EVALUATING ICE HOCKEY SPECIFIC ABILITY TESTS

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The purpose of this study was to evaluate on and off ice testing for hockey players. Eighteen National Collegiate Athletic Association (NCAA) level ice hockey players performed a series of on ice and off ice exercises, We compared the performance during these exercises to the plus minus scores for those players for the first half of their competitive season to identify which of those best correlate to performance on ice. The one ice sprints were performed as part of normal ice hockey practice. The off ice exercises were performed in the biomechanics and physiology laboratories at our university. Correlation analyses were performed to identify the extent to which the on ice and off ice drills were associated with on ice performance.

KEY WORDS: conditioning, specificity, sprinting

INTRODUCTION: The value of sport specific training is well accepted. A number of researchers have examined aspects of sport specific sprinting and conditioning (Walsh et al. 2007, Young; McDowell and Scarlett 2001). The sport of ice hockey poses challenges regarding training and conditioning for several reasons. Although speed is important in ice hockey it is often not straight line speed. Contrary to many sports ice hockey includes a number of high intensity intervals lasting typically about 45 seconds with 1.5-3 minutes rest between bouts. Ice hockey is a sport in which conditions change rapidly so it is important to react quickly while maintaining a high skating speed. Additionally, many teams spend considerable time performing off ice training so there is a need to identify off ice exercises that relate to ice hockey performance. To our knowledge a comprehensive evaluation of ice hockey training exercises has not yet been performed. The purpose of this experiment is to evaluate the use of both on ice and off ice exercises and relate them to performance on the ice.

METHODS: Eighteen NCAA Division I ice hockey players were recruited to participate in this study. Players performed a series of on ice sprint tasks and off ice power/speed/conditioning tasks that are regularly used by the university ice hockey team during the season as part of training of testing. The on ice tests consisted of speed tests, a speed endurance test and a speed/change in direction test. The speed tests consisted of a 9.1 meter, 19.5 meter and 27 meter straight sprint from a standing start. The speed endurance test was a 6 sprint test in which players sprinted 54 meters turned around and sprinted back 35 meters. Once the players finish a sprint they coasted back to the starting line and waited for the next sprint. Each of the last 5 sprints started 30 seconds after the previous sprint started. The speed/changed of direction test is a short straight sprint after which one of three lights in front of the player illuminates to indicate that the player continues the sprint to a timing gate that is either straight ahead 15 feet or if the player needs to change direction and veer to the left or to the right to another timing gate. This test was included to add processing ability to the physical ability of sprinting and changing direction. There are many instances during a game that a player needs to change direction suddenly as they receive new information. The off ice tests included a vertical jump on a force plate, a VO2 max test and a Wingate test on a cycle ergometer. All players performed both on ice testing and dryland testing.
As a measure of performance on the ice we used the plus minus rating system for hockey players. In this system each player on the ice receives a plus point when their team scores an even strength or shorthanded goal. Every player one the team that was scored against in those cases gets a minus point. To confirm the usefulness of the plus minus rating we compared the plus minus values of the offensive player's to their line order. The team that

participated in this study had 4+ offensive lines. Using the line each player was assigned over games near the testing period and their plus minus rating a Pearson's correlation coefficient of -0.59 was calculated for the forwards (offensive players). A correlation coefficient between 0.50 and 0.70 is considered a moderate correlation (Mukaka, 2012). Since the team didn't rank the defensive players the same way we didn't use the same line ranking like the forwards.

RESULTS: The plus minus scores of the players ranged from -7 to +3. Pearson correlation coefficients were calculated between the plus minus rating and the on and off ice tests and variables of interest. These can be seen in Table 1. The variance between the times of the 2 trials of the 9.1 and 18.9 meter sprints was high so we did not use those times for the correlation with the plus minus ratings. For the change of direction tests there were not enough valid completed trials in which the players turned left or right to test the reliability of this measure so those trials were not included in our correlations. Of the three change of direction sprints the only one for which we had enough data to analyze was the condition in which the athletes continued to skate straight ahead after the timing gate. From the 6 sprint test results we used the total sprint time of all 6 sprints and the time increase between trials 1 and 6 as possible variable of interest. From the Wingate results we used the average power/kg and the drop in power from the maximum value to the lowest value as variables of interest. The individual correlations can be seen in table 1.

Table 1
Pearson correlation coefficients (PCC) between the plus minus ratings and the exercise test results (PCC)

Exercise	PCC
One Ice Testing	
27 Meter Sprint	-0.22
Change of Direction Test (straight)	-0.16
6 Sprint	-0.32
6 Sprint Time Increase	-0.59
Off Ice	
Wingate Peak Power/kg	-0.08
Wingate Average Power/kg	-0.10
Wingate Power Drop	-0.59
VO2 Max (ml/kg)	0.34
Vertical Jump	0.21

After examining the correlations were performed a multiple regression. After dropping the variables that did not meet the significance cut off of $P<0.05$ we were left with 2 predictors, The drop in power during the Wingate and the drop in time over the 6 sprints in the 6 sprint test. The results of the regression analysis were: R square = 0.561, F= (2, 15) = 9.57, p=0.002.

DISCUSSION: The results show a range of correlations between the measure of performance and the exercises we chose for the players for their on ice and off ice training. The exercises measure a range of abilities. The exercises that measured resistance to fatigue were the most effective predictors of a players plus minus score. This was the case for both the drop in power during the Wingate test which is only 30 seconds as well as for the 6 sprint test with lasts almost 3 minutes. Although it is clear that power, speed and changing direction quickly are important for ice hockey performance, variables such as max power/kg, average power/kg and the change in direction test had no or a very weak relationship to the plus minus score. This may be because the maximum power that a player can produce when rested decreases rapidly with continued high exertion and hockey games include a number of high intensity bouts. This may also indicate deficiencies in the plus minus scores. Although one might think that multicollinearity would prevent us from using both the power drop during the Wingate test and the time drop during the 6 sprint test for our regression because they are measuring the same thing, those 2 factors only had a PCC of 0.24. This indicates that the Wingate is not an off ice test that could be used in place of the 6 sprint test but rather that it is likely measuring and different ability is also important in ice hockey performance. No variable had a higher correlation with the plus minus scores than 0.59. This is no surprise as Ice hockey is a team sport and requires an understanding of the game as well as the ability to control the puck, to read the plays and anticipate what players from both teams are going to do. Those facets of performance would not be captured by physical tests as the ones we administered. One of the limitations of this study is that the tests we administered were limited to physical ability. The exception was the change of direction test, but we did not collect data on enough valid trials to have a large enough number of completed trials to use for our analysis except in the cases in which the athletes continued to sprint forward after the first timing gate. If we were to perform a follow up study it would be advisable to put more effort into getting reliable data for the short sprint tests and change of direction tests. In the case of this study the on ice sprints were part of actual practice so we were not able to increase the number of attempts of an exercise.

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CONCLUSION: Our results indicate a wide range in correlations between the chosen exercises and game performance. Of the exercises we chose, those that measured fatigue resistance were the best predictors of performance throughout an entire hockey game. Although puck handling, game vision and changing direction at pace are also arguable very important we were not able to measure those factors in this study. More work needs to be done to identify ice hockey specific training and diagnostic exercises.

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