When a horse needs shoes

Part 1 - A story with legs

by Andrew Bowe, B. App.Sc., Master Farrier

Photos courtesy of Mayfield Barehoof Care Centre - www.barehoofcare.com

This story has legs

Regular readers of this column would identify the author as very much an advocate of keeping and riding horses without shoes.

Indeed, visitors to the home farm of Mayfield would know that the saddle horses here are successfully kept barefoot or wear tips or hoof boots, but are not shod (and the Mayfield horses certainly earn their hay most of the year; they are no paddock decorations). There would not have been a shoe put on a saddle horse at Mayfield for many years, probably a decade or more now. They are going as good as ever and, considering several of the most hard-ridden mounts have previously been rehabilitated from life-threatening laminitis, the story has got legs.

Over the same decade, the author has had quite the journey from working as a 'traditional' farrier shoeing horses all day everyday, to a 'barefoot' farrier trimming horses all day everyday.

Why?

The bare-boned truth is that there are certain unavoidable and deleterious consequences of long-term shoeing. If there weren't such outcomes and the barefoot alternative was not viable, then the author would have long ago gone back to what he always did. He would still be plating gallopers at the track every morning in the high country frost. And the Mayfield horses would be shod.

Despite this, our philosophy at Mayfield is not about never ever shoeing, but rather that shoes shouldn't automatically be the first option when a horse is working under saddle.

The author still works as a farrier, trimming a large number of horses, and even though there is a nice hint of rust on the well worn face of the anvil, it still travels in the wagon. There is always a horse somewhere that 'needs' shoes and, in the broader industry, the reality is a lot of horses still get shod.

Shoes may be the only practical way to overcome issues such as excessive abrasion or the need for traction or to protect soft, thin soles. Sometimes it is simply what the rider wants.

The short answer?

The time has therefore come to write about shoeing. But don't expect a short answer to a long question! This is the start of a series of articles that will attempt to answer the riddle of shoeing for long-term soundness.

It is quite ironic just how much the author has learnt about shoeing by studying the principles of 'barefooting'. Gaining a far greater understanding of how the equine hoof functions has had a profound effect on his very approach to shoeing; realising that shoeing for long term soundness requires more than just the relentless pursuit of next weekend's elusive blue ribbon. So where do we start?

Controversial territory

Before the general principles and specific parameters of horse shoeing are explored, it would be timely to discuss what exactly is physiologically wrong with the shod hoof.

Of course, this subject is venturing into controversial territory. A lot of horse riders believe quite firmly that there is nothing at all physiologically wrong with shoeing. That's why it is important to delve into the underlying science as objectively as possible.

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It's all about weight bearing

The effect of horse shoes can be summed up quite succinctly. When shoes are put on, hoof function is almost fully impeded. Whilst great lists have been made in recent years about all the myriad (supposed) manifestations of the effects of shoeing, the problem can be realistically distilled down to the creation of incorrect weight bearing, which directly affects how blood flows into and around the hoof and how concussion is dealt with.

This is the fundamental difference between the traditional model that requires the horse to carry all of its body weight on the laminar bond and the progressive model of bare hoof care that suggests that the body weight should be shared between some of the wall, some of the sole and all of the frog.

The two photos below pronounce the difference quite clearly. There is plenty of daylight under the shod hoof, but the frog is fully grounded on the unshod hoof.

A valid question to ask would be: is there any other mammal on the planet that carries its entire body weight on its hoof walls (or claws)? No, their body weight is distributed across their whole foot, but predominantly on their pads. It should be no different for the equine species. Even though horses have a hard hoof, they have a large weight bearing pad which we all know as the frog. The frog is there for a reason.

What happens when a shoe is attached to a hoof and the horse is now carrying its full body weight through the walls to the laminar bond, as per the traditional model?

First and foremost, circulation is significantly impeded.

Circulation is vital, not only for local purposes of feeding the cells that grow the hoof, but there is a huge volume of blood that passes through the hoof with every heart beat. This blood is required for hoof function.

