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The use of enamel matrix derivative (Emdogain®) for improvement of probing attachment level of the autotransplanted teeth

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Abstract – The enamel matrix derivative (EMD, Emdogain®) was used for the purpose to obtain the periodontal regeneration on the denuded root-surfaces of the donor teeth in two cases of the immediate tooth-transplantation. The root-surfaces at the cervical portion of the teeth were denuded because of extrusion. The healthy periodontium of each tooth remained at the apical portion of the roots. The denuded root-surfaces were cleansed before extraction. Then, the donor teeth were gently extracted with forceps, administered EMD, and transplanted so that the denuded surfaces were covered by gingival flaps. After the transplantation, the mean probing attachment level (PAL) improved 3.2 mm and 1.5 mm, respectively. The mean probing pocket depth was within normal level. The actual supporting areas of the roots of the transplanted teeth increased and the teeth worked as the abutments of prosthetic bridges.

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Key words: tooth autotransplantaion; Emdogain; periodontal regeneration; probing attachment level

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The effect of the enamel matrix derivative (EMD, Emdogain®) to the periodontal regeneration after periodontal flap operation is clinically confirmed. According to the study by Kalpidis and Ruben, clinical attachment gain amounted to 3.2 ± 0.9 mm (33% of the original attachment level) and probing reduction averaged 4.0 ± 0.9 mm (50% of the baseline probing depth) for a total of 317 lesions with a mean baseline depth of 5.4 ± 0.8 mm. in intrabony periodontal defects (1). The operation should be performed carefully and gently because the vital periodontal cells in the neighboring area play an important role (2, 3).

In the animal experiments on the transplantation and replantation of the avulsed teeth, the EMD decreases the root resorption and induces the periodontal regeneration. In the experiment using dog's incisors, which are dried in room temperature for 15, 30, and 60 min and replanted with and without the application of EMD, the EMD group shows the higher incidence of healed periodontium and the lower incidence of ankylosis than those of the controls. However, the incidence of root resorption in both groups increases according to extension of drying time (4). In the experiment using rats, the EMD induces the periodontal regeneration after transplantation of the teeth dried in room temperature for 30 min, although the degenerated tissues remain on root-surface in portion (5). The effect of the EMD is not recognized, when the replanted teeth are dried for an hour and the periodontium is removed mechanically in the experiment using monkeys (6). In the clinical cases, the progressive root resorption partly occurred in the replanted avulsed teeth despite the administration of EMD. It is likely that the EMD does not work sufficiently in the severely compromised situation where the vital periodontal cells hardly

remain in the degenerated periodontal tissue (7). Obviously, the EMD decreases root resorption and induces periodontal regeneration of the avulsed teeth, although the effect is influenced by the condition of the root-surface and the extent of damage. The appropriate procedure of the EMD-administration, which brings satisfactory clinical course in transplantation and replantation of teeth, is not established yet.

The acquisition of periodontal regeneration on the damaged root-surface is absolutely important to expand the indication of tooth-transplantation. This article reports that two cases of transplantation of the teeth, in which the donor teeth with the partially damaged periodontium because of denudation of root-surface were transplanted with EMD and were satisfactorily used as the abutment of prosthetic bridge.

The procedure for transplantation

The preparation of the denuded root-surface and the tooth-transplantation in both cases were performed as following procedure (2, 8).

1. Cleansing of the denuded root-surface with manual and ultrasonic scalers. Washing with physiological saline before extraction.
2. Extraction of the donor tooth gently with forceps. Measurement of the length and width of the root.
3. Preparation of the recipient socket with an electric engine and round bars, cooling with physiological saline.
4. Administration of EMD on the whole root-surface.
5. Placement of the donor tooth in the recipient socket. Veiling the denuded root-surface fully by gingival flap. Registration of the new positions of each root aspects.
6. Suturing of the wound tightly for the healing by primary intention.
7. Keeping the transplanted tooth in rest without occlusal contact.
8. Root canals treatment with calcium dihydroxide 3 weeks after transplantation.
9. Short-term splinting with wire and resin for a month.
10. Instruction on the self-care for chewing and oral hygiene to the patients.

The periodontal regeneration was examined with the measurement of the probing pocket depth (PPD) and the probing attachment level (PAL). The PPD and the PAL were measured with a pocket probe at six points around the root [bucco-mesial, bucco-central, bucco-distal, lingo-mesial (palato-mesial), lingo-central (palato-central), and lingo-distal (palato-distal) aspect] before and after transplantation. Approximately a year after transplantation, the preparation for prosthetic bridge was performed and the PAL was unable to be measured because of the loss of the anatomical enamel–cement junction.

