

January 12, 2011

2011-01-12: A step forward in arthritis prevention

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Recommended Citation

St. Martin, Greg, "2011-01-12: A step forward in arthritis prevention" (2011). *News@Northeastern*. Paper 783. <http://hdl.handle.net/2047/d20002026>

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A step forward in arthritis prevention



In their study, Northeastern professors measured the degree to which participants had irregular knee alignments.

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Osteoarthritis (OA), caused by the breakdown of joint cartilage, leaves more than 20 million people in the United States suffering from recurring pain and frustrated over their limitations in movement. But **physical therapy and mechanical and industrial engineering** researchers at Northeastern University have broken new ground with an interdisciplinary study of factors that cause and exacerbate OA.

To explore these factors—including body weight and knee-joint abnormalities such as frontal knee alignment—the study required subject-specific knee-joint analyses. Researchers found that these individualized assessments from 3-D imaging, along with earlier diagnosis based on a patient's knee alignment, are critical factors

in dramatically improving treatment and prevention. Their research, which was recently featured on the cover of the *Journal of Orthopedic Research*, advances Northeastern's research mission to solve global challenges, with a focus on health, security, and sustainability.

A recent Northeastern graduate, Nicholas Yang, spearheaded this research as the basis for his **PhD thesis** in mechanical engineering. Yang was the paper's lead author, joined by three coauthors: professor Hamid Nayeb-Hashemi and assistant professor Ashkan Vaziri—both in the Department of Mechanical and Industrial Engineering—and Assistant Professor of Physical Therapy Paul Canavan.

"It's groundbreaking because we're integrating the biomechanics, physical therapy, gait analysis and the engineering," Canavan said.

"Not only can we see if someone is more at-risk, but we can apply this subject-specific model for interventions in the future," Nayeb-Hashemi said.

Researchers said sharing their expertise in human anatomy and calculating force distribution was integral to the collaboration.

"The project was very interesting and challenging, because I had to learn how the human body works so I could apply engineering principles to answer biomechanical research questions," Yang said.

The knee is one area where osteoarthritis, the most common form of arthritis, can develop. The research indicated that people with irregular knee alignment — either varus (bow-legged) alignment or valgus (knock-kneed) alignment — are more susceptible to developing this condition.

Northeastern students volunteered for the study, which required them to walk on a platform that measured applied force to the knee while high-speed motion analysis cameras captured their movements. This data was fed into software to build 3-D models of each student's knee joints, allowing researchers to measure individualized stress levels on the knee cartilage.

Given that the geometry of knee joints varies from person to person, researchers said their methodology more accurately gauges strain and stress distribution to the knee joint when compared to past studies that have used generalized assessments. As a result, preventative measures such as customized shoe inserts, strengthening of specific leg muscles or weight loss, can be tailored to each person.

"This (subject-specific method) is something that makes our research unique," Vaziri said.

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