DEVELOPMENT OF A SKILLS OBSERVATION PROTOCOL FOR SLEDGE ICE HOCKEY – PILOT STUDY

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Over the past few years opportunities have been increasing for individuals with physical disabilities to become involved in physical activities; hence there is a recognition of the importance of mastering sport skills before participation.

Currently there is little research that has been performed on the increasingly popular sport of sledge hockey. A major component of performance is skill analysis. Having recognised its importance and the current unavailability of relevant research in the area, this study used video recordings of the Torino 2006 Paralympic sledge ice hockey tournament to provide a setting in which to produce a skill observation protocol with detailed criteria of what constitutes a mature professional sledge ice hockey skill. Experts in the field were consulted and their feedback enabled the construction of the instrument. Once this protocol was complete a pilot evaluation was done in which players were selected on the basis of statistics from the Paralympics and then evaluated using the protocol. It was determined that the protocol could successfully differentiate between higher and lower level players.

Keywords: Disability, Paralympic games, Torino.

INTRODUCTION

Sledge hockey has been credited as one of the fastest growing winter Paralympic sports. Since its inception as a Paralympic sport in the 1994 Lillehammer games the number of teams, and therefore athletes, participating at an international level has steadily increased. Sledge hockey came into existence in the early 1960's, originating in a rehabilitation centre in Sweden (Lindstrom, 2002). It provided a sport for those who were no longer able to compete (recreationally or competitively) in traditional ice hockey. Norway quickly introduced their own teams and at last count there were approximately ten countries involved in international competition. Eight teams recently competed at the highest level in the 9th Winter Paralympic Games in Torino, Italy (TOROC, 2005a).

When it comes to winter sports, researchers have traditionally focused on able bodied sports which are more established and well known disciplines and much literature exists on ice hockey, Alpine and Nordic skiing. The overall focus of these studies appears to be the optimization of performance as most will agree that this is the main goal in researching sports; to ensure that the competitors have the maximal advantage in technique, physiological variables and psychological techniques. While the research questions vary, the aim or goal of research into competitive sport is to enhance individual and team performance.

To this day there has been little research performed on sledge ice hockey and consequently the information is scarce on performance parameters, psychological variables or physiological comparisons. As there is still so much to be done it is necessary to examine the current availability of research to direct the most appropriate research questions in beginning to investigate sledge hockey. To date, the research on skills and hockey is focused on ice hockey for able bodied athletes and field hockey; however there is much we can learn from these sports as sledge ice hockey shares many characteristics (SLOC, 2001). Where it differs the most is in equipment. The sledge and sticks used in sledge ice hockey are unique to the game (Doyle, n. d.) The sticks allow the athlete to maneuver the sledge as well as to shoot and deal with the puck. In international competition the rules, which have been developed from standard hockey, are governed by the International Paralympic Committee. One major difference is the penalty for teeing, which does not exist in standard hockey (International Paralympic Committee, 2005).

For many years researchers have been investigating ways to maximize the parameters of performance. Much research exists on the psychological aspects of ice hockey. References exist for coaches and athletes, as many believe that improving mental skills is often an excellent way to improve on ice performance (Miller, 2003).

There are countless other tests and methods to investigate general sport performance depending on the

requirements of the sport, the availability of equipment, the desired results, and many more parameters. Field tests and laboratory tests exist for ice hockey; the 20 m shuttle run has been adapted for ice sports (Kuises, 2003) as a way to measure aerobic capacity in the most sport specific way and provide more detailed information on ice hockey performance.

While it can be noted that all components of performance are necessary to maximize individual performance, it is interesting to observe that at least half of the components mentioned in the relevant studies are skill related (Doroshuck & Marcotte, 1965; Hermiston, 1975; Merrifield & Walford, 1968) therefore making the assessment of skills imperative in any sport, including sledge ice hockey.

The weight of evidence seems to suggest that the research into ice hockey skills and their measurement is not altogether recent. However while the evidence base might not be there, there is a significant number of tools being used in clubs and teams all over the world to determine the skill level of ice hockey players. These observational tools are used for many purposes:

a. identifying strengths and weaknesses of players,
b. as a coaching tool to enable coaches to break down skills to better teach their athletes how to perform the given skill to the highest level,
c. in identifying talent,
d. to monitor performance.

