

The Hoof Lies!

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The hoof is a highly adaptable structure and can change dramatically under the influences of trimming and shoeing methodologies. Moisture, diet, age, riding styles and soil conditions also play a role in the shape of the hoof. The keratinous part of the hoof, commonly referred as the hoof capsule, is probably the structure that shows the most immediate changes to the naked eye. Changes in other hoof structures may not be as obvious to notice. Bones, cartilages, tendons, ligaments and dermis of the hoof can undergo changes without showing signs of pathologies, at least not initially.

Biomaterials have distinct physical properties: they often stretch, shift and remodel to a certain extent without reaching mechanical failure. The study of tissue mechanics combines the fields of biology and engineering. While there is a lot of published materials concerning equine anatomy and some concerning biomechanics, there is little on the topic of tissue mechanics. There is little on the topic of joint kinematics and the study of form and function. When compared to human biomechanical research, equine research is in its infancy and under-funded. Generally speaking, the study of biomechanics is a relatively new field compared to that of the well-established fields of biology and physiology. There is still much to gain by future exploration of biomechanics.

The hoof capsule is made of alpha-keratin, a substance found in all mammals. For instance, the last outer layer of your skin or epidermis is made of keratin, so are your hair and nails. Obviously your skin and hair are quite different to the touch than the keratinous capsule. It is truly how the keratin is structured at a micro scale that allows for the difference in mechanical properties and ultimately function. In material science terminology, the keratinous capsule can be categorized as a composite material. Composite materials come in different forms from things like plywood to various mesh re-enforced materials. The keratinous capsule – the sole excluded - is structured like a plywood material re-enforced by

fibers, i.e. the tubules. Composite materials exhibit great mechanical strength. The difference between man made composite materials and living natural composite materials lies in their capacity to restructure and mend themselves during their lifetime. Keratin is a dead material but it owns its structure and its replenishing from various live parts of the hoof dermis, namely, sole dermis, coronary papillae and sensitive lamina.

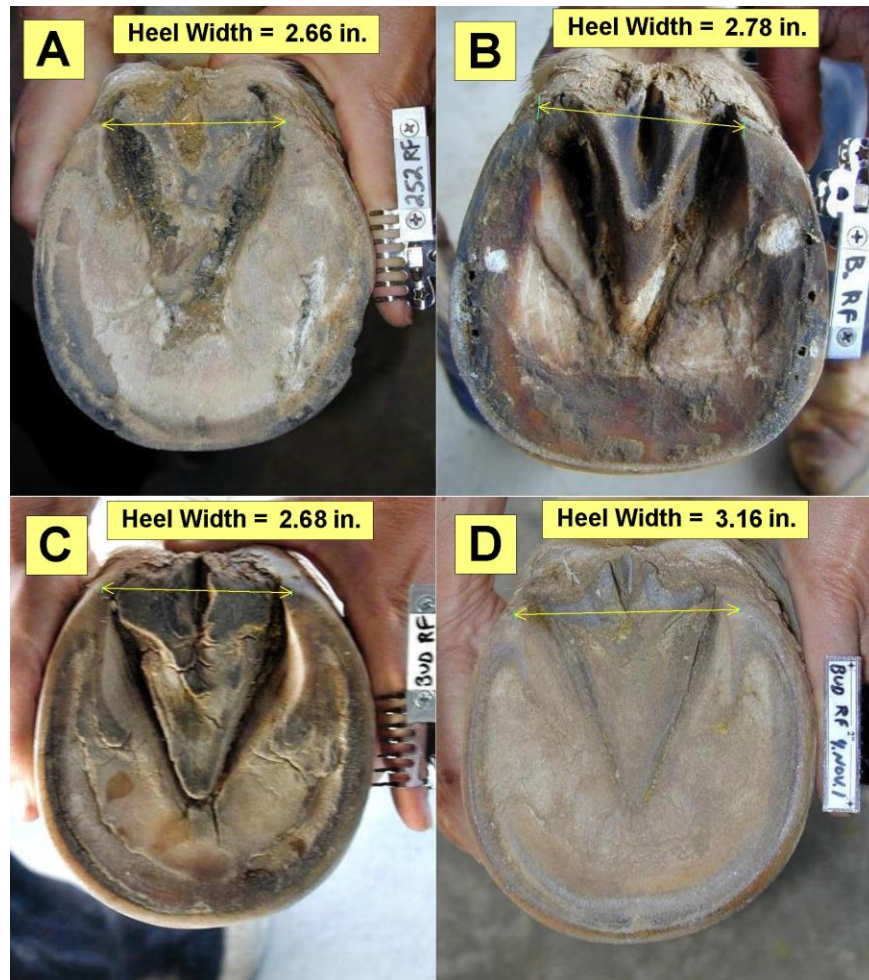


Figure 1: These images are of the same hoof over the course of 14 months. Each image was taken at the end of the shoeing/trimming cycle – so in each case, it is time for a trim. Figure 2A taken on August 2000, this hoof was shod according to the AFA standards. Figure 2B taken on January 2001, the hooves were shod according to the EDSS standards. Figure 2C taken in June 2001, this hoof was left barefoot. Figure 2D taken on November 2001, was shod according to my standards (i.e. no fixed method) with glued-on Marathon composite shoes.

