

1

rhBMP - 2/ACS가

. . .

I. Melcher가

14)

가

가

1-5)

6-9)

10-12)

가

가

15,16)

17)

4).

가

가

가

가

13).

1976

11,12),
 Lynch platelet derived growth factor (PDGF) insulin like growth factor (IGF)
 23,24),
 11), Becker
 PDGF
 가 가 가 가 ,
 가
 10), Joyce transforming growth factor - (TGF -)가 가 BMP 28-
 가 31),
 18), absorbable collagen sponge (ACS)
 bone morphogenetic protein (BMP) Urist가 32). Nevins BMP collagen collagen 33),
 19),
 20,21), Sigurdsson ACS rhBMP - 2
 BMP (BMP - 2 BMP - 9) TGF - super family , Wang 34), Boyne 12 rhBMP - 2 ACS
 30kDa , BMP - 1
 BMP - 9 22). Wozney 23), , rhBMP - 2/ACS
 BMP
 20 BMP가 35),
 BMP
 가 , recombi -
 nant human BMP (rhBMP) native BMP 24) 1
 25 - 27), rhBMP - 2 8 rhBMP - 2/ACS
 BMP rhBMP - 2 가 가

II.

(2) sodium pentobarbital(Entobar
30mg/kg)

1. 2% Lidocaine HCl
1, 2

(1) . 24 ,
1 20kg , 3
4 , 4mm, 가
, 4mm 1 ()
1).
3 1/4 round bur notch
가 (2),
Gore - Tex## . 1
(2) , 2
rhBMP - 2* (0.20mg/ml), ### , 0.12% Chlorhexidine† 8
buffer** (5mM sodium glutamate, 2.5%
glycine, 0.5% sucrose, 0.01% Tween 80,
pH 4.5), absorbable collagen
sponge*** (ACS, Helistat , 1" x 2" sterile
sponge) (3)
10% formalin
nitric acid 1 ,
paraffin , 3μm , 60μm
block
2. 3 Hematoxyline - eosin
(1) 4 x 4mm(,) 1 , PC - based
buffer/ACS image analysis system† †
, rhBMP - 2/ACS
1)
2)

*rhBMP - 2, Genetics Institute, Inc, Cambridge, MA., USA.

MFR 00906 buffer, Genetics Institute, Inc, Cambridge, MA., USA.

***Helistat , Integra Life Science, USA.

#Entobar , Hanlim Pharm. Co., Seoul, Korea

##Gore - Tex Suture, W.L. Gore & Associates, Inc., Flagstaff, AZ., USA.

Ampicillin, Jong - geun Dang Pharmaceutical Company, Seoul, Korea

†Hexamedin , Chlorhexidine - digluconate 0.1%, 250ml, , Seoul, Korea

††Image - Pro Plus, Media Cybernetics, Silver Spring, MD., USA.

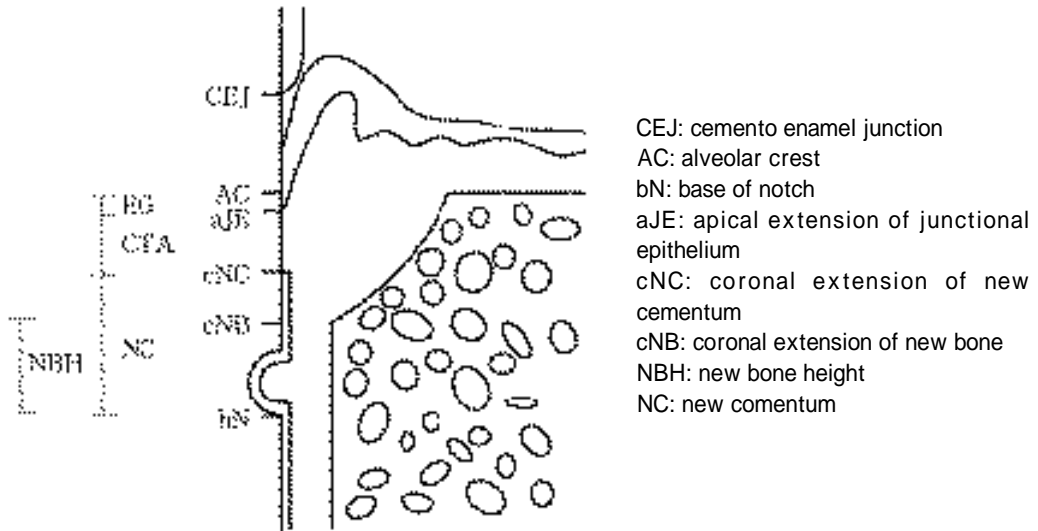


Figure 1. A schematic diagram depicting the landmarks and the parameters used in histomorpho -

