Effect of a slowly resorbing cross-linked collagen membrane with highly soluble biphasic calcium phosphate on localized bone regeneration

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Introduction

The aim of this study was to evaluate bone regenerative capacity of a cross-linked porcine collagen membrane (CM, Collagen membrane-P®, Genoss, Suwon, South Korea) with highly soluble biphasic calcium phosphate (BCP, New Bone, Genoss, Suwon, South Korea).

Materials and Methods

Ten 16 weeks old New Zealand white male rabbits were used. Four circumferential bony defects were created on sagittal plane with a 8mm diameter trephine bur under copious saline irrigation. Each defect was randomly allocated following 4 groups.

- 1) BCP-CM : Biphasic calcium phosphate (HA/ β -TCP : 20/80) with cross-linked porcine collagen membrane. 0.1g of BCP particles grafted defect was covered with porcine collagen membrane.
- 2) CM : The defect was covered with porcine collagen membrane without bone graft materials
- 3) BCP : The defect was filled with prepared 0.1g of BCP particles.
- 4) Control : The defect was filled with blood clot.

Animals were sacrificed at 2 weeks (n=5) and 8 weeks (n=5).

Results

	2 weeks	8 weeks
Control	7.40±2.21	8.20±1.46
CM	11.90±2.20	9.01±3.52
BCP	21.97±2.27 ^a	22.48±1.10 ^a
BCP-CM	27.12±3.99 ^{a,b}	25.75±1.82 ^{a,b}

Table 1: Area of total augmentation (mm²; Group Mean ± SD; n = 5)

a : Significantly different from control group at 2 and 8 weeks postoperative (p < 0.05).

b : Significant difference between BCP group and BCP-CM group at same experimental period (p < 0.05)

Within the augmented area, a significantly higher bone formation was observed for the two BCP groups (5.35±2.42mm²; 3.91±1.47mm²) (BCP-CM, BCP) compared to CM (1.89±0.82mm²) and control (1.79±1.18mm²) at 2 weeks. Similar observations were made at 8 weeks being significantly different between two BCP groups (BCP-CM: 7.33±1.90mm²; BCP: 7.71±1.26mm²) and other groups (CM: 2.10±1.03mm²; C: 2.97±0.95mm²). Bone formation increased significantly from 2 to 8 weeks in groups BCP-CM and BCP only.

Figure1: Clinical photographs of the experimental sites. (a) Four circumferential defects with 8mm diameter were created on ten New Zealand white rabbits' calvaria. Full thickness of the bone was carefully removed. (b) Four different groups were randomly allocated. (C : control, CM : cross-linked porcine collagen membrane, BCP : BCP with HA/β-TCP: 20/80, BCP-CM : BCP with HA/β-TCP: 20/80 and covered with cross-linked porcine collagen membrane.)

Figure 2 : Transversal histologic section of BCP-CM group at 2 weeks (a and b) and 8 weeks (c and d). Arrow head: defect margin, NB: new bone, AC: adipocyte, RM: residual material, NV: new vessel

Conclusion

A slowly resorbing cross-linked porcine collagen membrane combined with highly soluble BCP enhances regeneration, providing sufficient space maintaining capacity to supplement rapid resorption of BCP which has superior osteoconductivity.

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