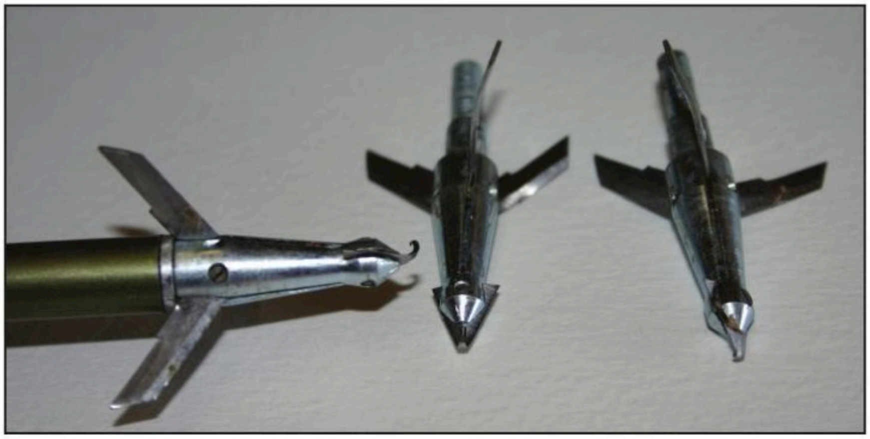


Allow me to begin this discussion of mechanical, or open-on-impact broadheads, with a quote from my 2004 Broadhead & Arrow Lethality Study Update:

"But: 'mechanicals'? — None yet tested have given adequate performance ... "

Subsequently, much of the 2005 Update was devoted to reporting on the performance of various classes of broadheads, including mechanicals on the market at the time. Since then, I've continued to include mechanical broadheads in my testing, but have not

A Critical Look at Mechanical Broadheads

By Dr. Ed Ashby

Top of Page—Steelhead broadheads all failed to penetrate bone, and all were damaged when shot.
Above—Rage broadheads failed to penetrate ribs.

updated a report on their performance. In sum, *in my subsequent testing of newer designs of mechanicals no significant change or improvement in their level of performance has been evident, compared to older mechanical designs*.

By no means have I tested every mechanical broadhead on the market. But I have sampled most of the popular mechanicals of all configurations, including those with "bacon skinner" tips and those with rearward-deploying blades. To date, none has shown a level of performance approaching that of modular broadheads using fixed-position replaceable blades ... even as broadheads using fixed-position replaceable blades don't display a consistency of performance approaching that of rigid broadheads.

Based on the performance shown by mechanical broadheads in all my testing to date, I find them unsuitable for hunting very large game, such as elk and moose in North America. Further, I find it difficult to recommend their use on *any* big game animal. Major problems include unpredictability of performance and a high damage rate, which greatly reduces penetration. Restated: Even when they hold together, the mechanical's basic design — a target point with wide, thin blades — cannot be relied on to produce acceptable penetration in large, tough animals. Moreover, failure of these blades to deploy properly and their tendency to bend or break on entry is all too common. For example, during skip-angle testing, which involves shots taken at impact angles from 25 to 45 degrees, it's not uncommon for one mechanical blade to open before the other(s). This frequently causes the arrow to cartwheel off the animal, causing little more than a flesh wound.

Following are supporting details from my 2005 Study Update, based on the 364 Asian buffalo test shots shown in the database at that time (it now contains more than double that number). When testing broadheads I use a systematic approach. Initial testing is with perpendicular impacts on the ribs, with all shots taken from 20 yards. Unless the broadhead shows an unacceptably high failure rate on the perpendicular rib impacts, I then take a series of angular rib-impact shots. Unless the failure

Broadhead Type	Avg. Penetration	Avg. Impact KE	Avg. Impact-momentum
Mechanical Broadheads	7.32"	50.74	0.47
Modular Broadheads	9.23"	45.25	0.46
Rigid Broadheads	11.41"	34.76	0.49

Chart 8
Average Penetration, Impact-kinetic-energy and Impact-momentum
All Shots
2004-2005 Asian Buffalo Testing
N = 364

