The Effect Of Nail Placement On Hoof Capsule Distortion

Martin Kenny

Farrier's observations contradict some traditional thinking

By Martin D. Kenny, CJF, RJF

"The thickness of the wall is variable. In front hooves, the wall is thickest at the toe and becomes gradually thinner towards the quarters ... The more slanting half of the hoof is always the thicker."

— Anton Lungwitz

"In a shoe with six nails, these must be in the first half of the shoe."

— Charles Holmes

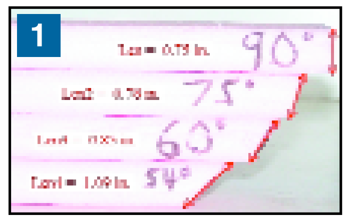
We are all familiar with this line of thought and these references are far from being the only ones stating the same thing. But the facts do not support the two quotes. Let's look first at the thickness of the wall. If you do 90-degree cross sections of the wall, you will find that it is not thinner at the heel than at the toe.

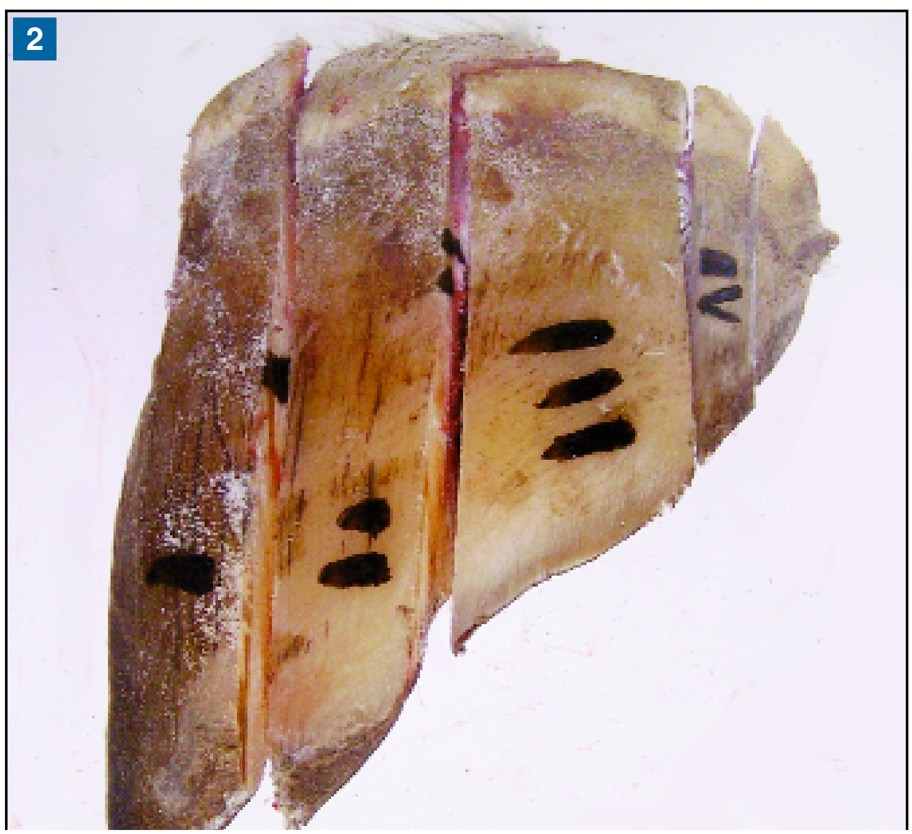
FIGURE 1 illustrates where that school of thought may have came from. I took a 3/4-inch foam board and cut it at various angles. These angles depict the angles of the hoof wall at the ground surface. The heel-wall angle cut is shown at 75 degrees and slowly decreases until at the toe, the angle of the cut is 54 degrees. You can see that while the foam is still 3/4-inch thick, the cuts lead to a longer measurement as the angle of cut decreases.

Let's look at this in relation to a real foot (**FIGURE 2**).

