Have Today's Increased Bore Sizes Improved Trap Gun Performance?

February 2016
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Have Enlarged Bore Diameters Led to Better Trap Guns?

A comment on an online forum outlining the benefits of back-boring caught my attention recently. Explaining why he was having his gun’s bore enlarged, that is, “back-bored,” a correspondent wrote:

“It’s been proven that there’s plenty of gas seal in a 0.740”-diameter barrel with less shot deformity and less perceived recoil.”

Yes, there is usually plenty of gas seal and it is routinely claimed that over-boring leads to reduced recoil, but has anything been “proven” about the beneficial effect of larger bores on “shot deformity?”

I’m all for customizing a shotgun to better suit its intended use, but before I spend my money I’d like to know if the benefits of the proposed modification are backed by scientific testing. “What would this help and why?” I ask myself, “And how much?”

I have been disappointed with the many magazine “tests” of the new Beretta DT11 and its unusual boring, each enthusiastic writer describing the improved patterns and reduced recoil Beretta’s Stellium product confers, without providing any evidence at all that it is true. Instead of actual test results, the articles I’ve seen are no more than barely-reworded sales brochures. How much does what we talk about at the club or online differ from that? Rather than just repeating what we have been told, let’s see what testing tells us.

How We Test for Shot Deformation

We don’t test deformation directly, but we can look at shot patterns to infer facts about shot deformation. It’s reasonable to assume that deformed pellets will scatter more during their high-speed trip to the target than will pristine, spherical pellets and so the patterns formed by damaged pellets will be “thinner” and more widely-spread. Do the patterns produced by standard-bore guns show evidence of more shot-deformation than those with larger bores?

In his 2010 book Sporting Shotgun Performance, Dr. AC Jones compared two guns, a Browning B25 with a 0.725” bore and a Miroku MK3 with a 0.736” bore. He found no difference in pattern percentages, pattern spreads or pellet distributions in the patterns of these two guns when the choke constrictions were similar. He reported that he found no evidence that a back-bored barrel is in any way superior to standard-bore ones (pages 151-153).

I think that an extension of Dr. Jones’ tests with guns more typical of those used by US trapshooters will not only interest readers here, but also introduce them to the data collection and analysis methods I will use in many of the experiments I will report on in the future.

An Early Test of Five Full-Choke Perazzis

In 2006 I tested five Perazzis with unmodified or, alternatively, over-bored barrels, to see what sort of pattern percentages they shot, that is, the percentage of the pellets in the load they put in a 30” circle at 40 yards. (See TERMS EXPLAINED on claytargettesting.com for more information.) They all had chokes close to 0.040” and were tested with ten counted patterns at 40 yards. All my other tests were carried out the same way, the shells used being the best available at the time. This is what I got:

Figure 1. Pattern percentages of five old Perazzis
There was nothing in my results that led me to believe that over-boring offered anything special, performance-wise, to old Perazzis, but I did not know how the modified guns had performed before the work was done, or what had been specified as the work’s desired outcome. I needed to know more about the guns I tested.

Performance Testing Guns With Different Bore Diameters

TEST 1: An "Old-Style" Compared to a "New-Style" Perazzi

Four years ago I set out to make a better-controlled test. I already had an MX2000 with “current” dimensions: 0.740” bore, 0.040” choke, and a 3-inch chamber. With the help of Texas Perazzi dealer Doug Gray, I had Perazzi make me a TM9X with “classic” measurements: 0.728” bore, 0.040” choke, and a 2¾” chamber. Thus I had two guns of recent manufacture with known histories to see how much had been gained in the changes made over the last two decades, in particular the drift toward longer chambers and larger bores.

TEST 1 COMPARISON 1: Pattern Percentage at 40 Yards

Again, if you don’t understand the “pattern percentage” statistic look for the explanation in TERMS EXPLAINED on claytargettesting.com.

Because this is scientific pattern testing we will not just evaluate our patterns by eye; we will count all the pellets in dozens of patterns. Remember, if you were just looking at these patterns you would have little idea about their relative pattern-percentages, that is, their pellet-counts, so you couldn’t even take the first step as is pictured to the right.

As you see, pattern percentages vary randomly, shot to shot. In this case, which gun is performing “better” changes several times in just this 10-shot test and these two guns differ in some shot-paired comparisons by only a little and in others by a lot.
The only way to make sense of these data is to organize our results to show what’s happening.

Let’s rearrange the graph to put the patterns with the lowest pattern percentage on the left, the highest on the right, and fill in the rest, in ascending order from the left.

