Performance Analysis in Professional Ice Hockey

Using Tracking Data to combine Tactical and Physiological Analysis

John Komar[1], Jules Girard[2], Thomas E. Brownlee[3], Allistair P. McRobert[3]

[1] National institute of Education, Nanyang Technological University, 1 Nanyang Walk, Singapore, john.Komar@nie.edu.sg
[2] Normandy University, UNIROUEN, Boulevard Siegfried, Mont-Saint-Aignan, France, jules.girard@outlook.com
[3] Liverpool John Moores University, 5 Primrose Hill, Liverpool, L3 2EX, {T.brownlee,A.P.McRobert}@ljmu.ac.uk

- Is Heart rate monitoring necessary in Ice Hockey?
- Can we use tracking player to assess the demand of a game?
- Are the play-off games more intense?

INTRODUCTION

Ice hockey is a sport that requires repeated, high-intensity bouts of skating, interspersed with on-ice gliding and rest between bouts, leading to high rotations between players (i.e., every 40 seconds in average) (1). Although heart rate (HR) has been used to assess the fitness demands of such an intermittent activity (2), in the present research we sought to investigate the HR of players in relation to actual time on ice versus time in activity and time at rest.

- Are the heart rate indicators correlated with the time in activity?
- Is there a difference in player's activity between the regular season and the play-off?
- Investigate the use of the rate of discovery as an indicator of fatigue during the season

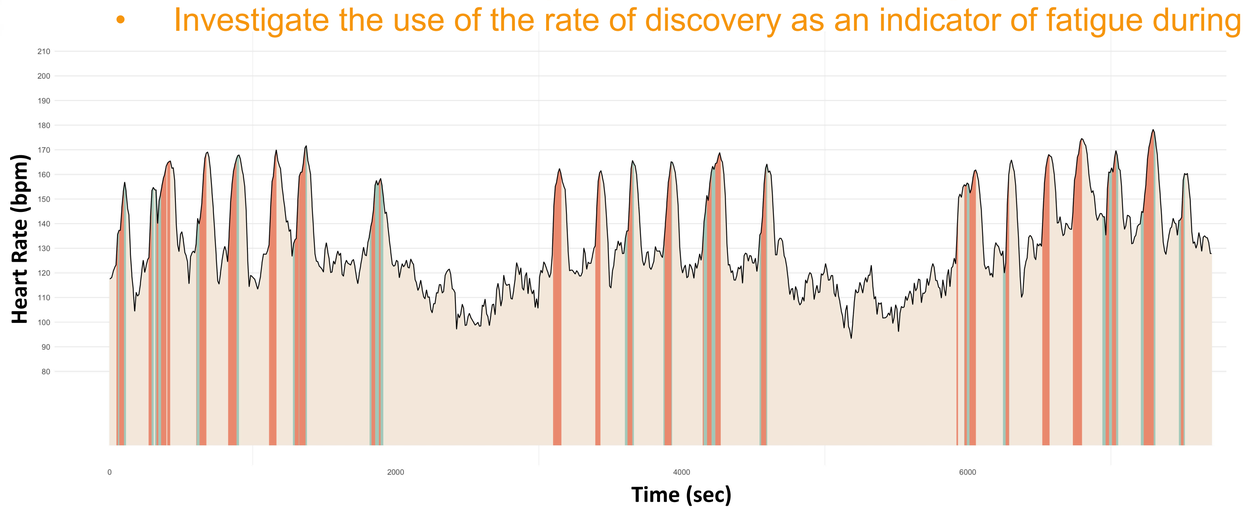

Figure 1. Tracking of Time On Ice in activity (on ice with the clock running) and heart rate of a ice hockey player in a playoff game.
- In orange: time on ice while the clock is running
- In green: time on ice while the clock is stopped

METHOD

During a regular season and during the playoffs (quarter-final to the final) of the French National Hockey League, the HR of every player was recorded during all the games using a Firstbeat® wireless system. This allowed physiological tracking of players specific to periods spent in activity (on ice with the clock running) and resting periods (based on player tracking data). Both time series were subsequently synchronized (Figure 1). In addition to regular measurement (HRmax, time above 80%HRmax, time above 90%HRmax, see (2)), "rate of recovery" was calculated as the exponential decrease of HR during the 60 s from the end of each bout of play. The sampling rate of all measurement was set at 1Hz.

RESULTS & DISCUSSION

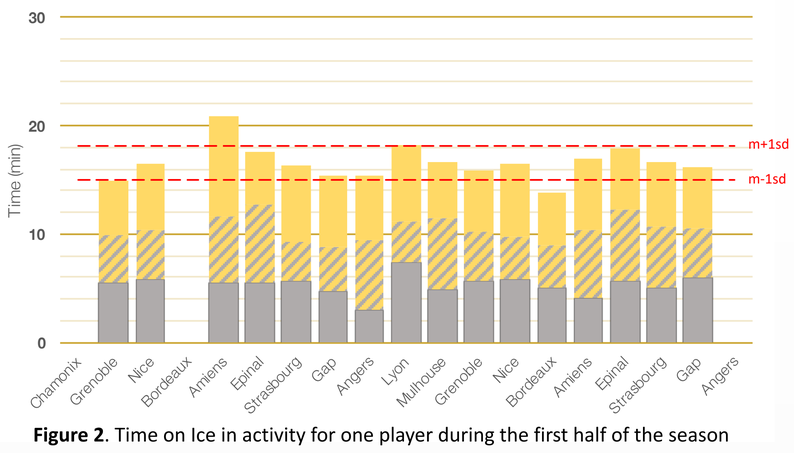

Figure 2. Time on Ice in activity for one player during the first half of the season

