THE MOTION ANALYSIS OF WALK ON RACE WALKING PLAYERS

Yoshinori Takeuchi, Yoshinari Oka, Tatsuya Nishimura*, Kenji Kawabata*, Kengo Sasaki*, Ami Ushizu*, Yu Nakashima and Hiroh Yamamoto

Biomechanics Lab., Fac. of Ed., Kanazawa Univ., Kanazawa, Japan
***Biomechanics Lab., Graduate School of Ed., Kanazawa Univ., Kanazawa, Japan**

The purpose of this study was to determine what characteristic race walking players have in their daily walking motion. The healthy four female race waking players and healthy four female university students were determined as subjects in this study. The 13m walking road was set. Each group conducted three Normal Walking trials (NW) and three Brisk Walking trials (BW). After that, the Race Walking group conducted three Race Walking trials (RW). The 3D motion analysis system (Frame Dias□ver.3.0 for windows) was used to calculate parameters. As to NW knee segment parameters, the maximum knee extension angle, range of motion and average knee angles of race walking group were significantly different from that of control group ($p<0.05$). The most important discovery of this study was that race walking player's daily walking motion was influenced by their race walking characteristic.

Key Words: Motion Analysis, Race Walking

INTRODUCTION: The walking motion of race walking in track and field is greatly-different from that of daily walking. So, we think that race walking players maintain their race walking characteristics in daily walking motion. However, there are no reports that investigate biomechanics difference of normal walking motion between race walking players and general people. The purpose of this study was to determine what characteristic race walking players have in their daily walking motion.

METHODS: Subjects: The subject of this study were healthy four female race waking players (Race Walking group : W) and healthy four female university student (Control group : C). Informed consent was obtained from all subjects.
Design: The 13m walking load was set. The Race Walking and Control group conducted three Normal Walking trials (NW) and three Brisk Walking trials (BW). After that, the Race Walking group was conducted three Race Walking trials (RW).
Data Collection: The definition of calculated these kinematics parameter were shown Figure 1-3. Observed from above, as to the θ3, left ASIS was regarded as plus when it goes forward. Observed from forward, as to the θ4, when horizontal ASIS was horizontal against ground, it was regarded as standard. In addition, condition that it turns down for left side was defined as plus. The definition of kinematics parameter was shown Table 1. Reflection markers were attached on C7, right and left shoulder, ASIS, knee, foot, heel and toe (M5) for calculation of parameter. The 3D motion analysis system (Frame Dias□ver.3.0 for windows) was used to calculate parameters. The synchronized four video cameras were used to record motion.

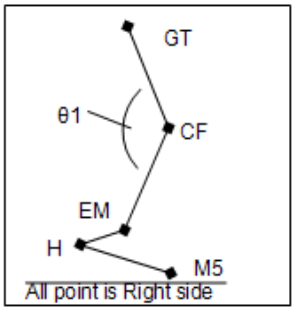

Figure 1: Knee angle

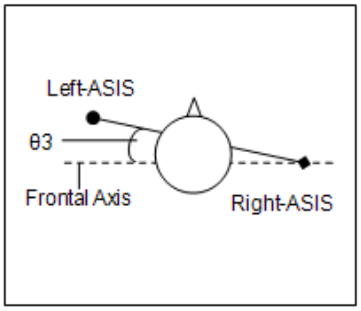

Figure 2: Pelvis revolution

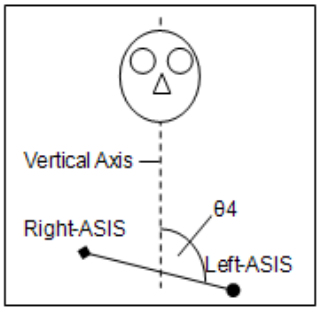

Figure 3: Pelvis tilt angle

Table 1: Define Kinematics parameters

Parameters	Define
Maximum Knee Extension Angle Maximum Knee Flexion Angle Range of Knee Motion Average Knee Angler	Maximum θ1 Minimum θ1 Maximum θ1- Minimum θ1 Average θ1 in 1 cycle
Range of pelvis revolution	|Maximum θ3 |□|Minimum θ3|
Maximum pelvis left tilt angle Maximum pelvis right tilt angle Range of pelvis tilt angle Average pelvis tilt angle	Maximum θ4 Minimum θ4 Maximum θ4-Mimimum θ4 Average θ4 in 1 cycle