3) 가 .
 4) (, ,) (5)
 5)
 6) Wilcoxon signed rank test
 7) ACS , .
 (4) (AC) , reference notch(N) III.
 ence notch refer - (DH) 1.
 (EG) , (1)
 (CTA) , reference notch 가 ,
 (NC) , reference notch (3, 4).
 (NBH) , (6).
 (NBA) , (NBD)
 (Figure 1). 4mm , (

3).

(5).
ACS

(2)

7, 8, 9).

가 (

Table 1. Histomorphometric analysis

	Control	Experimental	P value
	Median(Range) Mean(SD)	Median(Range) Mean(SD)	
DH(mm)	4.1(0.8) 4.2(±0.3)	4.0(0.6) 4.1(±0.2)	0.4609
EM(mm)	0.3(4.6) 0.9(±1.5)	1.2(4.1) 1.2(±1.4)	0.4609
CTA(mm)	2.8(3.9) 2.4(±1.3)	1.0(3.1) 1.2(±1.1)*	0.0391
NC(mm)	0.8(3.1) 0.9(±1.0)	1.8(2.4) 1.7(±0.8)*	0.0234
NBH(mm)	1.8(1.9) 1.9(±0.6)	2.1(2.5) 2.4(±0.9)	0.0781
NBA(mm ²)	4.6(5.5) 4.7(±1.7)	7.6(6.5) 8.0(±2.0)*	0.0078
NBD(%)	71.0(44.0) 73.0(±8.6)	63.0(22.0) 66.6(±15.3)	0.2656

* : Statistically significant difference compared to control group, P<0.05

DH: defect height, EM: epithelial migration, CTA: connective tissue adhesion, NC: new cementum, NBH: new bone height, NBA: new bone area, NBD:

Table 2. Proportion of teeth with root resorption and ankylosis

	Control	Experimental
Resorption	3/8	2/8
Ankylosis	0/8	1/8

10).

가
(
7, 11, 12).

9).

10). ACS

2.

(1)

(AC - aJE)

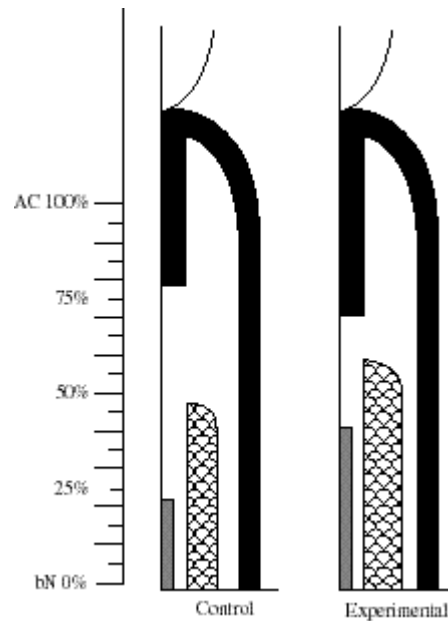


Figure 2. A schematic diagram depicting histomorphometric analysis of control and experimental groups

1.5mm(21.4%),
 1.2 ± 1.4mm(29.3%)

0.9 ±

(Table 1).

(2) (aJE - cNC)

1.3mm(57.2%),
 1.2 ± 1.1mm(29.3%)

2.4 ±

가

가

1-5)

6-9)

(P<0.05)(Table 1).

10-12)

(3) (cNC - bN)

1.0mm(21.4%),
 1.7 ± 0.8mm(41.4%)

0.9 ±

가

(P<0.05)(Table 1).

(4) (cNB - bN)

0.6mm(45.2%),
 2.4 ± 0.9mm(58.5%)

1.9 ±

36).

