Investigating the micromechanics of tendon

Problem
• Musculoskeletal conditions = 4th most common problem managed by GPs
• Tendinopathy (tendinitis and tendinosis) = disease of the tendon
• Caused by irregular strain patterns in the tendon

Tendon
• Soft connective tissue
• Transmits loads generated by muscle to bone
• Designed to support uniaxial tension
• Consists of water, collagen fibres, glycoproteins and tenocytes

Tendon healing
• Mechanical stimulus important in healing and development of tissue
• Mechanotransduction – cellular conversion of mechanical stimulus to chemical activity

Research Questions
• How does strain transfer from the tendon to the cellular level? i.e. what strain fields are produced?
• How do changes to the micromechanics affect the process of strain transfer?

Testing
• Strain tendon in the ex vivo and in situ environments
• Image tendon using Laser Scanning Confocal Microscope (ex vivo) and Arthroscope (in situ)
• Evaluate local vs. gross strain using cell tracking software in ImageJ
Hypotheses
1. Strain fields important to tissue homeostasis.
2. Diseased tendon has greater strain magnitudes at cellular level.
3. Replication of healthy strain fields during healing leads to improved clinical outcomes.
4. Replication of strain fields during tissue engineering leads to improved tendon development for surgical intervention.

Significance
Results will be used to:
• Develop tendinopathy models
• Improve design of preventative/rehabilitation techniques
• Improve bioreactor design for tissue engineering

References