Smart materials for accelerated single-surgery repair of bone defects

James H. Henderson, PhD, Associate Professor & Director of Bioengineering Graduate Program, Syracuse University

ABSTRACT

Treatment of complex bone defects places a significant burden on the US health care system. Current strategies for treatment include grafting and stabilization using internal metal plates/screws, intramedullary rods, or external fixators. Here, we will present the use of shape memory polymer (SMP) materials for grafting and adjunct stabilization of segmental defects. This presentation will focus on work in which we have developed and evaluated, in a mouse segmental defect model in vivo, self-deploying SMP grafts and SMP sleeves capable of expanding and contracting, respectively, under intraoperative conditions. The extent to which integration between grafts/sleeves and native bone, as assessed using x-ray radiography, microcomputed tomography, and torsional mechanical testing, occurs will be discussed. Collectively, the findings to be reported suggest that incorporation of shape memory into synthetic bone graft substitutes and adjunct stabilization devices can enhance functionality of synthetic materials employed in both applications.

BIOGRAPHY

James (Jay) Henderson, PhD, is an Associate Professor of Biomedical and Chemical Engineering and the Bioengineering Graduate Program Director at Syracuse University. His training in Mechanical Engineering was performed at Rice University (BS) and at Stanford University (MS, PhD), where he was a dual Hertz Foundation/Burt and Deedee McMurtry Stanford Graduate Fellow. He performed postdoctoral training in the departments of Biology and Orthopaedics at Case Western Reserve University as an Arthritis Foundation Postdoctoral Fellowship. Having joined the faculty of Syracuse University in 2008, Dr. Henderson’s lab focuses on the study and application of mechanobiology, with a special emphasis on orthopedic tissue engineering. Dr. Henderson is a faculty member of the Syracuse Biomaterials Institute and of the SUNY Upstate Medical University Cancer Research Institute and holds an adjunct position in the Syracuse University department of Biology. He received the Aspiring Investigator Award at the 5th Annual Meeting of the Midwestern Tissue Engineering Consortium in 2005, the New Investigator Recognition Award at the Combined Meeting of the Orthopaedic Research Societies in 2007, the College of Engineering and Computer Science Faculty Excellence Award in 2010, and the DARPA Young Faculty Award in the class of 2012.