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Detecting knee-cushion problems early could lead to better treatments

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Within the knee, two specialized, C-shaped pads of tissue called menisci perform many functions that are critical to knee-joint health. The menisci, best known as the shock absorbers in the knee, help disperse pressure, reduce friction and nourish the knee. Now, new research from the University of Missouri shows even small changes in the menisci can hinder their ability to perform critical knee functions. The research could provide new approaches to preventing and treating meniscal injuries as well as clues to understanding osteoarthritis; meniscal problems are one of the major causes of joint pain and degeneration.

"The menisci are sensitive, and a fine line exists between the menisci doing what they're supposed to do and the menisci not functioning properly," said Trent Guess, the HealthSouth associate professor of physical therapy in the MU School of Health Professions and orthopedic surgery in the MU School of Medicine. "As the meniscal attachments to the tibia—the calf bone—become more lax, it doesn't take much for the menisci to lose all their function. This function declines as individuals age and could be one contributing factor to osteoarthritis."

Osteoarthritis occurs when cartilage on the ends of bones degrades over time, which can lead to painful bone-on-bone rubbing during movement. Many individuals suffer from the condition, which commonly affects joints in the knees as well as in the hips, ankles, shoulders, elbows, fingers, toes and spine.

Guess leads the Mizzou Motion Analysis Center, which houses a gait lab

that uses a variety of sensors to evaluate how people walk and move. In the lab, participants walk on sensors called force plates that measure the force exerted between the individuals' feet and the floor. Participants attach small, reflective sensors or "markers" to their bodies, and infrared cameras capture the movement, which is sent to a computer for analysis. The researchers use this data to see which muscles are being activated during each movement. Using computational models that combine gait measurements with medical images, the researchers can predict how much force is exerted on knee structures—such as cartilage, ligaments and the menisci—during a particular movement.

"Getting up and out of a chair, an individual can put four times her body weight just across one knee," Guess said. "Can you imagine a basketball player jumping up and down, the force that he would put across his knees? It is a huge amount of force. If someone doesn't have functional menisci, basically all those forces are concentrated in a small area, which creates a lot of pressure on the joint and is bad for the cartilage, which over time, could lead to osteoarthritis. The menisci act as a cushion, distributing forces over a larger area while also nourishing and lubricating the knee."

Guess said his research can inform physicians and physical therapists, who may want to reconsider how they treat injuries, such as a torn meniscus.

"It's hard to believe that only 20 years ago people didn't think the menisci were important, so if the menisci were injured, they'd be removed," Guess said. "Now, we realize their importance for all aspects of knee function and preventing osteoarthritis. Surgeons might not have bothered to fix meniscal tears in the past, but our research suggests repairing these injuries might be worthwhile because, if left untreated, damage to the menisci could contribute to osteoarthritis in the near future."

More information: The study, "Predicted Loading on the Menisci during Gait: The Effect of Horn Laxity," recently was published in the *Journal of Biomechanics*.

Provided by University of Missouri-Columbia

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