Performance Evaluation of Western Saddle Pads

A new study evaluating the cushioning and moisture characteristics of six western saddle pads.

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The local tack shop has them in all shapes, sizes and colors, and they are an essential part of every horse's tack – the saddle pad. Lately, interest in the equine industry has lead to an increase in the manufacturing of technologically advanced saddle pads – often at a higher price. But what makes a good saddle pad? Although there has been little research conducted to measure the performance of these high-tech pads, there is a growing interest in providing more information to consumers regarding the purpose of saddle pads and the materials used in them. Nevertheless, as anyone who has purchased a saddle pad recently knows, the endless combination of materials used in pads today makes purchasing one extremely confusing, especially when each manufacturer claims his is the best. But which pads are "the best" and what does "the best" mean?

The primary purpose of a saddle pad is to facilitate riding comfort for the horse. It does this by easing the connection between the horse's back and the hard surface of the saddle. A pad can ease minor fit problems by acting as a space filler, evenly distributing pressure and eliminating high pressure points underneath the saddle. It can also pull moisture away from the horse's back, anchor the saddle, and protect it from sweat and dirt. However, saddle pads are not designed to fix major saddle fitting problems and should not be used as the solution to an ill-fitting saddle.

Why study saddle pads?

The ridden horse experiences repetitive patterns of pressure that increase in severity with increases in speed, weight and instability of the rider, and ill fit of the saddle. These pressures in addition to sweat and shifting can lead to bruising, scalding, breakage of hairs, high pressure points, pressure sores, decreased performance of the horse, and interrupted communication between the horse and rider.

Pressure sores are one example of the damage that can occur under the saddle pad. Pressure sores are caused by pressure, shearing forces (sliding of two opposing surfaces against each other), friction, and moisture. Many times, pressure sores are only visible on the surface once permanent internal damage has already occurred (Todd & Thacker, 1994). Therefore, it is important to choose a saddle pad that fits with the saddle you will be using, and works to eliminate these problems before they cause damage.

Therefore, a saddle pad should provide the following performance characteristics:

- cushioning and shock absorption, evenly distributing pressures and eliminating high pressure points,

Gel. The Impact Gel® Close Contact Contour Pad uses a gel for its core. Gels have characteristics of both a liquid and a solid. For example, the gel in the Impact Gel® did not run like a liquid when it was cut, but when enough pressure was applied to the sample, the gel deformed and oozed slightly out of the sides of the sample. Gels are most widely recognized for their use as shoe inserts and are known for their shock absorbing capabilities.

Fleece vs. felt. The terms fleece and felt both refer to fabric structures and both can be made with manufactured and/or natural fibers. Fleece is a soft, bulky fabric made with a pile (upright ends of the fibers protruding from the fabric). Felt is created when heat, moisture, and pressure are applied to a mass of fibers causing them to become entangled, forming a felted fabric. The Reinsman® uses an acrylic/polyester blend fleece liner and the SMx® Air-Ride™ pad uses a merino wool fleece liner – a very fine, soft wool from the merino sheep. All other pads tested used either a wool or wool blend felt as their liner or top.

Testing Procedures

All of the tests were conducted on the new saddle pads before they were used. The pads were then sent to an equine training facility where they were ridden vigorously for 200 hours. All pads were then returned to Kansas State University to be re-evaluated using the same tests in order to evaluate their durability.

Pressure distribution. The Force Sensing Array (FSA) pressure mapping system made of a pressure mat containing 256 pressure sensors was used to evaluate the pressure distribution of the pads. The FSA system was developed by Vision Engineering Research Group (VERG, Inc.) of Winnipeg, Manitoba, Canada. The mat was placed on a horse under a saddle and rider, and the pads were tested for 30 seconds at three different gaits – walk, jog, and lope. The mat communicated with a computer to create a scan of the pressures measured underneath the saddle pad. A still image of this pressure scan is shown in Figure 1. We used the data collected and a video of the horse and rider to create what we called the dynamic compilation video (Figure 2). A key of the pressures corresponding to each color in the compilation video is provided in Figure 3.

