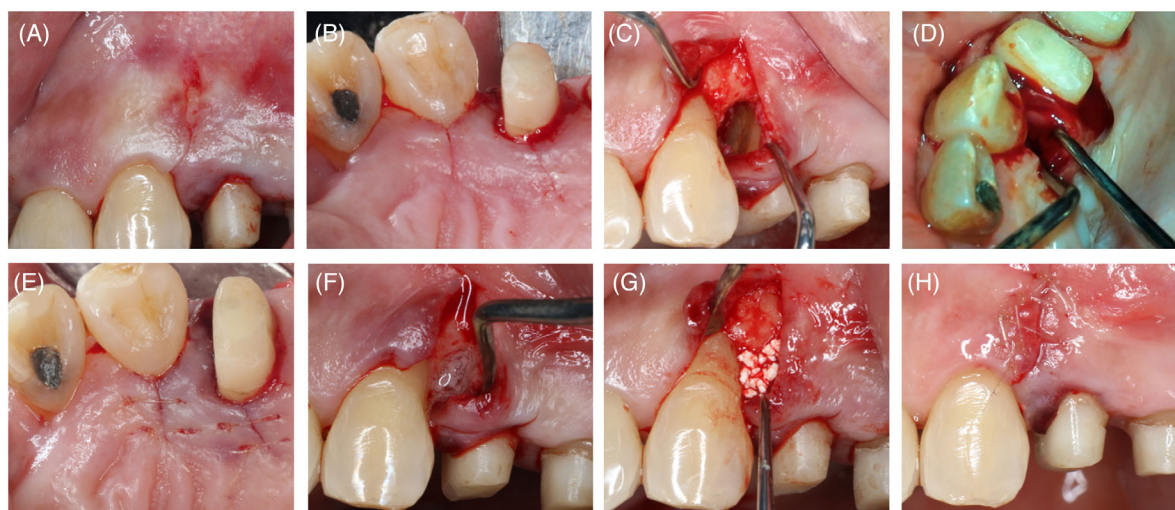
Following local anesthesia (2% xylocaine with 1:80,000 adrenaline), bone sounding was performed. Given the extension of bone defect, both buccal and palatal approaches were deemed necessary. In order to minimize the risk of rupture of the interdental papilla and to gain sufficient access to the 1–2 wall intrabony defects between #11 and #12, a vertical incision of the #11 distal, which is the incision of the EPP, was made on the buccal side (Figure 2A). The approach from the palatal side was also made through a vertical incision at #11 (Figure 2B), without

TABLE 1 Changes in periodontal clinical parameters.

Parameters	#11		First visit	Baseline	6 months	9 months	12 months
PD (mm)	Distal	Buccal	3	3	2	2	2
		Palatal	5	5	3	3	3
GR (mm)	Distal	Buccal	0	0	0	0	0
		Palatal	0	0	0	0	0
CAL (mm)	Distal	Buccal	3	3	2	2	2
		Palatal	5	5	3	3	3
Parameters	#12		First visit	Baseline	6 months	9 months	12 months
PD (mm)	Mesial	Buccal	6	5	2	2	2
		Palatal	6	6	2	2	2
GR (mm)	Mesial	Buccal	0	0	0	0	0
		Palatal	0	0	0	0	0
CAL (mm)	Mesial	Buccal	6	5	2	2	2
		Palatal	6	6	2	2	2

Baseline, post-initial periodontal therapy.

Abbreviations: CAL, clinical attachment level; GR, gingival recession; PD, probing depth.

**FIGURE 1** Clinical and radiographic image of the target site (#12) at baseline (post-initial periodontal therapy). Buccal (A) and palatal (B) oral views and dental X-ray image (C). At the mesial palatal aspect of #12, probing depth (PD) was 6 mm and clinical attachment level (CAL) was 6 mm at baseline.**FIGURE 2** Surgical procedure using the Double-sided (buccal-palatal) entire papilla preservation (DEPP). A vertical incision was made on the bucco-distal aspect of #11 (A), which is the incision used with the EPP. A vertical incision was also made in the palatal aspect (B). Defect view (#12) after debridement from buccal and palatal aspects (C, D). Suturing of the flaps with poliglecaprone sutures (E). Recombinant human fibroblast growth factor 2 (rhFGF-2) formulation was applied to the defect and the defect was filled (approximately 80%) with CO₃Ap⁺, which was pre-mixed with rhFGF-2 (G). Buccal view after suturing (H).

