Karen Lindsay Troy, University of Illinois at Chicago

Introduction: Mechanical loading of bone stimulates an adaptive response that can result in localized bone apposition and resorption. The purpose of this study was to detect specific locations of bone apposition and resorption within the tibiae of mice using micro-CT, with the long-term goal of linking local remodeling activity with local mechanical conditions.

Methods: The left tibiae of sixteen female C57BL/6 mice aged 18 weeks were mechanically loaded to 8 N at a frequency of 0.5 Hz with a 15 second rest period between cycles, for 50 cycles per day, three days per week. Animals were divided into three loading groups: 3-day (8 mice), 7-day (4 mice) and 10-day (4 mice). DXA data were collected pre-loading and post-sacrifice. Micro-CT data were collected post-sacrifice.

Results and Discussion: Similar to our previous data, whole-bone BMC and stiffness in the 10-day group decreased by 1 mg and 12.7 N/mm respectively. The 3-day group had increased trabecular spacing in the loaded limb, while the 10-day group had decreased trabecular spacing and increased trabecular number. This suggests that trabecular resorption occurs immediately, followed by thickening and formation of additional trabeculae during the following week. The micro-CT data also suggest endosteal resorption in the 3-day group, but cortical thickening in the 10-day group. Future micro-finite element models may provide insight about the mechanical conditions that are experienced by osteocytes, and may provide a basis for understanding the sequence of biological events that occur immediately following the application of novel mechanical loads.