I marked the foot into sections 1 to 4. I followed specific tubules when sawing. Then I marked the cut surfaces to correspond to the exterior markings.

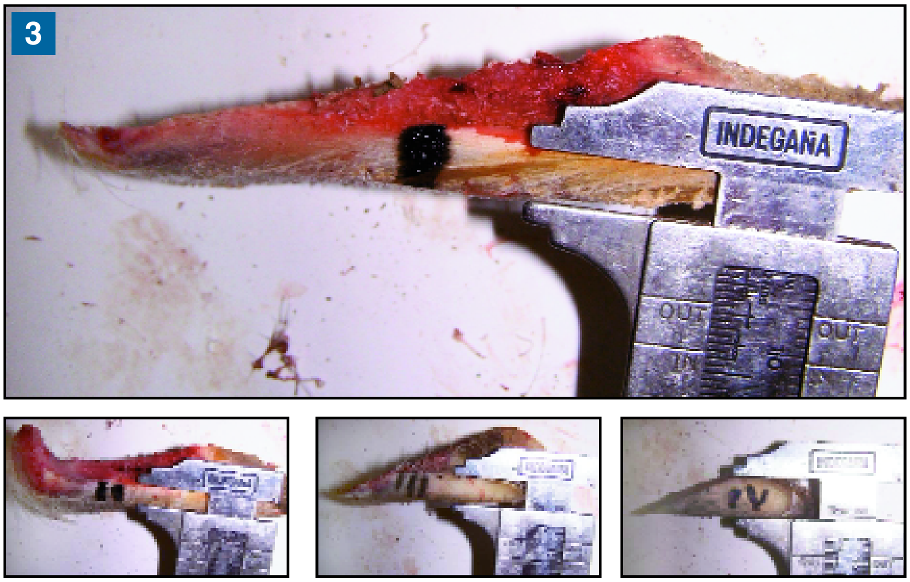
I then measured the actual thickness of the wall at the same area in relation to the hairline for each section. Measurements were taken at a 90-degree angle to the

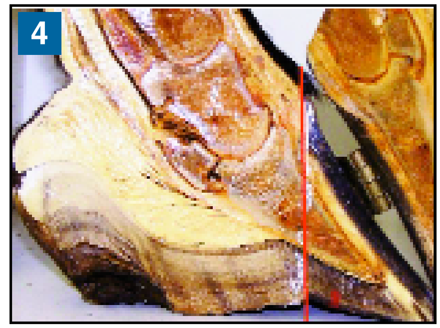




Second In A Series

Next Up. The series will conclude in the May/June issue with a look at the bearing surface of the shoe itself and the effect that aspect of shoeing





exterior surface (**FIGURE 3**).

Cut 1 was 12 millimeters thick, Cut II was 12 mm, Cut III was 13 mm and Cut IV was 14 mm. The heel cut (IV) is actually 2 mm thicker than the toe cut (I).

This means that if there is appreciable expansion at the heel region of the properly loaded hoof capsule, it is not aided by the wall being thinner. It also means that the heel area is capable of handling at least as much weight and force as the toe region without detriment.

We must fully understand the way that the hoof capsule is best able to absorb concussion, as well as the needs of the structure to be able to alter its shape for load transfer during the various stages of impact, absorption of load and — finally — the release of that energy.

Rotation of energy (ROE) is a term that I use to refer to a location on the hoof of a vertical line dropped from the dorsal aspect of the non-distorted coronet band to the weight-bearing surface. (**FIGURE 4**). It is also the location at which both the extensor and flexor tendons attach to P3 and create the energy to rotate it, with P3 and the bones working in conjunction for the locomotion of the horse. This is also the location at which the healthy hoof capsule begins to have support from the digital cushion palmer of P3.

It winds up being very close to Duckett's Dot, but allows for a different point of view that I find more useful in dealing with distorted hoof capsules.

