European Journal of Physical Education and Sport Science
ISSN: 2501 - 1235
ISSN-L: 2501 - 1235
Available on-line at: www.oapub.org/edu

DOI: 10.46827/ejpe.v8i6.4448 Volume 8 | Issue 6 | 2022

COMPARISON OF OPEN AND CLOSED STANCE FOREHAND STROKES AMONG YOGYAKARTA JUNIOR TENNIS PLAYERS

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Abstract:
Background: Tennis develops faster nowadays, and tennis players are able to powerfully hit from a variety of angles. Effective training and planning will help achieve these goals by designing safe, effective and productive programs to optimize the performance of tennis players. **Objective**: This study examined the effectiveness of open and closed stance forehand stroke in terms of percentage of success, accuracy and also investigated whether there is a relationship between the level of accuracy and the choice of forehand stroke used by tennis players. **Method**: Participants were divided into two groups, namely males and females who were included in the junior players category of 12 – 16 years old. The participants were tested using two skill tests for the percentage of success and the level of accuracy. **Results:** It was found that the closed stance forehand stroke had a much better percentage of success and accuracy in junior tennis players, but the difference was not significant. In addition, male players showed more precision and success in this study, and also accuracy did not have a significant influence on the choice of forehand stroke among junior tennis players. **Conclusion**: This study can improve the design of the exercise program for teaching closed and open stance strokes.

Keywords: forehand stroke, open stance, closed stance, tennis accuracy, percentage of success

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1. Introduction

Tennis is a popular sport played around the world. Tennis is often played between two players (single) or between two teams of two players each (double) (Ireland, Degens, Maffulli, & Rittweger, 2015). Each player uses a racket to hit the ball directed at the opponent's court and past the net (Brown & Soulier, 2013). Tennis is an Olympic sport and is played at all levels of society at all ages. This sport can be played by anyone who can hold a racket, including people in wheelchairs (Bahamonde & Knudson, 2003; Duane, 1991; Sandamas, 2013). Forehand stroke is the most important shot in a player's arsenal after the serve (Matsuzaki, 2004; Roetert & Gropel, 2001). The rotation of the lower body and upper body has been described as a significant source of force in the forehand stroke. Energy is transferred upward from the legs to the pelvis, through the trunk of the body to the outside of the arms and then to the racket. In the kinetic chain of the lower body, the knee joint is considered a "*critical middle link*" in the proximal transfer of forces (Whiting & Zernicke, 2008). The rotation of the trunk and the pelvis involves a torsional force in the lower body, not only during the forward swing but also during the follow-up where this rotational energy is being dissipated. Research on lower extremity kinetics of close stand (CS) forehand has shown that foot drive is essential to create high axial hip rotational torque to assist the rotational trunk (Iino and Kojima, 2003). In researches by Bryant (2011) and Gallwey (2010) is stated that recovery time is faster in open stances because a player is already facing the net in a ready position after hitting the ball, as opposed to a closed stance where the weight moves forward from the step in and then has to take an extra step back to the ready position. Only the knee moment of the sagittal plane has been described in previous studies (Fleisig, Nicholls, Elliott, & Escamilla, 2003; Roetert & Groppel, 2001).

1.1 Closed stance forehand

A forehand stroke in tennis has long been qualified and done as one of the styles. This style is identified by three names: closed, squared, or sideways stance forehand. The closed stance forehand brings up the situation during and before contact with the ball. A stripe sketched from the back foot to the front foot should run equivalent to the planned ball path (Elliott, Reid, & Crespo, 2003).