Such an observation instrument currently exists for wheelchair basketball but not for sledge ice hockey. Zwakhoven, Evaggelinou, Daly and Vanlandewijck (2003) identified the need for an observation protocol for skill proficiency for similar reasons to those which have been identified for the use of such a tool in the sport of sledge ice hockey. The skills protocol developed by Vanlandewijck and colleagues included 7 skills with between 3 and 6 criteria each. The researchers selected the dribble, bounce stop, bounce spin, passing, catching, the shot and the lay up as the skills they would choose to describe. They used video observation and expert validation to create a useful instrument. This research set out to do the same thing for the sport of sledge ice hockey. This study aimed to develop an observation protocol of the skills used in sledge ice hockey and provide a detailed description of the criteria that constitute a mature skill level.

METHODS

Participants

The players involved in this study were sledge ice hockey players playing at the Paralympics in Torino, March 2006. There were 8 teams and a maximum of 15 players per team. Teams were from Great Britain, Canada, the United States of America, Japan, Norway, Sweden, Italy and Germany. Ages of the players ranged from 15 years old to 58 years old. Of the 40 players whose disability was recorded in the player profiles, over half (22 players) have an amputation, varying from a single leg below the knee amputation to bilateral hip amputations. Other disabilities that are listed include paraplegia, spina bifida, spondyloschisis and cerebral palsy (TOROC, 2005b).

Procedure

In order to be able to describe the most mature skill possible, it was necessary to collect data at the most elite level of competition. In the winter Paralympic games in Torino, March 2006, 8 teams competed in the sledge ice hockey tournament. The competition consisted of 2 pools who then participated in preliminary games. These preliminary games consisted of 12 games over a period of 3 days. All preliminary games were recorded on handheld video recorders (50 HZ) and individual players were filmed on and off for a total time of 10–20 minutes during the games they played. The players were followed regardless of the puck's position and as closely as possible while still ensuring that their figure remained fully visible on the screen at all times.

Formation of the checklist

This recordings data was combined with coaching manuals and IIHF regulations for standard hockey through which the major skills for sledge ice hockey were isolated. The video observations were watched to closely monitor movements and positions of players with respect to their sledges, the puck, and other players. All were designed to glean as much information as possible for each skill. Each skill was listed according to whether it was offensive or defensive and corresponding criteria were listed for each skill. As many criteria as possible were recorded.

Validation by experts and the creation of an observation protocol

This original criterion was sent out to a panel of experts including the coach of the United States sledge hockey team, a previous player with nearly 10 years experience in playing, administration and coaching sledge hockey and a manager from the Czech Republic national team. These experts were able to give feedback, change skill descriptions, change criteria or modify any of the skill descriptions or individual criteria. This information was then used to formulate the observation protocol. Additions were considered and then entered and the criteria were limited to 4 to 6 key points for each skill. This information was tabulated and justifications and observational directions were created for each skill to

aid observers when utilizing the document. A scoring system was also created depending on the number of observations recorded and successful performance of the given criterion.

Pilot evaluation of protocol

Once the observation protocol was finalized, 20 players were selected from the Torino Paralympic video recordings in order to analyse their performance using the protocol. This was done by first selecting the two top teams (Canada and Norway) and two bottom teams (Italy and Great Britain) from the Torino results and statistics. From each of these teams five players were selected based on the scoring leaders and plus minus leaders for the top teams and based on the lowest number of points for the two teams ranked in 7th and 8th position. These players were evaluated using the protocol to observe any differences. Players were scored firstly depending on whether they could be observed performing the criterion. If a player was not observed with regard to a particular criterion they scored a 0 for that point. If they could be observed once or twice with regard to a specific criteria then they received a score of 5 out of 10 for that point and if the player was observed with regard to a selected criterion three or more times then a score was calculated, depending on the ratio of successfully performed criteria to those which were, non-successfully, observed. For example, if a player is observed during pass receiving the first criteria is "immediate control of the puck". If the player was able to show this criterion 4 out of the 5 times they were observed for this, then they received a score of 4/5 or 8 out of 10. The scores for the criteria are tallied to give a score for each skill. The skills were then broken up into groups of similar skills giving 4 sub groups.

To calculate the scores for the sub groups each skill was given a ratio of how often it generally is used in a game, which was determined from the video observations. The scoring for the sub scores then would look as follows:

Sub score 1 = (0.7 * skating with the puck – total) + (0.3 * receiving checks total).

Sub score 2 = (0.5 * passing total) + (0.5 * pass receiving total).

Sub score 3 = (shooting total).

Sub score 4 = (0.8 * body checks total) + (0.2 * stick checks total).

Sum of sub score 1 + sub score 2 + sub score 3 + sub score 4 = TOTAL score.