- Mainly due to the different available players for the different lines, a significant difference appeared in Time on Ice in Activity between player's position (offensive line between defensive line). Although the total time per game is very stable between games for each player, a high variability is observed within a game (between thirds), showing that a player highly used in the first third is usually less used in the last third (Figure 2). Player's activity management has to be considered when preparing the tactics of the game.
- The Heart Rate indicators (max HR, time spent above 80% of maxHR, time spent above 90% of maxHR) were all correlated with the time on ice in activity (Figure 3) – with all $p < 0.001$.
- I addition, no significant difference between the games of the regular season and the play-off was observed neither in time on ice nor in heart rate indicators, showing that the
- The rate of recovery (i.e. the exponential coefficient) was not correlated with the time of ice. In addition, the value of this coefficient did not show any difference between the different thirds, neither between the regular season and the play-offs

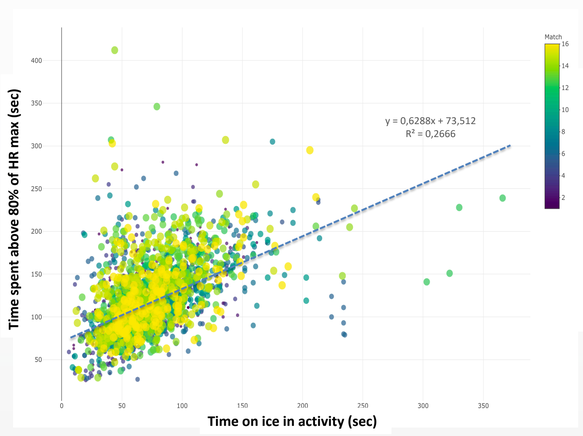

Figure 3. Association between Time on Ice in Activity and the time spent above 80% of the HR max – the color shows the time in the season (game 1 early season and game 16 play offs)

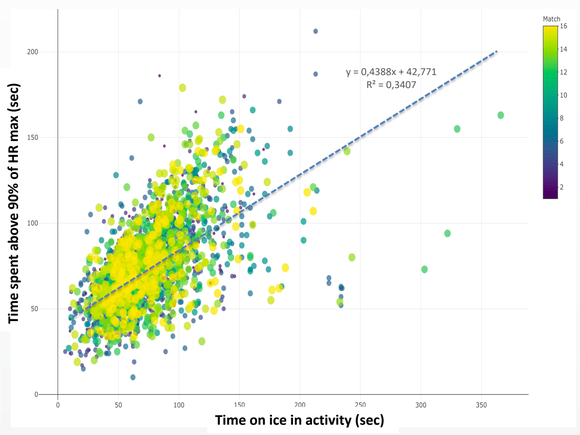

Figure 4. Association between Time on Ice in Activity and the time spent above 90% of the HR max – the color shows the time in the season (game 1 early season and game 16 play offs)

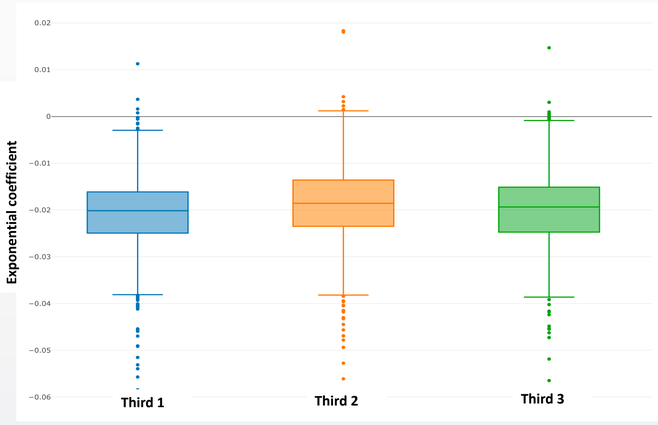

Figure 4. Average value of the exponential coefficient per third during the game.

- No difference of activity demand between regular season and play-offs
- Time on ice is strongly correlated with Heart Rate and can be used to quantify the physiological demand
- The "rate of recovery" is independent on the intensity and duration of the previous bout

REFERENCES

1 - Swartz, T. B. (2017). Hockey Analytics. In N. Balakrishnan, T. Colton, B. Everitt, W. Piegorsch, F. Ruggeri, & J. L. Teugels (eds), Wiley, Chichester, UK.
2 - Barry A. Spiering, Meredith H. Wilson, Daniel A. Judelson, AND Kenneth W. Rundell. (2003). Evaluation of Cardiovascular Demands of Game Play and Practice in Women's Ice Hockey. Journal of strength and condition research, 17(2), 329-333.