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The Rider Weight Study

Part 2: The effects of rider size and saddle fit for horse and rider on forces and pressure distribution under the saddle

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Introduction

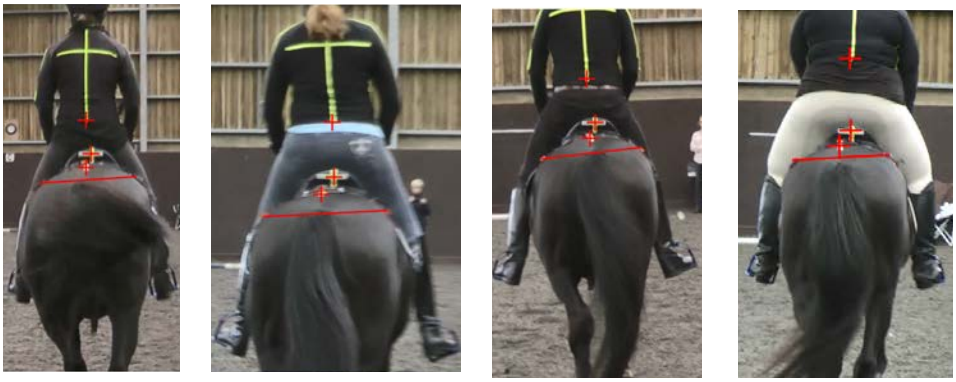
There has been a growing concern within the equine industry that as the human population gets larger, horses are increasingly being subjected to excessive loading. The problem that we currently face however, is a lack of objective evidence that can provide guidelines for appropriate size ratios of horses and riders. A recent study set out to investigate the effects of rider size on the horse in an attempt to move closer to solving this complex problem. The multi-disciplinary study took place at World Horse Welfare's Norfolk headquarters and represented an extraordinary level of collaboration and cooperation from across many sectors of the UK equine industry.

Part 1 of this article, published in October's edition of the SRT Newsletter, discussed the influence of rider size and saddle fit on equine gait and behaviour. In Part 2 the focus is on the riders' positions, the effect of rider size and the saddle fit to both horse and rider.

Study design

Although force mats have been used to measure pressures under the saddle, limited work has been done to investigate the effect of rider size on those measurements. Pressure measurements may be influenced by the horse's locomotion, the fit of the saddle to the horse and the rider, rider weight and the distribution of the rider's weight. The research team designed a study that aimed to quantify the magnitude and distribution of pressures under the saddle for a group of horses and riders. The study also aimed to relate pressure measurements to rider position, saddle fit and saddle movement. A key objective was to mimic the real-life situation when frequently riders are riding in saddles which do not fit them.

A group of six sports horses were ridden in a standardised exercise test by four riders of different body weights but similar ability, in a randomised order. The riders were all capable of riding in balance and although none were familiar with the test horses, they all were accustomed to riding a variety of horses. Horses and riders were selected so that the relative rider and horse bodyweights were in one of four categories: Light (rider L), 10-12%; Moderate (rider M), over 12% and up to 15%; Heavy (rider H), over 15% and up to 18%; Very Heavy (rider VH), over 20%.



11% 15% 17.9% 27.5%

The relative weights of the four riders when riding the same horse

Although saddle fit was assessed by a qualified saddle fitter before the study and adjustments were made to improve fit when required, no saddle fitted each horse ideally. A calibrated force mat (Pliance) was placed under the saddle by an experienced operator. This technology measures only forces perpendicular to the sensors and there is no measurement of shear forces, which obviously can be influential.

A calibrated force sensor mat was placed under each saddle

Results

All the tests for the two heavier riders were terminated prematurely because of the appearance of transient lameness or, in one horse-rider combination, the demonstration of 10 or more of the 24 behavioural markers of the Ridden Horse Pain Ethogram. When re-assessed moving in hand after each abandoned test, no lameness was observed in any of the horses, all of which subsequently performed satisfactorily with the lighter riders.

