Methods: A 3D VTE sequence was developed which dynamically scales the length and amplitude of the phase and slice encode gradients to allow for acquisition of the minimum possible TE near the center of k-space (typically around 0.8-1ms when using partial k-space in the readout dimension). The echo time is then extended by 0.05ms increments as the position in k-space increases. Two echoes can be acquired within one TR due to a reverse readout gradient after the first echo. To obtain T2* maps of hip labrum, the left or right hip of 10 subjects were scanned with 2D T2-weighted FSE images. Comparisons between the first and last echo were used to distinguish labrum from the adjacent cartilage. A three parameter fit for T2* ($T2^*$) was calculated using in house software in Matlab (Mathworks, MA).

Results: The four echoes of an axial VTE slice from one volunteer with no visible labral tears is shown in Figure 1 to demonstrate the T2* decay of the labrum and the overall signal quality. T2* maps for the same subject are shown in Figure 2 compared to a slice from another volunteer with a labral tear visible in the VTE images. A plot of the signal across echoes along with the fit of the T2* in one pixel of the healthy volunteer is shown in Figure 2. The average T2* values for all ten of the volunteers were 3.70±0.58ms for the anterior labrum and 3.50±0.67ms for the posterior labrum. Three patients had a labral score of 0 for both labral sections while seven volunteers had a score of 2 in the anterior labrum and a score of 0 in the posterior labrum. No significant differences were found between the two groups. The mean values for the healthy volunteers were 3.68±0.16ms for anterior labrum and 3.25±0.89ms for posterior labrum. The mean values of the volunteers with a labral score > 0 were 3.71±0.70ms for anterior labrum and 3.60±0.60ms for posterior labrum.

Discussion: Figure 1 shows substantial signal decay in the labrum with all images maintaining good image quality and signal to noise ratio. The T2* relaxation values obtained in the labrum are similar to those of tendon or ligament (2-4ms [4]), which are fibrocartilagenous tissues with a similar composition to hip labrum. There were no correlations with clinical score, but the distribution and number of subjects may not be large enough to see differences. However, two of the higher T2* values were seen in subjects that were either recovering from a labral injury or had obvious tears in the images. Additionally, the mean T2* values were calculated for the entire anterior or superior labrum, whereas the clinical score was also divided by superior and inferior tears. Hence, sub-regional analysis of T2* may be needed to detect differences. The lack of significant difference between populations may demonstrate that even with a simple tear, the majority of the labrum may be healthy and functioning.

Conclusions: This study demonstrates the feasibility of VTE and T2* imaging of the hip labrum. Signal in the labrum was obtained with good signal to noise ratio and reasonable T2* values were calculated. While no correlations with clinical score were seen, this technique may allow for investigation into the nature of labral injury and the effect of injury on the biochemical nature of the labral tissue. Further work will be focused on the acquisition of additional subjects and correlation with specific areas of labral injury.