BACK STABILITY

NEW TECHNOLOGY IS ALLOWING RESEARCHERS TO EXAMINE HOW A DRESSAGE HORSE'S BACK MOVES UNDER THE SADDLE.

The horse's back connects the hindlimbs to the front and is a complex biological mechanism which undergoes three rotations as the horse moves (see panel opposite). In a worldwide first, a team which included Dr Russell MacKechnie-Guire and Fairfax Saddles, used small inertial measuring units (IMUs) to record back movement, including the area beneath the saddle, and reveal how these rotations are influenced by the rider in trot and canter.

STABLE TALK

Dynamic stability is the combination of strength and suppleness – not stiffness – and when the horse's back is dynamically stable it allows the efficient transfer of locomotor forces from the hindlimbs. In order to remain synchronised with this dynamic platform, the rider needs to follow the movements of the back without restriction.

Because the team also collected data relating to rider seat pressures, saddle pressure and gait analysis, researchers were able to show that when the saddle is stable and the rider is symmetrical in the saddle, they remain synchronised for longer. The horse can stabilise his back dynamically and his whole movement improves.

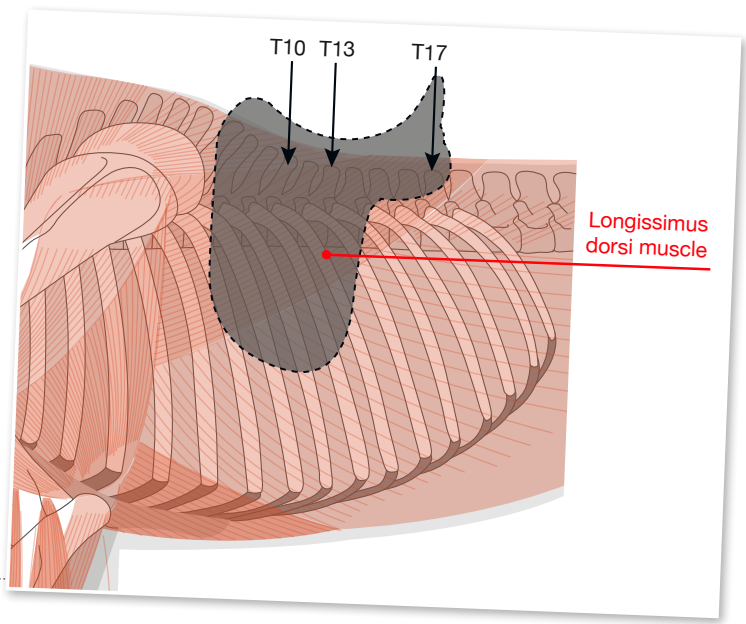
PRESSURE REDUCES STABILITY

Anatomically, a saddle sits over 10 or so of the 18 vertebra that make up the thoracic part of the spine. It has been shown that even correctly fitting saddles can cause high pressure around the area of the 10th-13th thoracic vertebrae (base of the wither). The horse can develop a compensatory strategy to alleviate any discomfort caused by high pressure and, as part of this strategy, his back becomes stiff, stride length decreases and hindlimb engagement is reduced.

When the pressure is removed there is a significant increase in range of movement and symmetry, which allows an increase in

DID YOU KNOW?

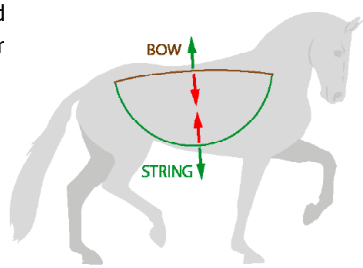
- The overall force acting on the horse's back at walk is equivalent to the body weight of the rider. At trot this leaps to two times the rider's weight and it's two-and-a-half times at canter.
- The horse's spine also supports the entire weight of his intestines which is around 300kg.
- The horse does not have a collarbone.



BELOW: THE LONGISSIMUS DORSI MUSCLE TRANSFERS FORCES FROM THE HINDQUARTERS TO THE FRONT OF THE HORSE AND IS MOST ACTIVE IN THE REGION OF T12 – WHERE THE RIDER SITS.

