"How High or Low Should You Hit the Cue Ball?" ILLUSTRATED PRINCIPLES

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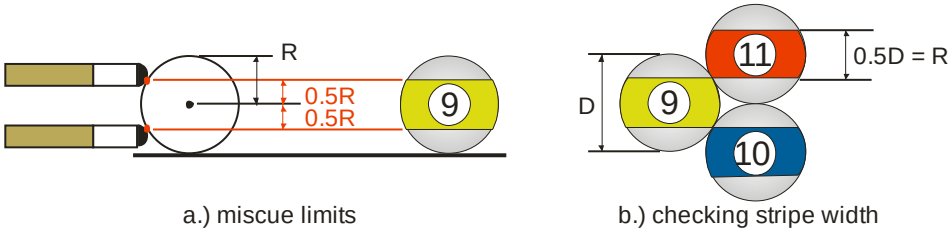
*Supporting narrated video (NV) demonstrations, high-speed video (HSV) clips, and technical proofs (TP), and all of my past articles, can be accessed and viewed online at **billiards.colostate.edu**. The reference numbers used in my articles will help you locate the resources on the website. If you have 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**.*

In this article, we look at how high or low you should hit the cue ball (CB) for different types of shots. Let's start with some basics. Whenever you need to hit the CB off center to impart spin, it is very important to know how far off center you can hit without risking a miscue. If you hit farther from center than the miscue limit, the tip will slip off the ball, resulting in a poor hit. As illustrated in **Diagram 1a**, the miscue limit is generally accepted to be half the ball's radius (0.5R) from center. It just so happens that many pool balls have a stripe width that is very close to half the ball's diameter. Therefore, the edges of the stripe can help you visualize how high or low you can safely hit the CB, assuming, of course, your tip is well chalked. But, not all balls have the same stripe width. As shown in **Diagram 1b**, you can check a given set of balls by placing three striped balls together in a triangle with the three stripes oriented in the same direction. If the edges of the stripes align, then the stripe widths are in fact half the ball diameters and the correct size for demarcating the miscue limit.



a.) miscue limits b.) checking stripe width

Diagram 1 Miscue limit

Diagram 2 shows several important tip height references. **Diagram 2a** shows the tip height that causes the CB to roll immediately on the table surface as it leaves the tip. This immediate-roll height is just below the miscue limit at 40% of the ball's radius (0.4R). Hitting below this causes the CB to first slide across the cloth with less topspin than is necessary for the CB to roll naturally. While sliding, drag action between the CB and cloth gradually slows the ball down while simultaneously increasing the amount of topspin. The sliding continues until the ball begins to roll forward naturally. An example of where you would want to hit the CB at the immediate roll height is a fast-speed follow shot (AKA a "force follow" shot). You want the CB to have full roll when it arrives at the object ball (OB) to generate good follow action. If you were to hit lower than the 0.4R height, the CB probably wouldn't have full roll when it reaches the OB.

Diagram 3 shows another example where an immediate-roll shot is necessary. The CB is very close to the 6-ball and our options are limited. However, the carom shot (the billiard off the 6 into the 9) is a natural, provided the CB is rolling into the 6-ball. Remember the 30 degree rule? (If not, see the 30˚ rule FAQ page on my website). With many shots, because of the distance separating the CB and OB, the CB develops roll on its own even if you hit at or below center. Here, however, there isn't enough distance for that to occur. So you must hit the CB close to the 0.4R height to ensure rolling. Because the 9-ball is in the natural-angle direction, this shot is really tough to miss, provided the CB hits the 6-ball with roll. Just be careful to not use too much speed, which can cause the CB to swing out too much before curving and go wide of the 9-ball.

