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Effectiveness of Temporal Structure for Forehand and Backhand Straight Strokes Performance According to Rebound Time in Squash

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Abstract

This research was conducted to identify the effectiveness of temporal structure for forehand and backhand straight strokes performance according to rebound time in Squash. Descriptive design was used. Study participants consisted of seven Squash players were internationally classified from Official Women's Squash World Ranking participated in the Women's World Open Squash Championship "Cairo 2014". With following characteristics: mass 61.16±5.87 kg, and length 165.67 ± 3.72 cm. Strokes had monitored and analyzed of the seven matches in Women's World Open Squash Championship 2014, matches of quarter-finals, semi-finals, and final match. Dartfish v.7 software motion analysis used to analysis 1256 strokes (463 straight forehand strokes and 793 straight backhand strokes) by using normal motion, slow motion, frame by frame, and stop cadre. Phases of skill performance had classified into preparatory, execution and follow-through phases. Times of skill phases had divided into: first period from 0.001-0.127 part of second, second period from 0.128-0.255 part of second, third period from 0.256-0.510 part of second and fourth period from 0.511-1.0 second. The rebound time of the ball had divided into fast, moderate, and slow rebound. Statistical analysis was done with SPSS software package by using mean and standard deviation. It is concluded that, levels of effectiveness had increased in fast, moderate, and slow rebounds during performance of forehand and backhand straight strokes in first and second periods during the three phases of skill performance. Also the effectiveness degree of backhand straight strokes had elevated during preparatory and follow-through phases in third period.

Key words: Temporal Structure - Rebound Time- Forehand and Backhand Straight Strokes – Squash-shorthand

Introduction

Squash is one of the fastest and most athletic sports where the ball often moves at speeds of more than100 miles per hour (161 km/hr.).Also the popularity of this sport is due to large part in the intensely competitive workout which generates in such a short time. In addition, Squash is increasingly popular with more than 15 million regular participants worldwide (Girard, Micallef, Noual, & Millet, 2010) . So, the Squash player had two purposes in the match, the first one is offensive for scoring points in the games, while the second purpose is defensive to prevent the opponent from scoring points. Therefore, when the player steps in the court to begin the match, he thinks about trying to establish the basic game. This involves pinning the opponent into the back corners with solid drives and beginning to hit more to the frontcourt to work the opponent around the court. Because of Squash performance is largely characterized by the movement of players and shot selection. The main objective is to move an opponent away from a central area of the court, commonly referred to as the 'T area. So the player ought to remember the three basic good habits which are; watch the ball, move to the T area, and prepare the racket early. Also the player should remember that, if things aren't going in wanted way, he should try something different to break the opponent's rhythm (Vuckovic et al., 2014; Yarrow & Harrison, 2010).

At the beginning of 2011, the rackets industries had experienced a rapid development which made from the wood chips to the basalt material. Because of the basalt is characterized by working for long period. Also it added to the racket stiffness and lightness in weight. In addition, it provides the racket with high capacity to absorb the strong and fast hating strokes. The great development in the rackets resulted in a significant increase in power and speed of strokes (ElShafie, 2001; Mckenzio, 1993).

Further, at 2008, the World Squash Federation was conducted for many modifications to the Squash rules from the British scoring system which relied on hand-out system to the American scoring system. Actually, the American scoring relied on each game is played to eleven points, except that if the scores reached ten-all, the game continues until one player leads by two points. A match is normally the best of five games, but may be the best of three games. These modifications make the game take a fast rhythm, provide opportunity to show the different

skills, help to increase the chances of winning and increase the viewing enjoyment (World Squash Federation, 2014).

Moreover, the speed of high ball and relatively small court make the ball more dynamics. These affect the movements of the players and their skills. So the players should perform well to have the ability to control the match, the exploitation of the opponent skill errors and endurance the high speed match. As great development in the rackets, modifications in Squash rules and the speed of high ball make the time is becoming the most one from the main factors for winning the match (Wilkinson et al., 2012).

In addition, it was confirmed that forehand and backhand straight strokes are first strokes for the beginning of the attack in Squash. As well as they considered the basic rules for any distinct match. Therefore, the good stroke should have two vital dimensions, which are longitudinal and width .The good longitudinal stroke puts the opponent in a difficult situation at the back court to become under pressure (Hirza, Azuan, & Juliana, 2012; Shoy, 1991). it was reported that the motor skills searched through three levels namely; temporal structure, dynamic analysis, and kinetic analysis. Because of the temporal structure is an account detail of the total time components of the motor performance. Also the time is a basic variable and other biomechanical variables are calculated by it. In addition, the time can be measured through devices as cinematography (Miller & Nelson, 1973).

