SCIENTISTS DISCOVER PERFORMANCE INHIBITING SPINAL PRESSURE UNDER ROLLERS

Reducing pressure under the saddle, bridle and girth has been found to significantly improve performance, and now the roller has been scientifically tested.

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Lost training days, treatment and medication for back problems are time consuming and costly, so optimising equine spinal health from early on is an essential consideration in improving equine health and welfare. When a young horse is started, one of its first experiences is to have tack on its back, initially a lungeing roller. The roller, a seemingly harmless piece of equipment and its effect on the horse, has previously been overlooked. However, it has now come under scientific scrutiny by the same research team that investigated the impact of pressure distribution under the saddle, bridle and girth on equine health and performance.

Their recent study used high-tech pressure mapping to examine the pressures exerted on the horse's back during lungeing (see technology panel). Localised areas of high pressures were consistently recorded under the roller on the midline of the horse's back directly over the spinous processes in the region of the 10th and 12th thoracic vertebrae (T10-T12, see anatomy panel).

High pressure directly in this region, as seen under a conventional roller, is likely to cause the horse to seek a compensatory locomotor strategy and adopt a posture where the back is stiffened and hollowed, resulting in an extended spine. Previous research has shown that back function and gallop kinematics are compromised by a stiffened spine.

Studies have demonstrated that pressure-relieving modifications in a saddle result in increased stride length and hip flexion, along with a greater femur-to-vertical angle (indicating that the hindleg is being brought forward more as the horse gallops). Reducing saddle pressures leads to a marked improvement in the horse's locomotion, allowing it to gallop more efficiently. The roller is positioned over the part of the back where the front half of the saddle sits; by applying these principles, modifying the roller to remove pressure would allow unhindered back function.

The equine back is an essential component of the locomotor apparatus, transferring biomechanical forces from the hindlimb. So, a modified roller will not only result in improved locomotion and performance but will also have long-term spinal health benefits.

Strong start

In racing, where lungeing is primarily used prior to backing, what we do to and the equipment we use on the young horses in the preparatory stages are likely to have a significant impact on the development of the horse's posture, back health and locomotion.

If a young horse begins the training process of being lunged with a roller that exerts pressure directly on the spine at T10-T12, it will develop a strategy to compensate for the discomfort. Then, as the horse progresses to a saddle—which similarly exerts high pressure in the same area—it is inevitable that this will have an effect on the locomotor system. The horse's athletic performance will be significantly compromised before it even gets on the track.

Innovative pressure-relieving modifications in tack design have demonstrated improved locomotion when pressure is reduced. Identifying and replacing any equipment that has limiting effects on locomotion or development could have long-term benefits for the longevity and performance of the horse. This applies particularly to the lungeing roller as it is the first piece of tack a youngster has on its back. It is essential that the horse does not develop a locomotor strategy to compensate at this stage.

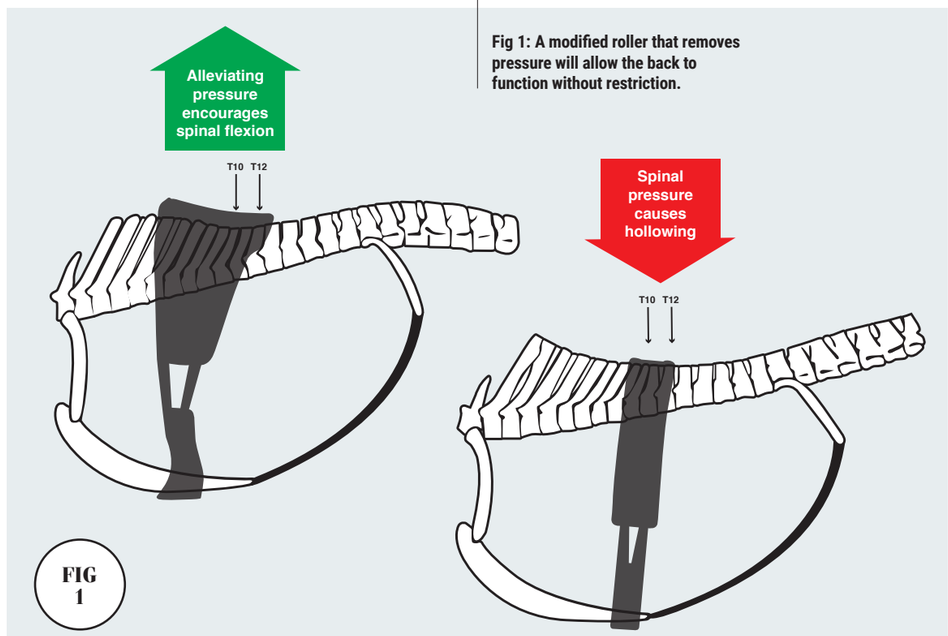

Fig 1: A modified roller that removes pressure will allow the back to function without restriction.