The hoof capsule rotates with the bone column as a result of the attachment of the capsule to P3 via the laminae of the foot. Therefore, placing nails (or anything else, such as clips or casts) ahead of this point sets the hoof capsule up for a shearing effect when the hoof rotates forward for the next stride. These types of attachment inhibit the capsule's ability to alter shape as needed to absorb energy and then return to an earlier state of no distortion.

Research has shown that the dorsal aspect of the hoof wall changes shape upon the movement of weight over the toe. (Pollit, Bluegrass Laminitis Symposium, Lexington, Ky., 1988) This study shows that the placement of nails ahead of ROE creates resistance forces that distort the hoof capsule and does not allow it to return to its original state (position).

Now let's move on to the idea that it is best to nail in the front half of the foot.

A study was performed at The Hoof Redevelopment Center in 2007 to assess that process for nailing the shoe to the horse's foot.

Materials And Methods

A total of 80 horses (320 feet) were used in the study. All horses had been shod by the author for more than 1 year prior to the start of the study.

protocol for trimming and shoeing used prior to the study period, except for nail changes as described later in this article.

Of those 80 horses, 58 horses had Victory Elite aluminum shoes on the front feet and St. Croix Eventer steel shoes on the rear feet. The remaining 22 horses had St. Croix Eventer steel shoes on all four feet.

Capewell No. 5 race nails were used in aluminum shoes and Capewell No. 5 slim blade nails in steel shoes.

All horses used for this study were considered sound and in regular work as well as being shown (and placing) regularly in their respective disciplines.

Those disciplines broke down as follows:

- 6 horses were used for serious trail riding (over 100 miles per month).
- 8 horses were used for barrel racing.
- 12 horses were used for eventing.
- 26 horses were used as show hunters.
- 9 horses were used as show jumpers.
- 19 horses were used for dressage.

The riders all indicated that these horses were performing freely and without specific gait shortness or difficulties.

The study period lasted 56 days for each horse (two 28-day shoeing cycles per horse) from January 2007 through March 2007.

At the start of this study, the weather was such that the hoof capsules were neither wet and soft, nor hard and dry. All hoof capsules showed adequate hydration and pliability. At the end of the study, the weather was the same as it had been at the beginning of the period (except for normal seasonal changes).

The subjects' hoof angles were aligned acceptably, meaning that from a lateral view, the pastern was in alignment with the hoof capsule. When viewed from the front, the capsule was evenly under the bone column and the hairlines showed even, straight lines from all viewing angles.

All subjects had adequate sole concavity in all feet and had no signs of bruising. There were no signs of hoof wall failure (chipping, cracking, flaring etc.). There was no sign of tearing along the white line (delamination).

Shoes remained tight (with no rising clinches) until the next regular shoeing 28 days later. Each horse had hooves that were growing with either no or very limited distortion between shoeings, thus requiring very limited dressing of the hoof wall with the rasp.

Prior to the start of this study the nails were being placed so that the first nail in each quarter was not ahead of ROE and the last nail was not placed behind the widest part of the foot. At the start of this study, shoes were fitted to follow the shape of the trimmed hoof capsule and ended at the buttress of the heels. The locations of the nails were altered so that the first nail was moved forward of ROE. None of the other nail locations were altered.

Nails were driven so that they entered and exited the wall both anterior and posterior to ROE. They were driven to exit in a straight horizontal line at an average of 7/8 inch from the ground surface of the hoof capsule. They were clinched and finished in no particular order. No clips were used prior to or during the study period.

Results and Discussion

At the end of the first 28-day cycle, it was noted that the toe areas of the hoof capsules were migrating forward, creating a flared toe wall. Clinches were beginning to rise. There was a small amount of cracking around the first two nail clinches on each branch of shoes in 37% of the subjects. Neither the weather nor work had changed substantially.

It was also found that in 48% of the feet, there was a local delamination occurring in the region of the second nail. This directly corresponded with the ROE location of the hoof capsule.

