

Ice Hockey Players Demonstrate Reduced Balance and Gait Velocity Compared to Non-Contact Athletes

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Summary

Following concussion, individuals often present with balance loss, slower gait, neurocognitive deficits, and behavioral changes. Duration of symptoms may vary between individuals greatly based on genetics, medical history, and mechanism of injury, although post-concussion balance changes have been shown to persist up to two years after sport-related concussion [1]. The purpose of this study was to evaluate balance and gait characteristics among high- and low-impact athletes across the course of a season. Among the 40 athletes evaluated, hockey players demonstrated slower gait velocity during single- and dual-task walking and increased sway during standing tasks. Results might indicate persistent deficits and a potential cumulative effect of subclinical concussive hits throughout an athlete's career.

Introduction

Approximately three million sport-related concussions occur annually, though this is likely an underestimate due to under-recognition, under-reporting, under-diagnosis, and gaps in surveillance [2]. Return-to-play decisions are typically based on self-reported symptoms and subjective assessments by clinicians, which may fail to detect persistent subclinical neuromuscular deficits [1].

Injury from subclinical repetitive head impacts have been shown to contribute to pathological conditions such as CTE [3]. However, more research is needed on the potential long-term and residual effects of repetitive head impacts on gait and balance function. Therefore, this study aimed to evaluate athletes' preseason and postseason balance and gait characteristics in low- and high-impact sports. We hypothesized that there would be H1: no difference in preseason balance and gait performance among age-matched male ice hockey and CrossFit athletes; H2: reduced gait speed and greater standing sway for athletes with prior concussion history; and H3: reduced performance following a full season of hockey versus a time-matched season of CrossFit, due to repetitive head impacts.

Methods

Male ice hockey (n=24; age= 24.5±2.2years; BMI= 25.7±2.3kg/m²) and low-impact (n=16; age= 25.3±5.2years; BMI= 26.6±3.9kg/m²) athletes were recruited from the local semi-professional team and CrossFit gym, respectively. All participants provided written informed consent to the study protocol before enrollment. Participants were instructed to stand quietly on a Biodex Balance SD force plate under four conditions, including with eyes open or closed and on a firm or foam surface, with a sway index calculated for each 30-

second condition. Participants also walked at a self-selected comfortable speed across an instrumented 4-meter GAITRite walkway. Primary outcomes of sway index and gait velocity were evaluated using a two-way repeated measures ANOVA, with group allocation (hockey vs CrossFit) as the between-subjects and time (pre-season vs post-season) as the within-subjects' factors. An independent sample t-test was used to evaluate pre-season performance among hockey players based on self-reported concussion history. All analyses were completed in SPSS 28.0, with an alpha level set at $p = 0.05$.

Results and Discussion

For gait velocity, results were in contrast to all hypotheses, as hockey players walked 0.12m/s slower than CrossFit athletes ($p=0.02$) at preseason, hockey players with and without a self-reported history of concussion demonstrated similar performance during gait and balance tasks ($p=0.557$), and no visit effects were found for hockey or CrossFit athletes ($p=0.185$). Though no interaction effect was found ($p=0.119$), hockey players further demonstrated larger sway during all balance conditions, when compared to CrossFit athletes (Figure 1; $p=0.023$).

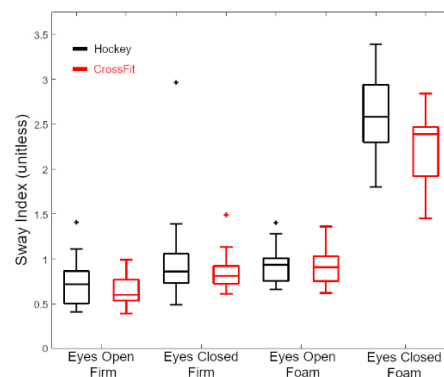


Figure 1: Preseason Sway Index of athletes across four conditions.

Conclusions

Results suggest that subclinical head impacts are at least as important as concussion history, and may result in balance deficits that outlast the off-season. It is further possible that all hockey players have a history of concussion, even if unrecognized or unreported, with long-duration balance and gait alterations present post-injury [1].

References

- [1] Johnston et al. (2020). *Scand J Med Sci Sports*, **54**: 1497-1505.
- [2] Daugherty et al. (2024). *Head Traum Rehab*, **39**: 121-129.
- [3] Daneshvar et al. (2023). *Nat Commun*, **14**: 3470.