The compilation videos were used to determine the most appropriate way to statistically analyze the pressure data. We used the average peak pressure to represent the highest pressure measured under the pad and the standard deviation to indicate how evenly the pressures were distributed on the horse's back. It was our assumption that the ideal saddle pad would have a more even distribution of pressure (i.e., low standard deviation) and low peak pressure.

Compression resistance and recovery. Compression resistance is a material's ability to resist change in dimension while under a heavy load. Compression recovery is a material's ability to recover to its original dimensions after the load is removed. The ideal level of these variables is unknown in a saddle pad application; however, they are crucial factors in shock absorption. These variables were measured using a deadweight compression system where a 3 in. x 6 in. sample of each pad was placed on a platform and compressed under a load equivalent to the highest peak pressure measured with the FSA system. The samples were then allowed to recover from compression for 8 hours.

Wicking. Saddle pads are designed to protect the saddle from getting wet. Therefore, along with the saddle, they block the movement of moisture through the saddle pad, reducing the evaporation of sweat from the horse's back. Consequently, much of the sweat produced remains in the liquid state. Liquid moisture can be transferred along the surface of the saddle pad liner via wicking – the spontaneous flow of liquid in a porous substrate (e.g., fabric) as a result of wetting (Kissa, 1996). The movement of liquid moisture through a textile is dependent upon whether the material is hydrophilic or hydrophobic. A hydrophobic fiber will repel liquid, while a hydrophilic fiber will attract liquid, allowing it to wick or move along the surface. The liquid wicking rate of each sample was measured by hanging a 10 in. x 3 in. sample 0.5 in. under water and measuring the distance the water traveled up the sample after one hour of submersion. It was our assumption that the ideal saddle pad would have a high wicking rate, which would mean it has a better ability to pull liquid off of the horse's body and spread it along the surface of the lining fabric.

Which pad performed the best?

It is difficult to determine which pad is "the best" because pads provide different levels of performance on different variables. Therefore, we need to prioritize which characteristics are the most important in maintaining the health and comfort of the horse.

Pressure distribution. The Force Sensing Array (FSA) analysis provided the most important and meaningful information in the evaluation of the saddle pads. This is because peak pressures felt by the horse can cause the most potential damage under the saddle pad during riding.

We cannot assume that the pads in this study that exhibited the highest peak pressures and highest standard deviation are "bad" or harmful to the horse, because the level of pressure that will potentially injure a horse is not known. The pads that gave the poorest performance are only less desirable in comparison to the other pads tested.

Before use, the SMx® Air-Ride™ and ESP™ Memory Foam saddle pads performed significantly better than the Pro-Ride Neoprene saddle pad, as they were better able to reduce the peak pressures. The Pro-Ride Neoprene pad exhibited the highest peak pressure and standard deviation of all pads. The SMx® Air-Ride™ and ESP™ Memory Foam, as well as the Reinsman® pads were better able to evenly distribute the pressures under the saddle, as indicated by significantly lower standard deviation values. (See Figure 4.)

Professional trainers at the training facility where the pads were ridden refused to ride the Pro-Ride Neoprene saddle pad due to a concern that the center seam construction would impose on the horse's spine. Therefore, only five pads were ridden and evaluated after use.

After 200 hours of use, all ridden pads displayed slightly lower average peak pressures; however, these differences from before to after use were not statistically significant. Nevertheless, this decrease in peak pressure suggests that the saddle pads experienced a period of wear-in before exhibiting their best performance, similar to the wear-in period of a shoe. After use, the Wrangler® SMx H.D. Air-Ride™, ESP™ Memory Foam, and SMx® Air-Ride™ pads had

significantly lower peak pressures than the Impact Gel® saddle pad (also a premium priced pad). (See Figure 5.) Lower peak pressures indicate superior cushioning performance.

Compression resistance. We performed this lab test to determine if the results could be correlated to the FSA system data measured with a horse and rider. Although, there was no overall correlation between the results of the two tests, the findings did suggest that those pads with a high compression resistance might actually be very stiff and not able to conform well to the horse's body, causing high peak pressures on the horse's back. However, it is questionable whether the compression test is able to provide any meaningful predictive results regarding the performance of saddle pads.