Thus, the time is one of the most important indicators for description of skill performance and reflects the complex relation for many limited factors for skill performance characteristics. Besides, it is one of the most important assets and the motives that relate the autonomous kinetic elements in total unit of skill performance. Therefore, the temporal structure does not affect only the kinetic image for physical exercise but also intervenes largely to determine the final results of skill performance (Metwally, 2013).

The rebound time of the ball from the floor effects on type and speed of strokes in Squash. Because of the high speed performance in Squash may require from the players to use some of kinetic shorthand in order to put the opponent under pressure. The kinetic shorthand means that the player reduces the time period in part from the skill to perform it in less time or do not perform it according to the play situation or tactic play. In fact that the strokes in the Squash are the way to win, so there are many factors that affect the effectiveness of each stroke. One of these factors is the time, when it performed through the stroke phases (preparation, execution and follow-through).

Consequently, the aim of this research was to identify the effectiveness of temporal structure for forehand and backhand straight strokes performance according to rebound time in Squash.

Material and Methods

Participants:

Seven Squash players are internationally classified from Official Women's Squash World Ranking who participated in the Women's World Open Squash Championship "Cairo 2014", with following characteristics: mass 61.16±5.87 kg, and length 165.67 ± 3.72 cm. The reasons for selecting the research participants; tactical character in this championship takes a great importance due to the convergence of levels, physical abilities, mental skills. They are the elite athletes in the world, and this championship is one of the best Squash tournaments in the world.

Procedures:

A descriptive method with the survey technique was used.

Research variables:

In terms of the research aims, the researchers determined the technical and tactical variables as follows:

First: Rebound time of the ball.

Second: Determine the component phases of offensive skills performance in Squash as follows:

- Preparation phase: From the beginning of the back-swing to the beginning of the front-swing.

- Execution phase: from the beginning of the front-swing to the moment of clash the ball with the racket.

- Follow-through phase: From the moment the ball out of racket until the braking.

Third: The result of the stroke where the stroke's efficiency lies according to six levels as follows:

1. Scoring a direct point = (6 degrees).

2. Scoring a point from the opponent error= (5 degrees).

3. Staying the opponent in a defensive situation= (4 degrees).

4. Starting a rally= (3 degrees).

5. Staying the opponent in an offensive situation= (2 degrees).

6. Losing the point= (one degree).

Research tools:

1. Computer device that includes a Sony DVD player.

2. Two digital cameras "Panasonic" used for recording matches.

3. CD's and DVD's where the matches research samples are copied after recording.

4. Dartfish v.7 software motion analysis was used for its high accuracy in account of the times and the possibility of divided and follow-up times in skill performance (up to 1,000 of a second).

5. Data recording sheet that was developed through the researchers and that was organized according to the sequence of the monitored variables and situations. (appendix 1)

Validity and reliability of the data recording sheet:

The data sheet was evaluated through some experts to confirm the validity of the sheet contents. The researchers tested the reliability of the data recording sheet by using the application and reapplication of it after ten days on 40 strokes from the first round in the same championship. The simple correlation factor was (r=.954**).

Main study:

Strokes had monitored and analyzed of the seven matches in Women's World Open Squash Championship 2014, matches of quarter-finals, semi-finals, and final match. Dartfish v.7 software motion analysis used to analysis 1256 strokes (463 straight forehand strokes and 793 straight backhand strokes) by using normal motion, slow motion, frame by frame, and stop cadre.

After that the researchers divided the times of skill phases into the first period from 0.001-0.127 part of second, second period from 0.128-0.255 part of second, third period from 0.256-0.510 part of second and fourth period from 0.511-1.0 part of second. Additionally the rebound time of the ball had divided into the fast rebound (first period from 0.001-0.200 part of second), moderate rebound (second period from 0.201-0.333 part of second) and slow rebound (third period from 0.334-1.0 second).These classifications were done after showed on some experts.

