One Foot For All Seasons?

9-8-06 Pete Ramey

[Note: This is a follow-up to the previous article, "Understanding the Soles" available at http://www.hoofrehab.com/horses_sole.htm . Please read the other article first for clarity. Pete]

Important definition from previous article:

Collateral Grooves - *The "seam" between the sole and frog (also known as frog/sole juncture). They are a significant landmark, because their distance from the external surface to the corium surrounding the coffin bone and the lateral cartilages is consistently around 1/2 inch [except in the rare case of a previous subsolar abscess of frog and sole corium, which can push them farther away]. Given the concaved shape of the coffin bone and lateral cartilages, the higher the collateral grooves are lifted off the ground by the outer perimeter of sole, the more sole there is under this outer perimeter. They can accurately be used to judge sole thickness anywhere in the outer perimeter of sole adjacent to the white line by visualizing how high this outer perimeter of sole would lift the collateral grooves above a flat ground surface.*
I am equally convinced that hoof boots can, should and will be the "21st Century Horseshoe". Boot quality and technology continues to improve every day, and as better boots with a wide range of traction variations hit the market, it will continue to make less sense to limit the options available to the horse and rider by attaching permanent hoof protection or traction devices.

Note: The prospect of supporting P3 through the sole often seems impossible and generally foreign to many farriers. They know from experience that if you get too much sole pressure on a shoe, the corium will bruise and abscess. But understand the difference between 'constant pressure' and 'pressure and release'. P3 can only be truly supported through the sole when the pressure to the sole's corium is being released during flight. This is one of the primary reasons I favor hoof boots with padded insoles, rather than shoeing systems with impression material for laminitic horses.

When many people first study the deep solar concavity of most desert feral hooves and healthy domestic hooves, they get the idea that the sole and frog are passive; lifted off the ground by the "suction cup" bowl in the bottom of the foot.

The problem is; many farriers and trimmers were incorrectly taught to evaluate and think about hooves while the horse is standing square on concrete, with less thought given to the hoof and limb mechanics in motion or the terrain the horse lives and works on. In fact, in the varied terrain, deep or rocky footing that forges these deeply concaved soles everything that casts a shadow bears weight. In the front half of the foot; given the larger surface area, even a deeply concaved sole actually bears more weight than the much smaller surface area of the hoof wall unless the horse is standing on a flat, hard surface. This is very safe, natural and comfortable for horses if adequate sole thickness and callusing are present in the hoof.

Study of healthy, sound feral horses and recent research from Robert Bowker VMD, PhD suggests that the horse was never intended to "hang" from the laminae as most of us were originally taught. Direct support of the coffin bone through the sole is essential to preventing unnatural, excess stress on the laminae that can contribute to lamellar failure. The deeply concaved soles provide this support when the horse is working on rocks, dirt and grass as the foot sinks into the varied terrain.

Photo A: Quarter Horse front hoof; pasture/arena
This deeply concaved front foot [pre-maintenance trim] functions beautifully for this horse in the yielding terrain he lives and works on: Unparalleled traction, soundness and function. Aside from a shedding frog that should probably be peeled away, the foot has almost perfectly maintained itself for its terrain for the last six weeks; it doesn't even need a trim. If you put the same foot on hard flat terrain, however, it would be all wrong: Suddenly there would be no natural support of P3 through the sole, no much-needed frog pressure and the bars would be completely out of functional use.

But what if the same horse routinely lives and works on perfectly flat surfaces? Then our natural P3 support is missing and that same deeply concaved foot will cause peripheral loading… The horse is right back to hanging unnaturally from the laminae. Healthy laminae are strong enough to withstand this occasionally, but the repeated insult will cause damage or failure of the hoof wall/coffin bone attachment. It is my opinion that the hard surfaces that are commonly blamed for "road founder" (mechanical damage to the laminae) are not the culprit at all; instead it is the peripheral loading that usually results from a hard, flat surface. The horse simply needs sole pressure/support.

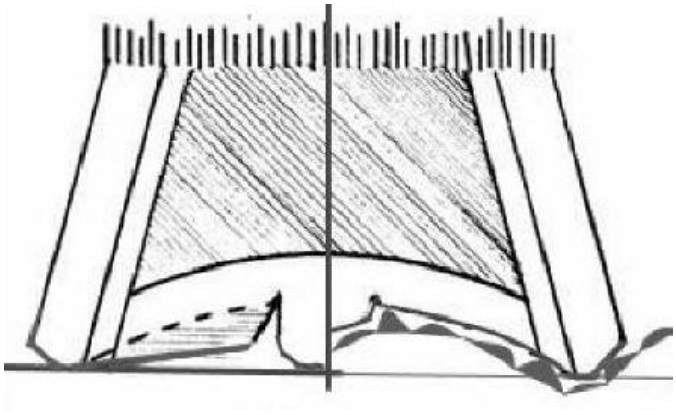
The expansion of the hoof capsule on hard impact is essential to the horse for both energy dissipation (much like the flexion of your car

tires) and for healthy circulation [Bowker '99]. The primary force that causes this necessary expansion is the weight of the horse descending onto the concaved sole; drawing it out flat, thus pushing the walls apart on impact. To my knowledge, no one has ever actually studied how much hoof expansion is necessary or natural, but my personal observations leave me suspecting most hooves should expand about ¼ to ½ inch on hard impact. To achieve this, the arc of the sole should be able to flatten about ¼ inch on hard impact as well.

