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Training with a heavy puck elicits a higher increase of shooting speed than unloaded training in midget ice hockey players

Head Title: Heavy Puck Midget Shooting

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Abstract

A method of load variability is a common way of developing specific skills in various sports, however, not explored considering the use of different ice-hockey pucks. Therefore, the purpose of this study was to compare shooting speed, shooting accuracy, and handgrip strength changes after training with variable training loads (lighter 60 g pucks and heavier 260 g pucks) in the wrist shot and snapshot. Sixteen male ice hockey players (13.62 ± 0.35 y; 167.67 ± 7.71 cm; 53.87 ± 7.55 kg) were subjected to a 12 week experiment during which they trained six weeks with a light puck and six weeks with a heavy puck and were tested for shooting speed, shooting accuracy and handgrip strength. The variable load training increased shooting speed (the long hand snapshot by 7.4%, the shorthand snapshot by 8.5%, and the wrist shot by 13%), shooting accuracy (by 14%), and handgrip strength (by 8.7%) of the bottom hand; all at $p < 0.001$. Training with heavy pucks was more effective ($d = 0.50 – 0.86$) than training with lighter pucks ($d = 23-25$) for increasing puck speed. Shooting accuracy was increased by variable load training with a similar effect of heavy and light puck training. The variable training load had a positive effect on shooting speed and accuracy and the use of a heavier load was more effective than using the unloaded puck. Variable load shooting training in youth ice-hockey players is more effective with heavier pucks than lighter ones, and the improvements are greater in players with better shooting skills.

Keywords: variable load, motor learning, heavy-weight puck, light-weight puck, contrast training.

Introduction

A method of load variability is a common way of developing specific skills in various sports (Cormier et al., 2021; Derenne et al., 2001), developing speed and strength, and reducing the risk of injuries (DeRenne and Szymanski, 2009). Well-known is the relationship between relieving the load in basketball to allow better shot technique (Regimbal, 1992) and positive effect on dribbling and passing skills (Arias et al., 2012). Another example is the use of light- and heavy-weighted baseball for increases in throwing and hitting velocities (DeRenne and Szymanski, 2009), where the possible mechanism is the modification of the recruitment pattern of motor units in the central nervous system (DeRenne and Szymanski, 2009). Therefore, the same effect can be expected in ice hockey, where using variable puck weight might influence puck velocity during the slap shot (Gilenstam et al., 2009). The use of light-weighted pucks is typical in teaching less-skilled ice hockey players basic technical skills (Nimmins et al., 2019). However, there is a lack of research regarding the effectiveness of long-term training programs with light-weight and heavy-weight pucks.

Shooting is a main ice hockey skill along with skating and checking and is directly related to the match results (Pearsall et al., 2000). In order to take effective shots in ice hockey, players must maximize shooting speed and accuracy (Robbins et al., 2020). However, shooting depends on several factors such as stick properties (stick construction, stiffness), player characteristics (skill level, body mass and muscular strength), ice surface conditions, blade-puck contact time, shooting technique, and body size (Bežák and Přidal, 2017; Jakobsen, 2021; Kays and Smith, 2014; Robbins et al., 2020; Wu et al., 2003). There are seven basic types of shots: slap shots, wrist shots, snapshots, sweep shots, backhand shots, flick shots, and lobs (Pearsall et al., 2000). Wrist shots and snapshots (which can be divided into long and short types of swing) are two the most common shot types (Robbins et al., 2020) since they are effective for quick execution by a short swing movement. They are used in 23-37% of all shots taken in all positions, but the speed of the puck is lower than in the slap shot (Jakobsen, 2021; Kays and Smith, 2014; Michaud-Paquette et al., 2009, 2011). In the slap shot, the stick is initially raised and swung forward with maximum effort to impact the puck up to 100 km/h, where the current fastest snapshot is recorded at 180 km/h, but the accuracy is not as high as with wrist shots (Wu et al., 2003). Thus, evaluating the wrist shot and the snapshot is necessary to assure the players shooting skills.

