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Comparative Kinematic Analysis of Forehand Drive Variations in Tennis

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Abstract

The point to take up this study is to investigate and to explicate the forehand drive technique of tennis to compare the two different variation of forehand drive in tennis. A total of 5 male university level subjects were selected (aged 20.54 ± 2.11) from tennis match practice group of Lakshmibai National Institute of Physical Education by using consecutive sampling. The results of the study reveals that the comparison of angles at angular kinematic variable (right shoulder joint, right elbow joint, right hip joint, right knee joint.) and Linear kinematic variable (height of center of mass at moment contact) was found to be insignificant at the moment contact as the p – value was more than 0.05.It means all the selected kinematic variables for both the technique of forehand drive were almost of similar in nature and only the contact point was different.

Keywords: Forehand drive, tennis, angular kinematics, linear kinematics, centre of mass.

Introduction

In early era most of the games were primarily based on fitness. But in today's game all top players have incredible fitness and mobility. A racket sport requires different techniques and strategies. The ball travels faster around the court and thus requires quicker reflexes and proper technique to play effective shots. Apart from fitness and technique there are other factors which also contribute for high performance. In recent trends, biomechanics is most important field which plays incredible role in player performance. The analysis of technique provides important points in relation to shot played and their effectiveness. The angles of various joints while performing any skill plays important role to be effective. Applying their scientific skills to racket sports, has seen a rapid growth in scientific endeavor[1]. The forehand is one of the most spectacular, devastating and basic shots in tennis. Except in the context of the phrase forehand volley, the term refers to a type of groundstroke a stroke in which the ball has bounced before it is struck. It contrasts with the backhand, the other type of groundstroke. For a right-handed player, the forehand is a stroke that begins on the right side of his body, continues across his body as contact is made with the ball, and ends on the left side of his body. It is considered the easiest shot to master, perhaps because it is the most natural stroke. Beginners and advanced players often have better forehands than any other shots and use it as a weapon.[3]

Methodology

Righteous Permission**:** Subjects were explained about the cause of the study and taken virtuous consent to participate in the study.

Selection of Subject: A total of 5 right handed male university level subjects were selected from tennis match practice group of Lakshmibai National Institute of Physical Education by using consecutive sampling. The age of the subjects was ranged from 18 to 28 years and all were regular tennis players with good level of skill. The purpose of the research was explained to the subjects and they were motivated to put their best during each attempt.

Criterion Measures and Reliability of Data: The performance of forehand drive of each selected subject was taken as the criterion measure for the present study. The performance was recorded on the basis of execution of the skill; this was evaluated by Hewitt forehand Drive Test, and the sum total of ten trials was taken as score. The reliability was insured by establishing the instrument's reliability of test and tester's competency. The instruments namely, the camera, steel tape, geometric were standard instruments available in the research laboratory of L.N.I.P.E. The reliability of data for the selected biomechanical variables was established by the test-retest method. The photography was done by the professional photographer. The other tests were conducted under the guidance and presence of the experts in specified area available in the institute. So, the data collection for the present study was considered reliable.

Result and Discussion

The mean value of selected angular and linear kinematics variables and their relationship with dependent variables are presented separately in table-1 and table-2.

The statistical analysis of the data, collected on five Tennis players and the results of the study have been presented in this

chapter. Paired t-test was used to find out the Biomechanical comparison of two different variations of forehand drive in Tennis. The value 0.05 was kept as level of significance.

The values of mean and standard deviation for the angular kinematic variables at moment contact are shown in table-3. These values may be used for further analysis in the study

The values of mean and standard deviation for the all linear kinematic variables at moment contact in technique of forehand drive are shown in table-2. These values may be used for further analysis in the study.

The performance of each subject on forehand drive was collected on tennis court as per Hewitt tennis test. The recording was conducted in the outdoor tennis complex.

Table-1
Mean and Standard Deviation of Angular Kinematic Variables at Moment Contact in Technique of Forehand Drive

KINEMATIC VARIABLES	MEAN (in degrees)	STD. DEVIATION
Angle of right knee down the line	143.2000	25.40079
Angle of right knee cross court	150.0000	39.15354
Angle of right hip down the line	173.4000	12.97305
Angle of right hip cross court	173.4000	10.11435
Angle of right elbow down the line	114.6000	7.50333
Angle of right elbow cross court	103.6000	21.72096
Angle of right shoulder down the line	57.2000	12.45793
Angle of right shoulder cross court	57.2000	21.81055

Table-2
Mean and Standard Deviation of Linear kinematic Variable at Moment Contact in Technique of Forehand Drive

KINEMATIC VARIABLE	MEAN (in cm)	STD. DEVIATION
COM of down the line	151.0020	11.28944
COM of cross court	153.4180	12.57974