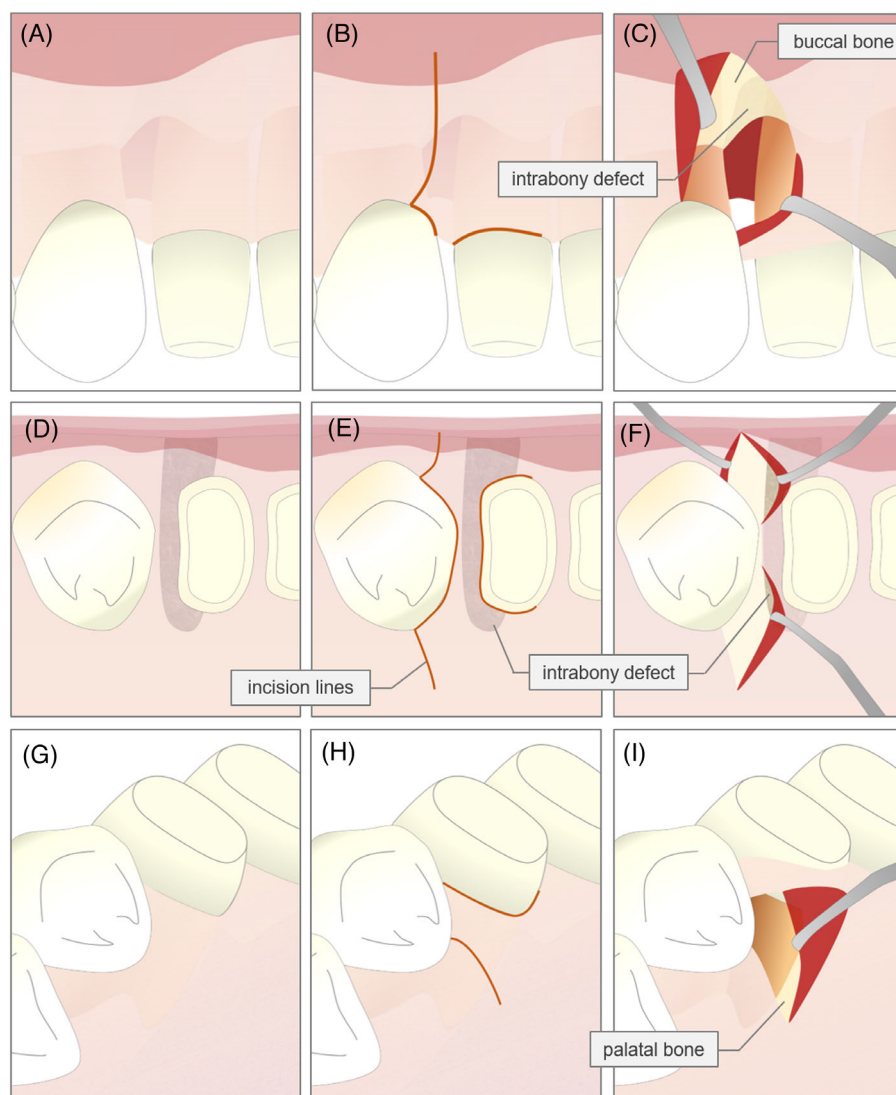


FIGURE 3 Schematic presentation of the surgery using Double-sided (buccal-palatal) entire papilla preservation (DEPP). Illustrations show the buccal (A–C), occlusal (D–F), and palatal (G–I) view. The vertical incisions of the #11 distal were made on the buccal and palatal side (B, E, H). The full-thickness flaps were elevated (C, F, I).

disturbing the papilla. Then a buccal full-thickness flap was raised. The defect and root surfaces of #11, 12 were clearly revealed by elevating from the buccal side to the palate side as much as possible. Additionally, the palatal full-thickness flap was elevated and debridement was performed from the palatal side. Although the palatal flap had less flexibility, the release from the buccal side and the vertical incisions on the palatal side enabled the entire flap on the defect to be free, thereby allowing for secure debridement with a clear view from the palatal and buccal sides. After meticulous debridement (Figure 2C,D), the flaps were repositioned and the palatal vertical incisions were closed with simple interrupted sutures (Figure 2E). Then the commercial formulation of 0.3% rhFGF-2* was

applied to the intrabony defect (Figure 2F). CO₃Ap[†] premixed with rhFGF-2 was used to fill the defect (Figure 2G). Finally, the buccal vertical incision was closed with simple interrupted sutures (Figure 2H). A schematic presentation of the procedure is shown in Figure 3.