At the end of the second 28-day cycle, 100% of the feet showed toe distortion that required substantial dressing of the outer surface of the hoof capsule with a rasp. There were various signs and degrees of tearing (delamination) in various locations along the white line in 100% of the feet. Most showed this at the area in line with ROE (bilaterally on the hoof capsules) and many also showed it starting behind the last nail of the quarters.

The most notable of those posterior delaminations were in the lateral quarters of the rear feet. These heels showed the worst tearing of the white line. The majority of hooves had visible loss of sole concavity. In 78% of the front hoof capsules and 72% of hind hoof capsules, ROE was further back on the shoe, so that the second nail hole was now ahead of ROE, instead of at or slightly behind ROE, as it was at the beginning of the study period.

All subjects' hooves showed loose nail clinches at this point in the study. Over 75% of shoes were loose (able to be moved with a slight tap with a hammer) to some degree. Many were not in the same position that they had been placed 28 days earlier, having been driven rearward or rotated.

Many of the riders were beginning to complain about performance issues. This aspect of this study was discontinued at the request of the owners/trainers due to deteriorating performance issues.

It should be noted that the owners/trainers were not told of the study prior to its conclusion. After returning nail placement to the same location as used before the study, owners and trainers reported a return to previous performance levels at the 28-day return for the next shoeing. Within 28 days of returning nails to a location no further forward than ROE, 100% of hoof capsules began to return to their pre-study state and by the end of the 28-day, post-study period, the second nail holes were again in a position at or slightly behind ROE.

FIGURES 5 through 8 show a foot that is in the process of hoof capsule redevelopment. The subject has gone approximately 10 days longer between

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shoeing than I would like, but as we all know, stuff happens and we were late getting him done.

Prior to using the ROE nailing protocol, I would have seen the signature bending of the walls at both the toe and quarter regions that our industry is used to seeing every day.

I will readily admit that the wall of this foot is not yet where I want it to be (it is not nearly as upright in any of the views as I would desire). I have chosen to share these photos precisely because they are of a still-compromised hoof capsule. This is a perfect example of how you can limit toe-wall and quarter-wall distortion (bending of the wall) by nailing in accordance with ROE locations, even with a long-toed, underrun-heeled foot that was allowed to grow beyond the ideal protocol parameters.

Toe Distortion

Toe distortion will create the largest percentage of increased basal circumference measurements of the hoof capsule. While quarter distortion will also create an increase in basal dimensions, these will generally not be as drastic (in linear measurements) as those caused by toe distortion. **FIGURES 9 and 10** show the overall increases in basal measurements of the hoof capsule once the nails were moved ahead of ROE.

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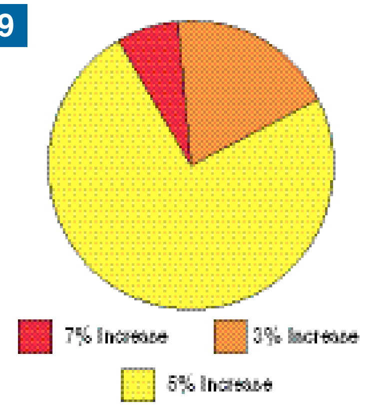

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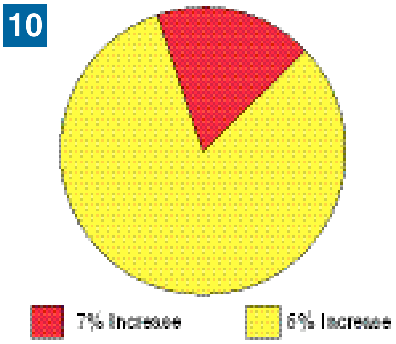


