The Degradation of Bioactive Bone Cement for Vertebroplasty and Kyphoplasty in vivo

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Purpose: To observe the degradation process of calcium phosphate cements (CPC) and calcium sulfate cement (CSC) in vertebrae, and explore the ideal filler for vertebroplasty and kyphoplasty.

Methods: Bone voids were created in L2- L5 vertebrae of twenty-four female mature sheep. CPC, CSC and polymethylmethacrylate (PMMA) were injected into one bone voids randomly, the remaining void was served as the blank control, and L6 vertebra served as the normal control. Eight sheep were sacrificed at 2w, 12w and 24w after operation randomly. Gross observation, biomechanical test and undecalcified bone histology analyses were used to determine the performance of the three cements.

Results: Gross observation showed that fibro-like scar was seen around the vertebrae with bone voids at 2w, some callus was seen covering the bone voids at 12w and 24w. Biomechanical analysis showed that the vertebrae could be augmented by CPC and CSC. The mechanical properties of vertebrae augmented with CSC decreased from 2w to 12w, however, increased from 12w to 24w after operation. The mechanical properties of vertebrae augmented with CPC increased from 2w to 24w, however, lower than the vertebrae with PMMA. Histology analysis showed CSC was mostly absorbed at 12w, however, the bone voids were repaired only in large part at 24w. CPC was absorbed partly at 24w, and new bone was formed in contact with the surface of the CPC. Fibrous membrane was observed in the interface between the PMMA and bone trabeculae.

Conclusion: The vertebrae can be augmented instantly by CPC and CSC. As time went on, the evaluation process was different in two cements, CSC was absorbed fast and CPC was absorbed very slowly.