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Understanding Hoof Balance From the Ground Up!

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Many horse owners have been faced at one point or another with lameness issues resulting from poor hoof balance. It has often been standard practice to correct these issues by artificially manipulating hoof balance through mechanical tricks. The current hoof care market provides horse owners with a perplexing arsenal of therapeutic shoes and therapeutic trimming methods.

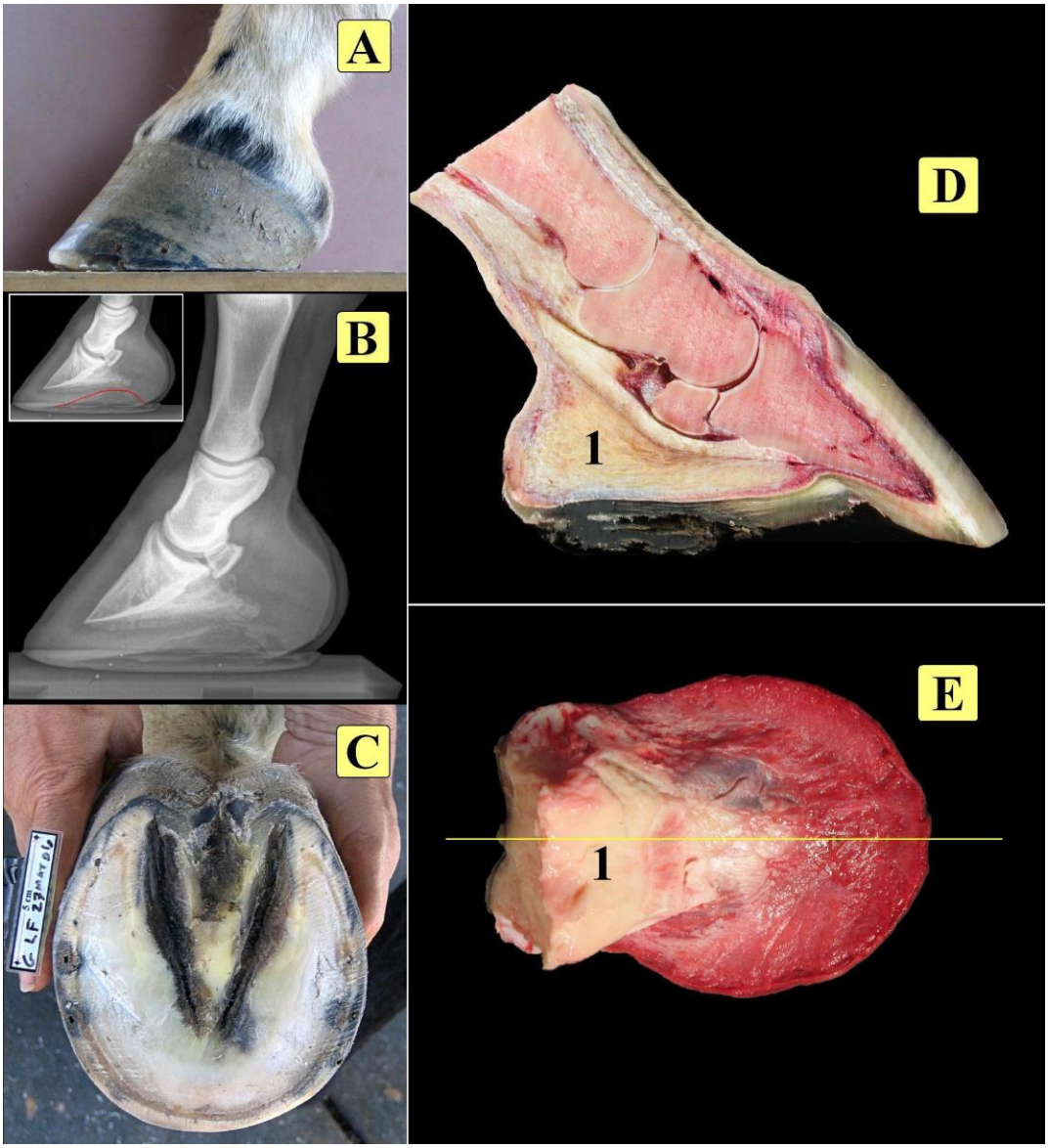


Figure 1: A foot with good conformation - images A,B and C. The digital cushion is labeled "1" in images D and E.