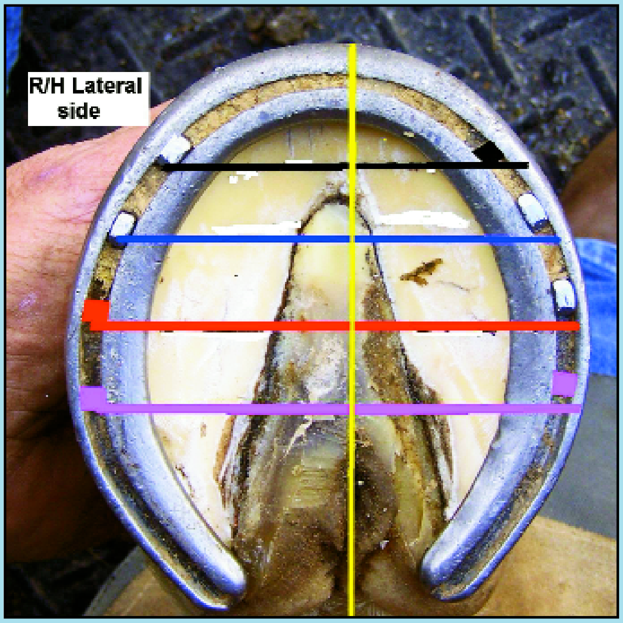
In subjects' front feet (**FIGURE 9**), 91% increased in basal surface measurements of hoof capsule within the 56 days of the study. Of those that increased in basal measurements, 19% increased basal measurements by 3%, 74% increased by 5% and 7% increased by 7%. Other indications of flaring as well as flattened soles were also observed.

Of hind feet (**FIGURE 10**), 82% had increased basal measurements of hoof capsule, with 82% increasing by 5% and 18% by 7%.

ONE FARRIER'S VIEWPOINT

One example of using nail placement as a tool

Using data I have collected regarding nail location in relation to what I call the rotation of energy (ROE), I have found it possible to redirect the horizontal forces in a positive manner. ROE is a vertical line dropped from the dorsal aspect of the coronet band.



All of us have seen a foot like the one shown here, with the lateral quarter moved lateral to the center line (yellow line) forcing the frog to bend laterally as well. The lateral bulb gets shoved posterior to the medial bulb (green line).

As part of the ROE principal of nail location (black line), I have found it advantageous to bring the medial nail pattern posterior to that of the lateral pattern after the first nail in each branch.

When we draw lines across the foot at a 90-degree angle to the center line of the non-distorted frog, we see that the second, third and fourth nail locations no longer are directly across from each other, as are the first nail locations. The lateral locations become further posterior to the corresponding medial locations as we move rearward along the capsule.

I have found that keeping lateral nail locations ahead of the medial locations rapidly removes the lateral twisting of the hoof capsule. When shod in this manner, the hoof capsule will derotate back to a straighter position under P3. You should only have to use this nail pattern 2 or 3 times before you see that the nail locations are once again across from one another. The frog will no longer be twisted as it is in this photo.

Play with nail location, take plenty of photos and watch for trends in the way the locations affect the horses you work on. You will be glad you did, and so will the horses under your care.

— Martin Kenny

Toe distortion was measured using Metron computer software and a distance guide to insure that the camera was a specific distance and alignment from the subject with each photo.

Deviation was quantified by finding a point of deviation in the toe and measuring the angle of that deviation (**FIGURE 11**).

At the beginning of the study, no subjects were found to be 180 degrees (perfectly straight). The closest to 180 was 179.936 degrees and the worst case in the study group was 178.992 degrees. The average toe deviation angle was 179.464 degrees.

The study group showed consistent indications of toe distortion that occurred at the upper toe wall at the first 28-day check on each horse. Even greater amounts of deviation were found at the second 28-day check.

At the beginning of the study period, none of the subjects had a deviation angle less than 178.992 and the average was 179.464. But when looking at the toe distortion at the first 28-day interval (after moving nails ahead of ROE) that deviation average jumped to 177.742 degrees. They reached an average of 175.754 degrees at the second check (**FIGURE 12**).

Quarter regions also became distorted once nail locations were moved ahead of ROE. When viewed from the front, the angle of deviation was measured using Metron Software in the same manner as in the photo under toe distortion.

At the start of the study, the average medial deviation was 174.43 degrees, while the average lateral deviation was 176.84 degrees. At the conclusion of the study, the average medial deviation was 169.81 degrees and the average lateral deviation was 173.13 degrees (**FIGURE 13**).