Nevertheless, before use results showed that the Wranlger® SMx H.D. Air-Ride™, Impact Gel®, and Pro-Ride Neoprene saddle pads appeared less flexible than the other pads as they had higher resistance to compression. Those pads with high resistance to compression had high recovery because they did not compress that much in the first place so they would be expected to recover the most. On the other hand the ESP™ Memory Foam pad, after compressing significantly under load, recovered significantly indicating it's superior resiliency. After use, all pads displayed an increase in resistance to compression, which is most likely due to their decrease in thickness and resultant increase in density (measure of mass per unit volume).

Wicking. The ideal saddle pad should have a relatively high wicking rate. Before use the Reinsman® and SMx® Air-Ride™ pads had superior wicking properties compared to all other pads. The Wrangler SMx H.D. Air-Ride™ and ESP™ Memory Foam pads, had significantly better wicking rates than the Pro-Ride and Impact Gel® pads, which did not wick at all.

After use, wicking rates of all pads became more similar, which may be related to the build up of dirt, horsehair, and sweat, and the abrasion of the lining materials of each pad. However, the SMx® Air-Ride™ had a significantly higher wicking rate than all other pads tested after use.

Overall Comparison of Saddle Pad Types

The reasoning for elimination of the Pro-Ride Neoprene lower priced pad from the durability evaluation of this study was supported by the pressure distribution data collected on this pad before use. This pad exhibited the highest average peak pressure and standard deviation, the highest resistance to compression and consequently, the highest recovery from compression. Additionally, this pad displayed a 0 mm wicking rate.

The Reinsman®, also a lower priced pad, seemed to have provided middle-of-the-range performance when compared to other pads tested. Although this pad displayed the highest wicking rate before use, its wicking rate decreased after use. It also had the second highest peak pressure and standard deviation after use.

Before use, the Impact Gel® pad exhibited mid-range performance for average peak pressure and pressure distribution. It also had poor wicking and a high resistance to compression. Even though this pad displayed an increase in wicking rate after use, it gave the highest peak pressures, standard deviation, compression resistance, and compression recovery after use. These

results may indicate that the type of gel used in this pad is very stiff. Although we do not know whether the pressure levels measured under this pad are harmful to the horse, this premium-priced pad did not perform as well as the other premium-priced pads.

The SMx® Air-Ride™ (premium-priced) displayed superior performance with the lowest peak pressure and standard deviation before use and significantly lower peak pressure than the Impact Gel® after use. This pad also exhibited superior wicking properties both before and after use.

Along with the SMx® Air-Ride™ and ESP™ Memory Foam pads, the Wrangler® SMx H.D. Air-Ride™ exhibited the best performance in peak pressure elimination and pressure distribution after use. This pad contains a thicker core of the same material found in the SMx® Air-Ride™. Thus, the fact that there were no significant differences in pressure distribution between these two pads after use suggests that the extra thickness of the core material in the Wrangler® SMx H.D. Air-Ride™ may not be necessary.

Finally, the ESP™ Memory Foam pad (premium priced) performed as well as the Wrangler® SMx H.D. Air-Ride™ and SMx® Air-Ride™ in pressure distribution testing and gave superior compression resistance and recovery values. However, the compression evaluations revealed that when under load, the Memory Foam component of this pad completely collapsed. It appeared that the materials actually providing the cushioning were the woven wool top and wool felt liner. This suggests that the Memory Foam available in the ESP™ pad may not be an appropriate or necessary component.

Conclusions

The many types of saddle pads available to consumers today make purchasing a pad a difficult. When choosing a pad, consumers should consider several factors including the price, quality, and durability as they relate to the anticipated level (rigor) and length of use. Consumers should seek advice from a reputable retailer (preferably with riding experience) and search for technical performance information from manufacturers that is based on independent scientific research.

In general, the premium-priced saddle pads evaluated in this study performed better than the lower-priced pads, with one exception. However, all pads remained durable through 200 hours of use and actually improved slightly in performance after their initial use. A consumer who will only be involved in light riding once a week may not require the level of performance from a pad that someone who rides vigorously five times a week needs. Nevertheless, the consumer's first concern should be to protect their horse and provide him with a pain-free riding experience.

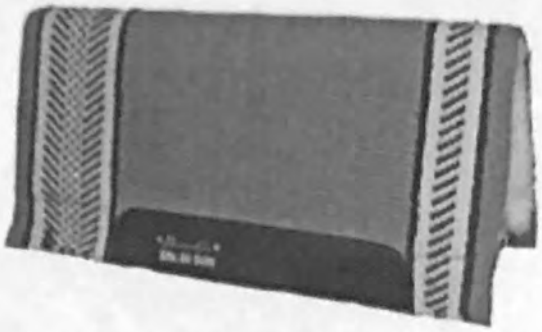
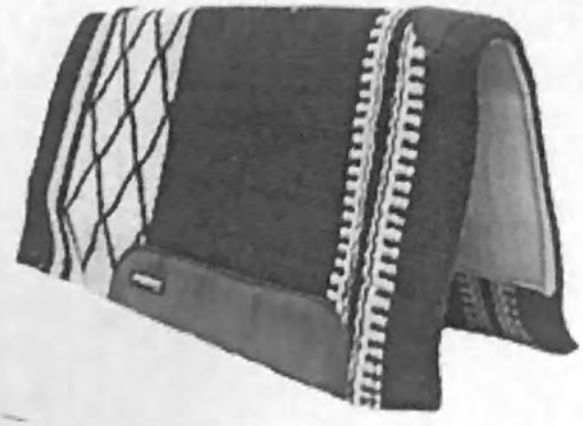
References

Brock Performance Composites. (n.d.). Retrieved July 30, 2006, from http://www.brockusa.com.htm

Kissa, E. (1996). Wetting and Wicking. *Textile Research Journal, 66*(10), 660-668.

Todd, B. A., & Thacker, J. G. (1994). Three dimensional computer model of the human buttocks. *Journal of Rehabilitation Research and Development, 31*(2), 111-119.

Table 1. Western saddle pads selected for study

Saddle Pad Description	Picture of New Saddle Pad
SMx® Air-Ride™ Western Show Pad Professional's Choice Sports Medicine Products, Inc. *www.profchoice.com* **Price:** $169 **Composition:** Top is made of a woven wool Navajo blanket, the core material is a 0.5 in. closed-cell composite foam, while the liner is a merino wool fleece. **Weight:** 5.8 lb. **Dimensions:** 34 in. x 36 in.	
Impact Gel® Close Contact Contour Pad Impact Gel Corporation *www.impactgel.com* **Price:** $130-$170 **Composition:** Both the top and liner are made of a wool/polyester felt, and the core material is a semi-solid gel. **Weight:** 5.15 lb. **Dimensions:** 29 in. x 32 in.	
ESP™: Extra Sensory Protection Memory Foam pad EquiBrand – Classic Equine Products *www.equibrand.com* **Price:** $137 **Composition:** Top is a woven wool blanket, core material is 0.5 in., 4 lb./ft.^{3} Memory Foam, and liner is 0.75 in. wool felt. **Weight:** 8.2 lb. **Dimensions:** 34 in. x 36 in.	

Wranlger® SMx H.D. Air-Ride™ Saddle Pad Professional's Choice Sports Medicine Products, Inc. *www.profchoice.com* **Price:** $130 **Composition:** Top is a woven wool Navajo blanket, 0.75 in. core material is a closed-cell composite foam, and the liner made of wool felt. **Weight:** 5.6 lb. **Dimensions:** 34 in. x 36 in.	
Pro-Ride Saddle Pad Pro-Ride **Price:** $90 **Composition:** Top is a felted wool, while a 0.75 in. 1.2 lb./ft.^{3} density Neoprene makes up both the core and liner. **Weight:** 6.1 lb. **Dimensions:** 31 in. x 32 in.	
Reinsman® Fleece Bottom Pad Reinsman® *www.reinsman.com* **Price:** $58 **Composition:** Top is a Herculon polypropylene fiber woven fabric, the core material is a wool felt filler, and the liner is a 10% acrylic/90% polyester fleece. **Weight:** 5.3 lb. **Dimensions:** 3 2in. x 32 in.	

