SIMPLE ATTACK ANALYSIS OF JUNIOR FEMALE EPEE FENCERS

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The objectives of this study were to profile basic fencing variables and to determine the inter-relationship of these variables on attack for junior female epee fencers. The motion was filmed with a video camera (50Hz) during the 6th Asian Youth and Cadet Fencing Championships. Then the selected video materials were processed by Peak Performance System to produce co-ordinates for selected body landmarks. The correlation coefficients of reaction time versus sword separation ($r=0.55$, $p<0.01$) was positive. This shows clearly the interdependence of reaction time with sword separation. The correlation coefficients of defender movement time and initial sword speed was negative ($r=-0.51$, $p<0.01$). However, no significant correlation was found between defender movement time and reacted sword speed.

KEY WORDS: fencing, kinematic, lunge, simple attack, reaction time

INTRODUCTION: Fencing requires quick and agile bodily movements, fast reactions, as well as accurate lunges and thrusts at the opponent (Singer, 1968). The execution of lunge provides forward propulsion of body mass and balance of the body in the guard position. One of the crucial characteristics in fencing is the ability to act and react accordingly to the opponent's sudden and unexpected movements. The control of the attack is highly dependent on the fencer's agility, speed, as well as to catch the opportunity when the opponent is unprepared. Fencing is the art of offense and defense with a sword. Superior fencers possess quicker reaction body movement time with precise movement pattern (Singer, 1968). The "safety" distance between fencers just before attack may closely relate the characteristics of offenders and defenders. Besides that sword speed from initiation to touch of offender may have effect on the body movement time of defender. The objectives of this study were to profile the basic fencing parameters and evaluate the inter-correlations among different variables for the successful attack in junior female epee fencers.

METHODS: The fencing events at the 6th Asian Youth and Cadet Fencing Championships, 2000 held in Hong Kong were videotaped using two Sony digital video cameras (50Hz). Heats, semi-finals and finals were recorded for female epee fencers. The distance between the motion plane and video camera was about 10m apart. Representative motions of successful attack were chosen by coach and the motions selected were typical simple attack technique of fencers. Totally, 52 trials were selected from the video clip. Then, the selected video materials were processed by Peak Motus System to calculate the co-ordinates of selected body landmarks. The following variables were determined. Sword separation was the distance between fencers' hand guard just before the initiation of lunge. Sword displacement was the distance of offender's hand guard moved from initiation of lunge until defender reacted. Reaction time of defender was the time from offender's initiation of lunge to defender's reaction. Initial sword speed was the speed between initiation of lunge by offender and movement initiated by defender's reaction. Reacted sword speed of offender was the speed between defender reacted and being touched. Shoulder separation was the distance between fencers' sword shoulders just before the initiation of lunge. Defender movement time was the time of sword shoulders moved between defender reacted and being touched. Toe separation was the distance between fencers' front toe just before the initiation of lunge. Moreover, mean and standard deviation values were determined for all variables. To determine any inter-correlation between variables calculated in the competition analysis, Pearson Product Moment was used to determine correlation between the different variables. A t-test for paired samples was performed to test for significance of group differences between initial sword speed and reacted sword speed.

RESULTS: Table 1 shows the mean value of fencing variables. The mean value of sword separation was found to be 1.36m which was the shortest distance compared with shoulders and toes as the landmark for distance measurement. The average reaction time and movement time of the defenders was found to be 0.45s and 0.44s respectively. Table 2 shows the reacted sword speed was significantly greater than initial sword speed ($p < 0.01$). The sword speed was increased from 0.93m/s at initial to 1.44m/s after the defender reacted.

Table 1 Variable Mean and Standard Deviation in Simple Attack

	Mean (N=52)	S. D.
Sword separation (m)	1.36	0.30
Sword displacement (m)	0.43	0.33
Reaction time (s)	0.45	0.27
Initial sword speed (m/s)	0.93	0.44
Reacted sword speed (m/s)	1.44*	0.38
Shoulder separation (m)	2.71	0.27
Defender movement time (s)	0.44	0.23
Toe separation (s)	1.51	0.24

* Significantly greater than initial sword speed at 0.01 level.

