

BIOMECHANICAL ANALYSIS OF BADMINTON NET SHOT BETWEEN TUMBLE AND WITHOUT TUMBLE TECHNIQUES OF TAIWAN ELITE PLAYERS

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INTRODUCTION

Badminton is one of the most popular racket sports in Taiwan colleges. From the pioneer researchers, Poole, 1970; Adrian, 1971; Gowitzke and Waddel, 1979, they used 2D method to describe the forehand overhead strokes, Tang, et al, 1995, and Tsai, et al, from 1997 they used 3D kinematics and inverse dynamics to describe the different badminton techniques. Pan, et al, they used 3D method to compare the forehand and backhand net kill strokes. Among all the badminton strokes, the net shot is the finest and is one of the most important techniques in badminton competition. There are many kind of net strokes, some of them will make the shuttlecock tumbling fast. The purpose of this study was to compare the differences in kinematics variables between tumbling and dab (no tumbling) forehand net shots.

METHODS

Ten Vicon Ten Vicon MX-13⁺ cameras (Vicon, Oxford, UK, 500Hz) were set up to record the 3D movement of eight Taiwanese male collegiate elite badminton players (height 176cm, weight 68kg, ages 21 years). One high speed camera (Redlake, 500HZ) was synchronized to collect the 2D image of shuttlecock from the sagittal plane. The 3D kinematics data were calculated by Vicon Nexus 1.2 and Visual 3D system, the 2D kinematics data of the shuttlecock was calculated on the Kwon3D system. The Wilcoxon matched-paired signed-rank nonparametric statistical test was used at a .05 significant level.

RESULTS AND DISCUSSION

Table 1: The kinematics variables of the dab and tumble net shots at contact point

Variables	Dab	Tumble	p
Contact Height (m)	1.21	1.24	
Velocity of COM. (m/s)	1.5	0.6	
Tumble Angular Velocity (rev/s)	13.4	22.2	*
Racket Angle (deg)	33	21	*
Racket Head Horizontal Velocity (m/s)	2.33	4.20	*
Racket Head Vertical Velocity (m/s)	0.55	0.13	*
Elbow Angle (deg)	142	139	
Elbow Extension(+) Ang. Vel. (deg/s)	2.16	86.40	*
Wrist Flex.(+) Ang. Vel. (deg/s)	10.39	145.78	*
Wrist Pronation(+) Ang. Vel. (deg/s)	30.80	-34.16	*
Wrist Ulnar Flex.(+) Ang. Vel. (deg/s)	7.31	86.98	*

* $p < .05$

In the results, there were insignificant differences in the movements of center of mass (COM), the contact height, the contact point between shuttle and COM and the shoulder angular variables between the dab and the tumble net shots. Table 1 shows the kinematical data of the dab and tumble net shots at the contact point. There were significant differences between the dab and the tumble net shots in shuttle velocity, tumble angular velocity, racket angle with horizontal plane, racket head horizontal and racket head vertical velocity, elbow extension angular velocity, wrist flexion angular velocity and wrist pronation angular velocity, wrist ulnar flexion angular velocity. The differences of the participants' movements between the dab and the tumble net shots were come from the distal segments movements in the elbow and the wrist (figure 1).

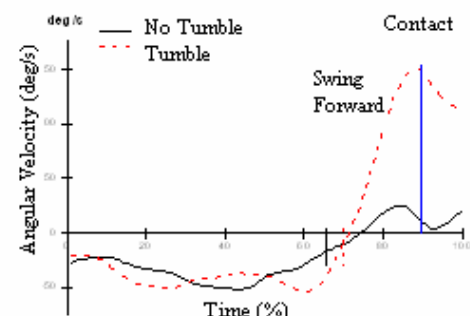


Figure 1: Angular velocity of wrist flexion and extension

CONCLUSIONS

The results showed that there were insignificant differences in the upper extremity proximal segments just like the shoulder joint movement. But there were significant differences at the distal segments just like the elbow and the wrist. Both movements of the dab and the tumble net shots were not obey the kinetic chain rule. When the elite players want to perform the tumble net shots, they should perform the greater racket horizontal velocity, elbow extension velocity, forearm pronation, wrist angular velocity and wrist ulnar flexion.

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REFERENCES

- Gowitzke BA & Waddell DB. Technique of Badminton Stroke Production: *Science in Badminton. In Racquet Sports*, d. J. Terauds. Del Mar, CA: Academic Publishers, 1979.
- Pan KM et al. Biomechanical Analysis of Badminton Net Kills Upper Limb Movements Between Forehand and Backhand Grips. *Proceeding of 2008 International Joint Conference of Sports Science and Sports Engineering*, Vol. 2, Nanjing, 127~132, 2008.