Ligament repair strain sensors: improving monitoring after ligament reconstruction surgery

Theme: Infection, Immunity & Repair
Reference: MRC19IIRBa Pegg

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To really understand how a reconstructed ligament is performing after surgical treatment, you need to be able to view the ligament directly and examine its performance during real-time motion. Currently that is not possible because the ligaments have low X-ray attenuation and cannot be distinguished from the surrounding tissue. Consequently, surgeons are reliant on indirect methods, such as manual manipulation of the joint and patient reported pain, which can result in misdiagnosis and limit refinement of surgical technique. Quantitative, reliable, non-subjective outcome measures are required for informed decision making.

This project will create novel polyethylene sutures for suture augmented ligament repair, which have radiopaque (X-ray visible) marker lines along the length; these lines will enable quantification of strain and suture position during real-time fluoroscopic imaging. The method used to make polyethylene radiopaque is unique to Dr Pegg's research group. Research to date has achieved radiopacity with bulk polyethylene components; for the first time this project will create radiopaque patterns on polyethylene.

The project will be in collaboration with orthopaedic surgeons and medical device manufacturers. This predominantly lab-based research will be split into three main work packages:
(WP1) will create radiopaque marker lines on polyethylene sutures and assess how accurately strain can be measured;
(WP2) will assess the mechanical and chemical properties of the material, and the durability of the sutures in terms of marker intensity with time, fatigue strength and creep resistance;
(WP3) will assess the biological safety of the treated polyethylene, and will involve testing in line with ISO 10933.

By the end of the project, the potential and clinical safety of the suture strain sensors will be known. Imaging of the sutures clinically using standard radiography will have been optimised, and the accuracy to which they can measure strain determined. Throughout the project, two medical companies will be kept updated on the progress: Arthrex and Zimmer-Biomet. Arthrex produce medical sutures, and Zimmer-Biomet produce synthetic ligament reconstruction products. The relationship with these industry partners will be crucial to the successful translation of the research. The final results from the project will be used to justify in vivo testing and to encourage financial industry support, with a view to gathering the case for clinical trials of the technology.

IMPORTANT: In order to apply for this project, you should apply using the DTP's online application form. https://cardiff.onlinesurveys.ac.uk/gw4-biomed-mrc-dtp-student-2019

More information on the application process may be found here:
http://www.gw4biomed.ac.uk/doctoral-students/

APPLICATIONS OPEN ON 24 SEPTEMBER AND CLOSE ON 23 NOVEMBER 2018.

You do NOT need to apply to the University of Bath at this stage – only those applicants who are successful in obtaining an offer of funding form the DTP will be required to submit an application to study at Bath.