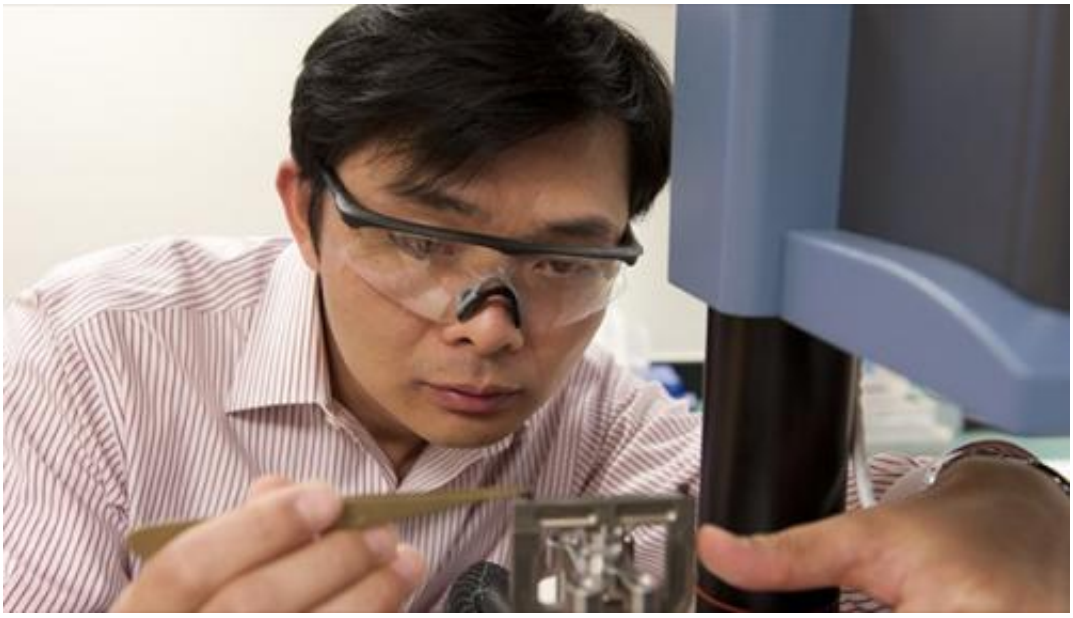
Cartilage repair: Effects of weight bearing rehabilitation after microfracture surgery studied

February 26 2013, by Sarah E. Meadows



X. Lucas Lu is studying weight bearing rehabilitation after microfracture surgery. Credit: Kathy F. Atkinson

In the body, bones are padded with a smooth cartilage layer at the ends, allowing smooth motion where two bones meet and form a joint. When cartilage around the bone becomes degenerated or lost due to osteoarthritis or traumatic injury, however, joint mobility decreases and can become painful.

Young athletes suffering from trauma induced cartilage loss are typically treated with microfracture surgery, a minimally invasive procedure that creates tiny punctures in the bone to stimulate bone marrow to the damaged area and the creation of new articular cartilage by the stem cells in bone marrow.

After surgery, rehabilitation therapy is a crucial component of patient outcomes. Traditional physical therapy procedures, however, limit weight bearing for the first eight weeks, particularly the application of weight to the joint.

X. Lucas Lu, assistant professor in the University of Delaware's Department of Mechanical Engineering, is principal investigator of a new grant investigating whether weight bearing during microfracture rehabilitation will enhance the deposition and quality of newly repaired tissue at the injury site. Lynn Snyder-Mackler, Alumni Distinguished Professor in the Department of Physical Therapy, is a co-investigator on the project.

The project is funded through a $96,276 Junior Investigator Grant from the Musculoskeletal Transplant Foundation.

Under the grant, Lu and Snyder-Mackler will develop a unique bioreactor system to simulate micro-fracture surgery in the laboratory. Using a novel mechanical loading device, they will subject 3D organic cartilage-bone replicas to weights resembling those applied shortly after surgery. Lu will measure and compare the longitudinal changes in the biomechanical and biochemical properties of the repaired tissue generated by the stem cells.

"If successful, the system could provide a low-cost, yet powerful tool to study the repair mechanisms of microfracture surgery," said Lu.

In particular, it could provide new details on:

- The interaction between bone marrow and surrounding cartilage;
- The role of controlled-release of growth factors in the development of cartilage; and
- The effects of different rehabilitative treatment protocols on cartilage recovery.

"This system has the potential to fill a critical gap in knowledge regarding cartilage lesion repair in microfracture surgery and to further improve the design of rehabilitation protocols," remarked Suresh G. Advani, George W. Laird Professor and chair of the Department of Mechanical Engineering.

Provided by University of Delaware