

異なる接地パターンが足部に作用する力に及ぼす影響 — 足部ランニング障害予防のための接地方法の提案 —

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Influence of Foot Strike Patterns on the Forces Applied to Foot -Effective Foot Strike Pattern for Prevention of Running-Related Injuries Occurring on Foot and Ankle-

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ABSTRACT

Ground reaction force is often used to predict the risk of injuries but may not coincide with the forces applied to commonly injured regions of the foot. This observational study examined the forces applied to the foot and the associated moment arm made by three foot strike patterns. Ten male runners ran barefoot along a 15 m runway at 3.3 m/s using forefoot, midfoot, and rearfoot strikes. Three-dimensional coordinates of markers and ground reaction force were recorded. The Achilles tendon and ground reaction force moment arms represented the shortest distance between the ankle joint axis and the line of action of each force. The Achilles tendon and joint reaction forces were calculated by solving motion of the foot equations for each instance during the contact phase of running. The ground reaction force was significantly greater for the forefoot and midfoot strikes than for the rearfoot strikes, whereas there was no difference between the midfoot and rearfoot strikes. The Achilles tendon and joint reaction forces were significantly greater for the forefoot strikes than for the other foot strikes, and these forces were greater for the midfoot strike than for

the rearfoot strike. The ground reaction force moment arm was significantly greater for the forefoot strike than for the other foot strikes, and was greater for the midfoot strike than for the rearfoot strike. Meanwhile, there were no significant differences in the Achilles tendon moment arm among all foot strikes. The Achilles tendon and joint reaction forces were greatest for the forefoot strike, followed by the midfoot strike, and rearfoot strike. These differences were attributed mainly to differences in the ground reaction force moment arm among the three foot strike patterns.

要 旨

地面反力はランニング障害のリスク評価に広く用いられている。しかし、地面反力は障害が起きる部位に作用する力と必ずしも一致しない。本研究では、異なる接地パターンが足部に作用する力および関連する力学変数へ及ぼす影響を明らかにすることを目的とした。男性ランナー 9 名を対象とし、前足部接地、中足部接地および後足部接地による走行を 3.3 m/s の走速度にて実施した。光学式モーションキャプチャおよびフォースプレートを用いて、下肢に貼付した反射マーカの 3 次元位置座標および地面反力を取得した。足部の並進および回転の運動方程式を解くことで、アキレス腱張力および足関節の関節間力を算出した。アキレス腱張力および関節間力は、前足部接地にて最も高い値を示し、中足部接地、後足部接地の順で低値を示した。その主要因として、アキレス腱モーメントアームが接地パターン間で差がなかったこと、地面反力のモーメントアームが前足部接地、中足部接地、後足部接地の順で高値であったことが挙げられる。