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**BASc (Mechanical Engineering), University of Waterloo, 2003**

**MASc (Biomedical Engineering), Dalhousie University, 2005**

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**TITLE OF THESIS:** IMPLANT FIXATION: THE INFLUENCE OF PATIENT AND IMPLANT CHARACTERISTICS IN TOTAL KNEE ARTHROPLASTY

**TIME/DATE:** 9:00 am, Friday, January 5, 2018

**PLACE:** Room 3107, The Mona Campbell Building, 1459 LeMarchant Street

**EXAMINING COMMITTEE:**

Dr. Maiken Stilling, Department of Clinical Medicine, Aarhus University (External Examiner)

Dr. Michael Dunbar, Department of Surgery, Dalhousie University (Reader)

Dr. Joanna Mills Flemming, Department of Mathematics and Statistics, Dalhousie University (Reader)

Dr. Mark Filiaggi, Department of Applied Oral Sciences, Dalhousie University (Reader)

Dr. Janie Astephen Wilson, School of Biomedical Engineering, Dalhousie University (Supervisor)

**DEPARTMENTAL REPRESENTATIVE:** Dr. Robert Adamson, School of Biomedical Engineering, Dalhousie University

**CHAIR:** Dr. John Archibald, PhD Defence Panel, Faculty of Graduate Studies

**ABSTRACT**

Implant fixation following total knee arthroplasty (TKA) can be evaluated by quantifying the motion of the implant components relative to the underlying bone. Radiostereometric analysis (RSA) is a stereo imaging technique that permits high-resolution measurement of these motions. The overall aim of this thesis was to examine the influence of patient and implant factors on tibial component migration and inducible displacement in a dataset of 418 primary TKAs.

In the first study, migration patterns of cemented and uncemented components were compared. While uncemented components had significantly higher one-year migration, they achieved equivalent stability between one and two years post-operatively, suggesting that an initial settling period does not compromise long-term fixation.

In the second study, longitudinal data analysis methods were used to investigate the influence of implant factors (fixation, tibial component area), and patient characteristics (age, sex, body mass index, smoking status) on tibial component migration. Uncemented components had higher magnitudes of migration in the first two post-operative years. Analyzing uncemented components separately by sex revealed female smokers had higher migration magnitudes but male smokers had lower migration compared to non-smokers, although there were relatively small proportions of smokers. Increasing age, especially above age 60 in female patients with uncemented components was associated with higher migration. For cemented components, tibial component area was significant, with larger sizes associated with greater migration in female patients.

The third study investigated the utility of inducible displacements over ten years of follow-up from loaded single leg stance RSA exams. Inducible displacement was significantly different for cemented and uncemented components, but not sensitive to patient factors. Uncemented components demonstrated higher early inducible displacement within the first three post-operative years, but lower late inducible displacement at ten years compared to cemented implants. The correlation between migration and inducible displacement was greatest for uncemented components in the first year. Inducible displacements were significantly higher for continuous migrators.

The overall findings support the use of uncemented fixation of tibial components in TKA and revealed differences in female and male patients. In addition to migration, inducible displacements have significant potential to evaluate implant fixation, especially as an early screening tool.