FIGURES

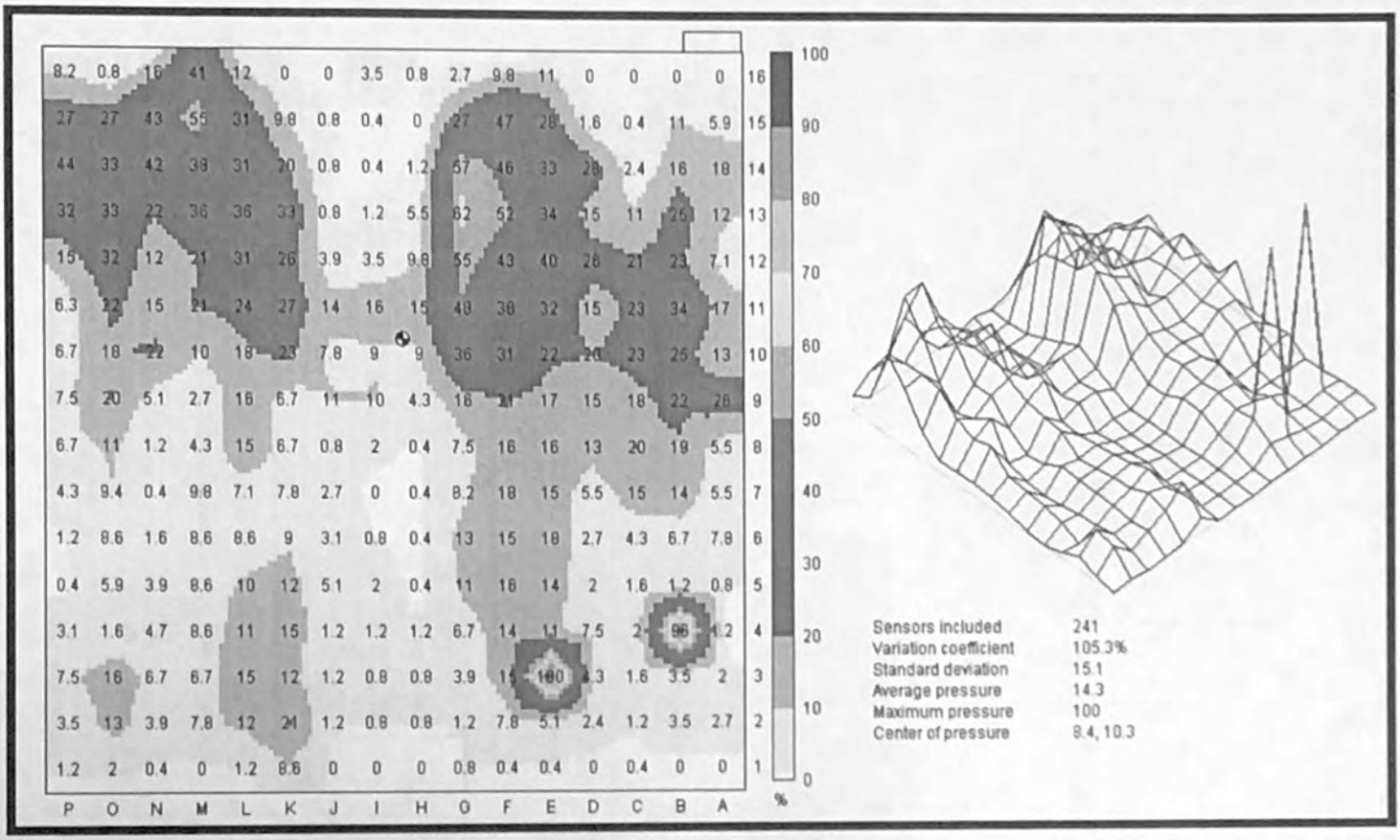


Figure 1. Still image of Force Sensing Array (FSA) pressure scan. The pressures in this scan are concentrated in the area of the withers. The two peak pressures in the lower right corner are from the two broken sensors found during testing, these values were controlled for and did not affect the results of the study.

