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The truth about breakover

Breakover is probably the most commonly discussed phase of equine movement - and for good reason too - because it is the part of a horse's stride that incorporates the greatest pressures. There is more to an efficient breakover than a short toe, as Master Farrier Andrew Bowe, 'The barefoot blacksmith", explains...

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When a horse moves, enormous forces are generated which need to be accommodated by flexible structures of the lower legs.

With a large body mass, long legs, single toes and a biomechanical action that propels and elevates (see main image above), everything is geared for movement and impact. It is a highly evolved system of springs and shock absorbers that has undoubtedly contributed significantly to equine survival as a prey animal across the millennia.

Then we go and add the weight of rider and saddle to the equation! A well used old racetrack adage suggests that every ounce in the saddle becomes a pound on the hoof. There are implications for long term soundness.

But wait, there's more. What about landing after a jump, or stopping on a dime, or working for long periods in a deep surface, or forcing tight changes of direction or sustained galloping at absolute top speed?

Even though the lower leg of the horse is an engineering masterpiece, it is finely tuned. Too much pressure or strain and things can break. Not only can there be short term trauma to connective tissue such as tendons and ligaments, but ongoing stress leads to long term degradation of the coffin joint and navicular bone regions.

Unfortunately, scar tissue is not flexible. Injuries to the structures of the lower leg are better prevented than fixed, which means that forces acting on the lower leg need to be minimised. Hoof management has a huge bearing on this.

An understanding of equine movement underpins principles of correct hoof management.

A horse's movement is fluid and without delineation, but for the purpose of study, it can be conveniently broken into the individual phases of landing, loading and breakover. Within each phase the grand equine design has inbuilt features to deal with mechanical stresses (see image 3).

Landing

When a hoof lands, there is massive deceleration requiring correct alignment of all the lower leg joints. This is coupled with a high frequency shockwave that needs to be captured in the hoof and kept away from load bearing structures above the hoof.

Image 2

Narelle Wockner Photography

Image 3: Phases of limb movement

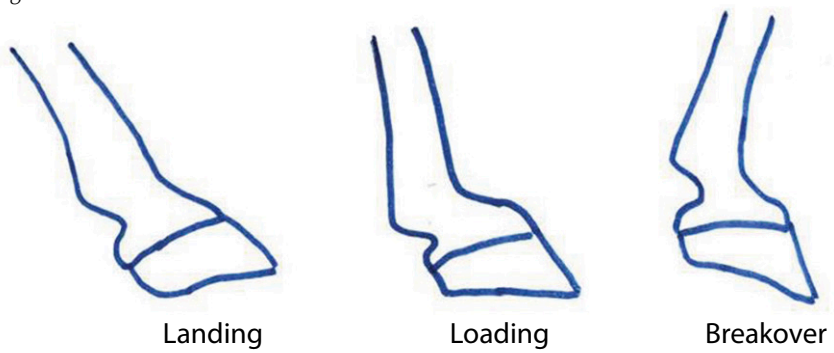

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Image 4: Heel first landing

Correct alignment of the joints comes with full extension of the lower leg and concussion absorption is initiated by frog contact. Both of these can only occur with a heel first landing. (See image 4)

Toe first landing (except when a horse is 'lifting' itself up a hill) must be avoided. (See image 5)

Not only do all of the energy dissipating mechanisms present with correct heel first landing become null and void with toe first landing, there are destructive forces literally tearing apart all of the connective tissues within the lower leg (See images 6a and 6b).

Image 5: Toe first Landing

Loading

This is when the descending weight of horse (and rider and saddle and rhinestones) versus the ground. It is when the spring gets coiled and is characterised by the sinking of the fetlock as the horse's weight is transferred into the suspensory apparatus.

A radiograph of a normal hoof shows that the pedal bone angles away from the ground. If such an image could be taken at the exact moment of full loading, it is thought that the pedal bone would then be parallel to the ground surface.

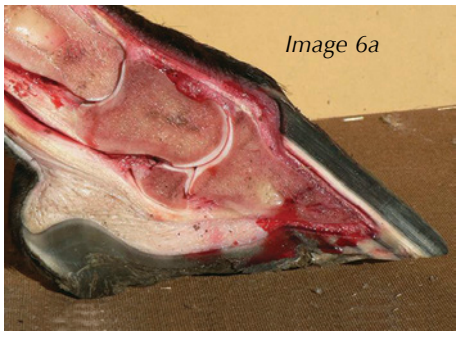

Image 6a

Correct alignment of the joints comes with full extension of the lower leg and concussion absorption is initiated by frog contact.

