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Investigating the Role of Ipsilateral and Contralateral Eye-Hand Dominance in ATP Qualification and Tennis Serve Performance of Professional Tennis Players

Mavvidis Alexandros[1], Ziagkas Efthymios[2*], Dallas Georgios[3]

[1]*Professor, Department of Physical Education and Sport Science, Democritus University of Thrace, Greece*

[2]*PhD candidate, Department of Physical Education and Sport Science, Aristotle University of Thessaloniki, Greece*

[3]*Professor, Department of Physical Education and Sport Science, National and Kapodistrian University of Athens, Greece*

Corresponding Author:** ***Ziagkas Efthymio, *PhD candidate, Department of Physical Education and Sport Science, Aristotle University of Thessaloniki, Greece*

Abstract: *Eye dominance is the tendency to prefer visual input from one eye to the other. However, the side of the dominant eye and the dominant hand do not always match. The aim of this study was to investigate the role of ipsilateral and contralateral eye-hand dominance in ATP qualification and in tennis serve performance. One hundred professional tennis players participated in this study and divided in two groups. One group was the "best in ranking" players consisting of 50 players, 29 ipsilateral and 21 contralateral eye hand dominance. The second group was "the best in serve" players, consisting of 50 players, 32 ipsilateral and 18 contralateral eye hand dominance. One way Anova analysis has shown no significant differences in accuracy of the first serve between the two groups of ipsilateral and contralateral eye-hand dominance. The present study demonstrates that tennis athletes with contalateral eye hand dominance seems to have a little advantage in serve, but not statistically significant.*

Keywords: *Eye Dominance, Professional Players, Tennis, Serve, Accuracy*

1. INTRODUCTION

Serve is the most important shot in tennis (Cauraugh, Gabert & White,1990; Bahamonde, 2000; Elliott & Wood, 1983). One of the most important factors, affecting tennis serve performance is the ball toss. One parameter, which is not mentioned as in recent literature, is the eye contact with the bal. in which the player must always gaze at the ball from the very beginning of the toss. Some players avoid visual contact when tossing the ball and then start looking for it in the air. One other common mistake is when players take their eyes off of the ball and look at the court. That means he just dropped his head, which causes instability in serve.

Visual contact with the ball, while tossing the ball during serve, is a basic prerequisite of expertise technique (Knudson, Luedtke, & Faribault, 1994; Brown, 2004). A critical detail at this point, is player's eye dominance when tossing the ball with the non-dominant hand and just before the contact between the ball and the racquet, i.e. the Synchronism of hands' movement during the serve process (Mavvidis, Ntinopoulos, Dallas & Mavvidis, 2015).

Coordination seems to be the main factor affecting tennis serve performance (Schoenborn, 1998; Durovic, Lozovina & Mrduljas, 2008; Reid, Whiteside, & Elliott, 2011). Muscle synergy and coordination depends on the side of the serving court. A recent study (Wend, Ehstand & Prechtl, 2010), found that a training program aiming to improve serve speed, shown better results when athletes performed serve from the right side (5,49 km / h) than the left side (4,81 km / h).

Lower limps technique also, during the serve, i.e if the player holds behind the right foot (right-handed) (foot-back technique) or moves it next to the left (foot-up technique) seemed to affect the service speed. The foot up technique accomplishes higher speeds on the vertical axis (larger vertical forces) according to the study of Elliott and Wood (Elliott & Wood, 1983).

The problem of motor lateralization in ontogenesis is important for understanding adaptation development (Kurzina, Aristova & Volnova, 2018). About 35% of right-handers and 57% of left-handers being left eye dominant (McManus, Porac , Bryden & Boucher, 1999). The majority of right-handers (66%) and left-handers (57%) display side congruent (right/right or left/left) eye-hand preference. However, there are substantial numbers of people with crossed preference where the preferred hand and the preferred eye are on opposite sides of the body. Left-eye preference occurs for 34% of right-handers while 43% of left-handers show right-eye preference (Hiraoka , Igawa , Kashiwagi , Nakahara, Oshima & Takakura 2018).

From the beginning of the 20th century studies about eye dominance mentioned that about 15% of humans have no eye preferences, i.e., are ambiocular. On the average 64% have a right monocular preference and 21% a left monocular preference. There seems to be no perfect matching between hand preference and eye preference (Snyder & Snyder, 1928).

