Echogenicity and Stiffness Changes of Healing Flexor Digitorum Profundus Tendons in Zone II: a Rabbit Model
Danielle Stoll, Sarah Duenwald-Kuehl, Nathan Blankenheim, Ellen Leiferman, Ray Vanderby Jr., Jonathan Tueting
Department of Orthopedics and Rehabilitation
University of Wisconsin Madison, WI

INTRODUCTION
Lacerations to flexor tendons can be debilitating and life altering. Surgical repair is often necessary, and proper rehabilitation is the key to regaining acceptable function. Early movement of the tendon postoperatively reduces the development of adhesions, but excessive movement can cause suture rupture. Acoustoelastic ultrasound (based on the theory of acoustoelasticity) provides a means to accurately evaluate the degree of healing and strength after surgical repair. Acoustoelasticity relates changes in wave propagation velocity and reflection coefficient to the mechanical state and properties of a material. This study investigates the use of acoustoelastic ultrasound to detect echo intensity and stiffness changes in healing rabbit tendons.

METHODS
The middle FDP tendon (left forepaw) of female New Zealand white rabbits (n=3) were transected in zone II. Each tendon was repaired with a modified Kessler stitch. Using a GE Logiq ultrasound (linear array transducer 12-RS) at 12 MHz, videos of the 3rd digit were obtained preoperatively and 1, 3, 5, 7 weeks post-operatively. During each video the digit was extended from a neutral position to initiate a small tendon stretch. The videos were processed in an image analysis program (Echosoft™, Echometrix, Madison, WI) to compute strain, stiffness, and changes in echo intensity in the healing tendon.

DISCUSSION
Compared to the normal tendons, healing tendons show a shorter and wider echo intensity curve indicating inhomogeneity in the tendon. As the tendon heals the curves become taller and narrower indicating increased homogeneity. After transection and repair, the normalized stiffness of the tendon falls with a given strain. As the tendon heals, the stiffness values for an applied strain increase suggesting returning strength to the tendon. Acoustoelastic ultrasound can therefore detect changes in tissue stiffness from echo intensity in healing FDP’s of the rabbit forepaw.

RESULTS

REFERENCES