# Comparing the Most Demanding Passages of Official Matches and Training Drills in Elite Roller Hockey

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## Abstract

The aim of this research was to identify and compare the most demanding passages (MDP) in elite roller hockey in competition and in different training situations. Data were collected using WIMU PRO™ sensors with inertial micro-technology and ultra-wide band positioning. Eight professional roller hockey players from the Spanish First Division League (Ok Liga) were analysed during the 2017-2018 season. The MDP were studied using a rolling average method in which maximal values were calculated for three different time windows (1', 2' and 5') in official matches and in four different training drills commonly used in the weekly team-training schedule: practice match (TRAINING MATCH), 4 vs. 4 in half court and one transition (4vs4+1T), 4 vs. 4 in half court and two transitions (4vs4+2T) and 3 vs. 2 wave transition drill (3vs2). The variable used for the comparison was the distance covered in high speed skating (HSS: >18 km·h⁻¹; m·min⁻¹) and only the maximum value of each player, drill and time window were stored for the study. The results show that training drills could not reproduce the maximum conditional effort that occurs in an official match in any time window. Moreover, all the situations and games analysed had higher levels of effort as the time of the window studied decreased. The analysis of shorter time windows could be a topic for future research. In conclusion, the findings of this study pave the way for future research into the identification and comparison of the most demanding scenarios in elite roller hockey that may help coaches to design training situations.

**Keywords:** external load, UWB, roller hockey, most demanding passage, team sports.

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2020, n.º 140. 2nd Quarter (April-June), pp. 77-80          77

D. Fernández et al.                    Comparing the Most Demanding Passages of Official Matches and Training Drills in Elite Roller Hockey

SCIENTIFIC NOTES

## Introduction

The intermittent pace of team-sport games involves a set of actions and stimuli within a time range in which conditional demands are greater than other moments. These brief time periods are called Most Demanding Passages (MDP). An MDP may be described as a multifactorial phenomenon which occurs within a defined time period, when all the conditional and emotional variables will be more demanding as opposed to the other moments inside a game or training session.

The MDP of matches or drills has been analysed using different techniques (Martín-García et al., 2018), dividing matches into different quarters (Morencos et al., 2019) or dividing matches into parts of 15 minutes to 5 minutes, since, as the parts analysed were smaller, higher demands were placed on the players (Malone et al., 2017; Young et al., 2019). However, the rolling average seemed to be the most appropriate method for describing these scenarios (Delaney et al., 2017), since results constitute a good tool for designing training tasks (Campos-Vázquez & Lapuente-Sagarra, 2018).

Although there are numerous descriptive studies in different team sports, hitherto, research into conditional demands in roller hockey has been somewhat scant. Only few studies were found (Fernández-Raventós et al., 2019; Merino Tantiña et al., 2014; Trabal et al., 2020) and the clearest conclusions reached in the descriptive papers was that there were no significant differences between player positions. For this reason, the objective of this research was to identify the MDP in competition and in training tasks (without making any distinction between player positions) and to ascertain whether training drills could simulate match MDP.