가

가

(Table 1).

4).

가

(5) (NBA)

8.0 ± 2.0mm²
 4.7 ± 1.7mm²,

(P<0.05)(Table

13).

가

1).

(6) (NBD)

66.6 ± 15.3%
 73.0 ± 8.6%,

(Table

가

1).

16),

가

IV.

37).
 17).
 38,39). 1962
 Cohen epidermal growth factor(EGF)가 platelet derived growth factor(PDGF), endothelial growth factor(EGGF), nerve growth factor(NGF), transforming growth factor(TGF), insulin like growth factor(IGF), fibroblast growth factor(FGF) bone morphogenetic protein(BMP) 가 , PDGF, FGF, TGF - , IGF BMP가
 12).
 Rutherford PDGF dex - ametasone
 40), Lynch PDGF IGF
 11),
 Joyce transforming growth factor - (TGF -)가 가
 18). BMP 1965 Urist가
 19) BMP 가
 20,25,27,30,34,41,42). BMP 30 - 38kDa
 BMP - 2 BMP - 9 TGF - super

family
 43). 1988 Wang
 BMP - 1 BMP - 9 22),
 Wozney BMP(recombinant BMP, BMP - 1, BMP - 2, BMP - 4)
 23). BMP
 BMP recombinant human BMP - 2(rh BMP - 2)
 44), 25), 45)
 Ishikawa 3
 46), Sigurdsson rhBMP - 2
 25). Ripamonti 2 native BMP
 47). 가
 가
 BMP , , 가 BMP 28 - 31).
 BMP 가
 48), 31), hydroxya -

apatite²⁹⁾, biphasic calcium phosphate²⁸⁾, Wikesj ²⁶⁾,
 poly(D,L - lactide - co - glycolide)(PLGA)³¹⁾, Sigurdsson ³¹⁾ 1
 poly(lactic acid granules³¹⁾ .
 Ripamonti porous hydroxy 51)
 apatite native BMP ,
²⁹⁾, Ishigawa 가
 poly(lactic acid - polyglycol acid copolymer

가 BMP
⁴⁶⁾.

sponge(ACS) absorbable collagen Wikesj ²⁶⁾ 0.0mm, Sigurdsson
 type I 25) 0.8mm
 가
³¹⁾. 1
 ACS 52)
 0.62mm 가
³²⁾. Nevins ACS
 BMP

collagen col -
 lagen 4.7mm²,
³³⁾. 8.0mm²
 rhBMP - 2/ACS 가
 Howell ⁴⁹⁾, Boyne 가
³⁵⁾ , rhBMP - 가
 2/ACS가 가
 rhBMP - 2 anti - human colla - Wikesj ²⁶⁾
 gen 9.4mm², Sigurdsson ²⁵⁾ 8.4mm²
 anti - bovine collagen 가
 가
 1 rhBMP - ⁵³⁾,
 2/ACS 2.4mm 73.0%, 66.6% .

, Sigurdsson ²⁵⁾
 ACS 45%
 , Wikesj ²⁶⁾ 3.6mm, DBM(demineralized
 Sigurdsson ³¹⁾ 5.1mm, 3 bone matrix), PLGA
 Ishikawa ⁴⁶⁾ 4.5mm , Bio - Oss Drilac(poly lactic acid)
 , Kinoshita ⁵⁰⁾ 0.68mm

23% 30%

Ripamonti ⁴⁷⁾ Kuboki ⁵⁷⁾

가

BMP

8

, Rutherford BMP -
BMP가

7

가 , BMP가
가

rhBMP - 2
³⁴⁾

⁵⁸⁾ MacNeil BMP

⁵⁴⁾, 1

0.9mm,

1.7mm

가

. BMP - 2
BMP - 2

Sigurdsson rhBMP - 2

⁵⁹⁾.

가

⁴⁵⁾.

가

osteo -
calcin, bone sialoprotein, PTH/PTHrP
receptors

Giannobile ⁴¹⁾, Ishikawa ⁴⁶⁾

가

²⁵⁾,

^{55,56)}.

