The PERFECT canter

Moving in harmony with your horse will help you develop that winning canter. Understanding how you move together is the key – we discover what biomechanics can do for you…

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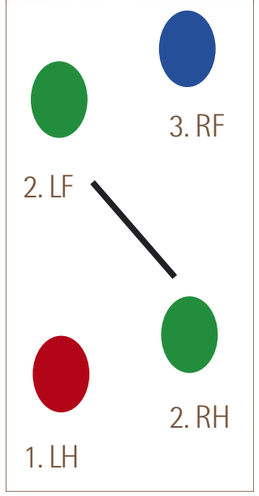
What is equine biomechanics?

Demands placed on modern sports horses have increased over the years, as has the prevalence of injuries. In current equine sports science various techniques are applied as a means to identify the causes of injury and help reduce loss of performance.

Biomechanics is one of the youngest branches of equine physiology, started by Eadweard Muybridge in 1899 when he used a series of battery operated cameras to capture the sequence of limb movements in horses. In biomechanics the horse's gait is lameness and gait asymmetrics.

The canter sequence

The canter footfalls



The footfalls in right lead canter – LH, RH and LF together, RF followed by a moment of suspension.

For more information

on biomechanics and Equinalysis system contact Centaur Biomechanics LTD, Horse & Rider Performance Analysis by visiting www.centaurbiomechanics.co.uk or tel 01926 651657.

The canter sequence

The canter has a three-time-beat which should have a clearly seen period of suspension. It's an asymmetric gait (the movement of the limbs on one side do not mirror the movement of limbs on the other). Various disciplines require varying degrees of canter. For instance, within dressage there are four types of canter – collected, working, medium and extended – all of which place different biomechanical demands on the horse.

The rein which the horse is on will determine the limb sequence of the canter in order to establish the correct canter lead. For example, for a horse in right canter, the order of footfalls would be:

1. Left Hind (LH)
2. Right Hind (RH) Left Fore (LF) together
3. Right Fore (RF)
4. Moment of suspension
5. Sequence starts again

A good canter

When looking at the biomechanics, a good canter would show an increased protraction (the horse steps under itself well) of the leading hind limb, in this case the right hind.

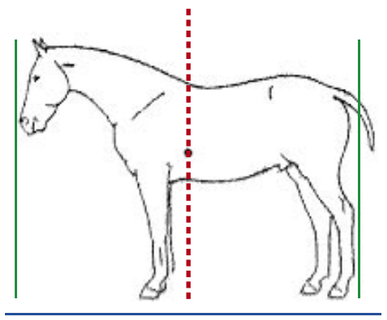
The non leading hind limb (LH), transfers the downward energy gained at the end of the suspension phase into a forward motion, which in turn produces power used to propel the horse forward.

During a good canter, especially when the horse advances in training, you would see an increase in balance, athletic ability, and elasticity of the back.

- Three footfalls separated by comparatively long intervals of stance
- A clear suspension phase
- You should hear a clear, regular three-beat rhythm

Weight distribution – achieving a better canter

Research shows horses have a greater weight distribution when standing square, with more weight exerted on the fore limbs (60%) than on the hind limbs (40%). One way to establish a good canter is to have an elevated forehand with more weight being carried by the hindquarters. This moves the centre of gravity (CG) backwards resulting in a greater degree of hind limb engagement.



Centre of Gravity (CG) in the static horse. When cantering the CG moves towards the hind quarters, allowing for a more elevated forehand.

Common problems – the horse

In canter the rider is aiming to maintain a good rhythm ensuring it maintains the three beat pattern and engages the hind quarters by moving the centre of gravity backwards (see diagram, below left).

In some cases riders may ask the horse to perform movements within the canter, such as a flying change; or lead variations such as counter canter which test the horse's balance and limb co-ordination.

A poor canter can be caused by:

- Lack of balance/suppleness
- Loss of rhythm
- Incorrect strike off
- Disunited stride
- Incorrect bend
- Stiffness
- Muscle asymmetry
- Skeletal maturity

Common problems – the rider

The rider plays a large part in determining a horse's way of going. Problems may include:

- Leaning forward – this encourages the horse to go on to his forehand and increases weight distribution on to the forelimb, which then prevents hind limb engagement.
- Leaning back – causing the rider to be behind the movement. This can affect the athleticism of the horse by preventing elastic use of the back.
- Sitting to one side – this will also affect the canter as the weight distribution is uneven. This not only affects the canter but can also affect muscle development.

Leaning back is a common problem in canter.

In all cases, the addition of a rider alters the movement of the horse (kinematics) and the ground reaction forces (GRF) with changes being more pronounced in the forelimb. This happens during all gaits, so can affect the canter.

All of these rider faults can be identified with the use of rider analysis (see page 108).

