SYMMETRY AND ASYMMETRY IN THE LOWER LIMBS OF ATHLETES DURING GAIT

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INTRODUCTION

Gait analysis is an effective tool for evaluating and quantifying effects of a surgical intervention or rehabilitation on a patient's gait (Schutte et all., 2000). Although gait symmetry has often been assumed to simplify data collection and analysis (Heydar et all., 2000), asymmetry of the lower limbs will be an indication for a risk of abnormality in the physical function. The similar idea may be applied to gait analysis for athletes who suffered from various injuries of the lower limbs. The symmetry-asymmetry analysis in athlete's gait will provide us with useful information to precaution and prevent from serious injuries which may be induced by the asymmetry in the lower limbs. Therefore, investigating symmetry and asymmetry in the lower limbs of athletes has a special significance. The purpose of this study was to investigate gait pattern of uninjured and injured athletes to determine symmetry and asymmetry in the lower limbs.

METHODS

The gait of 8 injured athletes (age 20.3±2.3 yrs) and 10 uninjured athletes (age 19.2±0.8 yrs) from a university track club was analyzed. After the explanation of the procedure and safety of the experiment, informed consent was obtained from the subjects. Three-dimensional coordinates of 47 reflective markers attached to the subjects were obtained with an optical motion measurement system (VICON 612) with eight cameras operating at 120Hz, which was synchronized with two KISTLER force platforms. Subjects were asked to walk in barefoot at a self-selected speed on the laboratory floor under which the force platforms were mounted.

Kinematics and force platform data were used to estimate the joint torque and joint torque power at the hip, knee and ankle of the lower extremities during the stance phase by an inverse dynamic approach. Asymmetry index of the lower limbs was calculated for gait descriptors such as step length by the following equation.

$$AI = | \text{Right} - \text{Left} | * 100 / (\text{Right} + \text{Left}) / 2$$

ANOVA was used to test differences in gait descriptors and asymmetry index (AI) between two groups with significant level of 0.05.

RESULTS AND DISCUSSION

Table 1 shows mean and standard deviation of AI. Although there was no significant differences in AIs of gait descriptors such step length (SL), step frequency (SF)
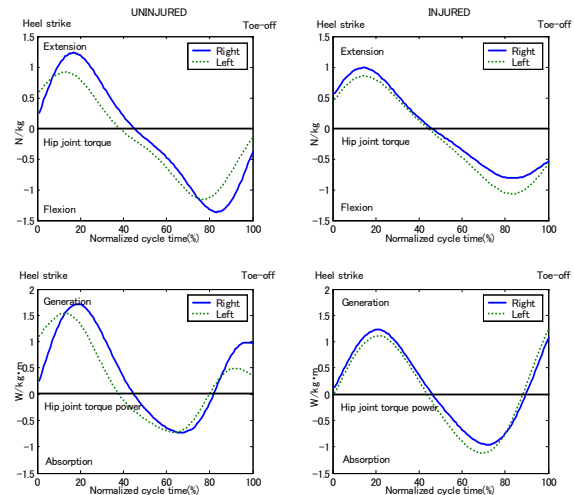

Figure 1: The hip joint torque and torque power for an uninjured and an injured athlete

and so forth, AI of SL and walking ratio(SL/SF) tended to be larger in the uninjured athletes than those of the injured athletes. The AI of double support time for the injured athletes was significantly larger than the uninjured athletes. Smaller AI of gait descriptors for the uninjured athletes was expected, but the results indicated that this hypothesis was not accepted, except for double support time which was a symptom of the asymmetry for the injured athletes.

Figure 1 shows hip joint torque and torque power patterns for the uninjured and injured athletes. The peak torque and torque power of the right hip for the uninjured athlete were greater than that of the injured athlete. However, no big difference was observed in the joint torque of the left leg between two athletes. This may be interpreted as an over-exertion of the torque and power at the right hip joint of the uninjured athlete because he could cancel out the asymmetry in joint kinetics through his adaptability. It is speculated from these results that injured athletes might change the gait pattern involuntarily not so as to be beyond the range of control, while uninjured athletes could control their gait pattern over their asymmetry in the lower limbs by the uninjured physical function. The other possible reason for the asymmetry of uninjured athletes may be laterality in their leg which is used as take-off leg and so forth.

REFERENCES

1. Schutte L.M, et al. *Gait and Posture* 11, 25-31, 20

Table 1: Asymmetry indexes for the athletes
*: P<0.05

	step length(%)	step frequency(%)	walking ratio(%)	STT(%)	SWT(%)	SST(%)	DST(%)
uninjured	17.9±9.4	4.8±3.0	24.2±14.4	1.9±1.9	8.9±6.3	6.1±4.5	0.08±0.01*
injured	9.2±8.0	4.7±5.4	19.2±18.3	3.6±4.8	4.4±6.8	4.4±6.8	0.1±0.02*