Radiographical Assessment of Injectable Calcium Phosphate Bone Cement (Osteopaste) in Critical Size Bone Defects of Rabbit's Tibia Model

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Abstract

Introduction: Recent advances in orthopaedic research focus on improving bone healing and grafting. Osteopaste, a synthetic bone cement made from tetra-calcium phosphate (TTCP) and tri-calcium phosphate (TCP) has been developed to overcome limitations of traditional bone grafts. This study evaluates the radiographic density and new bone formation to bridge the critical size defect of Osteopaste compared to two other synthetic grafts, JectOS (calcium phosphate) and MIIG-X3 (calcium sulfate) at 6, 12, and 24 weeks. Materials and methods: A critical size defect measuring approximately 4.5mm (width) x 9.0mm (length) was surgically created at the proximal tibial metaphysis and implanted with Osteopaste, JectOS, or MIIG-X3. Following cement implantation, surrounding soft tissues were repositioned and sutured with bioabsorbable surgical suture. Bone defect healing and cement density were qualitatively and quantitatively evaluated using plain radiographs and computed tomography (CT) scans at 6, 12, and 24 weeks. Results: The Osteopaste group showed radiographic density levels between those of JectOS and MIIG-X3. JectOS had the highest density, while Osteopaste was higher than MIIG-X3. In the Osteopaste group, new bone formation bridged the critical size defect by 12 weeks, but no bridging occurred in the other two groups at any time point. Statistical analysis showed significant differences in mean density among the groups at 6, 12, and 24 weeks ($P<0.0001$). Conclusion: Osteopaste effectively promotes new bone formation. Its performance falls between that of JectOS, which has the highest density, and MIIG-X3. These results suggest that Osteopaste could be a useful alternative for bone grafting.

Author keywords

bone formation; calcium phosphate; calcium sulphate; critical size defect; osteointegration

Indexed keywords

EMTREE drug terms

alkaline phosphatase; bone cement; calcium; calcium phosphate; hydroxyapatite; isoflurane; ketamine; xylazine

EMTREE medical terms

adult; animal experiment; animal model; animal tissue; Article; bone defect; bone development; bone graft; bone regeneration; bone remodeling; computer assisted tomography; controlled study; fracture healing; male; micro-computed tomography; nonhuman; rabbit model; radiography; tibia

Chemicals and CAS Registry Numbers

Unique identifiers assigned by the Chemical Abstracts Service (CAS) to ensure accurate identification and tracking of chemicals across scientific literature.

alkaline phosphatase	9001-78-9
calcium	7440-70-2, 14092-94-5
calcium phosphate	10103-46-5, 13767-12-9, 14358-97-5, 7758-87-4

hydroxyapatite 1306-06-5, 51198-94-8

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