Exploring Gender-Dependent Differences in Patterns of Cartilage Loss Using Responsiveness Heat Maps: Data From the OAI

*Duryea, J., *Ragati Haghi, H., *Amesbury, R., *Laffaye, T., *Stein, R. *Mathiessen, A., **Kwoh, C.K.,
*Brigham and Women's Hospital, Harvard Medical School, Boston, MA, USA
**University of Arizona Arthritis Center, the University of Arizona College of Medicine, Tucson, AZ, US

Background

Understanding gender-specific differences in patterns of cartilage loss can improve our knowledge of the pathogenesis of knee osteoarthritis (KOA) development and progression, and may inform clinical trials of treatments for KOA.

- The Local Area Cartilage Segmentation (LACS) software uses robust coordinate systems to measure cartilage change in focused regions in the femur and tibia.
- Objective: To examine gender differences in patterns of cartilage loss in the central weight-bearing regions of the medial femur (MF), lateral femur (LF), medial tibia (MT), and lateral tibia (LT) using cartilage segmentation software.

Methods

- 480 OAI subjects with KL 1, 2 and 3 were selected
- Cartilage volume was measured at the baseline and 96-month time points.
- Using the coordinate systems, LACS permits assessment of change in sub-regions (Figure 1)
- Cartilage change was calculated as standardized response mean (SRM) for each plate separately.
- LACS SRM was estimated over grids in the sample and displayed in the form of responsiveness heat maps.
- Responsiveness heat maps show cartilage volume change in highly local regions with red for loss and blue for gain, and increasing intensity to indicate more change
- We show the heat maps for all 480 participants and for separate analyses stratified by BMI, age, and KL score.

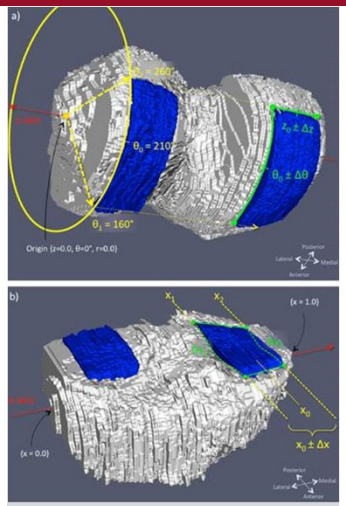

Figure 1. Example of LACS

Results

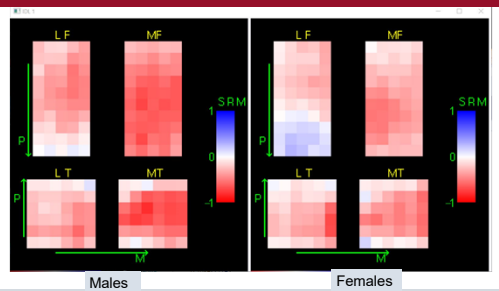

Figure 2. Responsivness heat map for all 480 participants with males on the left and female on the right. The orientation of each plate corresponds to the layout in Figure 1.

Results

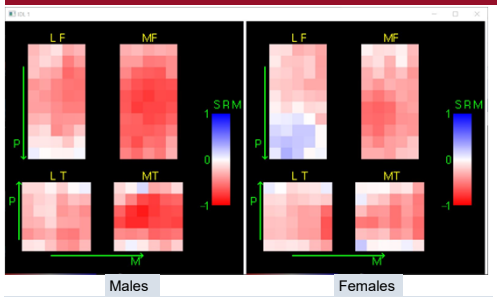

Figure 3a BMI > 28 kg/m² (N=261)

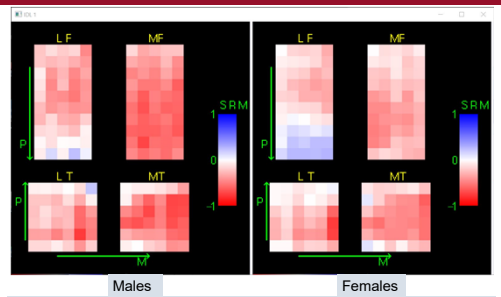

Figure 3b BMI ≤ 28 kg/m² (N=219)

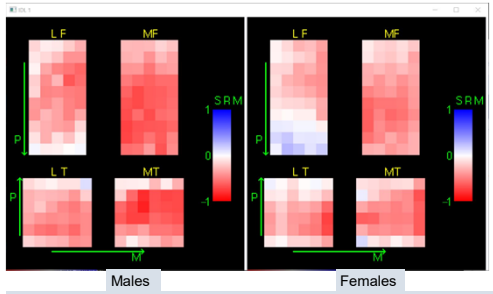

Figure 3a. Age > 60 yr. (N=260)

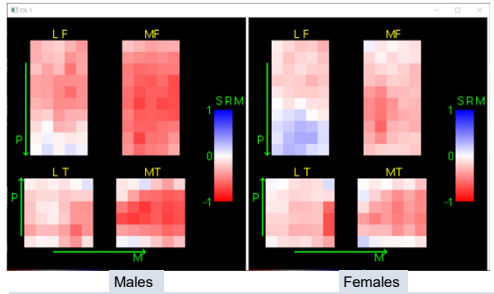

Figure 3b Age ≤ 60 yr. (N=220)

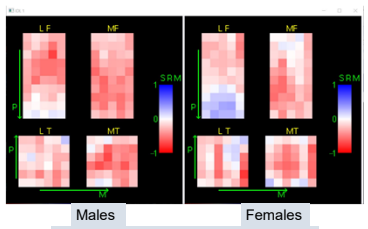

Figure 4a. KL=1 (N=118)

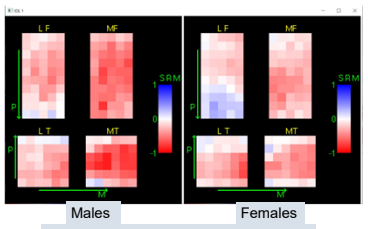

Figure 4b. KL=2 (N=241)

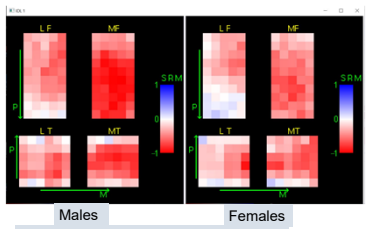

Figure 4c. KL=1 (N=121)

Discussion and Conclusion

- Heat maps of smaller subregions were capable of illustrating gender-specific differences in patterns of cartilage loss,
- We observed more focused thinning for females in the lateral/posterior portion of the MF and the medial side of the LT.
- An increase in cartilage volume in the posterior side of the LF sub-region was also observed for females.
- Some variation evident when stratifying by BMI, age, and KL score
- Heat maps may be useful in evaluating the benefit of interventions for KOA.
- Similar patterns were observed for other follow-up time points (not shown)

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jduryea@bwh.harvard.edu