

T2 Relaxation Time Variations in the Knees of Girls with JRA: The effect of side dominance.

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Introduction

The overall study was designed to evaluate the spatial variation of T2 relaxation times in axial patellar cartilage in healthy children and in children with juvenile rheumatoid arthritis (JRA). The data from girls, ages 5-11 years with JRA, was used to determine the spatial variation of T2 due to side dominance.

Materials and Methods

MR Images were obtained using a Bruker 3.0 T 30/60 MR system (Bruker BioSpin MRI GmbH, Ettlingen, Germany) using a 12-14 cm diameter Litz coil (Doty Scientific, Columbia, SC) or a home-built T/R wrap coil. Females, ages 5 to 11 years old with JRA, (n = 20) were imaged in the axial plane to obtain T2 relaxation time maps of the cartilage of the knee. In 8 of the girls, the knee that was imaged was the non-dominant knee or the knee that was used less frequently. The knee chosen for imaging was the more diseased knee as determined by a pediatric rheumatologist on clinical examination.

A multi-slice multi-echo (MSME) spin echo imaging technique was performed to calculate the T2 relaxation time maps. The axial images were acquired with repetition time (TR) of 1500 msec, echo time (TE) from 9 to 99 msec in 9 msec increments, 3 mm slice thickness, 1 mm gap, 12 x 12 cm field of view (FOV), 256 x 160 (read x phase) matrix, bandwidth of 71.43 kHz, for a total scan time of 4 min and 15 sec.

The region of interest (ROI) was defined by using CCHIPS (a semi-automated software program developed with IDL (RSI, Boulder, CO)) to define the patellar cartilage (1). Multiple profiles extending from the subchondral bone to the articular surface of the cartilage were generated. These profiles were averaged for all the patients in each group to obtain the average T2 values. The averaged T2 values were compared between the two groups using a two-sampled T-test.

Results and Discussion

The subject summary is given in the following table.

Type of knee scanned in females with JRA 5-11 years old	Total number of subjects	Total number of profiles	Average Age \pm sd
Dominant knee	12	1859	7.6 \pm 1.8
Non-dominant knee	8	1369	7.4 \pm 2.0

The spatial distribution of the T2 relaxation times is illustrated in Figure 1. The T2 relaxation time is significantly higher ($p < 0.001$) in the transitional and superficial zones of cartilage in the non-dominant knee. The spatial variation of T2 was not significantly different in the radial zone (the first 20% normalized distance). Figure 2 shows example T2 maps for a non-dominant and dominant knee. Similar results were implied in a recent study Kight et al. (1).

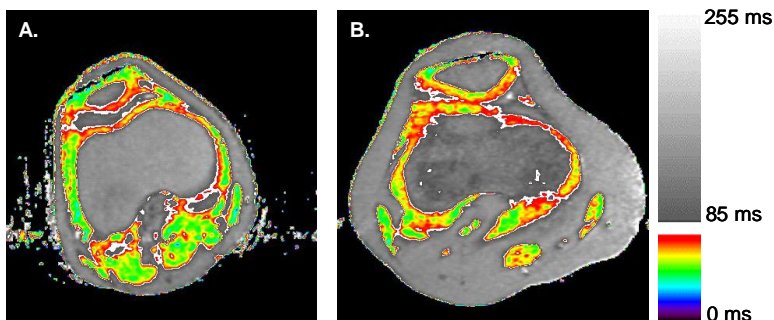


Figure 2: Example T2 relaxation time maps of the axial patellar cartilage. A. Non-dominant knee of a 5.8 yo girl. B. Dominant-knee of a 5.5 yo girl.

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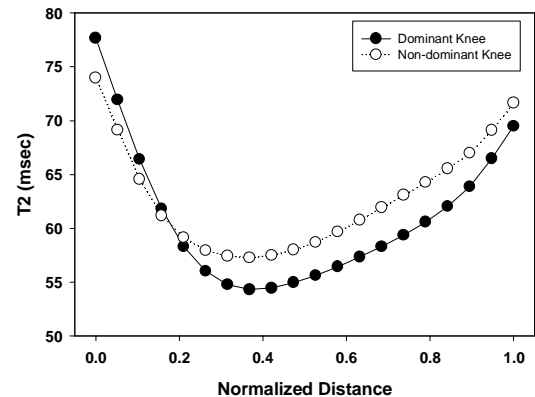


Figure 1: Average spatial variation of the T2 relaxation time of axial patellar cartilage in 12 dominant knees and in 8 non-dominant knees of girls. All children were diagnosed with JRA.

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Conclusion

The shape of the spatial variation of the T2 relaxation time between the two groups is maintained. The non-dominant knee has a higher T2 value than the dominant knee which might reflect the difference in water content and collagen orientation due to use. The effect of dominance on the T2 relaxation time spatial variations could not be determined for normal children since the knee that was imaged was always on the dominant side.

References

1. Kight et al., *Arthritis Rheum.* 2004 Mar;50(3):901-5.