Currently, there are few (if any) reliable scientific studies that validate or repudiate the long-term effectiveness of any given shoeing or trimming technique. The fickle nature of the horse industry is partly to blame for this. Most horses change owners several times throughout their useable lives. It may not always be possible for horse owners to keep the same hoof care professionals and veterinarians. These two situations alone make it difficult to gather reliable information on hoof care techniques.

I think that the lack of comprehensive data is at the base of the current shoeing and trimming state of confusion. Ideally, hoof care professionals should have regular access to quality diagnostic images - such as digital radiographs - while working on horses. This would alleviate some of the guessing game while at the hoof. Unless one has psychic abilities, it is impossible, without radiographs, to reliably assess the placement of the pedal bone within the hoof capsule - let alone make exact measurements of other things such as sole depth, medial-lateral balance, etc! There is also a need for a preventative hoof care program. Such a program involves having preventative radiographs taken every so often. Good record keeping on a horse may help avoid further complications down the road. Eleven years ago, out of frustration with the lack of evidence-based hoof care, I designed a software program called Metron[1] which can be used to measure and track changes to the hoof. I also wanted to help with preventing lameness issues caused by improper hoof balance. At this time, neither preventative hoof care nor the availability of radiographs while working at a horse has become standard practice. This situation may be attributed to the added costs of this style of hoof care, but as the saying goes 'an ounce of prevention is worth a pound of cure'! Finally, there is a need for a more biomechanical approach to hoof care. I must point out that biomechanics is not just the study of gaits but also that of tissues mechanics and other aspects of the leg and hoof.

I feel that it is possible, based on a few logical points (and despite the current hoof care situation) to present a valid argument for the importance of assessing hoof balance from the ground up. Here are a few points of my argument.

Horses first appeared in 4 million years ago. Unlike other domesticated animals, horses have not been altered significantly by humans. For instance, the hoof still has a vestigial pad which occupies approximately two thirds of the hoof capsule (figure 1.) The pastern is designed to load over this padded area. Therefore it is not outrageous to want the hoof conformation to be such that the hoof is ‘under the bony column’. In order to assess if a hoof is under the bony column, one just needs to drop a line from the fetlock perpendicular to the ground. If the bulbs of the hoof are reasonably close to this line, one can say that the hoof is under the bony column.

With proper hoof care, most hooves can be returned or maintained to this generalized shape and stance. This statement is valid even when hooves display significant differences in conformation; some hooves may have lower heels or show a different hoof angle (figure 2.) Prosthetics (shoes or boots) should not be used to cover up deformities but rather to assist proper hoof function.

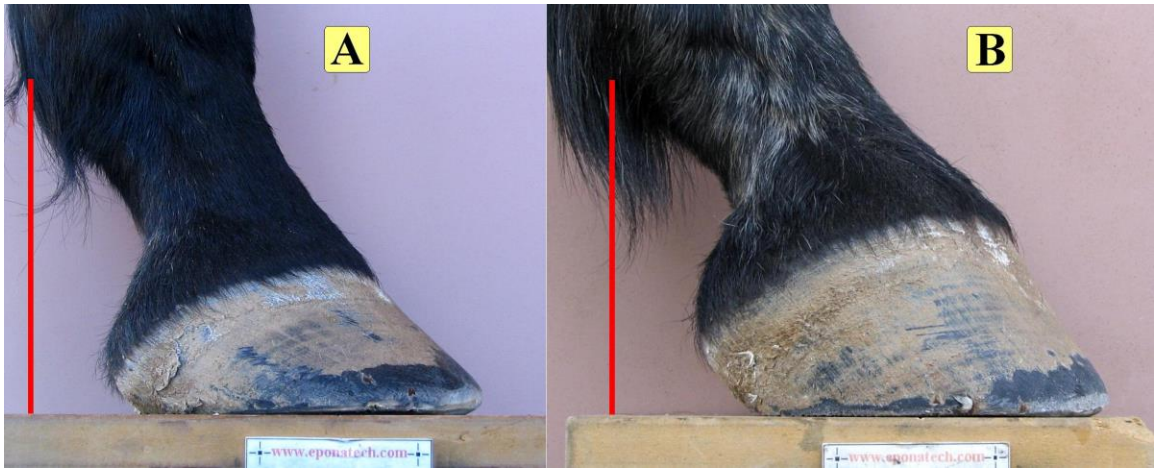


Figure 2: Most hooves, even with various conformations, should be placed 'under the bony column'. Hoof (A) has lower heels and a lower hoof wall angle compared to hoof (B) but both are standing under the bony column.

