PHD SCHOLARSHIP RECIPIENT

SEAMUS THOMSON

Seamus is a recent graduate of Mechanical (Biomedical) Engineering and Medical Science from the University of Sydney. He is passionate about the process of bone remodeling and the application of tissue engineering to solve many of the problems associated with current implant solutions. In 2014-15, Seamus completed an internship in the United States at the Institute of Materials Science where he investigated the substitution of different chemicals into synthetic bone scaffolds. His honours thesis, investigating the role of manganese and the bone remodeling process, won the VSSEC-NASA Australian Space Prize Category for Biology and Human Physiology. In addition to Seamus' research interests, he is a keen innovator of medical technology; his vascular-modelling team won the major prize in the Sydney Genesis Innovation Competition.

Research

A relatively new and increasingly popular strategy to overcome the shortcomings associated with orthopaedic cemented fixation is the application of osseointegration to load-bearing implants that are situated in osseous tissue. Osseointegration is defined as the direct structural and functional connection between ordered, living bone and the surface of a load-carrying implant. Osseointegrated implants eliminate many of the complications associated with socket-suspension prosthetics and are osteoconductive, unlike bone cement. These characteristics render osseointegtrated implants as suitable candidates for load-bearing environments, especially for amputee patients in that these implants can allow them to walk again. The Osseointegration Group of Australia Osseointegration Prosthetic Limb (OGAP-OPL) implant is appropriate in this context and can be used for above and below the knee amputees. It is directly implanted into the femur or tibia where appropriate and has many advantages when compared to other solutions for amputee patients.

It is important to appreciate that the overall success of osseointegrated implants are dependent on many key factors including: implant material properties, surface characteristics, biocompatibility, design elements, and surface coatings. Host factors also play important roles for the overall success and are usually patient-specific such as: the mechanical loading environment, inherent host biology, implant location, and local bone integrity. These factors for both implant and host present important considerations for the fine-tuning of this unique technology as well as its retention. Shortcomings of osseointegrated implant success appear when investigating two main areas of concern - infection and stress shielding – both of which are related to implant and host factors. Furthermore, current clinical knowledge is limited in context of longitudinal studies due to the novelty of this technology. Consequent to such, in order to further the development and application of osseointegration, it is crucial that extensive clinical research must be conducted. From this and current research, the study of new types of design elements and materials must also be investigated for their suitability of enhancing osseointegrated implants whilst addressing its areas of concern. The purpose of this course of study is to investigate two areas of research in relation to osseointegration: clinical and laboratory. The

goal of the clinical research is to contribute to the current understanding, development, and application of osseointegration. The goal of the laboratory component is geared towards improving the key aspects of osseointegration as well as solving its associated problems as described above.