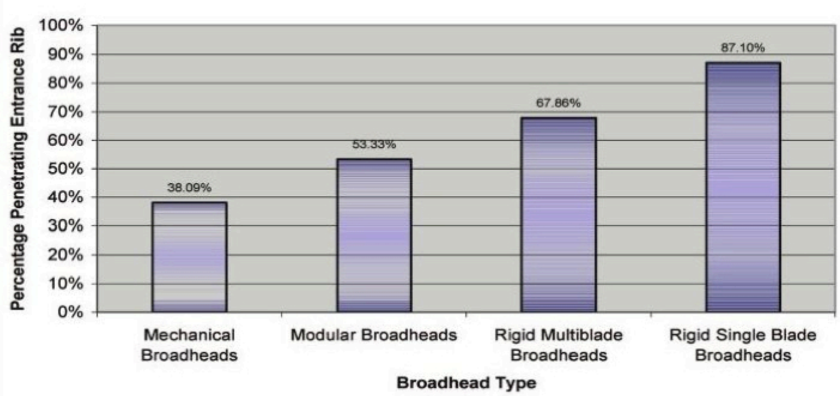
rate on the angular rib impacts is unacceptably high, I then take a series of scapular impact shots (though I often end up with a few unintentional scapula hits during rib-testing). Many broadheads that perform well on the perpendicular and angular rib impacts show failures on the scapular impacts. In essence, I'm looking for the "failure point" of the broadhead as well as its "penetration potential".

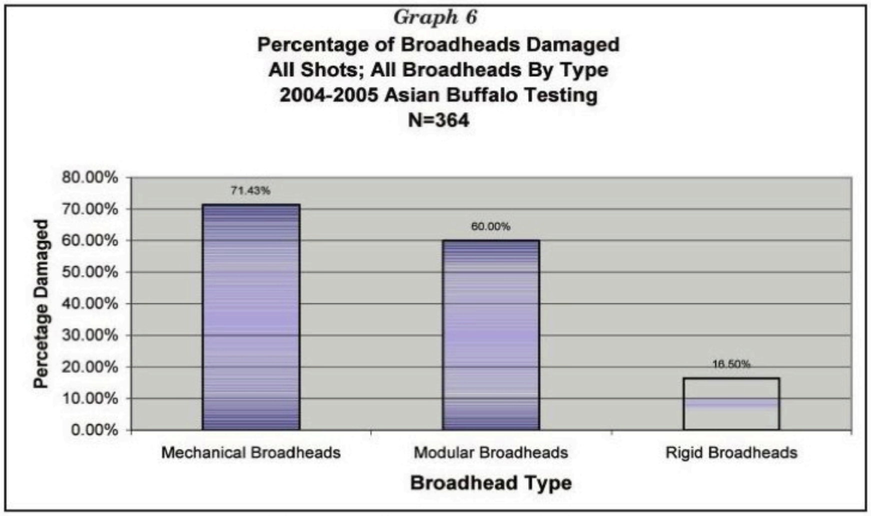
Chart 8 summarizes average penetration for all broadheads tested, categorized by type: mechanical, modular (replaceable blade), and rigid. These results reflect all "test shots," but exclude "focal study" shots such as skin and skip-angle testing. *The combined average for all rigid broadheads, both single and multiblade, shows 24 percent more penetration than modular broadheads, and 56 percent more than mechanical broadheads.* Making these results even more revealing, it's noteworthy that the mechanical broadhead test data contains only 9.5 percent scapular hits, compared to 16.7 percent for modular broadheads and 19 percent for rigid broadheads. All other shots are rib impacts. The scapula on a buffalo presents a much thicker and tougher target than do the ribs. Their lower percentage of scapula-impacts gives mechanical broadheads a marked test-specific advantage in averaged penetration over the modular and rigid broadheads, skewing upwards. Even so with this advantage, the mechanical broadheads show markedly less average penetration than either the modular or rigid broadheads.

