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BASIC RESEARCH

EMD-liquid as adjunct to natural bovine bone grafting at buccal bone dehiscence defects at implant sites: an experimental study in beagle dogs

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Abstract

Objectives: To evaluate the effect of enamel matrix derivative in liquid form (EMD-liquid) as adjunct to grafting with natural bovine bone (NBB), on new bone formation and osseointegration in buccal dehiscence defects at dental implants.
Material and Methods: In six beagles, 3 months after extraction of the mandibular premolars and first molars. 3 titanium implants (3.3 Ø × 8.0mm) were inserted and dehiscence-type defects (mesiodistal width 3mm × 5mm depth) were created on their buccal aspect. The defects were randomly assigned to one of the following 3 treatment groups: Group 1: NBB, Group 2: NBB+EMD-liquid, Group 3: Control. All sites were covered with a collagen membrane. Histomorphometric measurements were performed after 3 months of healing.
Results: New bone area, bone-to-implant contact (BIC), and first BIC (fBIC) in the NBB and NBB/EMD-liquid groups were significantly greater than in the control group ($P < 0.05$). Further, f-BIC was at a significantly more coronal position in the NBB/EMD-liquid group (0.4±0.1 mm) compared with the NBB group (1.2±0.2 mm).
Conclusions: NBB grafting enhances bone regeneration and osseointegration at implants with buccal bone dehiscence compared with no grafting, and adjunct use of EMD-liquid appears to further enhance bone formation and osseointegration.

Background and Aim

Enamel matrix derivative (EMD) is primarily used to promote periodontal regeneration[1]. However, most of studies[2.3] concluded EMD-gel failed to promote bone formation. Recently, EMD-liquid mixed with bone grafts may stimulate bone regeneration.

Natural bovine bone (NBB) is relatively new bone graft and effect of NBB combined with EMD liquid remains unclear.

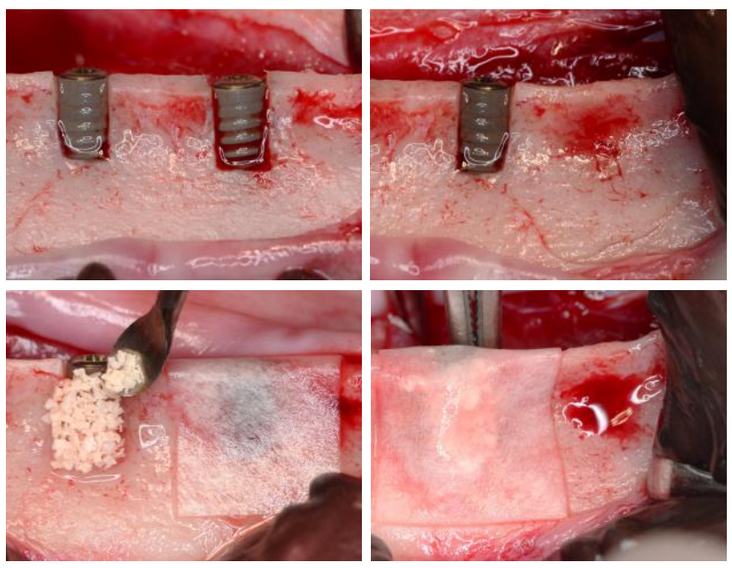
The present study aimed to evaluate osseointegration and bone formation after application of NBB combined with EMD-liquid in buccal bone defects at dental implants.

All animal experimental procedures were approved by the Institutional Animal Care and Use Committee of Tokyo Medical and Dental University (0160370A), and follows the ARRIVE checklist for all relevant items[4] .

Methods and Materials

Clinical procedures

- Six beagle dogs
- Both sites of the mandible
- 3 implants with 3 mm × 5 mm buccal bone defect.
- Treatment randomly;
  1) NBB group : grafting of NBB
  2) NBB/EMD-L group :grafting of NBB with EMD-liquid
  3) Control group :no grafting
- Collagen membrane covering the defect.