Table 2 Pair t-test on Initial Sword Speed and Reacted Sword Speed

	Paired diff. mean	S. D.	t	Df	Sig. (2-tailed)
Initial sword speed - Reacted sword speed	-.511	.480	-7.69	51	.000

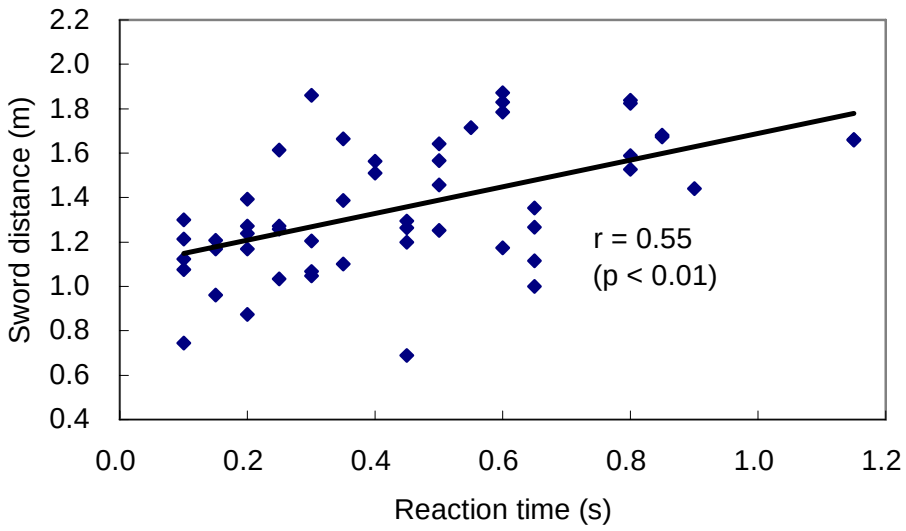

Figure 1 - Relationship between sword distance and reaction time.

Linear correlations were determined among all seven fencing variables. A significance level of 0.05 was set for the evaluation of these coefficients. Correlation matrix of fencing variables in simple attack was shown in Table 3. The correlation coefficients of reaction time versus sword separation ($r=0.55$, $p<0.01$), sword displacement ($r=0.72$, $p<0.01$) and toe separation ($r=0.40$, $p<0.01$) were positive. This shows clearly the interdependence of reaction time with other three variables, such that fencers with small reaction time values concurrently had small sword, shoulder and toe distances with opponents and vice

versa. The relationship of sword distance and reaction time was presented in Figure 1. The correlation coefficients of defender movement time and initial sword speed was negative ($r=-0.51$, $p<0.01$). However, no significant correlation was found between defender movement time and reacted sword speed. Furthermore, there was a positive relationship between sword displacement and initial sword speed ($r=0.718$, $p<0.01$). Sword displacement and opponents' reaction time was also found to be positive ($r=0.66$, $p<0.01$).

Table 3 Inter-correlation between Different Fencing Variables in Simple Attack

	Sword displacement	Reaction time	Initial sword speed	Reacted sword speed	Defender movement time	Toe separation
Sword separation	.354*	.550**	-.005	.119	.032	.589**
Sword displacement		.718**	.658**	.127	-.446**	.243
Reaction time			.077	-.100	-.101	.401**
Initial sword speed				.326*	-.506**	.115
Reacted sword speed					-.221	.149
Defender movement time						-.031

* Correlation is significant at the 0.05 level.
** Correlation is significant at the 0.01 level.

DISCUSSION: Compared with sword separation, shoulder separation and toe separation, sword separation just before attack was the closet point between two fencers. This implied the opponent's sword arm especially the hand and wrist would give the least amount of risk during attack. Sword separation and toe separation just before the attack were positively correlated with the reaction time. The greater the reaction times, the greater the distance of separation would be created by the defenders and vice versa. This indicated that defenders used their basic instinct to judge the optimal distance of separation. The opponents continued to adjust the distance with offenders in the game. So that a rather stable and safety distance for both offenders and defenders was created until one of them start the attack. The reacted sword speed was significantly greater than initiation sword speed. This explains the sword was accelerating towards the defenders. The defender movement time was negatively correlated with sword speed at initiation and no relationship was found with the sword speed after the defender reacted. This demonstrated the initial sudden attack of offender might pay an important role to reduce the movement time available for the defender. Short movement time may hinder the correct response for an attack. So a rapid initial attack may reduce the time available for defender and hence may increase the chance of successful attack. However, this advantage may be lost after defender reacted. Furthermore, the sword displacement of offender contributed to the reduction of movement time of defender. This, in turn, may reduce the time of defender to response and may increase the chance of defender making errors.

CONCLUSIONS: Sword separation and toe separation were positively correlated with the reaction time. The defenders used their basic instinct to judge the optimal distance of separation during the game. The movement time of defender was negatively correlated with initiation sword speed and no relationship was found between movement time and the reacted sword speed. The initial sudden attack of offender would reduce the movement time available for the defender.

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