Dr. Kristoffer W. Dean
University of Nevada, Las Vegas

Aug 3rd, 9:00 AM - 12:00 PM

3d micro-mr and micro-ct models for determining in-vivo function in the Guinea Pig knee model of Osteoarthritis (OA)

Repository Citation
https://digitalscholarship.unlv.edu/cs_urop/2010/aug3/19

This Event is brought to you for free and open access by the Undergraduate Research at Digital Scholarship@UNLV. It has been accepted for inclusion in Undergraduate Research Opportunities Program (UROP) by an authorized administrator of Digital Scholarship@UNLV. For more information, please contact digitalscholarship@unlv.edu.
Osteoarthritis (OA) is a debilitating disease that affects an estimated 27 million adults in the United States. OA causes damage to cartilage in the joints resulting in bones that rub together. This creates pain, swelling, loss of motion of the joint, and bone spurs. As the number of adults above 65 grows (an estimated 72 million people by 2030) even more people will be at high risk for OA. It is the most common type of arthritis by far yet very little is known about it including relationships between joint structure and function.

In 2004, the NIH created the Osteoarthritis Initiative (OAI) which tracks participants for 5 years looking for physical signs that indicate changes in the joint cartilage [1]. Other research includes the creation of diagnostic tools to detect onset of the disease. Genetic studies search for ties between OA and gene mutations. This research involves the creation of accurate 3D models to determine the in-vivo function in the guinea pig knee model of osteoarthritis. These models will be created using a 3D imaging technique called X-Ray Reconstruction of Moving Morphology (XROMM).

**MICRO-MR**

Osteoarthritis is characterized by the degradation of the articular cartilage. For this reason it is vital to any osteoarthritis research to image the soft tissue in the joint area. Micro-MR scans are unable to image the soft tissue effectively and therefore the need arises to use micro-MR. The image below was taken using a Bruker 7T Biospec System at Nevada Cancer Institute. These images make possible the analysis of the tissue for any signs of osteoarthritis in the test subjects. Thickness of the articular cartilage can be analyzed as can the volume. In longitudinal studies this is invaluable to determine the progress of the disease. The image below is taken using a MSME-PD-T2 protocol which shows the articular cartilage in white (Figure 4). Adjacent to the articular cartilage you can see the subchondral bone in black.

**REFERENCES**


**SUMMARY**

Osteoarthritis is a debilitating disease that is increasing in occurrence as the mean population increases. This research project was based around helping to find a real solution to a real problem. Project goals were to determine necessary settings of micro-MR in order to be able to reproduce results in longitudinal studies. It was quickly realized that micro-MR would not work to create a 3D model of the joint but rather a combination of micro-MR and micro-CT. 3D renders of the imaging data were created and protocol written to create future renders of in-vivo knee scans. Data collection was completed on the first sets of force plate data and dual axis X-ray scans. Complete working models of the guinea pig knee model have yet to be completed however much progress has been made toward that end.

**ACKNOWLEDGMENTS**

Special thanks to:
Dr. David Lee, Associate Professor, UNLV-Laboratory of Comparative Biomechanics
Dr. Michael Gach, Director of the Research Imaging Facility at NVCI
Kevin Maillard, Lab Technician, Laboratory of Comparative Biomechanics
Theresa Schill, Lab Technician, Laboratory of Comparative Biomechanics
Radu Bolbos, Project consultant, ANIMAGE, Lyon, France

The project described was supported by NIH Grant Number P20 RR-016464 from the INBRE Program of the National Center for Research Resources