To the best of our knowledge, despite a few researches who mentioned eye movements when tossing the ball (Knudson et al., 1994) and the eye hand coordination while hitting the ball (Sahan & Erman, 2009), there are no many studies investigating eye hand dominance in tennis (Ziagkas, Mavvidis, Grouios, Laios, 2017). The aim of this study was to investigate the effect of ipsilateral and contralateral eye hand dominance in ATP qualification and in tennis serve performance. Additionally, the aim of this study was to test two hypothesis. The first hypothesis is that athletes with ipsilateral and contralateral eye hand dominance do not differ significantly on first serve performance and the double faults in ATP ranking and the second hypothesis that athletes with ipsilateral and contralateral eye hand dominance do not differ significantly on first serve performance and the double faults among the best in serve ranking.

2. MATERIALS AND METHODS

2.1. Participants

For this study we collected data from two samples. In order to investigate the first hypothesis we collected data from the first 50 tennis athletes of the ATP ranking (sample 1) For the second hypothesis we collected data demonstrating the best athletes in serve from the same database (sample 2). Both groups consisted of 50 professional tennis players.

2.2. Procedure – Tools – Measures

Many different methods have been proposed in order to assess eye preference, including eyedness questionnaires and sighting tasks that require binocular and monocular alignment of a target through a hole in the middle of a card or funnel (Ehrenstein, Arnold-Schulz-Gahmen, Jaschinski, 2005). In the present study, eye and hand dominance were evaluated using photographies from the web (Image 1).

Image1. *Eye dominance examination of the participants*

The sample was divided into two groups: the ipsilateral eye-hand dominance group and the contralateral eye-hand dominance group. Also, we recorded from the official web pages the percentage “of first serve in’ and the number of double faults. The first group was the “best in

ranking" players (ATP- Ranking) and consisted of 50 players, 29 ipsilateral and 21 contralateral. The second group was "the best in serve" players (accuracy and speed) consisted of fifty players, 32 ipsilateral and 18 contralateral.

2.3. Statistical Analysis

Data was processed using SPSS v.24. We performed descriptive statistical analysis (means, standard deviations and cross-tabulation of qualitative variables) and inferential statistics in order to test the two hypotheses (One way ANOVA). The significance level was set at p = 0,05.

3. RESULTS

In the "best in ranking" group, as regards handedness, 13 were left handed (26%) and 37 right handed (74%) (table 1). As regards eyedness, 18 (36%) players showed left eye dominance and 32 (64%) players, right eye dominance (table 2). Also in the best in ranking group, 29 (58%) athletes showed ipsilateral eye-hand dominance and 21 (42%) showed contralateral eye-hand dominance (table 3).

Table1. *Descriptive statistics concerning hand dominance*

		Hand dominance		Total
		Right hand	Left hand	
Best in rank	Count	37	13	50
	% within Group	74,0%	26,0%	100,0%
Best in serve	Count	38	12	50
	% within Group	76,0%	24,0%	100,0%

Table2. *Descriptive statistics concerning eye dominance*

		Eye dominance		Total
		Right eye	Left eye	
Best in rank	Count	32	18	50
	% within Group	64,0%	36,0%	100,0%
Best in serve	Count	36	14	50
	% within Group	72,0%	28,0%	100,0%

Table3. *Descriptive statistics concerning eye-hand dominance*

		Eye-hand dominance		Total
		Ipsilateral	Contralateral	
Ranking	Count	29	21	50
	% within group	58,0%	42,0%	100,0%
Bests in Serve	Count	32	18	50
	% within Group	64,0%	36,0%	100,0%

Concerning tennis serve performance the mean percentage of the first serve was 60,97% (SD=±6,86) for the ipsilateral athletes and 62,62% (SD=±6,38) for the contralateral athletes. Furthermore, the ipsilateral group shown at means 3,79 (SD=±1,42) double faults instead of the contralateral eye hand dominance athletes which mentioned at means 3,24 (SD=±1,95) double faults. It was found that the eye hand dominance seems not to affect either the first serve performance F (1, 48) = 0.750, MSE = 44,373, or the double faults F (1, 48) = 1.358, MSE = 2,762 (table 4).

