INDIVIDUALIZATION IN IMPROVING WRIST SHOT TECHNIQUE AND ACCURACY FOR HOCKEY PLAYERS AGED 12–13

Agita Ābele[1], Edgars Kulda[1], Tatiana Yordanova[2]
[1]Riga Stradiņš University, Riga, Latvia
[2]National Sports Academy Vassil Levski, Sofia, Bulgaria

ORCID
Agita Ābele
https://orcid.org/0000-0002-7916-8150
Tatiana Yordanova
https://orcid.org/0000-0002-7750-5774

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ABSTRACT
Ice hockey is a dynamic and intense team sport where success relies on technical, physical, tactical, and psychological preparation. This study explores the importance of individualized training in improving wrist shot technique and accuracy among young ice hockey players aged 12–13. The aim was to enhance wrist shot effectiveness through a specialized and personalized set of exercises.
Ages 12 to 13 represent a critical stage in a young athlete's development, marked by significant physical, cognitive, and emotional growth. At this stage, children develop strength, coordination, and reaction speed - skills that are foundational to future athletic progress. It is also an optimal period for learning complex technical and tactical elements while fostering emotional and social intelligence.
Individualization during this developmental phase is particularly important, as players' abilities and potential vary greatly. Personalized training methods, which include specialized exercises and regular feedback, allow coaches to identify each athlete's strengths and areas for improvement, ensuring steady progress and sustained motivation.
The study involved 20 players from the Grīziņkalns Hockey School, who participated in a one-month training program that combined dryland drills, enhanced with modern equipment such as BOSU balls, weighted pucks, and resistance tools, with on-ice practices. Wrist shot accuracy was evaluated before and after training through a designated target-based marking system. The findings support the hypothesis that individualized training can boost wrist shot accuracy.

Keywords: *ice hockey, wrist shot, technique, accuracy, individualization*

INTRODUCTION

Ice hockey is a dynamic and intense team sport that demands a high level of technical, physical, tactical, and psychological preparation. From the very beginning of a player's career, it is essential to teach children the correct techniques. Coaches working with children and adolescents must consider all aspects of player development – including child psychology, individual characteristics, and an appropriate training methodology with suitable exercises. According to Miller (2001), it is the coach who has the greatest potential to influence a young athlete's sports development.

The wrist shot is the most used shot in hockey. It is a quick and accurate motion where the player propels the puck toward the goal using wrist movement rather than a full backswing. This allows for rapid execution, giving defenders little time to block and goalies minimal time to react (Vasiljev, 2023). The shot's velocity is primarily achieved through multidirectional body movement and explosive wrist rotation at the final moment of effort (Panov & Berestnev, 2023).

There is a need to improve wrist shot technique among adolescent hockey players in order to enhance their potential for success in a professional sports career.

A clear correlation exists between a player's shot technique and their overall skill level and ability to score goals successfully. Increasingly, Latvian hockey players transitioning from youth or junior levels to professional play face significant challenges in shot execution. These difficulties are often rooted in a lack of emphasis on proper shooting technique during early training stages.

To address this issue, a targeted set of exercises will be proposed to improve wrist shot technique. These exercises can be individualized based on the specific needs of each player or group, taking into account factors such as body proportions, current shooting ability, and dominant hand. The training set will include modern equipment such as BOSU

balls, weighted pucks, and resistance tools, which are intended to enhance both precision and power in wrist shots.

METHODOLOGY

This study aims to develop a set of exercises and drills designed to improve wrist shot technique and scoring efficiency among young hockey players, incorporating an individualized approach based on anthropometric evaluation, and to assess the impact of implementing this training set.

Significance of the study

Enhancing wrist shot technique and scoring performance will provide young hockey players with greater opportunities to succeed and express their full potential in the sport.

Research tasks

1. To analyze academic and specialized literature on wrist shot technique and shooting exercises in youth hockey, with a focus on individualized approaches to athlete development;
2. To assess the anthropometric parameters and wrist shot performance of young hockey players;
3. To design and test an individualized set of exercises and drills aimed at improving wrist shot technique;
4. To evaluate the dynamics of wrist shot scoring performance among young players after implementing the developed exercise program.

The following research methods have been used:

- To establish the theoretical foundation of this study, an extensive review and analysis of academic and specialized literature was conducted.
- Semi-Structured Observation.
- Sports-pedagogical testing.
- Observational Study is used to monitor the progress and preparedness dynamics of specific athlete groups or teams over time (Grants, Gravītis, 2024).
- Math statistical methods – Descriptive statistics and Comparison of Student's t-criterion.

