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YOUTH TENNIS PLAYER SERVES ACCURACY WITH RESPECT TO DIFFERENT RACKETS VARIATIONS

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ABSTRACT. Introduction. Historically, biomechanics research has examined discrete kinematics, however there is now a general appreciation that tennis racket weight, size and sweet-spot vibration play equally important roles in the execution of assorted movement skills in youth players. **Objective.** The aim of this paper was to determine if young tennis players can accurately perform a tennis serve with altered forms of their preferred rackets. **Materials and Methods.** The participants in this study were young tennis players (N = 12), males, with the ages between 14 and 15 years old. **Results.** There was a significant difference in the scores for weighted and threaded rackets for both the left-to-right and right-to-left serve directions. **Conclusion.** Our study managed to show that a different kind of racket can affect the serving accuracy in youth tennis players.

Keywords: *tennis, accuracy, youth, equipment, serving.*

REZUMAT. ***Acuratețea serviciului în tenis la jucători tineri în funcție de rachetă*. Introducere.** Istoric, cercetările din biomecanică au examinat particularități ale mișcării dar acum există un consens că particularitățile rachetei de tenis au un rol la fel de important în execuția procedeelor tehnice la jucătorii tineri. **Obiective**. Scopul acestei lucrări este de a vedea dacă jucătorii tineri de tenis pot să servească cu acuratețe cu o rachetă diferită de cea preferată. **Material și metode.** Participanții în acest studio au fost jucători tineri de tenis (N=12), băieți cu vârsta între 14 și 15 ani. **Rezultate**. S-a observat o diferență semnificativă pentru rachetele diferite atât pentru serviciile stânga-dreapta cât și pentru cele dreapta-stânga. ***Concluzii.*** Studiul nostru a reușit să arate că tipuri diferite de rachetă pot influența acuratețea serviciului la jucătorii tineri de tenis.

Cuvinte cheie: *tenis, acuratețe, tineri, echipament, serviciu in tenis.*

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Introduction

Historically, biomechanics research has examined discrete kinematics, however there is now a general appreciation that tennis racket weight, size and sweet-spot vibration play equally important roles in the execution of assorted movement skills in youth players (Bartlett, Wheat, & Robins, 2007). Despite the apparent mechanical disparity between these equipment options, their critical end-point parameters, such as trajectory, as well as release speed and projection angle of the ball displayed variations. There is also some evidence to suggest that coupling perception and action may augment the adaptation process. In other words, external information is used as a reference against which players continuously calibrate their mechanics to ensure that desired end-point parameters are consistently attained. The high consistency of the end-point parameters infers that these are the critical aspects of projectile skills, whose impropriety may compromise task success. Indeed, a consistent projection angle and release speed is considered critical to the successful execution of tennis strokes (Knudson & Blackwell, 2005). Therefore, serve success is expectedly contingent on a consistent projection angle and ball speed, while at the same time dependent on repeatable sensory adaptation to equipment.

Designing effective sports tasks and competitions for young players is a complex process where many factors interact in learning functional skills and behaviours (Chow et. al., 2016; Renshaw et. al., 2010). Therefore, the design of adequate learning environments must be supported by a robust theoretical framework that understands the complexity of learning movement skills in which the environment and players interact (Correia et. al., 2019; Newell, 1986). One pedagogical and coaching principle states that through the manipulation of constraints, one can shape the exploration and acquisition of different movement patterns owing to the self-organization process inherent in human movement systems (Chow et. al., 2016; Renshaw et. al., 2010; Newell, 1986; Passos et. al., 2008). These constraints were classified in three different categories: “performer constraints” are the physical attributes (height, weight and body composition); “environmental constraints” are of a physical nature (light, temperature) or social (peer groups, coaches, parents); and “task constraints”, which include game rules, sport equipment (balls, nets, rackets), playing areas, number of players and information sources specific to each sport context (Ranganathan & Newell, 2013).

Studies grounded in nonlinear pedagogy and the constraints-led approach highlight constraints manipulation (especially task and environment constraints) as a powerful principle because of their significance in learning (Correia et. al., 2019). In this sense, an effective modification of task or environment constraints could influence the player’s intention to explore functional movement patterns and decision–making behaviours to help them solve problems in a real context (Oppici et al. 2017). In summary, appropriately modifying task constraints (rules, playing spaces, sports equipment) can improve the learning opportunities afforded in ecological environments, promoting movement variability and creativity (Brocken et. al., 2020).

Objectives

The aim of this paper was to determine if young tennis players can accurately identify the location of their tennis serve with altered versions of the rackets they use.

Methods

Subjects

The participants in this study were young tennis players (N = 12), all males, with the ages between 14 and 15 years old.

Methods and the Steps of the Research

For the purpose of this study three tennis rackets variations were used (for each type handled by the subjects): normal (no modifications), weighted (small weights were used to change the tilt of the racket) and threaded (changed sweet-spot). To minimize the number of variables, only one type of tennis balls was used (official balls approved by the ITF (International Tennis Federation)).

Each subject had to serve from the baseline from left-to-right direction, and also from right-to-left direction. They were required to execute sets of 2 serves (as it would happen in a match) until they were able to achieve 2 consecutive serves that would land in the predetermined location (a square of 6 cm by 6 cm at the upper left and right corners of the serving halves). They had 1 minute break between each set of 2 serves where they were allowed to hold the racket but not to play with a ball. The type of serve curvature, style or effect was left completely at the subject's decision. We quantified the number of serves required to reach the 2 consecutive ones (excluding them). The data was collected and analysed using SPSS 17b.

Results

After the tests were finished, we've collected the following data for each subject and for each background tested.

