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The effect of shoe cushioning on landing impact forces and spatiotemporal parameters during running: results from a randomised trial including 800+ recreational runners

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INTRODUCTION:
The cushioning of running shoes is considered a key feature to modulate external loads applied to the musculoskeletal system and, possibly, influence running injury risk. In a recent randomised trial including 800+ recreational runners with a 6-month follow-up, injury risk was lower in those who received the Soft shoe version compared to those using the Hard version (Hazard ratio=0.67; 95% Confidence Interval=0.47-0.94). Therefore, the main objective of this study is to seek a functional explanation to the protective effect of the Soft shoe version observed previously. Here, we present a comparison of the kinetic and spatiotemporal data from our two study groups, to investigate the influence of shoe cushioning on running biomechanics.
METHODS:
This double-blinded randomised trial included 848 healthy runners who randomly received one of two shoe prototypes that differed only in their cushioning properties (Global stiffness: 61±3 and 95±6 N/mm in the Soft and Hard versions, respectively). Participants were tested on an instrumented treadmill in the allocated study shoes at baseline. Ground reaction force (GRF) data was recorded over 2 minutes at the participant's preferred running speed. An analysis of variance was used to compare the mean results between the two study groups, with speed as co-variable.
RESULTS:
Mean running speed during the test was 9.9(±1.5) km/h. The number of steps analysed per participant was 325±19. No difference was observed among the spatiotemporal variables. A higher Vertical Impact Peak Force (VIPF) was observed in the Soft shoe group compared to the Hard shoe group (1.53±0.21 vs. 1.44±0.23 BW, respectively; $p<0.001$). However, the proportion of steps with detectable VIPF was lower in the Soft shoe group (84 vs. 97%, respectively; $p<0.001$) and Time to VIPF was longer (46.9±8.5 vs. 43.4±7.4 milliseconds, respectively; $p<0.001$). No significant difference was observed between the two study groups for Vertical Instantaneous Loading Rate (VILR; 60.1±13.8 vs. 58.9±15.6 BW/s for Soft and Hard shoe group, respectively; $p=0.070$), or any other kinetic variable.
CONCLUSION:
In contrast to what might be expected, runners from the Soft shoe group had greater VIPF compared to the Hard shoe group, while no difference was found for VILR. On the other hand, time to VIPF was longer and the proportion of steps with detectable VIPF was lower in participants with the Soft shoe version. As our previous prospective follow-up of this cohort revealed that injury risk was lower in the group with the Soft shoe version, the current results show that the beneficial effect of greater cushioning cannot be explained by a decrease in VIPF or VILR. Taken alone, these GRF metrics are likely not appropriate markers to illustrate the relationship between shoe cushioning and injury risk, while delayed VIPF and the proportion of steps displaying a VIPF may be of relevance here.

Topic: Biomechanics

Presentation form: Oral