INTRODUCTION: Many bone graft substitutes have become available to assist in increasing healing rates and decrease donor site morbidity resulting from orthopaedic procedures. Calcium sulfate is a widely used bone graft substitute, and is now available as a bone void filler as well as in pellets. We wished to examine:
1. The effect of a solid calcium sulphate cylinder in an intercalary defect in the rabbit tibia
2. The effect of systemic or local bisphosphonate administration on the performance of such a filler

METHODS: Animal ethics approval was received (WAEC-101.04-02). A 10mm mid-diaphyseal tibial defect was prepared in 36 New Zealand White rabbits, a cylinder of calcium sulphate (Osteoset BVF Kit) placed in the defect and the tibia stabilised with an external fixator. The rabbits were randomly allocated to one of three groups: Saline, Systemic ZA (0.1 mg/kg 2 doses) and Local ZA (0.05 mg/kg adsorbed onto cylinder). Second-weekly radiographs were performed, and rabbits euthanased at 4 and 6 weeks for QCT analysis of the tibiae. Four week specimens were examined histologically.

RESULTS: We noted gross swelling of the legs in the first 2 weeks after implantation. CT results showed the bone area was significantly increased at 4 weeks in treated animals (p<0.05), with the largest effect in the Local ZA group (Fig 2). By six weeks the total amount of bone was similar across groups. Qualitatively, the amount of bone at the site of the cylinder was increased in the Local ZA group, in controls reactive bone formation predominated. Bone mineral content (BMC) and polar moment of inertia were significantly increased at 4 weeks Saline < Systemic ZA < Local ZA (p<0.05).

DISCUSSION: Calcium sulphate alone caused little direct bone formation, while the local application of ZA favourably altered the early amount and density of reactive periosteal bone formation. We have modulated the behaviour of calcium sulphate by the local application of ZA, with a significant increase in the bone area, BMC and moment of inertia at 4 weeks in both systemic and local ZA groups. Further study in a defect model excluding reactive periosteal bone formation is warranted to assess the viability of this approach in promoting healing of metaphyseal defects in bone.

REFERENCES: