VERTICAL REACTION FORCE AND KINEMATICAL ANALYSIS OF DROP LANDING MOVEMENT IN OBESE AND NORMAL SUBJECTS

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INTRODUCTION: During the landing moment, the maximum knee flexion angle of 90 degree is considered as the standard, and deviation from this is considered as either stiff or soft landing (DeVita & Skelly, 1992). It's been reported that the increased risk of injury during landing activities is related to the subjects' physical and physiological characteristics such as gender, weight and age facilitating different landing strategies (Decker, Torry, Wyland, Sterett & Steadman, 2003). Especially, weight differences result in diverse landing strategies to prevent lower extremities injuries. The purpose of this study was to compare the vertical reaction force and kinematical factors of landing movement between obese and normal subjects.

METHOD: Eight obese (age = 27.3 ± 4.63 yrs, height = 179.5 ± 5.17 cm, mass = 114.7 ± 15.25 ㎏, BMI: 35.6 ± 4.9 ㎏/㎡) and Eight normal (age = 26.13 ± 4.57 yrs, height = 177.03 ± 4.41 cm, mass = 69.58 ± 4.47 ㎏, BMI: 22.2 ± 1.2 ㎏/㎡) subjects performed the drop landing task consisted of stepping off a 40 cm box onto a landing platform (1000Hz/s.). Twelve reflective markers were placed over the greater trochanter, lateral epicondyle, lateral malleolus, shoulder (lateral acromion process of the scapula). Additional markers were placed on the back edge of the shoe at mid-upper height and on the fifth metatarsal head. Drop landing motions were captured by six synchronized CCD cameras at 60-Hz.

RESULTS AND DISCUSSION: The obese group showed significantly greater peak vertical force and less range of flexion/extension motion at the lower joints than the normal group did. The obese group showed the lower joint angular velocity and linear velocity from T1(foot contact) to T2(maximum knee flexion). This implies that the obese group landed stiffer than the normal group did. When compared to the obese subjects, the softer extremity joint angles of normal subjects seem to more efficiently absorb the shock force during the landing.

Table 1 Vertical reaction force and kinematical variables of landing

		Hip		Knee		Ankle		VGRF
		angle(˚)	PAV(˚/s)	angle(˚)	PAV(˚/s)	angle(˚)	PAV(˚/s)	PF(N/BW)
Normal	T1	33.1 (7.9)	264.2 (58.4)	-23.9 (3.1)	-444.2 (39.6)	-22.51* (10.7)	389.9* (70.2)	3.19* (0.49)
	T2	85.9 (27.5)		-95.4 (17.6)		28.5* (5.1)		
Obese	T1	33.5 (7.6)	276.1 (44.5)	-24.6 (4.5)	-442.9 (29.4)	-0.71* (7.3)	185.2* (74.9)	3.76* (0.48)
	T2	81.8 (13.7)		-83.1 (8.5)		21.13* (4.1)		

*$p < 0.05$; .Ankle, Hip angle (+: flexion, -: extension), Knee (+: extension, -: flexion), PAV: peak angular velocity. PF: peak vertical reaction force. T1: foot contact, T2: maximum knee flexion,

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