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## DIFFERENCES IN THE TOSS STRATEGIES FOR THE FIRST AND SECOND TENNIS SERVE

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### SUMMARY

The serve starts the rally in tennis matches and mastering this skill depends on a perfect ball toss. The aim of the present study was to compare the position of the ball in the anteroposterior, vertical and mediolateral axes during the first and second serve when: 1) the ball loses contact with the practitioner's hand, 2) maximum ball height, 3) the ball contacts the racket strings, and 4) the ball is placed in the position that the athlete believes to be the best position of the ball at the instant of contact with the racket. Seven young competitive tennis players made serves in the center of the serve area while being filmed by 2 cameras (60hz). Paired t-test, with significance level of 0.05 was used to compare first and second serves. The ball at the moment of contact with the strings of the racket is positioned significantly ( $t = 3.16$ ,  $p = 0.02$ ) ahead in first serve, compared to the second. When athletes were asked to position the ball at the position considered ideal for contact with the racket, this was done significantly ( $t = 2.57$ ,  $p = 0.04$ ) farther away from the support leg and the athlete's body in the mediolateral axis in the first compared with the second serve. However, this does not occur when the service is actually performed. The results of this study provide information to coaches about the throwing of the ball during the first and second serve, as well as differences in the positioning of the ball between what athletes consider ideal and what actually takes place.

### INTRODUCTION

The serve is the stroke that starts the rally in tennis matches, bringing immense interest in the understanding of its technical elements. Mastering this skill depends directly on a perfect toss of the ball. The rule allows the server to perform a second serve in the case that the first was unsuccessful. This allows the athletes to use a more aggressive technique in the first attempt.

The technique to toss the ball during the serve is focused on reducing the ball trajectory variation [1]. Chiang et al. (2006) [2] found that the ball is thrown forward and to the left of the athlete (right-handed), either in the first and the second serve, and that it is thrown significantly ahead of the athlete on the second serve. Despite the importance of the ball toss, there are few studies that describe and compare the techniques used for the first and second serve.

The aim of this study was to compare three strategic positions of the ball during the toss for the first and the second serve. It is also investigated the best position in space, established by the athletes, for the racket/ball contact.

### METHODS

Seven competitive players, with a mean age of 15 years ( $\pm 1.1$ ), years of practicing of 6.7 ( $\pm 3.5$ ) performed the first and second serve, respectively, until they reached 15 correct services of each type in the center of the serving area, simulating serve towards the opponent's body. Participants were also asked to place the ball in what they supposed to be the best position for racket/ball contact in the anteroposterior, vertical and mediolateral axes. For this purpose, it was used a support allowing the attachment of the ball in the position indicated by individuals.

The images of the services were captured by two digital video cameras (60 Hz) placed at a height that allowed the capture of the image of the whole body, and the racket over the ball throughout the service movement. A mark placed immediately in front of the supporting foot of the athlete's foot was used as a reference for measuring the distances obtained in the three axes studied.

The captured images were transferred to the computer, using the Pinnacle capture card and video editing and digitalizing was performed using the program Dvideow [3].

Student t-test was used to compare first and second serve. A significance level of 0.05 was considered.

### RESULTS AND DISCUSSION

For the present study sample, at the instant that the ball loses contact with the athletes' hand, during the toss, the ball is located approximately 0.20m ahead, 1.80m high, and 0.20m to the left foot (right-handed players). Since there were no significant differences between the first and second serve, it can be assumed that this is the chosen position for the serve, no matter if it is the first or the second.

In the second position considered in that the ball is in its maximum height, the ball position is, respectively, at 0.30m ahead, 3.19m in the vertical axis, and at 0.15m to the left of the individual, for both the first and second serve. Again, the toss was conducted in the same manner regardless the serve to be carried out [1].

For the third ball position analyzed, prior to the contact of the ball with the racket strings, there was a significant difference between first and second serve in the anteroposterior axis. In the first serve, the ball was hit 0.07m ahead ( $t = 3.16$ ,  $p = 0.02$ ), compared with the second serve. On the vertical and mediolateral axis, the ball was hit, respectively, at 2.56m high and 0.30m to the left of the athlete.

This difference in the anteroposterior axis meets the result obtained in the literature [2], since the moment before impact, on the first serve the ball was also significantly positioned more forward than in the second.

By simulating the best position to reach the ball at its height, anteroposterior and mediolateral distance, participants positioned 0.45m forward and 2.5m height, regardless of serving carried out, first or second. However, there was a significant difference ( $t = 2.57$ ,  $p = 0.04$ ) of approximately 0.08m in the mediolateral axis, with the ball being positioned more to the left for the first serve.

Comparing the position of the ball in the first and second serve, the instant prior to contact with the strings of the racket, in real situations and the considered ideal by the practitioner, there were no significant differences, indicating that the movement is performed the way it is idealized. However, in the real situation, the ball is projected more forward when performing the first service, compared to performing the second.

Comparing the position of the ball in the first and second serve, in ideal situation considered by the practitioner, it was observed that in the first serve, the ball should be positioned more towards the left. In the ideal situation, the ball was placed, by the athletes, always closer to the body for the first service, compared to the second.

Tennis players had good connexion between what they do and what they believe they should do. However, the present study shows slight ball toss differences for the first and second serves, although the athletes are instructed to perform the same toss, no matter if it is for the first or second attempt.

Our results show that the athletes believe that, for the second serve, they should hit the ball closer to their body, in a medial/lateral axis. However, they actually hit the ball further ahead, in the anterior/posterior axis.

## CONCLUSIONS

Although the ball position during the toss for the first serve is very similar compared with the second one, racket/ball contact is made in a more distant posterior-anterior position from the body in the first serve, showing a different strike strategy.

The results of this study provide information to coaches about the ball toss for the first and second serve, as well as differences in the positioning of the ball comparing what athletes consider ideal and what actually takes place.

## REFERENCES

1. REID M, WHITESIDE D, ELLIOTT B. Serving to different locations: set-up, toss, and racket kinematics of the professional tennis serve. *Sports Biomechanics* .10: 407-414, 2011.
2. CHIANG CC, CHIANG JY, CHEN CY. A three-dimensional kinematics analysis of the ball and racket during first and second tennis serves. *Journal of Biomechanics*.39, 2006.
3. FIGUEROA JP, LEITE NJ, BARROS RML. A flexible software for tracking of markers used in human motion analysis. *Computer Methods and Programs in Biomedicine*.72: 155 - 65, 2003.