The hoof capsule - the hard or keratinized part of the hoof is structurally well designed. It has great mechanical strength and yet it is able to flex. However, the hoof capsule is not impervious to changes or damage. Hoof care is the most common factor affecting the capsule shape and function. A hoof can change quite significantly in shape depending on what is done to it (figure 3.)

Figure 3: The same hoof changing over about 14 months due to being trimmed and shod with different philosophies and shoes.

These changes can occur relatively quickly. Changes in moisture content can also affect the capsule. Hooves with similar shape can look quite different in dry versus wet environment (figure 4.)

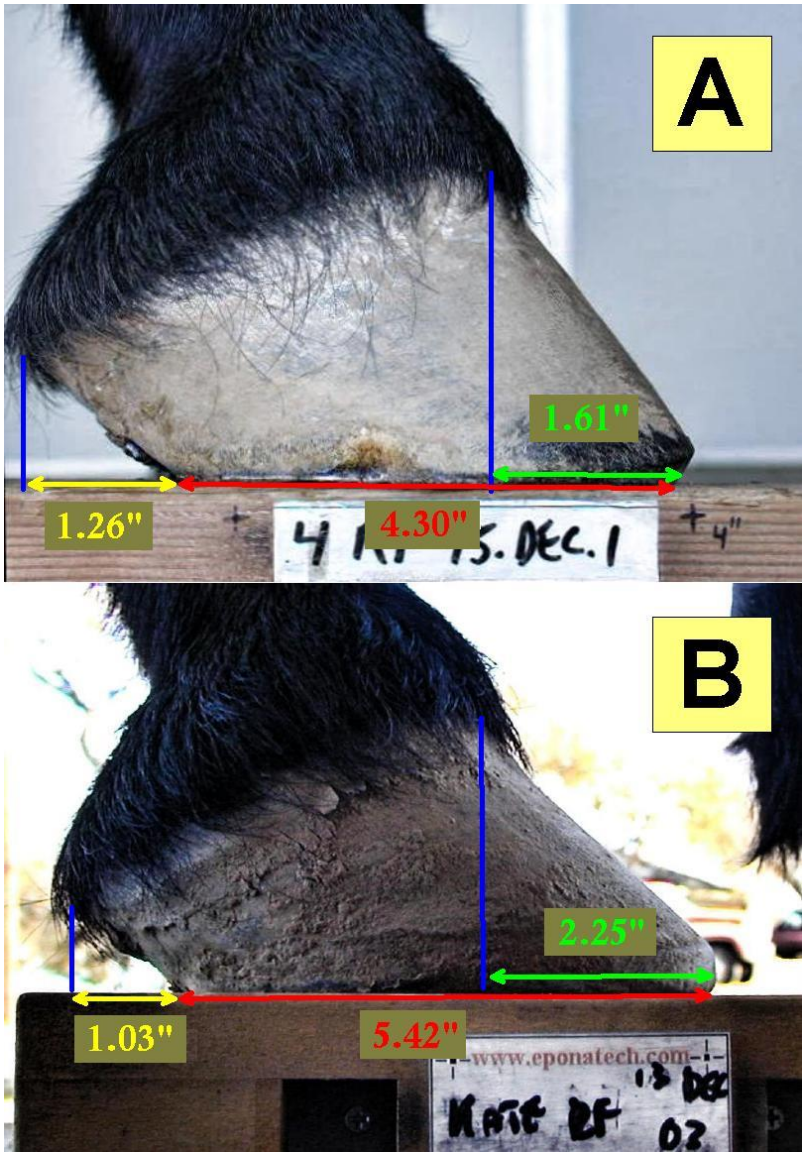


Figure 4: The same barefoot hoof, trimmed by the same person, shows tremendous variation due to seasonal weather which causes varying levels of hoof hydration. Figure 4A shows the hoof during a very dry winter and figure 4B show the same hoof during an exceedingly wet winter. Both pictures were taken just prior to trimming.

Finally, loading and shearing forces contribute to changing the capsule shape. These factors indicate that the hoof capsule is adaptable and deforms for a variety of reasons. This raises the question: 'what is considered normal for a hoof?' Given the highly adaptable nature of the hoof capsule, I feel that it is unwise to infer too much about hoof and limb conformation issues from how the hoof looks at any one time (figure 5.)