Statistical analysis:

Statistical analysis was done with SPSS software package by using mean and standard deviation. After data collection the results were statistically processed through cross tabulation for calculating the percentage and the repetitions of the efficient strokes using the following equation:

Effectiveness degree =

Total of the repetitions below the efficiency level x the adjacent degree for the efficiency level

Total number of repetitions

Results

Table 1

Effectiveness of Temporal Structure for Forehand and Backhand Straight Strokes Performance in Fast Rebound

Levels of effectiveness			Scoring a direct point			Scoring a point from the opponent error			Staying the opponent in a defensive situation			Starting a rally			Staying the opponent in an offensive situation			Losing the point			Total frequency	Effectiveness degree
Skill	Skill phases	Time periods of skill	Frequency	Frequency		Frequency	Frequency		Frequency	Frequency		Frequency	Frequency		Frequency	Frequency		Frequency	Frequency			
				Period %	Effecti veness level %		Period %	Effecti veness level %		Period %	Effectiv eness level %		Period %	Effecti veness level %		Period %	Effectiv eness level %		Period %	Effective ness level %		
Forehand straight stroke	Preparatory phase	1st period	1	1.9	20.0	3	5.6	75.0	28	51.8	53.8	16	29.6	57.1	5	9.25	45.5	1	1.9	100	54	3.75
		2nd period	3	8.1	60.0	1	2.7	25.0	19	51.4	36.5	10	27.0	35.7	4	10.8	36.6	-	-	-	37	3.71
		3rd period	1	10.0	20.0	-	-	-	5	50.0	9.7	2	20.0	7.2	2	20.0	18.9	-	-	-	10	3.60
	Execution phase	1st period	1	2.2	20.0	-	-	-	23	51.1	52.3	12	26.7	41.4	8	17.8	44.4	1	2.2	100	45	3.36
		2nd period	4	7.1	80.0	4	7.1	100	21	37.5	47.7	17	30.4	58.6	10	17.9	55.6	-	-	-	56	3.55
	Follow-through phase	1st period	3	4.5	60.0	2	3.0	50.0	32	47.8	64	19	28.4	65.5	10	14.9	83.4	1	1.5	100	67	3.57
		2nd period	2	6.3	40.0	2	6.3	50.0	16	50.0	32	10	31.3	34.5	2	6.3	16.7	-	-	-	32	3.31
		3rd period	-	-	-	-	-	-	2	100	4.	-	-	-	-	-	-	-	-	-	2	4.00
Backhand straight stroke	Preparatory phase	1st period	-	-	-	2	11.1	50.0	7	38.9	14.9	6	33.3	9.8	3	16.7	13.0	-	-	-	18	3.44
		2nd period	1	.9	100	2	1.8	50.0	37	32.5	78.7	54	47.4	88.5	20	17.5	87.0	-	-	-	114	3.21
		3rd period	-	-	-	-	-	-	3	75.0	6.4	1	25.0	1.6	-	-	-	-	-	-	4	3.75
	Execution phase	1st period	1	2.7	100				14	37.8	29.8	19	51.4	31.1	3	8.1	13.0	-	-	-	37	3.38
		2nd period	-	-	-	4	4.1	100	33	33.7	70.2	42	41.8	68.8	20	20.4	87.0	-	-	-	99	3.21
	Follow-through phase	1st period	-	-	-	2	3.6	50.0	17	30.9	36.2	21	38.2	34.4	15	27.3	65.2	-	-	-	55	3.11
		2nd period	1	1.3	100	2	2.6	50.0	27	34.6	57.4	40	51.3	65.6	8	10.3	34.8	-	-	-	78	3.33
		3rd period	-	-	-	-	-	-	3	100	6.4	-	-	-	-	-	-	-	-	-	3	4.00

Table 2

Effectiveness of Temporal Structure for Forehand and Backhand Straight Strokes Performance in Moderate Rebound