1.2 Open stance forehand

An alternative option for a closed stance forehand is an open stance forehand. This method has become important because of the absolute power of the game. The situation of the body in the open stance forehand is that the hips and shoulders are equivalent or "open" to the net (Alizadehkhaiyat & Frostick, 2015). The right foot (for the right-hand dominant players) is placed in the back as the player progresses sideways and gets ready for the ball as the shoulders and hips are turned in anticipation of the approaching ball (Gallwey, 2010). The open stance forehand has been explained as weak and less effective in the early literature and has been noted as less optimal. The references state that if the

feet are parallel to the net when a player hits the ball, then after that they are in the wrong position (Roetert & Groppel, 2001). Nevertheless, there is very little data was published on biomechanical three-dimensional tennis and almost nothing was related to the kinetics of the lower extremity forehand. This study intends to generally examine and compare the effectiveness of open and closed stance forehand stroke, and to determine whether there is a relationship between open and closed stance forehand in terms of percentage of success and level of accuracy. This study also specifically aims to measure and analyze the percentage of success and the level of accuracy using open and closed stance forehand among tennis players. Several previous research studies in the literature are usually involved in investigating the effects of tennis strokes on different parts of the body. Several studies have also examined the analysis of tennis hits in relation to the percentage of success and the level of accuracy among tennis players. However, there is a lack of studies on the relationship between different tennis strokes and stance positions (Roetert & Groppel, 2001).

2. Material and Methods

The population of this study are junior tennis players aged 12-16 years who have often conducted regional and national matches in the Special Region of Yogyakarta, Indonesia. From the study population, thirty players were selected as samples for the study. The framework for this study is described in Figure 1. Participants consisted of 16 males and 16 females. All participants are categorized as junior participants and have agreed to the specified requirements and criteria. Participants got a four-week training program, three times a week for one 90-minute session. After the training program, the participants were divided into two groups, namely 'open stance forehand group' and 'closed stance forehand group'. The criterion for this classification is their performance in hitting open and closed stance forehand strokes during the training program.

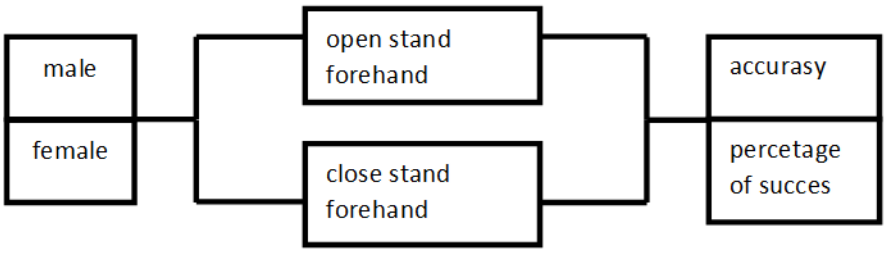

Figure 1: Framework

Tennis players were asked to hit AC and DL strokes from the baseline with their preferred technique and to hit balls from the ball feeder. It is important for the coach to

learn the feeding techniques and procedures, so that the feeder can provide challenging situations through proper and consistent feeding, and also to provide more repetition of special situations to test the percentage of success and the level of accuracy regarding closed and open stance forehand position. The coach stands right at the specified location. The coach can modify the position to make a positive change, but progressively returns to the right position. Basically, the coach is feeding the ball in the ground strike zone. This is the tennis court area to get a point. This requires patience, planning and focus. Players should be consistent in this situation. It constitutes the basic for the forward strokes or the rotary strokes.

2.1 Testing procedure

This study examined the difference between open stance forehand stroke and closed stance forehand stroke when hit and down the line (DL) and across the court (AC). Each participant hits (20) forehand strokes in an open or closed stance as if they were playing a real tennis match (strong forehand strokes and no effect), trying to hit four pre-established targets. Players have been instructed to take only one ball at the same time with the aim of keeping an interval of (5) to (7) seconds between each open or closed stance forehand when occurring in real matches. Three sessions were designed for each group, i.e., open stance, and closed stance, and the total stroke score of each player was recorded. According to the difficulty level of the task, the assessment record of each target is determined, as follows: Three points on the desired target, two points in the middle area and one point if the third area is affected. Zero points are given for not hitting the area, at the net. According to Figure 2, each side of the field is divided into three parts. It depends on the number of forehand stroke on the goal (area). Participants can get 0 to 3 points. Tennis players must hit the forehand five times for each target. Data is considered a categorical variable so the reliability test is carried out between the observed sample and theoretical distribution and the contingency test for independence between two or more variables. Each tennis player from the open stance forehand group and closed stance forehand group must stand behind the tennis court baseline, so that they can receive optimal feedback. Players hit five forehand strokes on each of the AI, FV, FL, and AV targets. The coach (feeder) standing on the opposite side of the player's side can accelerate the rhythm and provide better feedback for the test. The feeder should use a continental grip to allow any type of feed when creating a specific situation, although the assist may use the required handle to provide the right aim. The feeder can feed from any stroke without looking at the ball, so the feeder can maintain eye contact with the students.