Table-3
Paired Samples Test at Moment Contact in Technique of Forehand Drive

Pair	Variable	Paired Differences					T	Sig.
		Mean	Std. Deviation	Std. Error of mean	95% Confidence Interval of the Difference			
					Lower	Upper		
Pair 1	COM down the line - COM of cross court	-2.41	15.23	6.81	-21.32	16.49	-.355	.741
Pair 2	Angle of right knee down the line and cross court	-6.80	36.21	16.19	-51.76	38.16	-.420	.696
Pair 3	Angle of right hip down the line and cross court	.00	16.07	7.19	-19.96	19.96	.000	1
Pair 4	Angle of right elbow down the line and cross court	11.00	18.85	8.43	-12.41	34.41	1.305	.262
Pair 5	Angle of right shoulder down the line and cross court	.00	18.72	8.37	-23.24	23.24	.000	1

Since the p value is more than .05 in all the selected kinematic variables of Tennis players, it may conclude that the null hypothesis is failed to be rejected at 5% level. Hence it may be inferred that the center of mass down the line and cross court and angle of various selected joints of down the line and cross court for both the techniques of forehand drive are almost equal.

Discussion: No statistical difference was observed when comparing the two different variations of forehand drive in tennis i.e. down the line and cross court. It means all the selected kinematic variables for both the technique of forehand drive were almost similar. It may be due to the nature of both the variation as only the direction of the hitting the ball was changing because of the contact point. The tennis players mostly use the wrist and elbow angles to change the direction of the ball. At the high level the players are very less concerned about the body alignment and various joints angles. Most of players keep their body erect to reduce the energy input and to move fast. But, the racquet angle is most important factor which has to be kept optimum in relation to clear the net. The most common mistakes player does at beginner's level are the use of wrist, which does not allow producing much force. Thus, the ball speed reduced. Not only angles but the position and contact point is also important while hitting the ball. While hitting the ball down the line the ball should be kept close to body and in cross court the ball should be away from the body. But, to hit the ball hard and with greater speed the body alignment and optimum angles of hitting side have great importance[4].

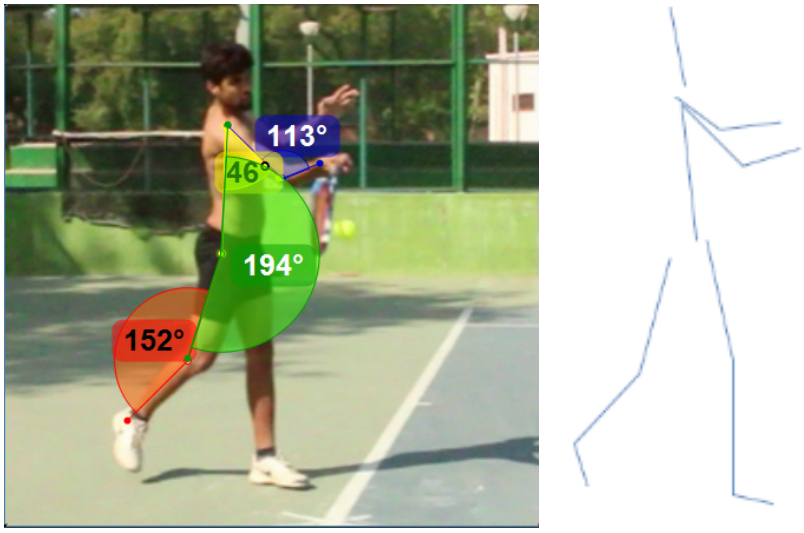

Figure-1
Angles and Stick figure of Moment contact in forehand drive during down the line

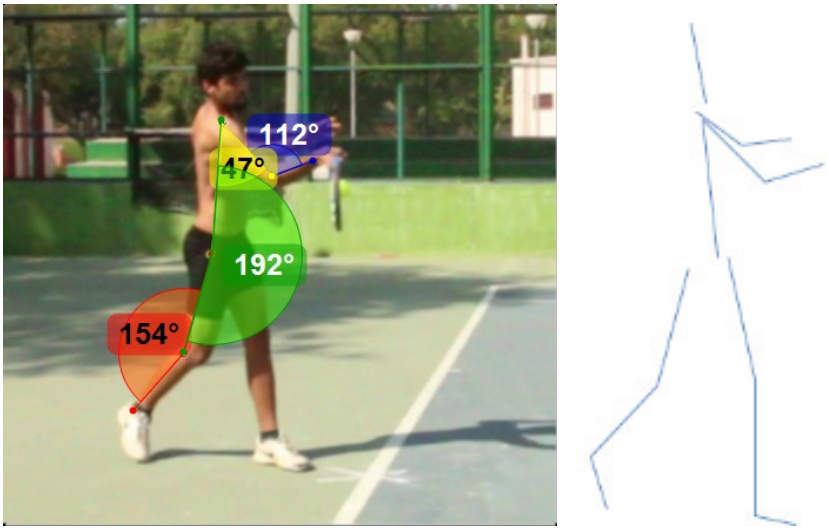

Figure-2
Angles and Stick figure of Moment contact in forehand drive during cross court

Conclusion

Based on the analysis and within the limitations of present study, it was concluded that all selected kinematic variables had insignificant difference in comparison of two different variations of forehand drive in tennis. Because drive is a similar shot either it is played down the line or cross court. Instead of body alignment the player mostly use the wrist to change the direction of the ball in both the variations. The conclusion for such result could be that both the techniques are of similar nature only the contact point was different.

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