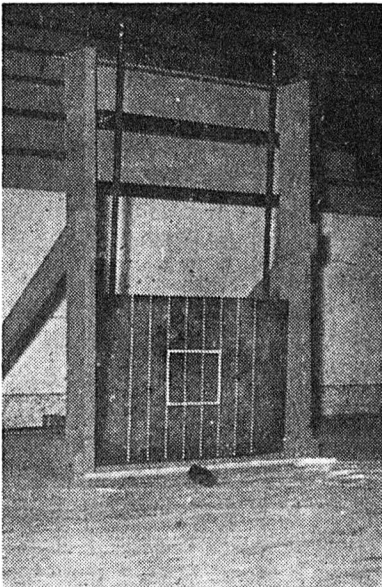


# Hockey Research: Mean Shots And Mean Velocity

by Ray St. Arnaud

"He sure let that one fly!" "You couldn't even see it." These are frequent comments at any hockey game. But just how fast is a hockey shot? How accurate can it be? Every hockey arena every beer hall where you find sports buffs congregating is haunted by these problems.



The University of Alberta's Physical Education Department, composed of sportsmen of one type or another, has completed one study of this question and is in the midst of a second, more specific and extended, study.

Last year Dr. John Alexander undertook an enquiry of the speed and accuracy of four distinct hockey shots. His thirty subjects were drawn from four different teams of different proficiency level. The players involved were members of the Edmonton Flyers, a professional team, the Lacombe Rockets, the Edmonton Oil Kings and the University of Alberta Golden Bears.

The velocity of a hockey puck was computed by a device designed by Dr. Haddow of the Department of Mechanical Engineering, the Ballistic Pendulum.

The Ballistic Pendulum is a rectangular structure of about five feet in height. Two vertical rods support a two by three foot board. The center of this suspended board is the target. A player attempts to hit the target. When the puck hits the board, it transfers its momentum to the board. A dial gauge located at the point where the suspension rods are attached to the frame, indicates the amount of movement by the board after the impact of the puck.

The final velocity of the puck is computed by the movement of the board and the point on the board where the puck hit. The Ballistic Pendulum works on the principle of conservation of angular movement. It is an adaption of an earlier machine used to compute the velocity of bullets.

Studies were also made of the relationship between the dominant grip strength of an individual and the velocity and accuracy of a shot. On this relationship Dr. Howl of the Physical Education Department stated: "The relationship between strength of an individual and his speed of movement is low, but the correlation increases with strength."

The results of last year's tests are listed in the accompanying table.  
MEAN VELOCITIES AND STANDARD DEVIATIONS OF ICE HOCKEY SHOTS BY CHAMPIONSHIP TEAMS OF DIFFERENT LEVELS IN MILES PER HOUR

	1	2	3	4
	62.4±4.3	72.3±1.9	70.5±5.3	79.0± 4.0
	54.3±5.3	59.5±4.7	73.5±3.5	75.5± 5.7
	63.1±5.9	74.5±4.8	78.6±5.2	85.6± 6.1
	58.7±8.0	69.6±5.8	69.1±5.8	75.7±12.4

Column No. 1—Standing Wrist Shot  
2—Standing Slap Shot  
3—Skating Wrist Shot  
4—Skating Slap Shot

Line No. 1—Team A N=11  
2—Team B N=7  
3—Team C N=6  
4—Team D N=6

The highest velocity of any single shot was by Eddy Joyal of the Edmonton Flyers. His skating slap shot travelled at a speed of 97.5 miles per hour.

The following conclusions were drawn from last year's experiments:

The velocity of the standing slap shot was greater than the velocity

of the standing wrist shot. The velocity of the skating slap shot was greater than the velocity of the skating wrist shot. The velocities varied according to the proficiency level of the teams involved and the type of shot under consideration.

Accuracy on the other hand did not vary according to the team or type of player. The skating wrist shot was the most accurate while the standing slap shot was the least accurate.