The patients were well informed on the use of EMD in transplantation of tooth. The ethical committee of Yamagata University, School of Medicine and Niigata University, School of Dentistry, recognized the use of EMD in tooth-transplantation.

Clinical cases

Case 1

The right maxillary second molar of a 60-year-old man was transplanted to the right mandibular first molar region. The donor tooth was extruded because of missing of the antagonistic teeth (Fig. 1a). The mean PPD was 2.2 mm and the mean PAL was 6 mm before transplantation (Table 1). The recipient site had the healthy bone and gingiva (Fig. 1b). The cervical one-third of the root of the extracted tooth was exposed (Fig. 1c). The donor tooth was rotated approximately 90 degrees and placed so that the buccal surface was turned to mesial direction (Fig. 1d). Four months after transplantation, the mean PPD was 2.7 mm and the mean PAL was 4.8 mm (Fig. 1e). There was no sign of progressive periodontitis by maintaining therapy and self-control although the tooth had the narrow pocket of 6 mm in depth localized at the lingo-central aspect. Eleven months after transplantation, the mean PPD was 2 mm and the mean PAL was 2.8 mm (Table 1). The tooth was used as the abutment of prosthetic bridge 12 months after transplantation. Two years and 2 months after transplantation, the mean PPD was 2.5 mm and the tooth showed physiological mobility without abnormal percussion sound and pain. The patient was satisfied with the clinical course (Fig. 1f).

Case 2

The left maxillary wisdom tooth of a 51-year-old woman was transplanted to the left mandibular second molar region. The donor tooth was extruded because of missing of the antagonistic teeth (Fig. 2a). The mean PPD was 2 mm and the mean PAL was 4 mm before transplantation (Table 2). There was no abnormal finding in the recipient site (Fig. 2b). The cervical one-third of the root of the extracted tooth was exposed (Fig. 2c). The donor tooth was rotated approximately 90 degrees and placed so that the buccal surface was turned to mesial direction. The defect of bucco-distal aspect was restored with glass-ionomer cement (Fig. 2d). The root canal of

