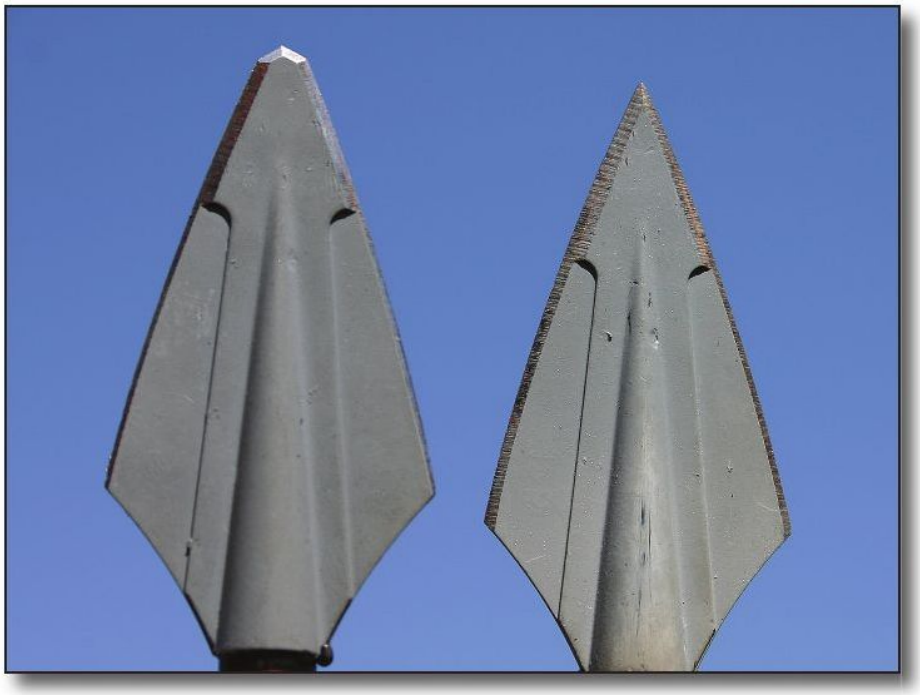
By Dr. Ed Ashby



The Tanto Tip Advantage

The first "focal study" testing I conducted during the 2005 Australian buffalo studies was an evaluation of the influence of tip design on broadhead durability and hard-tissue penetration. Since publication of the results, I've received numerous queries asking: "What *is* a Tanto tip, and what does it look like?"

The term "Tanto tip" is one I coined over a quarter of a century ago, chosen merely because the tip profile reminded me of two Tanto knife tips placed back to back. The accompanying photos will clarify what a Tanto broadhead tip looks like. "Tanto tip" is merely a profile, which can be applied in any width. Thus, one can have a narrow or wide Tanto tip, a cut-on-impact (CoI) Tanto tip, such as I modify the Grizzly factory tip to, or a non-CoI Tanto tip, such as comes on factory Grizzlies.

Initial Testing Specifications

The heads used for this study all were Tusker Concords. The Concord is a 155-grain two-blade with a long, narrow profile, having a 1.115" cut width, a cutting edge length of 2.651," and a considerable setback from tip to ferule. The steel is quite soft. In earlier test shots into buffalo, factory Concords had shown a tendency to bend frequently, especially with adverse-angle bone impacts. Specifically, 42 Concord broadheads were used for tip testing; six each of seven different tip profiles. Six of the heads retained the factory needle tip, while additional groups of six were modified to each of the following tip profiles: CoI arched, CoI round, CoI Tanto, flat (squared off at the tip), chisel (squared off and sharpened to a CoI edge), and CoI concave.

For this initial round of tests, all broadhead edges were sharpened with a *double* bevel of 25 degrees, for a 50-degree total sharpening angle. All were honed and stropped to a true shaving edge and mounted on tapered hickory shafts. Shaft/broadhead combinations were matched to give no more than plus or minus 7.5 grains variation in total mass. Both the average and median arrow mass was 771 grains. To facilitate placing all impacts on the test animals' scapular flats, shooting was done from a range of just 10 yards.

All shots were made with a longbow of 70 pounds draw weight. Average impact momentum for the test arrows was 0.442 Slug-Ft/Second. Average impact kinetic energy was 28.48 foot-pounds. This low impact force was chosen so that most of the broadheads would be unlikely to penetrate the scapula flat. Testing was conducted on two freshly killed buffalo; a young adult male and an adult female. Three shots were taken with each tip design into the scapular flats of each buffalo. All shots into the young male were taken from a broadside position, with arrows striking perpendicular to the bone's surface. All shots into the adult female buffalo were made quartering from the front, giving a sharply oblique 40-degree angle of impact on the bone.

Results

The accompanying chart shows the test results. Test numbers are fairly low, but indicate a clearly defined tendency. Even at low impact force, CoI tips having round or Tanto profiles show a marked increase in frequency of bone penetration and a low frequency of damage. No broadhead with a flat, chisel, or concave configuration penetrated the scapular flat. Needle-tipped broadheads had a low frequency of penetrating the scapula and a 100-percent bend rate.

Above—Left, an Eclipse broadhead with a Tanto tip filed into it. Right, Eclipse broadhead out of the package.

The arched tip profile faired only slightly better than the flat, chisel, and concave profiles. The stand-out durability of the Tanto profile came as no surprise, since in all prior testing not a single Tanto-profile tip had suffered damage.

