

An instructed start-to-run program is effective in increasing habitual duty factor and reducing loading magnitude

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Summary

Acute increases in duty factor are related to a decrease in musculoskeletal load. However these studies are focused on instantaneous increases during one experiment [1]. To date, it still unknown whether novice runners are able to increase the duty factor of their habitual running pattern. We performed a randomized control trial consisting of a pre-test, 10 week instructed start-to-run program, post-test, 16 week follow-up period and retention test. An instructed start-to-run program is effective in increasing the habitual duty factor of novice runners which subsequently reduced maximal vertical ground reaction force. However, 16 weeks after the intervention program habitual duty factor returned back to its initial value.

Introduction

Duty factor, the ratio of stance time over stride time, is a spatiotemporal characteristic of running style that is associated with reduced musculoskeletal loading [1]. One simple verbal instruction can acutely increase duty factor [1]. However, by doing so, individuals deviate from their habitual running style, causing the retention of these adaptations to be unknown. In order to reduce loading magnitude over a long term, a permanent increase in habitual duty factor is necessary.

This study aimed to determine whether a tailored start-to-run program with verbal instructions on vertical displacement is effective in increasing the habitual duty factor and reducing loading magnitude. Additionally, we assessed if these potential changes were retained after a period of 16 weeks.

Methods

The study was a randomized control trial consisting of a pre-test, 10 week intervention period, post-test, 16 week follow-up period and retention test. Forty subjects were recruited for this study and equally divided into two groups based on duty factor and preferred running speed. Twenty-six subjects (16 intervention, 10 control) performed the posttest. Two more control subjects dropped out during the follow-up period.

During the pretest subjects ran on a 25 m runway at a fixed speed of $2.36 \pm 0.1 \text{ m.s}^{-1}$. Next, both groups performed a 10 week start-to-run program with auditory instructions. The intervention group was instructed to go less up and down whereas the control group received a sham instruction. At the post- and retention test, subjects ran again at the fixed speed.

A linear mixed effect model was used to analyse the effect of group x time interaction ($DF = \text{Group} : \text{Time} + \text{Speed} + (\text{Foot} + \text{Time} + \text{Condition})|\text{SUB}$). A linear regression model was used to determine the relationship between the change in duty

factor and change in maximal vertical ground reaction force from the pre- to the posttest.

Results and Discussion

Table 1 shows the results of the linear mixed effect model, indicating a significant group x time interaction effect at the post moment. Subjects in the intervention groups increased their habitual duty factor from 42% to 43.48%, whereas the control group increased their duty factor marginally from 43.09% to 43.81%. However, these increases were not maintained after the retention period of 16 weeks.

Name	Estimates	p value
Intercept	54.044	< 0.001
Speed	-4.944	< 0.001
Intervention group x Posttest	1.523	< 0.001
Intervention group x Retention test	0.307	0.497

Table 1. Fixed effect coefficients of the linear mixed effect model:
DF = Group : Time + Speed + (Foot + Time + Condition|SUB)

An increase in the habitual duty factor from the pre moment to the post moment is related to a decrease in maximal vertical ground reaction force (adjusted $R^2 = 0.643$, $p < 0.001$, Figure 1).

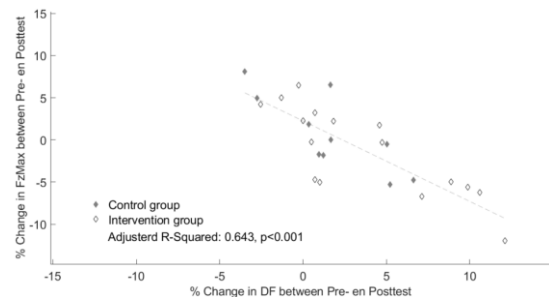


Figure 1. Relationship between the change in duty factor (DF) and maximal vertical ground reaction force (FzMax) from the pre-test to the post-test (adjusted $R^2 = 0.643$, $p < 0.001$).

Since a lower duty factor is related to a higher musculoskeletal load and higher risk for the development of running injuries [1,2], programs to increase the habitual duty factor might be effective in the prevention of running injuries.

Conclusions

An instructed start-to-run program is effective in increasing the habitual duty factor of novice runners. The increase in duty factor is related to a decrease in loading magnitude. However, this increase is not retained after 16 weeks.

References

- [1] Bonnaerens et al. (2022). *Med Sci Sports Exerc*, **54**: 1842-1849.
- [2] Malisoux et al. (2022) *Am J Sports Med*; **50**. 537-54

