

WHAT DO HEALTHY HORSE FEET LOOK LIKE AND HOW MIGHT WE FIGURE THAT OUT?

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One way to figure out how your clients' horses' feet should look like is to organize a preventive foot care program within your practice. Any preventive program within veterinary practices can have obvious value to animal health and potentially to their owners. For veterinary practices these programs

- Can be scheduled easily
- Spread out over various months for stabilizing cash flow
- Provide time for practice building with clients under non-stressful situations
- Provide income for the "half" practices to grow from 1 ½ to 2 (3,4) person practices by hiring a young veterinarian
- May develop into a service that is a major profit center for a practice
- Help enhance marketing planning within a practice

Any preventive program within a practice can be tailored to the practice's veterinarians and staff's expertise and available time and their clients' needs. Ideas of various preventive foot programs in practices and on farms including various measurements that can be considered have been reviewed. Also with computer programs various quality of reports can be generated for owners, farriers and other veterinarians. (1)

In 1998 we began using a formalized preventive foot care program. Obviously some form of evaluating the horse's external hoof conformation is critical. Radiographs in an organized fashion to enhance evaluation of the horses' front feet for their owners, farriers and in some cases their veterinarians have become the hallmark of any program. New information concerning these 50 horses' front feet was gained for 64% of these horses. (2) Consistency in taking the lateral radiograph is critical. Our protocol is

- If the horse is shod, LEAVE THE SHOES ON, so you can see the relationship of the shoe to the coffin bone
- The front feet blocks are constructed as mirror images of each other and the horse is on stood on each block. Its height is set so when the horse's feet are placed on the block the central beam will hit the foot about ½" above the shoe/hoof surface. The goal is to see the bottom of the coffin bone rather than joint evaluations.
- The cassette should be touching the medial side of the foot
- The beam is aimed at a point halfway between the anterior and palmar aspect of the coronet band. (see figure 1)
- Our film focal distance is 24" (61cm)
- The ultimate film has appropriate contrast so as the horn and bone can be evaluated.
- A fixed length marker (soldering wire) is applied to the front of the foot. If you want to have accurate evaluations of the actual start of the coronet band, consistent placing of the wire must be accomplished. Make sure the wire is taped flat against the hoof wall over its entire length.

Over the years we have developed additional ideas that we have included in some of our current evaluations depending on our initial clinical examination that have increased the efficacy of our evaluations.

CONSIDERING DORSO-PALMAR RADIOGRAPHS TO EVALUATE MEDIAL TO LATERAL BALANCE

At this time these views do not give as much information as the lateral views. Making sure the beam is directed at a 90 degree angle is important. The really only valuable measurement is the distance

from the distal medial and lateral wings of the coffin bone to the shoe or block. Evaluating joint compression or widening on either the medial or lateral side can be influenced by very small positional changes in the horse standing on the block. (3) A consistent and serial DP can be very helpful in evaluating any laminitic horse to evaluate the potential of medial (or less common, lateral) rotation or sinking of the coffin bone.

CONSIDERING LATERAL RADIOGRAPHS OF HIND FEET

Over the years we have become more concerned with the total evaluation of all 4 feet and how they connect to the total horse for its well being, causes for lameness and important in rehabilitating any lameness problem. Making radiographs the hind feet is more difficult than radiographing the front feet. The most significant difference is that many horses tend to toe out a bit and are reluctant to stand up on one block while the other limb is being lifted to be placed on an opposite block. We modified a “tray” concept that is filled with removable dowels. The “tray” is slid under the horse and he is then led up onto it. The dowels can be removed so the cassette can be set anywhere so it is 90 degrees to the x-ray beam. (see figure 2) The total height of the tray with dowels is set up as the same height as the front feet blocks.