41.4% Wikesj ²⁶⁾

. , King
rhBMP - 2

8%

Sigurdsson

10

38

²⁵⁾

expanded polytetrafluo -
roethylene(e - PTFE)

40%, rhBMP - 2

40%

⁴⁵⁾.

³⁴⁾

⁶⁰⁾.

rhBMP - 2

BMP

가

, BMP가

²³⁾.

¹⁷⁾.

BMP

(0.20mg/ml)

,

(0.05mg/ml)

가

²⁶⁾.

가

rhBMP - 2

0.20mg/ml

1.3mm,

1.2 ± 1.1mm

Wikesj ²⁶⁾

(P<0.05).

3.

0.9 ±

0.05mg/ml, 0.10mg/ml, 0.20mg/ml

1.0mm,

1.7 ± 0.8mm

BMP

(P<0.05).

phylogenetic tree

4.

1.9

가

± 0.6mm,

2.4 ± 0.9mm

61).

가

rhBMP - 2

5.

4.7 ±

1

1.7mm²,

8.0 ± 2.0mm²

(P<0.05).

가

6.

73.0 ±

가

8.6%,

66.6 ± 15.3%

가

가

1

V.

rhBMP - 2/ACS

1

, rhBMP - 2/ACS

가

가

VI.

, 4mm

3

4mm

1

buffer/ACS

, rhBMP - 2/ACS

8

1.

0.9 ± 1.5mm,

1.2 ± 1.4mm

2.

2.4 ±

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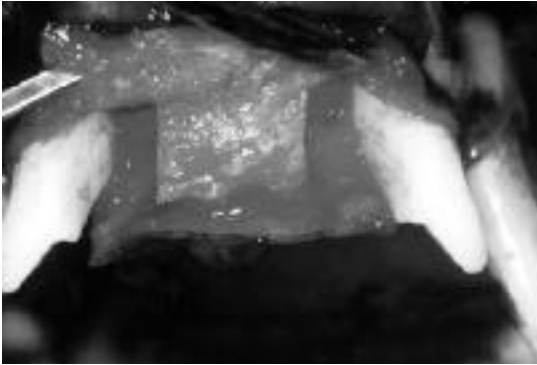
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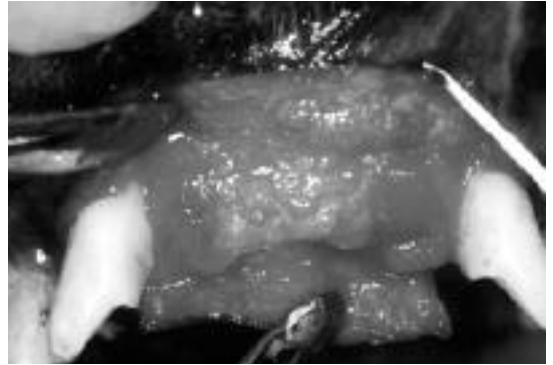
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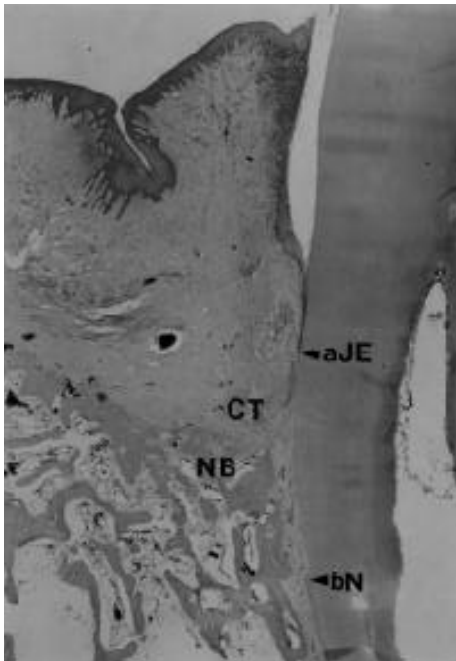
(I)



