Biomechanical Comparison of Open and Closed Stance Backhand Strokes among University Tennis Players

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Abstract

The purpose is to study Biomechanical comparison of open and closed stance backhand strokes among university Tennis Players. Five male tennis players were selected from the players studying in LNIPE Gwalior for the study. Their skills were captured using Nikon D- 3100, a motor driven camera, with the frequency of 24 frames per second. 8 reflective markers attached to anatomic landmarks for two-handed backhand drive data collection. The data was analyzed by paired sample t- test ascertains the comparison of the selected kinematic variables at moment of contact in open stance and closed stance backhand drive in Tennis. In case of selected kinematic variables, the linear kinematic variables, right knee angle of closed and open stance, left knee angle of closed and open stance has exhibited significant difference between the open stance and closed stance backhand strokes.

KEYWORDS: - Backhand drive, open stance, closed stance.

Introduction

The primary goal of the sport biomechanist is to improve athlete's performance and to reduce the risk of injury. Biomechanical research typically involved descriptive studies of the kinematics and kinetics of sport skills, electromyographic studies of muscle activation, and modeling and simulation studies. Engineering has played a prominent role in Tennis research on rackets, balls, shoes, and playing surfaces.

Tennis is a sport that can be played individually against a single opponent (singles) or between two teams of two players each (doubles). Each player uses a racquet that is strung with cord to strike a hollow rubber ball covered with felt over or around a net and into the opponent's court. The object of the game is to play the ball in such a way that the opponent is not able to play a good return.

For right-handed players, the backhand is a stroke that begins on the left side of their body, continues across their body as contact is made with the ball, and ends on the right side of their body. It can be executed with either one hand or with both and is generally considered more difficult to master than the forehand.

The Tennis double handed backhand stroke has changed drastically over the last 10 years. Today's players seldom use the traditional double handed backhand. Instead, the majority of the top amateur and professional players use the modern topspin double handed backhand stroke. Changes in the double handed backhand

technique have been attributed to new racket designs. Rackets are bigger, lighter, and stiffer than the traditional wooden rackets allowing the players to hit the ball with more power and control. These changes in the double handed backhand technique have influenced the type of grip, footwork and racket backswing and forward swing of today's Tennis players.

The double handed backhand can be one of the most complex tennis strokes. There are many key phases in the stroke which make the stroke one of the hardest to master, but mastery of the double handed backhand in Tennis is necessary in today's baseline game. The game of tennis has evolved into a power game and less finesse as it was in the past. Today, having a good double handed backhand means being able to hit the ball hard with topspin.

The **Open Stance** is very popular among tennis right now. To perform this correctly, you must coil and turn your upper body while keeping your lower body facing the net. This coil that you've just created, between your upper and lower body, is creating torque that you'll be using as an additional form of energy and power when you make contact with the ball. If done correctly, your body will act like a spring that has been wound because once you are ready to hit the ball your upper body will spring open. All of that energy and power will be passed on to the racquet when making contact with the ball.

In the closed stance, your feet should be creating almost a 90 degree angle with the baseline. If you are standing at the centre of the court, you will have to move your left foot slightly forward to assist you in hitting the ball. Then after contact, bring your right foot forward to return to ready position and be ready to hit the next shot. This is not a very big step stance, but it is very effective for Baseline players

Methodology

Selection of subjects: -Five male tennis players of LNIPE, Gwalior from the Tennis match practice group were selected for the present study. Therefore it was considered that subjects posses reasonable level of technique of backhand drive. Their age ranged between 20 to 24 years.

Selection of variables: - For the kinematic analysis of backhand drive following kinematic variables were selected:

a) Linear kinematic variables:

i. Height of centre of gravity (COG) at moment contact.

b) Angular kinematic variables:

i. Angle at right and left knee joint.

ii. Angle at right and left hip joint.

iii. Angle at right and left elbow joint.

iv. Angle at right and left shoulder joint.

Criterion measures: -The performance of double handed backhand 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 Double Handed Backhand Drive Test, and the sum total of ten trials was taken as score.

Statistical analysis: - For the purpose of the study, paired sample't' test was used and the level of significance was set at 0.05.

RESULTS

Means and standard deviations of angular kinematic variables of backhand drive in two different variations at moment contact are presented in table -1.