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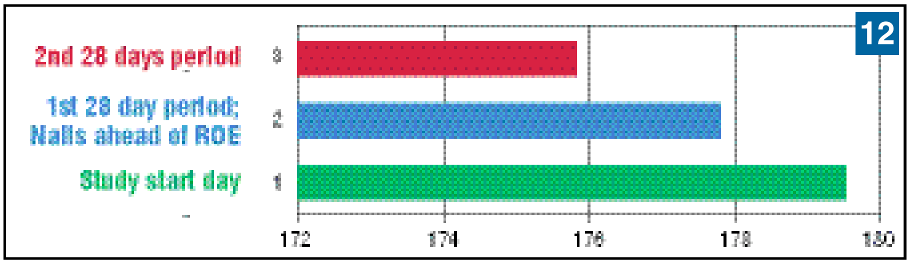

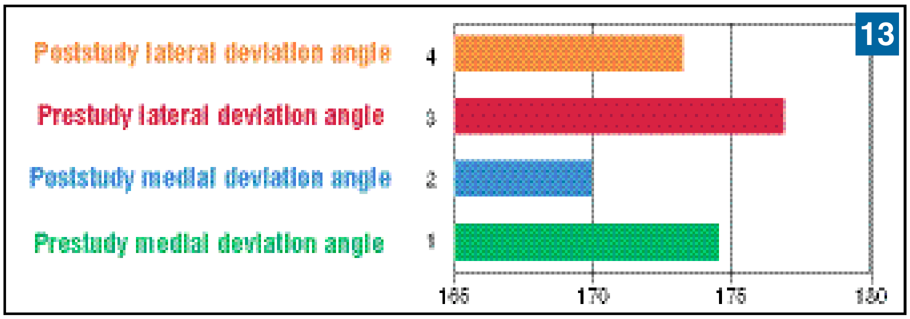

Conclusions

This study leads me to believe that there is a direct effect of the placement of the nails in the hoof capsule in relation to the dorsal aspect of the coronet band of the hoof capsule (ROE). I also believe it shows an indirect effect in relation to quarter-wall deviations.

It is my theory that the action of the extensor and flexor tendons on P3 and the resulting action of the hoof capsule is greatly impeded by the placement of nails dorsal to their attachment locations. It is also my conclusion that any research performed involving locomotion of the horse or the structure of the hoof capsule must take into consideration the methodology of the attachment of any hardware involved with the hoof capsule.

I believe this study also demonstrates one of the reasons that barefoot practitioners claim to see instant improvement in hooves. I believe that the removal of all nails with the shoes allows the hoof capsule to return nearer to a state of dynamic equilibrium that had been out of balance prior to the removal of the nails. Therefore the barefoot protocol does have a merit for the restoration of distorted hoof capsules of horses.

Historically, many equestrians have advocated removing shoes for a period of time in order for the foot to correct itself from the detrimental effects of shoeing. I believe that this practice came nails in the hoof capsule.

Understanding the effects of the correct anatomical placement of nails in the hoof capsule will greatly assist the farrier in keeping horses sound and hooves in a strong stable state of existence, even without periodic removal of shoes for extended periods of time.

While simply altering the nail location will not in of itself correct hoof capsule distortions, I have used the data described here to greatly assist in the process of reversing the distortions of hoof capsules. I have seen results that include racehorses hugging the rail more tightly in turns, barrel racers running faster times and taking both directions more evenly and jumpers who appear to land more easily. Trainers also report a marked decrease in the need for joint injections in horses that have developed dynamic equilibrium.

Martin Kenny is an American Farrier's Association Certified Journeyman Farrier and a Registered Journeyman Farrier with the Guild of Professional Horseshoers. He shoes out of The Hoof Redevelopment Center at his home in Carthage, N.C. He may be contacted through www.thehoofcenter.com or by calling (910) 947-9476.