Diagnostic system for pre-symptomatic detection of osteoarthritis

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Technology description

Summary

Osteoarthritis (OA), a disease hallmarked by the degeneration of cartilage in the joints, affects 80% of the elderly population. By the time OA is symptomatic, the disease is too far progressed for reversal by current medical treatments. These therapies seek only to manage symptoms, and in some cases, full replacement of the joint may be the only treatment option. Early detection of OA may allow for interventions that can stall or reverse the disease; however, there are currently no methods available for detecting pre-symptomatic signs of OA. This technology is a diagnostic system that uses computed tomography (CT) to monitor and assess the pathology of OA before symptoms arise. This system allows for early detection of OA and may enable early enough intervention to prevent further disease progression.

Computed tomography system detects trabecular bone resorption before damage to cartilage occurs

Current research suggests that the initial pathology responsible for the development of OA is abnormal resorption of the trabecular bone located directly beneath the cartilage of affected joints. The diagnostic system described in this technology is highly sensitive, and is able to detect subtle changes to the underlying trabecular bone of joints. The software uses high-resolution computed tomography (CT) images of the knee, wrist, or ankle, where more than half of OA cases occur. Because bone resorption can be detected before damage to the cartilage occurs, this technology may allow for timely introduction of interventions that forestall bone resorption and prevent OA symptoms from arising. It can also be used as a diagnostic tool to detect the progress of advanced OA and to evaluate the efficacy of therapeutic interventions.

This technology has been used to detect abnormal bone loss in knee samples removed during total knee arthroplasty surgery, before changes to overall bone density, mechanical structure, or the cartilage were observed.

Lead Inventors:

Publications

Chen Y, Wang T, Guan M, Zhao W, Leung FK, Pan H, Cao X, Guo XE, Lu WW. "Bone turnover and articular cartilage differences localized to subchondral cysts in knees with advanced osteoarthritis." Osteoarthritis Cartilage. 2015 Dec;23(12):2174-83.

Wang H, Liu XS, Zhou B, Wang J, Ji B, Huang Y, Hwang KC, Guo XE. "Accuracy of individual trabecula segmentation based plate and rod finite element models in idealized trabecular bone microstructure." J Biomech Eng. 2013 Apr;135(4):044502.

Wang H, Ji B, Liu XS, Guo XE, Huang Y, Hwang KC. "Analysis of microstructural and mechanical alterations of trabecular bone in a simulated three-dimensional remodeling process." J Biomech. 2012 Sep 21;45(14):2417-25.

Application area

Pre-symptomatic detection of osteoarthritis (OA)

Tool for monitoring the progress of OA

Tool for evaluating both pre- and post-symptomatic interventions against OA

Diagnosis of OA

Research tool for studying OA pathology

Advantages

Highly sensitive, high-resolution

Can detect trabecular bone resorption before other OA symptoms arise

Allows for pre-symptomatic detection of OA in at-risk patients

Institution

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