Post-surgical procedure

Amoxicillin 250 mg was administered three times daily for three days. Loxoprofen sodium hydrate 120 mg was administered as needed for mitigating pain. During the 2-week postoperative period, professional hygiene care was provided every three days. The patient used a

* REGROTH Dental Kit, Kaken Pharmaceutical, Tokyo, Japan.

† Cytrans Granules, GC, Tokyo, Japan.

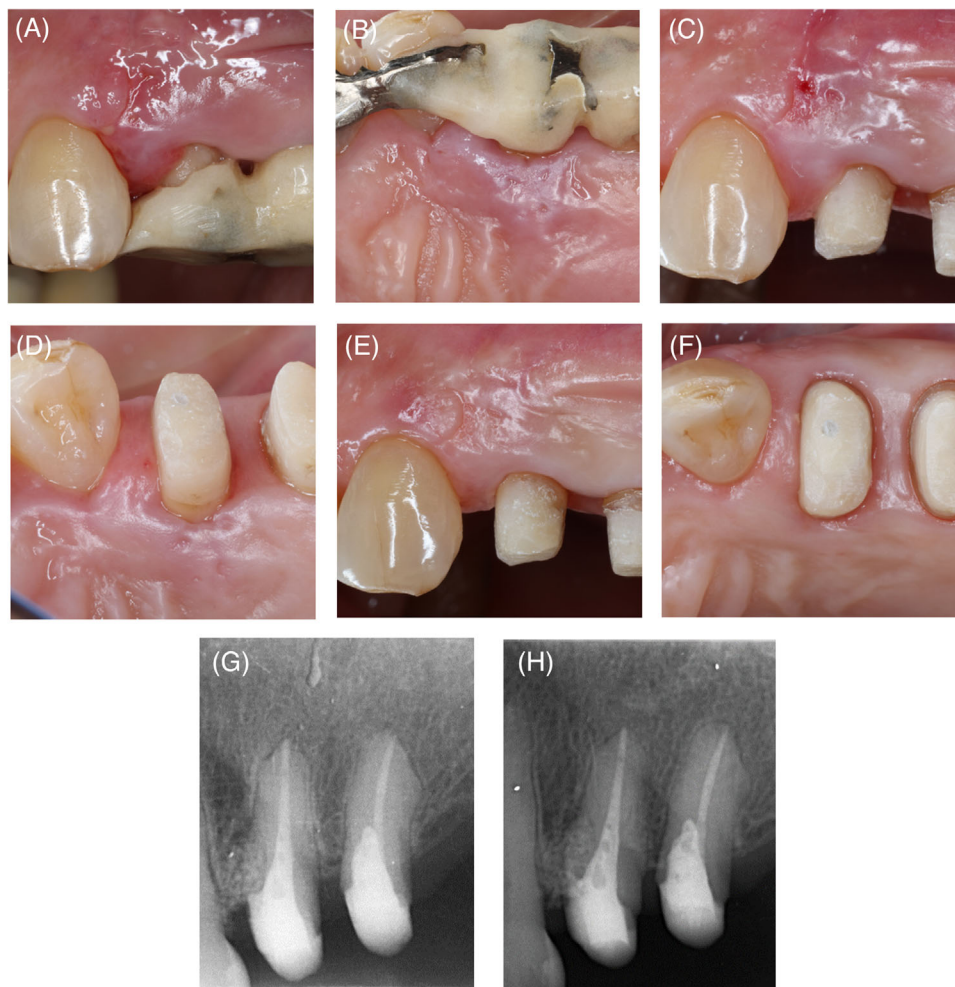


FIGURE 4 Postoperative clinical and radiographic images. At 1 week (A, B), 2 weeks (C, D), and 12 months (E, F). Dental X-ray images at 3 weeks (G) and 12 months postoperatively (H).

chlorhexidine-containing mouthwash[‡]. All sutures were removed after 7 days (Figure 4A,B). At 1-month postoperatively, normal brushing using a soft toothbrush was resumed. Then the patient was placed on a recall program. Reevaluation was performed 6, 9, and 12 months postoperatively (Table 1).

