SEMS: RESEARCH PROJECT DESCRIPTION

1. Project Background and Description

Tendon biomechanics and injury management: Novel clinical tools to detect, monitor and manage tendon injury

Tendon injuries are increasingly common, highly debilitating and very difficult to manage. Clinically, various physiotherapy exercise treatments have been proposed, but these have variable success, primarily as there is limited understanding of tendon injury itself, or the mechanisms by which treatments may be clinically effective. Recent trials demonstrate there are "responders" and "non-responders" to most treatments, highlighting the need to personalize treatment. However, successful implementation of personalized medicine necessitates improved approaches to characterize and diagnose tendon health and disease as well as monitor patients during rehabilitation.

Using in vitro experiments, our research group has recently identified a series of structural features that allow tendon to function in a healthy manner. This is important, as from these findings, we have shown how tendon injury develops, how local tendon mechanics are altered in injury, and also which specific local mechanical properties we can detect as indicators of increased injury risk. We are particularly excited, as this offers major opportunities to influence clinical management of tendon injury: detecting and monitoring these mechanical parameters in vivo, provides clinicians with tools to assess and categorize patients to optimize their rehabilitation.

With imaging experts, we have developed a novel ultrasound imaging approach, to detect the local tendon mechanics we have identified to occur with injury or in "at-risk" individuals. We now want to investigate these parameters in a range of tendinopathy patients, to develop optimal rehabilitation protocols for each individual from which we can develop clinical guidance on how to monitor and manage different groups of patients.

This project aims to investigate how local tendon strains vary at baseline in a range of tendinopathy patients, and follow patients through rehabilitation to establish how exercises which best return healthy tendon function and how to implement these in different patient groups.

2. Project Scope

1. Establish biomechanics & imaging protocols to detect local tendon strains in tendinopathic patients and identify how local mechanics is altered from healthy from healthy individuals

2. Follow patients through different clinical rehabilitation regimes, and develop a framework to determine best treatment approaches for different patient groups

3. Investigate how exercises can be used to manipulate local tendon mechanics and improve healthy tendon function, looking for optimal management strategies for preventing tendon injury in "at-risk" groups.

3. Desired Skills from the Student

This project is in the area of bioengineering and is multidisciplinary, so knowledge and skills are not expected in all areas.

Knowledge: An understanding of either of whole body biomechanics, or physiotherapy for musculoskeletal injuries is of benefit.

Research skills: Experience of carrying out in vivo whole body biomechanics experiments, analyzing mechanics data or working with human subjects is highly desirable.

A multidisciplinary supervision team has been brought together, to support each aspect of tendon mechanics, clinical biomechanics and medical imaging

4. Supervisory Team

The project will be based with Prof Screen's research group, working with other PhD students and PDRAs focused on tendon biomechanics. It will also bring together additional cross-sector supervision from SMD and external collaboration with the Institute of Cancer Research.

Main supervisor: Prof Hazel Screen (SEMS) h.r.c.screen@qmul.ac.uk. Tendon & tendinopathy expertise

Second supervisor: Prof Dylan Morrissey (SMD) d.morrissey@qmul.ac.uk. Clinical and translation expertise

Third Supervisor: Prof Jeffrey Bamber (Institute of Cancer Research) Jeff.Bamber@icr.ac.uk. Ultrasound imaging expertise