KINEMATIC DIFFERENCES OF TAEKWONDO ROUNDHOUSE KICK BETWEEN THAILAND NATIONAL AND YOUTH NATIONAL ATHLETES

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The purpose of this study was to compare kinematic in taekwondo roundhouse kick of Thailand National athletes to Youth National athletes. Both groups experienced and were successful in major international competitions. The athletes were instructed to promptly perform roundhouse kick at the target with their dominant leg when the LEDs above the target were turned on. Motion analysis system captured three kicks. The Mann-Whitney U test did not reveal significant differences of response time and selected kinematic parameters of the kicking leg between the two groups. In conclusion, both groups shows similar kicking pattern; nevertheless, this study only investigated the kick in static condition. Future research should include dynamic condition.

KEY WORDS: kinematics, roundhouse kick, taekwondo, lower limb.

INTRODUCTION: Originated in Korea, Taekwondo is a martial art which uses punch and kick to attack opponent (Lee et al., 2006). The roundhouse kick is a common technique used for attack and counter attack. Kinematic variables of a roundhouse kick have been previously studied under different conditions including with and without target (Nien et al., 2007), and different kicking distances (2012). Although kinematic charactersitics of roundhouse kick have been documented, only few research compared roundhouse kick of the adult to youth taekwondo atheletes (Vieten et.al., 2007). Thus, the purpose of this study was to compare response time and kinematic patterns of roundhouse kick between Thailand National athletes (NA) and Youth National athletes (YA).

METHODS: Five athetles from each group were randomly selected from the Thailand Olympic training camp. Prior to the study, all participants signed the consent forms which was approved by Mahidol University Institution Review Board (MU-IRB). Physical characterisitcs of both groups are presented in Table 1. Athletes were instructed to perform three roundhouse kicks to the target with their dominant leg. The distance and the height of the target were self-selected. The LEDs were installed on the stand above the target and connected to DAQ NI USB–6008 (National Instruments, USA). The custom Labview program was written to obtain response time. Response time was measured from the LEDs turned on until the foot hit the target. Eight 100-Hz cameras were used in order to capture the kicking motion (Natural Point Inc., USA). Nineteen retroreflective markers were attached to sacrum, left and right acromion processes, anterior superior iliac spine, greater trochanters, lateral femur wands, lateral femoral epicondyles, lateral tibial wands, mallleoli, 5th metatarsal heads and calcaneus. All raw coordinates data were exported as a C3D format. Bodybuilder program (Oxford Metrics Ltd., UK) was used to filter raw coordinate data and compute kinematic parameters. The Mann-Whitney U test was employed to determine statistically significant differences between the two groups ($p<0.05$).

RESULTS: Roundhouse kick in this study was divided into 3 phases: Push (Start to toe off), Release (Toe off to Max knee flexion (MKF)), and Striking (MKF to Impact) (Kim et al, 2010): Figure 1 and 2 illustrate angular displacements and velocities of hip, knee and ankle joints of the athlete who received the goal medal in 2011 World Taekwondo Championships. Selected kinematic parameters and response time were shown in Table 2. Nonetheless, no significant differences between the two groups were found.

Table 1: Physical characteristics.

Parameters	NA		YA	
	Mean	SD	Mean	SD
Age (yr)	21.4	2.3	16.8	0.4
Weight (kg)	60.6	10.4	63.3	12.5
Height (cm)	169.2	6.6	174.0	11.0
Leg length (cm)	84.3	3.0	85.2	4.3
Target height (%height)	71.2	2.0	72.0	3.0
Target distance (%leg length)	101.9	10.1	94.2	4.7

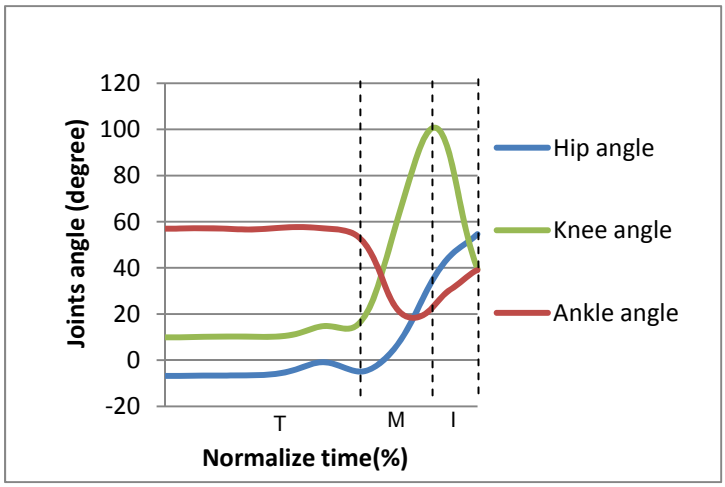

Figure 1: Typical angular displacement of roundhouse kick (1) Push, 2) Release, 3) Striking (direction of +/- defined Flexion/Extension).