Statistical analysis

In order to determine whether the group of more successful players could be distinguished from the group of less successful players based on skill observation, a Mann-Whitney U test was done to discover whether there were statistically significant differences between the sub scores and the total scores of the two groups (Canada + Norway as opposed to Italy + Great Britain). Spearman's correlation was performed to determine whether there was correlation between the sub scores to each other and also to the total score.

RESULTS

From the video recordings and ice hockey literature the checklist was created with 14 skills and key points for each. A full list of original key points can be gained from the author. Below is a list of the included skills.

Skills classification

Offensive skills

1. Skating with the puck dribbling.
2. Skating without the puck.
3. Receiving checks.
4. Deke.
5. Passing.
6. Pass receiving.
7. Shooting:
    - wrist shot,
    - slap shot,
    - flip shot.

Defensive skills

1. Checking without contact-angling.
2. Checking with contact:
    - body check,
    - stick check,
    - poke check.
3. Intercepting passes.

After input from the experts who made modifications to criteria and skills, the list was confined to 8 skills with between four and six criteria each. The skills were: skating with the puck, receiving checks, passing, pass receiving, shooting, checking without contact, body checking and stick checking. An example from the final observation protocol is in Fig. 1. A complete observation protocol can be obtained from the author.

After evaluation of 20 players, their sub scores for each skill and total scores were recorded. There was a large difference evident between the top teams in the tournament of Norway and Canada and the lower teams of Great Britain and Italy. The break down between sub scores can be seen in TABLE 1.

Fig. 1
Example of item from observation protocol (skating with the puck)

Control of puck with no loss of speed									
Puck stays within area of control									
Puck should be shielded from defensive players									
Control maintained while changing direction									
Head and eyes not fixed on puck									
Player uses both hands									

TABLE 1
Pilot evaluation results (descriptive information on sub scores)

Team	Sub score 1	Sub score 2	Sub score 3	Sub score 4	Total score
Canada	52.8	50	32	32	166.8
	38.5	50	0	36	124.5
	46.5	45	20	29.6	141.1
	52.2	50	20	22.4	144.6
	46.6	46.75	20	20	133.35
Norway	53.5	50	40	0	143.5
	48	38.75	15	0	101.75
	46.5	48.75	20	16	131.25
	49.25	43	0	20	112.25
	44.85	38.75	20	36	139.6
Great Britain	1.5	35	0	17.8	54.3
	4.5	10	20	11.6	46.1
	22.5	20	0	12	54.5
	7	27.5	0	16	50.5
	22.5	22.5	0	6	51
Italy	3.5	0	0	0	3.5
	1.5	0	0	0	1.5
	8	5	0	20	33
	0	20	0	8.64	28.64
	1.5	4.5	0	6	12

Statistical analysis showed statistically significant differences between the sub scores and the total scores of the successful teams compared to the non successful teams (TABLE 2).

TABLE 2
Differences between sub scores

	Sub 1	Sub 2	Sub 3	Sub 4	Total
Mann-Whitney U	.000	.000	14.500	21.500	.000
Wilcoxon W	55.000	55.000	69.500	76.500	55.000
Z	-3.788	-3.798	-2.985	-2.168	-3.780
Asymp. Sig. (2-tailed)	.000	.000	.003	.030	.000
Exact Sig. [2* (1-tailed Sig.)]	.000	.000	.005	.029	.000

Correlation also showed reasonable correlations between sub scores and total scores with the exception of sub score 4 (checking). While a significant correlation existed, it was considerably lower than the other sub scores (TABLE 3).

TABLE 3
Correlations of sub scores

		Sub1	Sub 2	Sub 3	Sub 4	Total
Sub1	Correlation coefficient	1.000	.827	.702	.354	.881
	Sig. (2-tailed)	.	.000	.001	.125	.000
	N	20	20	20	20	20
Sub 2	Correlation coefficient	.827	1.000	.645	.554	.929
	Sig. (2-tailed)	.000	.	.002	.011	.000
	N	20	20	20	20	20
Sub 3	Correlation coefficient	.702	.645	1.000	.247	.769
	Sig. (2-tailed)	.001	.002	.	.295	.000
	N	20	20	20	20	20
Sub 4	Correlation coefficient	.354	.554	.247	1.000	.600
	Sig. (2-tailed)	.125	.011	.295	.	.005
	N	20	20	20	20	20
Total	Correlation coefficient	.881	.929	.769	.600	1.000
	Sig. (2-tailed)	.000	.000	.000	.005	.
	N	20	20	20	20	20

