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# Quantitative Magnetic Resonance Arthrography in Patients with FAI

**Alan Zhang MD**, Assistant Professor
Sports Medicine and Hip Arthroscopy

Michael Samaan PhD, Matthew Gallo, Benedikt Schwaiger MD, Thomas Link MD, PhD, Sharmila Majumdar MD, Richard Souza PT, PhD

UCSF
University of California
San Francisco

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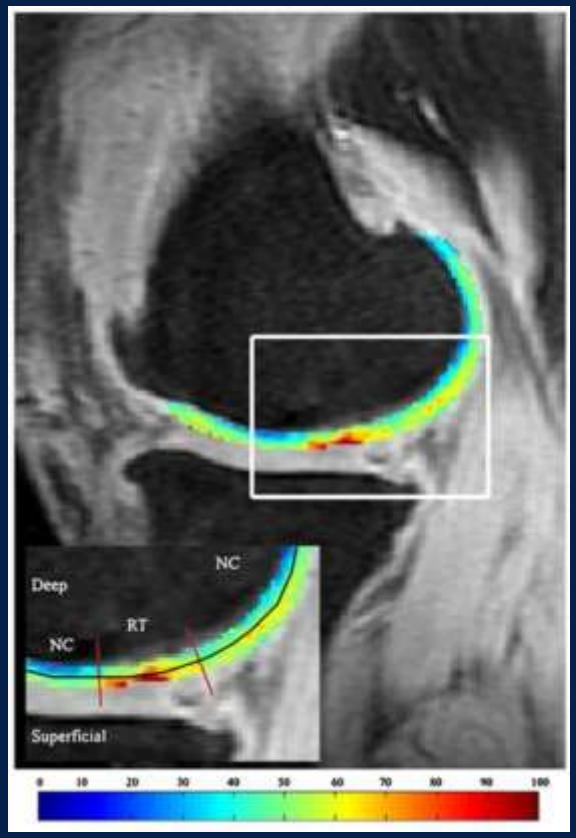
# Quantitative Cartilage Imaging

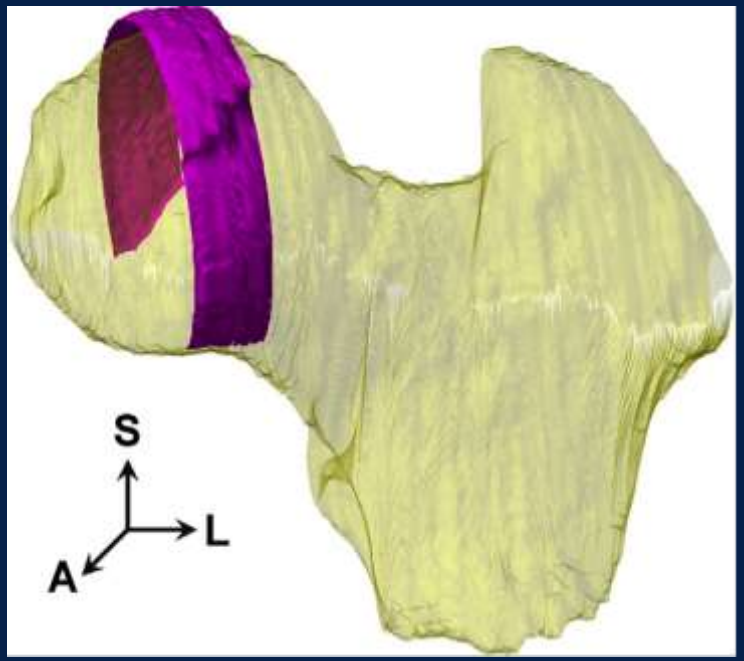
- Cartilage loss and OA symptoms are preceded by damage to the collagen-proteoglycan matrix
- Proteoglycan content increases while collagen content decreases during degeneration
- $T_{1\rho}$ and $T_2$ mapping are QMRI sequences used to probe proteoglycan content and collagen network integrity
  - Utilize variations in proteoglycan response to detect early cartilage injury




QMRI in the Knee

# Current State of Hip QMRI

- $T_{1\rho}$ and $T_2$ mapping of acetabulum and femoral head performed at UCSF
  - QMRI used in both healthy and FAI cohorts
  - Differences in femoral and acetabular cartilage composition in the anterior superior region of the hip for FAI patients
  - $T_{1\rho}$ also able to detect acetabular cartilage changes in FAI patients



