Grounded runners experience less severe ground reaction forces compared to runners who run with a flight phase

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SUMMARY

Grounded running is slow running without a flight phase. When young, athletic men changed their spontaneous running pattern – containing a flight phase – to grounded running, musculoskeletal and impact loading decreased. However, no information is available for runners who spontaneously perform grounded running. This study compared natural grounded runners with natural aerial runners and showed that measures for musculoskeletal and impact loading are respectively 10 to 16% lower for the grounded running group, which might have implications regarding the occurrence of running-related injuries.

INTRODUCTION

Every year recreational distance running gains in popularity, with a large proportion of runners preferring shorter distances at slower speeds (< 8km.h⁻¹) [1]. In this slow running population, not everyone runs with a clear flight phase, which has been called 'grounded running' (GR) [2]. Recent research showed that musculoskeletal and impact loading decreased with 17 to 30% when young, athletic men altered their spontaneous aerial running pattern (AER) into a GR pattern at the same slow speed [3]. The aim of this study was to gain more insight into the natural GR locomotion pattern rather than instructed GR, by identifying differences between runners who spontaneously perform GR or AER at a slow speed of 2.0 m.s⁻¹. We hypothesized that the GR group would show lower values for maximal ground reaction forces (FzMax) and for vertical instantaneous loading rate (VILR) compared to the AER group.

METHODS

Twelve slow runners $(11 \ \bigcirc, 1 \ \circlearrowleft)$ who participated in a recreational 5.2 km event were recruited based on their finish time (finish time > 39 min or average running speed < 8 km.h⁻¹, i.e. 2.20 m.s⁻¹) and duty factor (DF) to match 6 natural GR's with 6 natural AER's at the same slow speed. All subjects performed running on treadmill at 2.0 m.s⁻¹, which was close to their average preferred running speed (1.98 ± 0.21 m.s⁻¹) for 1.5 min and were categorized based on DF (GR: DF 54.60% ± 2.09; AER: DF 47.09% ± 1.56). FzMax was calculated as a general measure for musculoskeletal loading and VILR as a measure for impact loading.

RESULTS AND DISCUSSION

The subjects of the study were recruited from a field observation study. As a result of this, an equal number of

habitual GR's and AER's based on the absence or presence of a flight phase was easily obtained. For the GR group, FzMax values were 9.75% lower (p = 0.019) compared to the AER group (Figure 1). Also VILR was found to be lower in the GR group compared to the AER group (16.25%; p = 0.039). The smaller FzMax and impact loading in the GR group found in this experiment concur with previous research on (instructed) GR. Because FzMax relates to maximal loading at chronic running-related injury (RRI) sites [4] and VILR has been suggested to be a risk factor for lower-limb stress fractures [5], these results suggest that runners who opt for a GR pattern, whether it is spontaneously or based on an instruction, could benefit from this lower musculoskeletal and impact loading.



Figure 1: Musculoskeletal loading (**A** – FzMax) and impact loading (**B** – VILR) measures for grounded running (GR – black bars) and for aerial running (AER – grey bars) at 2.0 m.s⁻¹. * indicates p < 0.05

CONCLUSIONS

When running slowly, some runners prefer GR while others use a flight phase. This GR pattern could be a strategy to match the loading of the musculoskeletal system with its loading capacity, thereby possibly reducing the risk for RRI's.

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