Application of enamel matrix derivative and deproteinized bovine bone for the treatment of peri-implantitis after decontamination with an ultrasonic scaler

A case report

Jun-Beom Park, DDS, MSD, PhD

Abstract

Rationale: The purpose of this report is to present a case of peri-implantitis with successful regeneration. The surface of the affected dental implant was decontaminated with an ultrasonic scaler and treated with bovine-derived hydroxyapatite and enamel matrix derivative.

Patient concerns: A 52-year-old male was referred for evaluation of a dental implant placed in the mandibular right second premolar area.

Diagnosis: The radiographic evaluation showed the loss of supporting bone around the dental implant. Bleeding upon probing and suppuration were observed, with the deepest probing depth at 6 mm.

Interventions: The area was firstly treated with a nonsurgical approach. After re-evaluation, a full-thickness flap was elevated. The area was well debrided using various instruments, including curettes and an ultrasonic scaler. The defect area was grafted with bovine-derived hydroxyapatite and enamel matrix derivative.

Outcomes: Histopathologic evaluation revealed chronic inflammation with fibrosis and calcification. The evaluation at 2 years and 3 months after surgery showed that the prosthesis was functioning well. Bleeding upon probing and suppuration was not noted, and reduction of probing depth was seen, with the deepest depth at 4 mm. The area showed maintenance of graft material with increased radiopacity around the dental implant.

Lessons: In conclusion, a case of peri-implantitis can be successfully treated with bovine-derived hydroxyapatite and enamel matrix derivative after surface decontamination with an ultrasonic scaler.

1. Introduction

Enamel matrix derivative is used for various purposes, including periodontal regeneration and root coverage.[1,2] Enamel matrix derivative is prepared from porcine enamel matrix and consists majorly of amelogenin and ameloblastin.[3] Application of enamel matrix derivative is regarded to produce better results when compared to open flap.[4] It was previously reported that the combination of enamel matrix and bone graft produced enhanced clinical outcomes.[5]

However, there are limited reports on the use of enamel matrix for the treatment of peri-implantitis, especially for regeneration of lost bone. The purpose of this report is to present a case of peri-implantitis with successful regeneration. The surface of the affected dental implant was decontaminated with an ultrasonic scaler and treated with bovine-derived hydroxyapatite and enamel matrix derivative.

1.1. Ethics, consent, and permissions

This study was reviewed and approved by the Institutional Review Board of Seoul St Mary’s Hospital, College of Medicine, Catholic University of Korea, Seoul, Republic of Korea (KC18ZESI0491) and consent was obtained from the participant.
2. Case presentation

A 52-year-old male was referred to Department of Periodontics for the evaluation of a dental implant placed in the mandibular right second premolar area. Bleeding upon probing and suppuration were observed at the peri-implant mucosa (Fig. 1A). The deepest probing depth was 6mm. Clinical implication of the evaluated dental implant was peri-implantitis. The radiographic evaluation showed the loss of supporting bone around the dental implant (Fig. 1B). The area was firstly treated with a nonsurgical approach. After re-evaluation, the area was considered for the surgical procedure (Fig. 1C).

The crown portion was removed before the surgery (Fig. 2A). Immediately before the surgical procedure, the patient rinsed for 2 minutes with a 0.12% chlorhexidine digluconate solution (Hexamedine, Bukwang, Seoul, Korea). Following an injection of 2% lidocaine with 1:100,000 epinephrine local anesthetic, a full-thickness flap was elevated (Fig. 2B). There was a circumferential defect around the dental implant (Fig. 1B). The area was well debrided using various instruments, including curettes and an ultrasonic scaler (Satelec, Acteon, Merignac, France). The defect area was grafted with bovine-derived hydroxyapatite (Endobon; Biomet 3i, Palm Beach Gardens, FL) and enamel matrix derivative (Emdogain; Straumann AG, Basel, Switzerland) (Fig. 2C–E). The biopsy was performed at the time of the surgery and was sent to the Department of Pathology for histopathologic analysis, which revealed chronic inflammation with fibrosis and calcification (Fig. 2G, H).

The implant was loaded after removal of the sutures. The evaluation at 2 years and 3 months after surgery showed that the prosthesis was functioning well (Fig. 3A). Bleeding upon probing and suppuration was not noted, and reduction of probing depth was seen, with the deepest depth at 4mm. The area showed maintenance of graft material with increased radiopacity around the dental implant (Fig. 3B). The participant is under the routine follow-up check.

3. Discussion

This report showed regeneration of destructed bone with bovine-derived hydroxyapatite and enamel matrix derivative after surface decontamination with an ultrasonic scaler.

Enamel matrix derivative is regarded to simulate the enamel proteins during cementogenesis, and application of enamel matrix derivative may produce acellular cementum formation, followed by periodontal regeneration. More recently, enamel matrix derivative, which was seeded on the titanium surface, was applied to stem cells. The use of enamel matrix derivative applied on titanium surfaces produced increased proliferation and osteogenic differentiation of stem cells and enhanced expression of angiogenic genes in endothelial cells.
Figure 2. Surgical procedures. (A) Preoperative occlusal view. (B) Occlusal view after elevation of a full thickness flap showing loss of supporting bone. (C) The defect area grafted with bovine-derived hydroxyapatite. (D) The clinical photograph after application of enamel matrix derivative. (E) Occlusal view after suture. (F) The radiograph of the dental implant after surgery. (G) Immunohistochemical staining of biopsy from peri-implant mucosa. Histopathologic evaluation revealed chronic inflammation with fibrosis and calcification (hematoxylin-eosin [HE] stain; original magnification ×50). (H) Magnified view of HE stain (original magnification ×100).
showed a gain of bony level, along with recovery of soft tissue margin.\textsuperscript{[16]}

Decontamination of dental implants can be performed with various instruments, including hand instruments, titanium rotary instruments, and ultrasonic scalers.\textsuperscript{[17,18]} This report applied an ultrasonic scaler with a metal tip.\textsuperscript{[17,19]} It was shown that application of the ultrasonic metal scaler resulted in reduction of surface roughness with efficient removal of bacteria.\textsuperscript{[20-21]}

In conclusion, a case of peri-implantitis can be successfully treated with bovine-derived hydroxyapatite and enamel matrix derivative after surface decontamination with an ultrasonic scaler.

