IMMEDIATE EFFECTS OF AN INCLINED BOARD AS A TRAINING TOOL FOR THE TAKEOFF MOTION OF THE LONG JUMP

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INTRODUCTION

Various methods have been used to learn and improve long jump techniques in training. Since simplifying practice conditions with the use of auxiliary tools is effective in improving techniques, jumpers frequently use auxiliary training methods. An inclined board from which a jumper takes off may be one of the most frequently used technical training tools. Although there have been some investigations on the characteristics of the takeoff motion from an inclined board, changes in the takeoff motion immediately after the use of an inclined board have not been investigated thoroughly. Therefore, the purpose of this study was to investigate immediate effects of the use of an inclined board on the takeoff motion of the long jump.

METHODS

Eight male long jumpers from the varsity athletic club were videotaped with two high-speed VTR cameras (250 Hz) set perpendicular to the runway. Four different kinds of jumps were performed: normal long jump, long jumps on upward inclined boards with different inclinations (2.5 and 5.0 deg), and jumps on a raised flat board (0 deg, but at height of 5 cm). To investigate immediate effects of the boards on the takeoff motion, pre and post trials were performed by subjects, using their normal technique, before and after the jumps from the boards. Two-dimensional coordinates of the body segments were reconstructed by using reference markers set on both sides of the runway. Linear and angular kinematics of joints and segments and the location of the center of gravity (CG) were calculated. To test differences between pre and post trials, dependent t-tests were used with a significance level set at 5%.

RESULTS AND DISCUSSION

Jump distance for the post trial was significantly longer than that for the pre trial (post, 6.59±0.29 m; pre, 6.48±0.38 m; $p<0.05$). Table 1 shows the CG velocity at touchdown (TD) and toe-off (TO)

Table 1 Mean values of horizontal and vertical velocity (HV, VV) of the CG at the touchdown (TD) and toe-off (TO) of the takeoff, decreasing rate of the horizontal velocity during the takeoff phase, and ratio of the vertical velocity at toe-off to the reduction in the horizontal velocity during the takeoff phase (V-H ratio) for the pre and post trials

		Pre		Post		Difference
		Mean	SD	Mean	SD	(*p < 0.05)
TD	HV_{TD} (m/s)	8.89	(0.35)	9.01	(0.31)	post > pre *
	VV_{TD} (m/s)	-0.50	(0.17)	-0.61	(0.12)	ns
TO	HV_{TO} (m/s)	7.42	(0.47)	7.69	(0.36)	post > pre *
	VV_{TO} (m/s)	3.11	(0.16)	3.03	(0.14)	ns
	ANG_{TO} (deg)	22.8	(1.4)	21.5	(1.2)	pre > post *
Decreasing rate of HV (%)		-16.6	(2.7)	-14.6	(2.0)	pre > post *
V-H ratio		2.17	(0.36)	2.34	(0.20)	ns

of the takeoff phase. There was no significant difference in the vertical velocity at the TD and TO between pre and post trials. The horizontal velocity at the TD and TO for the post trial was significantly greater than that for the pre trial, and the rate of decrease in the horizontal velocity during the takeoff phase for the post trial was significantly smaller than that for the pre trial. No significant difference between the pre and post trials was observed in the ratio of the vertical velocity at the TO to the reduction in the horizontal velocity during the takeoff phase. However, six of the eight subjects enhanced the ratio for the post trial (116.1±10.3%) in comparison to that for the pre trial. These results indicate that the jumpers in the post trial were able to convert the horizontal velocity to the vertical velocity more effectively than in the pre trial, regardless of the higher approach velocity for the post trial.

Figure 1 shows the average thigh and shank angular velocities of the takeoff leg during the takeoff phase. Although there were no remarkable differences in patterns of the thigh and shank angular velocities during the takeoff phase, the forward rotation of the thigh just after the TD for the post trial was faster than that for the pre trial. Moreover, in the middle of the takeoff phase for the post trial, the thigh rotated faster than it did for the pre trial. An intersection of the thigh and shank angular velocities indicated the instant at which the takeoff leg knee flexed to its maximum. The intersection for the post trial appeared significantly earlier than that for the pre trial, resulting in less flexion of the takeoff leg knee for the post trial (post, 28.6±4.1 deg; pre, 32.4±2.8 deg; $p<0.05$) and a larger knee joint angle at the maximum knee flexion for the post trial (post, 134.6±4.9 deg; pre, 130.6±6.5 deg; $p<0.05$). The reduced knee flexion of the takeoff leg for the post trial was effective in exerting large extension torque because leg extension force abruptly decreased for a knee joint angle less than 130 degrees. These results reveal that inclined boards can induce immediate effective changes in the takeoff motion for the long jump, and that they would be an appropriate training tool for learning and improving the takeoff techniques of the long jump.

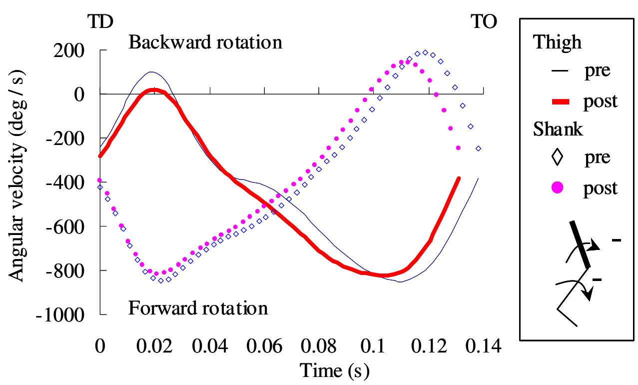

Figure 1 Averaged patterns of angular velocities of the thigh and shank of the takeoff leg during the takeoff phase for the pre and post trials