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“Targeted Delivery of Fetuin Using Titania Nanotubes for Prevention and Treatment of Heterotopic Ossification”

Heterotopic ossification (HO) is bone formation that occurs in muscle surrounding a patient’s joint following orthopedic trauma and hip replacement surgery. HO often leads to pain, loss of range of motion, and loss of function of the affected joint. The serum glycoprotein fetuin has been shown to inhibit hydroxyapatite crystallization and BMP-induced osteogenesis (i.e., bone formation). Although these properties can be very useful for HO prevention and treatment, an effective vehicle for local delivery of fetuin has not yet been developed.

To address these challenges, we have developed a fetuin-loaded Titania nanotube (TNT) matrix that upon ultrasound stimulation provides local release of fetuin. Our long-term goal is to be able to implant this device into the surgical site during fracture fixation or joint replacement, and thereby allow the release of fetuin as needed postoperatively to prevent HO formation.

Although we know that upon ultrasound stimulation fetuin can be released from TNTs, and that it retains its ability to block mineralization, we do not know whether the protein might undergo changes under these conditions that could alter its ability to inhibit HO formation. The purpose of our study is to determine whether TNT-released fetuin retains the ability to inhibit bone formation in-vitro as reflected by decreased alkaline phosphatase levels and decreased mineralized bone nodule formation.