Shooting in ice hockey is not a fundamental motor skill (Novak et al., 2020), therefore, it requires long term learning and systematic practice (Logan et al., 2012) to automatize this skill (Novak et al., 2020). The demands for the automation of these skills are very high for youth players (around 12 and 13 years of age) because they have to distribute their motor control between skating, controlling the puck with passes, and shooting in one moment (Clark and Metcalfe, 2002; Novak et al., 2020). This general requirement for motor control may lead to the presumption that shooting techniques should also be practiced in a variety of conditions such as different puck weights. Since regular puck weight is 156-170 g (Nimmins et al., 2019), it is appropriate to alternate the load up to 100% of the regular weight (e.g. 260 g) (DeRenne and Szymanski, 2009) or to use unloaded conditions (Montoya and Brown, 2009). The load selection may also be related to the player's grip strength which correlates with the wrist shot (Wu et al., 2003), however, these constraints might (or might not) also be reduced by the stiffness of the hockey stick (Kays and Smith, 2014; Michaud-Paquette et al., 2009; Worobets et al., 2006).

Currently, there is a lack of research which considers the relationship between different weights of the puck with puck speed in various types of shots, the accuracy of shooting, and grip strength. Therefore, the purpose of this study was to compare shooting speed, shooting accuracy, and handgrip strength changes after training with variable training loads (lighter and heavier pucks) in the slap shot, wrist shot, and snapshot. We hypothesized that the heavy-weight puck training program followed by the lighter-weight program would result in a higher increase in the speed of shooting compared to the reverse order of training.

Methods

This intervention study was performed following a cross-over design, where participants were split into two groups. Group 1 started training by a six week block with a heavy puck followed by 6 weeks of training with a light puck, while the second group (Group 2) trained in the reversed order. Three testing sessions were performed during the whole experiment, where initial testing was done before the whole training intervention (pre-test), one testing session was conducted after six weeks of training when the groups cross-changed the weighted conditions of the protocol (post-test 1), and after cessation of the whole training program (post-test 2). All three testing sessions (pre-test, post-test 1, and post-test 2) were performed in one day, consisting of measuring the speed of the shot in three styles of forehand shooting (short-hand snap-shoot, long-hand snap-shoot, and wrist-shoot), shooting accuracy, and handgrip strength. The experiment was conducted during the competitive season with a two week wash-out period between the blocks with light (90 g) and heavy pucks (260 g).

Participants

Sixteen male ice hockey players (n = 16; 13.62 ± 0.35 years; body height 167.67 ± 7.71 cm; body mass 53.87 ± 7.55 kg; BMI = 19.09 ± 1.65, 3 right-handed players, 13 left-handed players) from the same ice hockey club (SK Cernosice, CZ) competing in the highest youth league in the Czech Republic participated in the study. Only players with no current or recent injury were included. Players were divided into two groups according to technical skills criteria: a) correct transfer of weight to the standing leg during shooting, b) hip and shoulder rotation during shooting, c) an overall smooth technique of shooting. Group 1 consisted of players technically more advanced than participants in Group 2, which was the reason why this group started with a training program with heavy pucks, while Group 2 started the training program with light pucks. Players were familiarized with testing and training protocols three weeks before the study commenced.

The research and informed consent forms were approved by the institutional ethics committee of the Charles University Faculty of Physical Education and Sport following the ethical standards of the Helsinki Declaration of 2013 and signed informed consent forms were obtained from the parents of all players who participated in the study.

Shooting speed

Shooting speed was measured by a speed radar (Stalker Sport 2, Applied Concepts inc., Texas) where players had three trials for each shooting technique (long and short snapshot and wrist shot), and they had to score from the 7-10 m distance area. The best result was recorded for further data analyses.

Shooting accuracy

Shooting accuracy was measured by two variables (shooting time and effectiveness) during the standing shot test on the goal, where players attempted to hit 20 cm diameter targets positioned in the corners and low central part of the goal. They were allowed to use only short and long hand snapshots (without a wrist-handed shooting style). Each participant had 30 pucks available for the test and the minimum distance for shooting was 7.3 m from the net. The number of target hits, the number of pucks used, and the time the shooter needed to hit all five targets were measured, where shooting effectiveness was calculated as the ratio of five successful target hits and a total number of pucks used expressed in percentages.