Levels of effectiveness			Scoring a direct point			Scoring a point from the opponent error			Staying the opponent in a defensive situation			Starting a rally			Staying the opponent in an offensive situation			Losing the point			Total frequency	Effectiveness degree
Skill	Skill phases	Time periods of skill	Frequency	Frequency		Frequency	Frequency		Frequency	Frequency		Frequency	Frequency		Frequency	Frequency		Frequency	Frequency			
				Period %	Effecti veness level %		Period %	Effecti veness level %		Period %	Effectiv eness level %		Period %	Effectiv eness level %		Period %	Effectiv eness level %		Period %	Effectiv eness level %		
Forehand straight stroke	Preparatory phase	1st period	5	6.8	71.4	3	4.1	42.9	21	28.4	38.2	38	51.4	55.1	6	8.1	66.7	1	1.4	100	74	3.46
		2nd period	1	1.5	14.3	4	5.9	57.1	32	47.1	58.2	28	41.2	40.6	3	4.4	33.3	-	-	-	68	3.59
		3rd period	1	20.0	14.3	-	-	-	1	20.0	1.8	3	60.0	4.3	-	-	-	-	-	-	5	3.80
		4th period	-	-	-	-	-	-	1	100	1.8	-	-	-	-	-	-	-	-	-	1	4.00
	Execution phase	1st period	4	5.2	57.1	3	3.9	42.9	36	46.8	65.5	29	37.7	42.0	5	6.5	55.6	-	-	-	77	3.64
		2nd period	3	4.3	42.9	4	5.7	57.1	19	27.1	34.5	40	55.7	57.9	4	5.7	44.4	1	1.4	100	71	3.50
	Follow-through phase	1st period	6	7.6	85.7	3	3.8	42.9	23	29.1	41.8	41	51.9	59.4	5	6.3	55.6	1	1.3	100	79	3.51
		2nd period	1	1.5	14.3	4	5.9	57.1	32	45.6	58.2	28	41.2	40.6	4	5.9	44.4	-	-	-	69	3.56
Backhand straight stroke	Preparatory phase	1st period	-	-	-	2	6.1	40.0	12	36.4	16.9	11	33.3	8.3	7	21.2	25.0	1	3.0	33.3	33	3.21
		2nd period	3	1.5	100	3	1.5	60.0	55	27.2	77.5	118	58.4	88.7	21	10.4	75.0	2	1.0	66.7	202	3.22
		3rd period	-	-	-	-	-	-	4	50.0	5.6	4	50.0	3.0	-	-	-	-	-	-	8	3.50
	Execution phase	1st period	1	1.7	33.3	2	3.3	40.0	24	40.0	33.8	30	50.0	22.6	2	3.3	7.1	1	1.7	33.3	60	3.45
		2nd period	2	1.1	66.7	3	1.6	60.0	47	25.8	66.2	103	56.6	77.4	26	13.7	92.9	2	1.1	66.7	183	3.16
	Follow-through phase	1st period	1	.9	33.3	4	3.6	80.0	29	26.4	40.8	49	44.5	36.8	24	21.8	85.7	3	2.7	100	110	3.09
		2nd period	2	1.5	66.7	-	-	-	41	31.5	57.7	83	63.8	62.4	4	3.1	14.3	-	-	-	130	3.33
		3rd period	-	-	-	1	33.3	20.0	1	33.3	1.4	1	33.3	.8	-	-	-	-	-	-	3	4.00

Table 3

Effectiveness of Temporal Structure for Forehand and Backhand Straight Strokes Performance in Slow Rebound

Levels of effectiveness			Scoring a direct point			Scoring a point from the opponent error			Staying the opponent in a defensive situation			Starting a rally			Staying the opponent in an offensive situation			Losing the point			Total frequency	Effectiveness degree
skill	Skill phases	Time periods of skill	Frequency	Frequency		Frequency	Frequency		Frequency	Frequency		Frequency	Frequency		Frequency	Frequency		Frequency	Frequency			
				Period %	Effectiveness level %		Period %	Effectiveness level %		Period %	Effectiveness level %		Period %	Effectiveness level %		Period %	Effectiveness level %		Period %	Effectiveness level %		
Forehand straight stroke	Preparatory phase	1st period	1	1.0	20.0	5	4.9	50.0	47	46.1	48.5	24	23.5	40.7	25	24.5	59.5	-	-	-	102	3.34
		2nd period	4	15.4	80.0	5	4.8	50.0	50	94.2	51.5	35	56.7	59.3	17	27.9	40.5	1	1.0	100	112	3.47
	Execution phase	1st period	4	3.3	80.0	6	4.9	60.0	59	48.4	60.8	34	27.9	57.6	18	14.8	42.9	1	.8	100	122	3.52
		2nd period	1	1.1	20.0	4	4.4	40.0	38	41.7	39.1	25	27.5	42.4	24	26.4	57.1	-	-	-	92	3.27
	Follow-through phase	1st period	1	.9	20.0	5	4.5	50.0	45	40.9	46.4	27	24.5	45.8	32	29.1	76.2	-	-	-	110	3.24
		2nd period	4	3.8	80.0	5	4.8	50.0	52	50.0	53.6	32	30.8	54.2	10	9.6	23.8	1	1.0	100	104	3.60
Backhand straight stroke	Preparatory phase	1st period	2	3.6	14.3	3	5.5	27.3	23	41.8	15.6	8	14.5	4.7	19	34.5	25.7	-	-	-	55	3.29
		2nd period	11	3.3	78.6	8	2.4	72.7	108	32.1	73.5	154	45.8	89.5	54	16.1	73.0	1	.3	100	336	3.30
		3rd period	1	3.6	7.1	-	-	-	16	57.1	10.9	10	35.7	5.8	1	3.6	1.4	-	-	-	28	3.64
	Execution phase	1st period	5	4.5	35.7	3	2.7	27.3	62	55.9	42.2	32	28.8	18.6	9	8.1	12.2	-	-	-	111	3.67
		2nd period	9	2.9	64.3	8	2.6	72.7	85	27.6	57.8	140	45.5	81.4	65	21.1	87.8	1	.3	100	308	3.20
	Follow-through phase	1st period	5	3.2	35.7	6	3.8	54.5	49	31.4	33.3	45	28.8	26.2	51	32.7	68.9	-	-	-	156	3.16
		2nd period	9	3.5	64.3	5	2.0	45.5	96	37.6	65.3	122	47.8	70.9	22	8.6	29.7	1	.4	100	255	3.43
		3rd period	-	-	-	-	-	-	2	25.0	1.4	5	62.5	2.9	1	12.5	1.4	-	-	-	8	3.13