These images in figure 1 serve to showcase how much hooves can change shape and adapt. Each method of trimming or type of shoe creates its own environment for the hoof and can alter conclusions drawn by observers. The mechanical properties of keratin are different than that of metal. This is not to say that metal shoes should be tossed away, rather that one must be aware that the hoof capsule will change and function differently when shod in metal. Bare hooves are shaped in some measure by biomechanical influences, soil mechanics and moisture content. Dry abrasive ground will shape a hoof capsule differently than wet non-abrasive ground (see fig.2 A and B.) In real life, horses have different hoof morphologies, quality of horn and body conformation. There can be some variations on the same theme. Our domesticated horses are ridden. Different training and riding methods have a tremendous impact on hoof conformation and health.

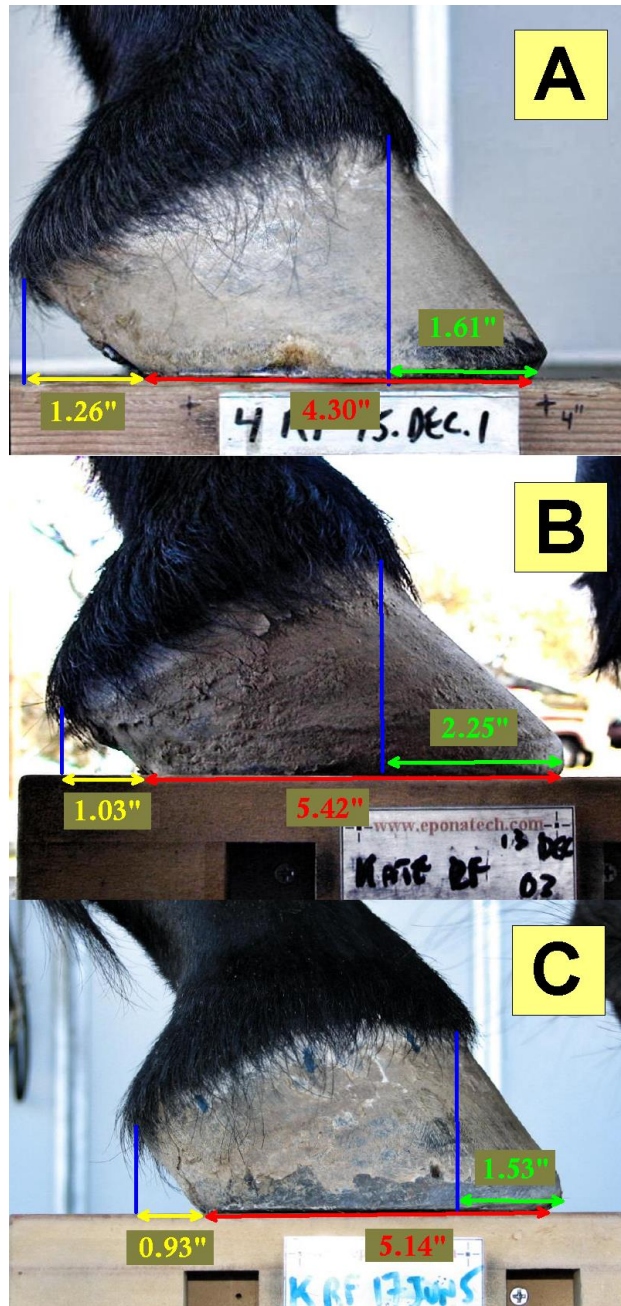


Figure 2: These images are of the same hoof taken in the course of four years. The winter of 2001 was dry and the horse lived on a non-irrigated pasture; the pasture was a mixture of adobe clay and limestone. The month of December 2003 was very wet. The horse lived then on a different pasture.

The soil was mostly wet adobe clay. In January 2005, this horse continuously wore composite shoes, figure 3C. These pictures were taken at the end of a five weeks trimming cycle. The trimming was the same over these years. It entails lowering the heels and leaving as much quality sole as possible.

Capsular changes will affect the shape and function of the entire hoof. Ultimately, these changes may also alter the conformation and locomotion of a specific horse. These changes can be very subtle and may not show any diagnosable pathology. This leaves us with an interesting question, namely how does one assess the ‘normal’ conformation and locomotion of our equine friends?

