OR-I-1. Study on the Peptide Engineered Synthetic Oligopeptide Domain for Bone Regeneration

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Background

Bone morphogenetic proteins (BMPs) are potent differentiation factors capable of inducing bone formation spontaneously when placed at subcutaneous or intramuscular site and recombinant human bone morphogenetic protein-2 (rhBMP-2) has been shown to stimulate clinically significant regeneration of alveolar bone and cementum in periodontal defects. These proteins are difficult to use because of their high molecular weights, immunological responses, cost, coupling to scaffolds, and problems in targeting to remote organs. Synthetic peptides have been suggested to overcome these shortcomings. Thus, development of the peptide mimicry of proteins has become of interest.

Materials and methods

In this study, the oligopeptide sequence with 15 amino acids containing the binding domains for both the BMP receptor I (BMPRI) and BMP receptor II (BMPRII) were used.

The osteopromotive effect of engineered peptide-containing bone graft in either rabbit calvarial defect model or beagle L-shaped defect model was investigated with the possibility of clinical implications.

Results

The cell attachment of the bone mineral without peptide was not as significant as that of bone mineral coated with peptide containing the binding domains for BMPRI and BMPRII. The nuclei of cells attached around the surface of peptide-coated bone mineral were more obvious than minerals without peptides.

The peptide-coated bone mineral enhanced the cell proliferation for 21 days.

The average area occupied by new bone was 6.60 ± 0.89 % for the peptide-uncoated bone and 23.72 ± 1.73 % for the peptide-coated bone at two weeks and 34.77 ± 3.31 % and 42.27 ± 2.35 % at four weeks in rabbit calvarial defects, respectively. There were significant differences in the regenerated areas between control and experimental sites at two and four weeks ($P < 0.05$).

The average area occupied by new bone was 5.7 ± 3.8 % for the uncoated sites and 25.6 ± 6.1 % for the peptide-coated sites in beagle dogs' alveolar ridge defect. There were significant differences in the regenerated areas between peptide-coated bone and uncoated sites ($P < 0.05$).

Conclusion

The results showed that increased new bone formation was observed within the experimental sites in rabbit calvarial and beagle alveolar defect using peptide containing the binding domains for BMPRI and BMPRII . The use of theses peptide revealed to be effective and application as peptide-coated bone is a promising material for bone regeneration.