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**Biomechanical characteristics of independent walking
in unilateral transfemoral prosthesis users**

by

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Abstract

Currently, lower limb loss affects millions of people worldwide, and is considered as a serious bodily impairment that can limit an individual's functional mobility. In particular, transfemoral prosthesis users (TFPUs) have more difficulty regaining independent ambulation compared to transtibial and foot prosthesis users. Because mobility is essential to a satisfactory quality of life for TFPUs, regaining the ability to walk is a primary rehabilitation goal after lower limb amputation. Therefore, the specific aim of this dissertation was to investigate the biomechanical characteristics of independent walking in unilateral TFPUs. Understanding these characteristics may provide insights into the improvement and evaluation of lower limb prosthesis design parameters and effective gait rehabilitation to resume independent walking. In this thesis, we focus on four areas; the balance of mediolateral ground reaction force, the lower limb joint kinematics and kinetics, the risk of prosthetic knee buckling, and whole-body angular momentum. **Chapter 2** presents the strategies of mediolateral ground reaction force generation adopted by unilateral TFPUs walking along a straight path. **Chapter 3 and 4** studied the lower limb joint kinematics and kinetics to enhance our understanding of the joint control, muscular effort, and the risk of the prosthetic knee buckling. Finally, **Chapter 5** investigates the whole-body dynamic balance by quantifying the whole-body angular momentum with segment contributions. These biomechanical analyses each expand our understanding of the underlying neuromechanical principle and control mechanism of bipedal locomotion in unilateral TFPUs, and indicate pathways toward the role of the prosthesis design and rehabilitation process to achieve independent walking.