Under pressure

In a recent study, horses were lunged on a 20-metre circle on both reins in trot and canter wearing a roller fitted with pads. In canter, peak pressures were seen each time the inside forelimb was in stance (on the ground). In trot, pressure peaks occurred each time a forelimb was in stance phase.

Given that the horse is experiencing high pressures under the roller directly on the spine in the region of T10-T12 in every repeated motion cycle (stride), it is inevitable that a compensation strategy will develop.

When trotting and cantering with no attachments, such as side reins or training aids, peak pressures under the centre of the roller were found to be similar to those seen under the saddle with a rider on board. Studies have shown pressures over 30kPa can cause back discomfort. In this study, researchers measured pressures up to 35kPa directly on the midline of the horse's spine, in every stride, with just a roller and pad.

With side reins attached, the location of the peak pressure was brought further towards the front edge of the roller. Essentially, the pull of the side reins caused a ridge of pressure under the front half of the roller, and the readings increased to 45kPa.

Compensation costs

Compensatory gait strategies lead to asymmetric forces which have a negative effect on limb kinematics (movement). The consideration here is that the horse is experiencing these locomotor compromises before the back has been conditioned to manage the increased forces, and before a jockey has even sat on its back.

It remains to be shown whether the compensatory gait and asymmetric forces caused by early roller pressure manifest as lameness or loss of performance later on. There is a coexisting relationship between back problems and limb lameness, but evidence is still being gathered as to which one comes first. Researchers are investigating to what extent loss of performance and lameness issues might be traced back to these 'training and backing' experiences. It is therefore essential that young horses are started with correctly fitting equipment to limit any long-term effect.

Lungeing for rehab

In addition to the backing process, lungeing also occurs during other influential periods of a horse's life, including rehabilitation after surgery. Post-operative recommendations for kissing spines can often include lunge work with training aids to induce spinal flexion and opening up of dorsal spinous processes. In these cases, if horses are being rehabilitated wearing a roller which creates high pressure on the very area it is supposed to be improving, it is likely that the benefits of using any training aid will be diluted.

It is also likely that lungeing for rehabilitation using a roller which creates high pressures will have a detrimental effect on any veterinary or physiotherapy programme.

Assess all areas

Thanks to advances in recent research developments and design, it is now possible to take a more holistic view and examine the whole horse when looking at training tack. Of course, there are benefits from making modifications to individual items, but maximum gains are achieved when the whole locomotor apparatus can function without restriction.

For example, girth pressure has been the subject of extensive investigation, and a modified girth design which relieves peak pressures behind the elbow has been proven to significantly improve gallop kinematics. Combining a pressure-relieving lungeing roller with a girth designed to de-restrict the musculature will maximise locomotor benefits.

Bridle design has also been shown to have a significant impact on the horse's locomotor apparatus. When bridle pressure is reduced and stability is improved by using a correctly-fitted noseband, gait analysis shows an increase in forelimb extension and a greater range of hindlimb motion. Using a modified bridle when lungeing will enhance the benefits afforded by the roller and girth. Each modification is a step towards improving comfort, which will improve athletic performance.

FIG 2

PRESSURE MAPPING DURING LUNGEING

Conventional roller
- 35kPa pressure directly on the spine at T10

Conventional roller & side reins
- pressure consistent at T10 but increases at T11 and T12 to 45kPa

New roller design, even with side reins
- all pressure is removed from the spine.

