NOTE ***Surgery***

Efficacy of Enamel Matrix Protein Applied to Spontaneous Periodontal Disease in Two Dogs

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ABSTRACT. Enamel matrix protein (EMP) was applied for regeneration of periodontal tissue in 2 dogs with spontaneous periodontal disease. Case 1 had bony resorption around the root and root apex of the maxillary fourth premolars. Case 2 had vertical resorption of bone between the mandibular first and second molars. A flap was formed in the buccal gingiva, and EMP was applied onto the surface of the exposed root. One or 4 months postoperatively, increased bone level and clinical attachment were recognized. EMP was therefore suggested to be effective to induce regeneration of periodontal tissues in the cases with periodontal disease.
KEY WORDS: canine, enamel matrix protein, periodontal disease.

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Periodontal disease is one of the most common diseases occurring in dogs [6]. In human periodontal disease, a new therapeutic technique to induce periodontal tissue regeneration using enamel matrix protein (EMP) has been developed recently [4]. EMP is known to have a common molecule structure in most mammals [2, 10]. Recently, EMP (=EMDOGAIN®: EMD, BIORA AB, Malmö, Sweden) extracted and refined from the tooth germ of the piglet has been applied for periodontal regeneration therapy in human dentistry [8].

There is, however, no clinical report of EMD application for spontaneous canine periodontal disease. This is the first report on the effectiveness of EMD in 2 dogs with periodontal diseases. The animals were treated at the Hokkaido University Veterinary Teaching Hospital.

Case 1 was a 7-year-old female Shetland sheepdog (21 kg) and was referred to the hospital with a history of serous nasal discharge for 3 weeks. Radiographically, the nasal cavity was normal, but bone resorption was observed around the root and root apex of the maxillary right and left fourth premolars (Fig. 1-a, b). Mobility of the right and left fourth premolars was not recognized. Four weeks after the first admission, root canal treatment was performed. The dentin of the root canal was fragile, and an infection was recognized at the buccal distal root canal of the maxillary left fourth premolar. The obvious abnormality was not recognized in the other roots. After 2 weeks, periodontal surgery was performed, and periodontal bone defects that approached the apex were recognized in the maxillary right and left buccal alveolar bone (Fig. 1-c,d). Further, the buccal cementum in the distal root of the maxillary left fourth premolar was absorbed, the dentin was exposed. The root of the buccal side was therefore covered with glass ionomer cement. The root apex was cut because of the radiographic bone defect and fragile root canal (Fig. 1-c).

Case 2 was a 10-year-old male beagle (17 kg). An oral examination was done because he could not chew hard food. The teeth had no mobility, but vertical resorption of bone was recognized between the mandibular right first and second molars. After 3 weeks, radiographic examination and periodontal surgery were done under inhalation anesthesia. The clinical attachment level on the distal aspect of the first molar was 7 mm, and bone resorption was observed radiographically around the distal root on the mandibular right first molar (Fig. 2-a). The radiographic bone level from the apex to the bottom of the distal defect was 3.5 mm (Table 1). A buccal, mucoperiosteal flap was formed in the right mandibula and vertical resorption of bone was recognized between the first and second molars (Fig. 2-b).

In cases 1 and 2, the area of the bone defect was debrided, and the root surface was exposed. Scaling and root planing were performed. The smear layer on the root surface was removed with neutrally buffered 24% ethylenediaminetetraacetic acid (EDTA) for 2 min. Immediately after the EDTA was thoroughly rinsed from the tooth with sterile physiological saline, EMD was applied onto the surface starting at the base of the bone defect. EMD was prepared 15 min before the application, and one vial (Enamel Matrix Derivative 30 mg, to be reconstituted with 1.0 m*l* of propylene glycol alginate solution) was used for one or two teeth. The flap was then returned to the original position, and sutured using a 4–0 nylon suture. Clindamycin (20 mg/kg, bid, po) was administered for 7 days postoperatively to prevent infection. They were fed a high-calorie supplement gel (Nutri-Cal®) only for 3 days postoperatively. The sutures were removed at 1 week postoperatively.

In case 1, the nasal discharge decreased gradually and disappeared at 1 week after operation. Radiographically, bone formation was observed around the root at 4 months postoperatively (Fig.1-e,f). It seems that regeneration of