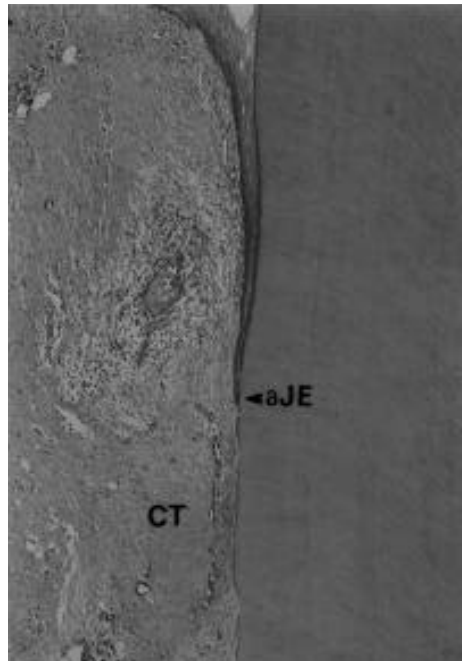
1.



2. rhBMP - 2/ACS

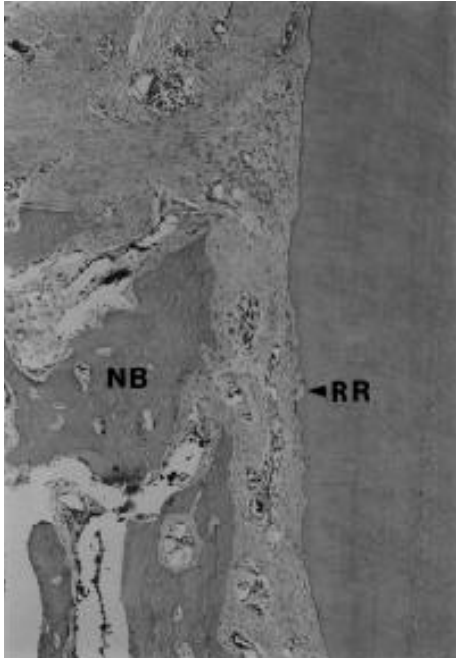


3. (H - E x 10)

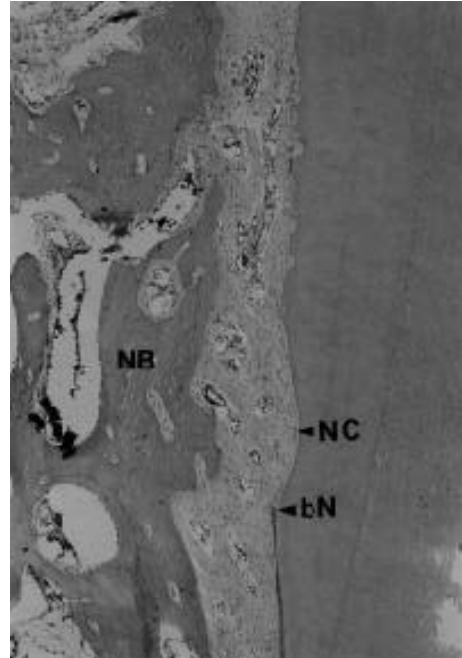


4. (H - E x 40)

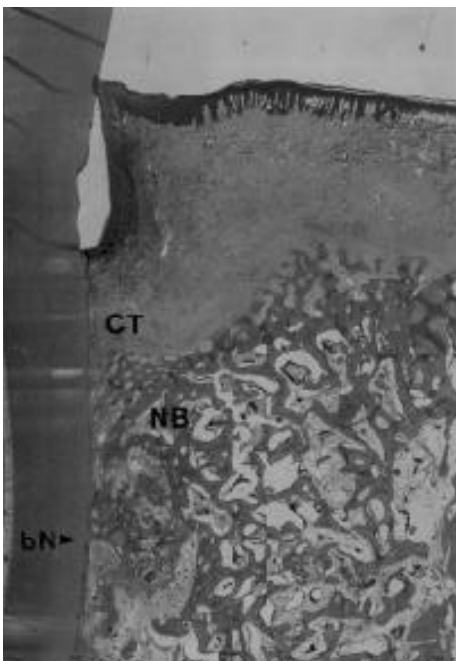
(II)