** Correlation is significant at the .01 level (2-tailed)
* Correlation is significant at the .05 level (2-tailed)

DISCUSSION AND CONCLUSIONS

Skill level is an important and measurable characteristic of performance. As no instruments have previously existed for the observation of skills within the sport of sledge ice hockey there was a conclusive need for such a tool to be developed to further enable players and coaches to evaluate and assess skills and, through this, performance. This study aimed to first provide such a tool, including detailed description of the skills involved in sledge ice hockey and then to perform a pilot

evaluation of the instrument to begin to assess whether it would be useful in the future. The results show that:

- The protocol achieved its goal and showed significant differences in observable skills between players who were more successful in competition compared to those who were less successful.

Researchers have confirmed that much of an ice hockey game is spent waiting for the puck or skating without the puck (Lafontaine et al., n.d.) and this was also clearly evident in the observation of sledge ice hockey. The skill was left out after the validation of experts as it was felt that much like the checking without contact it is impossible to observe in this manner. If future research found a way to include it in an observation protocol it would be interesting as there can be arguments made that it is an essential skill that all players should master before playing at a high level, however it could be seen from the recordings made at the Torino Paralympics that some teams, especially the Italian team, had large amounts of trouble with this as a skill.

Researchers have found in the past that teams play as well as possible regardless of a game's importance in a series (Ferrall & Smith, 1999); however it was clearly seen in the recordings that Norway in particular, played differently when playing a team like Italy than a team like Canada. When opposing Italy, the Norwegian players recovered from checks more slowly, skated less aggressively and were less protective of their puck handling. Therefore it would be interesting in future to apply the observation protocol in different situations and compare the results. For the purposes of this study this phenomenon did not interfere with the results as the more successful teams still scored higher on the skills protocol, however it would be interesting to know whether the difference would have been more pronounced if there was more pressure or whether Norway performed more skills more successfully when playing more challenging games.

Further research should be performed to determine inter and intra tester reliability. Also it is recommended that future studies again closely look at the skills involved in sledge ice hockey and determine whether it is in some way useful or possible to include the skills of skating without the puck and checking without contact as these were determined to be important skills by this research, although the observation was found to be beyond the scope of the current project. Once the protocol has been refined, reliability tested and an extension of the pilot evaluation performed, this observational protocol could be of great use to coaches, trainers and athletes in sledge ice hockey.

A limitation of this study was the number of players that were used in the pilot evaluation. While there were obvious differences found when looking at 10 successful players and 10 less successful players it resulted in the use of non-parametric statistics. While it would have been useful to look at effect size and parametric results the number of participants could not justify using different statistics. Perhaps in future all of the players in the competition could be evaluated and some interesting trends or details that were unavailable in this study could be found.

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REFERENCES

Doroschuk, E., & Marcotte, G. (1965). *An agility test for screening ice hockey players*.

Doyle, M. (n.d.). Retrieved 17. 5. 2006 from the World Wide Web, SledHockey.net: http://www.sledhockey.net/index.html

Elferink-Gemser, M. T., Visscher, C., Lemmink, K., & Mulder, T. W. (2004). Relation between multidimensional performance characteristics and level of performance in talented youth field hockey players. *Journal of Sports Sciences, 22*, 1053–1063.

Ferrall, C., & Smith, A. A. (1999). Sequential game model of sports championship series: Theory and estimation. *The Review of Economics and Statistics, 81(4),* 704–719.

Hermiston (1975). Functional strength and skill development of young ice hockey players. *J. Sports. Med. Phys. Fitness., 15(3),* 252–256.

International Paralympic Committee (2005). *IPC Ice Hockey Rule Book*. Bonn: Germany.

Kuises, S. M. (2003). *Modification of the 20 meter shuttle run test (20 MST) for ice sports.* Unpublished dissertation, University of Pretoria, Faculty of Humanities, Pretoria.

Lafontaine, D., Lamontagne, M., & Lockwood, K. (n.d.). *Time motion analysis of ice hockey skills during games.* Unpublished research, University of Ottawa, Laboratory for research on the biomechanics of hockey, Ontario.

Lindstrom, H. (2002). The sledge hockey story. *The Paralympian online: Newsletter of the International*

Paralympic Committee. Retrieved from 10. 4. 2006 the World Wide Web: http://www.paralympic.org/paralympian/20021/2002108.htm.

Merrifield, H. H., & Walford, G. A. (1968). Battery of ice hockey skill tests. *The Research Quarterly*, *40(1),* 146–152.