Participants and design of the study

The study was conducted from April 30 to May 31 and involved one group of 20 hockey players aged 11 to 14, with heights ranging from 145 cm to 180 cm and weights from 37 kg to 85 kg. The group included 16 left-handed and 4 right-handed shooters. Each participant's wrist shot technique, speed, and accuracy were assessed.

The first control exercise session was held on April 30. A specialized device was used to measure the speed and accuracy of the shots. Accuracy was assessed using the "Hockey Revolution" app, which randomly selected target zones in the goal; players were required to hit five randomly chosen targets.

The study involved 20 players from the Grīziņkalns Hockey School who participated in a one-month training program from May 1 to May 30, combining dryland drills - enhanced with modern equipment - and on-ice practices. The players trained 2–3 times per week using a specifically developed set of exercises aimed at improving wrist shot technique.

The second control exercise session took place on May 31, using the same format to ensure data comparability.

RESULTS

The wrist shot accuracy test revealed participants' performance across five different target zones (see Table 1). The most accurate shots were directed at the upper left corner, upper right corner, and center, each resulting in 6 successful hits. This suggests that these areas are more intuitive and accessible for players, possibly due to better visual targeting or stronger execution confidence.

Table 1. *Wrist Shot Accuracy (Before Training Program)*

1	A1	13	159	44	L	X	V	X	X	V
2	B1	12	169	66	L	X	X	V	X	V
3	G1	11	145	38	R	V	X	V	X	X
4	I1	12	160	58	L	X	X	X	V	X
5	J1	13	163	44	L	V	V	X	X	X
6	K1	12	160	64	L	X	X	V	V	X
7	K2	11	148	37	L	V	X	V	X	V
8	K3	13	153	40	L	X	V	X	X	X
9	K4	14	170	62	R	X	X	X	X	X
10	L1	13	160	50	L	X	V	X	X	X
11	M1	12	150	40	L	X	X	X	X	X
12	M2	13	165	55	R	V	X	X	X	X
13	O1	13	153	43	L	X	X	X	V	V

Nr.	Player	Age	Height (cm)	Weight (kg)	Grip (right/left)	Shot 1	Shot 2	Shot 3	Shot 4	Shot 5
14	O2	13	157	46	L	V	X	X	X	X
15	S1	13	175	70	L	X	V	X	X	V
16	S2	13	180	60	L	X	X	X	X	X
17	S3	13	159	47	L	X	X	X	X	X
18	Š1	13	165	47	L	X	X	X	X	X
19	Z1	12	164	70	R	X	V	X	X	X
20	D1	13	178	85	L	V	X	X	X	V

Notes:
Shot 1: Upper left corner
Shot 2: Upper right corner
Shot 3: Lower left corner
Shot 4: Lower right corner
Shot 5: Lower center

V: Hit
X: Miss

In contrast, accuracy toward the lower zones – particularly the lower right corner – was noticeably lower, with only three successful hits recorded in the lower right and four in the lower left. These findings indicate greater difficulty when aiming in these directions.

An analysis of grip type and its impact on accuracy showed that players with a left-handed grip made 21 successful shots out of 80 attempts, resulting in an accuracy rate of approximately 26%. Considering that this group included 16 players, the result can be considered relatively strong.

In comparison, players with a right-handed grip scored 4 hits out of 20 attempts, corresponding to a 20% accuracy rate. Although slightly lower, this result should be interpreted cautiously due to the small sample size of only four players, which limits the potential for a meaningful comparison.

In total, the group completed 100 shots, of which 25 were successful, yielding an overall accuracy rate of 25%. Among individual participants, K2 achieved the highest result, hitting the target 3 times out of 5 attempts, making it the best individual performance.

Content and Implementation of the Individualized Exercise Program

The individualized exercise program was developed to effectively enhance players' skills, with a specific focus on wrist shot accuracy, power, and technique. As one of the most essential skills in hockey, the wrist shot requires not only advanced technical proficiency but also quick reaction time, coordination, and the ability to apply force efficiently. To achieve these goals, the training program includes a total of 17 exercises – 8 for the warm-up phase and 9 for the main training phase – all conducted in a gym setting. On-ice practice, which usually followed dryland training, consisted of regular hockey sessions appropriate for 12–13-year-olds, providing players with the opportunity to apply and practice their wrist shot in game-like or drill-based situations on real ice.

Training sessions take place on a specially designed synthetic surface that simulates ice, utilizing modern training equipment such as BOSU balls, weighted pucks, stickhandling obstacles, and other tools. The warm-up phase primarily focuses on improving puck control and stickhandling skills, which are essential for mastering a high-quality wrist shot.

The main training phase includes a variety of exercises aimed at developing players' shooting technique, precision, and power through both static and dynamic drills. The program's design ensures that exercises can be tailored to each athlete's individual needs, allowing for the development of effective, personalized progress in wrist shot performance.