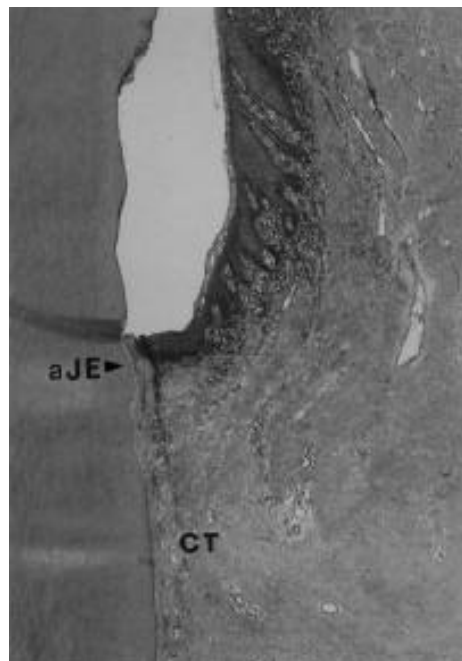
5. (H - E x 40)



6. (H - E x 40)

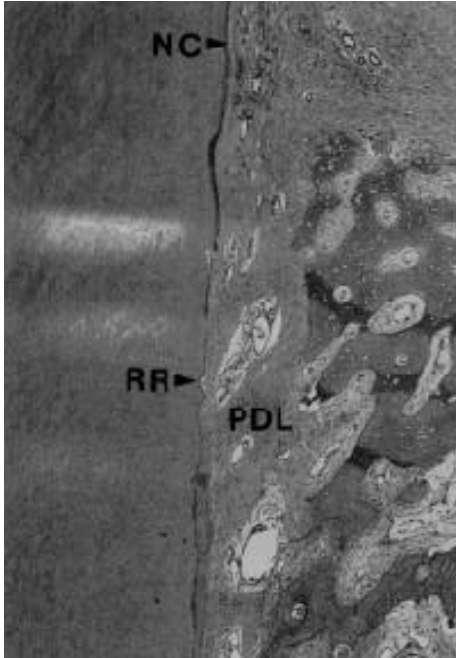


7. (H - E x 10)

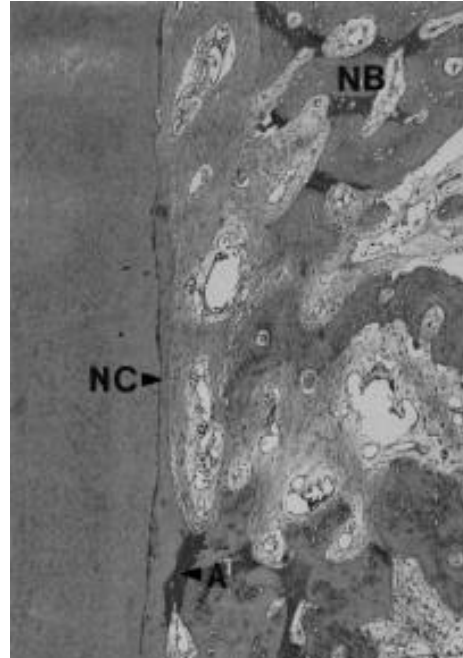


8. (H - E x 40)

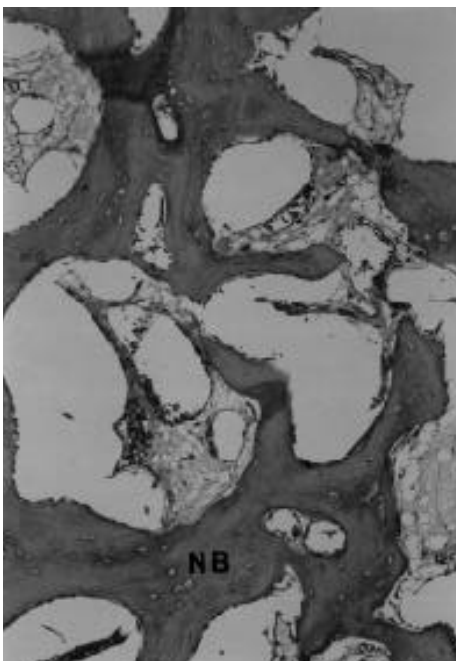
(III)