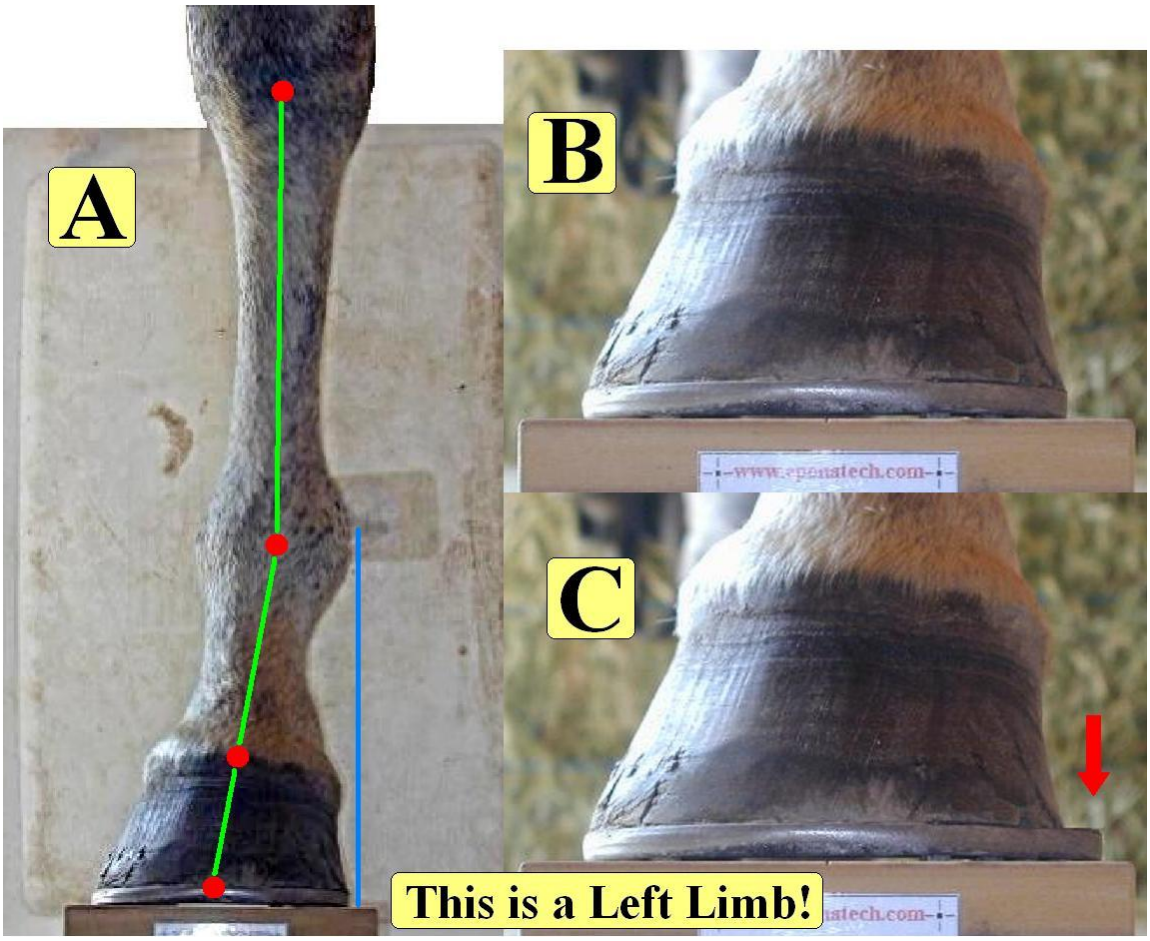


Figure 5: According to some traditional shoeing methods, an extension to the metal shoe might be is added to give support to the deviation at the knee and fetlock and to 'improve' the paddling gait of this limb - shown by the red arrow in (C). I do not believe this is the way to address this problem!

My approach to trimming and shoeing is a bit like peeling an onion. My first goal is to return the hoof to a more natural stance (figure 1 and figure 2) and to allow the hoof capsule to behave according to its natural physical properties.