Improving your canter – gait and rider analysis

To help maintain the balance of the horse in canter the rider should aim to sit upright so his/her centre of gravity is directly above that of the horse, encouraging engagement of the hindquarters.

Many changes to the canter gait (caused by horse or rider) are extremely subtle and cannot always be seen, so they can't always be assessed accurately. The human eye can capture only 15 frames per second; but the cameras used in gait analysis can capture 50-1500 frames per second, providing a greater amount of information at any one time. As well as the limitations of the human eye, visual assessment of the gait is also plagued with the inherent risk of subjectivity.

Case study

Henry Boswell is a young dressage rider who's used biomechanics and Equianalyis...

"I found out about Centaur Biomechanics and Equianalysis through World Class Start and Potential, which I'm on. It plays a big part in our training and any discipline can benefit from it.

"If I hadn't done it through Start and Potential I'd definitely do it anyway as it's opened my eyes – nothing quite highlights how you ride better than seeing it played back to you afterwards on a big screen. You can pick up on something you may have felt and see it straight away.

"The rider screening has really helped my test riding, especially how I prepare for movements. It's shown me that if I don't prepare for movements then the first four strides can suffer.

"I also use the horse screening. One of my young rider horses had soundness issues, no one knew what it was, not even the vets. Then we had the screening done and it threw up a slight problem with the coffin joint.

"The rider analysis is a great tool to help you see how you ride and pinpoint where issues are coming from. I do it about three-four times a year and it's really helpful to have your trainer with you."

Gait analysis

Gait analysis can assess stride characteristics and identify subtle changes that may lead to poor performance. Equinalysis is a system developed by Master Farrier Haydn Price DipWCF, designed to analyse how your horse moves.

Horses are screened using joint markers and video technology. The horse is usually analysed in both walk and trot. However, the canter can be analysed on a surface with a rider or on a treadmill. Spherical markers are placed on the horse, and a computer tracks them, creating quantifiable data relating to joint angles, velocity and acceleration. Various measurements are taken, such as stride length, carpal/tarsal flexion and fetlock hyperextension.

Post screening, the data and images are stored on a CD with a portfolio specific to each horse. This explains in depth the various measurements supported by visual aids and graphs with detailed explanations. The portfolio provides a benchmark of the horse's gait, which can then be accessed and reviewed by vets, farriers, physiotherapists and/or trainers.

It provides an accurate record of the horse's gait which can be referred back to should an injury or degradation in performance occur.

An example of how gait analysis works.

Rider analysis

Performance analysis has been used in other sports with great success and involves visual feedback analysis to complement current training programmes. The images illustrate the rider's position.

Similar to the gait analysis, rider analysis can be done on site, such as at a competition – especially useful when doing dressage as the rider can do one test and then have their performance analysed, providing immediate feedback and detailed information of any areas that need improving.

Centaur Biomechanics works closely with the trainer in providing targeted visual feedback to facilitate learning and create an active discussion between the trainer and rider. For example, if the rider was not aware of a weakness, such as leaning forward, the trainer could use visual aids to show him/her the exact point it happened.

The rider analysis being carried out.

How can it help?

Gait analysis is a pre-requisite to a greater understanding of biomechanical joint and limb range of motions. Accurate data can be extracted at any time allowing for more informed decision-making especially when looking at poor performance and subtle lameness issues.

Benchmark measurements can also be taken allowing for a more accurate mapping process through any stage of development and training. Any gait abnormalities or changes can be identified and/or muscle asymmetry can be managed with targeted treatment.

For example, the way the hoof is loaded can have a large affect on the forces exposed to the limb. The analysis allows farriers to de-stress a particular joint and ensure that, as well as the shoe protecting the foot, it also provides a foundation for the whole limb. The fitting of a shoe should take into account the 'loading' of each limb. Loading is directly related to the effectiveness of joints and can affect tendon and ligament health which, if poor, could affect the canter.

How can it help me?

Rider analysis can help improve your canter by assessing rider position. This can be seen clearly on the picture (right); the rider is demonstrating a good position with her shoulder, hip and heel in a vertical alignment (one measurement which indicates a correct position).

Some riders have difficulty maintaining their position and in this case angles and lines can be drawn on the images to assess the straightness of the rider. For example, a line drawn through the centre of the rider's body identifies if the rider is sitting straight or to either side. In addition, comparisons can be made between pre and post training.

The rider is able to see how they ride certain movements, for example, if the rider leaned forward during the canter transition this could be played back on the screen. In addition the rider would be able to see the effect that leaning forward has on the horse.

To summarise – the quality of any canter can be affected by the gait and rider alterations. Accurate assessment of horse and rider, by Equinalysis, field gait analysis system can be used to improve the canter.

Rider analysis can help improve your canter by assessing your position.