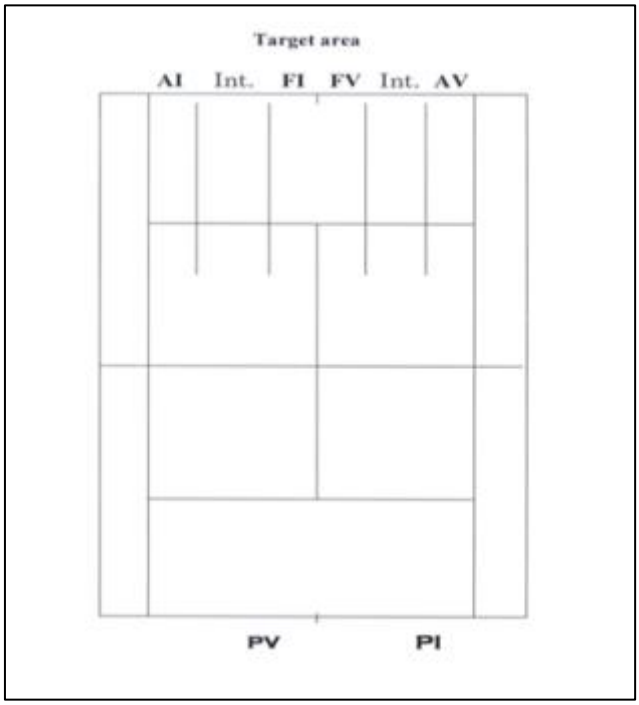

Figure 2: Tennis court

2.2 Data analysis

To compare open stance and closed stance strokes among junior tennis players, SPSS was used. The results of the statistical analysis were reported in relation to the independent T-test using SPSS version 21. This includes descriptive statistics for the age, weight and height of respondents, the effectiveness of the open stand and close stand will be measured in terms of success rate and accuracy.

3. Results and Discussion

Based on Table 4-1 in both groups, including open and closed stance, the age of respondents was between 12 to 16 and the average age in these two groups was M = 14.54 and M = 14.23, respectively. These differences between the two groups in terms of age were not statistically different. The average height in the open stance group was M = 140.93 and in the closed stance group of 145.78 which was also not significantly different. The minimum age of respondents in both groups was the same and the average body weight in the open group was M = 49.12 which was not statistically different from the closed stance group at M = 47.84. These results confirm that both groups are homogeneous (Table 1 and Table 2).

Table 1: Descriptive statistics for weight, age and height of tennis players

Learning		N	Minimum	Maximum	Mean	SD
Open stance	Age	16	12	16	14.54	1.638
	Height	16	124	168	140.93	6.384
	Weight	16	42	56	49.12	7.29
Closed stance	Age	16	12	16	14.23	1.595
	Height	16	110	165	145.78	6.194
	Weight	16	38	59	47.84	6.356

Table 2: Difference between open and closed stance for age, weight and height

	t	df	P value	Mean Difference
Age	0.524	32	0.510	0.323
Height	0.891	32	0.432	1.791
Weight	-0.203	32	0.742	-0.704

3.1 Differentiating between males and females

To determine the difference between males and females in terms of the percentage of success and the level of accuracy in both open stand and closed stand, an independent t-test was applied and the results showed that there was a significant effect of differences between females and males on success in all tests (Table 3 and Table 4). In the open stance forehand group, the average success of females in the first evaluation was 30.2±4.5 while for males 48.9±9.9. In the second evaluation, the percentage of success among males increased by 4%, but the success of females decreased by 1%. This difference is still significant in the third assessment where males have a higher percentage of success at 52.4±9.5 compared to females at 37.8±3.5.