RESULTS

Postoperative healing was uneventful, except for minor gingival swelling, which resolved after 2 weeks (Figure 4C,D). Wound healing occurred without significant scarring or atrophy of the interdental papilla. No obvious gingival recession was observed at 12 months postoperatively (Figure 4E,F). PD reduction was 4 mm and clinical attachment level (CAL) gain was 4 mm (Table 1). In the radiographic image at 3 weeks postoperatively, granules of the graft material were observed (Figure 4G). An improvement

in radiopacity in the previous bone defect was observed at 12 months postoperatively (Figures 4H and 5).

DISCUSSION

The EPP is an effective procedure for intrabony defects that can be approached from the buccal side.^{15,16} However, the limited access to the defect involving the palatal aspect may be one of the limitations of EPP (Table 2). In the present case, we employed the DEPP to circumvent this limitation. We define the DEPP as “EPP with the addition of a vertical incision on the palatal side”. Incisions are placed in areas with bone support, which is the critical incision design in terms of blood supply. Such a design reduces the risk of rupture. The proposed indications for DEPP are shown in Table 3.

The incision design of DEPP not only allows direct visualization of the defect area but also access from the palatal side. Elevation of the buccal flap becomes easier by the release of tension on the palatal gingiva. Further access could be gained by extending the longitudinal incision at

[‡] ConCool F, Weltec Co, Osaka, Japan.

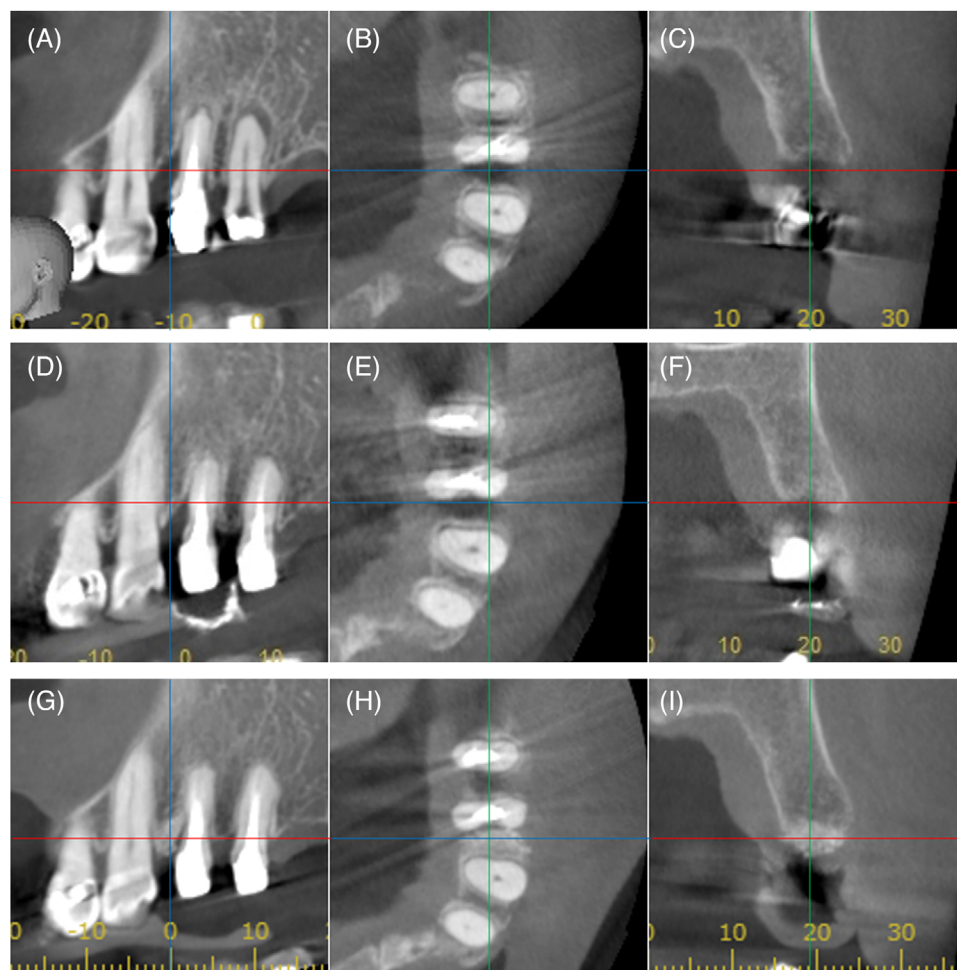


FIGURE 5 Comparison of baseline and 12 months postoperatively computed tomography (CT) images. CT images at first visit (A–C), baseline (D–F), and 12 months postoperatively (G–I). Sagittal view (A, D, G), axial view (B, E, H), and coronal view (C, F, I).