On gravelly surfaces or soft terrain the outer perimeter of the hoof can sink into, the "naturally" deep (1/2 inch to 3/4 inch) vault of solar concavity is necessary for this 1/4 inch of sole flattening to occur; causing expansion of the hoof capsule. However on a hard, flat surface 1/4 inch of total solar concavity may be all that is needed and having more solar concavity can actually deprive the hoof of necessary support.

In the real world (if you have grown well attached hoof walls), achieving the correct amount of solar concavity is usually pretty easy if the horse is moving on the same type of terrain 24 hours a day. The foot will do it for you if you allow it. If the horse is always on a hard flat surface, the inner part of the sole (closer to the frog) will fill in, and the ¼ inch of total solar concavity will usually wear into the foot, provided the walls are not allowed to overgrow and the horse has freedom to move. If the horse is always moving on a yielding or rocky surface, the soles will tend to callus into a deeply concaved shape with uniform sole thickness over the coffin bones and lateral cartilages, mirroring the individual's coffin bone shape. I think either way, the sole is seeking it's ability to provide the ¼ inch of flattening that is so critical to hoof expansion, while also seeking a critical need for this flattening to "bottom out" so that the coffin bone is supported and excess shear stress does not abuse the laminae.

Feral front hoof; hard terrain
Whether the sole has callused into a deeply concaved shape for rocky or yielding terrain, or filled into a flatter shape for hard, flat terrain, the collateral grooves (seam between the frog and sole) should be lifted 5/8 to 3/4 inch off the ground by the outer perimeter of sole adjacent to the white line. This ensures you have adequate sole thickness to protect the internal structures. (Please read "Understanding the Soles" for clarification of reading sole depth using the collateral grooves.)



Hard, flat terrain ***Yielding terrain***

If you cross-section a hoof an inch behind the apex of the frog you get a clear view of what the collateral grooves mean to sole depth in flat terrain feet vs. yielding terrain feet. The right side of this drawing shows the natural adaptation to yielding or rocky terrain. The left side of the drawing shows the "right foot" for hard, unyielding terrain.

In both feet, the collateral grooves are lifted 1/2 to 3/4 inch from a flat plane by adequate sole thickness in the outer perimeter, and both sole types offer both P3 support and hoof flexion in their given terrain.

Photo C: Feral horse; hard terrain
This wild foot has shaped itself "right" for hard, flat terrain. It has a 3/4 inch deep collateral groove (total height off a flat surface); indicating optimum sole thickness in the outer band of sole so important for protection from sensitivity and bruising, but the sole's actual "vault" is only 1/4 inch deep, allowing support on a flat, hard surface at peak expansion. Also note the frog can receive pressure and aid in the dissipation of energy and support; even on a flat, hard surface.

If you really spend some time pondering the forces on everything, the ratio of pressure to the frog, bars, sole and walls are probably identical in this hoof and the hoof in Photo A; given the difference in terrain! Each part of the foot is seeking a particular percentage of the load. The differences in terrain create completely different hoof forms that are performing the same function!!!

Thoroughbred; just pulled shoes; soles were thinned by previous farrier.

Compare this hoof at left to the feral horse in Photo C: Similar "flat" sole and protruding frog. The big difference is there is almost no sole under the outer perimeter of P3 to lift the collateral groove off the ground. The bottom of the collateral groove is almost the lowest thing on the foot, meaning the sole is literally paper thin! Keep this horse off rocks and hard terrain (!!!) until more sole can be built, and definitely leave your knife in your pocket.

The picture at right shows the same foot 5 months later as healthy callused sole is building in. The outer perimeter of sole would now lift the collateral groove 1/2 inch off the ground. (both pix pre-trim)

Quarter Horse front hoof; "concrete" frozen paddock

Quarter Horse pre and post 5 week trim (same photo). This foot has shaped itself perfectly for the hard-frozen Ohio paddock it calls home. The sole's total arch is only 1/4 inch, but the very bottom of the collateral grooves are lifted 5/8+ inch of the ground by the outer band of densely callused sole, indicating adequate sole thickness at the outer perimeter. Note the less sloping mustang roll necessary when the foot can't sink into its terrain and that there is frog, sole and bar support; even on the flat surface. The foot can flatten and expand, but still "bottom out" for support.

The best thing a trimmer can do to this foot is nothing; even if the owner just flew you 600 miles to do a maintenance trim on the horse (as was the case here). Horse owners want to pay for performance; not your sweat.

