

How Does Hockey Stick Flex Affect Accuracy and Speed?

Abstract

While watching an ice hockey game, have you ever wondered what differentiates a good player from a great player? For sure, the great player is athletically superior to the good player. But maybe it is a combination of athleticism and equipment. Maybe a great player knows which hockey stick is best for him or her. Hockey players can choose to play with hockey sticks with different flexibilities or "flex." In this science fair project, investigate how stick flex affects shot accuracy and speed. Who knows, if you figure this problem out, you could move from being a good ice hockey player to a *great* ice hockey player!

Objective

To investigate how hockey stick flexibility affects shot accuracy and puck speed.

Introduction

Historians are not sure when or where the game of ice hockey started, but the modern version of ice hockey was developed in Canada by J.G.A. Creighton, and the first game was played in Montreal, Canada in 1875. The first ice hockey rink was built in London in 1876. Hockey is a game that requires balance, agility, strength, and hand-eye coordination. Good hand-eye coordination skills are necessary in order to shoot the puck into the 4-ft. x 6-ft. goal.

Another thing that helps players play hockey is the equipment. The most important piece of equipment is the hockey stick. The hockey stick has two components: the blade and the shaft. Hockey sticks used to be predominantly made from wood. However, hockey sticks are now made from a variety of materials, including carbon, carbon-graphite, and aluminum. Some players like their hockey sticks to be long and straight, while others like a curve in the blade. Properties of hockey sticks include: **lie**, **blade pattern**, and **flex**. Flex is defined as the amount of weight required to bend the stick 3 inches. The higher the flex number, the **stiffer** the hockey stick.



Check out the video "Hockey by Tess, Alison, and Christina." This video was produced by DragonflyTV.

<http://pbskids.org/dragonflytv/show/hockey.html>

Flex has a lot to do with how fast a player's **slap shot** is. In the act of making a slap shot, the player will scrape the blade on the ice a few inches behind the puck. This pulls the blade back so that when the blade contacts the puck, it acts like a spring. This, in combination with the player transferring his or her weight from the back leg through to the stick, can transfer a lot of power to the puck and give it tremendous speed. You might think that all players should play with a high-flex stick but that's not quite so. Different positions (forwards, defensemen, and goaltenders) require sticks with different flex. Players also vary in physical strength. A weaker player might not be able to play effectively with a high-flex stick. Flex also affects shot accuracy.

In this science fair project, you will look at how flex affects shot accuracy and shot speed. This project is based on a DragonflyTV project called "Hockey by Tess, Alison, and Christina." Click the link on the right to watch how they investigated hockey stick flex. Now it's time to do your own investigation with wood hockey sticks and see if you get similar results as Tess, Alison, and Christina. If people ask why you're headed to the skating rink when you should be doing your science fair research, tell them that's exactly what you're doing!

Terms, Concepts and Questions to Start Background Research

- Lie
- Blade pattern
- Flex
- Stiffness
- Slap shot

Questions

- What are the different properties of a hockey stick and how does each property help the hockey player?
- What is the physics behind the hockey slap shot?
- From what kinds of materials are hockey sticks made? What characteristics does each material give to the hockey stick?

Materials and Equipment

To do this science fair project, you must have access to a hockey rink, all hockey equipment, all safety gear, and two volunteers who have the same. The test will likely be more accurate if you and the two volunteers are adept at playing ice hockey.

- Poster board
- Ruler
- Scissors
- Permanent marker
- Duct tape
- Plastic bin
- Hockey pucks (10)
- Measuring tape
- Volunteer players who are also adept at ice hockey and who have hockey equipment and safety gear (3, including you)
- Wood hockey sticks (3); you should have three wood hockey sticks, each with a different flex number. Try borrowing these, rather than buying them.
- Sporting radar gun; these are expensive to purchase. See if you can borrow one from your hockey gear shop or from a sporting goods store. Sporting radar guns are available for purchase online.
- Lab notebook
- Graph paper (optional)

Experimental Procedure

1. To start this science fair project, you should arrange a time with your local ice rink to do your project. Or perhaps arrange a time with your coach to perform this experiment before or after practice, if you play on a team. Be sure to give them details about what you will be doing.
2. Make your accuracy marker out of the poster board. Cut out a rectangle that is 1.5 feet x 2 feet. Make a big "X" on the poster board with the permanent marker. This is the shooting target.
3. Be sure to take all your supplies and gear listed in the Materials & Equipment list with you to the rink. Set up the testing area. Test for shot accuracy first. Place the target in the goal. Tape it to the net with the duct tape and support it from behind with the plastic bin so that the "X" is clearly visible. You will be shooting for this target in the accuracy test.

4. Measure 60 feet from the goal with the measuring tape. Line up 10 hockey pucks at this location.
5. Take the lowest-flex stick and shoot the 10 pucks toward the target, one right after another. Note down in your lab notebook the number of times you hit the target in a data table like the one shown below.
6. Repeat steps 4–5 with each of the different flex sticks. Record how many times you hit the target in your lab notebook.
7. Repeat steps 4–6 with each of your volunteer players. Record all data in your lab notebook.

Player	Flex	Did the Player Hit the Target?										Shot Accuracy Percentage

8. Now investigate how the flex affects the *speed* of a slap shot.
9. Read the instructions of the sporting radar gun and set it up at the side of the goal.
10. Line up five hockey pucks 60 feet away from the goal. With the lowest-flex stick, make a slap shot as hard as you can toward the target. Note the speed on the radar gun and have a volunteer player record it in your lab notebook. Repeat for each hockey puck.
11. Repeat step 10 for each of the different flex sticks, recording all data in your lab notebook.
12. Repeat steps 10–11 with each of your volunteer players. Record all data in your lab notebook.
13. Now it's time to work with the data. Make a bar chart of the data on graph paper, or if you need help with plotting or would like to make your plots on the computer, try the following website Create a Graph. Make a bar chart

with *Player* on the x-axis and *Shot Accuracy Percentage* on the y-axis. The "Shot Accuracy Percentage" is calculated by totalling the number of times the player hit the target, dividing the total by 10, and then multiplying by 100. For each volunteer player, plot the shot accuracy percentage for each flex stick.

Player	Flex	Slap Shot Speed					Average Slap Shot Speed

14. Make another bar chart with *Player* on the x-axis and *Average Speed* on the y-axis. For each volunteer player, plot the average speed for each flex stick. Do you notice any pattern? Is a particular flex stick better?

Variations

- Is flex the same? Extend your investigation by comparing hockey sticks of different materials.
- How does the weight of the stick affect the shooting accuracy and speed?
- How does the weight and strength of the player affect shooting accuracy and speed?
- For more science project ideas in this area of science, see [Sports Science Project Ideas](http://www.sciencebuddies.org/science-fair-projects/project_ideas/Sports_p049.shtml).

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