SCIENTIFIC RESEARCH QUANTIFIES THE IMPACT DIFFERENT PADS HAVE ON THE HORSE'S PERFORMANCE

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The use of pads under the saddle has been common for years, but now scientists are using dynamic testing technology to discover how well they really work.

In everyday yard situations where multiple horses use the same saddle, putting one or more pads under the saddle has been seen as a way of providing cushioning and comfort for the horse, or even relieving pain. However, there has never been any research in racehorses to demonstrate whether this reduces saddle pressures or provides comfort. Furthermore, there is limited scientific evidence to suggest which type of pad is most effective.

A recent study suggests that, depending on the material and design, using a pad beneath the saddle might not always achieve the desired pressure-relieving effect. And using multiple ineffective pads under the saddle might not only be a waste of time and money, but it could potentially cause areas of high pressures, compromising the horse's locomotor apparatus and affecting race performance.

MATERIAL MATTERS

Peak pressure of >35 kPa can cause compression of the capillaries, leading to soft tissue and follicle damage (ischemia) which, in extreme or prolonged cases, results in white hairs, muscle atrophy, skin ulcerations and discomfort.

A recent published study evaluated saddle pressure distribution in sports horses using pads made from sheepskin, viscose gel and a medical-grade closed-cell foam. When using a gel pad, the peak and mean pressures increased in the front region of the saddle in trot and canter. This is possibly due to the gel's lack of ability to dissipate shear forces compared to wool or foam.

Similar findings were seen in a pilot study of thoroughbreds galloping at half speed over ground. The same dynamic testing was used (see Technology & Anatomy section) to compare the forces and peak pressures under polyfill pads, as well as viscose gel and medical-grade closed-cell foam. From the initial trials, the overall forces recorded were significantly higher than those seen in the sports horse study. This seems reasonable, given the difference in locomotion and speed (see Speed & Force section).

Preliminary findings show the forces were 75% lower, and peak pressures were 65% lower under the medical-grade closed-cell foam pad than those recorded under the gel pad. Interestingly the polyfill pad, which deforms to the touch, reduced the forces and peak pressures by 25% and 44% respectively compared to the viscose gel pad.

The role of the pad is to act as a dampening layer between the horse and the saddle, reducing pressures and absorbing the dynamic forces which occur during locomotion.

Based on findings from the sports horse study, and initial findings from the racehorse study, it appears that the medical-grade closed-cell foam pad is superior in its effectiveness at acting as a pressure-reducing layer between the saddle and the horse.

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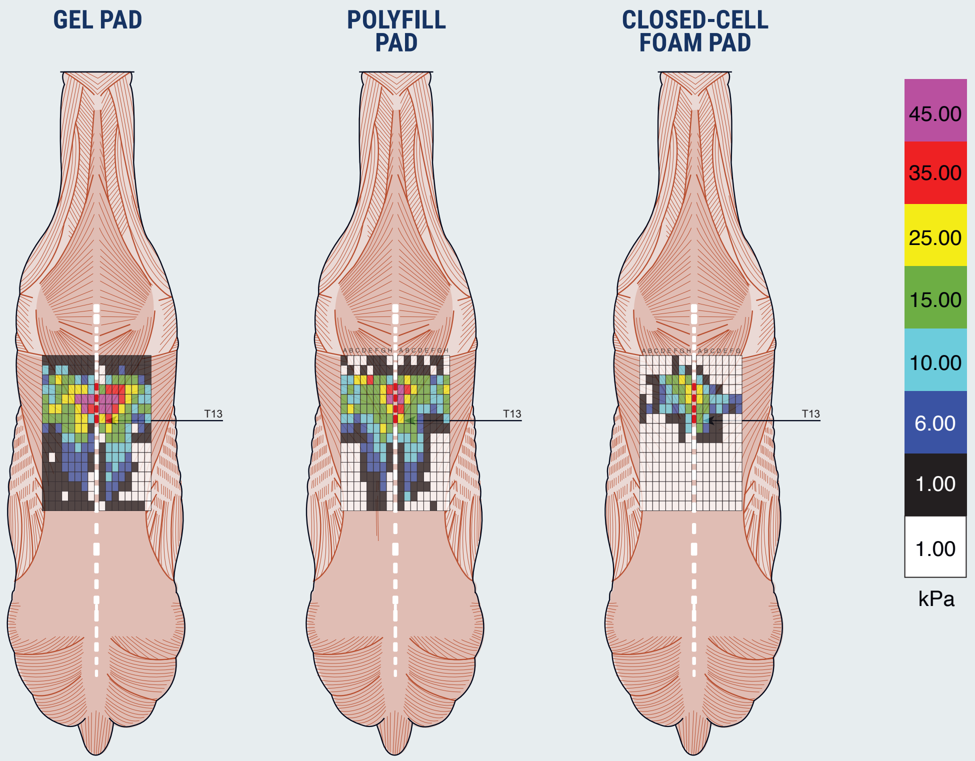
FIG 1