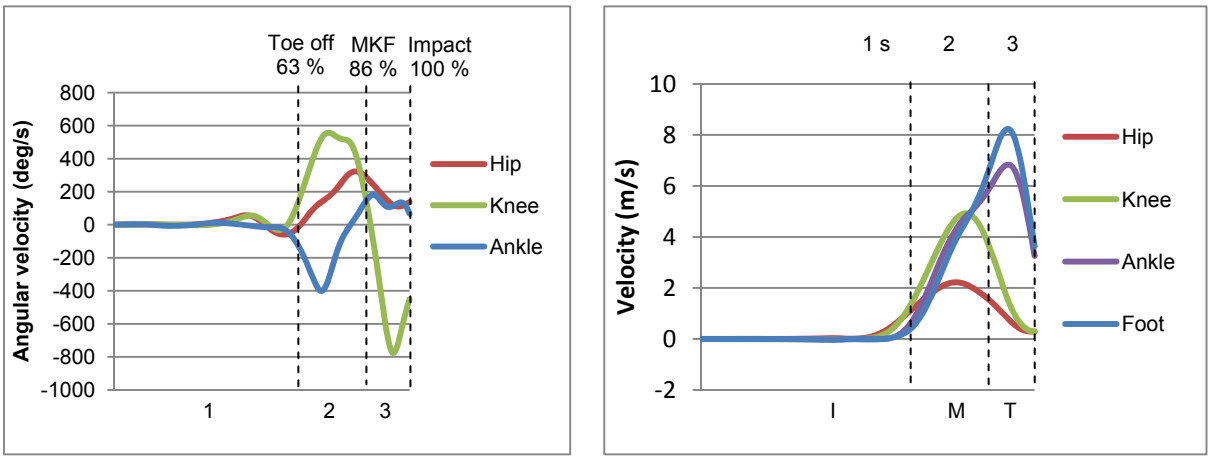

Figure 2: Angular and linear velocity of lower extremity .

Table 2: Selected kinematic parameters.

Parameter	NA		YA		*p*
	Mean	SD	Mean	SD	
Response time (ms)	0.78	0.09	0.76	0.04	0.754
Max hip angular velocity (°/s)	282.7	26.2	259.1	39.2	0.251
Max knee angular velocity (°/s)	-797.9	136.3	-874.3	85.2	0.248
Max ankle angular velocity (°/s)	-401.6	59.9	-416.8	35.6	0.917
Max foot linear velocity (°/s)	7.36	1.02	8.16	0.7	0.175

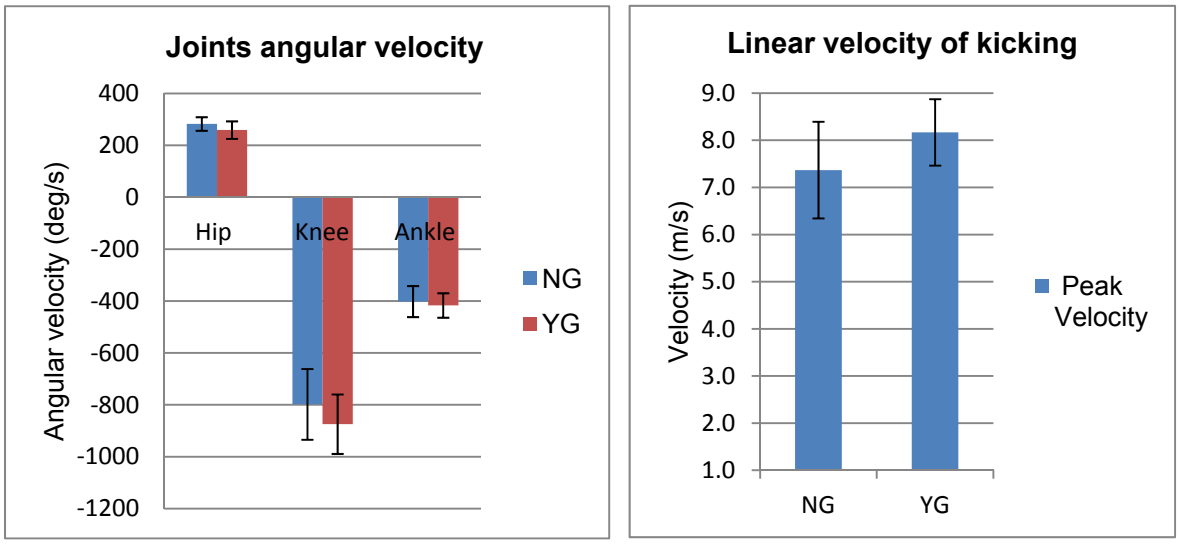

Figure 3: Joint angular velocity and foot velocity.

DISCUSSION: Both groups exhibit similar kinematic pattern of roundhouse kick. The response time of both groups is similar to the previous research (Chung et.al. 2000; Falco et.al. 2009). As most athletes in this study have experienced in several major international competitions such as the Olympics games, World Taekwondo Championships, the Youth Olympic games, etc. their respone time is fairly good. Vieten et.al. (2007) studied reaction time between adult and youth female taekwondo athletes but found no significant difference between the two groups.

For kinematic, knee angular velocity is one of the important factors in roundhouse kick. The peak knee angular velocity was found during the striking phase and in the same range of previous reports, but foot linear velocities were lower than the previous reports (Tang et.al., 2007; Kim et.al., 2011). This may indicate that speed training may need to improve kicking speed. Since both athlete groups are trained under the same program, their kicking technique may be similar. Although no significant differences between Thailand National and Youth National athletes were found, information of kinematic pattern of roundhouse kick in taekwondo is useful. Due to limitation of the instruments, kicking force is not investigated in this study. Future research should also study kinetic of kicking during dynamic condition.

CONCLUSION: Thailand National and Youth national taekwondo athletes have similar response time and kinematic pattern. Knee angular velocities are the highest for both groups during the striking phase of roundhouse kick.

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Acknowledgement: This research project was supported by Sports Authority of Thailand.