## Methodology

A retrospective observational study was performed during the 2017-2018 season. Positional data were collected with a wideband local system (UWB, WIMU PRO, Realtrack Systems SL, Almeria, Spain) for the subsequent determination of the MDP through the distance covered in high-speed skating (HSS: >18 km·h$^{-1}$, m·min$^{-1}$) during official games (MATCH), and also in different training drills (Figure 1) that are common in the training schedule of the team in question: (I) a 4 vs. 4 match played under formal game rules (TRAINING MATCH), (II) a half-court 4 vs. 4 scrimmage with a full-court transition by the defending team (4vs4+1T), (III) a half-court 4 vs. 4 scrimmage with a full-court double transition (4vs4+2T), and finally (IV) a 3 vs. 2 wave-transition drill in full court (3vs2). A non-experimental descriptive method was used to find the differences between the training drills and the match.
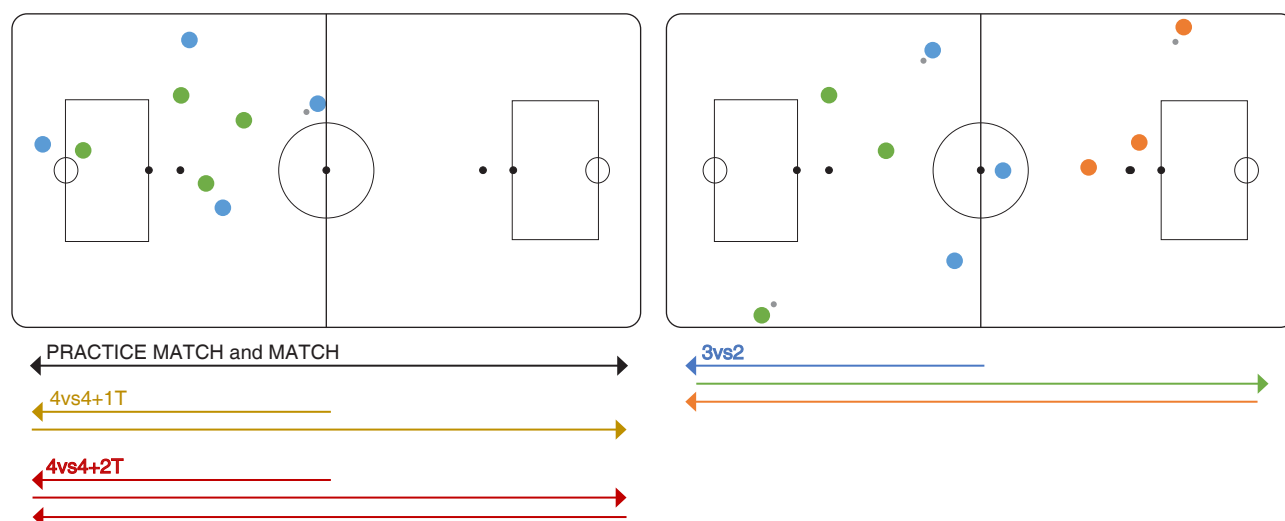
Eight professional male roller hockey players (age: 29.6 ± 5 years, weight: 78.1 ± 4.6 kg, height: 178.8 ± 3.1 cm) from the Spanish First Division (Ok Liga) participated voluntarily in the study. No goalkeepers were included. During the study, the team trained for 4 or 5 days and played between 1 or 2 games a week. A total of 886 individual records were obtained. The distribution of records in each training drill format is shown in Table 1.

**Table 1**
*Number of records in each drill and competitive matches according to the time window analysed*

| Time Windows | MATCH | TRAINING MATCH | 4vs4+1T | 4vs4+2T | 3vs2 | Total |
|---|---|---|---|---|---|---|
| 1' | 55 | 75 | 65 | 53 | 75 | 323 |
| 2' | 55 | 75 | 65 | 53 | 75 | 323 |
| 5' | 55 | 75 | 57 | 53 | – | 240 |

**Figure 1**
*Schematic representation of the four drills analysed and the competition match*

D. Fernández et al.                    Comparing the Most Demanding Passages of Official Matches and Training Drills in Elite Roller Hockey

SCIENTIFIC NOTES

The tasks analysed always correspond to sessions held three or four days before the match, and the data analysed were taken from the daily supervision of the player, hence no approval of an ethics committee was required. Nevertheless, this study was conducted in accordance with the Helsinki Declaration and the players gave their written consent before participating. The logging devices were located in the upper part of the back on tight vests. The data collected were analysed with computer software (SPRO, RealTrack Systems SL, version 946). The WIMU PRO™ sensors are equipped with three different inertial sensors: accelerometer, gyroscope and magnetometer, a GPS (10 Hz sample frequency), and a UWB (18 Hz sample frequency). The WIMU PRO™ presented both good/acceptable accuracy and inter- and intra-unit reliability for UWB positioning (Bastida Castillo et al., 2019)

To identify the MDP, the HSS variable of the different training drills and match was computed for each player using the rolling average method in 3 different time windows (1', 2' and 5'), the most common durations of the training tasks. The results were always expressed as the mean plus standard deviation (mean ± SD), and only the maximum value obtained for each player, location and time window was recorded.

