INTRODUCTION
Past studies have documented the spatial T2 change of human patellar cartilage at 3.0 T (1). Cartilage sample plugs and in vivo studies have demonstrated an increasing T2 from the subchondral bone to the articular surface. This pattern is proportional to the known distribution of water content in cartilage and is inversely proportional to the distribution of proteoglycans (2). Previous studies have been limited to cartilage plugs or only a few spatial profiles drawn across in vivo cartilage (1). This study was designed to compare the spatial change of T2 in adult articular cartilage at both 1.5 T and 3.0 T.

Additionally, past studies have been limited to manually drawn individual profiles across the cartilage or isolated cartilage plugs (1,3). This study will generate an average profile from multiple computer-generated profiles within a region of interest (ROI) around the cartilage in multiple slices.

MATERIALS AND METHODS
The right knees of 6 adult male volunteers were included in this study. Low field imaging experiments were performed on a GE LX 1.5 T using a quadrature T/R Volume Coil (IGC Medical Advances Inc Milwaukee, WI 53226). The “high” field images were acquired on a Bruker Biospec 30/60 3.0 T imaging spectrometer (Bruker Instruments, Ettlingen, Germany) and a home-built 9 cm diameter surface coil placed over the patella.

Five axial images were obtained through the middle portion of the patella. Imaging parameters were as follows: TR of 1,500 msec, TE from 9 to 99 msec in 9-msec increments, 3-mm section thickness, 1.5 mm gap, 12 cm field of view, 256 x 160 (read x phase) matrix, two signals averaged, and total acquisition time of 8 min. The read encoding (frequency) axis was chosen in the anterior-to-posterior direction to minimize artifact secondary to the popliteal artery.

Images were analyzed using software that generated multiple profiles within an ROI outlining the patellar cartilage (IDL, Research Systems, Boulder, CO 80301). Three of the 5 images with the largest amount of patellar cartilage were selected and ROIs were drawn by the computer. The computer chose the border of the subchondral bone but the operator drew the articular surface border because the femoral cartilage had similar T2 values and was difficult for the computer to differentiate. The software then generated multiple profiles perpendicular to the subchondral bone towards the articular surface.

All of these profiles were averaged together for each volunteer at each magnetic field strength. Average profiles for all the 1.5 T studies and all the 3.0 T studies were generated and compared as a function of normalized distance.

RESULTS AND DISCUSSION
The 6 volunteers had an average age of 32 years ranging from 25 to 43 years. The 1.5 T study generated a total of 829 profiles with a mean of 138 profiles per volunteer. The average profile length was 3.12 ± 0.75 mm. The average profile resulted in a minimum of 39.7 ± 0.9 msec at 0.16 the normalized distance, and then monotonically increased to 50.1 ± 1.5 msec. Results are presented in Fig. 1.

Upon comparing the results from the two groups, T2 reaches a minimum at a normalized distance of 0.16. Deep within the cartilage from a normalized distance of 0.2 to 0.8 the T2 increases 2.82 msec/mm in the 1.5 T group and 2.62 msec/mm in the 3.0 T group.

CONCLUSIONS
This study documents a decrease in T2 near the subchondral before increasing monotonically towards the articular surface. Every effort was made to segment out this area of the ROI by the authors. To investigate chemical shift artifacts, the read direction was changed from A/P to R/L which yielded identical results.

In conclusion, studies investigating the variation of T2 within articular cartilage can be performed at 1.5 and 3.0 T static magnetic field strengths, yielding nearly identical T2 values and spatial variation. Additionally, as profiles are drawn from the subchondral bone towards the articular surface, there is a small portion of cartilage immediately adjacent to the bone that has a decreasing T2.