For the closed stance forehand strokes group, the average success of females in the first evaluation was 40.1±8.4 while for males it was 52.3±5.7. In the second evaluation, the percentage of success among males decreased by 4% and the success of females decreased by 1%. The differences at this stage are significant. In the last assessment, males had a higher percentage of success of 50.2±5.7 compared to females of 42.4±5.6 (Table 3).

Table 3: Mean comparison between males and females for success in both closed and open stance

		Gender	N	Mean	SD	t	p value
Open stance	Success1	Female	8	30.2	4.5	-5.496	<0.05
		Male	8	48.9	9.9		
	Success2	Female	8	36.4	8.3	-6.489	<0.05
		Male	8	57.5	9.5		
	Success3	Female	8	37.8	3.5	-6.35	<0.05
		Male	8	52.4	9.5		
Closed stance	Success1	Female	8	40.1	8.4	-4.57	<0.05
		Male	8	52.3	6.9		
	Success2	Female	8	37.2	5.8	-3.67	<0.05
		Male	8	49.2	4.9		
	Success3	Female	8	42.4	5.6	-5.679	<0.05
		Male	8	50.2	5.7		

In the open stance forehand group, the average accuracy of females in the first assessment was 11.56±1,264, while males were 12.67±2,364 which was significant at the 0.05 level. The difference between males and females in the next assessment is again significant and males have higher accuracy than females. This difference is still significant in the third assessment where males maintained higher accuracy at 14.53±1.902 compared to females at 13.75±2.562.

For the closed stance forehand strokes group, the average accuracy of females in the first evaluation was 12.46±3,392 while for males it was significantly higher at 13.67 ± 1,463. In the second evaluation, the accuracy among males was higher than in females. The differences at this stage are significant. In the last stage, males at 15.65±2.48 showed higher accuracy than females at 11.24±1.324 (Table 4).

Table 4: Mean comparison between males and females for accuracy in both open and closed stance forehand

Learning		Gender	N	Mean	SD	t	p value
Open stance	Accuracy1	F	8	11.56	1.264	-3.142	<0.05
		M	8	12.67	2.364		
	Accuracy2	F	8	14.56	1.634	-3.23	<0.05
		M	8	13.34	1.356		
	Accuracy3	F	8	13.75	2.562	-3.84	<0.05
		M	8	14.53	1.902		
Closed stance	Accuracy1	F	8	12.46	3.392	-4.002	<0.05
		M	8	13.67	1.463		
	Accuracy2	F	8	11.44	2.352	-3.432	<0.05
		M	8	12.45	2.352		
	Accuracy3	F	8	11.24	1.324	-2.532	<0.05

Note: F = Female; M = Male; N = Number of players

3.2 Difference between open and closed stance for total success and accuracy

The total success score and total accuracy were calculated based on the average of the three scores and applied to the comparison between the open and closed stance groups. According to the normal distribution of both variables, an independent sample t-test was applied to study the differences between the two groups for total success and total precision. The t-test results showed that there was no significant difference between open and closed stances forehand for total accuracy and total success as shown in Table 5.

Table 5: Mean comparison between open and closed stance for accuracy

	Learning	N	Mean	SD	t	p value
Total accuracy	Open stance	16	12.3252	2.19425	-1.077	0.286
	Closed stance	16	13.2345	2.13433		
Total success	Open stance	16	41.2345	11.73442	-1.269	0.209
	Closed stance	16	45.245	9.93358		

3.3 Differentiating between males and females

To determine the difference between males and females in terms of the percentage of success and the level of accuracy in both open and closed stances, an independent t-test was applied and the results showed that there was a significant difference between females and males in total success and total accuracy (Table 6). In an open stance, the average success rate for females is 32.24±5.45 while for males it is 50.12±7.35. This difference is significant at the 0.05 level. In the closed stance forehand group, significant differences were also observed in total success between females 39.32±6.23 and males50.32±8.3. In the closed position, the total accuracy forehand group for females was 11.32±2.45, which was significantly lower than for males at 13.42±1.53.

