# Skating velocity in-game and during all-out, on-ice sprints in varsity-level female ice hockey athletes

Kyle MA Thompson[1], Christopher Pignanelli[1], Alexander SD Gamble[2], Jessica L Bigg[2], Lawrence L Spriet[2], Jamie F Burr[1]

*1 Human Performance and Health Research Laboratory, Human Health and Nutritional Sciences, University of Guelph, Guelph, ON, Canada, N1G 2W1*

*2 Human Health and Nutritional Sciences, University of Guelph, Guelph, ON, Canada, N1G 2W1*

## INTRODUCTION

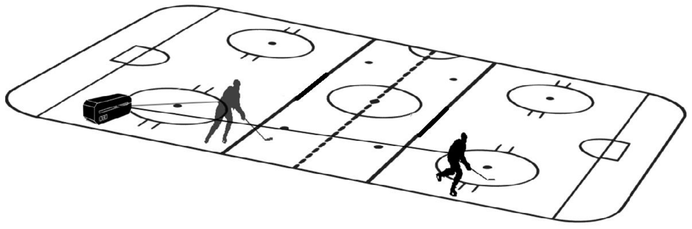
- Maximal skating velocity is thought to be a major determinant of hockey playing ability and is often used as an indicator of hockey performance.
- Despite the common use of maximal skating velocity as a performance test, the relative importance of this metric remains unclear.
- Local positioning systems (LPS) have made it possible to measure in-game, ice-hockey velocities.
- No work has compared objectively measured in-game skating velocities to maximal skating velocity measured using a linear sprint test, as would commonly be employed during on-ice fitness testing for player evaluation.

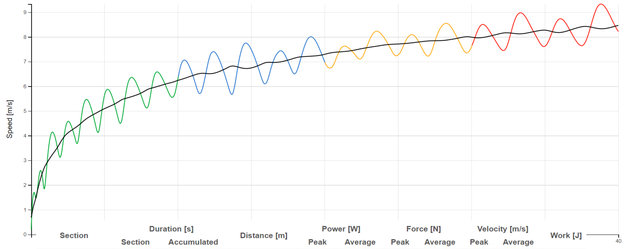
## STUDY AIMS

- Compare velocity outputs between local positioning system (LPT) (Kinexon GmbH, Munich, Germany) with an already validated linear position transducer (LPT) (1080 Sprint)
- Compare in-game skating velocities to maximal linear skating velocity.

## METHODS

- Varsity-level female ice hockey players (n=17) were recruited
- 3 x 40 m on-ice sprints from a static starting position
- Instantaneous velocity was simultaneously recorded using a LPT (1080 Sprint) and LPS (Kinexon)
- In-game time spent between 80-90% and >90% of peak speed (recorded during the linear sprint) was recorded during four ice hockey games
- In-game skating velocities were recorded using the LPS only






| Section | Duration [s] | | Distance [m] | Power [W] | | Force [N] | | Velocity [m/s] | | Work [J] |
|---|---|---|---|---|---|---|---|---|---|---|
| | Section | Accumulated | | Peak | Average | Peak | Average | Peak | Average | |
| Entire sprint | 6.26 | - | 39.98 | 448.56 | 186.85 | 50.52 | 27.67 | 9.33 | 6.39 | 1168.76 |
| 0m - 5m | 1.43 | - | 5.01 | 254.87 | 92.03 | 44.97 | 24.21 | 5.68 | 3.52 | 131.15 |
| 0m - 10m | 2.30 | 2.30 | 10.02 | 285.39 | 116.33 | 46.65 | 24.89 | 6.58 | 4.36 | 267.34 |
| 10m - 20m | 1.45 | 3.75 | 9.98 | 379.42 | 202.60 | 50.52 | 28.32 | 8.00 | 6.89 | 293.57 |
| 20m - 30m | 1.31 | 5.06 | 10.02 | 357.16 | 224.07 | 42.90 | 28.81 | 8.55 | 7.66 | 293.08 |
| 30m - 40m | 1.20 | 6.26 | 9.96 | 448.56 | 262.31 | 49.05 | 30.98 | 9.33 | 8.30 | 314.77 |

**Figure 1**. Representative 1080 Sprint data. Showing continuous, raw (colored) and rolling average (black) velocities, over 40m. 10m split times, power, force and velocity data are provided below the graph.

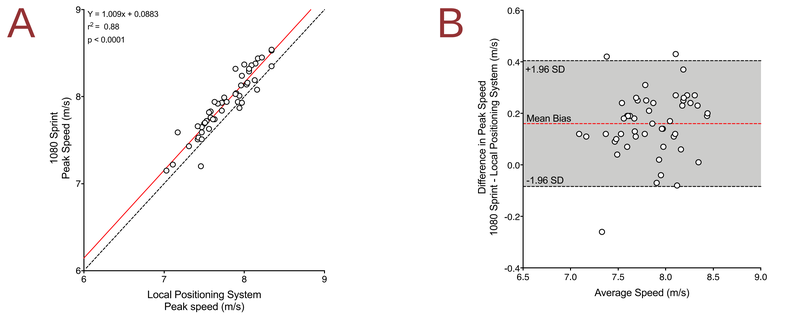



**Figure 2**. (**A**) Correlation analysis demonstrating a strong relationship between peak speeds recorded using the 1080 Sprint and the local positioning system during a 40m linear on-ice sprint. Circles represent individual data (n=50). Red line represents the linear regression line, and the black dashed line represents the line of agreement (x=y) (**B**) Bland-Altman plot demonstrating a mean bias (red dashed line) of 0.16 m/s for 1080 Sprint compared to the local positioning system. Shaded region represents the 95% confidence intervals or ± 1.96 standard deviation; SD.