TABLE 2 Accesses and incisions in the various papilla preservation techniques.

Techniques	Access	Incisions	
		Interdental papilla	Vertical
MPPT ¹⁰	B+P, L	Yes	No
SPPT ¹¹	B+P, L	Yes	No
MIST ¹²	B+P, L	Yes	No
M-MIST ¹³	B	Yes	No
NIPSA ²⁶	B	No	No
M-VISTA ²⁷	B	No	B
EPP ¹⁵	B	No	B
DEPP	B+P	No	B+P

Abbreviations: B, buccal side; DEPP, double-sided EPP; EPP, entire papilla preservation; L, lingual side; MPPT, modified papilla preservation technique; MIST, minimally invasive surgical technique; M-MIST, modified-MIST; P, palatal side; SPPT, simplified papilla preservation technique.

the buccal side. However, extending the palatal incision is difficult due to anatomical considerations.²⁰ Regarding DEPP, caution must be exercised particularly in placing a vertical incision on the palatal side.

TABLE 3 Proposed indications for the Double-sided (buccal-palatal) entire papilla preservation (DEPP).

Proposed Indications	
Intrabony defect configuration	Isolated intrabony defects 1–2 wall defect Depth > 4 mm
Tooth position	Anterior teeth or Premolars (Molars)
Access	The defect is difficult to gain access only from the buccal side

In the indication for DEPP by tooth position, anterior and premolar areas are the most appropriate, and maxillary molars may be considered, depending on the situation (Table 3).

The previous study showed that the application of EPP with and without EMD and deproteinized bovine bone mineral (DBBM) resulted in CAL gain and PD reduction.¹⁷ The decision to apply biological agents should be based on the bone defect morphology.²¹ In this case, the bone defect was a 1–2 wall, so combination therapy was indicated. Therefore, rhFGF-2 was used in combination with a

novel bone substitute, CO₃Ap. We reported the effect of combination therapy of rhFGF-2 and bone graft material on the healing of intrabony defects, using randomized clinical trials^{2–4} and basic research.²² In addition, the safety and clinical efficacy of combination therapy using rhFGF-2 and CO₃Ap for periodontal regenerative therapy has been confirmed.^{23–25} In the treatment of the present case, we selected the novel bone graft material, CO₃Ap, because we experienced the positive outcome of the combination therapy using rhFGF-2 and CO₃Ap in the treatment of intrabony defects. However, it is necessary to investigate which combination regenerative therapy works best with the DEPP technique. The DEPP technique allows the flap to be extended without incising the interdental papilla, making it easier to apply graft material and close the flap. The DEPP may promote attachment gain and interdental papilla reconstruction. In this case, clinically favorable results were achieved following the combination therapy using rhFGF-2 and CO₃Ap.

We consider that vertical incision on the palatal side can be used in combination with surgical procedures such as non-incised papilla surgical approach,²⁶ and modified vestibular incision subperiosteal tunnel access²⁷ which are limited to approaches from the buccal side (Table 2).

CONCLUSION

The DEPP is a novel technique that allows a buccal and palatal visual approach while ensuring flap extensibility without the risk of rupture of the interdental papilla. It is important to understand this concept not only as an incision design but also as a solution when the defect is deeper or wider than expected preoperatively.

AUTHOR CONTRIBUTIONS

Yudai Ogawa and Tomohiro Ishikawa developed the idea and protocol for this incision design. Yudai Ogawa performed the clinical evaluation and periodontal treatment. Tomohiro Ishikawa oversaw the procedure. Yudai Ogawa and Kouki Yoshikawa prepared the original draft. Kentaro Imamura and Atsushi Saito finalized the manuscript. All authors reviewed and approved the final manuscript.

CONFLICT OF INTEREST STATEMENT

The authors declare no conflict of interest.

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How to cite this article: Ogawa Y, Yoshikawa K, Ishikawa T, Saito A, Imamura K. Double-sided entire papilla preservation technique in the combination periodontal regenerative therapy: A case report. *Clin Adv Periodontics*. 2023;1-8.
<https://doi.org/10.1002/cap.10258>