Handgrip strength

Players were tested for grip force of the left and the right hand with a hand dynamometer (T.K.K. 5401 Grip D, Takei, Japan) in the half squat body position. Each player had two 3 s trials of maximum effort for both hands and the best result was used for further analyses.

Training program

The participant's regular in-season program consisted of weekly cycles, which included one or two competitive matches per week and four regular 60-min ice hockey training sessions per week. Between pre-test and post-test 1 measurement, participants completed 18 specific training units (which included six units of training on-ice and 12 off-ice) and six matches (Table 1). During post-test 1 and post-test 2 measurements, participants had 19 specific training units which included six training units on-ice and 12 off-ice, and 6 matches (Table 1). Participants had two weekly training sessions on-ice and two units off-ice. During on-ice sessions they shot approx. 100 pucks and during off-ice, they shot approx. 75 pucks at the net.

Specific exercises for shooting on-ice (exercise A – L)

During on-ice training sessions, players were divided into four groups of 3-4 players each. Two groups used heavy-weight pucks for shooting while two groups used light-weight pucks. All groups performed short-hand shooting, long-hand shooting, and wrist-shooting exercises for 15 min. Each exercise was performed 3-4 times.

The on-ice shooting drills were focused on large variable shooting positions and the optical response to the puck during shooting after a pass (Figure 2A and B), where the shooter passed the puck between the shooter's legs to bounce the barrier before the shooter. Then the shooter reacted to the puck, shot into the net, and returned to the starting position. In other exercises, players had to react to a bounce from the backside of the net, after the bounce, the shooter reacted to the puck position and shot to the net (Figure 2F). Another set of shots was performed after a direct pass, where players had to react to the position of the passing player, which was behind or next to the net (Figure 2C and I). The player shot three times from the forehand and three times from the backhand after receiving a pass from behind the net location (Figure 2D). Shooting three pucks from different angles after processing the puck is presented in Figure 2E. A player passed the puck to different places and the shooter had to react and shoot. The shooter started after the puck reached his legs, he had to react to the position of the puck, afterwards he skated and shot to the net twice, for the third shot he skated between the nets (Figure 2G). Another exercise was focused on shooting after the breaking, cutting maneuver, or skating around the obstacles (Figure 2J, K and L).

Specific exercises for shooting off-ice

During off-ice training, every player shot 75 pucks using hockey gloves from a standing position to the empty net trying to hit typical scoring areas. Players performed 25 long-hand snap shots, 25 short-handed snapshots, and 25 wrist-shots per session. The distance between the net and the player was 7.3 m, one set consisted of shooting 5 pucks and a rest interval was 60 s.

Statistical analyses

Data were processed using STATISTICA software 13.5 (TIBCO software Inc. Palo Alto, CA, USA) where statistical significance was set up at $\alpha < .05$. The normality was assessed by the Kolmogorov-Smirnov test and training effects were expressed as a percentage change. Since all variables were normally distributed, data are expressed as means and standard deviations. A repeated measures ANOVA (group x time) was used to evaluate the differences between pre-test, post-test 1, and post-test 2 measurements and between groups, where $p < 0.05$, and post hoc Tukey's tests, with Hays $\omega^2 > 0.09$ were considered significant. The ω^2 values of 0.10-0.29, 0.30-0.49, and >0.50 were considered weak, moderate, and strong associations, respectively. The effects between pre- and post-measures in both groups, and after each training block were evaluated using Cohen d and were considered small for d = 0.2, medium for $d = 0.5$, and large for $d = 0.8$. The Spearman correlation coefficient was calculated for the relationship between handgrip strength and each shooting type, and linear regression analysis was conducted to evaluate handgrip strength and all shooting conditions and accuracy.

Results

The Kolmogorov-Smirnov test did not show any disruption of data normality, and the results are summarized in Tables 2 and 3. Group 1 presented higher values of shooting speed during the pre-test, however, the difference was not statistically significant.

