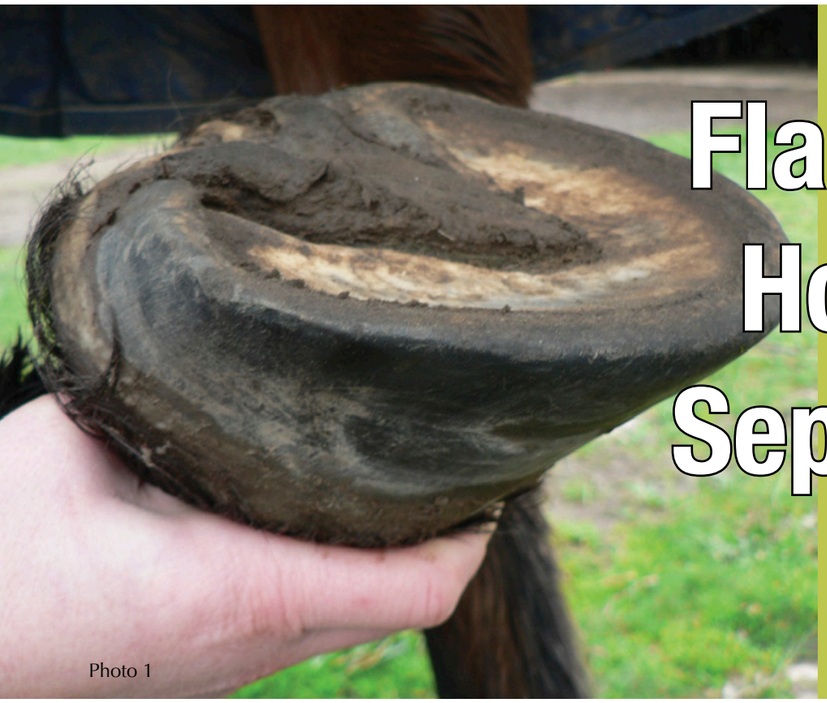
Photo 1

Flares and Hoof Wall Separation

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Photos courtesy of The Mayfield Barehoof Rehabilitation Centre

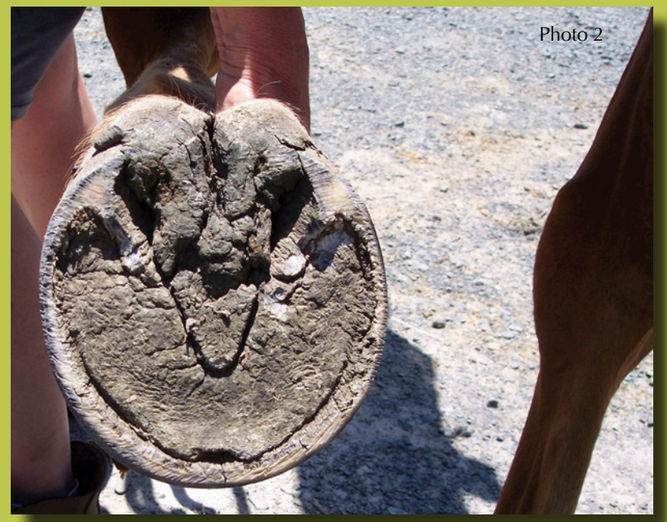
Photo 2

A large number of domestic horses have hooves that literally come apart at the seam

Tough hooves are the pillars of a horse. They are sturdily designed with the architectural principles of curves and arches, with each component held tightly together as a unit.

Vital to the overall strength of this unit is the line of laminar 'leaves' that joins the wall to the sole. This is a dynamic seam that allows the growing wall to 'slide' past the sole without compromising integrity; an engineering masterpiece.

In a healthy hoof, the laminar line is such a tight bond that it is virtually invisible to the naked eye (See photo 1 above).

Unfortunately, this sole to wall junction is also potentially the weakest link and a large number of domestic horses have hooves that literally come apart at the seam (see photo 2 on opposite page).

When this happens, all of a horse's weight is pushing down on weak, unsupported hooves and the growing hoof wall migrates away from the pedal bone, leading firstly to flaring of the hoof wall itself, then to mechanical breakdown of the laminar line and finally to separation of the wall from the sole.

This is one of the great frustrations of horse owners and so often has them reaching for shoes just to 'hold' the hooves together (see photos 3 and 4)

What causes such an important part of the grand equine design to fail?

There are two issues at play – mechanics and metabolics.

Mechanical stress

The laminar line is often subjected to unnatural mechanical stress. Unless the frog is on the ground where it can support the middle of the hoof, the vertical stress is fully transferred to the laminar line, literally forcing it to suspend the whole weight of the horse. It is simply not designed to do this.

See photo 5 on page 55, which shows a cadaver hoof cross section with the shod hoof bearing weight through walls only.

If the hoof capsule was meant to be an engine mount, it would need to be inverted the other way!

This scenario of mechanical distress can be avoided quite simply by trimming a hoof to keep the frog weightbearing over its entire surface area (hooves should be trimmed to this parameter if possible, but don't over-shorten heels to get a diseased frog onto the ground).

Regular maintenance trimming (every 2-3 weeks) is the key because the frog is able to remain as a primary weightbearing structure at all times.

The frog needs to be well grounded.

Photo 6 on page 55 shows a cadaver hoof cross section fully weightbearing.

Trimming also needs to follow physiologically correct parameters in terms of weightbearing distribution and both the quarters and outer wall should not have significant weight bearing responsibility (only the inner wall should bear weight).

Most importantly, the toe should be kept short.

It is also beneficial to keep a horse out of shoes whenever practical and, if your horse 'needs' to be shod, consider using wide web, flexible plastic shoes which support a large area of the hoof, including at least some of the frog.

Mineral balance

Trimming may well take away mechanical stress, but the ultimate path to tightly bonded hooves is to grow a strong laminar attachment.

Growth obviously originates at a cellular level and the creation of cells that have optimal health requires a balanced availability of minerals. A major part of the strong hoof equation appears to be fine tuning a horse's mineral balance.

Minerals are required by all living organisms for literally thousands of metabolic processes. Minerals seldom act alone. They interact with numerous other minerals and indeed relate to other minerals in homeostatic ratios, so not only do they need to be present in the horse's system in adequate quantities, but they need to be balanced in comparison to other minerals. If only one mineral is limited or in too great of a concentration, the whole system will not function correctly, especially the hooves.

This article can only be a brief synopsis of a huge subject and therefore, advice on equine nutrition should be sought from a qualified person. This article considers the two minerals that are arguably most commonly deficient.

Sulfur

Sulfur is needed in significant quantities because it is a constituent of several amino acids (methionine, cystine and cysteine), which help to form the reinforcing bonds between collagen molecules and therefore the fibres of keratin, thus adding strength and stability to the hooves.

Even though there has not been any officially recorded pathological deficiencies of sulfur in horses, horses with weak hooves manifesting with a separated laminar line often show significant improvement when supplemented sulfur.

Sulfur can be successfully added to a horse's diet through the additive MSM (methylsulfonylmethane) which is an organic form of sulphur that is readily absorbed.

Magnesium

Magnesium is an active participant in numerous metabolic processes, including the process of converting glucose into usable energy within cells, the basis of aerobic function. It would be possible that a deficiency of magnesium might cause glucose metabolism to be impaired. Whatever its exact role, supplementing magnesium has been found to help horses with weak hooves.

Magnesium is not stored anywhere in the body other than in the bones, so it needs to be constantly replenished. Calling on the reservoir of magnesium in the bones can only ever result in loss of bone density. It has probably been of such abundance in the horses' natural environment, that there was no need for the horses' system to evolve with any mechanism for storage or retention in times of deficiency.

Why would such an important mineral as magnesium ever be in short supply?

Very simply, horses did not evolve in Australia. They evolved in central Asia browsing tufty grasses and shrubs that grew in soils relatively high in magnesium.

The downside to Australian soils is that there may be mineral shortages – especially magnesium - for horses grazing pasture. A logical question to ask is why large herbivores didn't evolve in Australia, is it because the landscape is too old and devoid of minerals to sustain large animals?

In addition to this, Australian soils are mostly quite acidic which also greatly affects the availability of many minerals to plants, especially magnesium.


