A PILOT STUDY ON HOW WORLD-CLASS MALE VOLLEYBALL PLAYERS LAND AFTER A SPIKE

Walter Quispe Marquez, Masanao Masumura, and Michiyoshi Ae*

Doctoral Program of Health and Sport Sciences, Univ. of Tsukuba; *Institute of Health and Sport Sciences, Univ. of Tsukuba, Japan

KEY WORDS: volleyball, landing, kinematics, motion analysis.

INTRODUCTION: When attempting to improve the spiking ability of players, coaches should be concerned with preventing leg injuries, which may be induced by landing after spiking. Therefore, the purpose of this study was to analyze how world-class male volleyball players land after a spike during official games and obtain insights into a safer landing.

METHOD: The landing motions of three world-class volleyball players (age 25.7±3.5 yrs; height 2.0±0.1 m; mass 88.0±4.4 kg) during the Men's World Championship 2006 were videotaped with two high-speed VTR cameras (250 Hz, 1/2000s) for a three-dimensional analysis by a DLT method. Three motions of each athlete were further analysed. The foot angle was calculated as that formed by this segment with the floor. The knee and ankle joint angles were calculated as the angles formed by the segments that comprise these joints. The hip angle was calculated as the angle formed by the trunk and the thigh projected in the sagittal plane. The whole body CG displacements as well as all corresponding angular velocities were also calculated from the coordinate data. According to our previous study (Marquez *et al*., 2007), the vertical ground reaction force peak in landing after spiking occurred at about 40 milliseconds after the initial contact of the foot with the ground (IC), so the range of motions of the angles for this interval were also computed. The pair-wise comparisons by Manova were used for analysis of differences between subjects and Pearson *r* values for all landings (N=9) were used for correlations between variables.

RESULTS and DISCUSSION: Eight of the nine landings were left-legged. The CG vertical velocity at the IC did not differ, but the horizontal one was significantly larger in Dante (1.6±0.1 m/s, p=0.003) and Kaziyski (1.8±0.2 m/s, p=0.001) than in Giba (1.0±0.2 m/s). This parameter negatively correlated with the angle of the left hip at IC (r=-.66, p=.05). Table 1 shows relevant differences among the subjects. A large CG horizontal velocity may have caused Dante and Kaziyski to flex the hip prior to the IC to brake the accelerated body, which resulted in smaller left foot angles at the IC. Giba's smaller CG horizontal velocity and apparently better control of body in the air resulted in landings with the trunk slightly inclined backward, the hip extended, and larger foot angles, which according to Marquez *et al*. (2007), is a safer technique, since it elongates the time to force peak, reducing the mean loading rate.

Table 1 Joint angular kinematics for three top players (*p < 05; †Tendentious at p <.1.)

	Parameters	Subjects			Differences
		Giba	Dante	Kaziyski	
Angles	left hip	184.5 ± 9.0	177.1 ± 6.4	163.8 ± 10.9	*GI > KA (p =.044)
	left knee	165.2 ± 4.1	166.6 ± 5.0	160.4 ± 7.7	†DA > KA (p =.077)
	left ankle	118.5 ± 4.4	113.3 ± 1.3	119.1 ± 5.6	†KA > DA (p =.095)
	left foot	38.2 ± 4.9	21.9 ± 6.6	25.2 ± 4.6	*GI > DA (p =.015), *GI > KA (p =.033)
RoM	left hip	7.3 ± 5.4	1.1 ± 6.4	12.0 ± 4.0	*KA > DA (p =.048)
	left ankle	42.0 ± 3.7	31.6 ± 4.6	35.5 ± 5.6	†GI > DA (p =.052)
	left foot	33.9 ± 1.8	22.0 ± 5.5	24.4 ± 4.9	*GI > DA (p =.028), †GI > KA (p =.059)
Ang.Vel	trunk lean	-6.6 ±47.5	0.0 ± 67.0	96.3 ±28.2	*KA>GI (p =.045), †KA>DA (p =.055)
	left hip	-158.7 ± 32.8	-11.1 ± 95.6	-157.0 ± 56.1	*GI>DA (p =.026), *KA>DA (p =.027)
	left knee	-391.2 ± 90.4	-235.3 ±120.2	-211.3 ± 88.2	†GI>KA (p=.094)

Marquez, W.Q. et al. *Proceedings of podium sessions, XXI ISB Congress*.Taipei, Taiwan, s202, 2007.