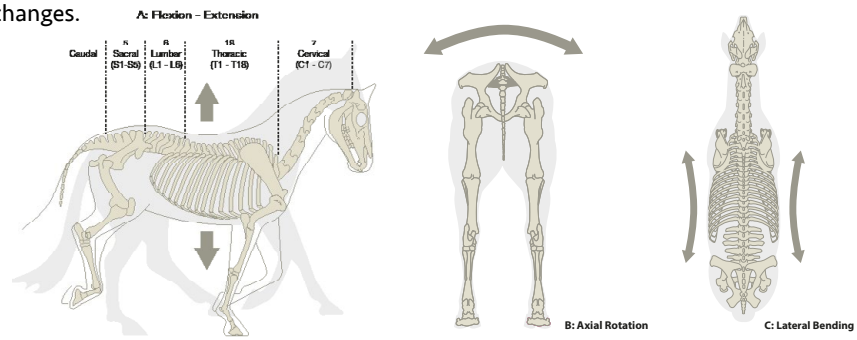
ANATOMY AND MOVEMENT

The bow and string theory helps explain how the horse's back functions and is based on the way a string makes a bow extend the spine and pelvis as the bow and the abdominal m as the string. When the front leg is retracted (back) and hindleg is protracted (forwards), the muscle attachments flex the bow and round the back. When the front leg is protracted (forward) and the hindleg is retracted (back) the string is relaxed, the bow is extended and the back drops.



ABOVE: THE FRONT LEG IS BACK AND HINDLEG IS FORWARDS, THE MUSCLES FLEX THE BOW AND ROUND THE BACK. WHEN THE FRONT LEG IS FORWARD AND THE HINDLEG IS BACK THE STRING IS RELAXED AND THE BACK EXTENDS.

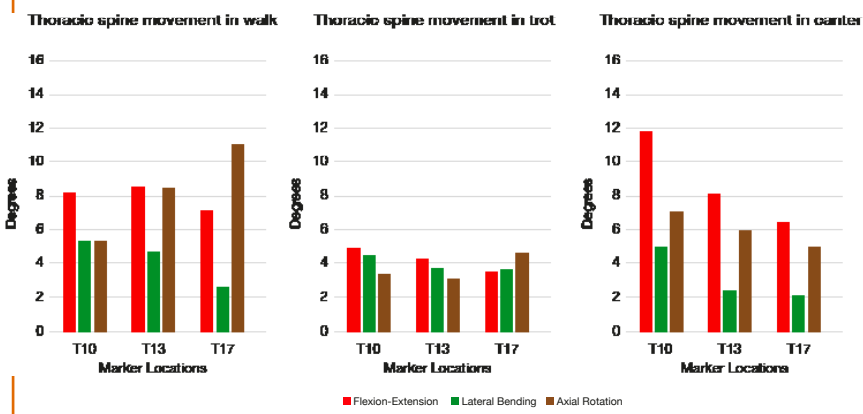
Back movement is not as simple as up-and-down - the spine also rotates and bends, moving in three directions. Furthermore, these movements vary along the length of the back and change across the gaits - and the saddle has to be able to manage all these changes.



ABOVE LEFT: FLEXION-EXTENSION - VERTICAL AXIS - UP AND DOWN. **ABOVE MIDDLE:** AXIAL ROTATION - LONGITUDINAL AXIS - ROLLING ONE SIDE TO THE OTHER. **ABOVE RIGHT:** LATERAL BENDING - TRANSVERSE AXIS - LEFT TO RIGHT (LIKE A FISH).

The back and neck muscles must be strong so they can support the spine, but flexible enough to allow the necessary range of movement required during all gaits:

- In walk, where the rider sits at T13 there are moderate levels of axial rotation and flexion-extension
- In trot there is less rotational movement in all directions – in fact the back is fairly rigid
- In canter we see more flexion-extension, including in the thoracic spine at T10. This is caused by the horse's head and neck acting like a lever - as the horse canters the lever pulls the spinous processes forward and the spine flexes



ABOVE: THORACIC SPINE MOVEMENT IN WALK, TROT AND CANTER.

WHEN THE HORSE'S BACK IS DYNAMICALLY STABLE IT ALLOWS THE EFFICIENT TRANSFER OF LOCOMOTOR FORCES FROM THE HINDLIMBS.

hindlimb engagement and impulsion. This was initially a surprise to the team, but it is hugely important for the dressage horse.

Scientists speculate this is associated with the activity of multiple muscles in this area, including the longissimus dorsi. This major muscle assists with back stabilisation and its role is to transfer forces from the hindquarters to the front of the horse. Longissimus dorsi is most active in the region of T12 – the lowest part of the back and where the rider sits. Without saddle pressure at T12, the longissimus dorsi is able to function, providing unhindered back movement.

This knowledge and understanding was instrumental in the development of the Fairfax World Class Monoflap which, thanks to the configuration and design of the knee block and seat, allows the rider's pelvis to remain stable and symmetrical in the saddle. This synchronicity leads to increased back stability and freedom of movement for the horse.

PRACTICAL TIPS

Trot is the default gait for warming up, but you can't influence much of your horse's movement in the gait where the spine is the most rigid. Consider going from walk to canter, and then trotting. The trot will be better after cantering because there is more potential to influence and improve the movement and flexibility in walk and canter. If you suspect you have a problem with saddle fit, any movement is likely to be far more visible in walk and canter, don't get stuck in trot trying to spot saddle slip.

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