Subsequent Tests

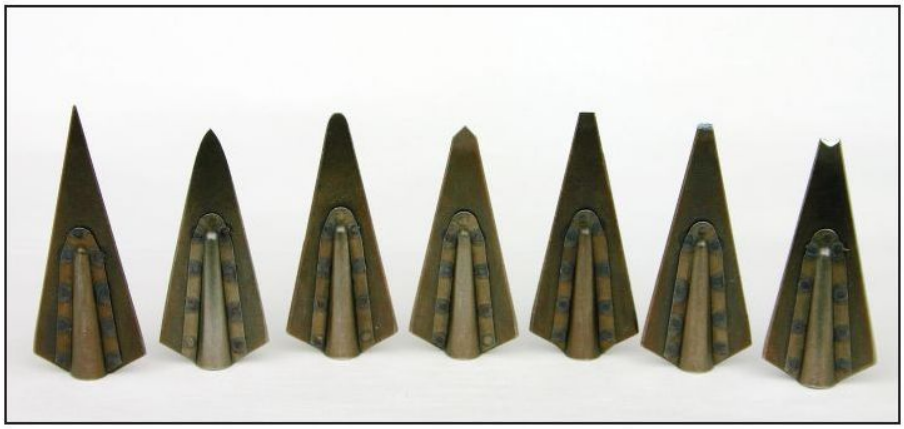
After conducting the initial Tusker Concord tip design tests, my next step was to expand the scope of research by modifying a number of different broadhead brands that had good blade strength, edge retention, and steel quality, but which, with factory tips, had demonstrated a frequent tendency to bend or break near the tip: Abowyer Custom, Eclipse, STOS, Wolverine (made by the same company as Grizzly), Magnus II, and Zwickey. The BlackStump was added to the list midway through the testing. In tests of these modifications, *no* further instances of tip damage were encountered subsequent to CoI Tanto modifications.

As you can see by these results, the Tanto tip provides by far the best overall performance on bone.

Tip bevel

At this point, I don't yet know with certainty which bevel design works best on Tanto tips. However, there is one bevel configuration to avoid: The tip should *not* be single-beveled on the same side as the main blade's edge bevel. Doing so increases the tendency for the broadhead to skid off the bone on all except precisely perpendicular impacts with the bone's surface. Certainly, skidding is not necessarily a bad thing with broadside rib impacts on open-ribbed animals, where the broadhead can slide off the impacted rib and enter the lung cavity at the next intercostal space. Yet skipping greatly reduces the broadhead's useful impact angle, increasing chances that the broadhead will skid off the rib on quartering impacts and slide along the surface of the ribs, rather than penetrating into the thorax.

Restated, a broadhead tip design that is prone to skipping on bone means that penetrating a flat bone, such as the scapula, becomes difficult on all except perpendicular impacts, with the broadhead showing a marked tendency to skid along the bone's surface rather than gaining sufficient purchase for penetration. The physical force that leads to increased skid tendency with Tanto tips that are same-side beveled is analogous to a spinning top. As you may recall from childhood, when a spinning top impacts a solid object, like a curb or wall, it rebounds, or "twists" away from the resistance.



The Tusker Concord broadhead with various tip designs.

Chart 1

Broadhead Tip Design Test

$N_{Total}=42$

Test Broadheads: Modified Concord

For all shots: Arrow Mass = 771 Gr. ± 7.5 gr.; Impact Momentum = 0.442; Impact KE = 28.48

Six shots with each tip design:
3 shots, each tip design, at approx. 40⁰ quartering from the front on an adult female Asian Buffalo;
3 shots, each tip design, from broadside on a young adult male Asian Buffalo.

All Impacts: Scapular Flat
Range: 10 yards.

N=	Tip Design	Number Broadheads Damaged	Number Pen. Scapular Flat	Average Penetration (Inches)	Range Of Penetration (Inches)	Median Penetration (Inches)
6	Tanto	1	5	9.73	6.4 - 12.1	9.07
6	Round	2	4	7.63	5.0 - 10.1	7.75
6	Chisel	2	0	6.00	5.5 - 6.6	5.94
6	Arch	3	1	5.63	5.0 - 7.1	6.06
6	Concave	0	0	4.63	4.5 - 5.0	4.50
6	Needle	6	1	5.33	4.9 - 6.1	5.00
6	Flat	2	0	5.42	4.8 - 6.4	5.06

Upcoming research

In upcoming tests, I'll further explore the ramifications of various bevel configurations for the Tanto tip, specifically (1) single-beveled from the side opposite the main blade's edge-bevel for that half of the blade, and (2) double-beveled. In either event, the angle of the edge bevel on a Tanto tip needs to be much more abrupt than the blade-edge bevel. For example, if a Tanto tip is single-beveled to 25 degrees, matching the single-bevel blade angle I've found to be most efficient, it tends to roll far too easily on heavy bone impact. This is why I'm using about 25 degrees on *each side* of the tip's double-bevel, for a total tip bevel-angle of 50 degrees.

Concerning the angle of the Tanto *slope*, where it shoulders off to either side from the tip, here too I'm yet to determine what works best, with further tests upcoming. With the factory 190 Grizzly and my own preferred Modified Grizzly design for hunting, I've been using about a 30-degree angle of attack, or tip slope. That means the total angle at the Tanto's tip is 60 degrees. While I've tested tip angles as acute at 120 degrees (total tip angle), I've encountered marked problems with such an abrupt tip angle on the short-wide 190-grain Abowyer left single-bevel head, which I'm using this year for tip-angle testing.

To date, all testing tends to *strongly suggest* that the wider the Tanto tip gets, the lower the tip's angle of attack needs to be. Restated — as the Tanto gets wider toward the rear, the tip needs to be made more pointed. I should know a lot more about the specifics after this year's testing, and will share my results in future updates.

Small Wonders

It's amazing how greatly a wide variety of such small-seeming details as tip design and angle can influence the overall performance of something as seemingly simple as a broadhead! The more I learn, the more I realize how little we've historically known with certainty about terminal arrow performance in animal tissues, and how much we've always assumed, based solely on blind faith, manufacturer hype, and unscientific anecdotal information.