

THE VELOCITY CHARACTERISTIC OF LOWER EXTREMITY DURING ROUND KICK PERFORMANCE

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INTRODUCTION

As a basic attack method of martial art, round kick was found to be one of the most important movements to get scores (Liou, Y., 1995, Yu-Ching Lan., 2000, Tsai, M.J., 1999). Also it was found that athlete uses this technique mainly because this movement could get high velocity (Yu-Ching Lan, 2000). However, up to now, though there were some researches relative to the speed of the lower extremity, few articles were regarding to the velocity from 3 dimensional directions. Therefore, the purpose of this paper is to find the velocity characteristic of lower extremity during round kick performance in Chinese Martial Art and to submit some reference for the further research in this field.

METHODS

Eight Chinese Martial Art athletes in Shandong Normal University were consent to participle this research. Their heights, weights, ages and training years were $1.76\pm0.03\text{m}$, $79.8\pm6.2\text{kg}$, $21\pm0.9\text{year}$, $10.5\pm1.6\text{years}$, respectively. The round kick performances during their training were recorded synchronically with two Sony video cameras in 50Hz. The best one of three performances of each person was selected to be digitized on China Engine Performance Analysis System. Four marks (hip, knee, ankle and toe) of lower extremity of each athlete got 3D displacements by DLT technique. The Data were smoothed by Butterworth filter with the cut-off frequency 6-8Hz.

RESULTS AND DISCUSSION

In this paper, X was chosen to be the forward direction. Z was perpendicular to horizontal plane. Y was perpendicular to XZ plane. H represented horizontal plane.

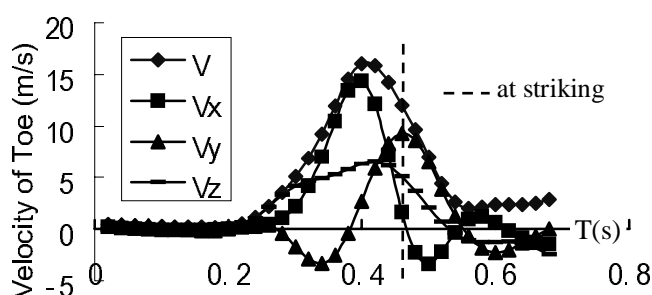


Figure 1: Typical Toe velocity during the Round Kick performance

The results showed that, in the Maximum Resultant Velocity (MRV), the toe is ranked first, ankle the second, knee third and hip is the last (see Table 1). The MRV of toe is about 15m/s, which is about 5m/s larger than that of the ankle. The MRV of ankle was 4m/s larger than that of knee. As the last one, the average MRV of hip was only 2.74m/s.

From X, Y, Z direction, it was shown that, in the maximum velocity of each article, the component V_x seems the largest, V_z the second, and V_y the last.

At the time of strike, the average velocity of hip and knee is very small (below 2m/s). This result agrees well with formal research (Pen Liu, 2000). However, it could be found easily that the MRV of toe and ankle are not always happened in the strike phase (see Figure 1). This phenomenon is probably relative to the rapid decrease of V_x (forward direction) and V_z (up direction). Toe velocity in X direction (V_x), for example, is decrease from $11.57\pm1.46\text{m/s}$ to $7.32\pm1.17\text{m/s}$ during the strike phase. On the other hand, in Y direction which is the most efficient for strike, the velocity of the toe and ankle seems to be near maximum at strike.

SUMMARY

In the maximum compound velocity, the toe is ranked first, ankle the second, knee third and hip is the last. In each article, V_x is the largest, V_z the second, and V_y the last. At the time of strike, the velocity of hip and knee is very small. The maximum compound velocity of toe and ankle are not always happened in the strike phase. However in Y direction which is the most efficient for strike, the velocity of the toe and ankle are near maximum at strike.

REFERENCES

- Liou, Y. et al. (1995), *Journal of Chinese Martial Arts Research*,4(2),45-72.
- Pen Liu. et al. (2000), *A Kinematic Analysis of Round Kick in Teakwondo*, Proceeding of XVIII International Symposium on Biomechanics in Sports. 2, 916-919.
- Yu-Ching Lan. et al (2000), *The Kinematical Analysis of Three Teakwondo Kicking Movements*, Proceeding of XVIII International Symposium on Biomechanics in Sports. 1,277-280.
- Tsai, M.J. et al. (1999), *The attack movement style analysis of attack rate, score rate and succeed rate in female Teakwondo player*. University of Physical Education, **37**, 75-82.

Table 1: The velocity characteristic of four articles (mean \pm SD m/s)

Variables	Toe		Ankle		Knee		Hip	
	maximum	at strike	maximum	at strike	maximum	at strike	maximum	at strike
V	15.63 ± 0.79	14.66 ± 1.42	10.80 ± 0.96	9.85 ± 1.18	6.48 ± 0.56	1.97 ± 0.56	2.74 ± 0.46	1.09 ± 0.26
V_x	11.57 ± 1.46	7.32 ± 1.17	7.91 ± 1.24	5.73 ± 0.44	4.87 ± 0.39	0.29 ± 0.67	2.39 ± 0.41	0.56 ± 0.58
V_y	9.33 ± 1.22	8.94 ± 1.50	5.67 ± 1.09	5.13 ± 1.09	3.24 ± 0.75	0.94 ± 0.60	0.88 ± 0.26	0.27 ± 0.54
V_z	9.05 ± 1.72	8.23 ± 1.58	6.24 ± 1.10	5.76 ± 1.33	4.35 ± 0.58	1.34 ± 0.58	1.33 ± 0.43	0.01 ± 0.38
V_h	12.87 ± 1.09	12.04 ± 1.00	8.77 ± 1.17	7.92 ± 0.84	5.05 ± 0.45	1.33 ± 0.58	2.33 ± 0.40	1.01 ± 0.20