**Understanding Research in Horse, Saddle and Rider Interaction: The Treeless Saddle**

*Anne Bondi*

Researchers at Michigan State University carried out a comparison of pressure distribution under a conventional saddle and a treeless saddle.

The application of pressure-measuring technology has highlighted the problems inherent in finding a saddle that fits well on an individual horse. After failing to find a conventional saddle that fits well, some riders have sought alternative solutions, such as the treeless saddle. (Belock et al., 2011)

Pressure mat analysis requires consideration of force, its distribution over the back area and how it changes as the horse moves. Clear parameters for assessment of saddle fit and force values have not yet been established. Some recent research suggests that maximum total force is the most important variable for evaluating saddle fit (Fruehwirth et al., 2004; Meschan et al., 2007; Kotschwar et al., 2010a, 2010b), whereas earlier work has stressed the importance of focal high pressure areas (Harman, 1997; Werner et al., 2002). If saddle pressure exceeds capillary pressure of 4.7 kPa (kilopascals) consistently throughout the stride, there is a risk of vascular constriction and loss of blood supply to the tissue (Reswick and Rogers, 1976). Clinical signs of pain under the saddle have been associated with maximal pressures above 34.5 kPa and average pressures above 13.2 kPa (Nyikos et al., 2005). Average pressure was also shown to be more reliable than maximal pressure (de Cocq et al., 2006) and to differentiate more clearly between groups of horses with and without back pain (von Peinen et al., 2010). The Michigan study evaluated pressure distribution using average pressure above 11 kPa, which has been indicated (Bystrom et al., 2010) as a threshold for stimulation of back pain.

In the Michigan study, the conventional saddle tested was custom made for the Arab horse back shape by Andy Foster at Lauriche Saddlery. The Lauriche model was assessed as an adequate fit on all the eight Arab horses used in the study, but the treeless model (Ansür Carlton) used was not assessed for fit on any of the horses. 80 – 90% of horses within a breed have been shown in previous studies to have a very similar back shape (Gresak et al., 2008), but in this study, the wide variation of results of the force patterns would seem to disagree with this. Only one brand and model of treeless saddle was evaluated in the current study, but other types of saddles of different functional designs should be assessed to determine differences in force distribution.

The results claimed to show that the conventional saddle distributed the rider's bodyweight over a larger surface area than the Ansür saddle by providing evidence that focal areas of force were concentrated under the rider's seat bones. From this information, the conclusion reached by the researchers was that the tree performed as intended to create a larger interface between rider and horse than that provided by the more flexible treeless saddle. However, the limitations of this study only compared an adequate fitting saddle with a badly fitting saddle and simply demonstrated that a well-fitted saddle provides a more even force distribution than a badly fitted saddle. It would, for example, be simple to use a similar study design to demonstrate that a well-fitted treeless saddle provided a better interface than a badly fitted treed saddle.

When the scanned images from this study are viewed, the focal pressure is at the front, over the wither and also under the girthing in the middle third, clearly demonstrating that the saddle was not fitted to the individual horses' back shapes. There seems to have been an assumption made, rather than an absolute measurement, as to where the seat bones were actually located on the saddle. The seat shape of the Ansür Carlton is specifically designed to carry the rider towards the rear third, so this force pattern also indicates that the saddle was not balanced to the rider.

The images below (Fig. 1) show the moment of maximal total force for the conventional saddle (left) and the Ansür saddle (right).