Rider position

At halt, the two lighter riders were positioned in the middle of the saddle for all horses, whereas the seat of the heavy rider was positioned at the rear (influenced partly by his long legs) for all but one horse and the seat of the very heavy rider hung over the cantle of the saddle for all horses.

Saddle fit for each rider was not optimal: The saddles were too short in the seat for Riders H & VH (images 3 & 4 on the right)

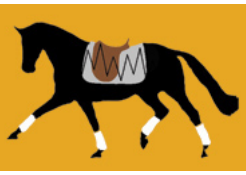
The shoulders, hips and heels of the heavier riders were not in vertical alignment. During the tests, the heavier riders were consistently misaligned. The very heavy rider adopted a "chair" seat, especially in the sit phase of trot and canter when she was behind the balance with the lower leg positioned too far forward. The alignment of the heavy rider was variable. In trot on 5 horses he demonstrated anterior pelvic tilt with a forward inclination of the torso, but on the sixth horse and in canter on all horses the torso was more upright with the lower leg more forward.

The effect of the rider

Perhaps unsurprisingly, analysis of overall mean pressure according to gait showed that the lightest rider exerted significantly less pressure compared with all other riders and that the heaviest rider exerted significantly more pressure. Although the increase in riders' bodyweights correlated well with increased pressure in all gaits, the increased maximum pressure was lower than the increase in bodyweight from the heavy to very heavy riders. This indicates that the lighter the rider, the greater the pressure in relation to bodyweight.

In walk, the heaviest rider exerted significantly higher pressure under the rear of the saddle. Alteration in the distribution of pressure has the potential to adversely affect thoracolumbar movement and hindlimb gait. Increased speed results in increased peak forces exerted onto the back and the highest maximum pressure of 26.4 kPa was recorded in canter for the heaviest rider. In this study, the speed of each gait could not be controlled and was not measured, however tests were completed in consistent times, suggesting similar speeds.

Linda Roost operated the force sensor measurement system, recording readings up to 26.4 kPa



Saddle movement

For all horses, saddle movement and rider movement were significantly positively correlated on both reins. For all riders, on the left rein there was a significantly greater movement of the saddle to the right than to the left. On the right rein, there was no significant difference in saddle movement to the left and to the right, but the riders moved more to the left than to the right. For all horses, the centre of pressure was more central during trot, compared with either walk or canter.

Summary

The rider's position in the saddle and on the horse's back was influenced by the size of the saddle: the taller and heavier riders in particular were unable to maintain optimum posture and balance in saddles that were too small for them and as a result, the weight distribution on the horse's back was altered. Provision of larger saddles for the heavier riders could have permitted a more uniform pressure distribution; however, such saddles would have exceeded the recommended tree length relative to the horses' back lengths. The saddle not fitting the rider reflects real life; for example, in riding schools, when adults warm up ponies for children to ride or native ponies are shown under saddle by adults. Along with the increasing size of the population generally, it is also regularly observed clinically among the general riding community. Studies that investigate the effect of increasing body weight by addition of static lead weights are unlikely to represent what happens in the real-world, and the results may be misleading.

In conclusion, although this study was limited to a small number of horses and riders, it nonetheless highlighted that there is not a completely linear relationship between pressure under the saddle and the bodyweight of the rider. There were differences in magnitude and distribution of pressures between the different rider sizes, which may have been influenced by saddle fit for both horse and rider. Rider body weight cannot be considered in isolation. It is clear that rider leg length is also an influential factor.

In Part 3 of The Rider Weight Study, which will be published in next month's edition of the SRT Newsletter, the influence of rider weight on exercise induced changes in the horse's back dimensions, muscle tension and pain will be discussed.

During their stay at World Horse Welfare's beautiful Norfolk headquarters, all the study horses enjoyed daily grazing sessions

Acknowledgements

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Reference

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The research team worked hard to maintain the high standards at World Horse Welfare's immaculate stable yard in Snetterton