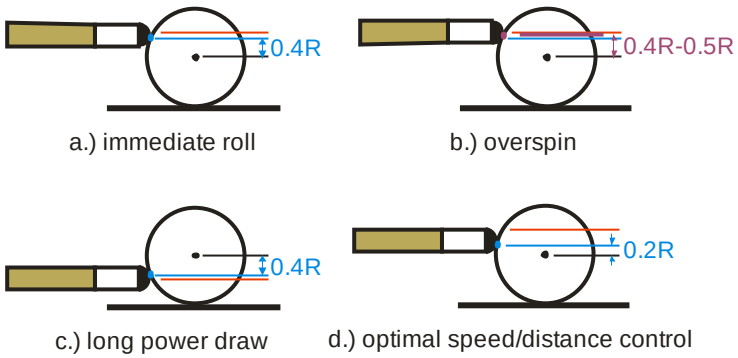


Diagram 2 Reference cue tip heights

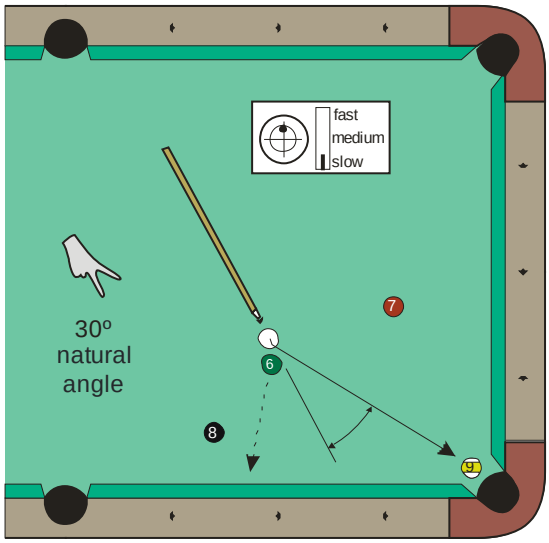


Diagram 3 Immediate roll carom shot

As illustrated in **Diagram 2b**, there is a small range of tip heights between the immediate roll height (0.4R) and the miscue limit (0.5R) where the CB can be given overspin, which is more topspin than the natural roll amount. However, as demonstrated in **NV B.36** and **HSV B.26**, it is very difficult to create significant overspin, and the potential benefit of such a small amount of additional topspin is very limited. Bottom line: it's really unwise and unnecessary to flirt with the miscue limit on follow shots. Immediate roll is more than adequate for even the most dramatic follow action.

When there's a large distance between the CB and OB and you want to draw the CB back a large distance, a "power draw" shot is required. **Diagram 2c** shows the optimal cue tip height for such a shot. It seems reasonable that to get the best draw with a shot like this, you would want to hit the CB as low as possible (i.e., as close to the miscue limit as possible). However, physics shows that the best draw action on shots like this results from hitting slightly above the miscue limit at about 0.4R (see my April '09 article for an explanation). You also need adequate cue speed to get good draw action. For more information and technique advice, see **NV B.65** and the power draw FAQ page on my website. Did you notice that the long-

power-draw tip height below center (0.4R) is the same as the immediate-roll height above center? This is just a coincidence, but it makes it easier to remember how high or low to hit the ball with these types of shots.

Diagram 2d shows another cue tip height reference at 0.2R. It turns out that this height results in the best (most consistent) speed and distance control. If you are interested in the physics behind this and don't mind a little math, see **TP B.12**. When you hit the CB in the center, it leaves the tip with maximum speed for a given cue speed, and it starts out with no spin. As the ball slides (drags) on the cloth, it slows down as it develops topspin and, eventually, natural roll. When you hit the CB at the immediate roll height, the ball doesn't slow from drag, but it has less forward speed initially than if hit at center ball. The 0.2R height provides a "happy medium" that creates the most consistent final rolling speed and eventual travel distance. Ball speed and distance will be least sensitive to slight changes in tip position at this height (see **TP B.12** for more info). Therefore, when executing a lag shot, or any shot where you want the CB to travel a precise distance, improve your consistency by hitting a little above center at 0.2R.


normal video

NV B.65 – Power draw technique advice from VEPS I
NV B.36 – Mike Page's overspin demonstration
NV B.65 – Power draw technique advice from VEPS I


high-speed video

HSV B.26 – Overspin with a follow shot


technical proof

TP B.12 - Optimal tip height for speed/distance control

I hope this article will help you be more aware of how high or low to hit the CB for different types of shots. And I hope you might have better success with these shots. Next month, we'll look at the lag shot in more detail, providing additional advice on how to be more effective and consistent with winning the break.

Good luck with your game,
Dr. Dave

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 on my website.
- I want to thank Jim Valasina. He graciously proof-reads my articles every month to help find errors and make suggestions. My article quality is better as a result of his efforts. Thanks again Jim!

Dr. Dave is author of the book, DVD, and CD-ROM: "The Illustrated Principles of Pool and Billiards," the DVD Series: "The Video Encyclopedia of Pool Shots," and the DVD: "High-speed Video Magic."