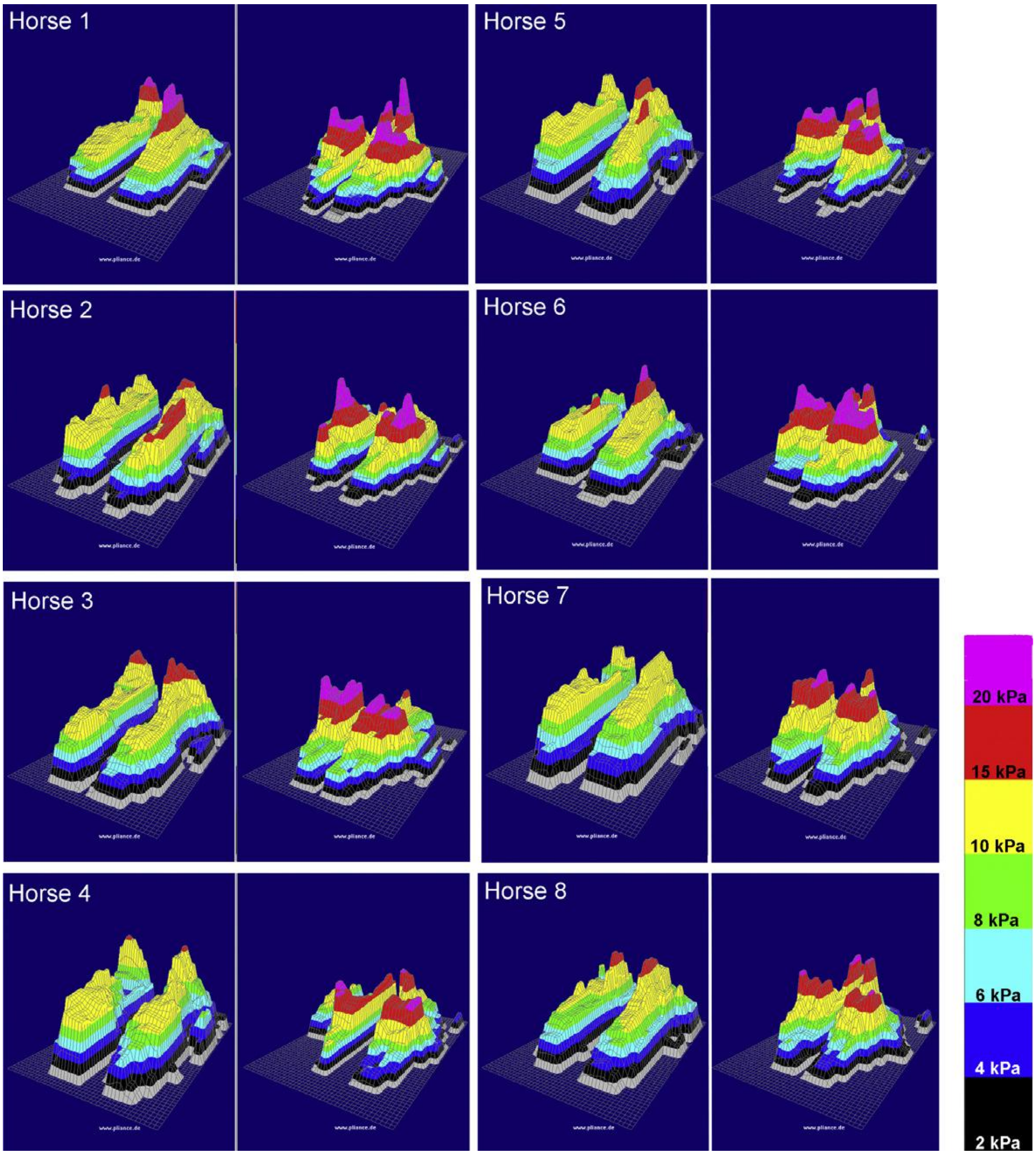


*Figure 1. Maximum total force*

The findings claim to indicate that a saddle tree was beneficial in spreading the force over a larger area and in distributing pressure more evenly over the horse's back, compared with the Ansür saddle. The Ansür saddle used in this study was also claimed to be an inferior fit on every horse, indicated by the smaller weight-bearing area, focal concentration of pressure under the middle third of the saddle beneath the rider's seat bones, and higher maximal pressures compared with the conventional saddle. However, these findings are not representative of a well-fitted Ansür or of any other treeless saddles. Professor Clayton, who headed up the research team admits, "We only used one brand of treeless saddle. We can't assume that all treeless saddles would be the same." Additional studies are required to compare different types of treeless saddles and to compare well-fitting treeless saddles with well-fitting treed saddles.

Prof Clayton suggests that in the future, it would be interesting to evaluate whether specific equine back shapes are more or less compatible with treeless saddles and evaluate the pressure profiles of treeless saddles on horses that are difficult to fit with a conventional saddle.

At the ISES Conference in the Netherlands in 2011, where Prof Clayton presented the results of the study, Anne Bondi, Director of the Saddle Research Trust, commended her for the much-needed work. Describing it as overdue, Mrs. Bondi commented that there was little information for the horse owner in the minefield of saddle selection. Different types of saddle function in different ways and most so-called "treeless" saddles are not actually treeless, if the definition is "free of rigid parts". The Ansür is one of only two currently on the market that is free of rigid parts. Mrs. Bondi asked Prof Clayton what the criteria had been in the selection of a treeless saddle model and type for the study. She also asked if the saddle had been fitted according to the manufacturer's guidelines or if a fitter had been used, as Ansür is one of the few treeless saddles that recommend correct fitting procedures. It is specifically designed to be fitted and is *not* a "one size fits all" brand.

Prof. Clayton replied that the Ansür saddle was selected for the study because it has no rigid parts and the researchers wanted to go to the far end of the spectrum in the comparison. She continued, "We did not have a fitter there and partly that was because we just wanted to take the saddle and put it on a lot of different horses. We were stuck between two things – did we want a completely non–rigid saddle or did we want one that did not need a fitter? Maybe I should add that to the list of limitations to the study."