The long hand snapshot speed was different between the measures ($F_{2,28} = 28.6$, $p < 0.001$, $\omega^2 = 0.66$) and between the groups ($F_{1,14} = 9.4$, $p = 0.008$, $\omega^2 = 0.49$) and between groups and measures interaction ($F_{2,28} = 3.7$, $p = 0.037$, $\omega^2 = 0.14$), where post hoc results showed increased shooting speed between pre-test and post-test 2 in both groups, increased shooting speed in post-test 1 in Group 1, and higher shooting speed during post-test 1 and post-test 2 in Group 1 than Group 2 (Figure 3).

The shorthand snapshot speed was different between the measures ($F_{2,28} = 49.2$, $p < 0.001$, $\omega^2 = 0.75$) and between the groups ($F_{1,14} = 8.01$, $p = 0.013$, $\omega^2 = 0.45$) and between groups and measures interaction ($F_{2,28} = 3.5$, $p = 0.044$, $\omega^2 = 0.14$), where post hoc results showed increased shooting speed between pre-test and post-test 2 in both groups, increased shooting speed in post-test 1 in Group 1, and higher shooting speed during post-test 1 and post-test 2 in Group 1 compared to Group 2 (Figure 3).

The wrist shot speed was different between the measures ($F_{2,28} = 46.8$, $p < 0.001$, $\omega^2 = 0.75$) and between the groups ($F_{1,14} = 13.8$, $p = 0.002$, $\omega^2 = 0.60$), and between groups and measures interaction ($F_{2,28} = 5.86$, $p = 0.008$, $\omega^2 = 0.25$), where post hoc results showed increased shooting speed between pre-test and post-test 2 in both groups, increased shooting speed in post-test 1 in Group 1, and higher shooting speed during post-test 1 and post-test 2 in Group 1 compared to Group 2.

The right handgrip strength differed between the measures ($F_{2,28} = 17.4$, $p < 0.001$, $\omega^2 = 0.25$), where post hoc results showed that handgrip strength was increased in Group 2 between pre-test and post-test 2 (Figure 4). The left handgrip strength differed between the measures ($F_{2,28} = 20.9$, $p < 0.001$, $\omega^2 = 0.55$), where post hoc showed that handgrip strength was increased in both groups between pre-test and post-test 2 (Figure 3).

Shooting time was also different between the measures ($F_{2,28} = 9.4$, $p < 0.001$, $\omega^2 = 0.35$) and between the groups ($F_{1,14} = 8.46$, $p = 0.012$, $\omega^2 = 0.31$), where post hoc tests showed shorter time in post-test 1 and post-test 2 than pre-test in Group 1 and shorter time in post-test 2 in Group 1 compared to Group 2 (Figure 4). Shooting effectiveness was different between the measures ($F_{2, 28} = 4.5$, $p = 0.019$, $\omega^2 = 0.18$) and between the groups ($F_{1, 14} = 9.4$, $p = 0.008$, $\omega^2 = 0.35$), where post hoc tests showed increased effectiveness pre-test and post-test 2 in Group 1 and greater shooting effectiveness in Group 1 than Group 2 during shooting post-test 1 and post-test 2 (Figure 3).

The training effect was higher for shooting speed after training with heavier pucks (Table 3) and similar for handgrip strength and shooting accuracy. The linear regression analysis showed that for both hands handgrip strength was related to shooting speed, and this relationship was stronger before the intervention (lower hand, $p = 0.008$, $R^2 = 0.44$, upper hand, $p < 0.001$, $R^2 = 0.65$) than after the intervention (lower hand, $p = 0.032$, $R^2 = 0.26$, upper hand, $p = 0.019$, $R^2 = 0.35$).

Discussion

Load variability is a popular method of developing specific sports skills, speed and strength (DeRenne and Szymanski, 2009). This study showed that both training programs (with heavy- and light-weighted pucks) were beneficial for shooting speed and accuracy in ice hockey, which supports the findings from previous studies (Bežák and Přidal, 2017; Nimmins et al., 2019). The mechanism of this effect is the inverse relationship between puck velocity and puck weight, which has been confirmed in the wrist shots (Gilenstam et al., 2009) using lighter (weight from 140 to 142 g; $p = 0.445$) and regular pucks (weight from 166 to 167 g; $p = 0.241$). Therefore, variable load training using different puck loads provides both overspeed and increases in training loads, which positively influence shooting speed without disrupting shooting accuracy. This effect of increasing shooting effectiveness is in accordance with the current theory that increased movement variability increases movement's precision (Rosenblatt et al., 2014). Another possible mechanism is the effect of postactivation performance enhancement and the overspeed stimulus (Krzysztofik et al., 2020a, 2020b), which improves power performance in each training session.