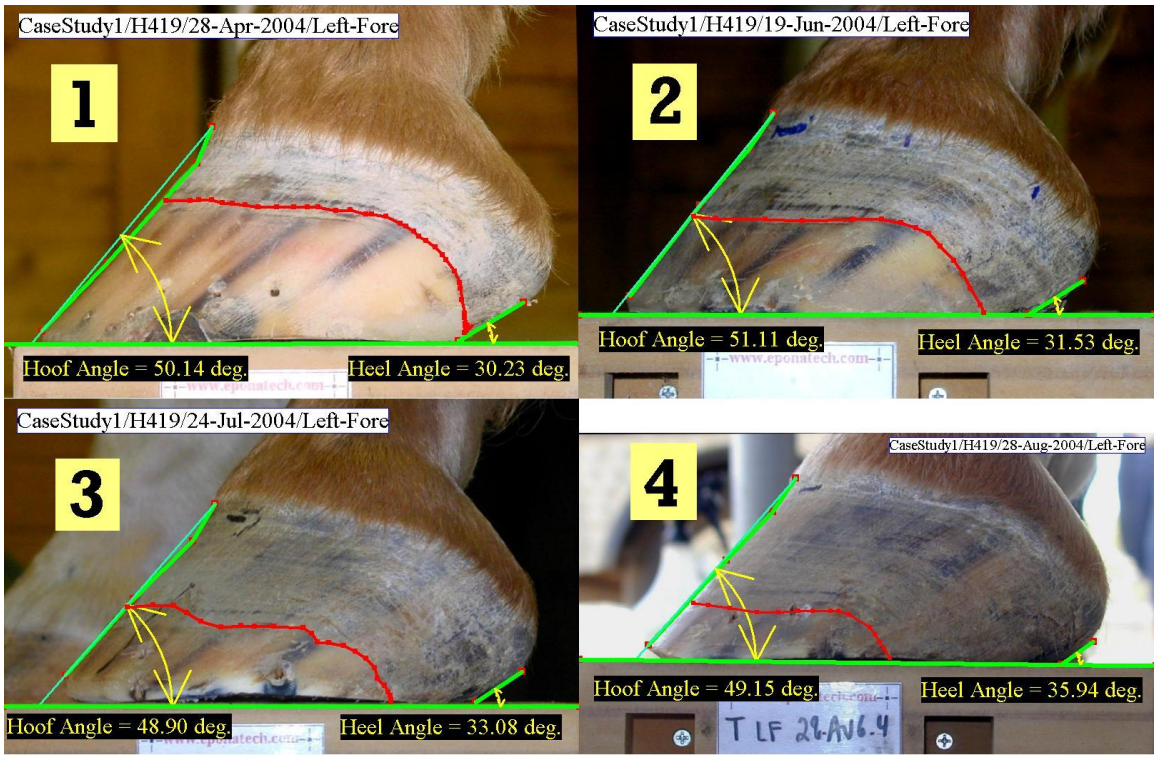
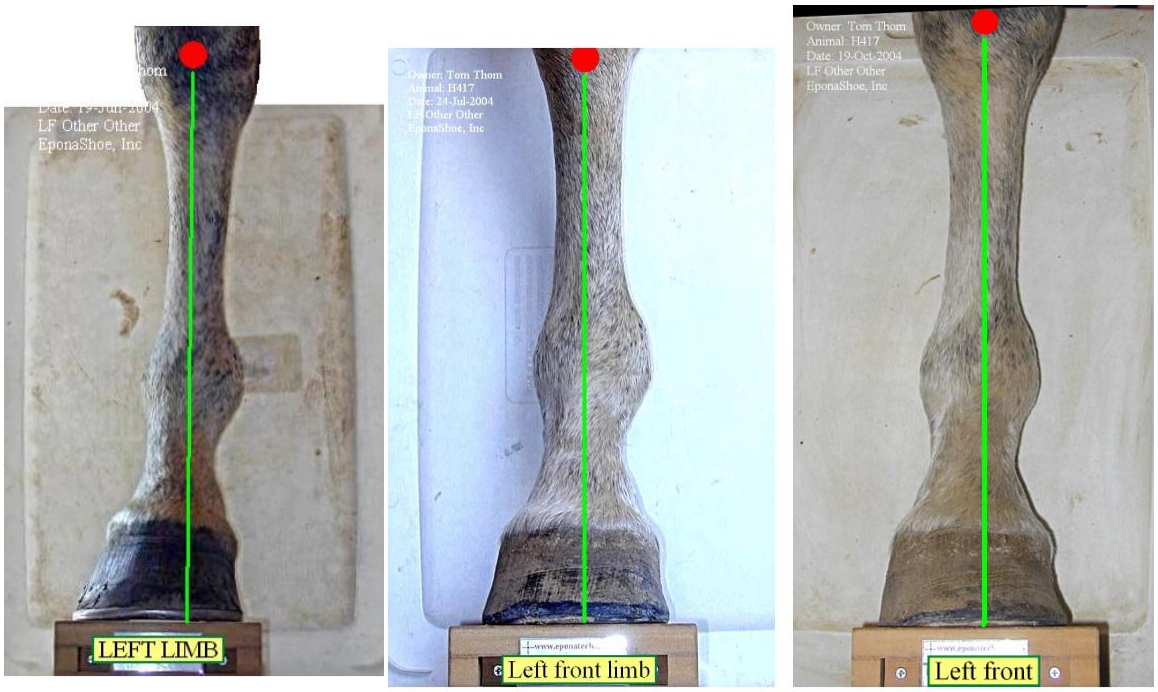