Fig 1: Peak pressure of more than 35kPa were recorded in two of the three pads.



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LEFT: A shaped saddle pad with a midline seam is less likely to draw down on the spine.

PRESSURE TO PERFORM

Reducing saddle pressures improves gallop locomotion. Horses will still perform when asked, despite areas of high pressures induced by the saddle and pad; but they develop a compensatory locomotor strategy in an attempt to alleviate any discomfort.

To increase speed, a galloping horse will either increase stride frequency or increase stride length. Both mechanisms can be used, but the horse will have a natural preference. Published pressure studies have shown that stride length is increased when saddle pressures are reduced. Now, new research is underway quantifying whether a stride frequency approach, which has higher peak forces, could be a compensatory strategy in response to discomfort caused by pressure.

Forces are influenced by speed and weight and are produced when the hoof comes in contact with the ground. At racing speeds of 38 mph, the hoof hits the ground approximately 150 times a minute. Stride frequency is an important consideration because a study has suggested that horses have around 100,000 gallop strides before the soft tissues fail. Therefore, any reduction in loading cycles (number of strides) could potentially help reduce injury risk.

Harder, faster, longer

Every stride impacts the horse's joints, causing wear and tear (see Speed & Force section), so fewer longer strides is the preference for optimum training efficiency. Although horses have a naturally imprinted option, the pressure studies demonstrate that they switch between the two in response to certain extrinsic factors, such as high saddle pressure.

Our task as trainers is to optimise the horse's locomotor efficiency by removing any impediment that might force it to adopt the shorter-stride compensatory gait. We speculate that equipment which increases pressure (such as an unsuitable design of saddle, bridle, girth or saddle pad) will be counterproductive because it may encourage an increase in stride frequency and compromise natural locomotor efficiency.

CONTOURING IS KEY

In both studies, the saddle pads that were designed to follow the contour of the horse's back and withers performed better than those that were flat with no shaping. Furthermore, pads with a midline seam connecting the two sides were able to maintain traction and position, providing spinal clearance even at speed.

In contrast, pads that were flat without any contouring or with no central webbing seam were observed to slip in response to the horse's movement, drawing down against the spine under the saddle. This was seen even when the pads were pulled up into the saddle channel before setting off.

Quality vs quantity

In an attempt to improve comfort, it's standard practice to use multiple pads under an exercise saddle. However, adding more shapeless padding can lead to instability and potentially saddle slip.

This feeling of instability can encourage the jockey to overtighten the girth in an attempt to keep the saddle still. One study demonstrated a relationship between increased girth tension and a reduced run-to-fatigue time on a treadmill, indicating that girth tension can affect the breathing of the galloping horse.

In addition, bulk under the saddle puts a feeling of distance between the horse and rider. This compromises the close contact feel and balance all jockeys strive to achieve and hinders the lowering of the jockey's centre of mass relative to the horse.

Age concern

It's worth noting that the ability of a material to absorb pressure can be significantly compromised with use and washing, as well as changes in climate. As some materials age, they degrade and lose any initial shock-absorbing qualities. For example, wool loses its 'crimp' over time and becomes less effective, so a well-used wool pad may not absorb as much pressure as a new one.

The medical-grade closed-cell foam used in the saddle pad studies was developed to prevent capillary damage in bed-ridden hospital patients and the pressure relieving properties are not affected by extremes of weather or machine washing.