The major finding of this study is that training with variable puck loads is effective in increasing shooting speed, accuracy, and handgrip strength in bantam players. However, the training effect is differentiated by the level of shooting skills, and using a heavier puck has a greater effect on training results. This is in agreement with a previous study, where manipulating the puck weight affected ice hockey performance with particular puck masses (light: 133 g, regular: 170 g, and heavy pucks: 283 g). Results indicated that the use of a light-weight puck by technically less-skilled players increased goal-scoring effectiveness (46.28 ± 25.11%) compared to the regular (33.66 ± 22.59%) and heavy puck (20.46 ± 22.01%) (Nimmins et al., 2019). However, there were differences in skilled technical players and their improvements. In addition, we acknowledge that shooting technique depends on many factors such as the skill level, ice surface conditions, stick material, as well as body mass and muscular strength (Wu et al., 2003).

One of the principal questions of this research application is the time span of the intervention taking into account that this study used six week periods for training modification as in previous studies (Melugin et al., 2021; Novak, 2020; Stark et al., 2009). This period is considered an optimal time to improve motor development with no stagnation effect in respect to psychological aspects (Silva-Moya et al., 2021). Therefore, our cross-over protocol resulted in longitudinal progress over 12 weeks. On the other hand, this research cannot determine whether variable load training should alternate in random order from one session to another. Based on these results we recommend six week block periods to maintain training progress while using variable load training for the development of technical skills.

Another aspect of the study is that players with better shooting technique (Group 1, starting with a heavy-weight puck program) reported greater improvements in shooting speed and accuracy, especially after the heavy-weight puck training program. On the other hand, technically worse players (Group 2, starting with the light-weight puck training program) reported greater improvements in long swing and wrist shot speed and accuracy after the light-weight puck training program compared to the heavy-weight puck training program. This suggests that shooting trainability by variable loads depends on the technical and performance level of the athletes, and that this method seems to be more effective in technically more advanced players. This was previously reported in a study with lighter and heavier pucks on skilled and less-skilled ice hockey players (Nimmins et al., 2019). Less-skilled ice hockey players using lighter pucks reduced errors during stick-handling and players could focus on particular game scenarios. Also, shot accuracy in less-skilled players can increase goal-scoring effectiveness with lighter pucks. Using a lighter puck in skilled players allows for much faster puck shots with the same amount of force they usually employ for a shot with a standard puck. Also, skilled participants were able to functionally adapt to the mass of the puck (lighter or heavier) for the shooting tasks (Nimmins et al., 2019).

The main study limitation is the lack of comparison of our results to other studies in regard to shooting accuracy, shooting speed, and handgrip strength with the same type of the experiment. This is unfortunately caused by the lack of similar data. Most previous studies have focused on other load variabilities, such as ice hockey stick properties (Hannon et al., 2011; Pearsall et al. 1999). Another limitation is the sample size, however, it should be underlined that this number of participants allowed a high level of control over the training intervention and the whole experiment. Therefore, future research should identify whether different loaded implements (balls, pucks, racquets, bats, sticks at different flexibility) should be used alternatively in a single training session or should such changes be planned in particular cycles.

Conclusions

The variable training load had a positive effect on shooting speed and accuracy and using a heavier load resulted in a greater effect than using the unloaded puck. It is also more effective to start variable load training load aimed at improving ice-hockey shooting skills using heavier pucks than the lighter ones, and training effectiveness is greater in players with better shooting skills. Six week periods seem optimal to maintain training progress for technical skills development using variable loads.