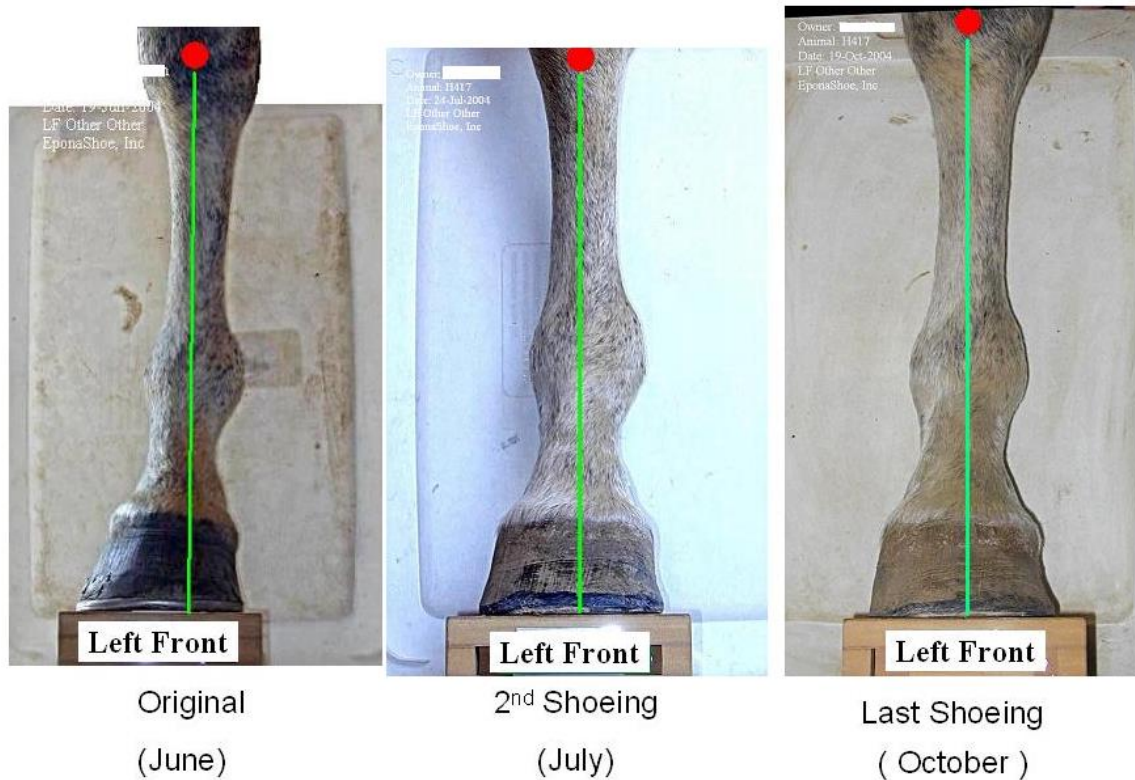


Figure 3: These images show the same leg from June to October of the same year and the changes that occurred to due trimming and shoeing.

Since, it is in the nature of the hoof capsule to deform even with proper hoof care, it may not be very prudent to trust physical landmarks on the hoof. It is easy for the human eye to be fooled which adds to the difficulty in assessing conformation. A fantastic method of documenting and tracking the changes in the hoof is to use photographs and radiographs and Metron software to measure physical attributes. These days this is done by many veterinarians, farriers and barefoot trimmers and some horse owners. Figure 4 shows how it is very easy for the human eye to be fooled, and care must be taken when documenting the hoof.

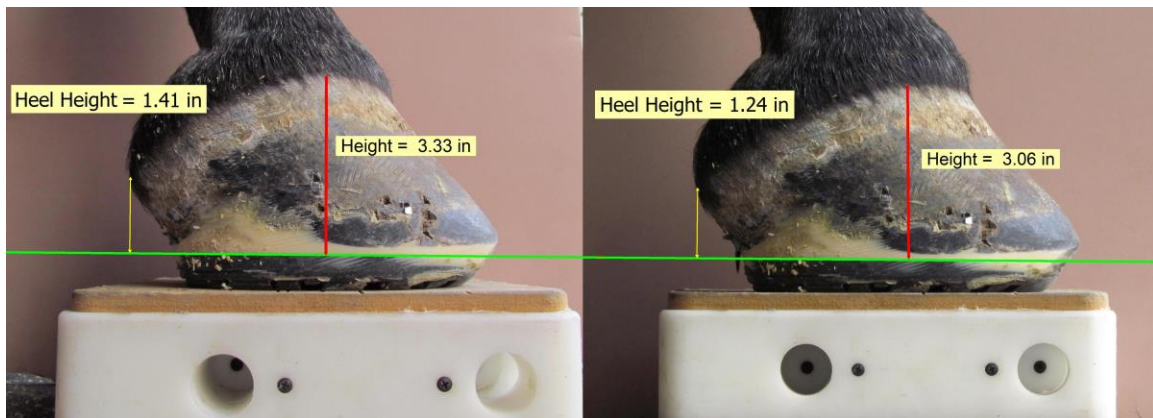


Figure 4: This is the same hoof photographed at nearly the same time (about 12 seconds apart!). The difference is that the image on the left was taken with the camera very close to the hoof while image on the right was taken with camera further away. The image on the left shows distortions caused by perspective effects. A more accurate image (on the right) is obtained by keeping the camera further away and zooming in.

I called this article 'The Hoof Lies' because it is easy to be confused by the changing shape of the hoof, and at times apparent changes when none occurred - as shown in figure 4. These different influences affecting the hoof (and our perception of it!) lead to many diverging opinions regarding hoof care.