

THE INFLUENCE OF ARCH SUPPORT INSOLE ON BASKETBALL JUMP SHOT

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The purpose of this investigation was to examine the effects of arch support insole on jump shot scored percentage and kinetics. Eleven females Division I basketball participated in this study. They performed the jump shots until 5 shots were scored in arch support insoles and flat insoles. Kinematic data were collected with a motion analysis system (Motion Analysis Corporation, Santa Rosa, CA, USA) at 200-Hz sampling rate. Kinetic data were collected with two AMTI force platforms (AMTI Inc., Watertown, MA, USA) at 2000-Hz sampling rate. Non-parametric Wilcoxon signed-rank test was used to compare differences between arch support insole and flat insole on variables. No difference was found on jump shot scored percentage, jump height, peak ground reaction force, time to peak force and rate of force development. Wearing arch supporting insole did not influence the jump shot scored percentage and kinetics during jump shot.

KEY WORDS: vertical jump, rate of force development, peak force

INTRODUCTION: The jump shot is distinguished as the most important of all the shooting actions (Hess 1980). The jump shot requires coordination of all body parts (good timing), delicate kinesthetic touch (fine movements of arm and hand), and powerful legs (strong, fast, conditioned) (Martin, 1981). The position of the shooter's feet at the start of the jump varies from player to player. The upward jump preceding the shot is obtained by quick forceful extension of hip, knee, and ankle joints (Hay, 1985). As the shooter extends the legs and pushes down against the floor with the feet, the ball is raised to a position just forward of the head. This lifting of the ball continues until just prior to the release when the ball is high overhead (Hay, 1985).

Previous researchers indicated that the normal foot arch structure provides stability for the lower extremity which could increase power production for performance (Mulford Taggart Nivens & Payrie, 2008). Normal foot arch structure may produce greater force outputs to transfer the increased jump height. Therefore, it may be hypothesized that wearing foot arch support insole could increase jump height, force and stability of the lower extremity during jump shot.

The purpose of this investigation was to examine the effects of foot arch support insole on jump shot scored percentage and kinetics.

METHODS: Eleven females Division I basketball players (age= 19.3 ± 4.2 years, height= 176.1 ± 3.9 cm, weight= 71.9 ± 6 kg) volunteered for this study. Exclusion criteria were a current lower extremity injury, any surgery in the lower extremities, or expressing an inability to perform the research protocol. Each participant gave informed consent before participation in this study. Before the start of the trials, participants performed five minutes warm-up involving running at a self-selected pace and dynamic stretching. Participants were instructed to perform the jump shot (Figure 1) in standardized foot wears (Model s.y.m.B9025, LurngFurng, Inc., Taipei, Taiwan) with either a pair of arch support insole (Footdisc, Inc., Taipei, Taiwan) or a pair of flat insole (Model s.y.m.B9025, LurngFurng, Inc., Taipei, Taiwan). The tested conditions were randomized by casting lots. A modified Helen Hays marker set was used to identify segments of the lower extremities. Markers were positioned on the right/left anterior superior iliac spine,

right/left posterior superior iliac spine, right/left anterior thigh, right/left lateral superior/inferior thigh, right/left knee, right/left anterior leg, right/left lateral superior/inferior leg, right/left ankle, right/left heel and right/left second metatarsal. The jump shot was performed in the laboratory in which set a basketball backstop 5.8 meters in front of the participant to simulate real basketball jump shot environment. The jump shot can be characterized by a stop jump followed by catching a basketball from another player's pass and immediately doing the jump shot. All participants performed the jump shots until 5 shots were scored. They were instructed to jump from both feet on two separate force platforms.