Discussion

Fast Rebound

In this study, the effectiveness of temporal structure for forehand and backhand straight strokes performance in fast rebound was illustrated in table (1). Regarding the preparatory phase in forehand straight strokes, it was found that the effectiveness degree increased during the first and second periods (3.70 to 3.75), with high frequency below the level of positive effectiveness. This finding may be due to the fast rebound forces the player to do shorthand backswing for doing fast stroke forcing an opponent to play shots under spatial and temporal pressure, as was found by Vuckovic, Pers, James and Hughes, (2009), and Yarrow and Harrison (2010).While forehand straight stroke was achieved the effectiveness degree 3.60 in performance of third period in spite of the limited number of frequencies. It is due to the desire of the player to complete this phase for providing the ball with power and horizontal speed for high rotating rate of the ball which change the tactical situation from defensive to offensive mode. These findings are consistent with Eldin and Abdel-Rahman,(1989) who reported that the preparatory phase performed in opposite direction of basic movement which leads to increase the participated muscles contraction in the performance which is required by the execution phase.

Concerning the execution phase in the forehand straight stroke, it was noticed that, the first and second periods were achieved effectiveness degree (3.36: 3.55), with frequency rate (45: 56), below the levels of positive effectiveness. These results could be attributed by forcing the player to complete the execution phase in the same speed of the preparatory phase. As regard the follow-through phase in the forehand straight stroke, it was observed that, the first and second periods were achieved effectiveness degree (3.31: 3.57), with frequency rate (32: 67). These findings may be explained by the player's desire to end the stroke quickly, as a desirable shot would be aimed towards the back of the court to try to maximize the time available to get back to the central part of the court (known as the T area), as was found by Vuckovic and James, (2010), and Yarrow & Harrison, (2010). While a high effectiveness degree in the third period to 4 degrees. This may be perhaps to the player's desire to lengthen the final stage to follow up the ball and take advantage of the transferable force to the ball instead of the shorthand in this stage which may lead to start a counter-attack from the opponent.

Concerning the backhand straight stroke, it was reflected that, the frequency rate of strokes through the three phases of skill performance was increased (78: 114) during the second period. These results perhaps due to the backhand straight stroke is a difficult one, as each player tries to force their opponent to move as much as possible over the playing area in order to make their opponent's ability to make a successful shot as difficult as possible. This finding is harmony with Vuckovic and James, (2010) Findings. In addition, it requires more effort and a special dynamic for its performance. Furthermore, the opponent doesn`t give the player enough space to swing at the ball. Thus, the player focuses on performing it correctly without making any errors.

Whereas, this stroke was achieved during the first period in the execution and follow-through phases with frequency rate 37 and 55 strokes respectively. These findings could be explained by the trial of the player to end this stroke quickly for taking the opponent away from the T area. Moreover, this stroke also achieved effectiveness degree (3.75: 4) in third period during the preparatory and follow-through phases. This finding may be due to working of the player on lengthening these phases to hit the ball with less power, so that he can concentrate on accuracy. More racket swings vertically or horizontally in any direction greater the ball rotation, as clarified by Allen, (2007).