**Author contributions**

JBP conceived of the study, participated in its design, analyzed the data, wrote the manuscript and approved the final manuscript.

**Conceptualization:** Jun-Beom Park.

**Data curation:** Jun-Beom Park.

**Formal analysis:** Jun-Beom Park.

**Funding acquisition:** Jun-Beom Park.

**Methodology:** Jun-Beom Park.

**Writing – original draft:** Jun-Beom Park.

**Writing – review & editing:** Jun-Beom Park.

**References**

\[1\] Cordaro L, di Torresanto VM, Torsello F. Split-mouth comparison of a coronally advanced flap with or without enamel matrix derivative for coverage of multiple gingival recession defects: 6- and 24-month follow-up. Int J Periodontics Restorative Dent 2012;32:e10–20.

\[2\] Miron RJ, Scolen A, Cochran DL, et al. Twenty years of enamel matrix derivative: the past, the present and the future. J Clin Periodontol 2016;43:668–83.

\[3\] Riksen EA, Landin MA, Reppe S, et al. Enamel matrix derivative promote primary human pulp cell differentiation and mineralization. Int J Mol Sci 2014;15:7731–49.

\[4\] DiGiovanni CW, Lin SS, Baumhauer JF, et al. Recombinant human platelet-derived growth factor-BB and beta-tricalcium phosphate (rPDGF-BB/beta-TCP): an alternative to autogenous bone graft. J Bone Joint Surg Am 2013;95:1184–92.

\[5\] Li W, Xiao L, Hu J. The use of enamel matrix derivative alone versus in combination with bone grafts to treat patients with periodontal intrabony defects: a meta-analysis. J Am Dent Assoc 2012;143: e46–56.

\[6\] Harrison JW, Roda RS. Intermediate cementum. Development, structure, composition, and potential functions. Oral Surg Oral Med Oral Pathol Oral Radiol Endod 1995;79:624–33.

\[7\] Gestrelius S, Andersson C, Lidstrom D, et al. In vitro studies on periodontal ligament cells and enamel matrix derivative. J Clin Periodontol 1997;24:685–92.

\[8\] Li G, Hu J, Chen H, et al. Enamel matrix derivative enhances the proliferation and osteogenic differentiation of human periodontal ligament stem cells on the titanium implant surface. Organogenesis 2017;13:103–13.

\[9\] Shi B, Andrukhow O, Ozdemit B, et al. Effect of enamel matrix derivative on the angiogenic behaviors of human umbilical vein endothelial cells on different titanium surfaces. Dent Mater J 2017;36:381–9.

\[10\] Valderrama P, Wilson TGJr. Detoxification of implant surfaces affected by peri-implant disease: an overview of surgical methods. Int J Dent 2013;2013:740680.

\[11\] Park JB. Treatment of peri-implantitis with deproteinised bovine bone and tetracycline: a case report. Gerodontology 2012;29:145–9.

\[12\] Hoffmann T, Al-Machot E, Meyle J, et al. Three-year results following regenerative periodontal surgery of advanced intrabony defects with enamel matrix derivative alone or combined with a synthetic bone graft. Clin Oral Investig 2016;20:357–64.

\[13\] Matarasso M, Iorio-Siciliano V, Blasi A, et al. Enamel matrix derivative and bone grafts for periodontal regeneration of intrabony defects. A systematic review and meta-analysis. Clin Oral Investig 2015;19:1381–93.
[14] Smeets R, Henningsen A, Jung O, et al. Definition, etiology, prevention and treatment of peri-implantitis—a review. Head Face Med 2014; 10:34.

[15] Kashefmehr A, Pourabbas R, Faramarzi M, et al. Effects of enamel matrix derivative on non-surgical management of peri-implant mucositis: a double-blind randomized clinical trial. Clin Oral Investig 2017;21: 2379–88.

[16] Froum SJ, Froum SH, Rosen PS. A regenerative approach to the successful treatment of peri-implantitis: a consecutive series of 170 implants in 100 patients with 2- to 10-year follow-up. Int J Periodontics Restorative Dent 2015;35:857–63.

[17] Isehed C, Svenson B, Lundberg P, et al. Surgical treatment of peri-implantitis using enamel matrix derivative, an RCT: 3- and 5-year follow-up. J Clin Periodontol 2018.

[18] Yang SM, Park JB, Ko Y. Use of confocal microscopy for quantification of plastic remnants on rough titanium after instrumentation and evaluation of efficacy of removal. Int J Oral Maxillofac Implants 2015;30:519–25.

[19] Mercado F, Hamlet S, Ivanovski S. Regenerative surgical therapy for peri-implantitis using deproteinized bovine bone mineral with 10% collagen, enamel matrix derivative and doxycycline - a prospective 3-year cohort study. Clin Oral Implants Res 2018;29:583–91.

[20] Park JB, Jang YJ, Koh M, et al. In vitro analysis of the efficacy of ultrasonic scalers and a toothbrush for removing bacteria from resorbable blast material titanium disks. J Periodontol 2013;84:1191–8.

[21] Park JB, Jang YJ, Choi BK, et al. Treatment with various ultrasonic scaler tips affects efficiency of brushing of SLA titanium discs. J Craniofac Surg 2013;24:e119–23.