The content and direction of the high-performance hockey players' technical training

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Abstract

Objective of the study was to describing a possible model of technical training for high-performance hockey players, namely, the structure, components, and principles of managing the training process.

Methods and structure of the study. To collect data on technical training of high-performance hockey players, the following methods were used: pedagogical observation, video and expert analysis of competition activities.

Results and conclusions. This study is based on video analysis of competition activities of high-performance hockey players. The focus of the analysis is put on the description of competition technical skills in terms of the complex conditions for performing the hockey competition exercise. The analysis of various aspects of competition skills in hockey is foregrounded as the key to managing the game performance. The study identified the most important components in the content and structure of technical readiness of high-performance hockey players and formulated the principles of improving hockey players' technical skills.

Keywords: *training of highly effective hockey players, pedagogical supervision, video and expert analysis*

Introduction. In hockey, the result is achieved by using sets of technical skills of the participants of the game. The skills constitute a system that is determined by the characteristics of team, group and individual tactics. Scoring a goal is one of the main tasks of hockey players on the ice. It is also important that the hockey line, which is on the ice, did not let a goal in their net. Solving these tasks requires the player to successfully perform combinations of various actions and techniques: various types of skating, stick and puck control, non-contact and contact checking (Figure 1) [1].

The volume and possible combinations of these actions are varied and determined by the characteristics of the opponent's game tactics and the conditions of the competition. Among other things, in hockey, the attack and defense actions are extremely different due to a variety of combinations of technical skills. These actions require the coordination of the interaction and coherence of the players.

Objective of the study was to describing a possible model of technical training for high-performance hockey players, namely, the structure, components, and principles of managing the training process.

Methods and structure of the study. To collect data on technical training of high-performance hockey players, the following methods were used: pedagogical observation, video and expert analysis of "competition activities" [2]. This study is based on video analysis of competition activities of high-performance hockey players. The focus of the analysis is put on the description of competition technical skills in terms of the complex conditions for performing the hockey competition exercise. The analysis of various aspects of competition skills in hockey is foregrounded as the key to managing the game performance. The study identified the most important components in the content and structure of technical readiness of high-performance hockey players and formulated the principles of improving hockey players' technical skills.

Results of the study and discussion. Experts have always been interested in the effect of hockey technical skills on the game performance and the use of specialized exercises to improve the characteristics of technical skills [3, 4, 5].

There is a consensus in the professional hockey that one of the most important skills for this sport is skating. Skating is considered as the core of the hock-

ey player's technical behavior, and an individual profile of the player's technical skills largely determines his style of play. In the professional community, there is an informal classification of hockey players: "the one who skates", "the one who thinks", "the one who skates and thinks". It might appear partially true, but undoubtedly the technical readiness of a high-performance hockey player is a much more complex property.

The skating techniques in hockey are the object of many studies [6, 7, 8] which focus on "biomechanical characteristics of skating", "the optimal range of variation in hockey technical training", "the development of advanced technical training model in hockey", "the relationship between technical skills and high performance in ice hockey", "the science and art of technical assessment and testing in ice hockey", "biomechanics of skating power", "the ways of skating faster and avoiding injury", "the relationship between ice hockey-specific complex test and aerobic capacity" [6, 7, 8]. In our view, one of the explanations for the increased interest of experts in studying different aspects of technical skills is the advances in methods for skating evaluation and thus a good measurability of skating.

The list of measured characteristics of skating is extensive: speed, power, acceleration. The listed features make skating skills a convenient tool for the coaches, managers, and scouts to consider the player's skating ability as a significant factor when selecting a player for a team. To illustrate this statement, examples are taken from the reports of professional scouts[1]: (1) "he is an offensive defenseman, who possesses an outstanding change of gear that he can display when given some open ice in the neutral zone"; (2) "he is an acute offensive impact, he moves the puck quickly, supports the play well, makes body fakes and quick cuts to force defenders to move their feet and open the space"; (3) "he gets to his top speed easily and quickly and has a knack for creating separation between himself and defenders".

Understanding the fundamentals of improving game performance for high-performance hockey players is important to coaches. Performance-based game characteristics are important for building a special physical training on and off the ice. These fundamentals embrace biomechanical, functional and technical aspects. Relying on these fundamentals has positive implications for the development of both technical skills research programs and practical methods of increasing the performance of skating. In the research of Bracko M.R. et al, National Hockey League (NHL) forwards are analyzed to investigate the time and frequency of 27 skating characteristics during a game (see table 1) [9].