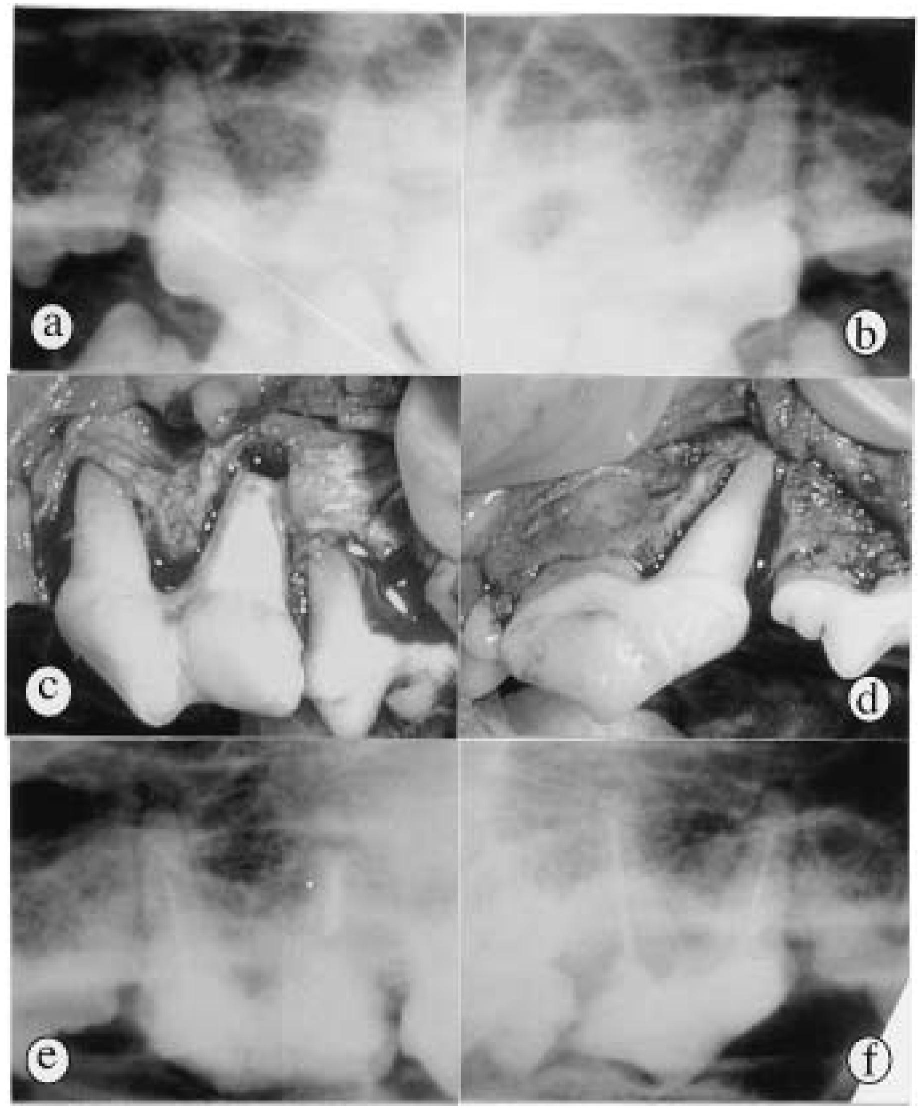

Fig. 1. Dental radiographs and the clinical findings in case 1. (a): Radiograph of the maxillary left fourth premolar at the first admission. (b): Radiograph of the maxillary right fourth premolar at the first admission. (c): The apicoectomy and covering with glass ionomer cement of the distal root in the maxillary left fourth premolar in operation. (d): Clinical findings of the bone resorption around the distal root on the maxillary right fourth premolar in operation. (e): Radiograph of the maxillary left fourth premolar at 4 months postoperatively. (f): Radiograph of the maxillary right fourth premolar at 4 months postoperatively.

bone and periodontal membrane was not found on the glass ionomer cement. But, elevation of the gingiva was observed.

In case 2, the dog could chew hard food at 2 weeks postoperatively. The bone defect of the mesial side in the distal root on the mandibular right first molar was completely cured (Fig. 2-c), but the gingival recession between the first and second molar remained at 1 month postoperatively (Fig. 2-d). The bone gain of the distal side was 91% of the initial bone loss (Fig. 2-e), and clinical attachment had increased by 5 mm at 8 months postoperatively (Table 1). The gingival recession was completely filled with interdental papilla at 8 months postoperatively (Fig. 2-f).

Canine periodontal diseases increase with aging and more than 80% of dogs are affected by 5 years of age [6]. In beagle dogs, gingivitis was occurred in younger (1–2 years old) animals and periodontitis was occurred in older (4–6 years old) animals [3]. Though the very high morbidity of canine periodontal disease is known, only scaling and extraction are performed in usual treatment. In these 2 cases, affected teeth would be extracted in routine clinical practice.

