Forefoot Running Barefoot vs. Shod and Risk of Stress Fracture

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Abstract

Introduction

Most research today focuses on comparing barefoot running to shod, rearfoot running patterns.[1] These studies suggest the benefits of forefoot striking include smaller collision forces than rearfoot striking, thereby contributing to smaller injury risk. In addition, shod running with a heel strike seems to increase injury risk due to less foot intrinsic muscle activation and subsequently increased collision forces.[2] However, in the current literature it remains unknown what contributes most to the cause of stress fractures - larger loading rates, longer stride length, decreased cadence, or other factors.[3]

The purpose of this study is to compare a forefoot strike pattern in both shod and barefoot conditions to measure the contribution that shoes make to decreasing collision force. In other words, it is to determine whether there are kinematic or kinetic differences between forefoot running with and without shoes and whether these differences may impact the risk for developing a stress fracture injury distal to the tibiofemoral joint, in order to make clinical recommendations for injury prevention and intervention for running-related stress fractures.

Methods

Two subjects ran on a Noraxon pressure treadmill at a self-selected 10K pace. Two one-minute trials, one barefoot and one shod, were conducted per subject using deliberate forefoot strike patterns for both. Data was recorded by the treadmill and synthesized by MyoPressure software to produce averaged vertical ground reaction force (VGRF) magnitudes, pressure prints, center of pressure diagrams, and amplitude parameters for each condition to ultimately be compared with one another.

Results

Data from both subjects' trials revealed that running barefoot decreased maximum VGRF. Subject 1's max force while shod was 1044N and decreased to 931N barefoot. Similarly, Subject 2's max force was 1000N shod, decreasing to 985N barefoot.

Discusshion

Results indicate that there is a difference in force production when running barefoot compared to shod. It is unknown whether the decrease in VGRF seen in our results is enough to contribute to an actual decreased risk in injury. Both subjects were actually midfoot-striking and were unable to fulfill the intended criteria for forefoot striking. Hence, any findings are nullified in direct regard to the researchers' original clinical question and hypothesis. It is, however, a practical indication of how difficult it is to deliberately alter an individual's natural running strike pattern. The lack of data on medial-lateral and anterior-posterior GRF further limits the scope of this research.[4] These values change between conditions along with VGRF and would certainly provide greater insight into the forces sustained by the bones and joints of the feet.

Conclusion

In shod running, there is a greater area available to disperse force. In barefoot running, there is less force but also less area to disperse forces. Neither condition is inherently superior.

Clinical Implications

Variability in running conditions is good when the runner is in control of parameters and is able to adapt to any unpredictable factors of which they are not in control. However, the choice to run shod vs. barefoot is dependent on many factors, including running distance and personal preference. It may be healthier to be shod for long-distance runs, in order to minimize impact forces over longer durations of time. At the same time, personal and natural preference may indicate the healthiest conditions for a runner. Consciously trying to change one's striking pattern may potentially lead to increased risk of injury. Such hypotheses warrant further research.[5]

References

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