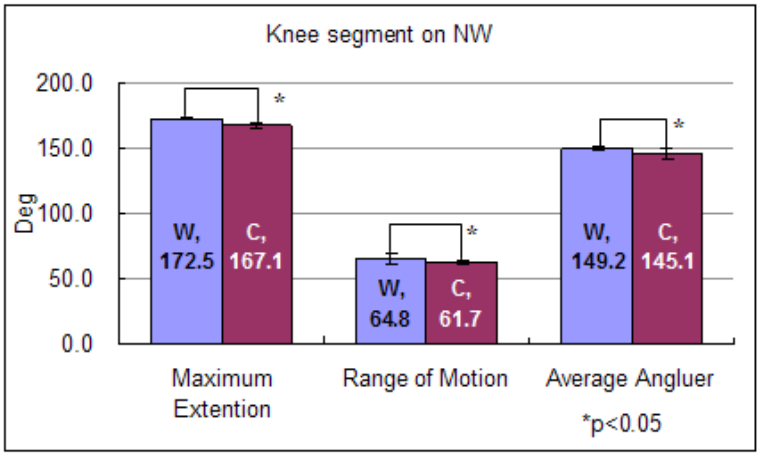

Figure 4: Knee segment parameters

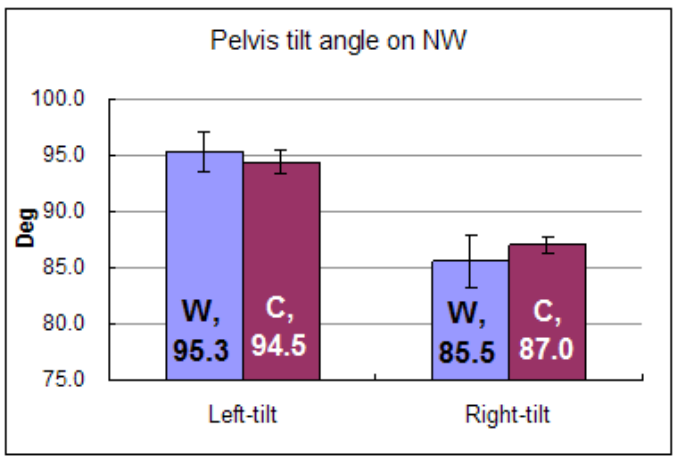

Figure 5: Pelvis parameters

Data Analysis: Paired t-test was used to determine differences between conditions. Significant level was set at 5%.

RESULTS: The results of comparing Race walking and Control group on Normal Walk were shown Figure4-6.
As to knee segment parameters (Fig.4), the maximum knee extension angle, range of motion and average knee angles were significantly different between race walking and control group ($p<0.05$). And the race walking group was wider than control group.
As to pelvis, left and right tilt angles were not significantly different between race walking and control group (Fig. 5). The pelvis tilt range of angles was significant different between race walking group and control group (Fig. 6). And the race walking group was wider than control group.

DISCUSSION: The subjects of race walking group who were trained as specialist of race walking tends to extend overly in 1 cycle walking in normal walking compared to control group. And, race walking group tended to tilt left and right pelvis deeper than that of control group, when race walking group walk BW. The race walking players who are subject of this study walked with their knee and pelvis mainly used at normal walking that is never fast. It is speculated that their walking way was reflected by their walking motion. The W subjects who were trained as race walking specialist, in both NW and BW compared to C, tended to extend knee widely to make their motional range wide. In addition, race walking group tilted pelvis wider than that of control group from when race walking group walk by 1.4(m/s). And, they convoluted their pelvis more actively when they walk by 2.0(m/s).

CONCLUSION: In this study, female university race waking players were mainly determined, but we never focused on the number of subjects. At further study, the larger numbers of subjects need to be determined including high school student and civilians. Sexual distinction needs to be considered and data of this study need to be compared to that of male race walking players. Finally, in further study, side motion like inversion and extroversion needs to be considered because, in this study, only longitudinal motion was focused.

REFERENCES:

Arne Nagel, Frauke Fernholz, Carolin Kibele, Dieter Rosenbaum. Long distance running increases plantar pressures beneath the metatarsal heads. Gait&Posture, 2008；27：152-155
Gabor Barton, Paulo Lisboa, Adrian lees, Steve Attfield. Gait quality assessment using self-organising artificial neural networks. Gait&Posture, 2008；25：374-379
Matthew K. Seeley, Brian R. Umberger, Robert Shanpiro. A test of functional asymmetry hypothesis in walking. Gait&Posture, 2008；28：24-28
Murray T Vanderpool, Steven H Collins, Arthus D Kuo. Ankle Fixation need not increase the energetic cost of human walking. Gait&Posture, 2008；28：427-433
5. Sadeghi H, Allard P, Prince F, Laabelle H. Symmetry and limb Dominance in able-bodied gait. Gait&Posture, 2000；12：34-45
Sasaki K, Neptune R. Differences in muscle function during walking and running at the same speed. Journal of Biomechanics, 2006；39：2005-2013
Wendy J, Terese L. Differences in normal and perturbed walking kinematics between male and female athletes. Clinical Biomechanics, 2004；19：465-472