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Riverside County, California

Computational method helps assess patient-specific progression of osteoarthritis in knee joint

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Osteoarthritis is a degenerative disease in which the articular cartilage protecting the joint starts to degenerate and wear off over time. The main risk factors of osteoarthritis are advanced age and overweight-induced significant stresses on the knee joint. Current imaging methods such as MRI and X-ray provide information about the thickness and composition of the cartilage, but they do not provide a quantitative estimate of the patient-specific risk of osteoarthritis or its progression.

Published in *Nature*, a recent study from the University of Eastern Finland developed and validated a novel computational modelling method for the assessment of the patient-specific progression of osteoarthritis in the knee joint by using MRI data. The research group comprises researchers from the University of Eastern Finland and Lund University.

"The method we have developed is based on stresses experienced by the knee joint during walking, and these were simulated on a computer. Our idea was that walking-induced cumulative stresses that exceed a certain threshold will cause local degeneration in the articular cartilage of the knee," says Postdoctoral Researcher Mika Mononen from the University of Eastern Finland's Department of Applied Physics.

The patient-specific estimates of the progression of osteoarthritis obtained by computer modelling were validated against four-year follow-up data from X-ray measurements, in which the thickness of the articular cartilage in the knee was evaluated by using the Kellgren-Lawrence method. For the validation of the model, two patient groups were established: the normal weight group and the overweight group.

In the normal weight group, the thickness of healthy cartilage did not change over the four-year follow-up, whereas significant degeneration was observed in the overweight group.

"The study shows that this new method, which is based on computer modelling, was able to predict similar changes in the articular cartilage of the knee as experimental follow-up data," Mononen says.

In the future, the method can serve as a new tool for making patient-specific prognoses on the progression of osteoarthritis. Furthermore, the method can be used for assessing the patient-specific effects of overweight on the future health of the knee joint as well as the success of clinical treatment such as menisectomy, a widely used surgical procedure.

Source:
University of Eastern Finland