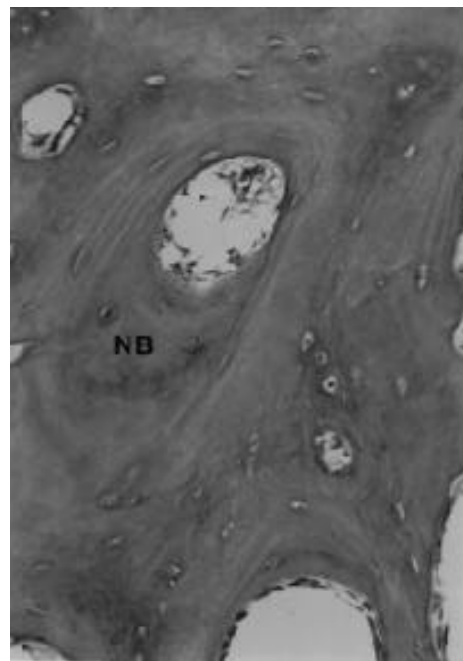
9. (H - E x 40)



10. (H - E x 40)



11. (H - E x 100)



12. (H - E x 200)

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1. 3 4mm 4mm 1
2. rhBMP/ACS buffer/ACS
3. (HE × 10)
4. (HE × 40)
5. (HE × 40)
6. (HE × 40)
- reference notch
7. (HE × 10)
8. (HE × 40)
9. (HE × 40)
10. (HE × 40)
11. (HE × 100)
12. (HE × 200)

aJE : , CT : , PDL : , NC : , NB : , RR :
 A : , bN : reference notch

Key words : periodontal regeneration, growth factor, rhBMP - 2/ACS, 1 - wall intrabony

- Abstract -

The Effects of rhBMP - 2/ACS on the Periodontal Healing of 1 - Wall Intrabony Defects in Dogs

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The ultimate goal of periodontal therapy is the regeneration of periodontal tissue and repair of function. For more than a decade there have been many efforts to develop materials and bioactive molecule (such as growth factor and differentiation factors) to promote periodontal wound healing. Among the bioactive molecules, bone morphogenetic protein (BMP) was studied for periodontal wound healing. Since Urist demonstrated that demineralized bone matrix could induce the formation of cartilage and bone in ectopic site, many studies on BMP have been reported. Among those BMPs, it was reported that rhBMP - 2 enhanced the healing of bone defects in animal studies and clinical studies. However, its efficacy in periodontal regeneration, especially 1 - wall intrabony defects is still unknown. The purpose of this study was to examine the

effect of rhBMP - 2/ACS on the epithelial migration, gingival connective tissue adhesion, cementum formation, alveolar bone regeneration in intrabony defects of dogs. Four millimeter deep and four millimeter wide 1 - wall defects were surgically created in the mesial aspects of the 3rd incisors. The test group received rhBMP - 2/ACS with a flap procedure and the control underwent buffer/ACS with a flap procedure. Histologic analysis after 8 weeks of healing revealed the following results:

1. The length of epithelial growth (the distance from alveolar crest to the apical end of JE) was 0.9 ± 1.5 mm in the control group and 1.2 ± 1.4 mm in the test group. There was no statistically significant difference between the two groups.
2. The length of connective tissue adhesion was 2.4 ± 1.3 mm in the control group and 1.2 ± 1.1 mm in the test group. The control group showed significantly enhanced adhesion ($P < 0.05$).
3. The length of new cementum was 0.9 ± 1.0 mm in the control group and 1.7 ± 0.8 mm in the test group. The test group showed significantly enhanced cementum regeneration ($P < 0.05$).
4. The length of new bone height was 1.9 ± 0.6 mm in the control group and 2.4 ± 0.9 mm in the test group. There was no statistically significant difference between the two groups.
5. The new bone area was 4.7 ± 1.7 mm² in the control group and 8.0 ± 2.0 mm² in the test group. The test group showed significantly enhanced

bone formed area($P < 0.05$).

6. The new bone density was $73.0 \pm 8.6\%$ in the control group and $66.6 \pm 15.3\%$ in the test group. There was no statistically significant difference between the two groups.

These results suggest that the use of rhBMP - 2 in 1 - wall intrabony defects has significant effect on new cementum and new bone formation area, but doesn't have any significant effect on the prevention of junctional epithelium migration and new bone formation height.