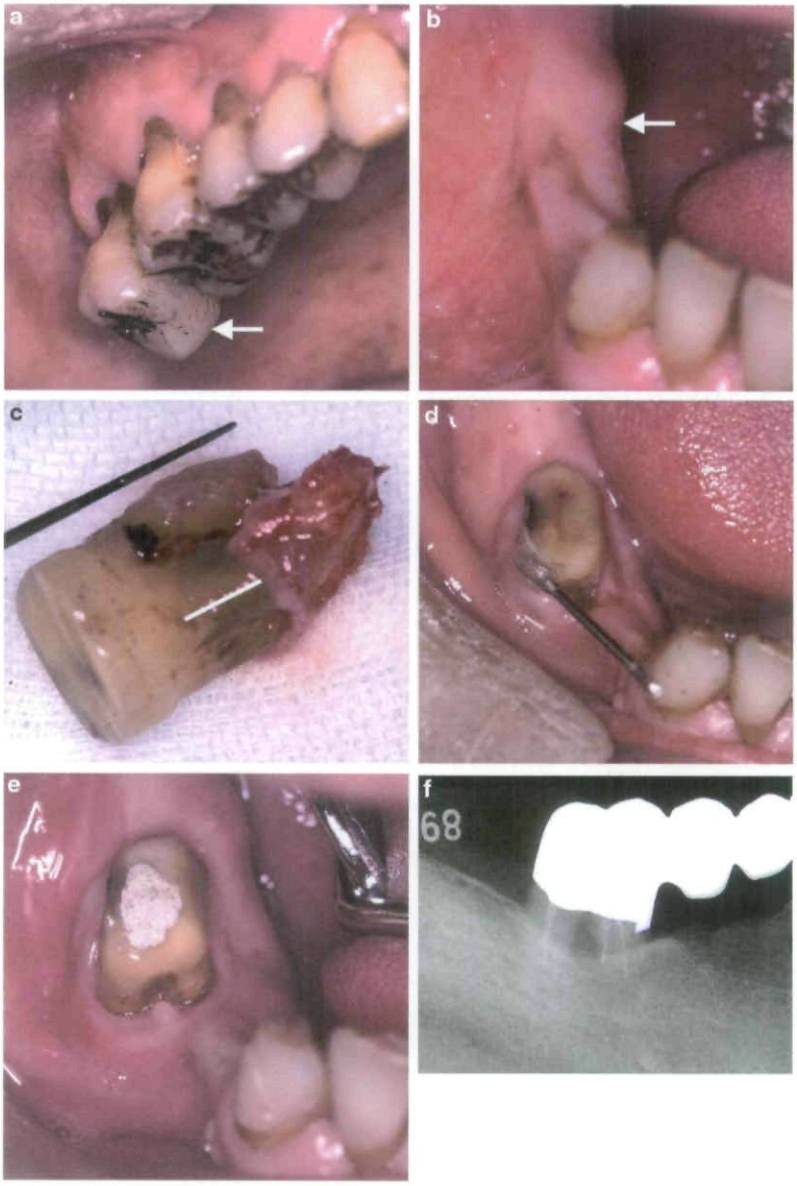

Fig. 1. Case 1. A 60-year-old male. (a) The extruded donor tooth, the right maxillary second molar (arrow). (b) The healthy recipient site, the right mandibular first molar region (arrow). (c) The photograph of the distal aspect of the donor tooth showing the denuded root-surface (bar). (d) The photograph of 3 weeks after transplantation showing that the gingiva covers the whole root of the donor tooth. (e) The photograph of 4 months after transplantation showing the good healing of wound. (f) The X-ray photograph of 2 years and 2 months after transplantation showing the sufficient level of alveolar bone and gingiva and no sighs of progressive root resorption and periodontitis.

the mesial root was not filled to the apex because of root-obliteration. Two months after transplantation, the mean PPD was 2.2 mm and the mean PAL was 2.8 mm (Fig. 2e). Ten months after transplantation, the mean PPD was 2 mm and the mean PAL was 2.5 mm (Table 2). The tooth was used as the abutment of prosthetic bridge 11 months after transplantation. Two years and 6 months after transplantation, the mean PPD was 2.3 mm and the tooth showed physiological mobility without abnormal percussion sound and pain. The patient was satisfied with the clinical course (Fig. 2f).

Discussion

In periodontal flap operations, the EMD is used for the purpose to reduce PPD and to improve PAL. The affected root-surface can be seen after elevation of the muco-gingival flap. The necrotic debris on the affected root-surface is removed mechanically and chemically. The operations should be performed carefully and gently to keep the periodontal cells in the neighboring area vital (1–3).

In replantation and transplantation of teeth, the EMD is expected to prevent the root-resorption at

Table 1. Probing pocket depth (PPD) and the probing attachment level (PAL) before and after transplantation in case 1 (mm)

Before transplantation			After transplantation	11 months		2 years 2 months
Tooth aspects	PPD	PAL	Tooth aspects	PPD	PAL	PPD
bc	2	8	bm	1	2	2
bm	2	6	bc	1	2	2
lm	2	7	bd	1	2	2
bd	2	5	lm	1	2	2
ld	2	4	lc	6	7	5
lc	3	6	ld	2	2	2
Average	2.2	6		2	2.8	2.5

bm, bucco-mesial; bc, bucco-central; bd, bucco-distal; lm, lingo-mesial or palato-mesial in maxilla; lc, lingo-central or palato-central in maxilla; ld, lingo-distal or palato-distal in maxilla.

Table 2. Probing pocket depth (PPD) and the probing attachment level (PAL) before and after transplantation in case 2 (mm)

Before transplantation			After transplantation	11 months		2 years 2 months
Tooth aspects	PPD	PAL	Tooth aspects	PPD	PAL	PPD
bm	2	4	bm	1	1	2
lm	2	4	bc	2	3	1
lc	2	4	bd	2	3	3
bc	2	4	lm	2	2	1
bd	2	4	lc	2	3	4
ld	2	4	ld	2	3	3
Average	2	4		2	2.5	2.3

bm, bucco-mesial; bc, bucco-central; bd, bucco-distal; lm, lingo-mesial or palato-mesial in maxilla; lc, lingo-central or palato-central in maxilla; ld, lingo-distal or palato-distal in maxilla.

the damaged root-surface. However, there are few clinical reports in which the EMD successfully induces periodontal regeneration (9). The root resorption is not prevented in the severely compromised situation (7). It is likely that the necrotic tissue on the root-surface, which is hardly distinguished from the vital tissue, disturb the effect of EMD (5).

