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[Food & Health Services]

LINKS WITH CANADA BENEFIT PROSTHESIS RESEARCH

Colm O'Kane is a lecturer in the School of Manufacturing and Design Engineering and a member of the DIT Biomedical Device and Assistive Technology Research Group. He is currently engaged in PhD research in the field of knee prosthesis development, focused on developing optimised strategies for partial and total joint replacements used in treatment of osteoarthritis of the knee joint.

This summer, Colm travelled to Vancouver, Canada on a research scholarship sponsored by the CHC Helicopter Corporation and awarded by the Ireland Canada University Foundation (ICUF). This foundation awards annual scholarships for research visits between Ireland and Canada with the aspiration of fostering links between the two countries' research communities.

Colm's PhD work is based in the Bioengineering research group in University College Dublin, headed by Dr David FitzPatrick, Head of the School of Electrical, Electronic and Mechanical Engineering in UCD. His research area is the geometric morphology of the knee joint, examined through analysis of medical images. He aims to use computer models to develop more sophisticated sizing and shaping rationales for knee replacement components, which more closely conform to the variation in the population's joints than present approaches. This work is based primarily on computational modelling so the prospect of a research linkup with UBC, who have expertise in the complementary field of practical testing of cadaveric samples, was very attractive. While in Vancouver, Colm worked with the University of British Columbia's Orthopaedic Engineering Research group, which is headed up by Dr David Wilson. The visit began with Colm giving a talk for the UBC group on research work currently being undertaken in this area in both UCD and DIT.

I presented an overview of our research group's work to the Canadian researchers, and the subsequent discussion uncovered possible areas for future collaboration. I also undertook training for working in the university's anatomy laboratory and in the MRI facility.

He worked closely with Emily McWalter, a PhD student supervised by Dr Wilson, whose field of study is the examination of risk factors for the development of osteoarthritis, through determination of the contact area of the joint. She has previously worked on the development of an MRI based method for the investigation of contact areas and pressures at the patellofemoral joint. The project Colm and Emily worked on together was the validation of this method through cadaveric experiments.

A succession of human specimens were dissected and mounted in an MRI-safe rig. The joint was subjected to external loading and then dye was injected into the joint space. Upon opening the joint capsule, areas not penetrated by the dye showed contact between patellar and femoral cartilage. The patellar surface was scanned using a laser scanner to give a measure of the 3D area. A pressure measurement system was also used to give a quantitative measure of joint pressures.

Finally, the knee was MRI scanned under the same loading conditions in order to establish agreement between the dye-based and image-based contact areas. Research work was divided between the anatomy laboratory (for dissection of the specimens), the biomechanics laboratory (for dye-based contact analysis), and the 3-Tesla MRI suite at Vancouver General Hospital (for MRI scanning of loaded specimens). The variety of the work ensured Colm got experience in a number of areas.

I gained invaluable experience in preparation and testing of specimens and I also worked on analysis and manipulation of the MRI and laser scanned data in order to give accurate and repeatable measurements for surface contact area.

Provisional results from the work show excellent correlation between the measurement methods and it is hoped that the MRI-based contact analysis method can be rolled out for patients, giving surgeons another tool for early identification of indicators for knee joint arthritis and other issues. Back in DIT, Colm plans to develop his research into the relationship between knee component shape and function and the prospect of developing statistical models to enable more effective diagnosis of joint-related conditions. He will also consult with surgeons in Dublin's Mater Hospital to compare knee replacement procedures here to the Canadian approach. He sees the UBC visit as a key step in the process of identifying the core research questions for his work.

I am very grateful to the board and sponsors of the ICUF for giving me the opportunity to undertake this research visit and to the UBC research group for hosting the visit. Through this work I have gained experience which will be invaluable to my PhD work and also made valuable contacts with academics in Canada which will hopefully form the basis for fruitful collaboration in years to come. The expertise gained in this visit has been instrumental in the development of my research.

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