THE EFFECT OF TARGET DISTANCE ON TRUNK, PELVIS, AND KICKING LEG KINEMATICS IN TAEKWONDO ROUND HOUSE KICK

Jae-Woong Kim, Sree Sushma Yenuga, and Young-Hoo Kwon

Biomechanics Laboratory, Texas Woman's University, Denton, USA

KEY WORDS: relative orientation angles, movement pattern, ensemble average

INTRODUCTION: The round house kick is one of the most frequently used kicks in Taekwondo competition. One of the main strengths of this particular type of kick is that it can be easily adjusted according to the target distance during a competition. Although a long kick is more difficult to perform than a normal or short kick, it is useful to score points in an unexpected attack. The purpose of this study was to investigate the rotational movement patterns of the trunk, pelvis, and the kicking leg (thigh and shank) during the round house kick with three different target distances.

METHOD: Twelve male black-belt holders (73.1 ± 8.9 kg, 175.6 ± 7.8 cm, and 2.75 ± 1.8 dan) participated in this study. Three target distance conditions were used: Normal (96.1 ± 3.5 cm), Long (122.0 ± 13.8 cm), and Short (70.1 ± 3.8 cm). Each participant's preferred target distance was used in the Normal kick condition. The longest target distance that each participant could achieve without losing kick power and balance was measured and used in the Long kick. To ensure equal distance spacing among the conditions, the target distance difference between the Long and Normal kicks was used in computing the target distance for the Short kick. A three-dimensional video motion analysis was conducted to quantify the orientation matrices of the trunk, pelvis and the kicking leg. The ensemble-averaged relative orientation angle patterns of the trunk, pelvis, and the kicking (right) thigh and shank to their respective linked proximal segments (the global reference frame for the pelvis) were derived subsequently.

RESULTS: Table 1 presents the rotational range of motion of the trunk, pelvis, thigh, and the shank. Significant differences were observed in the pelvis rotation (Short < Long), trunk rotation (Normal > Short), and knee flexion/extension (Long < Normal, Short).

Table 3 Range of the Relative Orientation Angles (in deg)

Axis	Condition	Pelvis (to Global)	Trunk to Pelvis	Thigh to Pelvis	Shank to Thigh
Mediolateral	Long	64.9 ± 9.5	23.3 ± 8.1	43.6 ± 9.0	104.0 ± 14.1
	Normal	60.2 ± 7.6	21.7 ± 7.4	55.4 ± 10.8[£]	101.2 ± 19.9
	Short	57.1 ± 8.4	23.9 ± 11.4	61.9 ± 13.7[£]	104.1 ± 9.3
Anteroposterior	Long	31.1 ± 10.1	16.1 ± 6.6	42.7 ± 11.2	
	Normal	30.5 ± 8.1	16.8 ± 4.2	44.0 ± 10.4	
	Short	29.2 ± 10.2	19.5 ± 5.3	38.7 ± 12.0	
Longitudinal	Long	137.0 ± 18.0	56.4 ± 11.8	42.0 ± 19.1	
	Normal	129.3 ± 14.5	52.8 ± 11.0	47.73 ± 19.1	
	Short	120.7 ± 16.9[£]	45.6 ± 10.8[§]	46.7 ± 14.2	

[£] Significantly different from the matching Long condition ($p < .05$); [§] Significantly different from the matching Normal condition.

DISCUSSION: As the target distance increased, the pelvis motion (all three axes) and trunk rotation tended to increase with trunk lateral flexion and hip flexion/extension showing a decreasing trend. Trunk flexion/extension, hip adduction/abduction, hip rotation, and knee flexion/extension revealed inconsistent trends. Among the segment/joint motions, pelvis flexion/extension, pelvis rotation, trunk rotation, and hip flexion/extension showed the largest changes in magnitude as the target distance changed.