Graph 5 depicts all shots impacting an entrance-side rib, showing percentage of shots penetrating by broadhead type. It excludes shots striking other bones, such as the scapula, before encountering the rib, but includes angular-impact (glancing) rib shots.

In evaluating Graph 5, consider that *all* mechanical broadhead shots (100 percent) were broadside, producing a perpendicular impact angle. Here

Graph 5
Percentage of Shots Penetrating Entrance Rib: by Broadhead Type
All Shots Impacting Entrance Rib; All Broadheads
2004-2005 Asian Buffalo Testing
N=224





again, this test-specific situation offered the mechanical broadheads a distinct potential penetration advantage over the modular broadhead shots, which include only 57.7 percent broadside shots, with the remaining 43.3 percent of shots quartering in from the rear (qfr) at an impact angle of 20 degrees. In the rigid-broadhead arena, multi-blade (three blades or more) shots include 10.7 percent qfr at 45 degrees, 7.1 percent qfr at 20 degrees, with 82.2 percent broadside. Rigid single-blade data include 9.7 percent qfr shots impacting at 45 degrees, 9.0 percent qfr at 20 degrees, 3.2 percent qfr at 15 degrees, and only 78.1 percent broadside. Findings reflected here are consistent with prior and subsequent data in demonstrating the mechanical broadhead's inefficiency compared to all other designs tested.

Graph 6 depicts percentage of broadheads damaged, by type. With the exception of Cape buffalo, no direct comparisons can be made between the Asian buffalo tests and my earlier studies conducted in Africa (including not only the Natal Study but also subsequent testing in Zimbabwe and Mozambique). Yet, the overall similarity to earlier results is striking. Mechanical broadheads were not generally available when the broadhead portion of the Natal Study was conducted. (On a historical note: The BH portion of the Natal study was conducted in 1984 and 1985. The Natal Study started in 1982, and I first participated in it in 1984.) Even so, the current damage rate for modular broadheads is 60 percent, compared to 64 percent in the Natal Study. Current damage rate for rigid broadheads is 16.5 percent. In the Natal Study, rigid broadheads were divided into single and multi-blade categories; while rigid single-blades showed a 15 percent damage rate, and rigid multi-blade heads suffered a 50 percent damage rate. (Worth noting is that rigid multi-blade heads used in the current testing are those that placed at the top of their category in previous testing, plus new designs not previously tested but highly recommended for inclusion by many who use them, such as the Wensel Woodsman.)

The accompanying photos show some of the typical problems and failures I've encountered with mechanical broadheads.

1. From broadside at 20 yards, all three of these 577-grain, NAP Spitfire 125 mechanical broadhead-tipped Easton Obsession arrows failed to penetrate the entrance rib on this very young female Asian water buffalo. In fact, two arrows *bounced back out* of the wound, with the third barely penetrating the rib's surface.

2. These Steelhead 125 XPs are proclaimed in ads to be "The World's Best Penetrating and Toughest Broadhead Ever Made." Yet two of these mechanical heads failed to penetrate the entrance rib at all, while the third barely made it through the rib, producing non-lethal penetration, and all three suffered blade damage.

3. No mechanical broadhead yet test-

Spitfire broadheads all failed to penetrate the entrance rib, and two of the three fired at the cow buffalo bounced out of the wound.

ed holds up well when heavy bone is encountered. Structural failure is the norm. The G-5 Tekan, with its rear-deploying blades and solid body construction, is the toughest mechanical I've yet tested. But even the Tekan routinely suffers performance-degrading damage when moderately heavy bone is encountered. Typically, the blade's retaining pin is forced through the machined steel of the ferrule's body, leaving only the tiny forward tip portion to penetrate into the thorax.

