

Foot X Rays: A Crystal Ball?

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When you look at a radiograph (X ray) of a horse's foot, do you visualize soft tissues, or do you only see bones? If there's one thing Ric Redden, DVM, founder of the International Equine Podiatry Center in Versailles, Ky., consistently teaches, it's that there is always more to learn about a horse's foot if you only know how to look. He recently offered a foot radiology short course for an audience of farriers, veterinarians, and horse owners June 1-3 in Versailles, Ky.

"The point here is to educate everyone that we're not looking for a nice outside, cosmetic appearance of the foot, we're looking for inside health," he began. "I want to teach you to look at a foot so it speaks to you and tells you what to do. It will speak very loudly if you know how to listen. Soft tissue parameters (as seen on a radiograph; more on these shortly) change long before you have bone damage or hoof capsule changes. They are the writing on the wall. Soft tissue changes tell you what's coming."

When you can identify impending problems, they can be addressed before they actually cause lameness and lost training/competition days.

Looking Inside the Foot

Physical examination remains the most important part of examining the foot, says Redden, followed by targeted radiographs.

"Interpreting the message from the soft tissue parameters offers great insight to many foot problems that can be missed by simply looking for bone pathology," he said. "Imbalances don't jump out as pathology unless you know what those measurements should be. Most lamenesses are caused by soft tissue problems, not bone problems."

These problems are identifiable and measurable via several soft tissue parameters.

"Start looking at these parameters on every radiograph," suggested Redden.

He cautioned that healthy parameters for a given foot vary by the age, breed, and use of the horse. All of these can be measured from an X ray taken with shoes on or off, as long as proper technique is employed (Redden prefers shoes to be left on for most views).

Here's what you are looking for:

Sole depth (SD) is the amount of sole under the apex of the coffin bone. A light-breed horse needs at least 15 mm of sole for soundness because it takes at least 10 mm to house a healthy vascular supply (blood vessels) plus 5 mm of sole for

Imaging

An X ray of your horse's foot can help you predict the future while it shows you the present.

MECHANICAL LAMINITIS TREATMENT

protection.

Palmar angle (PA) is the angle the wings of the coffin bone make with the ground surface. Normally a foot is most healthy when the PA is slightly positive; a zero to negative PA indicates heel crushing. PA as it relates to sole depth is one of the most important things to evaluate; a high PA or negative PA and thin sole is when you have problems.

Digital breakover (DB) is the horizontal distance between the apex of the coffin bone and the breakover point (the forwardmost point of the foot or shoe touching the ground on a hard surface). A high DB increases the pull on the deep digital flexor tendon (DDFT) and subsequently increases load on the laminae, sole corium, navicular bone, and navicular bursa. Shortening this distance can reduce strain on the DDFT and laminae.

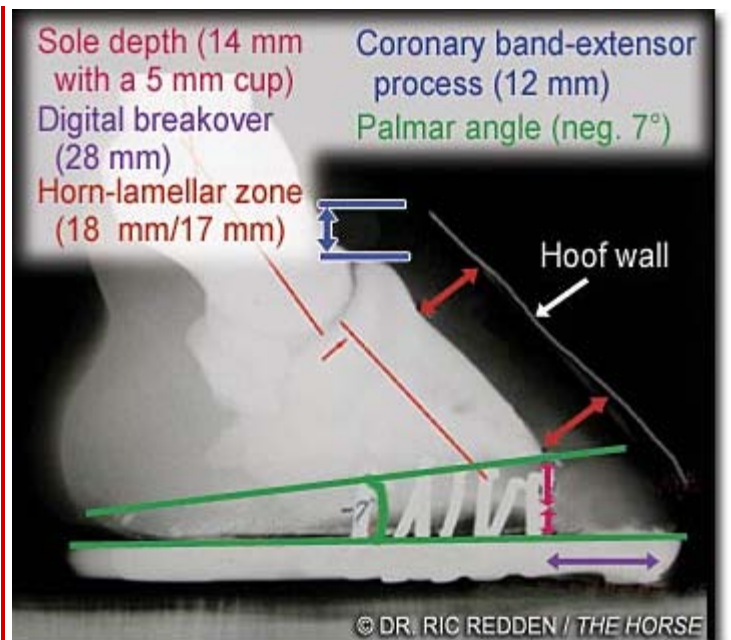
Horn-laminar zone (HL) is the perpendicular distance between the outside of the hoof wall and the dorsal face of the coffin bone, measured just below the extensor process of the coffin bone and again at the apex of the coffin bone. In a healthy foot the two are usually the same (i.e., 15 mm/15 mm). The lower measurement is higher in a laminitic foot in which the apex of the coffin bone is rotating away from the laminae. It might increase uniformly if the laminae are swelling (classic sinker). The HL zone is influenced by other problems as well.

Coronary band-extensor process distance (CE) This is the vertical distance between the top of the coronary band and the top of the extensor process of the coffin bone. It varies greatly from 0-15 mm in healthy feet, and will increase if the bony column is sinking down through the foot (comparative films are essential as well as the trimming history). This is sometimes called the founder distance, but this is misleading because of the aforementioned distance possible in a healthy foot.