Photo 2 Hoof Wall Separation

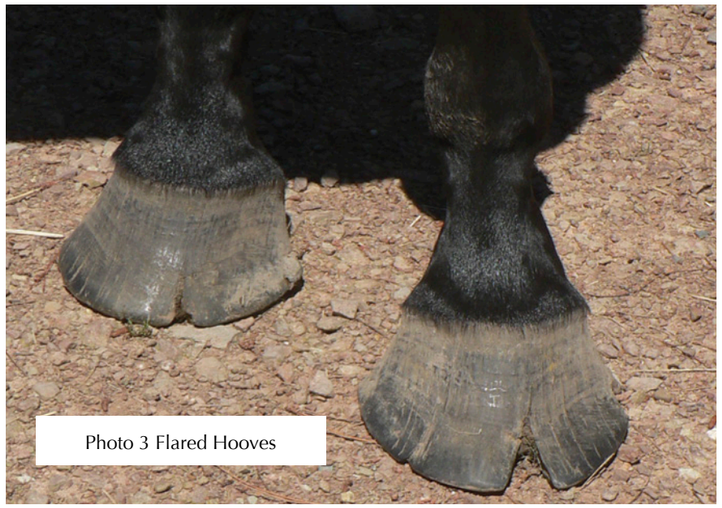

Photo 3 Flared Hooves

Adding to the magnesium problem, even if the ingested food has enough magnesium, there are several scenarios that may inhibit a horse's ability to absorb it, including a diet high in simple sugars (that would be most horses in the 'settled' areas of Australia).

The magnesium picture is actually quite a complex web.

Excessive calcium inhibits magnesium uptake. Unfortunately, there has been a tendency to over-simplify the mineral balance picture and concentrate – almost anthropomorphically – on calcium supplementation. Human nutrition seems very much focused on calcium.

There is also a link between potassium and magnesium, whereby excess potassium is known to cause magnesium shortage.

Adding to the problem of Australian soils is the history of fertilizer use which has been necessary to enhance agricultural profitably from such naturally mineral deficient soils. One of the main nutrients used has been potassium.

Just to show how complex and interrelated the mineral picture is, potassium can be put back into balance with magnesium by adding sodium into the equation. Sodium is found in common salt, which is why salt is an important component of a horse's diet.

Magnesium has long been known to assist horses suffering laminitis. In recent years, researchers have been extending the terms of reference for laminitis to include those horses at the very mild end of the spectrum with no major pedal bone rotation, but with characteristic hoof deformities that include weak laminar lines and associated flaring and separation (and thin, flat soles). By extrapolation, magnesium may well be the missing link in horses with weak hooves that are effectively suffering 'sub-clinical' laminitis.

Foremost of researchers in this field is Pauline Moore from Queensland who theorizes that magnesium may actually be required by horses living on Australian pastures in quantities far greater than previously thought, and that magnesium deficiency may be the main underlying factor implicated in weak hooves.

Field trials have been able to replicate significant improvement in hooves that have previously been pathologically weak by the addition of a significant quantity of magnesium.

Magnesium has been a difficult mineral to supplement effectively, but Pauline has been pioneering the use of magnesium chloride which is easily assimilated by horses (it is actually a naturally occurring salt that is sourced from central Asia, from the area that horses evolved in). The cats are starting to line up on the fence!

Pathogens

Any discussion of flaring and separation needs to consider pathogens, because a common complication of laminar line weakness is opportunistic invasion of pathogens such as bacteria and fungus. This creates pressure that damages the pedal bone and leaves a permanent weakness.

It is an insidious problem because the 'bugs' that break in are keratinocytes, which means they eat keratin, especially warm and damp keratin that is in a low oxygen (anaerobic) environment. There would be no happier place for these bugs than hidden away within the inner hoof wall.

At the front of the hoof, invading pathogens create what is commonly known as seedy toe, which can be easily controlled by complete resection and topical application of benign agents such as peroxide (3%) followed up by 'Black Healer'.

When the bugs invade and cause separation at the heel quarters, this is called white line disease. Even though the bugs involved are the same at the heels as they are at the toe, the problem is much harder to control at the heel quarters. It needs to be at least partially resected and also treated topically with peroxide (3%) but may also need to be treated with phenyle.

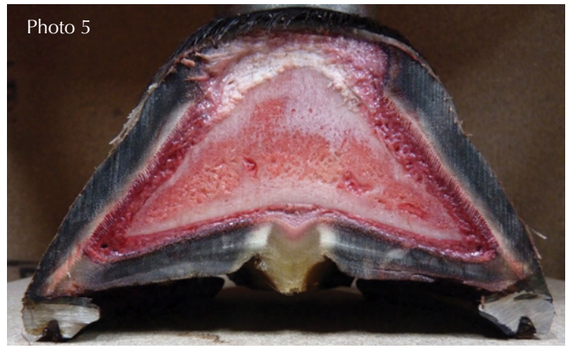

Photo 5 above shows a cadaver hoof cross section with the hoof bearing weight through walls only. Photo 6 below shows a cadaver hoof cross section fully weightbearing.