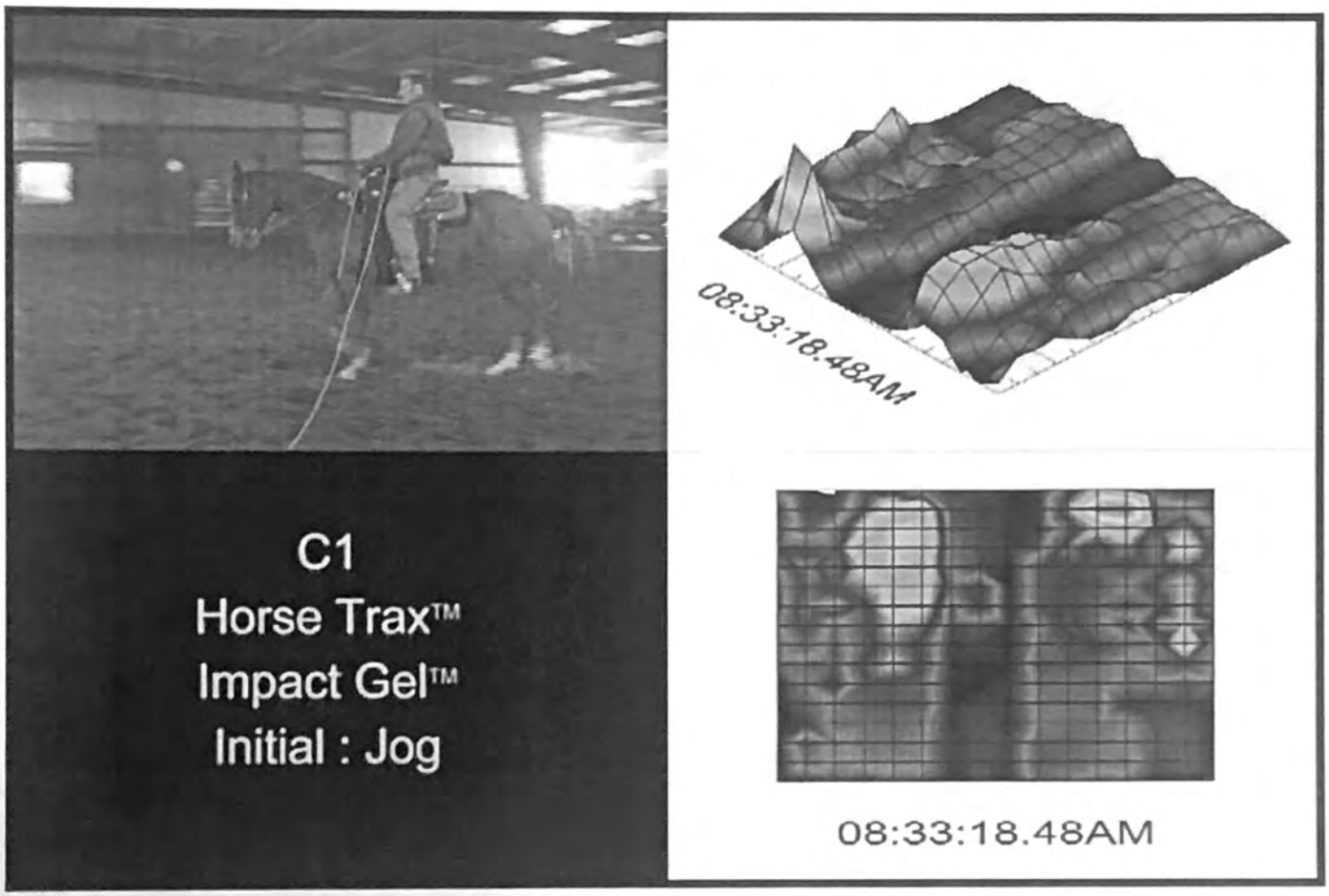


Figure 2. Still image of FSA dynamic compilation video. This scan displays a pressure peak on the right side of the wither and the variability in color indicates an uneven distribution of pressure.