Bone angle (BA) This is the angle the bottom of the coffin bone makes with its face at the toe. These can vary significantly from foot to foot, making it impossible to match feet on some horses. Trying to match them could cause soft tissue damage. Caution is due when trimming hooves to a predetermined angle without knowing this information.

Once you have this information on your horse's feet, how do you use it? Applying these measurements to your knowledge of foot anatomy and physiology offers you a much better chance to figure out problems. For example, let's say you have a grade 2 club foot (one that's at least five degrees steeper than the other front or hind foot). You might see a HL zone of 15/16 mm, 20 mm of sole, and a fairly high PA of 8°. If you take off the heel of that foot to try and match it to the lower foot, you are yanking that DDFT very tight and cranking the apex of the coffin bone into the sole. That will cause sole pain and quickly reduce sole depth, says Redden. The fact that this foot had plenty of sole tells you the foot is pretty happy as it was, because if it weren't it would not have grown a healthy sole.

Here's another scenario: Let's say you have a grade 3 club foot on each of two foals who are prospective speed or sport horses. Both hooves have a 62° hoof angle. The first foal's club foot has a slight dish in the front, a high PA of 12°, and a BA of 50°. That foot might be a candidate for check ligament desmotomy. But the other foal's club foot has a 2-3° PA and a BA of 60°; that's a completely different foot inside even though it has the same hoof angle. Cutting the check ligament in that foot likely will not



This image depicts the measurements Dr. Redden uses to evaluate and treat a laminitic horse, and to design the preventive shoeing package the horse needs.

change the overall hoof angle.

The Fallacy of Rotation

"Rotation as a sign of laminitis is probably one of the biggest misnomers we were ever taught," stated Redden emphatically. "Some think you don't need to take radiographs of a laminitic horse early because he's probably not rotated yet. **You don't want to wait for that!** And the horse that swells 10-15 mm (in the HL zone) and his bone goes through the bottom of his foot with no rotation at all is the worst case you'll ever see."

If you radiograph the foot early in a laminitis case, any swelling in the HL zone can tell you that a big problem is brewing before the bone starts to rotate and/or sink. Knowing that will dictate how aggressive you need to be with your mechanics. Greatly reducing the force of the DDFT can have profoundly positive results, he noted.

"I never want to see rotation," Redden noted. "I love it when people look at horses I've worked on and say, 'Redden just took your money; this horse never had laminitis.' That's the ideal, when you can't tell they were ever laminitic months later because you were ahead of the game enough to prevent significant damage. Effectively reducing the forces at play that cause rotation **before it occurs** greatly enhances the healing environment, offering much better results."

Venograms

Evaluating blood flow in the foot using a venogram (a radiograph taken after contrast dye has been injected into the foot) is the "most informative tool I've ever used in my life," said Redden. Areas with compromised blood flow tell him how he needs to alter mechanics (hoof angle, etc.) to restore healing blood supply to those areas. "I do a venogram on every laminitic horse at the first exam," he noted. He uses venograms to assess horses with other problems.

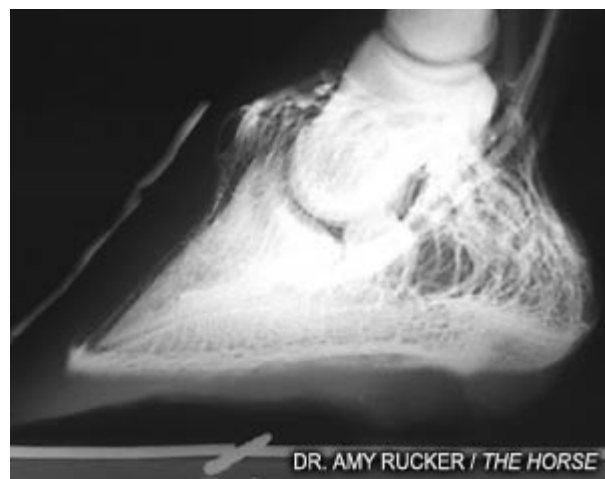
With severe laminitis, the circumflex vessel that normally runs 10 mm beneath the coffin bone is often pushed up above the apex of the coffin bone; this is Redden's prime criteria for knowing when to cut the DDFT to stop its rotational pull on the coffin bone. Other imaging modalities do not provide this information. Also, serial venograms can tell you whether compromised areas are getting better or worse.

"Venograms help me monitor a horse's feet before he tells me what's going on," Redden explained. "Never evaluate progress by the horse's response; they'll lie to you through their teeth. Trust your radiographs and venograms."

"Some people have asked why I do this (offer courses and symposia). I'm after that reward of knowing that some of you are really making this happen, and hearing you talk about horses that everyone wanted to kill and now they're running around," he concluded.

Further Reading

Redden, R.F. Clinical and Radiographic Examination of the Equine Foot. 2004; Jan. 28.
<http://www.thehorse.com/ViewArticle.aspx?ID=1457>.



Normal venogram, 5-year-old Arabian mare. This lateral (from the side) venogram (radiograph of foot with contrast media injected into the blood vessels) shows the information that an equine podiatrist can gain from this procedure.

Readers are cautioned to seek the advice of a qualified veterinarian before proceeding with any diagnosis, treatment, or therapy.



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