The Use of Calcium Sulfate and Calcium Phosphate Composite Graft to Augment Screw Purchase in Osteoporotic Ankles
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Introduction: Screws placed in the distal fibula do not have a satisfactory purchase during internal fixation of an osteoporotic ankle fracture. Tibia-pro-fibula screws that extend from the fibula into the distal tibial metaphysis provide additional purchase. The purpose of this study is to investigate if purchase of these screws can be enhanced further by injecting calcium sulfate and calcium phosphate composite graft in the drill holes prior to insertion of the screws.

Materials and Methods: Bone density was quantified using DEXA scan in paired cadaver legs. One leg from each pair was randomly selected for injection of composite graft into screw holes before insertion of the screws. Two screws were inserted through the fibula into the distal tibial metaphysis in each leg, at the level of the syndesmosis under fluoroscopy in a standardized fashion using a jig and pulled out using a MTS machine.

Results: After testing 4 pairs of cadaver legs, a statistically significant difference was noted in displacement (p=0.018 distal, p=0.0093 proximal), failure load, (p=0.0185 distal, p=0.0238 proximal), and failure energy (p=0.0071 distal, p=0.0115 proximal) between augmented and non-augmented screws, with the augmented screws being considerably stronger.

Discussion: Failure of a plate and screw construct following internal fixation of an osteoporotic ankle fracture occurs due to screws backing out. Improving screw purchase hopefully will prevent this method of failure. The aim of this study was narrowly defined to address this issue and was limited to testing screw purchase in the distal tibial and fibular metaphysis. The specimens therefore were loaded on to the MTS machine in a way that would allow the most direct method of pull possible on the screws to test their resistance against being pulled out.

There are no previous studies to the authors’ knowledge that determine if injectable composite graft can augment screw purchase in osteoporotic long bone metaphysis especially in the distal tibia. The current study shows that composite graft augmented screws are significantly stronger in one-time axial pull-out testing than non-augmented screws in osteoporotic distal tibial and fibular metaphysis.

Conclusion:
Screws augmented with composite graft provide significantly greater purchase in an osteoporotic distal tibial and fibular metaphysis than non-augmented screws.

Clinical relevance:
Composite graft augmented screws inserted in the distal tibial metaphysis may enhance the stability of the internal fixation of an osteoporotic ankle fracture. This may enable early weight-bearing mobilization and return to function which is important in elderly patients.

References:

Bone Mineral Density at the Distal Tibial Metaphysis