KINEMATIC ANALYSIS OF FOREHAND DRIVE IN FEMALE TENNIS PLAYERS

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INTRODUCTION: Successful performance of the tennis forehand drive (FH) relies heavily on the player's technique. Unless the stroke mechanics that make up good forehand technique can be identified, it is impossible for the player, coach, or biomechanist to strive for stroke production that integrates appropriate stroke mechanics and individual flair. The purpose of this study is to profile the biomechanical characteristics of Chinese female tennis players. The data was compared with western elite players reported in the literature. In this study, where applicable, kinematics analyses of particular aspects of the stroke were compared with qualitative and quantitative descriptions.

METHODS: Eight young female tennis players with a high level of forehand drive technique were used as subjects. The mean age, body height, and body weight of the subjects were 18.88±1.46 years, 170.50±5.07 cm, and 64.88±6.38 kg, respectively.
Two PEAK 3-D high-speed video cameras (operating at 120fps) were used to record the FH performed by the subjects. Each subject was required to hit the ball from the base line for 10 or more times. The highest velocity FH that landed in the prescribed area was selected for analysis. A model with 23 points on the body and 3 points on the racquet were used for motion analysis. The images from the beginning of back swing, to the end of follow-through were digitized. The DLT method was used for 3-D space reconstruction from 2-D images. The cutoff frequency for digital filter was 10 Hz.

RESULTS AND DISCUSSION: The maximum velocities of segment endpoints reached before impact. The maximum velocity of racquet head reached at 0.016 sec prior to impact. This is deemed to be helpful in maintaining a stable position of the racquet head on impact.

1. The sequence of each joint reaching its maximum velocity is shoulder, wrist and elbow, and then the racquet. The wrist reaches its maximum velocity prior to reaching the elbow. This factor may be helpful for production of higher linear velocity of the racquet head on impact. The results of this study were different from that of previous research.
2. During impact, the upper arm with horizontal flexion, makes an important contribution (92.64%) to the racquet head velocity, however, elbow extension creates a negative contribution (-32.79%). This result is different from the 34.1% and 41.8% reported by Elliott et al. (1997).
3. During the forward swing, the upper arm abduction angle and the elbow angle, decrease and increase at the same time.
4. Based on the results of this study, it has been determined that on completion of the back swing, the subjects have a smaller shoulder alignment angle. Compared with western high level players, the trunk twist angle, the upper arm horizontal extension angle, upper arm abduction angle and elbow angle, are also smaller. This results in less storage of elastic energy in muscles and associated tissues and therefore lower racquet head linear velocity. At the same time, the wrist angle shows a greater range of variation. This may affect the stability of the FH.