Puck Control Exercises

Players take a puck and repeat the coach's instructed tasks:

- Figure eight – the player controls the puck in a figure-eight pattern.
- Pulling the puck under the body from both sides – the player pulls the puck under themselves, alternating between the right and left side.
- Pulling the puck under the body with the non-dominant hand – the player focuses on pulling the puck using only their non-dominant hand.
- Figure eight through the legs – the player stickhandles the puck in a figure-eight motion between their legs.
- Extended reach dribble in place – standing still, the player holds the stick with both hands and reaches for the puck to one side, then uses one

hand to move the puck to the opposite side.
- Quick curved dribbling – the player quickly changes the direction of puck movement in a curved pattern.
- Dribbling while looking up – players control the puck while keeping their head up and eyes off the puck.
- Speed dribble – players move the puck quickly in a straight line.

Wrist Shot Exercises

Players take pucks, divide into groups at four goal stations, and perform the tasks assigned by the coach.
- Target shooting – the player performs wrist shots, aiming at specific targets.
- Wrist shot from a stationary position with puck pull under the body around a stick cone – the player stands still and practices a quick wrist shot around an obstacle from a fixed stance.
- Wrist shot from standing position (arms only) – the player executes wrist shots from a static position, focusing on arm movement.
- Pass and wrist shot – the player receives a pass from a partner and immediately performs a wrist shot.
- Wrist shot with weight shift – the player shifts body weight from one leg to the other while executing the shot.
- Wrist shot with one leg placed on a bench – the player places one foot on a bench, keeps the other on the ground, and performs a wrist shot.
- Wrist shot with one foot on a BOSU balance platform – the player places one foot on a BOSU ball, the other on the ground, and performs a wrist shot.
- Shooting with heavy pucks – players perform wrist shots at the target using heavy pucks (typically twice the weight of a standard puck).
- "Variable Power" – the player performs 5 wrist shots using heavy pucks, followed immediately by 5 shots using standard pucks to develop the transition between strength and speed.

Evaluation of the dynamics of wrist shot performance in hockey players after the implementation of the developed exercise program

Table 2. *Wrist shot accuracy (after the exercise program)*

Nr.	Player	Age	Height (cm)	Weight (kg)	Grip (right/ left)	Shot 1	Shot 2	Shot 3	Shot 4	Shot 5
1	A1	13	159	44	L	X	X	X	V	X
2	B1	12	169	66	L	V	X	X	X	X
3	G1	11	145	38	R	X	V	X	V	X
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8	K3	13	153	40	L	V	V	V	X	V
9	K4	14	170	62	R	X	V	X	X	V
10	L1	13	160	50	L	X	V	V	V	V
11	M1	12	150	40	L	X	V	X	X	X
12	M2	13	165	55	R	X	X	V	X	V
13	O1	13	153	43	L	V	V	X	V	V
14	O2	13	157	46	L	X	X	X	X	X
15	S1	13	175	70	L	X	V	V	V	X
16	S2	13	180	60	L	V	X	V	V	V
17	S3	13	159	47	L	V	X	X	X	X
18	Š1	13	165	47	L	X	V	X	X	X
19	Z1	12	164	70	R	X	X	V	X	X
20	D1	13	178	85	L	V	V	V	X	V

Notes:
Shot 1: Upper left corner
Shot 2: Upper right corner
Shot 3: Lower left corner
Shot 4: Lower right corner
Shot 5: Lower center

V: Hit
X: Miss

Before the exercise program, the overall wrist shot accuracy was 25% (25 successful shots out of 100 attempts). After completing the program, the total accuracy increased to 44% (44 successful shots out of

100 attempts), indicating a significant improvement. The distribution of successful shots across target zones was as follows:

- Upper left corner – 9 hits
- Upper right corner – 11 hits
- Lower left corner – 8 hits
- Lower right corner – 8 hits
- Lower center – 9 hits

These results show a notable improvement in the lower zones, which were initially the most problematic areas (see Table 2). Left-handed players made 21 successful shots out of 80 attempts in the first test. After the training program, their result improved to 37 successful shots, showing considerable progress. Right-handed players also improved. In the initial test, they made only 4 accurate shots out of 20 (20% accuracy). After the program, this increased to 7 out of 20 (45%). Although the percentage increase is significant, right-handed players still performed below the level of left-handed players overall.

The best individual results were achieved by players J1, K3, L1, O1, S2, and D1, who each reached an impressive 80% accuracy (4 successful shots out of 5).

Based on the analysis of the wrist shot accuracy test results, it can be concluded that the training program had a positive impact on more than half of the players. Out of 20 participants, 11 players improved their results, accounting for 55% of the group. Meanwhile, six players (30%) showed no change, and three players (15%) experienced a decrease in accuracy.