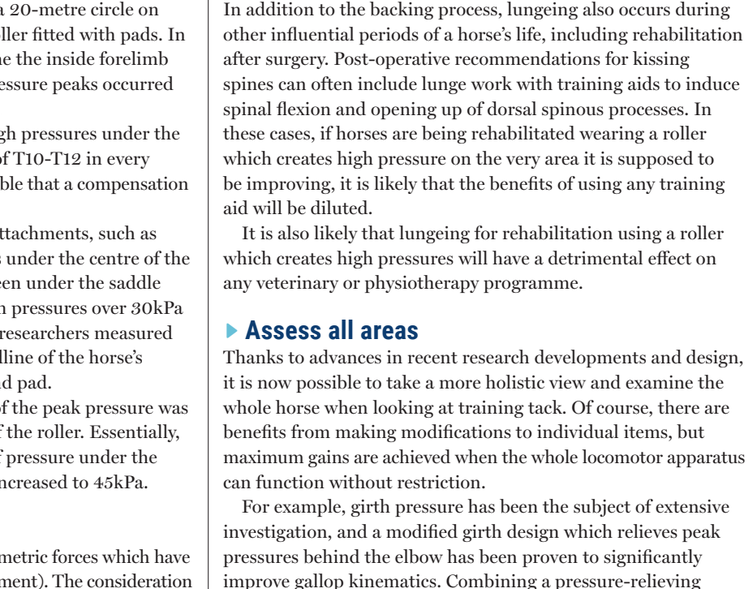

FIG 3

MODIFIED ROLLER DESIGN

A new design of roller, based on a tree similar to that used in a saddle, alleviates pressures directly on the midline of the back by ensuring clearance of the spinal processes is maintained while the horse is moving (Fig 3).

High pressure was recorded directly on the spine (T10-T12) under conventional rollers (with pads) used by the majority of yards. Even when used with pads, these rollers still draw down on to the spine when the horse is in motion because they have no integral support to ensure that clearance of the spinous processes is maintained.

Reins and rings

Usually, side reins are attached around one or both of the roller's 'girth straps'. The lungeing study demonstrated that this pulls the front edge of the roller forward, increasing pressures on the horse's back. A roller with ring attachments tends to stay parallel to the horse's back during motion—the ring provides articulation between the roller and the side rein, helping maintain stability.

An added benefit of a design with extra rings is that it enables the roller to be used throughout the backing process. For example, stirrups can easily be attached to prepare the horse for the saddle.

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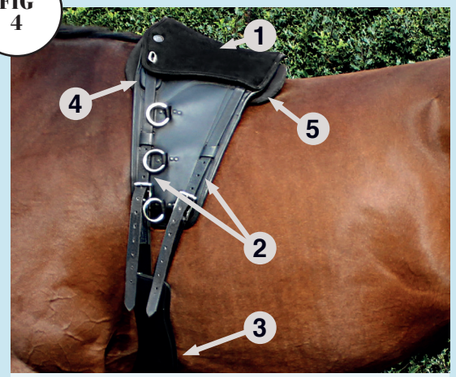
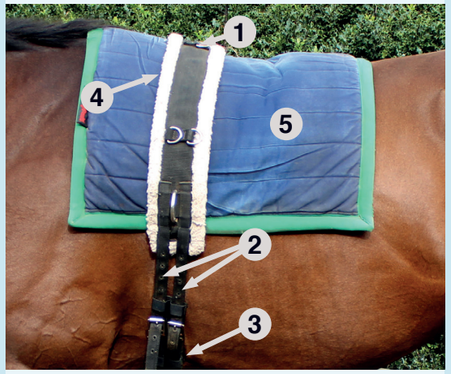
FIG 4



New Roller Design

1. Built on a contoured tree to maintain spinal clearance
2. Splayed girth straps stabilise the roller even when side-reins are attached
3. Anatomic long elasticated girth provides optimum clearance behind the elbows and increases freedom of movement
4. Can be adjusted to accommodate horses from narrow to wide
5. Built-in pressure relieving pads cushion the musculature at either side of the spine



Conventional Roller

1. No integral strengthener to prevent roller drawing down onto the spine
2. Narrow girth straps cause instability and tipping especially when used with side-reins
3. Short straight girth causes pressure behind the elbows and reduces freedom of movement
4. Cannot be adjusted to fit different widths of horses
5. Additional pads are used to increase comfort but don't prevent draw down onto the spine