Figure 3. FSA color-pressure key. This indicates the pressure (psi) that corresponds with each color in the compilation video shown in Figure 2.

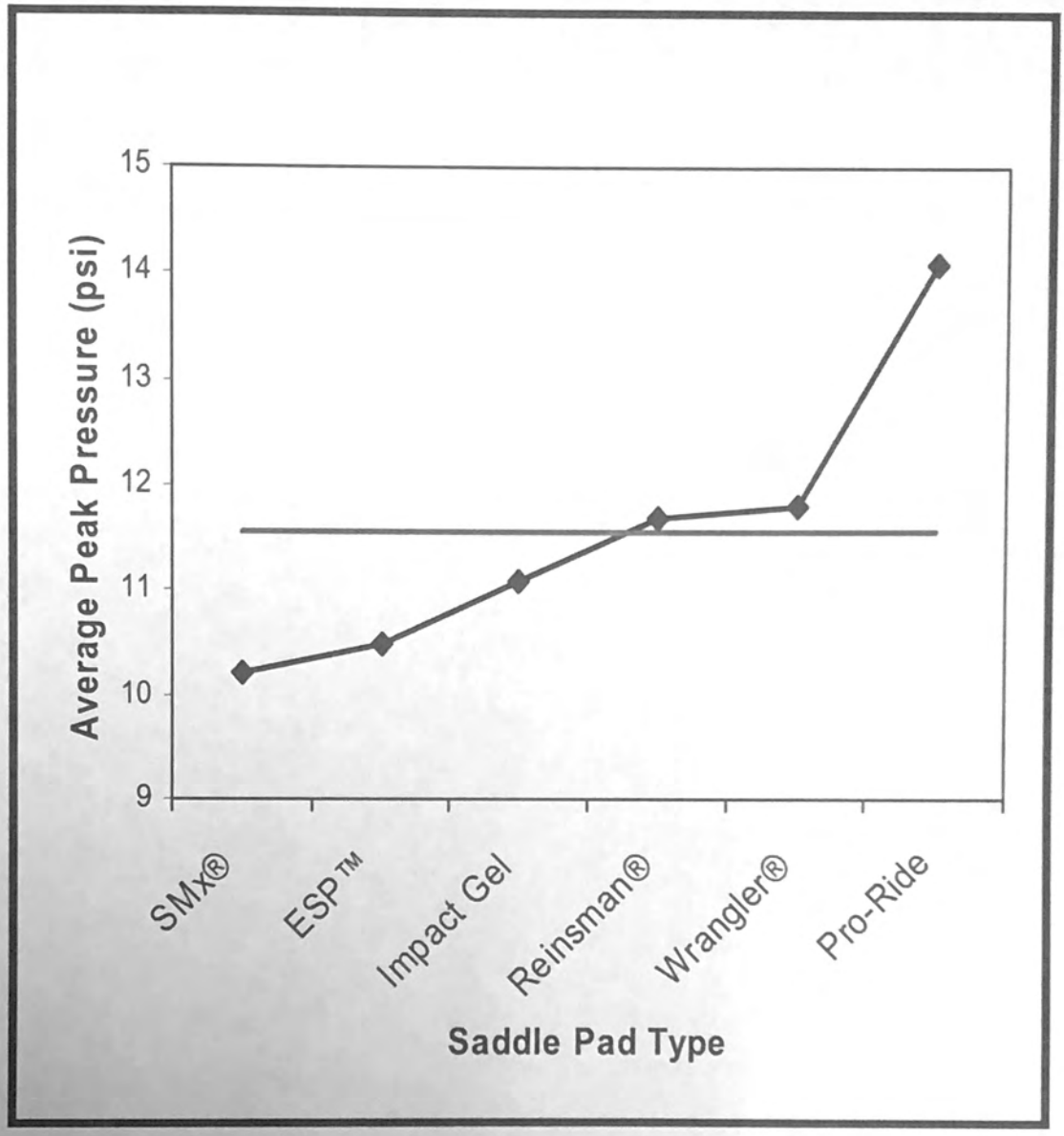


Figure 4. Results of statistical analysis for average peak pressure before use. The horizontal pink line indicates the average peak pressure of all pads.