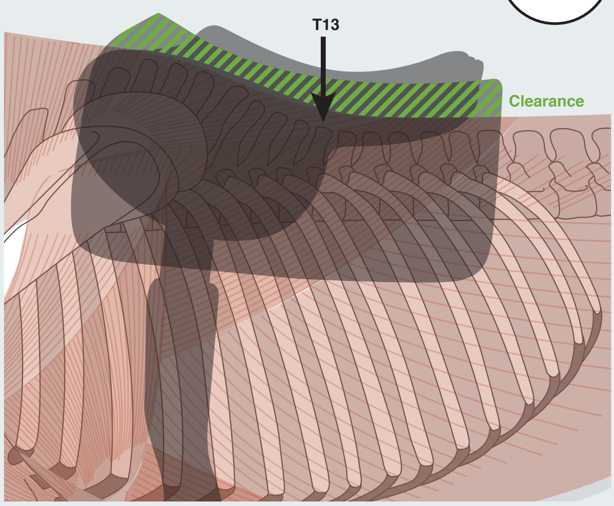
Saddle system

It is becoming clear that the saddle, pad and girth operate best when they are viewed as a complete system. When choosing a pad, it's worth bearing in mind that these pressure studies were carried out under correctly fitted saddles with wide channels and ample spinal clearance. The benefits of a pressure-relieving pad are diminished by a badly fitting or poorly designed saddle with a narrow channel and limited spinal clearance.

Likewise, trainers who are experiencing the performance gains associated with advances in saddle design will not reap the full benefits of a pressure-relieving saddle if the fit and effectiveness are compromised by poorly performing pads underneath.

Fig 2: A saddle pad that is shaped to follow the contours of the back is able to maintain better spinal clearance under the saddle when galloping.

FIG 2



SPEED & FORCE

In gallop, the forelimbs have to support two-and-a-half times the horse's body weight with every motion cycle (stride). In each motion cycle, a fast-moving front foot interacts with the stationary ground and, as the hoof comes to an abrupt halt, the forelimb has to absorb these forces. The forces are transmitted through the soft tissues and muscles to the thoracic vertebrae in the region where the saddle and jockey are positioned.

These thoracic vertebrae in front of T16 (the anticlinal vertebra) are responsible for force transmission from the forelimbs, head and neck. The horse's back does not just have to deal with the large forces from the forelimbs (and hindlimbs) but also the dynamic forces of the jockey, which can be in excess of two-and-a-half times the jockey's body weight.

As speed increases, so do pressures beneath the saddle and pad. There's a 5% pressure increase when the walk speed rises by 10%, and in trot it goes up to 14%. As the racehorse is travelling at a faster pace the forces involved are inevitably increased and, at gallop with the jockey 'up in his pedals', approximately 80% of his weight is focused on the front part of the saddle—the T10-T13 region (see Technology & Anatomy section).

If the saddle pad draws down along the spine during locomotion and creates restrictive pressure, this will interfere with muscle activation and force transmission, potentially causing the horse to adopt the compensatory short-stride gait.

The horse will not only need more strides to cover the same distance, but it will also experience more forelimb loading every stride due to the increased speed of each cycle.

Studies are ongoing into the long-term impact of this extra limb loading, but we speculate it will potentially result in poor performance and increased risk of injury.

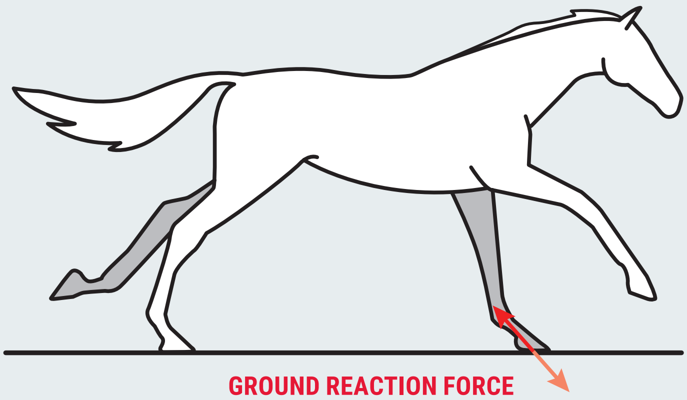


FIG 3

Fig 3: The hoof exerts a force against the ground, and the ground exerts a force against the hoof, which is transferred through the muscles and tissues of the forelimb.

STABILITY IN MOTION

The spine rotates in three directions, providing stability, forcing transmission and generating power efficiently.

- **Flexion-extension** – up and down
- **Axial rotation** – rolling one side to the other
- **Lateral bending** – left to right

For optimum locomotor efficiency, the vertebral column needs to be dynamically stable. Stability is the combination of strength and suppleness; it isn't stiffness. The muscles in the back and neck must be strong so they can support the spine but flexible enough to allow the necessary range of movement and transmission of the dynamic forces required during locomotion.