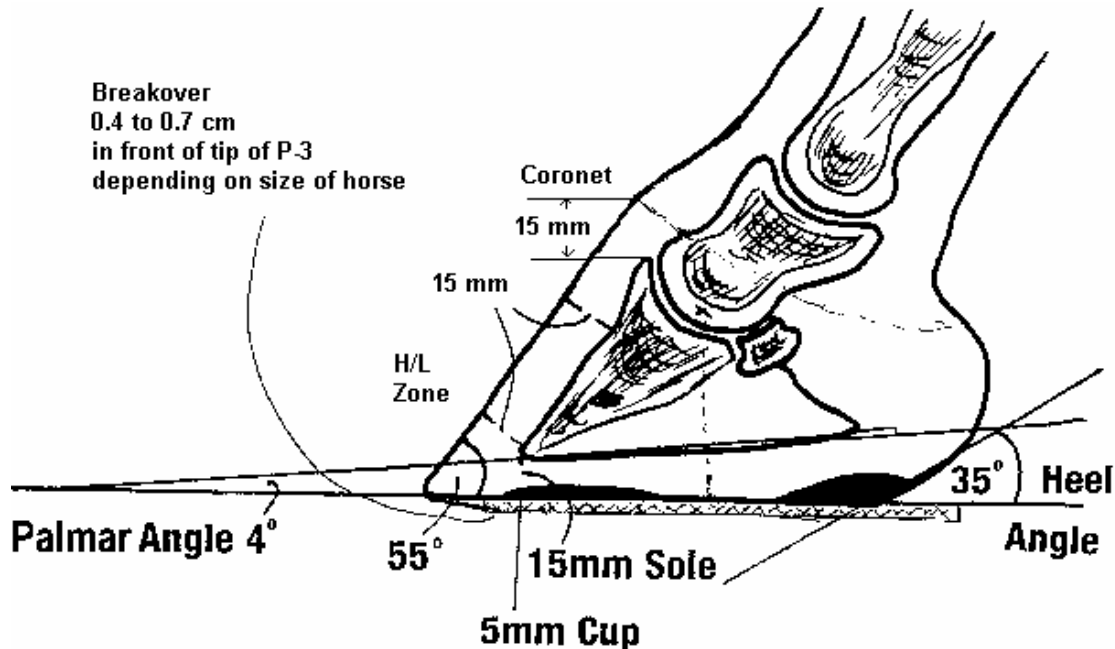
Figure 1. Block set up for front feet



Figure 2. Dowels removed for cassette

OBSERVATIONS RELATED TO THE FIVE “MOST IMPORTANT MEASUREMENTS” TO EXAMINE?

First of all you need to realize how close your radiographic system is to the real measurement of the foot. So if your wire in reality is 80mm long and then 88mm when measured on your radiograph, then the actual foot measurements are magnified by 10%.



Angles and dimensions found in a normal foot.

Figure 3. This schematic was adapted from Redden, R. (3) and Page, BT, et al (4). It corresponds to some of measurements we have observed in 108 “normal” horses in central North Carolina. (5)

It is always helpful to know when the horse was last shod with the assumption that measurements might change weekly. The horses in our preliminary data were considered sound by their owners, averaged 9.17 years of age, in 4.21 days of work and on average were last shod 3.06 weeks ago. (5)

Horn/lamellar zone (H/L zone) – the front wall of the hoof should be parallel to the front of the coffin bone. Its thickness is related to the size of the horse and should be the same in all 4 feet. Deviations with widening usually at the bottom indicate the horse has had some laminitis, whether in one foot or more feet. Maybe we would see more hind feet laminitis if we took hind feet radiographs. The amount of rotation is not that predictive of the seriousness of the laminitis. The difference between a mild case and severe case is directly related to the amount of initial inflammation in the laminae (leaves) between the outside of the coffin bone and the inside of the hoof. If there is rotation of the coffin bone at the clinical onset of laminitis then the horse probably has had a previous bout. Laminitis can reoccur and when it does is usually worse than before. So any horse with an unusual anterior wall thickness should be monitored with regular lateral radiographs. Where there is enough contrast in the lateral radiograph to see the juncture between the sensitive and insensitive laminae that line should be parallel to the coffin bone and external wall. If the horse's anterior wall is rasped parallel to the coffin bone the only way one potentially could tell the horse has had laminitis is to evaluate this juncture. In the 108 horses we are examining the average proximal H/L zone was 20.0 mm (170 feet) and 18.88mm (202 feet) at the distal H/L zone. Interestingly though in the 202 feet the distal H/L zone varied 1 mm wider for 11 horses, 5 feet had 3 mm wider and 1 foot each 4 mm and 5 mm wider respectively. We are reviewing further but this might indicate 9% of feet (or 18% of horses) could have some rotation! Might be a reason for survey lateral radiographs on an annual basis in itself? (5)