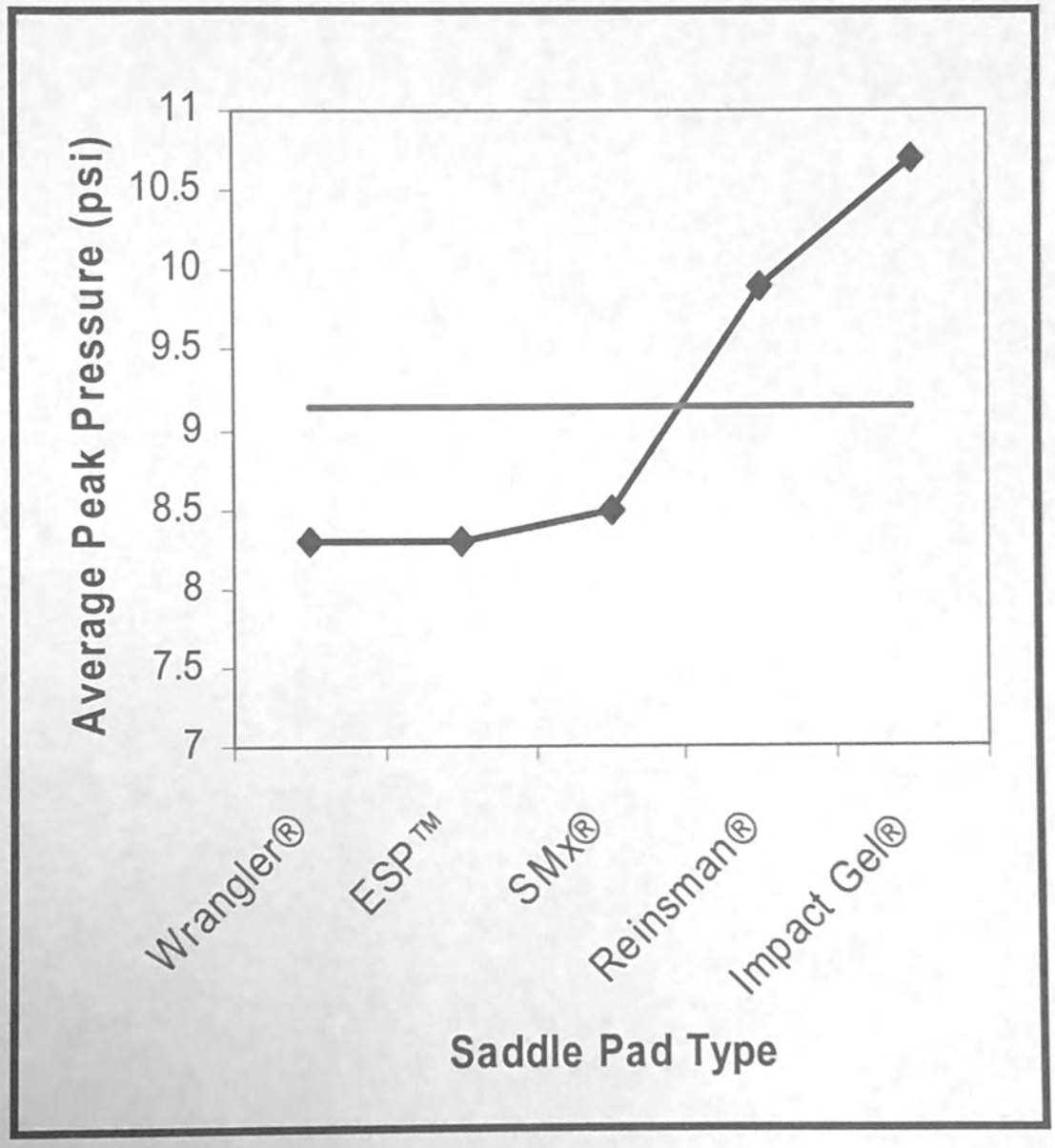


Figure 5. Results of statistical analysis for average peak pressure after use. The horizontal pink line indicates the average peak pressure for all pads.