On the other hand, functional periodontal regeneration of

Table 1. Clinical attachment level and radiographic bone level in case 2

	Baseline	2 weeks	1 month	2 months	4 months	8 months
Clinical attachment level (mm)	7	6	4	4	4	2
Clinical attachment gain (mm)	–	1	3	3	3	5
Radiographic bone level (from root apex to bottom of defect) (mm)	3.5	4	5	6	8	8.5
Radiographic bone gain of initial bone loss (%)	–	9	27	45	82	91

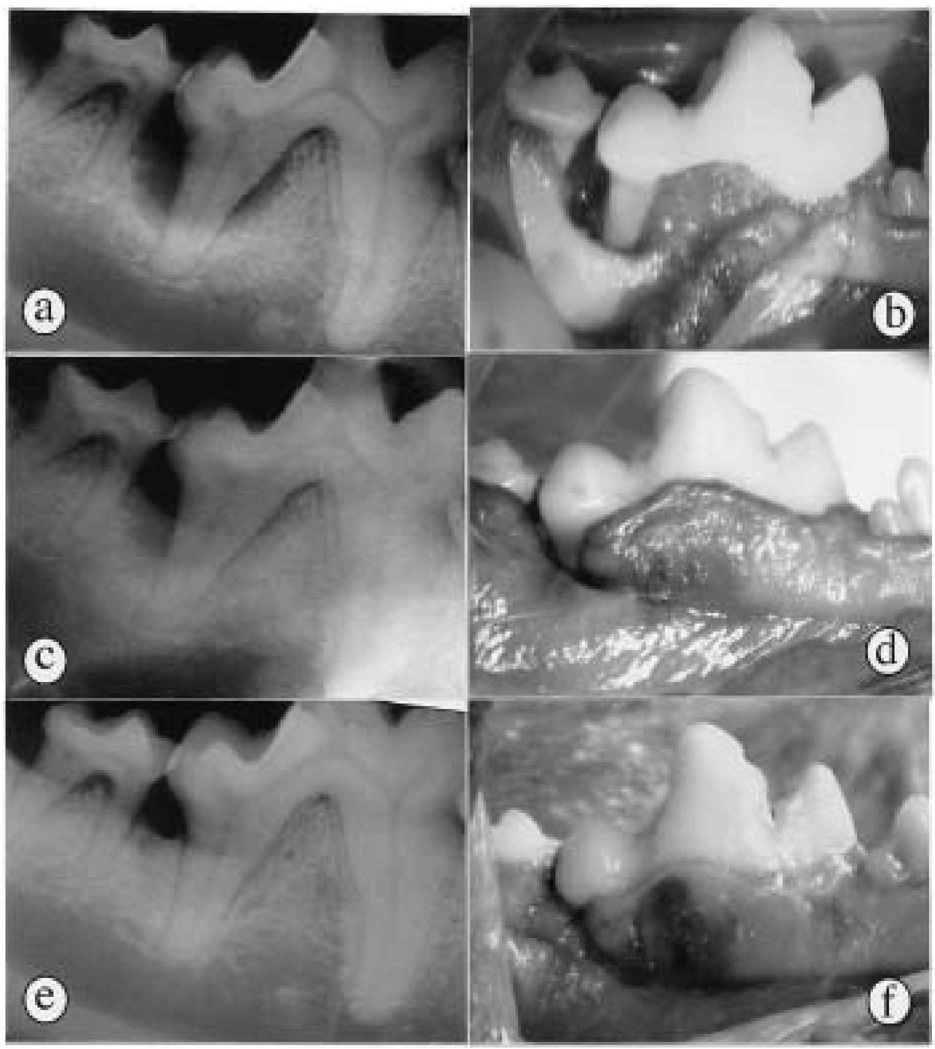

Fig. 2. Dental radiographs and the clinical findings in case 2. (a): Radiograph taken preoperatively. (b): Clinical view of a vertical resorption of bone in operation. (c): Radiograph at 1 month postoperatively. (d): Clinical view of the gingiva at 1 month postoperatively. (e): Radiograph at 8 months postoperatively. (f): Clinical view of the gingiva at 8 months postoperatively.

buccal dehiscence was induced by application of EMP in monkey models [5]. Additionally, clinical research in human dentistry obtained the same results [7].

In dogs, EMD was used for the treatment of dental furcation involvements created experimentally, and the regeneration of new acellular cementum was found [1]. We previously applied EMD to experimental apicoectomized lesion in dogs, and found that the regeneration of apical periodontal tissues (bone, collagen fibers, cementum) was significant, compared to the control group [9]. Clinical signs disappeared 1 or 2 weeks after EMD treatment in both patients. Radiographically, apparent bone gain in the root apex lesion was found especially in case 1. This findings suggest that EMD induced the regeneration of apical periodontal tissues [9]. In case 2, bone gain was observed earlier than that in a human case with the same degree of severity [8]. These results therefore suggest that EMP could be applied to more severe cases in dogs. Gingival elevation and increased attachment level also observed. EMP could be applied to gingival recession in dogs.

Appropriate surgical procedures and postoperative management were essential for the success of EMD treatment in dogs. Tooth mobility was not recognized in our patients. EMD treatment should not be applied to a tooth with mobility. If an infection is suspected in the root canal or apex, endodontic therapy should be performed before EMD application. Principally, the first protein that touches the root should be EMD, not blood or saliva. Therefore, gingival flaps were made, and judicious removal of all granulation tissue and through scaling and root planing were performed. After surgery, mechanical irritations on the treated tooth should be avoided. We fed a supplement gel to the dogs for 3 days, and performed scaling and root planing every one or two months for one year. Oral hygiene is also impotant during initial healing period.

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