



Biomechanical Analysis of the Tennis Volley

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INTRODUCTION

- Among all of the tennis strokes, the stroke characteristics of the volley are rarely investigated. This is surprising considering the stroke's importance as an offensive weapon in both singles and doubles play.
- Although descriptions of the tennis volley are useful for teaching and instruction, currently, there is little information about the process of transferring weight and propelling the body for the volley or detailed descriptions of the movements that comprise strokes.
- Furthermore, the common pattern or principles used for volleying at various ball speeds, locations, and heights have never been investigated. The present study sought to fill this gap in the research and the information available to coaches and other practitioners in the tennis world.

PURPOSE / METHODS

- The purpose of this study was to describe selected reaction and movement characteristics of the tennis volley.
- Seven skilled male tennis players (National Tennis Ratings of 5.5 or greater) with an average age of 24.7 years (ranging from 17.6 to 31.8 years) served as participants for this study. Four players were currently NCAA Division I players, while the other three had previously competed on Division I teams in previous years.
- These athletes were asked to perform volley strokes under 18 different conditions that varied across the lateral ball contact location [forehand (FH) and backhand (BH)], ball contact height (high, middle, and low), and ball speed (high, medium, and low). To initiate the volleys with the players, a ball machine was used which had been modified so that the players could not predict the ball trajectory before it was released from the machine. Each participant was assessed on his muscle activity, ground reaction force (GRF), and reaction time while performing the various volleys.



WHAT DID THE STUDY FIND / COACHING IMPLICATIONS

- According to the players, they could handle the volleys on both sides (FH and BH) with the same degree of success as long as the oncoming balls were 'within reach.'
 - When they needed to reach out to execute a volley, the players performed better on the FH side.
- The average reaction time (from ball release to the instant a player's racquet began to move) for the different stroke conditions ranged from 205 to 226 milliseconds.
- The stroke times (from initial racquet movement to ball impact) demonstrate that skilled tennis players could complete a volley successfully in under 0.4 seconds.
- Participants rarely had enough time to start the crossover step before making contact with the ball unless the ball speed was slow.
 - Even when the ball speed was slow, however, players timed their crossover so that the step was not completed until after they had made contact with the ball. This resulted in a forward motion that continued through the stroke.
- Punching actions (a forward racquet motion immediately before ball contact) occurred on 75% of the observed FH and BH trials.
 - Additionally, this action occurred most often in the low speed and middle height conditions.
- A sidestep of the foot on the side of the oncoming ball (before the crossover step of the other foot) occurred more often in the FH (45% of the trials) than in the BH (34% of the trials).



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WHAT DID THE STUDY FIND / COACHING IMPLICATIONS

- Players shifted their body weight toward the foot on the side of the oncoming ball before moving their racquet.
- During the pushing phase of the volley: The players' forward and sideward movements were the result of a push off with the foot on the opposite side to which the ball was traveling;
- Sideward movements were initiated by a sideward lean during low speed volleys and a vigorous push off from the foot opposite of the side to which the ball is traveling on the high speed volleys;
- Players significantly lower their center of gravity in the low volleys;
- The height gain needed for a high volley was accomplished by a strong push off with the foot on the side to which the ball is traveling.
- There was more wrist extension than flexion during the volleys because of the players' need to hold up the racquet head. In addition, players tightened the grasp on their racquets shortly before and through the point of ball contact.
- The greatest muscle activity in the players' triceps occurred during the forward swing of the volley.
- This result indicated that elbow extension is one of the principal components of the punching action.
- It was observed that the deltoid (antero-middle and postero- middle) muscles were used to stabilize the shoulder joint during the volley.
- The role of the pectoral muscles during the forward swing phase of the forehand volley was to move the arm and racquet forward during the punching action.
- However, in the low forehand volley, the responsibility of this movement was also shared with the deltoid (antero-middle) muscle.
- Players' upper bodies were more upright (with less forward lean) during the backswing phase of the low volley.

REFERENCES / RESOURCES

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