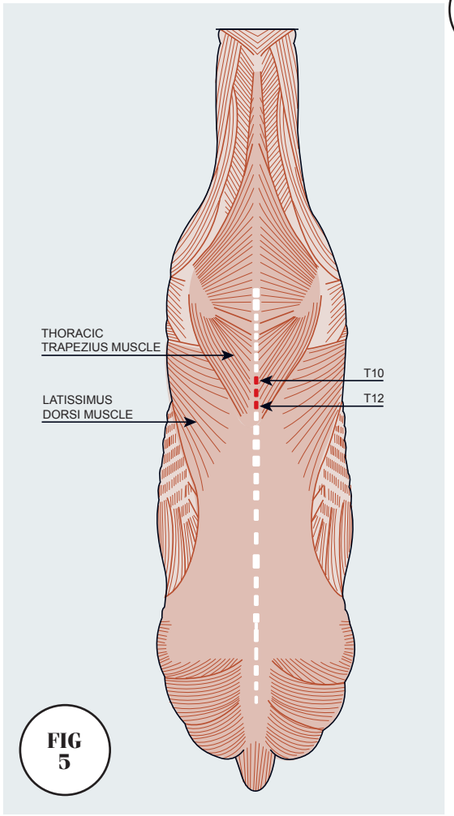


FIG 5

SPINAL ANATOMY

The area around the thoracic vertebrae T10-T13 (the base of the withers) is the location of a high concentration of muscle activity related to posture and movement.

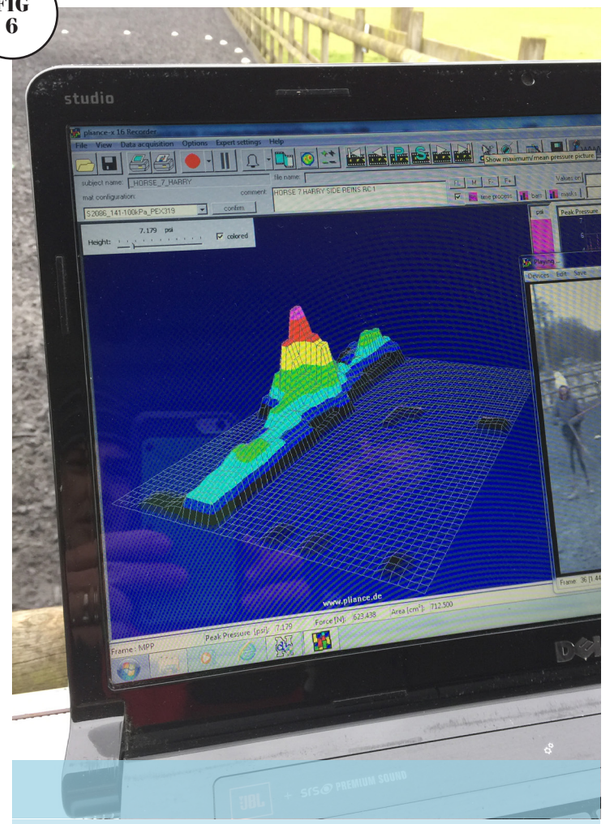
The Longissimus dorsi (*m. longissimus dorsi*) is a stabilizing muscle that's most active at T12, and spinal stability is essential for the galloping thoroughbred. This is because, in gallop, the forelimbs have to support two-and-a-half times the horse's body weight with every stride. In addition, the cranial thoracic vertebra (where the saddle, roller or jockey is positioned) are responsible for force transfer from the forelimbs, head and neck. It's the back that has to manage these high forces.

The horse has no collarbone, and the forelimbs are attached to the trunk by the thoracic sling musculature. Some of the most influential and important thoracic sling muscles attach to the spine, so it's easy to appreciate why spinal health is critically important. Any compromises in this area at any stage of the horse's career will impact on performance.

When compromises such as high pressures occur, the horse adopts a compensating strategy. It will still perform but will develop a gait that alleviates discomfort.

Anatomical structures or locomotion patterns that have been affected by a compensatory gait will be disadvantaged in terms of performance and, potentially, more susceptible to increased risk of injury.

FIG 6



PRESSURE TESTING

Pliance is the industry-standard method of measuring pressure on the horse's body. It has been utilised extensively in research under saddles, and it can operate in all gaits, including gallop and jumping.

A large mat with 128 individual pressure sensor cells on each side of the spine is usually positioned over the back, under the saddle. In this study, the mat was positioned transversely across the back, with sensors able to measure pressure directly on the spine.

Initially the results are displayed as a moving colour-coded image, with areas of peak pressure showing as pink and red. Data regarding peak pressures, maximum force and mean force is also available, and is extracted and processed for statistical analysis. T

Further reading

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- *European Trainer Magazine*, July-September 2020
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