BIOMECHANICAL ANALYSIS OF EMG ACTIVITY BETWEEN BADMINTON SMASH AND DROP SHOT

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INTRODUCTION

The forehand overhead stroke is one of the most typical and powerful badminton techniques. It can be divided into several types of stroke. Previous studies related to badminton skills had been conducted by several researchers, Gowitzke and Waddell, 1979, they used 2D model to describe the smash strokes. Tsai, et al, 1996, they used 3D model to analyze the smash strokes. Tsai, et al, 2001 used the inverse dynamic to investigate the upper extremities of Taiwan elite badminton players, they found the wrist joint exerted the greatest velocity and power value in both kinds of strokes than the elbow and shoulder, the extensor muscles of wrist were performing the eccentric contraction around contact. The purpose of this study was to analyze the kinematics and the surface EMG methods on the upper extremities of the elite badminton players when they were performing smash and drop shots.

METHODS

Four elite badminton players (age 21yrs, high 175cm, weight 68kg) in Taiwan were served as the subjects. The patterns of the shuttle in this study were divided into two different trajectories. While the players were performing the smash, the target of the shuttle was on the ground of opponent's middle court. The drop shot was landing on the opponent's frontal court. The upper extremity of the subject was separated into three segments. The segments were estimated by using the Dempster's parameter. Two Redlake 1000 high-speed digital cameras (Motion Scope, San Diago, USA, 250Hz) were used to record the 3D kinematics data, one Biovision EMG system was used to record the raw EMG signals of upper limb muscles, such as flexor carpi ulnalis, extensor carpi radialis, biceps brachii, triceps brachii, deltoid and pectoralis major. A dependent-pared t-test was used to test the selected variables at .05 significant levels.

RESULTS AND DISCUSSION

Table 1: The Kinematics Variables of the Smash and Drop Strokes

Variables	Smash	Drop	Sig.
Time of Contact (sec)	0.004	0.008	*
Shuttle Velocity(m/s)	75	27	*
Shuttle Angle (deg)	-7	-2	
Shoulder Angle (deg)	169	147	
Elbow Angle (deg)	189	164	*
Wrist Angle (deg)	187	185	
Shoulder Ang Vel..(deg/s)	-709	-302	
Elbow Ang. Vel.(deg/s)	-678	-404	
Wrist Ang. Vel..(deg/s)	-2040	-498	*

* $p < .05$

Table 1 shows the kinematical data of the smash and drop shots at the contact point. There were significant differences between the smash and drop shots in shuttle velocity, the contact duration time, the elbow angle at the contact point and the wrist angular velocity. contact.

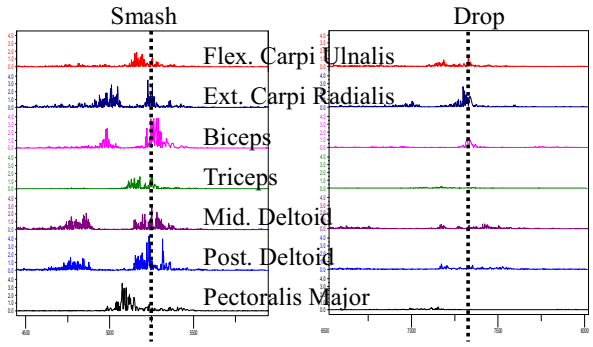

Figure 1: The EMG Signals of the Smash and Drop Shots

Figure 1 shows the raw surface EMG signal patterns of smash and drop strokes around contact. From the EMG patterns, we found the sequence of smash and drop shots were similar. The surface EMG activity of smash stroke was stronger than the drop shot. The Deltoids were acting in the very first period of the movement to raise the upper arm. Then the Ext. Carpi Radialis and Biceps to backward and downward the racket to prepare swing the racket upward. The Pectoralis Major acted to move the upper arm swing the arm upward. Before contact, the Triceps and the Flex. Carpi Ulnalis contracted to swing up the racket. The Biceps, the Ext. Carpi Radialis and the Deltoid acted to stable the upper extremities. Tsai, et al in 2001 had deducted that the Ext. Carpi Radialis and Biceps might be engaged in the eccentric contraction during the contact phase in the smash stroke. In this study, we verified that not only the extensor muscles of wrist but also the biceps were suffering the eccentric contraction around contact.

CONCLUSIONS

The results showed that there were significant differences in initial flight angle, contact duration time and initial shuttle velocity between the smash and the drop shots. The surface EMG activity of smash stroke was stronger than that of drop shot. The sequence of the movement of smash and drop were very similar. The EMG signal of smash was significant greater than that of drop shot. In this study, we verified the biceps and the wrist extensor were performing the eccentric contraction at the contact point.

REFERENCES

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ACKNOWLEDGEMENTS

We like to thank the financial support from the National Science Council in Taiwan.