

Use of Native Bovine Bone Morphogenetic Protein Extract in Healing Segmental Tibial Bone Defects in Goats

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Abstract

We tested the new bone-forming activity of injectable native bovine BMP extracted from cadaveric bones obtained from the abattoir after SDS PAGE electrophoresis was used to determine the molecular weights and extract was bio-assayed in the goat thigh muscle pouch model. The bovine BMP extract was further used as an implant in an absorbable collagen sponge (ACS) and hydroxyapatite to heal segmental bone defects in a large animal tibia fracture model. Open tibia fractures were created in 20 adult goats with loss of 1.5 cm segment of the bone. 10 goats were treated with an implant of the study device (0.2 mg of extracted bovine BMP, ACS and hydroxyapatite) while 10 goats were treated with an implant of Buffer, ACS and hydroxyapatite. The devices were implanted as a mould in the segmental defects. The animals were monitored for callus formation which was measured on lateral radiographs and mean callus indexes determined. Radiographs indicated increased callus at 3 weeks in the extracted bovine BMP/ACS/hydroxyapatite treated tibiae. At 6 weeks, the extracted bovine BMP/ACS/ hydroxyapatite treated tibiae had superior radiographic healing scores compared with the control group. The extracted bovine BMP/ACS/hydroxyapatite treated tibiae produced significantly larger volume of callus ($p < 0.02$) compared to the buffer/ACS/hydroxyapatite treated tibiae. Total callus and new bone volume was significantly increased ($p < 0.02$) in the extracted bovine BMP/ACS/hydroxyapatite treated tibiae compared with buffer/ACS/hydroxyapatite groups. Extracted bovine BMP/ACS/hydroxyapatite altered the timing of onset of periosteal/endosteal callus formation in the treated groups compared to untreated controls.

Keywords: Bone morphogenetic protein; Osteo-induction; Hydroxyapatite; Absorbable collagen sponge; Tibia; Segmental bone defects; Fracture; Bone graft; Bone healing