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## The Effect of Landing Surface on the Plantar Kinetics of Chinese Paratroopers Using Half-Squat Landing

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### ABSTRACT

The objective of the study was to determine the effect of landing surface on plantar kinetics during a half-squat landing. Twenty male elite paratroopers with formal parachute landing training and over 2 years of parachute jumping experience were recruited. The subjects wore parachuting boots in which pressure sensing insoles were placed. Each subject was instructed to jump off a platform with a height of 60 cm, and land on either a hard or soft surface in a half-squat posture. Outcome measures were maximal plantar pressure, time to maximal plantar pressure (T-MPP), and pressure-time integral (PTI) upon landing on 10 plantar regions. Compared to a soft surface, hard surface produced higher maximal plantar pressure in the 1<sup>st</sup> to 4<sup>th</sup> metatarsal and mid-foot regions, but lower maximal plantar pressure in the 5<sup>th</sup> metatarsal region. Shorter T- MPP was found during hard surface landing in the 1<sup>st</sup> and 2<sup>nd</sup> metatarsal and medial rear foot. Landing on a hard surface landing resulted in a lower PTI than a soft surface in the 1<sup>st</sup>phalangeal region. For Chinese paratroopers, specific foot prosthesis should be designed to protect the 1<sup>st</sup> to 4<sup>th</sup>metatarsal region for hard surface landing, and the 1<sup>st</sup>phalangeal and 5<sup>th</sup>metatarsal region for soft surface landing.

**Key words:** Half-squat landing, plantar kinetics, plantar pressure, surface reaction force, pressure time integral

### Key Points

- Understanding plantar kinetics during the half-squat landing used by Chinese paratroopers can assist in the design of protective footwear.
- Compared to landing on a soft surface, a hard surface produced higher maximal plantar pressure in the 1 to 4 metatarsal and mid-foot regions, but lower maximal plantar pressure in the 5 metatarsal region.
- A shorter time to maximal plantar pressure was found during a hard surface landing in the 1 and 2 metatarsals and medial rear foot.
- Landing on a hard surface resulted in a lower pressure-time integral than landing on a soft surface in the 1 phalangeal region.
- For Chinese paratroopers, specific foot prosthesis should be designed to protect the 1 to 4 metatarsal region for a hard surface landing, and the 1 phalangeal and 5 metatarsal region for a soft surface landing.

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