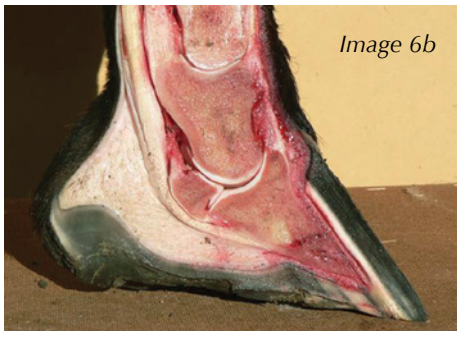

Image 6b

The energy dissipating mechanisms become null and void with a toe first landing, damaging connective tissues within the lower leg.

The hoof also 'coils' in order to complete the loading process, so the whole hoof needs to flexible, both inside and out (see image 2).

During loading, the pedal bone pushes downwards at its rear. This is why the pedal bone needs to be balanced so that when a horse is standing it is angled at 3 to 5 degrees away from the ground surface (when viewed from the side), but not ground parallel. (See image 8 below).

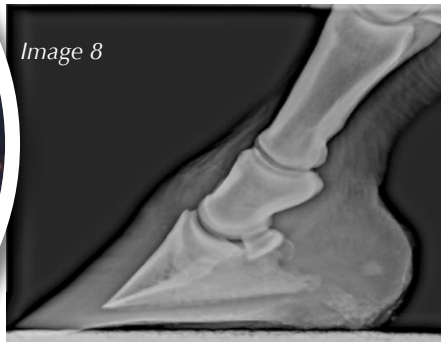

Image 8

The above radiograph shows pedal bone angulation away from the ground in a normal hoof (although the toe rather needs trimming!). If such an image could be taken at the exact moment of full loading, it is thought that the bottom of the pedal bone would then be parallel to the ground surface.

At the same time, the back part of the hoof needs to be well supported to prevent hyperextension of the fetlock and coffin joint (and therefore, excessive tension on the flexor tendons). Such support ultimately comes through the frog. It is the door stopper (see image 9).

The frog needs to be on the ground.

Image 9

continues next page...

Image 10

Breakover

Breakover is probably the most commonly discussed phase of equine movement - and for good reason too - because it is the part of a horse's stride that incorporates the greatest pressures.

A good way to define breakover is the period between when the hoof passes from full loading to when it leaves the ground.

As the body of the horse passes over a fully loaded hoof, the coiled spring begins to uncoil. The powerful flexor muscles then take charge and increase momentum by pulling on the pedal bones which pivot around the coffin joints and push the toes into the ground (see image 10 above).

Tension in the flexor tendons increases until it is sufficient to lift the heels off the ground.

The position of breakover is easy to locate on a hoof because it is simply the forward most weightbearing surface; the leading edge.

Just prior to when the heels snap up off the ground is when the maximum tensile strain bears upon the connective structures of the lower leg.

Toe length forms the fulcrum of the breakover equation. The longer the toe, the more delayed is breakover and the greater the pressure on the internal structures.

A short toe is vital for an efficient breakover, but there is more...

How important is a short breakover for a horse's long term soundness?

"*If there is just one thing you can do to a horse's hooves, keep the toe short*"- Professor Robert Bowker.

The position of breakover is easy to locate on a hoof because it is simply the forward most weightbearing surface; the leading edge.

Importantly, breakover is not just about a short toe. Rather, heel lift is actually initiated and controlled by tension in the deep flexor tendon below the check ligament. Timing of breakover is controlled by heel height.

A common misconception is that raising the heels hastens breakover.


Image 11


Image 12

Raising the heels actually has the effect of delaying breakover because it removes tension from the deep flexor tendon. Lowering high heels (within reason and with caution) adds tension and will tend to speed up breakover. That is the mind bending truth your honour!

Breakover and hoof landing are inexorably connected. A delayed breakover inevitably leads to a toe first landing. In turn, toe first landing delays breakover.

It's a perfectly vicious cycle!

What about hoof management?

Whether barefoot or shod, breakover 'balance' needs to be kept short.

Nothing is ever exact or written in stone on the equine hoof, but it seems that consensus suggests a two to one balance is sustainable; two thirds frog and one third of weightbearing hoof in front of the frog (see image 11 above).

If a forward running hoof with a long breakover doesn't have the structure to be 'backed up' sufficiently when bare, a set back tip is a good way to achieve a definite breakover without leaving a horse tender-footed.

"If there is just one thing you can do to a horse's hooves, keep the toe short"
Professor Robert Bowker

When shoeing hooves with a long breakover, several different types of shoes can be used to good effect, including rolled toes, rocker toes, 'natural balance' type shoes or even a plain hack shoe *sans* toe clip and set back under the leading edge of hoof wall (see image 12).

As previously stated, breakover is not just about the toes. Heel height also needs to be addressed and the heels should be dressed down to the widest part of the frog if possible, being careful not to pass through the boundary of the sole plane.

When shoeing, it is worth considering supporting the frog. Most of the newer 'plastic' shoes have excellent frog support bars.

Because a shoe takes hoof wear out of the equation, it is vital that shoeing is regular. Probably no more than four weeks should pass between re-shoeing in order to keep the breakover short.