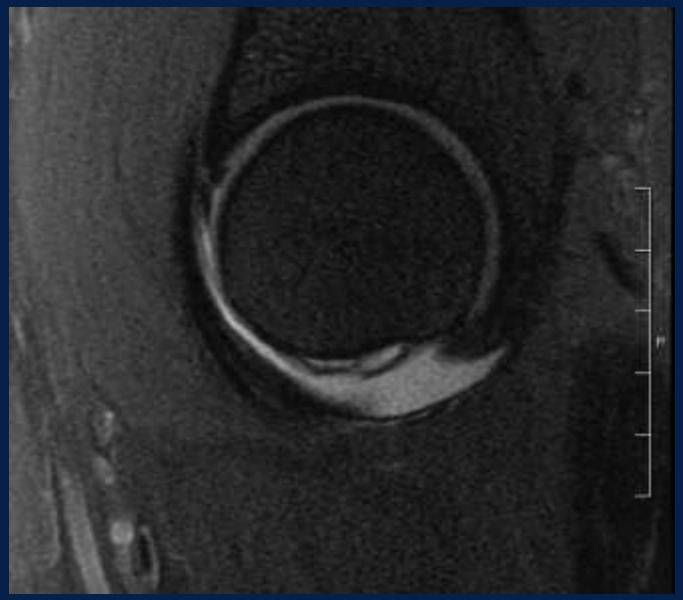
# MR Arthrography

- MR arthrography (MRA) is highly used in evaluating FAI pathology
- Intra-articular injection of gadolinium enhances MR ability to detect labral injury in the hip
  - Clinically valuable for localization of an intra-articular source for hip pain
- However, ability of MRA in assessing cartilage damage lacks sensitivity
- Use of QMRI in combination with contrast-based imaging in the hip joint is not well validated or understood

# Purpose

- Use of QMRI in combination with MRA may prove beneficial in assessing cartilage degeneration in FAI patients

- The purpose of this study was to compare $T_{1\rho}$ and $T_2$ values in an FAI population, using both MRA and MRI.



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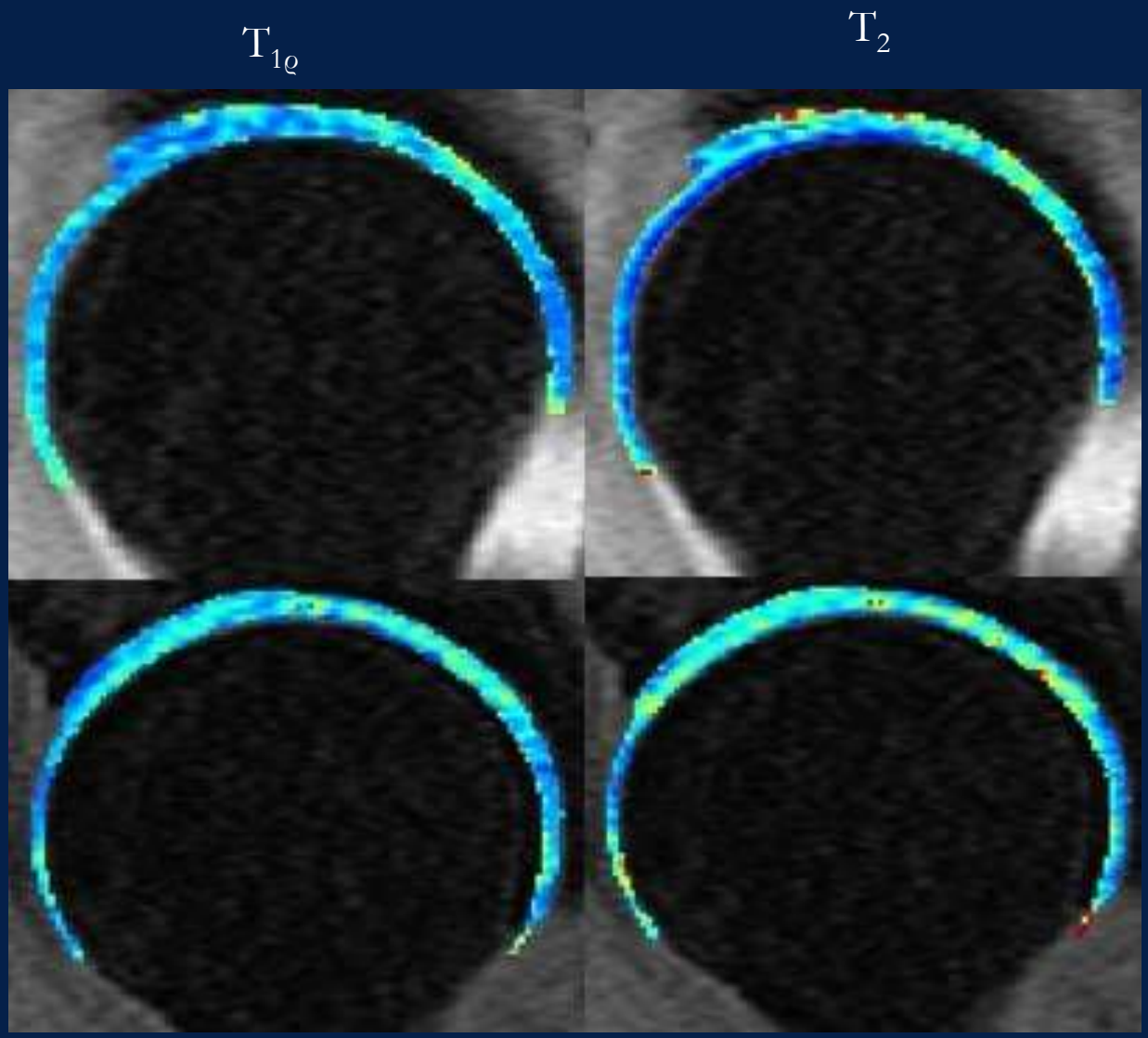
# Methods