Sole plane angle – this is the angle the bottom of the coffin bone makes with the ground. It should be slightly positive from plus 2 to 5 degrees. In the front feet the angle can be called the palmar angle; and behind, the plantar angle. The lower the sole plane angles potentially the more tension on the deep digital flexor tendons, thus increasing stress on the entire posterior portion of the limb. Also negative angles get the wings of the coffin bone closer to the ground and thus increase soreness, bruising and abscesses to the heel area of the feet.

In our group of 108 horses the average palmar angle was positive 2.35 degrees in 213 feet.

Sole thickness – thin soles can be obvious to a farrier. But in some horses there are other problems existing that may contribute to the thinning of the soles, such as mild laminitis or long toes with low heels. Correcting some of these issues can help thicken the soles. In our preliminary examination of 108 horses the sole depth at the tip of P-3 was 13.97 mm (203 front feet). Within in the 108 horses we did some breed analysis (but not many in each category) and found

TB (26) Palmar angle 1.26 /sole depth 13mm

QH/App(18) Palmar angle 1.69 /sole depth 14.71

WBDs (11) Palmar angle 1.79 /sole depth 14.27

Arab/SadBred (8) Palmar angle 3.78 /sole depth 17.06

Breakover – Breakover is the last point of the hoof or shoe to come off the ground. The further forward the breakover is, the more levering affect there is placed on the foot and potential strain on the entire back portion of the limbs. Reduction in breakover helped horses with navicular syndrome (4) and generally is very helpful to chronic laminitic horses. The longer the breakover is in front of the tip of P-3 potentially correlates to the length of the toe. In another study we have underway we feel that this levering affect in the hind feet can create back soreness if the breakover is too far forward of the coffin bone. In 24 horses with palpable sore gluteal horses and 24 horses without palpable gluteal pain the “breaking” point seems to be about 2 cm.; the majority of horses with greater than 2 cm breakover have pain and vice versa. (6) Learning more about the hind feet’s role in hind limb lameness is potentially very important.

Support of the coffin joint – Protecting the coffin joint requires a balance between heel and toe support. So there would be an ideal range that would be best for a horse. Determining the center of the coffin joint probably is not precise with each “measurer”. Also the potential ideal of having the shoe directly in the middle of the joint might not be practical in either a performance or turnout situation. In 204 front feet in our study the average was 59% of the shoe in front of the joint center and 41% behind. In another study of 230 horses it was found to be 65%/35%. (7)

Evaluating each of these five measurements does not exist alone in a vacuum, but need to be looked at together when evaluating a horse’s foot conformation, its relationship to soundness and shoeing. Each horse has their own ideal set of these five measurements that makes for that horse’s most mechanically efficient stride and works best for that horse’s upper limb conformation. Just like any situation the more we look the better the opportunity of finding out helpful and healthful aids for our horses. So when a horse is having difficulties either in soundness or performance carefully examining the foot conformation and shoeing including a lateral radiograph of each foot with the shoe on can be helpful. This radiograph then produces a picture of exactly where the shoe is placed in relation to the lower limb bones and joints.

REFERENCES

1. Mansmann,RA & vom Orde, K. Preventive Foot Care Programs. In Floyd, AE & Mansmann,RA,editors: *Equine Podiatry*, St. Louis, 2007, Saunders Elsevier, publishers
2. Mansmann, RA, King, C. and Stewart, E: How to Develop a Preventive Foot Care Program- A Model. In Proc. AAEP. 46. 2000, pp. 156-161.
3. Redden, R. Understanding Laminitis. The Blood Horse,Inc, Lexington, Ky. 1998. P.44
4. Page,BT,Bowker,RM;Ovniczek,RJF &Hagen,TL: How to Mark the Foot for Radiography. 45 AAEP pp148-150
5. Mansmann,RA and Donoho,S unpublished data. 2006
6. Mansmann,RA and James,S, unpublished data. 2007
7. Craig,J & Craig, M: Measuring the Horse's Hoof. The European Farriers Journal, #114, June, 2005. pp 8 – 24.