

Effect of Heading a Soccer Ball as an External Focus During a Drop Vertical Jump Task: Response

Authors' Response:

We thank the Editor for giving us the opportunity to respond to the letter concerning our recently published article in *The Orthopaedic Journal of Sports Medicine*.¹ We also thank the authors of the letter for their appreciation and interest in our work and for their valuable comments/suggestions, which will allow us and other researchers to improve the quality of future research in this area. We acknowledge the limitations of our study that they have pointed out, agree with their suggestions, and look forward to addressing the valuable comments they made regarding our work.

Their letter raises 2 main points, which we will respond to in turn.

(1) "The stated purpose of this study was to determine the effect of adding an external focus to vertical drop jump biomechanics. However, because of the specificity of a motor pattern in tasks that require high levels of proprioception and dynamic balance, such as in the vertical drop jump,³ we believe that, instead of observing the effect of an external focus on the biomechanics of a vertical drop jump, the authors rather observed the biomechanics of an entirely new skill. Because the methodology altered the movement pattern in addition to adding an external focus, causality cannot be assigned exclusively to the cognitive aspect of the external focus."

Response: Because our study participants were skilled college soccer players, heading a ball during a jump was a rather skilled task for them. Further, because they needed to execute heading during jumping, they did not have enough time to anticipate the distance to the ground before landing from the jump. Thus, due to the external focus during the jump, the participants had less time to prepare muscle preactivations and body positions sufficiently before landing while heading a ball than before landing without heading. So, although we cannot say that changes in the biomechanics of landing were entirely due to the external focus, we can say that those changes were at least partially due to the external focus during

the jump, which reduced time to anticipate the timing of landing in air and prepare the lower muscle preactivations and body positions sufficiently. In that sense, the landing part was very reactive because they had to prepare for landing in a much shorter time than normal jump landing.

(2) "Another stated purpose of the study was to represent the biomechanics of a game-like task more accurately in relation to movement injury. This was achieved by adding the heading of a soccer ball, but this does not address the 2 core facets of live play: anticipation and an open environment. The Russian physiologist and movement scientist Nikolai A. Bernstein postulated that anticipation of a task can modulate the motor program.² However, unlike live play, the design [of our study] was anticipatory and not reactive. Further, the pattern tested was highly constricted in a way that cannot be necessarily extrapolated to open and reactive play, as previously discussed. Finally, the specific movement pattern tested was using a stationary target. This likely requires different biomechanics than bracing to contact a moving soccer ball."

Response: We acknowledge the suggestion that adding a feedback (reactive) element would make the task more realistic. However, in our experience, more realistic experimental conditions would increase the intensity of the task and compromise both task safety and the reliability of the data. Thus, in the pilot study, we determined that the task we used would ensure both participant safety during the task and data reliability. In future research, however, it is an excellent idea to consider the assessment method for the risk of anterior cruciate ligament injury with a more realistic environment as per the suggestions of the authors of the letter while ensuring athlete safety and data reliability.

In summary, as the authors of the letter indicated, this is the first step in examining how dual tasks affect the biomechanics of landing. We have recognized some limitations of our study to investigate the influence of external focus. Therefore, further research will be required in the future, for example, in the manner the authors of the letter have suggested.

Thank you again for the valuable comments and suggestions.

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