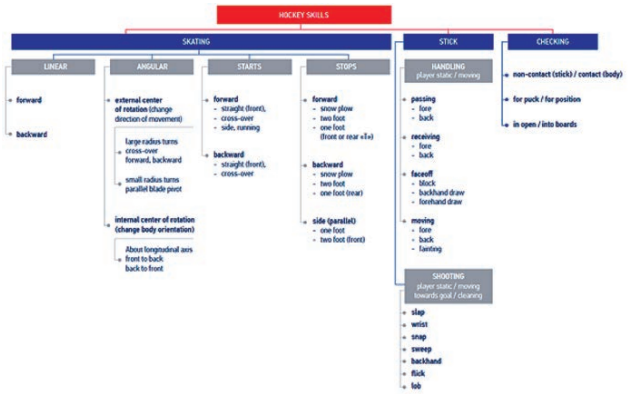

Figure 1. Structure of the hockey technique (cit. Pearsall et al 2000)

As a result of the study Bracko et al proved that (1) game-performance skating of high-performance hockey forwards is characterized by two-foot gliding, striding characteristics (low-, medium-, and high-intensity skating); (2) fast skaters have wide strides, quick recovery after push-off, deep knee flexion prior to push-off, and significant forward lean; (3) a wide stride (using hip abduction) with quick recovery is characteristic of a fast skater; (4) shoulders abduct and adduct in a smooth movement pattern coordinated with the abduction and adduction of the hips; (5) skill coaches and instructors should emulate, as much as possible, the game-performance skating [9].

The study of Bracko et al [9] offers original ideas and methodology, providing justification for the application of the most informative characteristics of the game-performance skating. However, we believe that the results obtained can be substantially supplemented, which will have a positive impact on the development of existing technical training methods of the high-performance hockey players (Figure 2).

First, it will be useful to study the characteristics of the skating skills of defenders. The concept of Bracko et al [9] which compares technical characteristics of "fast" and "slow" high-performance hockey players can be modified and extended. An advanced modification of this concept could be the creation of a scale classifying the hockey players' technical characteristics levels according to various game specializations (a left wing, a right wing, a center forward, etc.). Such a quality-and-quantity scale gives many opportunities for a coach to manage technical training [10].

Second, it is necessary to automate the methods of collecting data on technical characteristics of players' skating in real time. This task can be successfully solved by using artificial intelligence systems to recognize and evaluate movements and technical skills of high-performance hockey players. Of course, such research has begun, there are enough corresponding technologies [11,]. However, it must be recognized

1 https://www.eliteprospects.com

Table 1. Timed skating characteristics of (NHL) forwards (cit. Bracko et al 1998)

Skating characteristic	% Of total time on ice
Two-foot glide	39
Cruise slide	16,2
Medium intensity skating	10
Struggle for puck or position	9,8
Low-intensity skating	7,8
Backward skating	4,9
High-intensity skating	4,6
Two-foot stationary	3
Two-foot glide with puck	1,4
Medium-intensity skating with puck	0,8
Cruise stride with puck	0,6
Struggle with puck	0,6
Low intensity skating with puck	0,5
High intensity skating with puck	0,4
Two-foot stationary with puck	0,4

that the results of the studies are not sufficient enough yet to solve the problem. Nowadays, the hockey research is more focused on the study of high-performance hockey players' tactics. Meanwhile, the studies of technical skills have great potential and prospects because they can contribute to making dynamic models of players' technical readiness that consider many factors of internal and external conditions. To such external conditions such factors can be attributed as the sports form of the opponent team, games at home and on the road, the championship schedule, etc.

Third, the study should be extended to the long-term development of technical hockey skills. This assumes the period for young hockey players from 8 to 17 years of age. This is probably the most difficult study because it will require a long time to analyze hockey players from different realms. It will require complex mathematical calculations and computing power capable of storing and processing large amounts of data.