These two guns, the TM9X with “classic,” the MX2000 with “modern” dimensions, produced almost equal pattern percentages, differing in average by only 0.3 percent. Their equal pattern percentages provide no support for the idea that the larger bore of the MX2000 led to less pellet deformation or that the guns with different bore diameters differed in the pattern percentages they produce.
These two guns, one with “classic,” the other with “modern” dimensions, produced equal pattern evenness. The average central thickening values these guns produced, a bit less than 2, are typical of full-choke performance at 40 yards. Their equal and unremarkable performance lends no support to the idea that the larger bore of the MX2000 produced more even patterns.

**Figure 5. Central thickening arranged from lowest to highest**

The metric for “pattern spread” is “75% diameter.” That is, the diameter of a circle which would contain, on the average, 75% of the shot. (See terms explained on claytargettesting.com for more information.) You can't estimate it well by eye. OK, sometimes, if the difference is great enough, you might guesstimate, “this pattern is more open than that one,” but you can't do better than that. In particular, you can't say how much more open and that is, after all, what you want to know.

**Figure 6. 75% diameters displayed in order fired.**
It is often claimed that over-boring “brings pellets in from the far edges toward the center where they can do some good” or, conversely, “moves some pellets out from an excessively hot center to the periphery where they can raise scores by filling out the pattern where it is too thin.” In fact, in this experiment neither effect occurred.

I recently replicated the test above with a brace of respected trap guns. One was a mid-1980s Perazzi Mirage with a 0.724” bore and 0.038” choke, the other a Remington 870 Competition with a 0.745” bore and 0.040” choke. The latter has a reputation as a super-tight shooter. The results of the test mirrored those of the previous one.

<table>
<thead>
<tr>
<th>Gun</th>
<th>Shot size and speed</th>
<th>Pattern %</th>
<th>Central Thickening</th>
<th>75% Diameter</th>
</tr>
</thead>
<tbody>
<tr>
<td>Perazzi Mirage 0.724” bore</td>
<td>7½ 1200 fps</td>
<td>78.1%</td>
<td>1.8</td>
<td>28”</td>
</tr>
<tr>
<td></td>
<td></td>
<td>SD=4.3%</td>
<td>SD=0.35</td>
<td>SD=2.0”</td>
</tr>
<tr>
<td>Remington 870 0.045” bore</td>
<td>7½ 1200 fps</td>
<td>78.7%</td>
<td>1.9</td>
<td>27.4”</td>
</tr>
<tr>
<td></td>
<td></td>
<td>SD=2.9%</td>
<td>SD=3.0</td>
<td>SD=1.5”</td>
</tr>
<tr>
<td>Perazzi Mirage 0.724” bore</td>
<td>8 1145 fps</td>
<td>78%</td>
<td>1.9</td>
<td>27.1”</td>
</tr>
<tr>
<td></td>
<td></td>
<td>SD=3.2%</td>
<td>SD=2.6</td>
<td>SD=3.2”</td>
</tr>
<tr>
<td>Remington 870 0.045” bore</td>
<td>8 1145 fps</td>
<td>77.8%</td>
<td>1.7</td>
<td>27.9”</td>
</tr>
<tr>
<td></td>
<td></td>
<td>SD=3.3%t</td>
<td>SD=3.3</td>
<td>SD=1.3”</td>
</tr>
</tbody>
</table>

These two guns, one with "classic," the other with "modern" dimensions, produced equal pattern spreads. They both produced 75% diameters of about 28 inches, absolutely typical for full chokes at 40 yards. The equal pattern spreads provide no support for the idea that the larger bore of the MX2000 moved pellets either in from the edges or out from the center.

Figure 7. 75% diameters arranged smallest to largest

These two guns of differing bore-diameters shot virtually the same pattern percentages, central thickenings, and 75% diameters. In addition, this occurred with both 1200 fps “heavy 7½” and 1145 fps “light 8” shells, using Winchester AA shells with very hard shot.

The common assertion that 7½’s shoot higher pattern percentages or tighter patterns than 8’s was not supported by this test. Nor was the likewise-common assertion that heavy trap-loads spread more than lights. Both these findings are entirely consistent with my own past tests of and those of Dr. Jones as reported in his book.

Two legendary guns with different bore-diameters were tested. They produced patterns which did not differ, on the average, in pattern percentage at 40 yards, central thickening, or 75% diameter.
In the absence of contradictory data, collected and analyzed with the care used here, it is reasonable to conclude that good guns are insensitive to their bore diameters in the range of 0.724” to 0.745” and the near-universal move by manufacturers from the classic dimensions to the modern ones has not improved the patterns produced by their guns at all.

This result is consistent with Dr. Jones’ conclusion on page 153 of *Sporting Shotgun Performance*: “The story of over sized (Back-Bored in this case) barrels is no story. The onus is on the proponents of Back-Bored guns to produce robust evidence in support of their claims. I think it is unlikely that any will be forthcoming.”

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