chondral plate thickness and trabecular bone parameters of the tibial epiphysis were calculated. At the end of the 12-week period, histological analysis was performed on the proximal tibias. Cartilage damage was scored and GAG loss was evaluated using safranin-O staining.

Results: The thickness of the medial and lateral subchondral plate already decreased from 3 weeks post-surgery in the OVX+IA group. At 12 weeks post-surgery, both medial and lateral subchondral plate thickness was significantly lower in the OVX+IA group than in the Sham+Saline, Sham+IA, and OVX+Saline groups. The trabecular bone parameters in the tibial epiphysis did not change in all groups.

Overall, the cartilage damage was very mild. In the OVX+IA group, the damage at the medial tibia plateau was mildly higher than in the other groups. The GAG depletion was higher in both Sham+IA and OVX+IA groups at the medial tibia plateau, but OVX did not strengthen the IA effect. Osteophytes were found in both Sham+IA and OVX+IA groups, mainly at the medial tibia plateau.

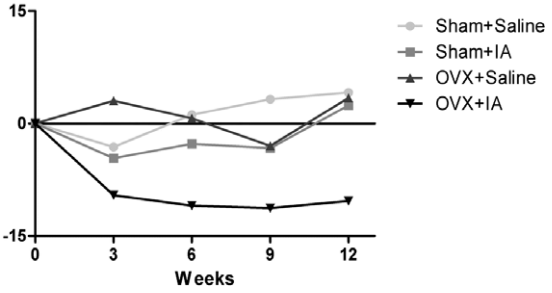

Figure 1. % Change in subchondral plate thickness.

Conclusions: In both the medial and lateral subchondral plate, the combination of IA and OVX lead to a decrease in thickness, whereas IA alone or OVX alone did not. This indicates that hormone depletion makes the subchondral bone plate more susceptible for thinning in a situation where cartilage damage is triggered by IA. The cartilage damage was very mild in all groups and occurred mainly at the medial tibia plateau. The bone changes did not seem to influence the cartilage damage.

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T1RHO RELAXATION EVALUATION OF KNEE OSTEOARTHRITIS IN A GUINEA PIG MODEL

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Purpose: T1rho-weighted imaging has shown promise as a diagnostic measure of early osteoarthritis. The T1rho relaxation time during a spin-locking pulse has enhanced sensitivity to the interaction between bulk water molecules and extracellular matrix macromolecules such as the proteoglycans in the articular cartilage. In this study, we evaluated the efficacy of T1rho MRI in determining the osteoarthritis changes in an animal model (Dunkin-Hartley guinea pig) of spontaneous osteoarthritis. Guinea pigs of young and old age groups (2.5 month and 9 month-old accordingly) are imaged with a T1rho MRI pulse sequence, and their cartilage T1rho values were measured at the femoral-tibial joint.

Methods: All animal-related experiments were reviewed and approved by our institute's animal use committee (IACUC). MRI was performed on the left knee joint of three 2.5-month-old and three 9-month-old guinea pigs on a Varian 9.4T horizontal-bore MRI scanner with a custom-built 2.5 cm diameter knee coil. Following localization of the joint with a standard gradient-echo protocol, a series of T1rho images were obtained in the coronal plane using a spin-lock prepared gradient-echo pulse sequence with the following parameters: TE/TR=8.04/1500ms, TSL (duration of spin-lock pulse)= 1, 10, 20, 30 and 40 ms, spin-lock frequency=1500Hz, slice thickness=1mm, FOV=3x3cm, Matrix=512x256. This protocol yields an in-plane resolution of 59x117 microns, with the highest resolution across the femoral-tibial cartilage. Cartilage was manually segmented from each image by simple thresholding of pixel intensities, and the cartilage signal was fitted to an exponentially decaying function in order to obtain T1rho values on a pixel-by-pixel basis.

Results: Figure 1 shows that the femoral-tibial cartilage from the old animal is thinner than that of the young animal and has elevated T1rho values. Indeed, the average T1rho is significantly greater ($p<0.025$) in the cartilage in all three 9-month animals compared to the three younger animals (Figure 2), suggesting that T1rho is directly related to the degree of cartilage degeneration in this model of spontaneous osteoarthritis.

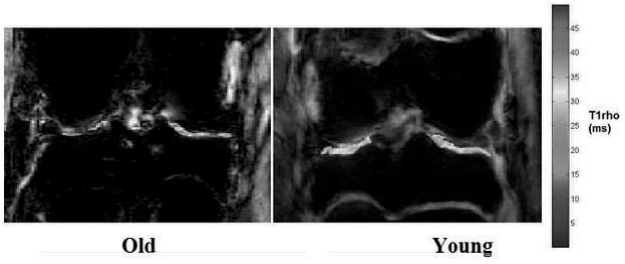

Figure 1. T1rho maps (in color) of articular cartilage overlaid on T1rho-weighted images (grayscale) of two representative guinea pig knees obtained *in vivo* with a pixel size of 59x117 microns in-plane resolution.

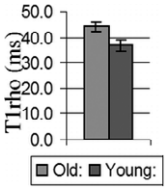

Figure 2. Average T1rho values and standard deviation bar.

Conclusions: T1rho is shown to be sensitive to knee osteoarthritis in this animal model. The protocol is sensitive to osteoarthritis cartilage degradation. In the future, we will use a 3D T1rho imaging protocol to image animals of multiple age groups. Although this result is preliminary, it nevertheless shows the feasibility of using T1rho MRI in conjunction with guinea pig model in evaluating potential therapies in longitudinal studies.

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DYNAMIC BONE HISTOMORPHOMETRIC ANALYSIS OF SUBCHONDRAL BONE CHANGES IN THE RAT MENISCAL TEAR MODEL OF OSTEOARTHRITIS

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Purpose: Osteoarthritis (OA) is a joint disease characterized by cartilage degradation, osteophyte formation, and changes to the subchondral bone. While rodent models of OA mimic the cartilage changes noted in the human condition, changes to the subchondral bone in these models have yet to be fully characterized. The purpose of the present study therefore was to characterize the subchondral bone changes using dynamic bone histomorphometry in the rat medial meniscectomy model of OA.