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Tables and Figures

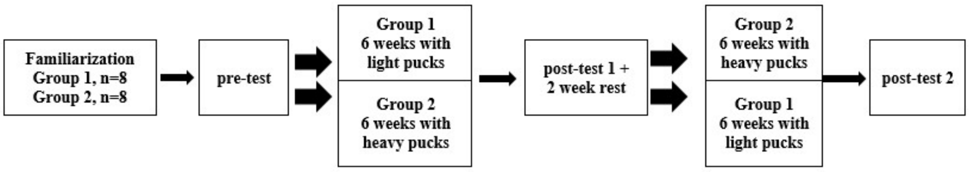

Figure 1.

Flow chart of the cross-over experiment and measures.

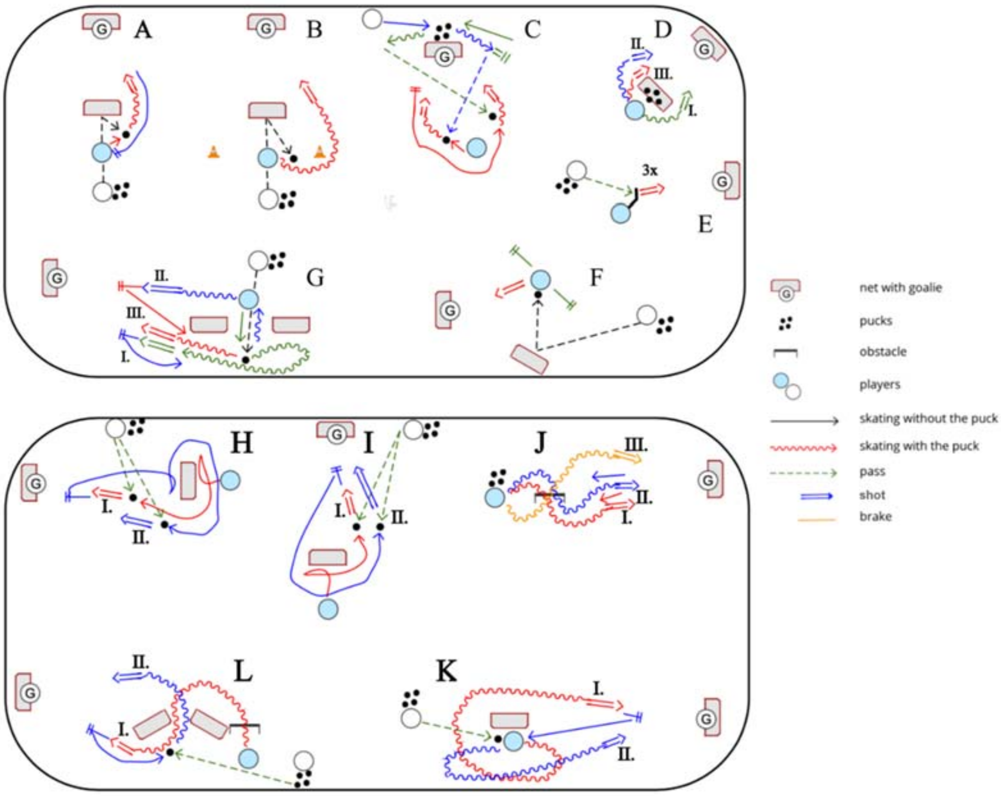

Figure 2

Specific exercises for shooting on-ice (exercise A – L).

