Original Article

The effectiveness of serve in tennis depending on the placement of palm across the racket grip inwards or outwards

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Abstract:

The purpose of this study was to investigate the accuracy and speed of serve in tennis depending on the placement of palm across the racket grip inwards or outwards. Apart from the personal grip two additional kinds of grip were examined, one with the wrist two cm “inwards” and a second with two cm “outwards”, from the tip of the handle of the racket. The research sample consisted of 31 tennis players, 16 advanced and 15 intermediate, aged 23±3,4 years old. The players performed 10 serves with each one of the three types of grip, aiming to achieve both valid and high speed serves. The measurement of speed was achieved with the use of a radar gun. Differences in the performance were tested using ANOVA analysis, while differences in speed of valid and invalid services among the three kinds of grips were tested using the Wilcoxon Test. The results indicated statistically significant differences between the two genders ($P<.001$). The differences among the grips were also statistically significant ($P<.05$). The advanced players showed better results using their personal grip. However the intermediate players using the “inconvenient” wrist position 2 cm “outwards” the handle, showed better results regarding the speed of serve and especially the speed of invalid serves ($P<.05$). The use of this type of grip without firmness produced serves of higher speed, probably due to the freedom in wrist and the longer lever that it offers. The current research reveals that when an intermediate player wants to change the serve technique, in order to achieve higher speed in serve, a change to position 2cm “outwards” off the handle would probably provide better results, but it should be combined with more training for high accuracy achievement.

Key Words: tennis, serve, grip, accuracy, speed

Introduction

Out of the four types of serve in tennis the flat serve is the only one in which the ball is hit with almost no rotation (spin). It is the easiest to perform and control and that which is proposed to be taught initially. Many men players perform this serve faster than 200 km / h, as well as some women, like the Williams sisters. The flat serve is considered as the basic (first) serve. The remaining three serves are called specific, due to rotations and the specific racket movement. The slice serve is hit with side rotations, transmitted by brushing the ball from its right rear part (for right-handed players). The top spin serve is hit with a combination of the two rotations, side and forward, transmitted by brushing the ball from back to top and right (Knudson, 2011). Finally, the twist serve, initially known as «American twist», is a special kind of topspin-slice serve where the ball behaves differently after its bounce in the court, because it has more topspin than sidespin rotations. When the twist serve executed properly the ball bounces in the opposite direction from that of the slice serve (Groppel, 1984). The ball should be tossed backwards and left of the head of the server and the racket to brush the ball from position 8.00 to 2.00 of a clock (Bahamonde, 1994). All three serves with rotation (specific) are used mainly as second and have less speed than the first (flat) serve (Bahamonde, 1994; Atkinson & Speirs, 1998).

In all tennis strokes the grip is a key success factor (Elliott, 1982; Elliott & Christmass, 1995; Elliott, Takahashi & Noffal, 1997; Reid, Campbel & Elliott, 2012, Rossi,Vigouroux, Barla, & Berton,2014). More commonly is mentioned that a cause for a no optimal impact of the ball over the strings of the racket is the incorrect grip (Groppel, 1984; Brody, 1987; Knudson & Elliot, 2004). In all kinds of serve, particularly in the specifics, the most used grips are the continental and the eastern backhand (Roetert & Ellenbecker, 2007; Brown, 2012; Rive & Williams 2012). Another particularity of the grip in general is to which level the player grip is “tangential” to the edge of the racket handle, which is the classic and most faced selection of players and coaches in the teaching process (fig. 1, left).

Fig. 1. Three ways of holding the grip of the racket in tennis serve, along the handle.

However some players hold the racket “inwards”, so that a part of the handle overhangs beyond the fingers of the athlete (Fig.1, middle). Some other players still hold the racket “outwards”, so as the tip of the handle of the racket not to be shown (Fig. 1, right). The effect of the above two selections of the players regarding the grip of the racket has not been investigated as far as the effectiveness of the serve is concerned. It is extremely interesting to study whether the two possibilities affect the performance of players’ strokes. The stroke which is more appropriate for the above purpose is the serve, because it is performed without any influence by the opposing player and with zero to the minimum speed of the ball during impact (Reid et al., 2012).