Moderate Rebound

This study has also shown the effectiveness of temporal structure for forehand and backhand straight strokes performance in moderate rebound as observed in table (2). As regard the forehand straight stroke, it was illustrated that this stroke was achieved effectiveness degree (3.46: 3.59) during the preparatory phase in first and second periods, with high frequency below the levels of positive effectiveness. It may be possible to the moderate rebound gives the player the choice to do shorthand backswing for doing fast stroke and putting the opponent under pressure. While during the third and fourth period in the preparatory phase, the effectiveness degree was increased (3.80: 4). It is possible to the desire of the player to gather his power for increasing the speed of the ball. These findings are in harmony with findings of Moen, (2013). While these strokes were achieved effectiveness degree (3.50: 3.64) during execution and follow-through phases in first and second periods. It may be explained by trial of the player to exploit the moderate rebound of the ball and return the ball quickly in order to put the opponent in out of position.

Regarding the backhand straight stroke, it was noticed that the frequency rate of this stroke was increased (33: 202) during the first and second period through the three phases of skill performance, below the levels of positive effectiveness. This can be attributed by the player's wishes to end the strokes quickly and puts the opponent in defensive position. Furthermore, in a more aggressive

mode, a player could try to play an outright winning shot or try to hit the ball to an area that maximizes the speed needed and minimizes the time available for the opponent, as reflected by findings of Vuckovic and James,(2010). On the other hand, this stroke was achieved high effectiveness degree (3.50: 4) in third period during the preparatory and follow-through phases. Thus, trial of the player to complete these phases in order to emphasize a direct path way of the ball to do some deep strokes accurately and strongly, which can explain these results. These findings are consistent with Bacon,(2003), and Yarrow and Harrison, (2010) findings.

Slow Rebound

Further, the effectiveness of temporal structure for forehand and backhand straight strokes performance in slow rebound was illustrated in table (3). Concerning the forehand straight stroke, it was found that this stroke was achieved frequency rate in first and second periods (92: 112) during the three phases of skill performance and effectiveness degree (3.24: 3.52). So these findings could be attributed by the ability of the player to take advantage of the slow rebound of the ball in order to return the stroke quickly with using the deception to increase the speed of the ball rotation which leads to low rebound. Therefore this requires from the opponent to have too much effort for returning the ball without clashing the tin. These findings are in agreement with Allen, (2007) findings.

Regarding the backhand straight strokes, the current study revealed a significant increase in the frequency rate of this stroke (255: 336) in second period through the three phases of skill performance. Because of the desire of the player to slow his performance during the three phases of skill for shot accuracy. So that this finding was assured by high effectiveness degree (3.46) in third period during the preparatory phase, as was illustrated in American sport education program, (2009). In addition, the frequency rate of this stroke was increased (55:156) in first period during the three phases of skill performance. It may be due to the desire of the player to use the shorthand performance. Where, if the opponent`s shot is softer, the player should shot more quickly to reduce the time of the opponent has to get to back of the court to return the shot thus send the opponent to the wrong way (wrong foot).

Conclusion

Based on the research findings, it is concluded that levels of effectiveness had increased during performance of forehand and backhand straight strokes in first and second periods during the three phases of skill performance (preparatory, execution, and follow-through) during time rebound (fast, moderate and slow) of the player. Besides, levels of effectiveness had increased in fast rebound during performance of forehand and backhand straight strokes in third period during preparatory and follow-through phases of skill performance. So that the fast rebound of the ball usually forced the player to do shorthand performance which leads to an offensive or a defensive position according to controlling of the player to the ball. Consequently, it makes a difficult return of the player for covering the T area. Moreover, the fast rebound of the ball especially playing it for the backhand of the opponent is effective factor for scoring points and forcing errors to the opponent. When the player relatively slows the skill performance during the preparatory and follow-through phases in backhand straight strokes, the player will return the ball accurately.

Moreover, the effectiveness degree of forehand straight stoke in moderate rebound had increased during preparatory phase in third and fourth period. On the other hand, the effectiveness degree of backhand straight strokes was elevated during preparatory and follow-through phases in third period, and the player may be forced to do shorthand or have a chance to do shorthand or not during performance of forehand and backhand straight strokes. Therefore the moderate redound of the ball helps the player to return quickly for covering the T area. In addition to that, levels of effectiveness in slow rebound had increased during performance of backhand straight strokes in third period during the preparatory phase of skill performance. As well as the player have a chance to do shorthand or not during performance of forehand and backhand straight strokes.

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