A Kolmogorov-Smirnov (K-S) normality test indicated that all the drill data were not normally distributed, and a Wilcoxon rank sum test was therefore conducted to evaluate possible differences between drills in the same time windows. The entire statistical analysis was performed using RStudio version 1.1.463 (RStudio, Inc.) for Windows version 10 Pro, with significance being $p < .05$.

## Results

Table 2 displays all the mean values and SD of each drill in the three different time conditions. The results show that the MATCH MDP is much more demanding than the other MDP analysed in all time windows, with clearly significant differences. Moreover, and for all time windows, TRAINING MATCH and 4vs4+2T MDP presented no significant differences between each other and for the windows of 1' and 2' TRAINING MATCH, neither did 3vs2 MDP present significant differences.

The 4vs4+1T drill presented fewest meters covered in the three time conditions and exhibited significant differences with all the other drills analysed.

## Conclusions

The purpose of this study was to identify the MDP in competition and in training drills and to compare them to find differences between them. The main findings were: (I) none of the training situations was capable of reproducing MDP MATCH demands; (II) all the drills analysed had more intense MDP when the time window was shorter and (III) TRAINING MATCH, 4vs4+2T and 3vs2 presented no differences with each other and similar MDP demands.

According to other research (Martín-García et al., 2018), most (not all) of the training games used in a weekly soccer schedule did not reach the high-speed running distances covered in official-match MDP, only the one with the largest team (10 vs. 10). The results suggest that the drills we analysed cannot reproduce match MDP, which may suggest that we chose the most common drills in the weekly microcycle and not the ones that seek to replicate the MDP of HSS in matches. It may also suggest that the variable analysed was not the most suitable one for the study of MDP in roller hockey, since it transpired that high-speed movement may be maintained through the use of inertia from a previous effort and not through the player's continual effort (Fernández-Raventós et al., 2019). It would be interesting to analyse other conditional variables related to high-intensity actions such as accelerations, decelerations or player load to complement the MDP information.

The results of this study pave the way for future research into the identification of MDS in professional roller hockey and may help coaches to design training drills with different physical conditioning finalities, adapting these requirements to the specific durations of the drills.

## Acknowledgements

**Table 2**
*Mean relative values ± SD (in m · min⁻¹) of the HSS variable in the drills and competitive matches*

| Time Windows | MATCH | TRAINING MATCH | 4vs4+1T | 4vs4+2T | 3vs2 |
|---|---|---|---|---|---|
| 1' | 78.42 ± 19.89[ABCD] | 49.98 ± 16.52[B] | 40.42 ± 13.94[CD] | 46.94 ± 19.61[D] | 50.76 ± 17.56 |
| 2' | 54.57 ± 15.18[ABCD] | 32.46 ± 12.15[B] | 27.81 ± 8.66[CD] | 36.43 ± 10.14[D] | 37.37 ± 13.55 |
| 5' | 33.14 ± 7.91[ABC] | 21.20 ± 7.92[B] | 18.38 ± 5.90[C] | 23.93 ± 7.02 | |

A: TRAINING MATCH; B: 4vs4+1T; C: 4vs4+2T; D: 3vs2; $p > .05$.

D. Fernández et al.  Comparing the Most Demanding Passages of Official Matches and Training Drills in Elite Roller Hockey

SCIENTIFIC NOTES

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Apunts. Educación Física y Deportes | www.revista-apunts.com

2020, n.º 140. 2nd Quarter (April-June), pp. 77-80

80