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©Journal of Sports Science and Medicine (2010) 09 , 56 - 61

Research article

The Influence of Ball Velocity and Court Illumination on Reaction Time for Tennis Volley

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ABSTRACT

The he purpose of this study is to examine the effects of ball velocity, court illumination, and volley type on the reaction time (RT) of a tennis athlete for a volley stroke. Eights cases with two different ball velocities (high and low), two volley types (forehand and backhand) and two court illumination levels (dark and bright) were studied. The 30 participating subjects consisted of 18 male and 12 female college tennis athletes (age: 24 ± 3.2 yr), with a United States Tennis Association (USTA) ranking above 2.5. In order to ensure the validity of real-world correlations, the experiments were designed to simulate real competition situations. Reaction times were measured for volley strokes in response to different approaching ball velocities (high: 25.05 ± 0.37 m/s and low: 17.56 ± 0.92 m·s⁻¹) for several volley types (forehand and backhand) and court illumination levels (55649 ± 4292 lux and 363.24 ± 6.53 lux on the court). During the tests, the signals from an electromyogram sensor and a 3-axis accelerometer (± 50 g) were recorded using an NI DAQ card (NI PXI-6251) and then analyzed to determine reaction time (RT), premotor reaction time (PRT), and motor reaction time (MRT) through the LabVIEW system. Subsequent 3-way ANOVA analysis indicated no RT, PRT, or MRT interaction between ball velocity, volley type and illumination. The ball velocity and illumination parameters did affect RT and PRT values significantly with $p < 0.05$, no significant variation in MRT was observed across any implemented experimental conditions. All experimental results indicate that ball velocity and illumination levels strongly affect the value of PRT, but have no significant effect on the value of MRT, the changes in RT were dominated by PRT.

Key words: premotor reaction time, motor reaction time, electromyogram, tennis

Key Points

- RT can generally be divided into two components with the help of the electromyogram (EMG) signal - the premotor reaction time (PRT) and the motor reaction time (MRT).
- The purpose of this study is to examine the effects of ball velocity, court illumination level, and volley type on the reaction time (RT) of the tennis athlete for volley strokes.
- Results strongly suggest that changes in RT were dominated by PRT; in light of this correspondence, it is clear that the ability to sense visual stimuli may be enhanced by proper training and practice.

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