TIMING OF EXPERT AND NOVICE TAEKWONDO ATHLETES DURING FRONT KICK MOTION

Li Li, Taegyong Kwon, Behdad Tahayori
Louisiana State University, Baton Rouge, Louisiana, USA, LLI3@LSU.EDU

INTRODUCTION

Taekwondo is a popular martial art for its powerful and fast kicking techniques, where the front kick is one of the most common forms of kicking. Although kinematics and kinetic characteristic of the front kick have been studied in different ways, little research has been carried out on execution time and timing differences between each event in a front kick. Such information could be used to discriminate the difference between expert and novice competitors and to apply it to Taekwondo coaching and training (Falco et al., 2009). Therefore, the purpose of the study was to exam the timing differences between expert and novice Taekwondo athletes performing the front kick. We hypothesized the expert athletes would kick faster with a fixed sequence of joint motions.

METHODS:

Eleven expert (2 female, 9 male) and 11 novice (2 female, 9 male) Taekwondo athletes participated the study from local Taekwondo clubs. The mean (± SD) age, body mass and height are 31 ± 12 and 34 ± 14 years old, 68 ± 15 and 68 ± 20 kg, 169 ± 7 and 170 ± 10 cm, for the expert and novice groups, respectively. Subjects stood upright with each foot in contact with one force plate and kicked toward a target hanging in midair with the pattern instructed by their coach. Kinematic data were collected using retroreflexive markers. Data were then analyzed. Times between maximum joint angles as defined in **Table 1** were determined for examining the hypothesis. The differences between group means were tested by using t-tests with significant level set at 0.05.

RESULTS AND DISCUSSION

All subjects kicked with their right leg, used the left leg for support, and followed the same instruction: to perform one front kick aimed at the hanging target.

There were 6 identifiable events after the initiation of the kicking motion. The sequence of the first four events was very consistent; they were in the order of: maximum left hip flexion, maximum right knee flexion, maximum right hip flexion and maximum right hip push (a slight hip extension after the first right hip flexion peak). The order of the next two events, maximum right knee extension and maximum left hip extension, was inconsistent among a few participants (**Table 1**). The durations between the identified events were different between the two groups (**Table 1**). The experts spent less time between the first two events, but more time between the next three events. The experts exhibited greater angular velocities ($P = 0.011$) while extending the hip joint of their supporting (left) leg. The angular velocities between maximum left hip flexion (event 1, **Table 1**) and extension (event 6, **Table 1**) were 159 ± 40 (experts) and 120 ± 29 (novices) deg/s. The ranges of motion between these two events were also different ($P = 0.011$). The range of motion between event 1 and 6 were 70 ± 16 (experts) and 56 ± 10 (novices) degrees.

Although both groups followed the same sequence, the novice group was more consistent than the expert group. The last column of **Table 1** shows the relative variation recorded in the study. SD_E and SD_N are the standard deviations for the expert and novice groups. The expert group exhibited larger time duration variations between the events 1-5 (**Table 1**).

CONCLUSION

As expected, the expert athletes kicked faster than novice with a larger range of motion. Group timing differences between the identified events may be used to determine difference between expert and novice (Falco et al., 2009). However, although it is common to expect that expert is more consistent than the novice group, our observations show that the novices were more consistence than the experts. Although several studies (see Yiou et al., 2001 for a review) have suggested that the simple movements cannot be used to differentiate between experts and novices, our observations showed that the experts exhibit more individuality in their faster movements.

REFERENCES

1. Falco C. et al. J BIOMECH, 42(3), 242-8, 2009
2. Yiou E, et al. EXP BRAIN RES, 137, 197–204, 2001.

Table 1. Time duration (seconds?) between sequential events during Taekwondo kicking

Consecutive events	Mean DUR (± SD)		*P*-values	SD_E/SD_N (%)
	Experts	Novices		
1. Maximum left hip flexion 2. Maximum right knee flexion	.245± .039	.274± .017	.023	229
2. Maximum right knee flexion 3. Maximum right hip flexion	.142± .064	.104± .024	.047	267
3. Maximum right hip flexion 4. Maximum right hip push	.152± .133	.076± .026	.046	512
4. Maximum right hip push 5. Maximum right knee extension*	-.121± .146	.012± .018	.005	811
5. Maximum right knee extension* 6. Maximum left hip extension**	.036± .054	.013± .099	.262	54

Note:
*Maximum right knee extension occurred before maximum right hip flexion among 4 expert athletes.
** Maximum left hip extension occurred before maximum right hip flexion among 1 expert and 2 novice athletes.