様式５号

論 文 の 欧 文 要 旨

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(Title)

Relationship between ball velocity and spin rate in tennis service for Japanese top athletes by means of doppler radar tracking system

(Abstract)

It is known that the significant advantage of servers is a characteristic of tennis and that the ball velocity and the spin rate affect the trajectory and movement of the ball after it is served. The purpose of this series of studies was to quantify the relationship between the velocity and spin rates in typical tennis serves (flat, slice, and kick) for Japanese top-level tennis players, and to clarify the evaluation method and its effectiveness in contributing to the improvement of serving performance. TRACKMAN was used for the measurements, and the subjects were required to hit the designated serve type to the selected course. In Study I, the measurement accuracy of the doppler radar tracking system, TRACKMAN, was verified using the 3D motion capture system, VICON camera. There was no statistically significant difference between the ball velocity and spin rate values calculated from both instruments. Additionally, the regression equation between the two instruments showed a high correlation, indicating that the values calculated from TRACKMAN were highly reliable. In Study II, we quantified the relationship between ball velocity and spin rate and the total number of attempts to accomplish the serving task in Japanese top-level tennis players. The obtained data showed a correlation with the competition level. In Study III, we quantified the relationship between the stance technique of the lower limbs and the ball velocity and spin rates. The results showed that the FU group had a higher overall serving performance than the FB group. In Study IV, the regression equations obtained from the ball velocity and spin rates of the serves in Japanese male and female Paralympian wheelchair tennis players (MP1, MP2, and FP) were clarified. As a result, a significant negative correlation was observed for all values,

indicating that athletes with a higher level of competition tended to be located in the upper right corner of the graph consisting of velocity and spin rate (x-axis: velocity, y-axis: spin rate). In the general discussion, based on the results presented in Studies I, II, III, and IV, we proposed measures for Japanese top-ranked tennis players to win in the world's four major tournaments and attempted to form a rubric evaluation system on serving performance (three-level evaluation table) for those players.