

Fibrin-Fibronectin Sealing System in Combination with Beta-Tricalcium Phosphate as a Carrier for Recombinant Human Bone Morphogenetic Protein-2: Effects on Bone Formation in Rat Calvarial Defects

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INTRODUCTION: Bone morphogenetic proteins (BMPs) are being evaluated as potential candidates for periodontal and bone regenerative therapy. In spite of good prospects for BMP applications, an ideal carrier system for BMPs has not yet been identified. The purpose of this study was to evaluate the osteogenic effect of a fibrin-fibronectin sealing system (FFSS) combined with Beta-tricalcium phosphate (Beta-TCP) as a carrier system for rhBMP-2 in the rat calvarial defect model.

METHODS: Eight-mm critical-size calvarial defects were created in 100 male Sprague-Dawley rats. The animals were divided into 5 groups of 20 animals each. The defects were treated with rhBMP-2/FFSS, rhBMP-2/FFSS/ Beta -TCP, FFSS and Beta-TCP carrier control or were left untreated as a sham-surgery control. Defects were evaluated by histologic and histometric parameters following a 2- and 8-week healing interval (10 animals/group/healing intervals).

RESULTS: The FFSS/ Beta-TCP carrier group was significantly greater in new bone area (Table 1) at 2 weeks ($p < 0.05$) and augmented area at 2 and 8 weeks ($p < 0.01$) relative to the FFSS carrier group. New bone area (Table 1) and augmented area in the rhBMP-2/FFSS/ Beta -TCP group were significantly greater than in the rhBMP-2/FFSS group at 8 weeks ($p < 0.01$). On histologic observation, FFSS remnants were observed at 2 weeks, but by 8 weeks, the FFSS appeared to be completely resorbed. rhBMP-2 combined with FFSS/ Beta-TCP produced significantly more new bone formation and augmentation in this calvarial defect model.

	2 weeks	8 weeks
Sham-surgery control	0.2 ± 0.1	0.4 ± 0.1
FFSS	0.4 ± 0.2	2.3 ± 0.7*
FFSS/ β-TCP	1.4 ± 1.2**†	2.1 ± 0.3*
rhBMP-2/FFSS	2.6 ± 0.6**†	3.4 ± 0.5**†
rhBMP-2/FFSS/ β-TCP	2.8 ± 1.4**†	5.3 ± 2.1**†‡

*: Statistically significant difference compared to surgical control group ($P < 0.05$)

**†: Statistically significant difference compared to FFSS group ($P < 0.05$)

†: Statistically significant difference compared to FFSS/β-TCP group ($P < 0.05$)

‡: Statistically significant difference compared to rhBMP-2/FFSS ($P < 0.01$)

: Statistically significant difference compared to 2 weeks ($P < 0.05$)

DISCUSSION & CONCLUSIONS: FFSS/ Beta -TCP may be considered as an available carrier for rhBMP-2.

REFERENCES: ¹Chang-Sung Kim, Joon-Il Kim, Jin Kim, Seong-Ho Choi, Jung-Kiu Chai, Chong-Kwan Kim, Kyoo-Sung Cho(2005) Ectopic Bone Formation of Recombinant Human Bone Morphogenetic Proteins -2 using Absorbable Collagen Sponge and beta Tricalcium Phosphate as Carriers; Histological and Immunohistochemical evaluation. *Biomaterials* 26(15):2501-2507. ²Suk-Ju Hyun, Dong-Kwan Han, Seong-Ho Choi, Jung-Kiu Chai, DDS, Kyoo-Sung Cho, Chong-Kwan Kim, Chang-Sung Kim (2005) The Effect of Recombinant Human Bone Morphogenetic Protein-2, 4 and 7 on Bone Formation in Rat Calvarial Defect. *Journal of Periodontology* ;76:1667-1674.

Table 1. New bone area (group means ± SD; n=9, mm²)