Table 6: Mean comparison between gender for total success and accuracy

	Learning	Gender	N	Mean	SD	t	p value
Open stance	Total accuracy	Female	8	11.3247	2.45328	-4.235	<0.05
		Male	8	13.4231	1.53226		
	Total success	Female	8	32.2431	5.45324	-7.432	<0.05
		Male	8	50.1241	7.3546		
Closed stance	Total accuracy	Female	8	12.3447	1.54548	-4.255	<0.05
		Male	8	15.2347	1.23556		
	Total success	Female	8	39.3235	6.23552	-4.355	<0.05
		Male	8	50.3255	.8.3239		

4. Discussion

This study aims to examine and compare the effectiveness of open and closed stance Tennis forehand, and to find out whether there is a relationship between open and closed stance Tennis forehand in terms of percentage of success and level of accuracy. This study also specifically aims to measure and analyze the percentage of success and the level of accuracy using open and closed stance forehand among tennis players. Several previous studies and research in the literature usually involve investigating the effects of tennis strokes on different parts of the body. Several studies also examined the analysis of tennis strokes in relation to the percentage of success and the level of accuracy among tennis players (Larson & Guggenheimer, 2013; Staring, Ibrat, & Filipčič, 2015; Vaverka & Cernosek, 2013). However, there is a lack of research on the relationship between different tennis strokes and positional stances (Erman, ahan, & Küçükkaya, 2013; Reid, Elliott, & Crespo, 2013)

Muhammad et al. in 2011 compared the effectiveness of single and double backhand strokes in terms of percentage of success, accuracy, and also to find out if there is a relationship between their level of agility and the choice of stroke used. To evaluate 16 different tennis players ranging from 16-25 years old from the National Tennis Center (NTC) and Bukit Jalil Sports School voluntarily participated in this study. Samples were tested for agility and two-item skills tests for accuracy and percentage of success. They found that the two-handed backhand was better than the results but the differences were

not significant and also the results showed that agility did not have effectiveness in the choice of backhand strokes (Muhamad, Rashid, Razak, & Salamuddin, 2011).

The first objective of this study is to study the level of accuracy and success of participants in both open and closed stance forehand groups in three stages. This research methodology includes, testing procedures (number of players, and groups), demographic data (age, weight, height), agility tests (success and accuracy), and statistical analysis. In this study, participants (ranging from 12 to 16 years old) were 16 males and 16 females. The participants were categorized into two groups, 'open stance forehand group' and 'closed stance forehand group'. Then, it means, the percentage of success, the level of accuracy, and the standard deviation of the performance of each player's forehand strokes are calculated. The results of the three test steps show that the closed stance forehand is more accurate than the open stance forehand. This may be due to the correct forehand technique used by tennis players in closed stance forehand strokes group in games or perhaps it is an easier method of handling high and fast balls. The success rate is considered between the closed stance forehand group and the open stance forehand group. Overall, the success rate between closed stance forehand groups is greater than open stance forehand groups. In other words, the closed stance forehand group has a better percentage of success for intermediate tennis players. The average score for accuracy and percentage of success for the closed stance forehand group is higher than for the open stance forehand group. This is probably due to the weight and experience of the previous players, which was slightly higher for that group. Therefore, better use of forehand techniques not only provides more tactical options but also more stroke efficiency. The results of this study are similar to previous studies conducted by Akram (2011) which considered as one-hand backhand and two hands backhand in tennis players (Muhamad et al., 2011).

5. Conclusion

Currently, tennis is developing rapidly, supported by many studies that discuss tennis courts. Players can hit hard and steer from all directions to earn points. Effective training program planning will help to achieve effective and efficient results by getting optimal results, therefore players need to practice according to the needs of their sport. Researchers feel that future research should be more detailed in discussing a matter. This information can improve the design of the Exercise program to teach open stand and close stands.

Conflict of Interest Statement

The authors declare no conflicts of interest.

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