Figure 6: The same hoof, taken out of metal shoes, and wall deformations growing out over a four month period. The full case study is posted at www.Epona-Institute.org .

I do not want to start a heated debate about good versus evil concerning metal shoes but in reality, there is quite a difference between the mechanical behavior of keratin versus that of metal. Metal shoes will deform the capsule to some extent (figure 6.) In general, deformities occur at the walls as well as at the sole. These deformities affect underlying soft tissues including internal bone stance. For instance, the sole provides support to the pedal bone as well as defining its placement inside the capsule. If the sole becomes badly distorted (see figure 3 A and B), the pedal bone will alter its position as a result. This change does not just stop at the hoof but may produce a trickle effect to the horse's entire skeletal system. I have noticed that once capsular deformities are reduced, it is possible (but not always!) to improve the hoof and limb stance (figure 7.)



Original | 2nd Shoeing | Last Shoeing

Figure 7: This picture shows the change in limb and hoof conformation. This change occurred in four months (from June to October.) My approach was to allow the hoof to flex while supporting its weight via composite shoes[2] and packing. This horse was a pregnant TB mare and needed extra help. The full case study is posted at www.Epona-Institute.org .

Next, I check if the sole has enough structural integrity to support the pedal bone adequately. Some hooves may have naturally weak soles and arches. Poor sole definition affects the internal stance of the bones. When I encounter such problem, I like to provide support to the entire sole via arch support and flexible support at the sole (figure 8.)

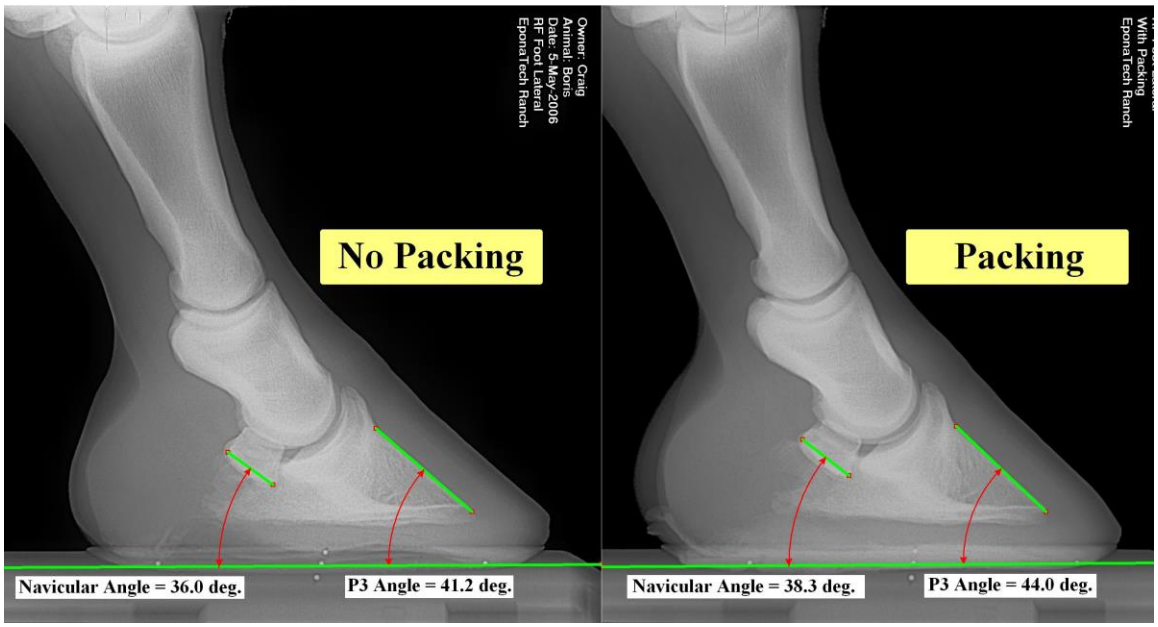


Figure 8: The addition of packing changes internal stance of the pedal bone. Note the difference in angles between the left radiograph (the sole is not packed) and the right radiograph (the sole is packed.) Note that this radiograph is that of the hoof in figure 2A. The hoof is under the bony column but its radiograph shows this hoof is less than perfect and needs a prosthetic besides packing.