Miller, S. L. (2003). *Hockey tough.* Champaign, IL: Human Kinetics.

SLOC (2001). *Salt Lake 2002 Paralympics: About this sport: Sledge ice hockey*. Retrieved 7. 4. 2006 from the World Wide Web: http://saltlake2002.paralympic.org/sports/ice_sledge/ish_ats/ish_history.html

TOROC (2005a). *Torino 2006 Paralympics: Sports and athletes: Sledge ice hockey.* Retrieved 7. 4. 2006 from the World Wide Web: http://www.paralympicgames.torino2006.org/ENG/ParalympicGames/sport_ed_atleti/hockey_su_ghiaccio.html

TOROC (2005b). *Torino 2006 Paralympics: Sports and athletes: Sledge ice hockey*. Retrieved 7. 4. 2006 from the World Wide Web: http://www.paralympicgames.torino2006.org/ ENG/IDFP/ATH/X01_IH_1.html

Zwakhoven, B., Evaggelinou, C., Daly, D., & Vanlandewijck, Y. (2003). An observation protocol for skill proficiency assessment in male wheelchair basketball. *European Bulletin of Adapted Physical Activity, 2(3).*

VÝVOJ PROTOKOLU O POZOROVÁNÍ DOVEDNOSTÍ PRO SLEDGE HOKEJ – PILOTNÍ STUDIE

(Souhrn anglického textu)

V průběhu několika posledních let vzrostly možnosti jedinců s tělesným postiženým zapojit se do fyzických činností. Z tohoto důvodu je uznáván význam zvládnutí sportovních dovedností ještě před samotnou účastí v soutěžích.

O stále oblíbenějším sledge hokeji bylo dosud provedeno málo výzkumů. Hlavní složkou výkonu je analýza dovedností. Vzhledem k její uznávané důležitosti a současnému nedostatku příslušných výzkumů na tomto poli jsme při této studii využili videozáznamů z paralympijského sledge hokejového turnaje z Turína v roce 2006, které nám poskytly možnost vytvořit protokol o pozorování s podrobnými kritérii toho, co utváří vyspělé profesionální sledge hokejové dovednosti. Proběhly konzultace s odborníky z tohoto odvětví a jejich zpětná vazba nám umožnila vytvořit tento nástroj. Po dokončení protokolu jsme provedli pilotní vyhodnocení, pro které byli hráči vybíráni na základě statistik z paralympijských her. Tito hráči byli poté pomocí našeho protokolu hodnoceni. Bylo prokázáno, že protokol dokáže úspěšně rozlišovat hráče vyšší a nižší úrovně.

Klíčová slova: tělesné postižení, paralympijské hry, Turín.

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2. Development of the observation protocol Several protocols have been previously developed to study diï¬€erent attributes that contribute to instructional eï¬€ectiveness. Our ï¬rst step in developing an Prateek Shekhar et al. observation protocol for student resistance was to examine existing classroom observation protocols for items or approaches that could be adopted or adapted to study student resistance. Characteristics of these protocols are summarized in Table 1. 2.1 Existing protocols The Reformed Teaching Observation Protocol (RTOP), developed by Sawada, Piburn, Judson, Turley, Falconer, B Once this protocol was complete a pilot evaluation was done in which players were selected on the basis of statistics from the Paralympics and then evaluated using the protocol. It was determined that the protocol could successfully differentiate between higher and lower level players. Keywords: Disability, Paralympic games, Torino. Prepublished online: February 3, 2009; Published: January 1, 2007Show citation.Â Beckman, E., KudlÃ¡Äek, M., & Vanlandewijck, Y. (2007). Development of a skills observation protocol for sledge ice hockey - pilot study. Acta Gymnica, 37(1), 45-50. Download citation. Development of a skills observation protocol for sledge ice hockey-pilot study. E Beckman, M KudlÃ¡Äek, Y Vanlandewijck. Acta Universitatis Palackianae Olomucensis.Â 12. 2007. Assessing muscle strength for the purpose of classification in Paralympic sport: A review and recommendations. EM Beckman, MJ Connick, SM Tweedy. Journal of science and medicine in sport 20 (4), 391-396, 2017. 10. 2017. Cluster analysis of novel isometric strength measures produces a valid and evidence-based classification structure for wheelchair track racing. MJ Connick, E Beckman, Y Vanlandewijck, LA Malone, S Blomqvist, Br J Sports Med 52 (17), 1123-1129, 2018.