Table – 1

Descriptive Study of Angular Kinematic Variables at Moment Contact in Technique of Backhand Drive

Kinematic Variables	Mean	Std. Deviation
Right elbow angle in closed stance	152.4000	20.67124
Right elbow angle in open stance	155.8000	11.58447
Left elbow angle in closed stance	141.8000	22.39866
Left elbow angle in open stance	141.4000	20.36664
Right shoulder angle in closed stance	30.4000	5.77062
Right shoulder angle in open stance	31.2000	8.07465
Left shoulder angle in closed stance	34.4000	16.25731
Left shoulder angle in open stance	34.2000	18.52566
Right hip angle in closed stance	145.2000	16.99117
Right hip angle in open stance	156.8000	17.93600
Left hip angle in closed stance	164.6000	14.13506
Left hip angle in open stance	172.8000	5.21536
Right knee angle in closed stance	151.4000	5.17687
Right knee angle in open stance	160.2000	11.12205
Left knee angle in closed stance	127.6000	18.14663
Left knee angle in open stance	140.4000	21.51279

$t_{.05}$ (4) = 2.776

The values of mean and standard deviation for the angular kinematic variables at moment contact are shown in table-1. These values may be used for further analysis in the study.

Means and standard deviations of linear kinematic variables of two handed backhand drive at moment contact are presented in table 2.

Table- 2

Descriptive Study of Linear Kinematic Variable at Moment Contact in Technique of Backhand Drive

Kinematic Variables	Mean (in cm)	Std. Deviation
COG of closed stance	136.5060	10.84645
COG of open stance	153.7100	10.03689

$t_{.05}$ (4) = 2.776

The values of mean and standard deviation for the all linear kinematic variables at

Moment contact in technique of two handed backhand drive is shown in table-2. These values may be used for further analysis in the study.

Table-3

Comparative Study of Paired Samples Test in between open stance and close stance Technique of Backhand Drive

Kinematic Variables		t	df	Sig. (2-tailed)
Pair 1	center of gravity of closed stance centre of gravity of open stance	2.513	4	.066
Pair 2	right elbow angle of closed stance right elbow angle of open stance	.648	4	.553
Pair 3	left elbow angle of closed stance left elbow angle of open stance	.199	4	.852
Pair 4	right shoulder angle of closed stance right shoulder angle of open stance	.547	4	.614
Pair 5	left shoulder angle of closed stance left shoulder angle of open stance	.061	4	.954
Pair 6	right hip angle of closed stance right hip angle of open stance	2.039	4	.111
Pair 7	left hip angle of closed stance left hip angle of open stance	1.568	4	.192
Pair 8	right knee angle of closed stance right knee angle of open stance	2.879	4	.045
Pair 9	left knee angle of closed stance left knee angle of open stance	5.438	4	.006

$t_{.05}$ (4) = 2.776

Table-3 revealed that the center of gravity of closed stance and open stance backhand drive and all the other angular kinematic variables (left hip angle(.192), left shoulder(.954) and left elbow angle(.852),Right knee angle(.045),right hip angle(.111),right shoulder (.614) and right elbow angle(.553)) have greater p-value.

Hence none of the selected angular and linear kinematic variables show significant difference at 0.05.

The linear kinematic variables, right knee angle of open and closed stance (.045), left knee angle of open and closed (.006) only show the significant difference at 0.05.

Discussion

In case of selected kinematic variables, the linear kinematic variables, right knee angle of open and closed stance, left knee angle of open and closed stance has exhibited significant difference between the technique of closed stance and open stance of two handed backhand drive. Only these two exhibits the significant difference because of the shifting of the right leg in front direction and the left leg comes in the diagonal position in closed stance of two handed back hand drive which may cause the change in angle.

The other kinematic variables showed insignificant result at moment contact of closed stance and open stance two handed backhand drive because the same patterns were adopted by the tennis player during judgment of ball in technique of backhand drive. Further the Arm moment is not purely in sagittal plane due to which, the measured arm angle through 2D analysis might not be accurate. It may also be due to the low level of performance of athlete, low sample size and execution of technique in different manner by the player during test.

Conclusions

Based on the analysis and within the limitations of the present study, it was concluded that:-

1. The two handed backhand groundstroke in tennis can be seen as a highly dynamic sporting movement. Identifying kinematics comparison between two different variations of stance in two handed backhand drive was the main purpose of the present study. Moreover, mechanical differences and similarities between the closed stance and open stance in the line situations were analyzed.

2. Right knee angle of open and closed stance, left knee angle of open and closed stance had significant difference between the technique of closed stance and open stance of two handed backhand drive.

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MISCELLANEOUS

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