Dynamics of Changes in Wrist Shot Performance Among Hockey Players (Mathematical Statistics)

To evaluate the effectiveness of the exercise program, the wrist shot accuracy of hockey players was analyzed before and after the intervention (see Table 3). Accuracy rates were calculated by recording the number of hits and misses during each shooting series. The results were used to compute the arithmetic mean, standard deviation, and coefficient of variation, and to perform statistical testing using the paired sample t-test.

The arithmetic mean, which reflects the group's overall accuracy, increased from 25% before the training program to 44% afterward. This rise indicates a general improvement in performance. However, the standard deviation increased from 0.44 to 0.50, suggesting greater dispersion in the post-training results. This means that individual player performance varied more after completing the program.

The coefficient of variation, which measures relative dispersion, decreased from 174.08% before training to 113.38% afterward. This reduction indicates increased consistency in the group's performance results following the training.

To determine whether the observed change in accuracy was statistically significant, a paired sample t-test was conducted. This test evaluates whether the difference in mean values between two related measurements (before and after the intervention) is due to random chance or is statistically significant. The t-statistic obtained was −2.75, and the calculated p-value was 0.007, which is below the conventional significance level of 0.05.

However, given the high variability within the group and the absence of additional distribution parameters (e.g., skewness and kurtosis), these results should be interpreted with caution. While the analysis indicates a positive trend in wrist shot accuracy, the data do not fully justify claiming that the differences are statistically reliable.

Table 3. *Wrist shot accuracy (mathematical statistics)*

Exercise phase	*Mean*	*SD*	Coefficient of variation %
Before	25%	0.44	174.08
After	44%	0.50	113.38

DISCUSSION

Technical skill development in ice hockey has long been recognized as a cornerstone of player performance and long-term athletic success. This study aimed to enhance wrist shot effectiveness among 12–to 13-year-old hockey players through the use of a specialized and personalized exercise program. The age of 12 to 13 is a critical stage in the development of young hockey players, as this period is marked by significant physical, cognitive, and emotional growth. At this stage, children develop strength, coordination, and reaction speed, all of which are fundamental for future athletic progress. Additionally, this age is suitable for learning more complex technical and tactical skills while fostering emotional and social intelligence.

Individualization at this stage of development is especially important, as players' abilities and potential vary widely. Personalized training methods, which include targeted exercises and regular feedback, enable coaches to identify each athlete's strengths and weaknesses, ensuring steady progress and sustained motivation (Kozina et al., 2015). As Solomatin (2011) points out, sports motivation is a combination of factors that influence an athlete's performance and drive, with a particular emphasis on a positive atti-

tude toward physical effort. Depending on temperament type (choleric, sanguine, phlegmatic, or melancholic), athletes may differ in their adaptability and psychological responses. Thus, both psychological and physiological aspects are essential elements in each athlete's development process.

The study data revealed a positive trend in wrist shot accuracy following the implementation of the specialized training program, with participants' accuracy rising from 25% to 44%. These findings are consistent with previous research (Novak et al., 2022; Bezaks & Pridals, 2017), which demonstrates that individualized training methods, including the use of variable loads and specialized equipment, can enhance both shooting accuracy and power.

However, the relatively small sample size, short duration of the intervention, and the absence of additional statistical parameters (e.g., skewness, kurtosis) limit the strength of the statistical conclusions. While the data point toward a positive trend, the variability among participants prevents the observed improvements from being interpreted as statistically reliable. Future research involving larger samples and longer training periods is needed to validate these preliminary findings and assess the long-term effects of personalized training interventions.

CONCLUSIONS

The review of academic and specialized sources confirmed that proper wrist shot technique is a key factor in hockey performance and that individualized training methods are widely recommended for developing technical skills in young athletes.

The assessment of anthropometric data showed substantial variation in height, weight, and age (11–14 years), which contributed to the high variability in wrist shot accuracy across participants.

An individualized exercise program combining gym-based and on-ice drills was successfully designed and implemented for players aged 12–13. Its effectiveness was evaluated using pre- and post-intervention testing to measure changes in wrist shot accuracy.

After one month of training, the mean wrist shot accuracy improved from 25% to 44%, indicating a positive trend. However, due to the small sample size, short duration, and lack of additional statistical parameters (e.g., skewness, kurtosis), these results cannot be interpreted as statistically reliable.

Overall, the study demonstrates that individualized training can improve wrist shot accuracy in young hockey players, but further research with larger samples, longer interventions, and more robust statistical analysis is required to confirm the effectiveness and long-term impact of such programs.

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Corresponding author:
Agita Ābele, DSc
Riga Stradins University/LASE,
Dzirciema street 16,
Riga, Latvia,
E-mail: agita.abele@rsu.lv

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