In other words, I like to create a platform under the hoof that helps with load sharing across the entire sole. I consider this approach to be a hoof extension rather than a traditional shoeing approach. Traditionally, shoes are only allowing for peripheral loading. Although metal shoes place extra constraints on the hoof capsule, they are not the only culprits when it comes to capsular distortions. Loading and shearing forces placed upon the hoof affect the shape and function of the capsule; this holds true even for unshod horses. Not every horse is born with perfect conformation and gaits. Riding styles bring also their own constraints to the natural biomechanics of horse, including the hooves!

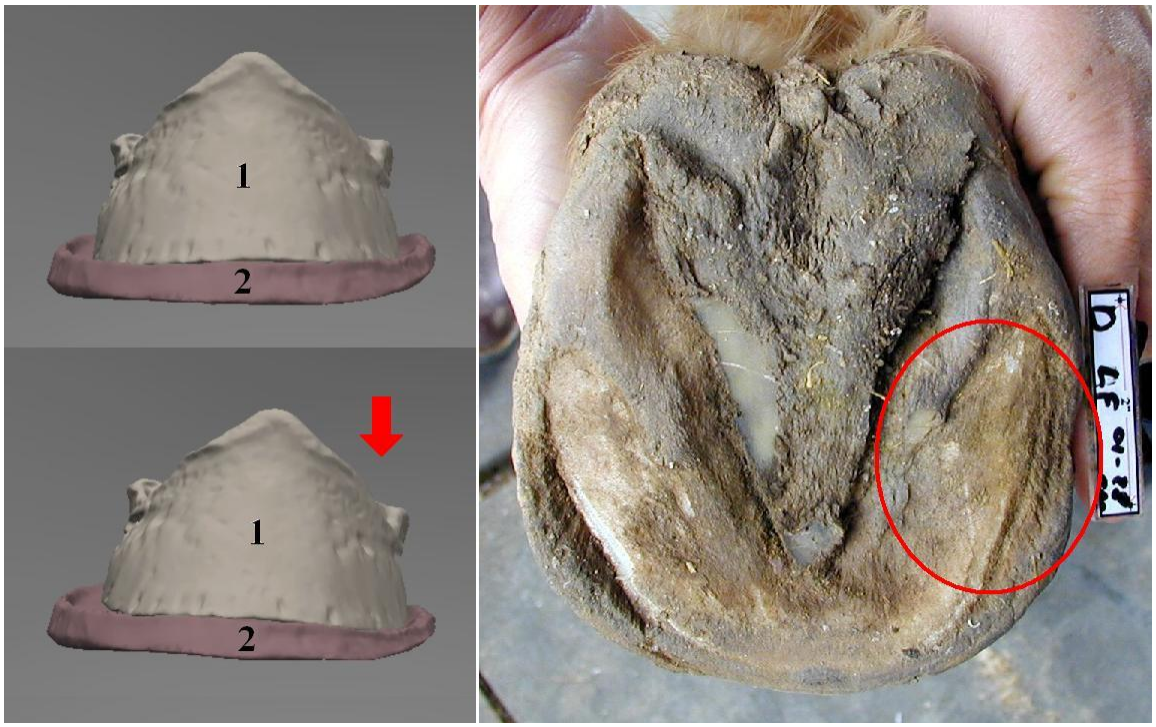


Figure 9: Loading, even or uneven, affects the stance of the pedal bone (1) within the capsule and how it loads down on the sole (2.) The hoof on the right is that of a feral horse and shows a "dropped sole" in the circled area.

The hoof has a complex interaction with the entire skeletal system and vice versa! This interaction is at this stage poorly understood. When a horse has hoof issues, it is difficult to look at stance or motion of the horse in order to infer the best path to fix it. Radiographs and a lameness examination help to a certain extent with diagnosing the problem but it does not necessarily mean that a solution can or will be implemented!

