Biomechanics of a tennis serve

Miguel Arenas
Science & Engineering
Manalapan High School
Englishtown, NJ
426marenas@frhsd.com

Brady Gorelczenko
Science & Engineering
Manalapan High School
Englishtown, NJ
426bgorelczenko@frhsd.com

Timur Neyir
Science & Engineering
Manalapan High School
Englishtown, NJ
426tneyir@frhsd.com

Abstract

Beginners in tennis often struggle with the serve since it involves complex motions. The purpose of this project is to improve tennis serves by analyzing key components of the serve and the kinetic chain (from the ground up to the racket): leg bend, shoulder rotation, arm extension, and wrist pronation. We measured the effects of these on serve speed using a radar gun. In addition, we recorded the accuracy of said serves by determining whether the ball landed within the service box (i.e., in or out of play). Using the motion-capture tool Factorial Biomechanics, we uploaded videos of our serves, allowing us to collect angular, vertical, and horizontal displacement data of our body parts and joint angles. We tested six individuals of varying backgrounds, skill levels, and experience over a series of trials. Each research subject gave feedback and their reaction to changes in their serve. Our findings provide a guide for new players to learn the serve and its mechanics. Our comparisons include: varying the angle behind the knees and elbows, wrist stiffness, and vertical vs. horizontal-based shoulder rotation. In the end, test subjects' services improved with increased speeds and lowered risk of injury through the implementation of the data we received from the biomechanical analyses.

Index Terms

biomechanics, sports, tennis, serve, kinematics, kinetic chain, Factorial Biomechanics, radar, speed