"Cue Tip Squirt Testing"

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*Supporting narrated video (NV) demonstrations, high-speed video (HSV) clips, technical proofs (TP), and all of my past articles can be accessed and viewed online at **billiards.colostate.edu**. The reference numbers used in the articles help you locate the resources on the website. If you have a slow or inconvenient Internet connection, you might want to view the resources from a CD-ROM or DVD. Details can be found online at: **dr-dave-billiards.com**.*

Recently, I was approached by an inventor to test a new cue tip he had designed. He claimed that it reduced or eliminated cue ball (CB) deflection (AKA "squirt"). This prompted me to do a series of tests to determine if tip type, construction, hardness, or height could have a significant effect on squirt or not. Tip choice definitely affects the "hit" or "feel" of a cue, but the question here was: Does tip choice affect CB deflection? The short answer is: No ... the tip has practically no effect on squirt. If you want the long answer, keep reading.

Online video **NV D.15** documents the results of an experiment used to test different shafts and various tips of different types, hardnesses, and heights to determine the effects on squirt. The video also presents a simple testing procedure that anyone can do on their own for any shafts and/or tips without requiring any special equipment. The tips tested included an Ultraskin (very soft), a Kamui black (hard), a novel two-material composite, and a phenolic. These tips cover a wide range of types and hardnesses. Each tip was mounted on the same cue with a 13mm solid maple shaft. Two different tip heights were tested: 0.275" (tall) and 0.155" (short), measured from the edge of the ferrule to the top-center of the tip (see the top of Diagram 1). Also, each tip at each height was shaped to the same US-dime radius.

Diagram 1 shows the layout used for the experiment. Three self-adhesive hole-reinforcement labels ("little white donuts") are located one diamond off the long rail adjacent to the first three diamonds. The donut at the third diamond helps ensure accurate and consistent CB placement. The other two, along with the first diamond on the short rail, define the center-ball hit line. The second set of donuts are 9/16" from the first, including one next to the first diamond on the short rail. These donuts are used to ensure accurate and consistent cue alignment and tip contact point for each off-center-hit shot. On the foot rail, there is a ruler template taped to the table with the zero mark aligned with the center of the first diamond. This template is available in the Instructor and Student Resources section of my website at ***billiards.colostate.edu***. A center-ball hit sends the CB to the zero point on the ruler. For the squirt test, the cue is aligned with the offset donuts and the CB squirts offline. We used a camera mounted above the rail ruler angled toward the oncoming CB to measure the CB deflection at the rail (see **NV D.15** for a demonstration).

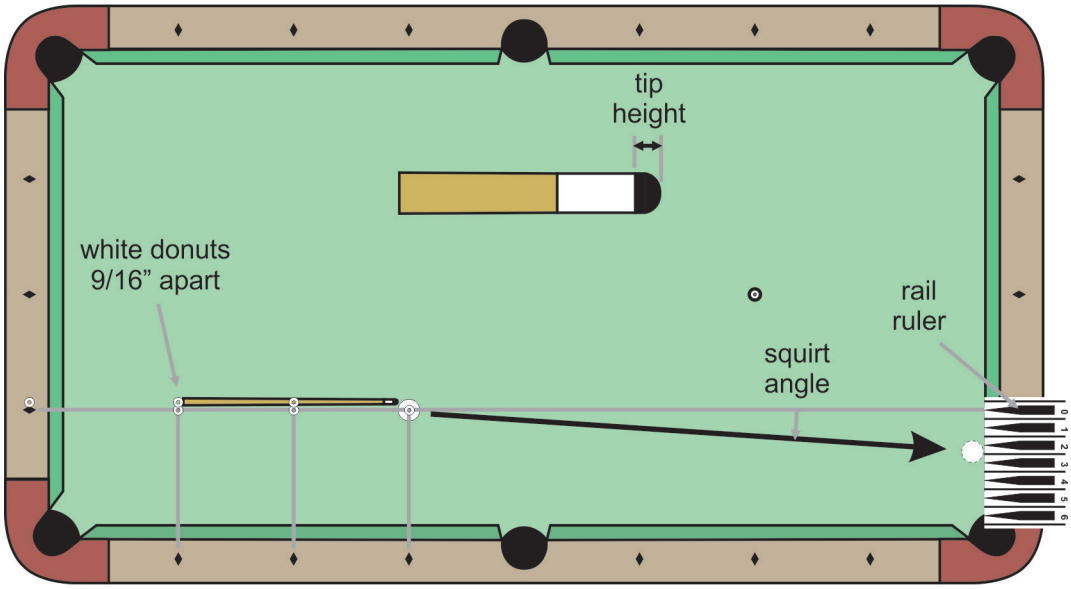

Diagram 1 Table layout for experiment

We used an Elephant Practice Ball as the CB. It has a 1 1/8" red circle indicating the miscue limit for the tip contact point. With the cue shifted to the left of center 9/16", the center of the cue is aimed at the center of the left side of the circle as shown in **Diagram 2**. (Note that this results in a tip contact point well within the red miscue circle.) The donuts and red circle help ensure an accurate and consistent line of aim and tip contact point. If you don't have an Elephant Practice Ball, you can use a striped ball instead, with the stripe vertical and the center of the cue aimed at the left edge of the stripe.