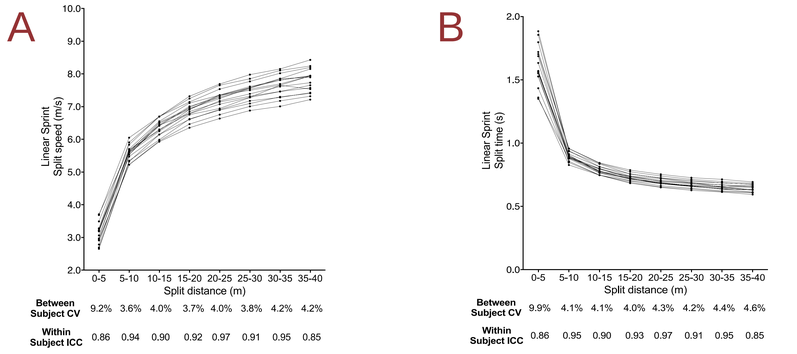



**Figure 3**. (**A**) Peak individual sprint velocities over each 5 m segment (averaged peak velocities from three, 40 m sprint trials). Group variation (CV) and individual subject reproducibility (ICC) are provided for each 5 m segment, below. (**B**) Individual 5 m split times (averaged split times from three, 40 m sprint trials). Group variation (CV) and individual subject reproducibility (ICC) are provided for each 5 m segment, below.

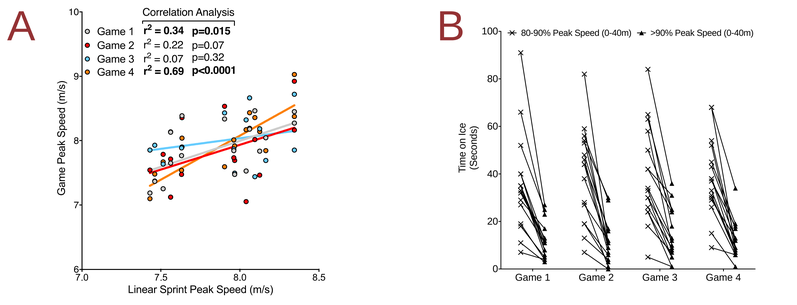



**Figure 4**. (**A**) Relationships between peak speed achieved during the linear sprint test and within one of four hockey games. Colored circles represent individual player data and correspond with the same colored regression line. (**B**) Time spent at different relative speed zones during 4 in-season hockey games.

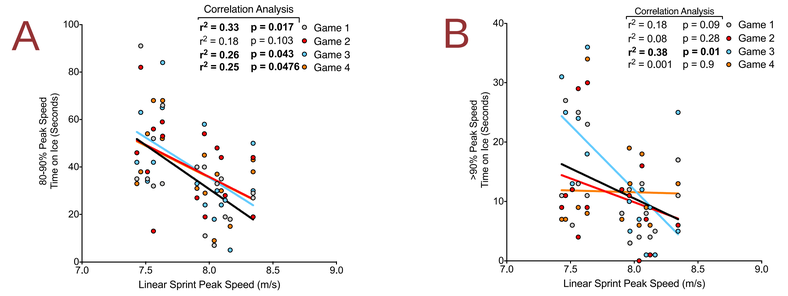



**Figure 5**. (**A**) Correlation between the amount of time spent within a hockey game at 80-90% of maximal velocity and maximal velocity achieved during the linear skating test. Colored circles represent individual player data and correspond with the same colored regression line. (**B**) Correlation

## RESULTS

- A small but significant difference in peak velocity during linear sprinting was observed between the two velocity recording devices (mean difference of 0.16 m/s or 0.6 km/h, P <0.0001)
- Both recording devices showed high within-subject repeatability (ICC: LPT-0.906 and LPS-0.859). High within-subject repeatability was observed for average velocity recorded over each 5m split (0-5m, 5-10m, …, 35-40m) (ICC: 0.817-0.958).
- Between-subject variation (CV=9.2%) was highest within the first 5m of the 40m on-ice sprint while low variation was observed between velocities at all other split distances (CV range= 3.6-4.2%)
- Within four intercollegiate hockey games, players reached near-maximal velocities (>90% of their 40m maximal velocity) on 6.5 ± 3.2 occasions, an equivalent of 11.8 ± 7.4 seconds.

## INTERPRETATIONS

- The LPS and LPT systems can both be used reliably. However, caution should be taken when comparing peak velocity values between measurement systems.
- Peak velocity is not achievable within 40 m (Figure 3. A/B). Since it is not achieved within a linear, all-out 40 m sprint, it is unlikely that there will be many in-game opportunities that require this skill.
- Maximal skating velocity is rarely achieved, in-game (Figure 4. B). Given its lack of occurrence during game situations, we would suggest time be spent training skating qualities other than maximal skating velocity .
- Faster players spend less time at relatively high velocities in hockey games (Figure 5. A). This is perhaps the only obvious benefit of having a greater skating velocity – it is likely that the athlete is spending time at a lower relative exercise intensity, which may allow them to perform for a longer period.

## PRACTICAL SIGNIFICANCE

- Although maximal velocity skating may still be important, the occurrence of within game events that require maximal skating velocities appear to be low. Therefore, the ability of a maximal velocity skating test to predict in game hockey performance should be questioned.
- Future work should examine the in-game occurrence rates of other skating qualities, such as acceleration or change of direction to help guide hockey testing and training focuses

Want a copy of this poster? Scan the QR code for a direct link to an online version