Table4. *Descriptive statistics concerning "best in rank" group*

		N	Mean	SD	Minimum	Maximum
First serve (percentage)	Ipsilateral	29	60,97	6,86	49,00	83,00
	Contralateral	21	62,62	6,38	51,00	73,00
	Total	50	61,66	6,64	49,00	83,00
Number of double faults (per match)	Ipsilateral	29	3,79	1,42	1,00	7,00
	Contralateral	21	3,24	1,95	1,00	8,00
	Total	50	3,56	1,67	1,00	8,00

In the "best in serve" group, as regards handedness, 12 players were left handed (24%) and 38 right handed (76%) (table 1). As regards eyedness, 14 (28%) players showed left eye dominance and 36 (72%) players right eye dominance (table 2). Also in the best in serve group, 32 (64%) athletes showed ipsilateral eye-hand dominance and 18 (36%) showed contralateral eye-hand dominance

(table 3). Concerning tennis serve performance the mean percentage of the first serve was 63,21% (SD=±2,44) for the ipsilateral athletes and 63,77% (SD=±2,89) for the contralateral athletes. Furthermore, the ipsilateral group shown at means 2,78 (SD=±0,84) double faults instead of the contralateral eye hand dominance athletes which mentioned at means 2,77 (SD=±0,92) double faults. It was found that the eye hand dominance seems not to affect either the first serve performance F (1, 48) = 0.521, MSE = 6,792, or the double faults F (1, 48) = 0.001, MSE = 0,759 (tab. 5).

Table5. *Descriptive statistics concerning "best in serve" group*

		N	Mean	SD	Minimum	Maximum
First serve (percentage)	Ipsilateral	32	63,21	2,44	59,80	70,80
	Contralateral	18	63,77	2,89	60,40	69,10
	Total	50	63,41	2,59	59,80	70,80
Number of double faults (per match)	Ipsilateral	32	2,78	,84	1,60	5,10
	Contralateral	18	2,77	,92	1,40	4,00
	Total	50	2,78	,86	1,40	5,10

4. DISCUSSION

The aim of this study was to investigate the effect of ipsilateral and contralateral eye hand dominance in ATP qualification and in tennis serve performance. The first hypothesis was accepted as we saw that the eye hand dominance seems not to affect either the first serve performance, or the double faults in the best in ranking group. The second hypothesis was accepted as we found that the eye hand dominance seems not to affect either the first serve performance, or the double faults among the best in serve ranking.

While in amateur tennis players the percentage of ipsilateral and contralateraλ eye-hand dominance players is almost the same, (48,8/51,2%, respectivly, Ziagkas et al., 2017), in athletes of the "best in ranking" and the "best in serve" group, ipsilateral eye-hand dominance players seem to be overrepresented (58% /42%, and 64/36% respectivly). However, as reported in the literature regarding other ball sports, athletes who are contralateral seem to benefit, especially right-handed players using the left eye for targeting (Siefer, Ehrenstein, Amold-Schuiz-Gahmen, Sökeland & Luttmann, 2003; Mann, Runswick, & Allen, 2016). The present study shows the same trend; especially in "best in rank" group were contralateral players mentioned higher scores at means in first serve than ipsilateral players (62.61/60.96). In the same direction, contralateral amateur athletes seem to benefit (Ziagkas et al., 2017) as regards technique and tennis serve accuracy.

In professional tennis players it is confirmed that contralateral players have the advantage on tennis serve, in best in rank group more than the best in serve group. Another finding as regards hand dominance in best in serve athletes but especially in best in ranking athletes show that left handed athletes are over presented in professional tennis athletes (26% and 24% respectively while 10% in general population (Grouios, Koidou, Tsorbatzoudis & Alexandris, 2002). In sports without ball, which require aiming skills e.g. archery or darts (Dart skills) recent findings (Laborde, Dosseville, Leconte, & Margas, 2009; Razeghi, Shafie, Shebab, & Maleki, 2012) demonstrate that athletes with ipsilateral eye hand dominance have the advantage.

5. CONCLUSION

The «best in ranking» and «best in serve » players, as regards laterality present different characteristics and abilities. However, the present study showed that the ipsilateral or contalaretal eye-hand dominance does not affect performance in tennis serve on professional tennis players. In best in rank players, contralateral eye-hand dominance players seem to have an advance.

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