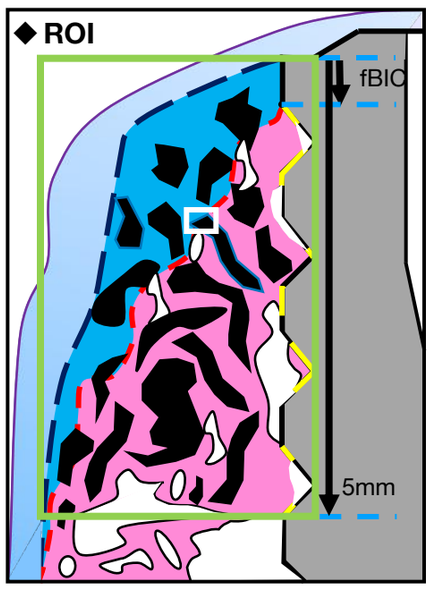


- Titanium Implant (Ø 3.3 mmx L 8.0 mm, Straumann Bone Level; Straumann)
- NBB (Cerabone®; Bottis Dental, Berlin, Germany)
- Collagen membrane (Collprotect®; Botiss Dental, Berlin, Germany)
- EMD-liquid(Osteogein®; Strauman AG, Basel, Switzerland)

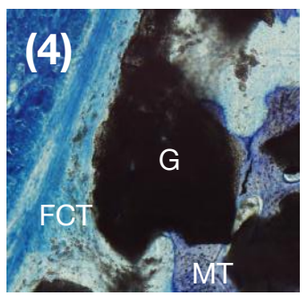
Histological and histomorphometric analysis

- A rectangular region of interest (ROI) =Previously buccal exposed implant threads (5 mm apically from the implant shoulder)
- Histomorphometrically measurements

(1) bone–implant contact (BIC; in %)
(2) first bone–implant contact (fBIC; in mm)
(3) augmented area (AA; mm²)
(4) the proportions of various components;



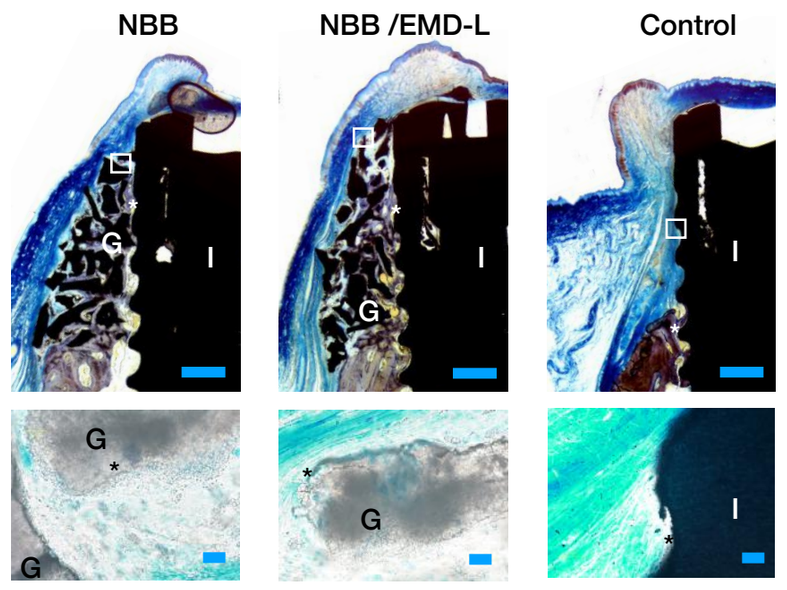
- Mineralized tissues (MT; %)
- Fibro-vascular connective tissues (FCT; %)
- Residual bone graft (G; %)



Statistical analysis

Descriptive statistics were calculated and the differences among groups were examined using the Friedman test ($P < 0.05$). Bonferroni correction for multiple tests was used to assess any significant differences among treatment modalities in a post-hoc analysis.

Photomicrograph of a buccal-lingual section (Toluidine blue and Safranin)



Histomorphometric measurements

	NBB	NBB/EMD-L	control
AA (mm²)	6.9 ± 2.3*	8.0 ± 1.5*	2.6 ± 1.4
MT (%)	32.8 ± 15.6	25.3 ± 14.0	26.5 ± 20.1
FCT (%)	36.2 ± 8.9	34.4 ± 9.3	73.4 ± 20.1**
G (%)	29.9 ± 16.3	35.3 ± 13.9	
BIC (%)	52.8 ± 11.7*	57.4 ± 7.1*	20.5 ± 5.6
fBIC (mm)	1.2 ± 0.2	0.4 ± 0.1****	2.0 ± 0.1***

Mean ± Standard Deviation were analyzed for statistical significance by Friedman test and the Bonferroni correction for multiple tests as a post hoc analysis.
* Significantly different from the control group ($P < 0.05$).
** Significantly different from the NBB/EMD-L groups ($P < 0.05$).
*** Significantly different from the NBB and NBB /EMD-L groups ($P < 0.05$).
**** Significantly different between NBB and NBB/EMD-L group ($P < 0.05$)

Conclusion

NBB grafting enhances bone regeneration and osseointegration at implants with buccal bone dehiscence compared with no grafting.

EMD-liquid as an adjunct appears to further enhance bone formation and implant osseointegration.

References

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