

## HIP AND KNEE JOINT MOMENT ANALYSIS DURING OBSTACLE CROSSING IN PATIENTS WITH UNILATERAL TOTAL KNEE REPLACEMENT

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### INTRODUCTION

Total knee replacement (TKR) may be the best choice for improvement of the quality of life as the severity of knee osteoarthritis is progressing. Many clinical studies have examined the differences in kinematics during locomotion, such as level walking and stair climbing, and their results have been controversial [1,2]. Stepping over obstacles is a non-stereotyped, functional task which the elderly may encounter on their activities of daily living. For performing the task safely, the person will need good postural control, providing by good lower limb strength and coordination, and proper joint proprioception. Reduced proprioceptive sensory feedback, muscle strength or balance may disturb balance control. Such a mechanism may allow acceleration of degenerative joint conditions, and may account for the increased prevalence of falls seen in elderly subjects. According to Saari et al [1], hip extension tended to decrease, and decreased hip extension moment was noted in TKR patients during stair climbing. The purpose of this study was to investigate the kinetics of lower limb in patients with unilateral TKR during obstacle crossing, the more physical demanded daily activity and the relationship between moment and muscle strength.

### METHODS

Ten subjects with average age of 68 years old receiving primary unilateral TKR participated in this study. The posterior cruciate ligament was retained in knees with 5° or less varus/valgus alignment. Motion analysis was done between half and one year after surgery. Eleven healthy, age-matched elderly were recruited to the control group. Each subject was instructed to walk on level and to cross obstacle. Seven digital cameras (Vicon, Oxford Metrics, U.K.) synchronized with 2 force plates (AMTI, U.S.A.) were connected to the motion system to provide 3D kinetic and kinematic data during obstacle crossing. The height of obstacle was 20 cm, chosen for the relevance to daily activities, equal to the height of non-standard curb or doorstep. The average peak values of hip and knee joint moments during stance phase were measured. Moments were normalized by dividing body mass and leg length to reduce intersubject variability. Isokinetic concentric strength of hip flexor and extensor and isometric strength of knee flexor and extensor were collected at the same session.

Nonparametric tests were used as the distribution material was skewed. For kinetic data, Kruskal-Wallis one-way analysis of variance by ranks was used for group difference (operated side, non-operated side and control group). Spearman correlation coefficients were introduced to evaluate association between joint moment and isokinetic concentric muscle strength. Statistical differences were defined as significant at the  $\alpha = 0.05$  level.

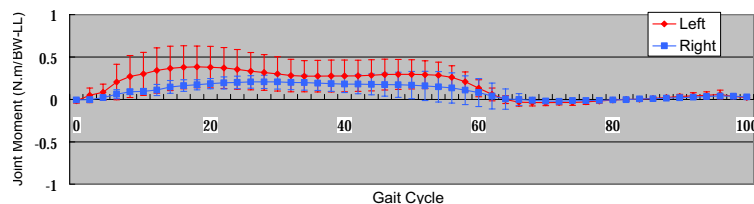


Figure 1: The knee adduction moment of right TKR (subject 8)

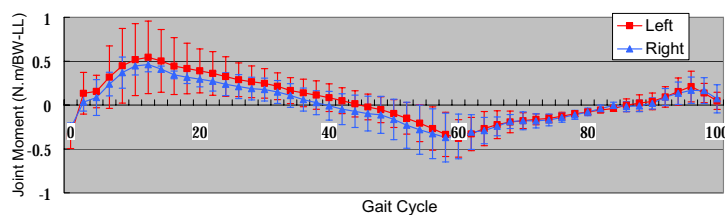


Figure 2: The hip adduction moment of right TKR (subject 8)

### RESULTS AND DISCUSSION

The first peak adduction moment of knee joint at the non-operated leg was higher than the contralateral side of the TKR group (Fig. 1). The difference between the non-operated leg and control group was not significant. The peak hip extension moment of non-operated extremities was higher than the operated side (Fig. 2). The hip joint moment was correlated with isokinetic hip extensor strength significantly.

Decreased hip extension moment may reflect a need to stabilize the lower leg in the beginning of stance. Higher knee adduction moment has been suggested as an indicator of static varus knee alignment [2]. Obstacle crossing could be sensitive to frontal plane movement of hip joint.

### CONCLUSIONS

Objective gait analysis assists for evaluation of the functional recovery and musculoskeletal deficiency after TKR. Hip adduction moment of the limb may be an indicator of medial knee compartment loading. Decreased hip extensor may influence the stability of knee joint. For patients with TKR, rehabilitation after surgery should focus not only on the gain of range of motion but also on of the strength training of knee joint as well as hip joint.

### REFERENCES

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