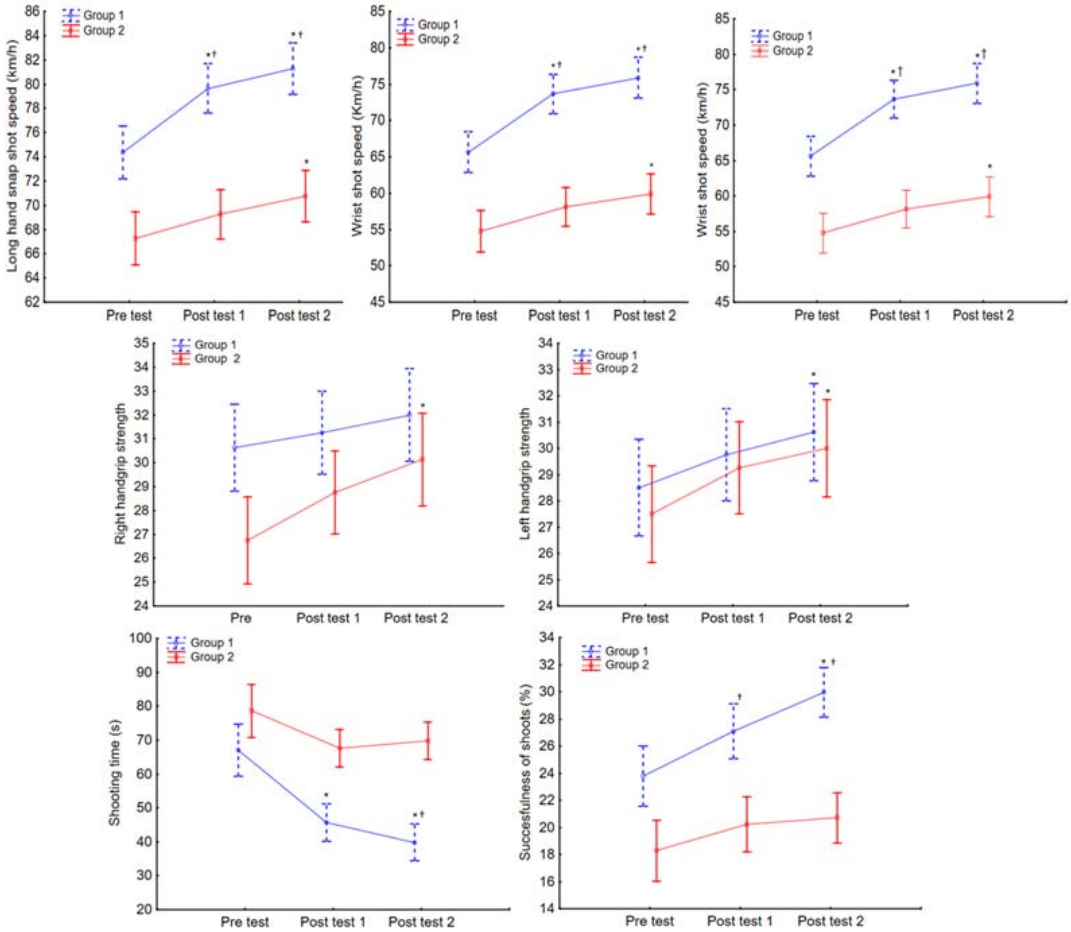

Figure 3

Results of the longhand snapshot, shorthand snapshot speed, wrist shot, handgrip strength, and shooting accuracy before and after training with variable puck loads.

*Group 1 = group that performed the heavy-weight puck training program first, Group 2 = group that performed the lighter-weight puck training program first. * significant difference by the Tukey's post hoc test to pre-test $p < 0.01$, † = significantly different to Group 2 at the same measurement.*

Table 1

General training schedule during the experiment.

Training item	Pre-test – Post-test 1	Post-test 1 – Post-test 2	Pre-test – Post-test 2
Number of training units	18	19	37
Number of specific training units on-ice	6	7	13
Number of specific training units off-ice	12	12	24
Number of matches	6	6	12
Number of pucks shot on-ice	600	600	1200
Number of pucks shot off-ice	900	900	1800

Table 2.

Changes in handgrip strength, puck speed, and shooting accuracy after twelve weeks of variable load training.