The purpose of this study is to investigate how the accuracy and speed of the serve varying in tennis depends on the placement of palm across the racket grip in advanced and intermediate men and women players. Depending i.e. by placing the palm over the handle to cover this handle or leave it in the back uncovered by a small portion. It was hypothesized that the serves with the personal grip would have a higher percentage of accuracy and also would be faster, both in advanced and intermediate players. The other hypothesis was the more free the grip is, i.e. the smaller part of the handle covered by palm (longer lever), the more fast will be the serve compared to the other option, where the palm is within the handle, so as to leave part of the handle outside the palm (shorter lever).

Method

Subjects

The sample consisted of $N = 31$ tennis players of which 20 were men and 11 were women, age $22 \pm 3,4$ years old. The 16 (11 men and 5 women) were advanced players with competitive experience, while the remaining 15 (9 men and 6 women) of them were intermediate tennis players without experience in tournaments.

Procedure

The test was conducted in open courts (synthetic grass) with no wind. New balls (Wilson US OPEN) were used for the test and all the participants had the appropriate time for serving according to the regulations of the ITF (International Tennis Federation). All the participants hit per five strokes for warm up and for familiarization with the process before the experimental procedure. A radar was used (Prospeed, Digital Signal Processing, Decatur electronics) for measuring the speed of serves. Also, a record sheet constructed for the purpose of research was used, in which the individual data of each participant were recorded, as well as the validity and the speed of their serves. The measurement process involved three people. One of them was holding the radar and announcing the speed of each serve; the second checked the validity or not of the strokes and the third recorded the speed and the validity of serves for each participant on the observation sheet (Fig. 2). It should be noted that all three people involved in the procedure were at a safe distance from the participants and the exanimate area, so as to avoid any harassment to the participants. Also, the participants had to perform the serve in accordance with the rules of the ITF. There was a break for every player after hitting 10 serves, while at the same time two others were tested. The external conditions were ideal with no wind and humidity and the hours of examination were after 18:00.

Statistics

Data is presented as numbers, percents, means and standard variations. The differences in speeds of serves were tested by one way ANOVA analysis and the differences in speeds of valid and invalid serves using the three different grips with the Wilcoxon test.

Fig. 2. Procedure for measuring the speed of the serve.

Results

The analysis of the data shows that the invalid serves to advanced players are less than the valid ones with the personal grip (57/93, 38 %). This relationship remains the same and with “two cm inwards” grip (40.7%), in contrast with the “two cm outwards” grip where the number of invalid serves is greater (76 /74, 50.7 %). The invalid serves present in both different playing levels higher average speeds than the valid ones, with the only exception of the serves with the “two cm inwards” grip, where there is no difference neither in the maximum nor in the average speed. Instead, this difference with the “two cm outwards” grip in intermediate players is sufficient in maximum rates (161/149 km / h) as well as in the mean (101,47/92,27) value (table 1) and generally is statistically significant ($p < .05$).

Table 1: Total number and speed of valid and invalid serves (Km / h) with the three different grips

	N		Minimum Km/h		Maximum Km/h		Mean Km/h		Std. Deviation Km/h		
	16	15									
	Advanced	Intermediate	Advanced	Intermediate	Advanced	Intermediate	Advanced	Intermediate	Advanced	Intermediate	
	150 serves	150 serves									
Valid serves with the private grip	93 62%	69 46%	98	59	179	143	139,96	94,88	20,93	23,88	
Invalid serves with the private grip	57 38%	81 54%	104	52	180	138	144,60	94,90	18,85	20,91	
Valid serves with the “two cm inwards” grip	89 59,3%	66 44%	93	59	180	150	139,58	95,44	21,49	23,36	
Invalid serves with the “two cm inwards” grip	61 40,7%	84 56%	93	53	180	147	139,23	96,87	20,01	25,02	
Valid serves with the “two cm outwards” grip	74 49,3%	71 47,3%	100	45	177	149	131,43	92,27	18,60	22,69	
Invalid serves with the “two cm outwards” grip	76 50,7%	79 52,7%	80	46	171	161	135,14	101,47	17,97	27,61	

The data also shows that both advanced and intermediate men players have clearly faster valid serves (statistically significant difference, $p < .001$) with their personal grip than advanced and intermediate women players (Table 2). As for the intermediate players’ average scores, they are slightly higher with the “two cm inwards” grip, either they are men or women (116,22 and 87,67 respectively, Table 2).

This difference is, however not statistically significant. Contrastingly, this difference is significant to the same players with the “two cm outwards” grip but only for the invalid serves ($p < .05$). In the comparison between the sexes using the three grips in both playing level players, the difference in the average values in valid serves is greater than 25 km / h (table 2).