"If someone were cutting half of the sole from your foot every 4-6 weeks, no one would wonder why you were lame. It would be obvious. In the horse world, this simple, "common sense" is very uncommon. Most professionals can list a dozen reasons why they think routinely cutting sole and frog off the horse offers protection, function and soundness. I'll "sugar-coat" this the best way I can: In almost every case they are wrong." Pete Ramey

Our problems begin when we suddenly switch the horse from one terrain to the other. For instance, in many areas the correct foot for winter is all wrong for summer. If your pasture or paddocks are yielding in the summer, but frozen solid in the winter, it is healthy to allow your horse to wear completely different feet during the "hard" times in winter. Let the center of the soles "fill in" to a flatter state. If you try to force your hooves to be deeply concaved, you will probably cause the damage, stress and distal descent of P3 associated with peripheral loading.

When springtime rolls around and the ground softens, it is usually best to help the horse adapt to a more concaved summer foot by taking out the retained sole adjacent to the frog, paralleling the inner structures and respecting natural sole thickness. The horse will usually start to try to 'let go' of this excess, indicating it is time to help it come out with your tools. Look carefully for and respect the true healthy sole plane that will usually be lying underneath the exfoliating material. Generally speaking, you only have to do it one time; then natural wear and callusing will take over for you. Please be careful, here. It is much better to do too little or nothing to the soles than it is to do too much. Again, the previous article, "Understanding the Soles" will help you do this correctly. After you do this "cleaning out"; recognize that the healthy sole underneath is a natural thickness, but is probably not well callused. There is a big difference between a 5/8 inch thick sole and a 5/8 inch thick callused sole! Use hoof boots for rocky terrain or when you add the weight of a rider until densely callused sole is achieved.

It is very important not to overdo it. When in doubt about the sole or frog; leave them alone. I strongly believe that the most common cause of hoof tenderness is constant "micro-management" of the sole and frog, so I'm not suggesting you run out and change the feet every time the weather changes. Instead you should accept, understand and respect the need for these different adaptations to terrain throughout the year. If you understand the need; when the terrain changes you will be able to notice the hoof trying to change on its own; you are just there to "help it along", because domestic horses don't typically move enough to do a complete job in a reasonable time.

In other regions it works in the exact opposite way. Soft mud and wet pastures in winter turn to dry, baked ground in summer. Other people deal with soft snow in winter and hard ground in summer…… The list goes on, but the point is, wherever we live we need to listen to the hooves and think about the mechanics in the living/working terrain rather than only in the wash rack on trim-day.

Tennessee Walker front hoof; pasture/arena
When it is time for change to yielding terrain, it is often correct to "clean out" the retained sole and excess frog. Note that the outer band of sole adjacent to the white line was untouched. Remember everything that casts a shadow bears weight in yielding terrain. You aren't making the walls, sole bars or frog passive. Don't thin the sole beyond 5/8 inch and don't repeat this trim over and over; areas of sole that "pop back" quickly are needed, whether you understand why or not! Use hoof boots for riding on rocky terrain until the newly exposed sole, bar and frog are heavily callused.

A trim like this is sometimes desirable for periods of change. But if you find yourself trimming bar, sole and frog over and over on the same horse you are probably making a mistake and working against the needs of the horse.

Another question that often comes up is "What if the riding terrain is wildly different from the living terrain". For the very healthiest answer, I'll quote Dr. Bowker again; "Bed your horse in the terrain you wish to ride". If you can't provide that, the next best option is usually to trim for comfort and function in the living terrain and boot for the riding terrain. If the soles are packed into a deeply concaved shape, I like to use dense foam insoles in the boots so the foot isn't peripherally loaded by the boot floor.

If the horse is worked enough, the foot will adapt to the work conditions instead of the living conditions; even if the horse actually spending more time loafing around in the pasture. It is a question of miles; not time. For example; hard-working barefoot carriage horses and mounted patrol horses tend to "want" the flatter, thicker "concrete hooves" that mirror their working conditions. I allow it; even encourage it. I did worry in the past that these hooves might experience problems because they were too flat and too hard to function properly in the pasture, but I've yet to see any real-world problems occur that suggested there was inadequate circulation or hoof function.

Unfortunately none of this can be "put in a box". I can't tell you exactly how much sole to leave or take from the center of the foot. I can tell you it is wrong at least 99% of the time to do anything at all to the outer inch of sole adjacent to the white line on a barefoot horse. The retained sole and bar that sometimes builds between this outer area and the frog, though, is a very complex variable; extremely important to optimum function and performance. No answer is always right or wrong. The best thing I can do for you here is give you something else to think about; another reason to constantly question everything you "know".

Both of these horses live on similar pastures, but the top photo shows a front hoof forged by hard work on gravel roads. The bottom photo shows a hoof forged by hard work on asphalt. Can you see that frog, sole, bar and wall pressure might be the same in both hooves; given the different terrain?

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