LOWER EXTREMITY JOINT TORQUE OF TAI CHI GAIT – A PILOT STUDY

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INTRODUCTION: Tai Chi is becoming popular among people of all age groups. Although a number of studies have reported the effect of Tai Chi practice on physical fitness [1], the evidence from biomechanical aspect has not been researched sufficiently. To interpret its effect, such as balance and muscle strength, biomechanical information is important. Therefore, the purpose of this study was to obtain information on the biomechanical characteristics of Tai Chi gait (TCG). In this study, TCG was compared to normal walking (NW) to characterize it.

METHOD: Three healthy young adult men (23.0 ± 2.6 yrs, 1.70 ± 0.02 m, 58.3 ± 3.5 kg experienced for 2.5 ± 1.3 years in Yang style Tai Chi) participated in this study. Subjects were asked to perform TCG and NW at moderate speed. Kinematics and ground reaction force of the right leg were measured by a motion capture system (MAC3D, Motion Analysis, USA) and force platform (AMTI, USA). Three dimensional muscle torques during stance phase were calculated using inverse dynamics (Winter, 2004). Each variable was separately compared with paired t-test (SPSS Ver.14.0).

Table 1. Stride characteristics

Variable	TCG	NW
Swing phase [s]	1.92 ± 0.48	0.43 ± 0.02 ‡
Stance phase [s]	19.04 ± 2.34	0.70 ± 0.04 ‡
Step length [m]	0.84 ± 0.20	1.50 ± 0.05 ‡

Values are means ± SD. †: p<0.1, ‡: p<0.05.

Tabel 2. Peak values of joint torque

Variable	TCG	NW
Hip flx	24.5 ± 6.0	37.4 ± 4.9
Hip ext	60.6 ± 5.2	82.1 ± 26.4
Hip add	24.5 ± 4.1	3.0 ± 2.9 ‡
Hip abd	42.4 ± 12.7	64.1 ± 5.8 ‡
Knee flx	9.8 ± 10.9	30.4 ± 13.0
Knee ext	44.1 ± 5.3	18.8 ± 13.2 †
Ankle drs flx	7.9 ± 2.5	12.9 ± 4.5
Ankle plnt flx	29.3 ± 7.9	38.9 ± 3.0 ‡
Ankle add	52.5 ± 11.4	18.7 ± 8.2 ‡
Ankle abd	4.2 ± 0.8	0.3 ± 0.2 ‡

Values are means ± SD in Nm.
†: p<0.1, ‡: p<0.05.

RESULTS AND DISCUSSION: Swing and stance phase during TCG were longer than NW, and step length was shorter (Table 1). In TCG, extension torque at the knee joint and adduction torque at the hip and ankle joint were greater than those of NW, whereas hip abduction torque and ankle plantar flexion torque were smaller (Table 2). Because, in TCG, sway direction for single support phase was obliquely forward and lateralward to total traveling direction, adduction torque at the hip and ankle joint would be required rather to maintain lateral movement and balance than NW. Lateral balance is important not to fall, and long term Tai Chi practitioners have better balance than non-practitioners [1]; therefore, it is suggested that joint torque in lateral direction during TCG is effective for balance improvement. Then, the subjects performed TCG in half crouching posture, so the larger knee extension torque would be induced than NW. It is also suggested that long term Tai Chi exercise strengths knee extensors. These results could give further biomechanical explanation to the effects of Tai Chi exercise.

CONCLUSION: The biomechanical description of Tai Chi gait is important for understanding its effect, such as balance and strength.

REFERENCES:

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