Repeated On-Ice Sprints Alter Skating Metrics and Increase Inter-Limb Asymmetry in Youth Hockey Athletes

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Summary

Lower-limb capacity of hockey athletes is often measured with off-ice assessments; however, the development of skate-secured 3D accelerometers permits novel insight into neuromuscular function during skating. Twenty youth hockey athletes performed 10 sprints of 30m, with 10s of rest between repetitions. Repeated on-ice sprints induced fatigue (reduced stride impulse), and led to increased ice contact time, stride recovery time, and inter-limb asymmetry (ILA).

Introduction

Neuromuscular function is a key component of athletic performance. Due to barriers with on-ice data collection, it is common to test lower-limb capacity of hockey athletes with off-ice assessments (e.g., a countermovement jump) [1]. Thus, limited research exists assessing neuromuscular function during on-ice activity, particularly in the context of fatigue (reduction in force or power in response to a voluntary task) [2]. Recent technological advances with skate-secured 3D accelerometers provide an opportunity to evaluate limb-specific function during on-ice activity. Identifying possible links among fatigue, skating performance, and ILA will provide further insight into limb-specific function during exercise, and could inform individualized on- and off-ice training programs. The purpose of this project was to investigate the influence of fatigue on lower-limb function during on-ice activity. It was hypothesized that fatigue would impair lower-limb function and increase ILA during skating.

Methods

Twenty youth hockey athletes (7 females, 16.4 ± 0.9 years) performed 10, 30-m sprints, with 10s rest between repetitions. Limb-specific measures from the accelerometers included stride impulse, ice contact time, and stride recovery time. ILA was calculated with the following formula:

$$\text{ILA} = \left(\frac{Stronger\ Limb - Weaker\ Limb}{Stronger\ Limb}\right) \times\ 100\%$$

Mean values of all strides were calculated for each sprint, and repeated measure ANOVAs were used to compare the mean of sprints 1-2, 3-4, 5-6, 7-8, and 9-10, which were organized into bins 1-5, respectively.

Results and Discussion

Due to the repeated-sprint protocol, baseline (bin 1) values for stride impulse (472 ± 77 kg·m/s), ice contact time (271 ± 31 ms), and stride recovery time (296 ± 15 ms) were reduced by 17%, and increased by 21% and 7%, respectively (Figure 1). ILA increased for stride impulse (Table 1), which may be due to increased reliance on one limb vs. the other, or a compensatory strategy to mitigate the influence of fatigue [1,3].

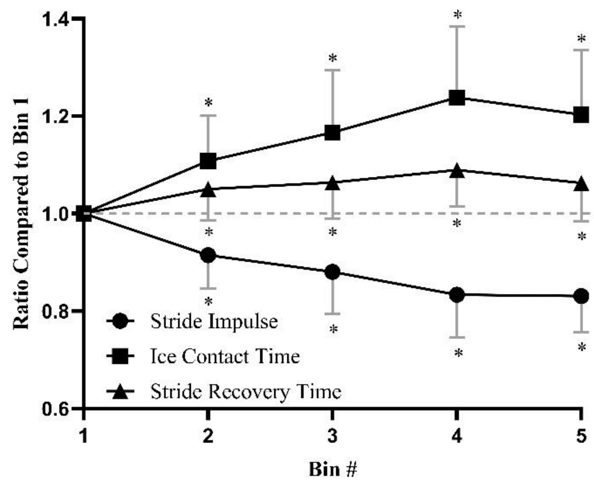

Figure 1: Skating metrics as a ratio of bin 1. Data are mean ± standard deviation (SD). * different from bin 1 ($p < 0.05$)

Table 1: ILA data as mean (SD). * different from bin 1 ($p < 0.05$).

ILA (%)	Bin 1	Bin 2	Bin 3	Bin 4	Bin 5
Stride Impulse	7.8 (5.3)	**9.9 (4.4)***	7.9 (5.2)	9.2 (3.9)	**10.0 (4.6)***
Contact Time	7.9 (4.5)	9.4 (4.4)	7.2 (3.8)	11.2 (5.9)	8.6 (5.0)
Recovery Time	8.5 (4.1)	11.9 (6.1)	8.8 (3.8)	8.9 (3.1)	9.8 (4.2)

Conclusions

The influence of fatigue on neuromuscular function during on-ice activity was investigated with competitive youth hockey athletes. On-ice fatigue reduced maximal output (stride impulse), increased ice contact time, stride recovery time, and stride impulse ILA. The results of this project demonstrate that skate-secured accelerometers can assess acute alterations of neuromuscular function, and thereby provide valuable insight into the influence of fatigue on skating performance during on-ice activity.

Acknowledgments

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References

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