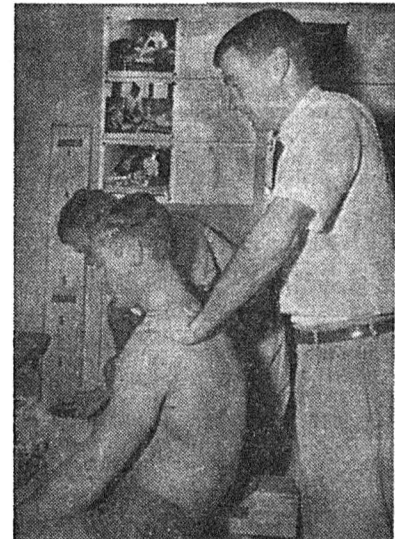
There was no relationship observed between dominant grip strength and the velocity of a shot. Nor was there a relation between strength and accuracy. A higher relation was found between body weight and velocity.

The lack of relation between dominant grip strength and accuracy or velocity appeared to contradict a belief held by most people connected with hockey. It is thought by these people that the stronger an individual's wrists, the higher the velocity and accuracy of his shot. This seemingly contradictory finding led Dr. Alexander to review his entire experiment and led to the development of this year's program.

The program was begun with a series of high speed movies of

Golden Bear hockey players, wearing shorts, shooting the skating slap shot and the skating wrist shot.

Analysis of the movies revealed distinct differences in the muscle groups used in the two shots. It was found in the wrist shot that the lower hand on the stick had a distinct pronation movement coupled with an adduction movement of the upper part of the arm. The upper hand displayed a supination movement. The power of the wrist shot comes from the upper hand.



In the slap shot the motion is almost entirely an adduction movement. The power of the slap shot comes from the lower hand.

Tests were derived by Peter Rechenback to measure the strength of the various muscle groups. Eighteen Bear players underwent the tests for velocity and accuracy. Half of the group have been assigned specific isometric exercises designed to develop the individual muscle groups involved in shooting. The other half, a control group, is not involved in any special exercises.

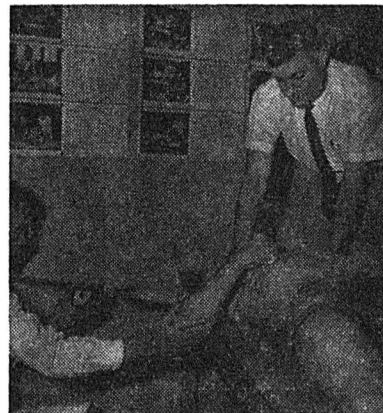
The mean velocities of the two shots for the bears this year are 71.6 mph for the skating slap shot, and 68.4 mph for the skating wrist shot. This is a decrease from the values obtained by the Bears in last year's program.

The eighteen players involved in the experiment will repeat the strength, velocity and accuracy tests at the end of the season. Dr. Alexander will then compare the results with those taken at the beginning of the season.

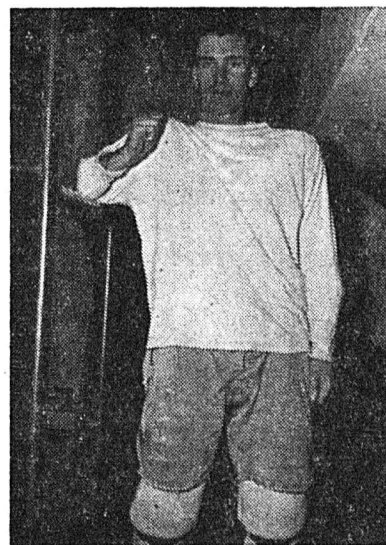
An interesting conjecture in the consideration of the above arises in respect to game conditions. A player seeing an opening for a shot has a choice of two alternatives, a wrist shot or a slap shot. A wrist shot does not require the player to take a windup. He is able to shoot immediately. A slap shot requires the player to swing his stick back and slap the puck.

It is reasonable to assume that total time involved in these two situations from the time the opening is seen and the puck reaches the goal is greater for the slap shot than for the wrist shot.

Possibly the only situation in which a slap shot would reach the goal faster than a wrist shot occurs when a player has a puck passed to him, and he then slaps the puck while it is still in motion. However, because he must still windup he is providing the goalie with a visual clue which permits him to prepare himself for the shot.



Isometric Contraction Exercises



Photos by Heinz Moller



Layout by Bill Winship