

# Cartilage Volume from MRI for Quantifying Osteoarthritis Progression

## Summary

- Fully automatic computer-based method
- Framework independent of scanner, but evaluated for 3D T1 sequence on a 0.18T scanner
- Evaluated on 159 subjects (288 knees at baseline, 245 at follow-up after 21 months)
- With a scan-rescan precision of CV 3.6%, the volume measurement can both diagnose levels of OA cross-sectionally and monitor progression longitudinally.

## Background and Methods

Cartilage loss is a central process during most stages of OA. We evaluated the measurement of the sum of the Tibial and Femoral articular knee cartilage volumes (in the medial compartments) using our fully automatic computer-based framework for cartilage quantification.

The subjects aged  $56 \pm 16$  years with BMI  $26 \pm 4$ . At baseline the count of knees with KL scores 0-4 were 145, 88, 30, 24, 1. Of the healthy knees, 101 remained healthy and 25 were early progressors at follow-up.

## Results

The scan-rescan precision was 3.6% (mean CV). Cross-sectionally, there is a clear trend of cartilage loss observed with increasing KL score (Figure 1). There is also a clear trend of increased longitudinal loss with increasing baseline KL (Figure 2).

Finally, there is significantly larger cartilage loss ( $p < 0.01$ ) in the group with radiographic progression compared to the non-progressors.

## Conclusions

The volume quantification was precise and proved to be suitable as a Diagnostic biomarker for both OA ( $p < 0.001$ ) and early OA ( $p = 0.002$ ), and may also be suitable as a Burden of Disease biomarker. Furthermore, the volume quantification could separate the healthy non-progressors from the early progressors ( $p = 0.003$ ) and is thereby likely suitable as an Efficacy of Intervention biomarker.

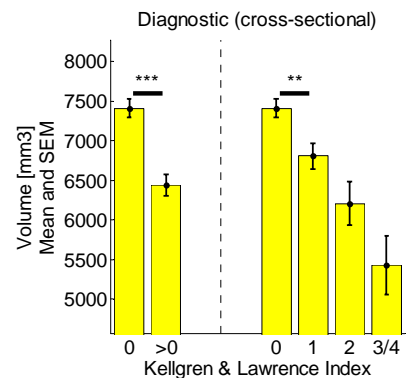


Figure 1

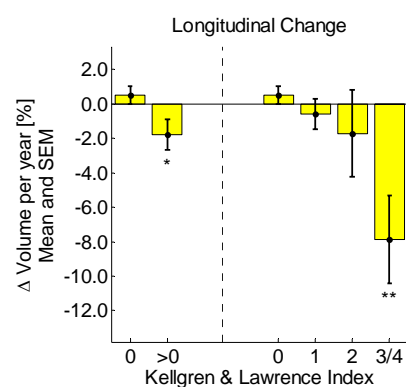


Figure 2

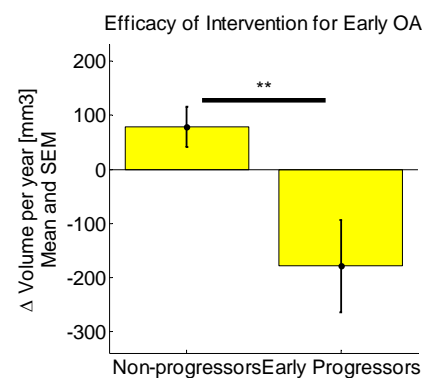


Figure 3

## Key Publications

*Segmenting articular cartilage automatically using a voxel classification approach.*

Folkesson J, Dam EB, Olsen OF, Pettersen PC, Christiansen C.

IEEE Trans Medical Imaging. 2007, 26(1): 106-15

*Automatic morphometric cartilage quantification in the medial tibial plateau from MRI for osteoarthritis grading.*

Dam EB, Folkesson J, Pettersen PC, Christiansen C.

Osteoarthritis & Cartilage. 2007, 15(7): 808-18.