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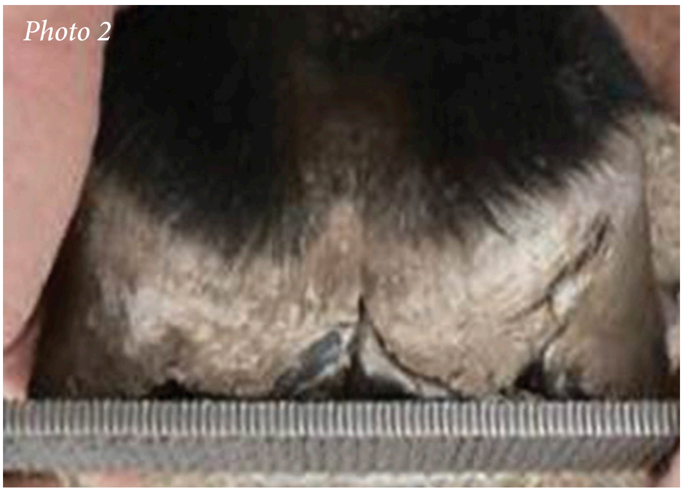
Photo 1

Photo 2



Thermoregulation

Horses have the unique ability to be able to thermoregulate their bodies and especially their hooves. They are adapted to coping with the enormous seasonal variation that is the reality of life in their natural environment of the high desert country of central Asia. They are able to stand in burning hot sand but also in freezing ice and snow.

This can occur because the amount of blood flowing into the hooves changes according to external stimuli. A basic way to explain a very complicated subject, is that there are numerous little bypass valves (called shunts) that can divert blood from the arterial plexus to the venous plexus. In other words, shunts provide a shortcut, so that not all blood goes the full distance to the extremities of the body (missing the smaller capillary network).

Unfortunately, such a system is not fool-proof and it also responds to incorrect pressure. Too much pressure arising from a downstream 'blockage' in the blood stream and the shunts open, effectively directing blood away from the extremities of the hoof. Blood flow into the hooves appears to be very much affected by physiologically incorrect weight bearing.

There is no rigid attachment between the pedal bone and hoof wall, only the thin fleshy corium which contains the laminar attachment. When weight bearing is spread over the whole hoof, but predominantly on the frog and specifically not on the outer wall, the corium exists as it should, as a mass of unrestricted vascular tissue with the channels for blood flow fully open *(Photo 3)*.

Conversely, when the horse's body weight is carried wholly on the outer wall *(Photo 4)* and the frog is totally non-weight bearing, the pedal bone moves downward relative to the hoof wall which rides upwards and effectively squeezes at least the coronary artery and possibly the circumflex artery as well.

It has long been theorised that putting shoes on horses' hooves has some anaesthetizing effect. Logically, less blood getting to the nerve endings nullifies sensation.

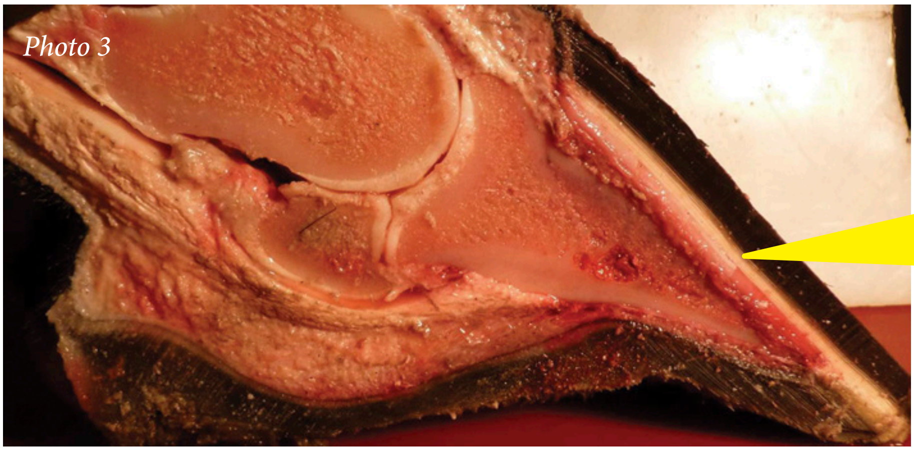
What about the science?