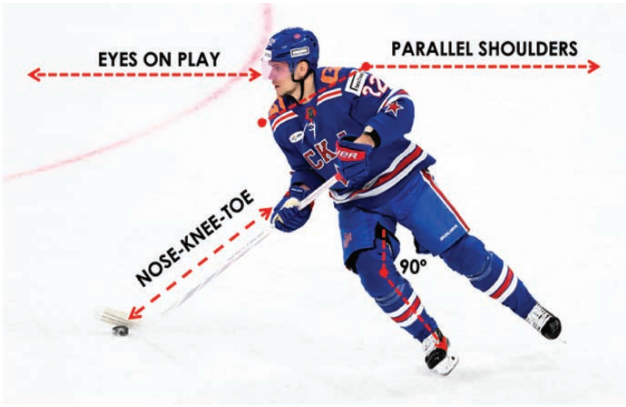

Figure 2. Biomechanical constants of high-performance hockey player technique

All items listed will allow accumulating enough information to study the relationship between skating and other technical skills, for example stick handling and checking. This approach allows to study ice hockey mechanics as a complex holistic phenomenon. Such holistic description can contribute to determining the predictors of high hockey performance. The specific subject of such research should be the study of the technical skills of a goalkeeper. On the other hand, studies that focus on the separate components of different technical skills are also important. It is also necessary to consider research works whose purpose is to describe the specifics of technical behavior not only in competitions, but also in the training process.

To scrutinize the content and direction of high-performance hockey players' technical training, we distinguish between three phases of training aimed at improving the technical skills: (1) special physical training on ice; (2) specialized technical training; (3) specialized stress skating.

The first phase includes training in the following key areas: (a) special physical training on ice with extensive methods; (b) improvement of elementary forms of coordination skills in exercise on ice; (c) proprioception and sensory control; (d) edge control in achieving stability of difficult dynamic poses. The recommended duration of this phase is 10-14 days. The duration depends on the level of players' readiness and their experience. This first phase should occupy the beginning of the preparatory period or the breaks in the competition period. Also, the first phase can be reduced to 5-7 days in the competition period. The first phase training should be organized by means of individual sessions on ice.

In the second phase the focus is on hockey specialization exercises. This part of training involves role-sharing: (a) working on hockey pattern movements; (b) accurate, effective and situational use of the hockey stick; (c) core control; (d) synchronous upper and lower body movement modes; (e) asynchronous upper and lower body movement modes. The second phase is 3 to 7 days in the preparatory period. It is also recommended to use training blocks of 1-2 days in the competition period. It is recommended to use specialized exercises in the underside or final part of practice, separately for defenders and forwards.

In the third phase the training focus is put on: (a) speed skating with puck control techniques (with obstacle or pressure); (b) enhancing puck control; (c) implementation of "standards" in different environments; (d) inclusion of situational non-standard elements in standard exercises. The exercises for the third phase are usually scheduled to 10-14 days be-

fore the competition. Such training should take place before pre-season tournaments, the first round of the championship or play-off (second round).

Our field research was based on video analysis as well as a comprehensive evaluation of the technical skills of high-performance hockey players (n=35, the players the SKA system hockey clubs). Expert evaluation methods were used at this stage. Automatic data collection was not fully implemented at this point. The software module was implemented to recognize and evaluate the skills of skating. The study was focused on developing criteria for the accurate description of skating. Successful solution of this problem allowed to move on to the recognition of individual properties of technical behavior. After solving these problems, the development of software for assessment of skating skills based on video fragments was planned. The limitation of the study is that it was conducted only during the preparatory period and during the intermission of the championship. During the study we developed principles of improvement of technical skills for high-performance hockey players which may be outlined in the following way.

(1) The regulation principle states that decisions on planning the training impact (workloads) should be based on the premise that during the high-intensity specialized training various motor qualities of players can enter into negative relationships, which can reduce the effectiveness of technical training.

(2) The synergy principle states that during high-intensity specialized training positive effects of a general nature can be observed, which can further improve individual technical components.

(3) The principle of taking into account spatial and temporal factors states that adaptation requires repetition of training effects with a given frequency, which allows to create an internal model presenting the main dynamic and static objects of the game.

C**onclusions.** Our study foregrounds the need to develop two approaches, one holistic and one non-holistic in the description of hockey technical behavior. Currently, the analytical approach is predominant, with selected technical parameters being studied. It should also be noted that hockey is in constant development, and therefore the technical side of the game is enhanced through new techniques that are to be taken into account when studying game performance.

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