Studies have shown that when the saddle and rider are stable and symmetrical, the horse's back can stabilise through the cranial thoracic spine at T13 (see Technology & Anatomy), allowing the efficient transfer of forces from the hindlimb.

A saddle pad that is causing pressure is likely to compromise this dynamic stability. From a preliminary study, it appears that high pressures are associated with increased spinal instability. This instability is likely to cause the horse to seek a compensatory locomotor strategy and adopt a posture where the back is stiffened. Previous research has shown that back function and gallop kinematics are compromised by a stiffened spine.

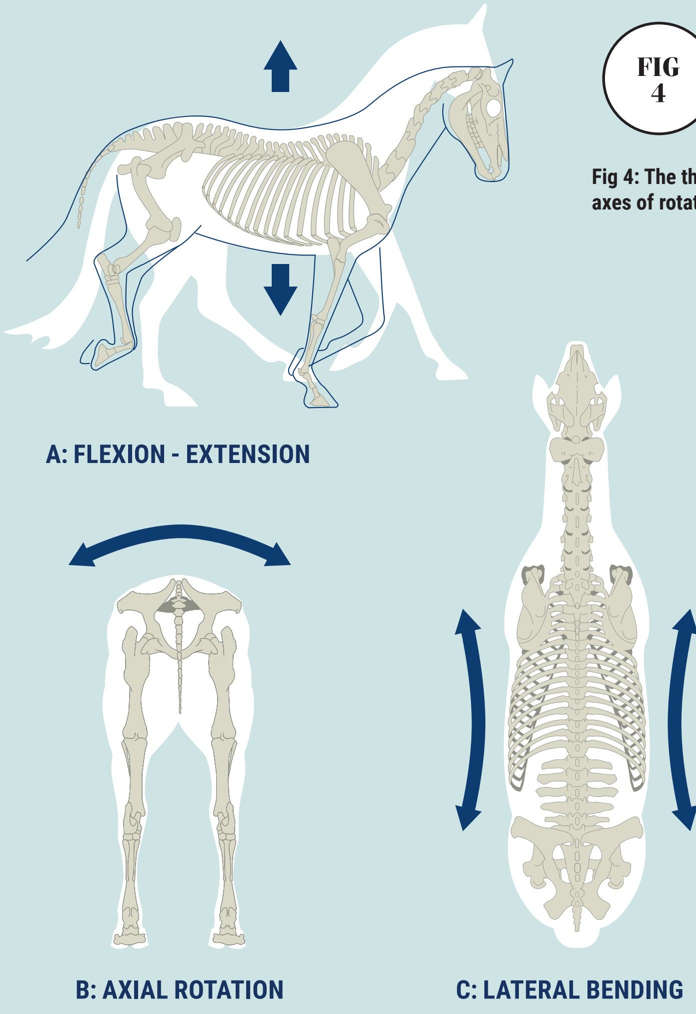


FIG 4

Fig 4: The three axes of rotation.

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FIG 5

Fig 5: Pressure mapping and 3D motion capture are used to quantify the effects of saddle pads on performance at gallop on the track.

TECHNOLOGY & ANATOMY

Thanks to extensive research, scientists now have a greater understanding of the importance of the area around the 10th-13th thoracic vertebrae (T10- T13). This is the location of a high concentration of muscle activity related to posture and movement. Repeated studies have demonstrated how pressure at T10-T13 compromises the locomotor apparatus of the horse and consequently performance. Relieving pressure here affects the mechanics of the whole back, allowing the transfer of propulsive forces from the hindlimb, creating increased power and longer stride length.

Testing equipment

Research teams employ pressure mapping (using a mat with 128 sensor cells on each side of the spine) and 3D gait analysis (using Inertial measuring units) to show precisely how changes in pressure affect spinal movement. The measuring units (IMUs) quantify flexion-extension, axial rotation and lateral bending. The combination of these state-of-the-art measuring systems allows researchers to prove that relieving pressure has a direct effect on spinal kinematics. Long-term trials using pressure testing and gait analysis have demonstrated that back discomfort associated with pressure can affect the development of the horse's posture, gallop stride and potentially long-term back health. T

Further reading

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