THE EFFECTS OF DIFFERENT BASKETBALL SHOES' TOPS ON LANDING STABILITY

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INTRODUCTION

For the past two decades, the advancement of technology has supported shoe makers to manufacture more comfortable and multi-functional shoes. For competitive sports like basketball, shoes provide an important protection to prevent joints injury. Most people think that the high-top basketball shoes can provide more support and protection than the low-top. The purposes of this study were to examine the effects of different tops of basketball shoes on landing stability in the joints of lower extremity.

METHODS

Ten healthy male subjects (mean 20±1yr, shoes size-US 9.5) with no evidence or known history of gait, postural, or skeletal disorder were used. These subjects undergone ten experiments in which they would wear shoes with different tops. Each subject landing naturally in vertical and was instructed to release from the ring pull-up in the ceiling when the signal began. In order to fix the landing impulse between different body weights (mass), law of conservation of energy and Newton's law was used to calculate the altitude of landing.

Parameter of shoes： High-speed camera was used to measure and calculate the heights of shoes and separated to three kinds of tops which were manufactured by Nike company in the fall of 2008(high-top-13.77cm, middle-top-11.48cm, low-top- 8.86cm). One-way ANOVA repeated measure was utilized to analyze the differences of the shoes (α =.05).

Joints of lower extremities： High-speed camera was used to masure four points marked at condyle and tibia including an angle which is universal in order to measure the subtalar joint. An electro-goniometer was also used to measure the flexion of hip and knee joint.

Postural sway was evaluated by using an AMTI DT-9008 force platform and signal conditioner to collected COP (center of pressure, COP) trajectories under a subject's feet during landing. S. J. Huang (2006) indicates that a human's COP is located under 1/3 of the rear calcaneus when standing. The set up for the standard of COP sway limitation is 8.67cm from rear calcaneus. It will fall when exceeding this standard.

EMG signal processes of filter and integration were used to measure four parts of muscle activities of lower extremities (Leis & Trapani, 2000).

RESULTS AND DISCUSSION

Table I illustrates

Each shoes showed a significant difference on the inversion in subtalar joint. The middle-top had the smallest twisted angle, followed by the high-top and the low-top exhibited the biggest twisted angle. This result seems warrented that basketball shoes with the middle-tops have better ankle joint support and protection during landing.

The rates of COP trajectories swaied over 8.67cm/0.001s while landing, the middle-top shoe showed a statistically significant difference from others. The middle-top covered the least percentage of support surface, followed by the high-top, and then the low-top cover.

The impulses upon impact cause the flexion in the lower extremity showed that the joint flexion were less in hip and knee joints, which provided better support and protection when wearing the middle-top basketball shoes. Higher impulse of the low-top shoes increased the second peak vertical force could be related to a greater risk of injury produced by the accumulation of repeated impacts which subjects frequently perform. The results revealed that different people will adopt different landing strategies when wearing different tops of shoes.

It was concluded that wearing the middle-top basketball shoes are more appropriate for playing basketball for the reason of the height of the middle-top is parallel with the fibula in lateral and deltoid ligament in medial ankle joint. It would produce fewer injuries in the direction of inversion. The high-top shoes revealed more limitation in the ankle flexion than do the middle one, and the low-top shoes have less support and immediate protection during sudden impact in the ankle joint.

REFERENCES

1. Baker, R., *Gait analysis method in rehabilitation*, Journal of Neuroengineering and Rehabilitation, 2006.
2. Mark D. Ricard, et al., *Effects of high-top and low-top shoes on ankle inversion*, Journal of Athletic training, 2000.

Table 1: The parameters of stability during the wear of different tops of basketball shoes.

	Joint flexion(degrees)			COP(0.001s)	Antagonistic muscles of lower extremities(mv)			
	ankle	**knee**	**hip**	**over 8.67**	**Quadriceps**	**Biceps**	**Tibial anterior**	**Gastrocnemius**
High	11.4±3.2	93.9±7.3	16.9±1.4	396.7	.38±.09	.64±.28	.13±.06	.35±.16
Middle	7.0±5.0	88.2±7.9	16.2±1.4	356.1	.38±.06	.60±.20	.14±.06	.28±.10
Low	15.5±4.2	86.1±7.8	17.2±1.6	440.3	.32±.09	.58±.22	.15±.06	.22±.08
barefoot	-15.2±3.6	110.1±8.5	18.9±1.5	597.9	.34±.09	.51±.32	.13±.08	.40±.21