In the present cases, the purpose for the use of EMD was to obtain the new periodontal attachment

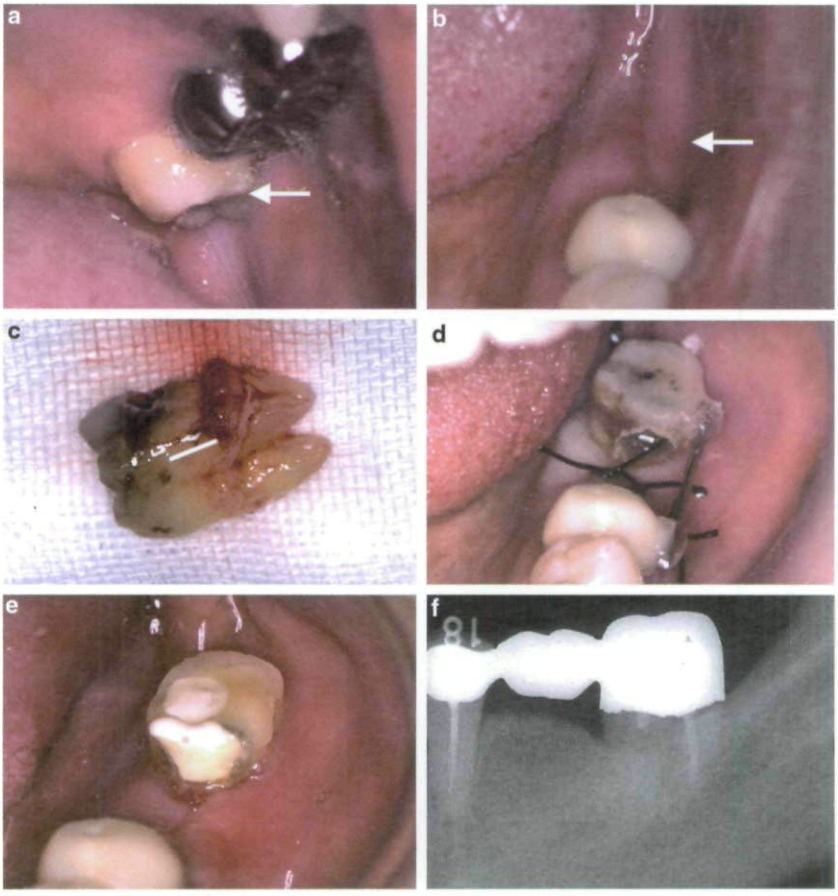

Fig. 2. Case 2. A 51-year-old female. (a) The extruded donor tooth, the left maxillary wisdom tooth of (arrow). (b) The healthy recipient site, the left mandibular second molar region (arrow). (c) The photograph of the distal aspect of the donor tooth showing the denuded root-surface (bar). (d) The photograph of the day of operation showing the gingiva covers the whole root of the donor tooth. (e) The photograph of 2 months after transplantation showing the good healing of wound. (f) The X-ray photograph of 2 years and 6 months after transplantation showing the sufficient level of alveolar bone and gingiva and no sighs of periodontitis. The apical periodontal space is vague and the root canal is not filled to apex because of root-obliteration.

on the denuded surfaces at the cervical portions of the transplanted teeth. After removal of necrotic debris and administration of EMD, the donor teeth were transplanted deeply in the recipient sockets and the denuded root-surfaces were fully covered by gingival flap. The PAL of the transplanted teeth was improved. It was likely that the EMD was effective in tooth-transplantation when it was administered on the cleansed root-surface with the vital periodontal cells supplied from neighboring healthy periodontium.

References

1. Kalpidis CD, Ruben MP. Treatment of intrabony periodontal defects with enamel matrix derivative: a literature review. J Periodontol 2002;73:1360–76.
2. Heijl L. Periodontal regenerative potential using enamel matrix proteins (Emdogain®). Tandlakartidningen 1998;90: 53–62.
3. Bratthall G, Lindberg P, Havemose-Poulsen A, Holmstrup P, Bay L, Soderholm G, et al. Comparison of ready-to-use Emdogain-gel and Emdogain® in patients with chronic adult periodontitis. J Clin Peridontol 2001;28:923–9.
4. Iqbal MK, Bamaas N. Effect of enamel matrix derivative (Emdogain®) upon periodontal healing after replantation of permanent incisors in Beagle dogs. Dent Traumatol 2001;17:36–45.
5. Hamamoto Y, Kawasaki N, Jarnbring F, Hammarstrom L. Effects and distribution of the enamel matrix derivative (Emdogain®) in the periodontal tissues of rat molars transplanted to the abdominal wall. Dent Traumatol 2002; 18:12–23.
6. Lam K, Sae-Lim V. The effect of Emdogain® gel on periodontal healing in replanted monkeys' teeth. Oral Surg Oral Med Oral Pathol 2004;97:100–7.
7. Schjott M, Andreasen JO. Emdogain does not prevent progressive root resorption after replantation of avulsed teeth: a clinical study. Dent Traumatol 2005;21:46–50.
8. Tsukiboshi M. Autotransplantation of teeth: requirements for predictable success. Dent Traumatol 2002;18:157–80.
9. Caglar E, Tanbora I, Susal S. Treatment of avulsed teeth with Emdogain – a case report. Dent Traumatol 2005; 21:51–53.