Injectable Calcium-Phosphate Composites for Bone Tissue Repair
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Abstract—Traditional bone repair techniques demand limited resources and often leave patients highly susceptible to infection. Through the use of calcium phosphate composites, clinicians have been able to reduce patient morbidity while leaving the tissue’s structural integrity unchanged.

I. INTRODUCTION
Bone tissue engineering has a wide range of clinical applications including spinal fusion, joint replacement, non-union fractures, and in instances of extreme bone deformation. This technology focuses on the development of an unlimited osteoconductive composite that supersedes the current autograft and allograft procedures. These traditional repair mechanisms often leave patients in pain for a number of years and lead to a high risk of disease transmission, infection, and natural immune reactions. The injectable cement serves as both a compliment and replacement to current techniques. As a hard-setting injectable paste, it provides mechanical strength while gradually resorbing and being replaced with new bone tissue.

II. METHODS
Injectable calcium phosphate contains the mixture of biocement powder with an aqueous solution to form a hard-setting paste that can be efficiently dispensed by physicians through a device mimicking the common syringe.

Calcium phosphate naturally contains properties conducive to bone regeneration and is able to attract local stem cells and growth factors. It serves as a porous scaffold that degrades overtime through the natural work of osteoclast cells. This allows doctors to more accurately reconstruct bone damage.

III. RESULTS
After clinical testing, calcium phosphate based biocement was found to rival the rate of bone repair found in traditional autograft techniques. Furthermore, calcium phosphate is a naturally occurring compound found in bone and thus allows for specific differentiation of osteoprogenitor cells. It also prevents the undesired formation of bone growth in surrounding soft tissue regions of the body. This cement can be infused with additional growth factors and antibiotics to serve as a slow-release drug delivery system throughout the regeneration of the trauma site.

IV. DISCUSSION
Calcium phosphate cement provides a number of advantages over traditional bone grafting techniques. It replaces the need for a small section of the patient’s own iliac crest and drastically cuts down the demand for bone bank materials. The injectable paste allows for a much less invasive procedure and limits the odds of infection or immune reaction. This procedure is used to fill large fissures, reconstruct articulation sites, and most notably spinal fusion. Its ability to harden and provide mechanical strength allows for normal rehabilitation of the injured site. Calcium phosphate materials are naturally osteoconductive and biocompatible. Osteoclasts are able to degrade the cement similarly to typically bone tissue. In doing so, this scaffold allows patients to fully heal and replace the material with new bone tissue, giving them the necessary structural stability. In the future, this cement can be used to fully reconstruct areas of bone trauma and deformation while lessening the demand for materials from bone banks and the very limited autograft locations.

REFERENCES