4. Supporters of mechanical broadheads may contend that testing against the ribs even of immature buffalo does not correlate with results from the game typically hunted in the States. The Tekan 125 mechanical broadhead shown here was recovered by a meat processor from a rifle-killed Georgia whitetail, and was delivered to me still imbedded in the entrance-side rib. Two of the three blades failed to deploy. Both non-deployed blades were imbedded in the rib. Note that all three of the blades are bent to the side, which prevented the deployment of two of the blades. The non-deployed blades are wedged so tightly that they can't be opened with finger pressure. It's impossible to know with certainty the particulars of the shot on this whitetail, but based on similar occurrences in my testing, I suspect that the arrow struck at a modest angle and one blade deployed at impact. The unequal deployment of the blades caused the arrow shaft to abruptly swing laterally, and the torque thus created caused the other two blades to be twisted laterally as they impacted tissue. Once twisted, these remaining two blades were wedged so tightly shut that they failed to open even when they hit bone.

5. Additionally, in the 2008 testing I included the Rage, one of the newer and most highly recommended rearward-deploying mechanical broadheads. As of this writing I have not yet entered or analyzed the full data from 2008, and although I have the field photos, much of the recovered-broadhead photogra-

phy remains to be completed. However, the field record sheets for testing of the Rage reveal that only 33 percent of test shots penetrated the entrance rib on a *young* adult male Asian water buffalo. Those Rage broadheads were shot from a Martin Jaguar compound drawing 60 pounds at 27 inches. All shots struck back of the shoulder, at the shoulder crease.

An interesting comparison can be made between the results shown by the Rage and results from extensive testing done this year with a 40-pound recurve at 27" draw with Grizzly rigid two-blade broadheads. There were 48 shots with the 40-pound recurve, using four different arrow sets of 12 arrows each. The arrow sets for the 40-pound recurve had mass weights of 620, 623, 691 and 723 grains. Though the arrows from the light draw-weight recurve had only one-third the kinetic energy and 70 percent of the momentum as those shot from the 60-pound compound, the rigid two-blade heads showed an entrance rib penetration rate 2.27 times greater than exhibited by the Rage. For all shots that did penetrate the ribs, the Grizzlies averaged almost one-third more overall penetration than the Rage.

The results of Spitfires shot into a buffalo; all failed to penetrate.

Conclusions

The biggest problems with mechanical broadheads are their high damage rate, which greatly reduces their penetration potential, along with their overall unpredictability of performance. Even when a mechanical head holds together, the basic design, often emulating a target point with thin wings, does not consistently produce acceptable penetration on large, tough animals. Moreover, failure of blades to deploy properly, and/or the blades' tendency to break or bend on impact, is a common occurrence with mechanicals. In all my testing to date, the "work" mechanicals do on impact is unreliable and clearly inferior to that shown by more traditional broadhead designs. Consequently, I find open-on-impact broadheads unsuitable for hunting very large game such as elk and moose. Furthermore, based upon their observed performance in fresh, real-tissue testing, *I find it difficult to recommend the use of mechanical broadheads on* any *big game animal*, no matter the draw-weight or delivery speed of the bow they are shot from.

Mechanical broadheads offer only one advantage over other types of broadheads: They shoot like target points. This allows the bowhunter to replace target tips with mechanical broadheads of the same weight and have the arrow shoot the same. There will be no need to retune the bow/arrow setup, and no need to change any sight-pin settings for compound shooters. But solely for the sake of this personal convenience one sacrifices a huge portion of the hunting arrow's terminal reliability and effectiveness and risks a troublingly higher wounding and loss rate on game. *In my opinion, based on a quarter-century of intensive testing and recording of results from real shots into real tissues,* in situ *on real animals — with alternative types of broadheads offering far superior terminal performance readily available — the use of mechanical broadheads presents a higher than acceptable ethical risk.*

Even while recuperating from major back surgery, Dr. Ashby continues his studies, currently experimenting with various techniques for achieving Extreme Forward of Center (EFoC) arrow-weight balance … the topic of our next installment in Traditional Bowhunter's ongoing arrow lethality series. For readers wanting more in-depth detail, the Traditional Bowhunter website maintains a full library of Ashby research reports and updates at www.tradbow.com. Dr. Ashby wishes to thank David Petersen for his contribution to this article and the previous condensed reports in this series.