- 10 FAI patients with hip pain presented for MRA of hip between 11/2014 and 8/2015.
  - 7 males, 3 females
  - Average age- 35, avg BMI-22
  - Avg Alpha angle- 58, avg LCEA- 34
- A combined $T_{1\rho}/T_2$ sequence was incorporated into sagittal plane scan in 3T scanner after arthrography
- Patients returned within 1 month to complete a standard QMRI of same hip without contrast for comparison

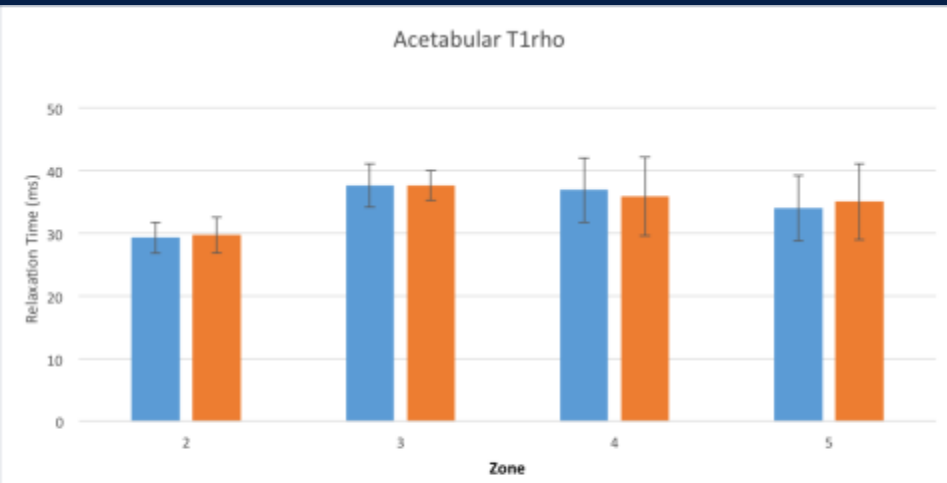
# Cartilage Segmentation/Quantification

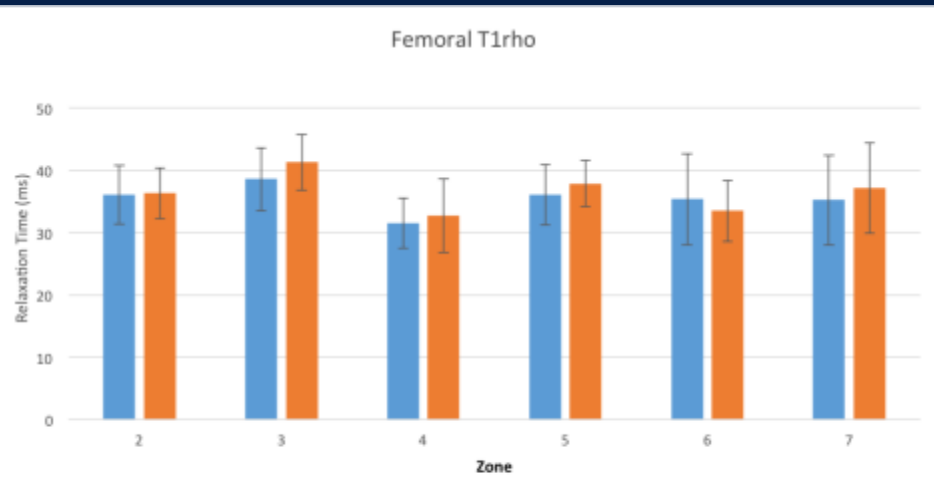
- Femoral and acetabular cartilage were segmented on the first echo of the $T_{1\rho}/T_2$ images
  - 4 slices near the center of the hip
  - Similar slices segmented in both the MRA and MRI
- Assessment of both global and sub-regional femoral and acetabular $T_{1\rho}/T_2$ values
- Agreement of $T_{1\rho}/T_2$ relaxation times in both the MRA and MRI were assessed using the Krippendorff's alpha coefficient and linear regression

