

ALEX LEE-MEDLAND

PHD STUDENT | PROGRAM 1
ARC TRAINING CENTRE FOR JOINT BIOMECHANICS

PhD duration: April 2022 - April 2025

My interests: I'm interested in examining material properties with a focus on biological materials and pursuing a career in research.

Collaborators: [Herston Biofabrication Institute \(HBI\)](#)



BEng (QUT) BSc (QUT)

Supervisors:

Prof Peter Pivonka, Dr Edmund Pickering, Dr Cameron Brown, Adj. Prof. Ashish Gupta, Adj. Prof. Ken Cutbush & Dr Deniz Erbulut

PROJECT OVERVIEW

Project Title: Multi-modal assessment of humeral head bone quality with implications for shoulder arthroplasty

THE PROBLEM

There is a lack of investigation into bone quality when examining implant stability and success. This investigation will not only examine how mineralisation effects the quality and strength of the bone but also how bone quality may affect implant success. The bone quality will be examined with a variety of techniques and scanning methods to be as comprehensive as possible.

Why does bone quality require more research?

There are insufficient studies of bone quality focusing on other metrics of bone quality as most studies focus on structural metrics rather than biochemical and mechanical properties. As well as a limited number of studies of osteoporosis and its effects on bone quality in the humeral head and how osteoporosis treatments effect bone quality in the humeral head.

How can an increased understanding of bone quality help?

In Australia orthopaedic surgery is the third most common surgery with revision rates of typically 6% after 5 years and 12% after ten years. These revisions are often due to an issue with the implant/bone interface. By investigating the bone measures can be made to be able to examine the bone health and its ability to support the implant.

HYPOTHESIS

Changes in the mineralisation due to osteoporosis treatments will cause the tissue to become more mineralised but with a reduced strength. To address this question this PhD will investigate bone quality and how mineralisation alters the material properties of the bone.

PROJECT AIMS

1. Examine the quality of bone through a number of analysis techniques
2. Examine the effects of drug treatments for osteoporosis on the quality of bone
3. Draw inferences on how bone quality is connected to implant failure

OUR SOLUTION & EXPECTED OUTCOMES:

The expected outcome of this project is a method for the examination of bone quality of collected bone tissue. From this method a model would be able to be made to draw relationships between bone quality, osteoporosis treatment & implant failure.

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