Table 2: Speed of valid services (Km / h) using the three different grips, in both sexes and level players

	Sex	N		Mean		Std. Deviation	
		Advanced	Intermediate	Advanced	Intermediate	Advanced	Intermediate
Personal grip	Men	11	9	157,18	114,22	17,09	19,73
	Women	5	6	127,60	85,17	12,18	16,83
“Two cm inwards” grip	Men	11	9	155,27	116,22	16,55	23,21
	Women	5	6	122,80	87,67	12,48	21,73
“Two cm outwards” grip	Men	11	9	148,27	114,67	18,89	18,45
	Women	5	6	122,60	84,50	13,45	11,06

Discussion

The analysis of the results shows, that men's serves are faster than women's in all examine cases. These data are completely normal as it is known that men have faster serves than women in professional tennis (Pugh, Kovalski, Heitman & Gilley 2003; Fleisig, Nicholls, Elliott & Escamilla 2003). Andy Roddick's serve has been measured at 249.4km /h, while in women Venus Williams' serve only at 207,6km /h. Moreover the average speed for advanced players is statistically significant higher than those of intermediate players. These results were reasonable considering that advanced players were more familiar with the sport in general, as well as with the serve stroke. The results of the advanced players were better, as was expected, with their personal grip compared to the other two, both in accuracy and speed. This is because these players have already chosen the grip that suits them and have been trained a lot with it.

By the comparison on the accuracy and the maximum speed of invalid serves between the other two grips emerges that for advanced players the hand position “two cm inwards” is more effective. However this was not expected, as the “two cm outwards” grip allows greater freedom of motion and flexibility in the wrist and would be expected, at least to the invalid serves faster speeds when using this grip. But it seems though that the advanced players at this point have no room to grow in strength. Instead it seems that the “two cm inwards” grip provides them with a better sense of the grip of the racket and therefore it is more effective in succeeding accuracy and maximum acceleration of the racket. From this research and in the particular sample, results that when an athlete of this level wishes to diversify a bit his/her serve in order to achieve more accuracy, it is more efficient to bring the grip closer to the throat of the racquet.

Subsequently, it was found that the results with the (more “inconvenient”) “two cm outwards” grip, due to lack of sensation of holding the racket, was much better than the “two cm inwards” grip, at maximum speeds at intermediate players and especially in invalid serves. At the intermediate level, therefore, the initial hypothesis of the study that higher speeds are achieved with the “two cm outwards” grip, exactly because of the freedom of movement in the wrist, the laxity and the extension of lever shock was confirmed. The last point indicates that in a potential change of grip, mainly for acceleration at this level and for the particular stroke of serve, choosing the “two cm outwards” grip would likely provide the best possible results. This is explained by the fact that the intermediate players because of their level are not in position to succeed with their serve the maximum speed and the desired accuracy at the same time. Therefore a longer lever, as it is known from the biomechanics, can improve the speed factor (Elliott, 1988; Elliott, Marshall, & Noffal, 1995; Gordon & Dapena, 2006; Tanabe & Ito, 2007; Knudson, 2011).

Observing the valid and invalid serves as a total for the three different grips in intermediate and advanced players it is clear that advanced players present more valid serves with their personal and the “two cm inwards” grips (Table 1). On the contrary unlike the intermediate players present worse results with the two above options than with the “two cm outwards” grip. The higher accuracy in the serve with a grip more free in the wrist but also unstable is unexpected. In intermediate players, in the present study sample, this applies perhaps because they generally use the wrong grip (eastern-forehand). So when this wrong grip is used, but at the same time the palm is placed across the racket grip “two cm outwards”, seems that this grip allows a wrist flexion, and so that the ball is driven to the right target - correcting error with another error.

Conclusion

The proper grip of the racket, as mentioned in the introductory part of this study, concerns mainly how the players place their palm around the handle, i.e. continental or eastern backhand grips. This study examined the grip of the racket depends on the placement of palm across the racket handle inwards or outwards. The players select and differentiate in these two categories depending on their personal style and tactical choices in the match. Based on the results of this study, it is suggested to an intermediate player to hold the “two cm

outwards” grip in order to acquire a faster serve. On the other side this proposal requires more technique training from the players (Emmen, Wesseling, Bootsma, Whiting & Wieringen, 1985), so as to have also a satisfactory accuracy level.

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