

18 UNDERGRADUATE RESEARCH CRITIQUE

Research Critique on “Footwear Insoles with Higher Frictional Properties Enhance Performance by Reducing In-Shoe Sliding During Rapid Changes of Direction”

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ABSTRACT

Introduction: Many team sports require rapid changes in directions that include the whole body. The foot faces large shear forces when performing movements like cuts and turns. However, the frictional properties of footwear can counteract these forces and reduce the amount of time needed to change direction. The amount of grip provided by sports footwear can determine adaptations sports players use for optimal performance.

Purpose: The purpose of this study was to determine if insoles with increased mechanical friction enhance actual and perceived change of direction performance.

Methods: Fifteen healthy participants (11 men and 4 women, 25 ± 4 years) completed 5 trials of a side cut (at a 20-degree angle) and 5 trials of a complete turn (at a 180-degree angle) with 90% of their self-reported max speed. Data were collected using force plates (Kistler) and a six Oqus camera motion capture system (Qualysis). Coefficient of friction (COF) and ground reaction force (GRF) was analyzed in braking and propulsive phases in both movements. Biomechanical data were analyzed using Visual 3D software. repeated measures multivariate analysis of variance was performed to determine mechanical frictions between insole types.

Results: Participants perceived the same comfort level between insole types. For the side cut, there were no differences in COF ($p < .01$), GRF ($p < .01$), or contact time ($p < .01$) during the braking and propulsive phases between insole types. For the turn, SI (Standard Insole) exhibited less mechanical friction [COF ($p < .01$); GRF ($p < .01$)], leading to increased in-shoe sliding compared to TI (Training Insole). There were no differences in contact time ($p < .01$) in either phase during the turn between insole types. Additionally, participants had to use more force to begin moving in the TI, resulting in greater static and dynamic COF.

Conclusion: The study found that the insole with enhanced mechanical friction (TI) increases both actual and perception of performance. These findings indicate that frictional properties in footwear insoles can enhance performance during changes in direction. The authors suggested that future developments in footwear and insoles should stress the importance of maintaining foot position for performance benefits.

Critique: The objective of the study was to determine if insoles with increased mechanical friction (TI) could enhance actual and perceived performance. The study evaluated COF and GRF. Findings suggest that TI decreases COF, GRF, and in-shoe sliding, thus keeping the foot in a better position during direction changes with a greater perception of performance. A notable strength of the study was the addition of a controlled variable for footwear. All participants were fitted with flexible shoes developed without midsole and outsole support. Having controlled footwear was vital as it allowed the study to highlight how the insole affected participant performance. It would be beneficial to the study to investigate rotational friction because the body has to create rotational friction to change direction. Therefore, analyzing how rotational friction changes between insole types during each movement can expand footwear and performance literature. Jumping would have also been a beneficial addition. Jumping is a fundamental skill in sports where gaining height or distance is an advantage. The addition of jumping to the study would highlight how the insole types effect braking and propulsive phases when moving vertically. COF, GRF, and rotational motion could be evaluated in the study while examining jump landing mechanics. Changes in deceleration mechanics based on insole type could also be evaluated. When decelerating, the body has to absorb force then quickly create force to change directions. Analyzing braking and propulsive phases during this movement in each insole type could be beneficial to the study. Lastly, though the inclusion of a controlled variable for footwear in the study is advantageous, using footwear with standard features would aid in making the research translate to practice. Taking these suggestions into consideration would expand the literature on footwear for future studies.

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