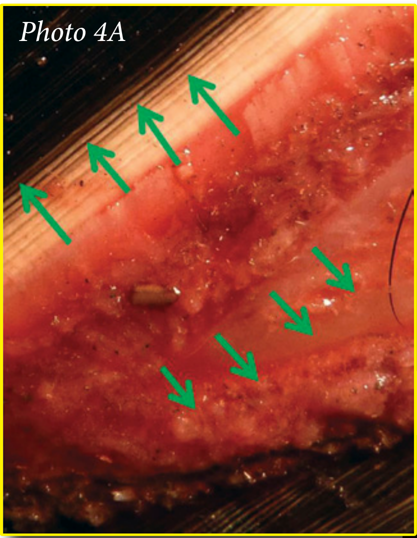
In recent years this theory has been validated by the findings of Professor Robert Bowker from Michigan State University, who has been objectively documenting the changes to hoof bloodflow under differing weight bearing scenarios with the aid of modern technology, such as Doppler Ultrasound.

Anecdotally, shod hooves are cooler to touch than unshod hooves that have a functional (weight bearing) frog. This is especially noticeable to the farrier on one of those frosty high country mornings!

There is another more sinister problem that arises in the long term from incorrect weight bearing.

The laminar bond is designed to hold the hoof wall parallel to the pedal bone and counteract the pull of the flexor tendon. It does not appear designed for significant vertical loading.





These photos show the inner structures of the hoof under pressure, which we have applied with a press. The above photo shows the bare hoof, and below with a shoe. The closeups show that weight bearing on the outer wall (with shoes) effectively and constantly pulls apart the corium.

In a normal hoof that is supported by the frog and a rim of sole and inner wall, but does not carry weight through the outer wall, there is no tension on the corium *(Photo 3A)*.

Compare this to a hoof that is loading up through the hoof wall and bearing the whole weight of the horse's body vertically through the laminar bond. The corium is constantly being stretched apart *(Photo 4A)*.

In a normal and fully functional hoof, the corium is predominantly vascular tissue with a smaller component of connective tissue. There is literally a cascade of blood around the whole corium. Remember that huge volume of blood that passes through the hoof?

The corium is, however, amorphous tissue that is able to change its very structure. Over time, with excessive stress, it is believed that there is a change away from it being predominantly vascular to it becoming predominantly connective tissue. The downside of this is that there is less capacity to move the huge volumes of blood around the hoof. Loss of function and mediocre health at best.

There is also the spectre of bone density loss (i.e. osteoporosis) arising from the pedal bone 'hanging' from its dorsal surface for long periods of time, often with great stretching forces pulling at its surface. Bone is designed to exist in a state of compression, not expansion.

The traditional model has the whole weight of the horse hanging from the laminar attachment. From an engineering perspective, if it was meant to be a shock absorbing engine mount, it would need to be inverted the other way around!

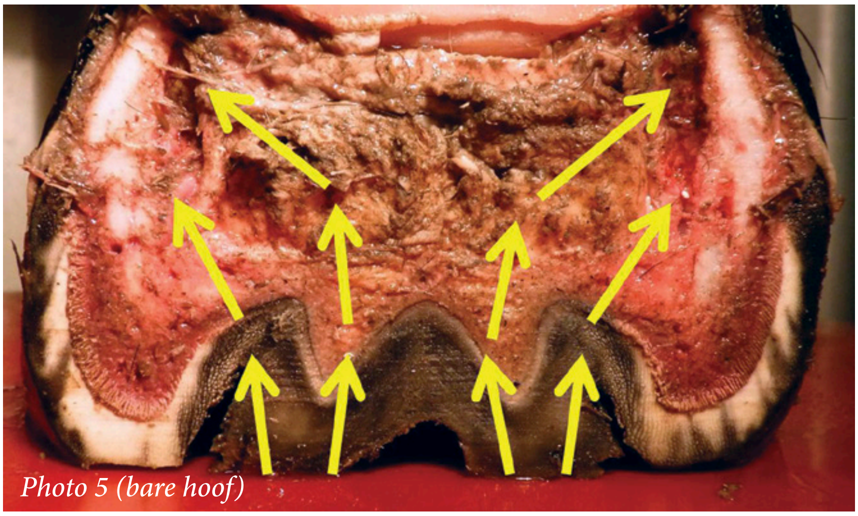


Photo 5 (bare hoof)

Photos: a cadaver cross section showing loading pressures. Above: the bare hoof with a weight bearing frog bulges sideways diverting the shock waves. Below: When the frog is not on the ground, the shock wave travels up the hoof wall.