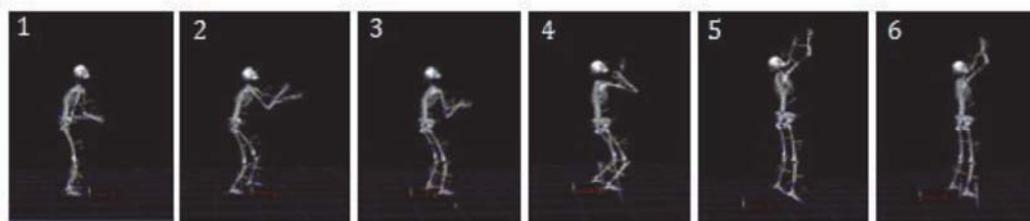


Figure1: Jump shot

Kinematic data were collected with a motion analysis system (Motion Analysis Corporation, Santa Rosa, CA, USA) at 200-Hz sampling rate. Kinetic data were collected with two AMTI force platforms (AMTI Inc., Watertown, MA, USA) at 2000-Hz sampling rate. One platform collected the right leg data, whereas another collected left leg data. The cameras were synchronized to two force platforms. Kinematic and kinetics data were transformed and analyzed using the MotionMonitor software (Innovative Sports Training Inc., Chicago, Illinois, USA).

Peak impact force was calculated by the vertical ground reaction force (GRF) data from the foot initial contact and takeoff of the ground. Time to peak GRF was calculated from the foot initial contact to the instant of peak vertical GRF. The initial contact and takeoff was determined by assessing 50-Newton vertical ground reaction force threshold. Kinematic and kinetics data of the right leg which was the dominant leg for all participants were analyzed. Jump shot scored percentage was calculated using each participant's scored jump shots divided by all jump shots then multiply by 100. Jump height was calculated by subtracting the sacrum height in the upright standing posture from the maximal height after takeoff. Rate of force development (RFD) was calculated using peak force divided by time to peak force. The GRF was normalized by body weight (BW).

All statistical analyses were performed using SPSS 18.0 software (SPSS, Inc., Chicago, IL). The value include positive and native ranges. Therefore, we used a statistical method of non-parametric Wilcoxon signed-rank test to compare differences between the foot arch support insole and flat insole on variables. The level of significance was set at $p < .05$.

RESULTS: Non-parametric Wilcoxon signed-rank test showed no difference in all variables. Please refer to Table 1.

Table 1
Kinetic and kinematic data

	Arch support insole	Flat insole	<i>p</i> -value
Jump shot scored percentage (%)	84.1±0.15	82.0±0.13	0.44
Jump height (m)	0.17±0.04	0.18±0.04	0.37
Peak GRF (BW)	1.06±0.18	1.17±0.17	0.07
Time to peak GRF (sec)	0.22±0.07	0.20±0.05	0.06
RFD (BW/sec)	6.06±2.48	6.09±1.97	0.33

DISCUSSION: The purpose of this investigation was to examine the effects of arch support insole on jump shot scored percentage and kinetics. In this study, no difference was found in the scored percentage and kinetic variables.

Although the rate of force development in the arch support insole showed no difference compared to the flat insole in the current study, the rate of force development shall be improved through plyometrics or weight training. Just wearing arch support insoles could not significantly improve the propulsive force production during jump shot. Previous researchers indicated that rate of force development is critical for sports performance because most sports movements are happened within a short period of time (Hernández-Davó and Sabido, 2014). Higher rate of force development in lower extremity is generally correlated with greater jump heights. This may indicated that increasing rate of force development is valuable for activating muscles to reach maximum propulsive force production.

Previous researchers mentioned that effective take-off kinetics for vertical jump was associated with of the ground reaction force and time to reach peak ground reaction force (Ali Asghar Arastoo, 2014). However, no difference was found in the ground reaction force and time to reach peak ground reaction force during jump shot between the arch support insole and flat insole. It inferred that the arch support insole may not directly influence the kinetics during jump shot. More kinematics data would be needed to further look into the effects of arch support insole on jump shot.

Moreover, the jump shot scored percentage showed no difference in this study. The reason could be that the participants are elite basketball players who have high level of the skill in jump shot.

CONCLUSION: Wearing arch supporting insole did not influence the jump shot scored percentage and kinetics during jump shot.

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