Lesley Hawson, from the University of Sydney asked, "Did you use balance pads under the saddle?"
Prof Clayton replied, " When we test saddles, we never use any pads. The only time we would use a pad is if we wanted to actually test the effect of the pad."
Lesley Hawson continued, "So, in fact, the testing situation did not reflect most people's use of treeless saddles?"
Agreeing, Prof Clayton said, "Yes, but if we tried to do it as most people do it, we introduce another variable. When we test, we try to reduce the variables as much as possible. Also, none of the horses were used to being ridden in a treeless saddle, so I would regard this as just a first step and there is a whole lot more that could be done."
Lesley Hawson commented further, "The Pliance pressure mat does not have sensors over the spine, so we still do not know what is going on under any of these saddles."
Again in agreement, Prof Clayton replied, "No, and the mat only measures perpendicular force. It is possible for the mat to pull down on the wither and create shear force where there is none. So there is a lot of trade–off in study design. Life is all compromise."

Andrew McLean, founder of the Australian Equine Behaviour Centre asked, "Do you think that a flexible saddle may allow the horse to feel the seat aids better?"

"Good question and I don't know the answer!" was the immediate reply. "The seat aids will be transmitted somewhat differently. When you give an aid, particularly in turning, it does not go straight through a rigid framed saddle – it can cause the saddle to twist and create a diagonal force underneath. So it may be that a treeless saddle would give a more direct force transmission."

At the Saddle Research Trust's International Conference at Anglia Ruskin University in Cambridge in 2012, Prof Clayton was one of a group of top researchers in this field who gathered to discuss ways of objectively measuring the effects of saddles on the welfare and performance of horses. There is much debate around the developing technology of pressure mapping and Prof. Clayton's presentation described some of the current research work being carried out around the world.

In Prof. Clayton's opinion, constant pressure is certainly worse than a changing one, but exactly how much damages the tissues is not yet known. Although focal high pressure is considered to be above 30kPa (4.35 Psi), pressures under the saddle particularly at canter are very cyclic. High pressure followed by low pressure, repeatedly coming and going, is likely to alleviate the overall problem. Average pressures above 11kPa (1.59 Psi) are associated with the onset of pain. Dry spots under the saddle after exercise may be caused by local pressure to the sweat glands, but muscle appears to be the most susceptible tissue to injury. The cutaneous muscle, which lies over the scapula, extends dorsally under the saddle area. It bonds tightly with the skin in order to move it and is very thin, giving rise to the question of whether this may be a source of saddle-related pain.


*Fig. 2 The cutaneous muscle*

All the horses used in the Michigan study were Arabs. The back shape of the Arab horse often has a low, wide wither, creating an imbalance in the saddle by tipping it backwards towards a relatively low weak loin. A pilot study run by the SRT looked at pressure recordings on a different back shape in order to assess if the force patterns would change. Using a similar study design, an unfitted saddle of the same Ansür design was tested on a fit, well muscled Warmblood, recording average pressures of 9.5 kPa (1.37 Psi). This figure is slightly higher than the Michigan study and due to a heavier (by 7kgs) rider. The highest peak pressure, reaching up to 30kPa had a duration of only 0.015 seconds. The concentration of pressure was at the front of the saddle over the wither. This simple comparison shows that the wither profile will affect saddle balance and therefore pressure distribution. It also underlines the importance of correct fitting in order to achieve lower peak values.

A pilot study run by the SRT compared six horses in their usual saddles (all different makes) with a RigidFree™ intervention saddle (Solution *SMART™*). The horses' usual saddles were considered to be a better than average fit. Both maximum and average total forces between the two types of saddle were fairly similar and within acceptable ranges. Horse 1 had high peak pressures over the wither where the intervention saddle fitting did not allow sufficient clearance. Horse 2 moved asymmetrically giving high peak readings on the lateral aspect of the wither due to saddle slippage. This was slightly improved with the intervention saddle.

| Horse and saddle | Av. total force | Max total force |
|---|---|---|
| 1.1 | 2.025 | 6.675 |
| 1.2 | 3 | 18.975 |
| 2.1 | 3.4 | 16.225 |
| 2.2 | 1.825 | 10.7 |
| 3.1 | 1.375 | 4.45 |
| 3.2 | 1.175 | 6.975 |
| 4.1 | 1.4 | 6 |
| 4.2 | 1.3 | 4.775 |
| 5.1 | 1.65 | 6.075 |
| 5.2 | 1.825 | 8.75 |
| 6.1 | 1.525 | 6.1 |
| 6.2 | 1.55 | 4.85 |

*Fig. 3 Comparison of forces under usual saddle and a flexible intervention model. (All measurements in kPa.)*

Figure 1 shows a table of force comparisons under both saddles in the study group. Saddle 1 is the horse's usual saddle in each case.

The limitation of this study was that the riders and horses were not accustomed to the intervention saddle. The intervention saddle was not optimally fitted due to time restrictions. Future study design should assess and review the fit before data collection and allow time for accustomisation.

In conclusion, the results of the SRT pilot studies demonstrate that a well-fitting saddle, whether of traditional treed or flexible treeless design, exert forces on the horse's back that are within what are considered to be acceptable limits. A saddle that is not fitted optimally will increase the pressure measurements. A flexible saddle may lower pressure in cases of gait asymmetry.

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