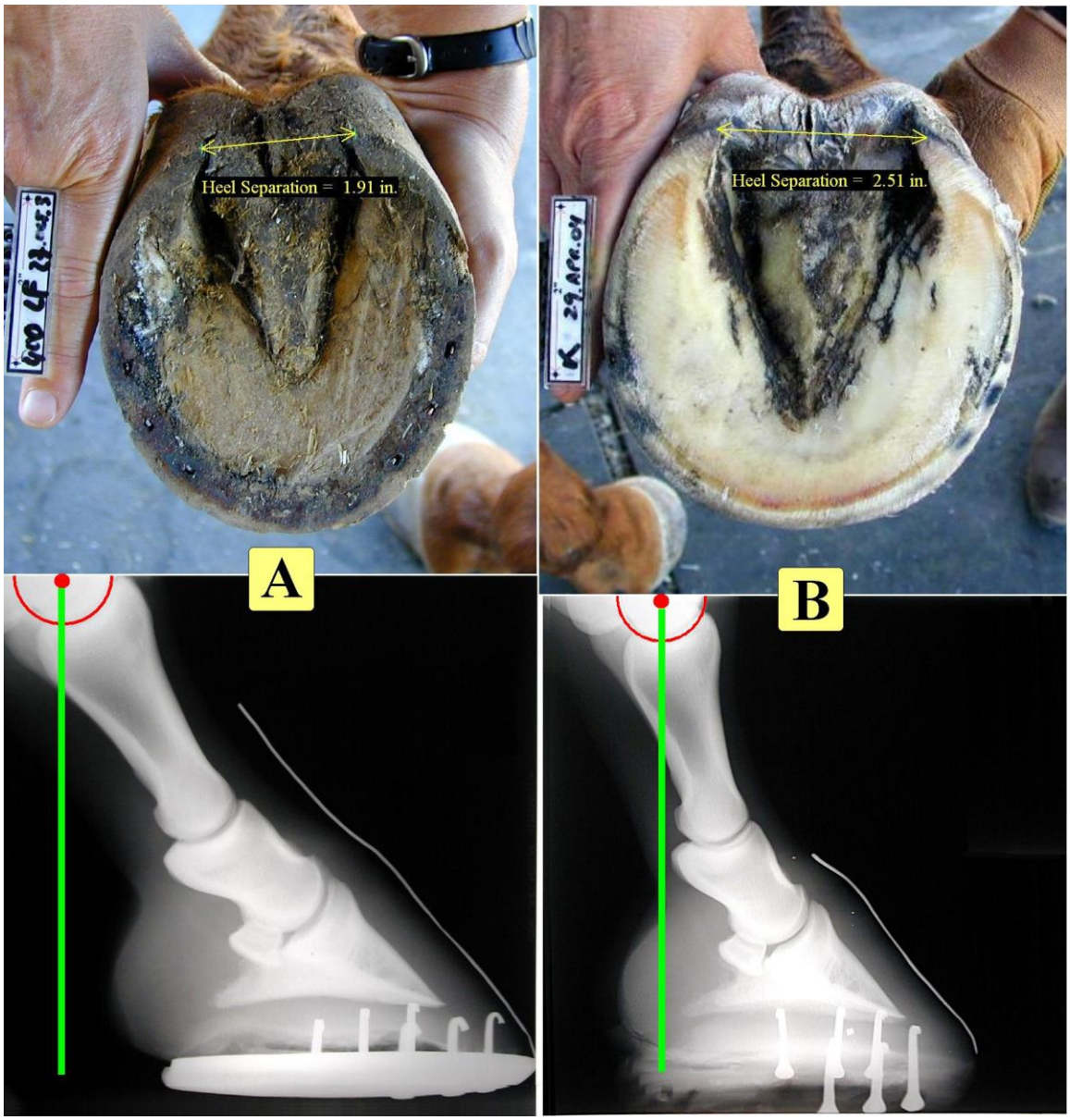


Figure 10: Images in (A) are 'before' (Oct.2003) and images (B) are 'after' (Apr.2004). Note how the hoof has expanded at the heels and moved 'under the bony column.

To summarize, I feel that we need to approach hoof balance through a process of elimination. This means first and foremost to assess the position of the sole in relationship to the bony column. Secondly, assess the position of the pedal bone within the hoof capsule and in relationship to the bony column. This is truly what it means to understand hoof balance from the ground up.

[1] Metron Software. www.Metron-Imaging.com.
[2] EponaShoe, flexible polyurethane horseshoes for performance horses. www.EponaShoe.com and www.Epona-Institute.com