Table 1. Number of serves required for each subject for each racket type for the left-to-right direction

	Boys Left-to-Right		
Subject	Normal_Racket	Weighted_Racket	Threaded_Racket
1	8	9	5
2	7	8	6
3	9	8	5
4	5	7	6
5	5	8	7
6	4	7	7
7	7	8	5
8	7	9	5
9	6	8	7
10	5	7	4
11	9	7	5
12	9	7	4

Table 2. Number of serves required for each subject for each racket type for the right-to-left direction

	Boys Right-to-Left		
Subject	Normal_Racket	Weighted_Racket	Threaded_Racket
1	7	8	4
2	6	7	5
3	8	7	4
4	4	6	5
5	4	8	7
6	4	7	7
7	8	8	6
8	8	9	6
9	7	8	7
10	5	8	5
11	9	7	7
12	9	8	5

Table 3. Mean, Standard deviation and standard error mean calculated for each pair of rackets for the left-to-right direction

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Normal_LtR	6.75	12	1.765	.509
	Weighted_LtR	7.75	12	.754	.218
Pair 2	Normal_LtR	6.75	12	1.765	.509
	Threaded_LtR	5.50	12	1.087	.314
Pair 3	Weighted_LtR	7.75	12	.754	.218
	Threaded_LtR	5.50	12	1.087	.314

Table 4. Mean, Standard deviation and standard error mean calculated for each pair of rackets for the right-to-left direction

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Normal_RtL	6.58	12	1.929	.557
	Weighted_RtL	7.58	12	.793	.229
Pair 2	Normal_RtL	6.58	12	1.929	.557
	Threaded_RtL	5.67	12	1.155	.333
Pair 3	Weighted_RtL	7.58	12	.793	.229
	Threaded_RtL	5.67	12	1.155	.333

Table 5. Mean, Standard deviation and standard error mean calculated for each pair of the same racket for the left-to-right and right-to-left direction

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Normal_LtR	6.75	12	1.765	.509
	Normal_RtL	6.58	12	1.929	.557
Pair 2	Weighted_LtR	7.75	12	.754	.218
	Weighted_RtL	7.58	12	.793	.229
Pair 3	Threaded_LtR	5.50	12	1.087	.314
	Threaded_RtL	5.67	12	1.155	.333

Table 6. Paired sample t-test for each pair of rackets for the left-to-right direction

		Paired Differences							
					95% Confidence Interval of the Difference				
		Mean	Std. Deviation	Std. Error Mean	Lower	Upper	t	df	Sig. (2-tailed)
Pair 1	Normal_LtR - Weighted_LtR	-1.000	1.758	.508	-2.117	.117	-1.970	11	.074
Pair 2	Normal_LtR - Threaded_LtR	1.250	2.563	.740	-.378	2.878	1.690	11	.119
Pair 3	Weighted_LtR - Threaded_LtR	2.250	1.288	.372	1.432	3.068	6.051	11	.000

Table 7. Paired sample t-test for each pair of rackets for the right-to-left direction

		Paired Differences							
					95% Confidence Interval of the Difference				
		Mean	Std. Deviation	Std. Error Mean	Lower	Upper	t	df	Sig. (2-tailed)
Pair 1	Normal_RtL - Weighted_RtL	-1.000	1.809	.522	-2.149	.149	-1.915	11	.082
Pair 2	Normal_RtL - Threaded_RtL	.917	2.392	.690	-.603	2.436	1.328	11	.211
Pair 3	Weighted_RtL - Threaded_RtL	1.917	1.311	.379	1.083	2.750	5.063	11	.000

Table 8. Paired sample t-test for the two serve directions on the same racket

		Paired Differences							
					95% Confidence Interval of the Difference				
		Mean	Std. Deviation	Std. Error Mean	Lower	Upper	t	df	Sig. (2-tailed)
Pair 1	Normal_LtR - Normal_RtL	.167	.835	.241	-.364	.697	.692	11	.504
Pair 2	Weighted_LtR - Weighted_RtL	.167	.718	.207	-.289	.623	.804	11	.438
Pair 3	Threaded_LtR - Threaded_RtL	-.167	1.030	.297	-.821	.488	-.56[illegible]	11	.586

A paired-samples t-test was conducted (Table 6) to compare successful marks between weighted and threaded rackets during the serves from left to right. There was a significant statistical difference in the scores for weighted racket (M=7.75, SD=0.754) and threaded racket (M=5.5, SD=1.087) conditions during the left-to-right direction; t(11)=6.051, p = 0.000. This means that the change of racket type from weighted to threaded has an influence over the accuracy of the subjects' serve.

A paired-samples t-test was conducted (Table 7) to compare successful marks between weighted and threaded rackets during the serves from right to left. There was a significant statistical difference in the scores for weighted racket (M=7.58, SD=0.793) and threaded racket (M=5.67, SD=1.115) conditions during the left-to-right direction; t(11)=5.063, p = 0.000. This means that the change of racket type from weighted to threaded has an influence over the accuracy of the subjects' serve.

The other paired sample t-tests performed for either another racket variation or direction of serve didn't show any important statistical difference.

Conclusion

Our study managed to show that there is an important difference between the serving accuracy between weighted and threaded racket variations. This may indicate that there is a need for more reaction training on either weighted or threaded rackets to be able to adapt to different playing conditions. This result may also indicate that training on either weighted or threaded rackets may affect the accuracy of the serve when changing to the other racket type.

These results may point towards the idea that tennis players must train their accuracy according to the type racket they will play with. The fact that there was no significant difference between normal racket and the rest may indicate that training done on normal doesn't affect the accuracy of the serve on the other rackets.

There was no significant difference between the accuracy of the two directions tested. Left to right serve and right to left serve directions means were almost the same for all three racket variations.

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