Predicting progression of osteoarthritis by feature analysis of bone radiographs

Unmet Need

Osteoarthritis (OA) is a leading cause of disability among adults, it currently affects more than 27 million Americans and more than 300 million individuals worldwide. Currently, there are no validated predictors of OA progression. Risk factors such as body mass index, age and gender are commonly used but have not been highly successful. The most commonly used method to track OA progression is the radiographic evaluation of joint space narrowing. However, this method suffers from multiple problems including the need for high-quality images (often beyond the general quality of clinical images) and difficulty in consistent patient positioning. A recent promising tool that provides a clear indication of changes occurring early in OA development is the fractal signature analysis (FSA) of bone texture from radiographic images of OA joints. FSA assesses the degree of complexity of the bone texture at a variety of spatial scales. The complexity is determined principally by the number, spacing and cross-connectivity of trabeculae in spongy bone and is quantified by “fractal dimension” (FD). FD can serve as an indicator of perforation and disappearance of trabeculae and therefore be a good indicator of OA progression. While very promising, to be reliable FSA currently has to be applied in conjunction with other non-radiographic methods, and therefore an improved method of using FSA as a predictor of OA progression is a critical need.

Technology

Duke researchers have developed an improved method of using FSA of radiographic images to predict the progression of OA development. Their approach is based on the finding that OA progression defined by

Duke File (IDF) Number

IDF #:T-003137

Patent Information

Patent #: 9,211,103
Patent Title: SYSTEMS AND METHODS FOR GENERATING AN OSTEOARTHRITIS PROGRESSION PREDICTOR AND SYSTEMS AND METHODS FOR USING THE PREDICTOR
Country United States of America

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Publication(s)

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External Link(s)

• From the lab of Dr. Virginia Kraus

joint space narrowing is associated with the shape of FSA curves. They use a model that involves a generalized “shape analysis” of the FSA data and calculates the trends of FD change for each individual. The model also addresses statistical correlations between clinical observations for each individual and generates a statistical score representing OA progression status independently on non-radiographic variables such as age, gender or BMI.

Advantages

- Robust method of OA progression prediction independent on non-radiographic variables
- Can be used to power OA treatment trials using more rapid progressors to minimize cost and patient drug exposure
- Was reduced to practice in the Horizon 1 Murdock study