Measure		Group	Pre-test Mean ± SD	Post-test 1 Mean ± SD	Post-test 2 Mean ± SD	Pre-post test 2 change (%)	Pre-post test 2 Cohen *d*
Handgrip Strength	Left	1	28.5 ± 6.0	29.8 ± 5.9	30.6 ± 6.3	7.8 ± 8.7	0.34
		2	27.5 ± 4.1	29.2 ± 3.8	30.0 ± 3.9	9.5 ± 7.7	0.60
		both	28.0 ± 5.1	29.5 ± 4.8	30.3 ± 5.1	8.7 ± 8	0.45
	Right	1	30.6 ± 5.6	31.3 ± 5.4	32.0 ± 6.5	4.2 ± 3.3	0.23
		2	26.8 ± 4.7	28.8 ± 4.4	30.1 ± 4.4	13.4 ± 9.5	0.72
		both	28.7 ± 5.4	30 ± 4.9	31.1 ± 5.4	8.8 ± 8	0.44
Puck speed	Snapshot longhand	1	74.4 ± 7.9	79.6 ± 6.9	81.3 ± 6.7	9.6 ± 5.7	0.94
		2	67.3 ± 7.8	69.3 ± 4.3	70.8 ± 5.3	5.2 ± 4.8	0.52
		both	70.8 ± 7.0	74.4 ± 7.7	76 ± 8.0	7.3 ± 5.0	0.69
	Snapshot shorthand	1	69.6 ± 7.8	74.3 ± 7.3	76.3 ± 7.1	9.8 ± 5.1	0.89
		2	63.3 ± 3.0	65 ± 3.6	67.8 ± 4.0	7.1 ± 4.9	1.10
		both	66.4 ± 6.3	69.6 ± 7.1	72.1 ± 7.1	8.5 ± 5	0.85
	Wrist shot	1	65.6 ± 10.2	73.6 ± 9	75.9 ± 9.1	16.6 ± 9.8	1.10
		2	54.8 ± 4.8	58.1 ± 5.8	60.0 ± 6.8	8.1 ± 5.9	0.88
		both	60.0 ± 9.5	66 ± 10.8	68 ± 11.6	12.0 ± 8.0	0.75
Shooting accuracy	Shooting time (s)	1	67.0 ± 28.8	45.7 ± 16.3	39.9 ± 12.5	30.8 ± 30.6	1.25
		2	78.6 ± 11.5	67.6 ± 15.3	69.7 ± 18.0	10.9 ± 20.7	0.59
		both	72.8 ± 22	56.7 ± 19	54.8 ± 22.0	20.1 ± 26.0	0.81
	Effectiveness (%)	1	23.8 ± 8.4	27.1 ± 6.2	30.0 ± 5.7	19.7 ± 24.7	0.86
		2	18.3 ± 3.0	20.2 ± 5.2	20.7 ± 4.7	10.3 ± 9.4	0.61
		both	21.0 ± 6.7	23.7 ± 6.5	25.3 ± 6.9	14.2 ± 18.0	0.63

Table 3.

Changes in handgrip strength, puck speed, and shooting accuracy after six week blocks of training with lighter and heavier pucks.

Measure		Training block	Pre-block	Post-block	Pre-post block change (%)	Pre-post block Cohen *d*
Handgrip Strength	Left	Heavier puck	28.8 ± 4.9	29.8 ± 4.6	3.7 ± 4.5	0.21
		Lighter puck	28.8 ± 4.8	30.2 ± 5.0	5.1 ± 4.6	0.28
	Right	Heavier puck	29.7 ± 4.8	30.7 ± 4.6	3.6 ± 4.8	0.21
		Lighter puck	29.0 ± 5.2	30.4 ± 5.4	5.1 ± 6.8	0.26
Puck speed	Snapshot longhand	Heavier puck	71.8 ± 6.5	75.2 ± 7.2	5.75 ± 5.0	0.50
		Lighter puck	73.4 ± 8.1	75.3 ± 8.2	2.5 ± 1.8	0.23
	Snapshot shorthand	Heavier puck	67.3 ± 6.1	71.0 ± 6.4	5.5 ± 3.7	0.59
		Lighter puck	68.8 ± 7.5	70.6 ± 7.5	2.8 ± 2.1	0.24
	Wrist shot	Heavier puck	65.6 ± 8.6	73.6 ± 10.1	7.9 ± 7.8	0.86
		Lighter puck	64.2 ± 11.5	67.0 ± 11.3	4.6 ± 3.1	0.25
Shooting accuracy	Shooting time	Heavier puck	67.3 ± 21.5	57.7 ± 20.1	10.0 ± 25	0.47
		Lighter puck	62.1 ± 21.2	53.3 ± 19.2	11.9 ± 12	0.44
	Effectiveness	Heavier puck	22.0 ± 6.7	23.9 ± 6.0	12.9 ± 19.1	0.31
		Lighter puck	22.7 ± 6.3	25.1 ± 7.0	10.5 ± 9.8	0.36