

## **A Novel Method For Identifying Radiographic Baseline Risk Of Osteoarthritis Using An Anisotropy-Based Texture Analysis Algorithm: Data From The Osteoarthritis Initiative**

Orthopaedics / Knee & Lower Leg / Epidemiology, Prevention & Diagnosis

**Richard Ljuhar**<sup>1</sup>, Tobias Haftner<sup>2</sup>, Benjamin Norman<sup>1</sup>, Davul Ljuhar<sup>3</sup>, Astrid Fahrleitner-Pammer<sup>4</sup>, Hans-Peter Dimai<sup>4</sup>, Stefan Nehrer<sup>2</sup>

1. ImageBiopsy Lab, Vienna, Austria
2. Danube University, Krems, Austria
3. Braincon Technologies, Vienna, Austria
4. Medical University Graz, Graz, Austria

Keywords: Early Prediction Of Osteoarthritis, Subchondral Bone, Texture Analysis, Bone Micro Architecture, Osteoarthritis Initiative

### **Background**

Osteoarthritis (OA) is the most common form of arthritis and affects in a disproportional way the knee. Recent research developments in imaging options showed that OA is not just a joint disease but also involves progressive changes in the subchondral/subarticular bone area of the tibia. Besides the accepted methods of measuring the joint space width, assessments of the trabecular bone structure in selected regions of interest (ROI) of the knee based on conventional x-rays may be offering an alternative method for quantifying the risk and progression of the disease.

### **Objectives**

The accepted method for assessing OA - Joint space width (JSW) and Joint Space Area (JSA) measurements - have limited capabilities with respect to early identification and reproducible follow-ups of the disease. The objective of this abstract is to evaluate trabecular bone structure as area for early identification of OA risk, applying texture anisotropy algorithms and subsequently comparing the results to standard JSW and JSA measurements.

### **Study Design & Methods**

This study was performed using data form the Osteoarthritis Initiative. The image data set was restricted to female, Caucasian, right knee exams of the same modality which had a KL grade of 0 at the baseline exam with a deteriorating KL grade  $\geq 2$  at 96 months follow up. 22 CASES fulfilled these criteria with matching 22 CONTROLS with no signs of OA at 96 months follow up. The selected region of interest (ROI) for the analysis of the radiographic texture encompassed four ROIs in the subchondral tibia and one additional ROI in each femur condyle – in total 6 ROIs. For each individual ROI, the degree of texture anisotropy was calculated and compared between case/controls. In addition, JSW/JSA were calculated in both groups using a software-based method (i3a Technologies).

### **Results**

Whereas the JSW and the JSA measurements did not yield any significant differences with respect to their mean values (Cohen's  $d = 0.139$  and  $0.028$ ), the calculated texture parameters showed that differences in values between Cases and Controls can be found in ROI1 and 2 with Cohens'd values of  $0.625$  and  $0.831$ . With respect to selected patient groups, the differences in anisotropy results were significant using these texture parameters.

### **Conclusions**

Our results indicate that using the selected radiographic texture parameters, an early identification of patients at risk for developing OA using conventional x-rays can be achieved. This may offer an

additional method for quantifying the risk of baseline OA. This is supported by the Conhen's d values that are by definition relatively large (0.625 and 0.831). Ongoing research focuses on larger sample set validation and the use of such algorithms for additional applications, such as the early identification of patients at risk for fractures.