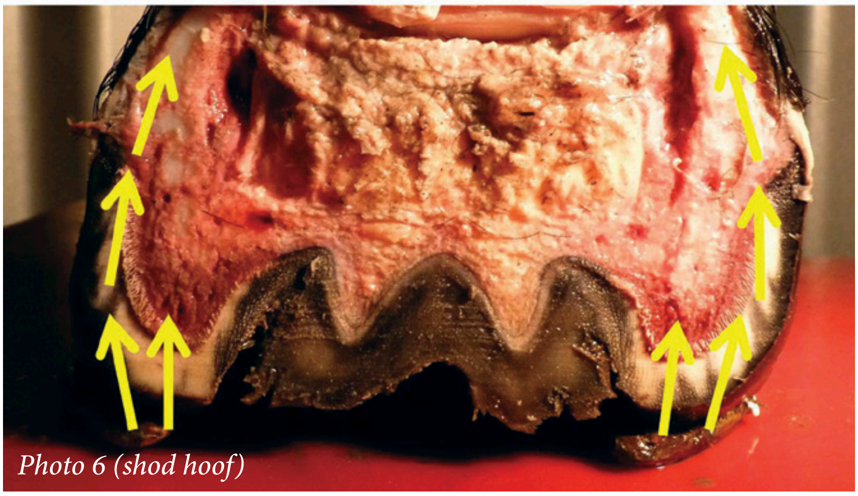


Photo 6 (shod hoof)

The matter of concussion

When that hard toe on the end of the long equine leg strikes the ground, significant impact forces are generated. This is why the equine hoof is a highly evolved structure that is primarily designed to dissipate high frequency shock waves, which it does by utilising the large volume of moving blood. Moving fluid is one of the most efficient ways known to pick up and move energy.

When a hoof strikes the ground frog first, the shock waves enter the frog and pass to the digital cushion which itself gets 'squashed' by the descending weight of the bony column above and bulges sideways, thus diverting the shock waves straight through the wall of tiny veins either side of the back of the hoof *(see Photo 5)*. The moving blood effectively picks up the shock wave, which is transferred into heat energy and dissipated around the horse's body. It is indeed an engineering masterpiece, the equine design.

What about when the frog is not on the ground?

In such a case as shown by *Photo 6*, the shock wave is concentrated into the shoe and therefore, travels directly up the hoof wall and into the bony column above.

For concussion to be effectively dealt with, it is vital that the frog is on the ground first and the great volumes of blood required for effective energy dissipation are allowed free access into the hoof. For optimum, long-term hoof health, these requirements are non-negotiable.

Scientists love concussion because it is tangible and objective and easy to measure. There are plenty of facts and figures readily available on the internet that show the huge increases of concussion when hooves are shod compared to left bare. There is even some compelling slow motion video footage; slow enough to show the shock waves travelling up the legs of shod hooves, but the same shock waves seem to disappear into the hooves of barefoot horses.

Despite the long term effects of shoeing that have been discussed here, the great conundrum (and indeed the foundation of the great debate between proponents of barefoot or shod) is that so often, horses go better under saddle when shod.

Long-term impact

The loss of function does not create a problem today. Rather, it may manifest as chronic lameness years down the track (issues such as navicular, ringbone, chronic laminitis, sidebone etc.). It is easy to sell today at the expense of paying the price tomorrow and just live in the moment, but try selling tomorrow at the expense of today's pleasure or convenience!

Either way, the question is, can horses be shod to maintain long-term soundness? That is, address these two issues of blood flow and concussion?

Next month's article will explore ways to manage shod horses for minimal long-term impact.