Diagram 2 Elephant Practice Ball

The first cue tested was a Predator Z2 with a medium-hardness Moori tip. The purpose for this was to provide a low-squirt baseline to which to compare other measurements. For the main experiment, three different people (myself, cue mechanic Rolland Becker, and local player Pom Rai) took 5-7 shots for each tip type and height on the same high-squirt test shaft, doing our best to maintain a consistent aiming line, tip contact point, and speed for each shot. People are not perfect, and each person could have a slightly different cue alignment, tip contact point, speed, and stroke for each shot, but we did our best to be as consistent as possible. Only the 3 most consistent shots were kept from each 5-7 set, and then the results were averaged to help reduce variability. All averages were rounded to the nearest 1/8". The cue was kept as level as possible and fast speed was used to minimize the effects of CB curving (swerve). Obviously, it would have been better to use a robotic testing machine instead of silly humans, but with careful shooting and consistent testing procedures, impartial human results can be fairly accurate and consistent.

Table 1 shows a concise summary of the averaged squirt data from all of the tests. As is clear in the bottom two rows, squirt (CB deflection) did not vary much with tip type, hardness, or size. These things definitely affect the sound, feel, and efficiency of a cue (for more info, see the "feel, hit, feedback, and playability" resource page in the FAQ section of my website), but the tip appears to have very little effect on CB deflection. Over the extremely wide range of tip types, hardnesses, and heights we tested, the average squirt varied over a very small range of 2 1/8' to 2 1/2" (see the last row in Table 1). Tip height didn't seem to make much of a difference at all. With the Ultraskin and experimental tips, the squirt was a little larger with the shorter height; and with the Kamui tip, the squirt was a little smaller with the shorter height. Generally, a harder tip is expected to produce slightly less squirt than a softer tip since the tip contact time is less with a harder tip; however, a harder tip is also heavier, which contributes to added "endmass" and squirt. For more info, see the "squirt - tip hardness effects" resource page in the FAQ section of my website. For the data in these experiments, the hardest tip tested (the phenolic tip) had slightly more squirt than the others.

One thing that is well understood concerning squirt is that the effective "endmass" of the shaft is the primary predictor of squirt. The Predator Z shaft, the end of which is hollowed out, with a shorter and lighter ferrule, and with the shaft diameter turned down to 11.75 mm, had a much smaller squirt than the solid maple test shaft with a diameter of 13 mm and a larger ferrule. The test shaft had an average squirt of about 2 1/4", which is about 40% larger than the 1 5/8" produced by the low-squirt Predator shaft.

Table 1 Squirt Test Results

	Predator Z-2 shaft	tip						
		Ultraskin (very soft)		Kamui Black (hard)		experimental (2-material composite)		phenolic
		tall	short	tall	short	tall	short	short
Pom		2"	2 1/4"	2 3/8"	2 1/8"	2 1/2"	2 7/8"	2 1/2"
Rolland		1 7/8"	2 1/8"	2 1/8"	2 1/8"	2 1/4"	2 3/8"	2 1/8"
Dave	1 5/8"	2 1/2"	2 1/4"	2 5/8"	2 1/4"	2 1/2"	2 1/2"	2 3/8"
average		**2 1/8"**	**2 1/4"**	**2 3/8"**	**2 1/8"**	**2 3/8"**	**2 5/8"**	**2 3/8"**
overall average		**2 1/8"**		**2 1/4"**		**2 1/2"**		

I hope you enjoyed and learned something from my myth-busting experiment dealing with the non-effects of tip type, hardness, and height on squirt. Now you have one less excuse when missing a shot using english. You can't blame it on the tip! It ain't the tip!

Good luck with your game,
Dr. Dave


normal video

NV D.15 – Cue and Tip Testing for Cue Ball Deflection (Squirt)

PS:

- I know other authors and I tend to use lots of terminology, and I know not all readers are totally familiar with these terms. If you ever come across a word or phrase you don't fully understand, please refer to the online glossary at ***billiards.colostate.edu***.

Dr. Dave is author of "The Illustrated Principles of Pool and Billiards" book and DVD, and co-author of the "Video Encyclopedia of Pool Shots (VEPS)," "Video Encyclopedia of Pool Practice (VEPP)," and "Billiard University (BU)" instructional DVD series.