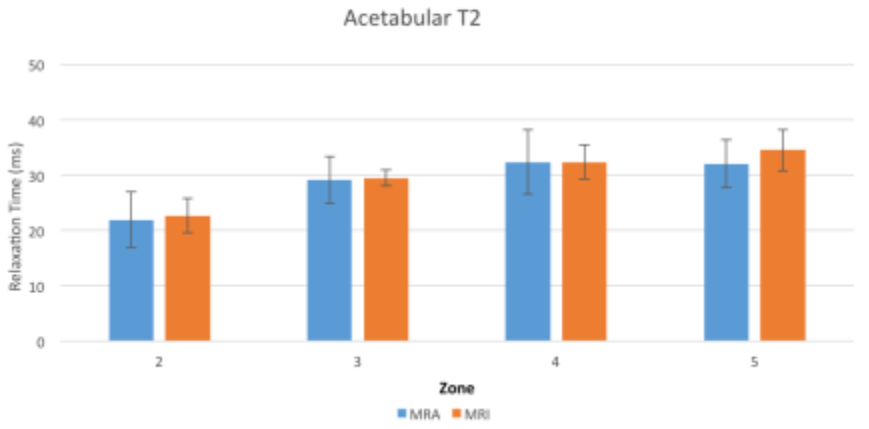
# Results

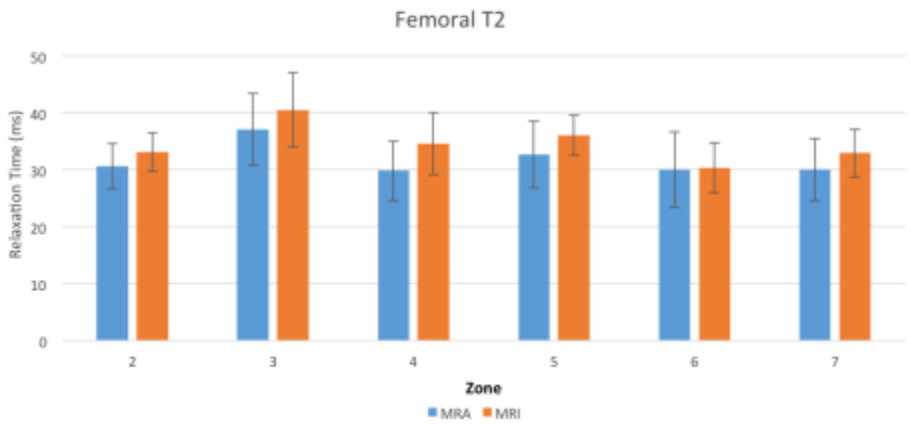


# Sub-region Relaxation Times

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# Results Summary

- All patients demonstrated elevated $T_{1\rho}/T_2$ relaxation times in the anterior-superior region of the femoral head and anterior-superior region of the acetabulum near the chondrolabral junction
  - Indicates early cartilage injury in these regions
- The average global and sub-regional $T_{1\rho}/T_2$ relaxation times in the acetabular and femoral cartilage layers demonstrated strong agreement, independent of intra-articular contrast
  - Krippendorff's alpha values of 0.83 – 0.97
  - Linear regression analysis slopes of 0.85 – 1.0

# Conclusion

- This study demonstrated the feasibility of $T_{1\rho}$ and $T_2$ mapping for use in MRA with FAI patients.
- The inclusion of $T_{1\rho}/T_2$ mapping in MRA provides a quantitative assessment of the effects of FAI on hip joint articular cartilage while allowing for detailed assessment of labral pathology with the use of intra-articular contrast.

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# References


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