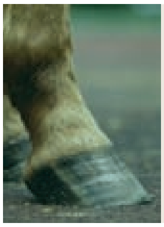


TRADE ZONE *Hoof Care and Disease*

Notes from the 2012 AAEP Conference Programs

A club foot, right, might appear at birth or develop later in a horse's life

ERIN RYDER

BY DR. NANCY LOVING

Not all horses have symmetrical feet, and one of the more common problems they develop is a "club foot" appearance. This problem might appear at birth or develop later in life and can be identified based on classic signs and grades of severity.

Dr. Robert Hunt, of Hagyard Equine Medical Institute in Lexington, defined a club foot as having an angle greater than 60° (the angle the dorsal hoof wall makes with the ground). Usually there is at least a five-degree discrepancy between the affected foot and its opposite.

"Initially an owner may recognize a space between the heel and the ground that develops slowly over two to three hoof trims," Hunt explained. "The second sign is that the coronary band appears square and full. Then, the foot appears boxy with a dish in the front of the hoof wall. And eventually, the frog becomes quite recessed, the hoof contracts, and the horse appears 'back at the knee.' "

With this change in biomechanics, Hunt said, "The foot is prone to injury since loading on the foot moves forward, altered from its normal, heel-first landing."

A more accurate description of a club foot is a flexural limb deformity of the coffin joint. In most cases, it is caused by a shortening of the musculotendinous unit (which runs down the back of the leg) that shifts the load dorsally (forward) in the foot.

Veterinarians have used multiple club foot classification systems: Type 1 refers to a club foot with a hoof axis less than 90°; Type 2 is greater than 90°. Or, they can use a grading system of the hoof axis relative to the opposite limb to define severity: Grade 1 is 3-5°; Grade 2 is 5-8°; Grade 3 has a broken-forward hoof-pastern axis (HPA)—in which the hoof wall angle is steeper than that of the pastern, hoof wall dishing, and irregular growth rings; Grade 4 has a hoof angle greater than 80°, a severely broken-forward HPA, marked concavity to the dorsal hoof wall, and the coronary band height at the heel is the same as at the toe.

ANNE M. EBERHARDT

Practitioners should be able to detect pain with sharp eyes and deft hands

Usually, congenital cases (present at birth) "are self-correcting with minimal treatment other than toe protection," Hunt said. Veterinarians can also administer systemic oxytetracycline, but he says too much oxytetracycline treatment can cause excessive joint laxity.

An acquired flexural deformity usually appears when a foal is 4-6 months old.

"It may result as a primary problem possibly due to a genetic predisposition," he said. But "it is often secondary to other lameness...such as pain elsewhere in the limb that alters weight-bearing on that leg.

"Treatment varies depending on age of horse, severity, and client expectations," he stressed. "The guiding principle is to improve comfort and minimize toe trauma while trying to reestablish load bearing on the heels."

Hunt cautioned against using external shoe devices that improve the 'look' but don't achieve a long-term solution. In assessing an adult horse with a club foot, Hunt urged veterinarians to consider carefully the horse's intended use and to pay close attention to current management, including farrier care and nutrition.

Localizing Pain in the Feet

Practitioners must hone skills and strategies for pinpointing equine foot pain so they can detect the slightest aberration with sharp eyes and deft hands. Dr. Debra Taylor and Dr. John Schumacher of Auburn University's College of Veterinary Medicine, described methods for pain localization.

Veterinarians should examine all aspects of a lame foot, noting any abnormal biomechanics that could contribute to pain. Taylor said, "The coronary band normally is straight or slightly arched, running at an angle about 20-25° from the ground plane. Hairs should lie flat against the coronary band, and the coronary band should feel full and spongy without a ledge."

Hoof wall "tubules…should be straight without flares or bends," she added. "The white line should be tight and about a quarter-inch wide (not stretched/separated). Normal frog width is 50-60% of its length. Its depth should reach the bearing surface with no relative space under the rear of the foot. The central sulcus should be wide enough to fit an index finger." Contraction indicates possible pain.

The heel should feel like a tennis ball on palpation, added Taylor, and there should be at least three- to four-fingers' width between the bulbs. Collateral cartilages should feel flexible with finger pressure, and the digital cushion should fill to the top of the cartilages. Always compare each foot to its opposite, and use hoof testers to assess for specific pain areas.

Changing gears, Schumacher described using digital anesthesia (nerve blocks) to localize lameness, suggesting that mepivacaine is the least irritating drug to use for regional or joint anesthesia. Historically, clinicians thought palmar digital nerve (PDN or heel) blocks numbed the back third to one-half of the foot. However, researchers have shown this block can also anesthetize the coffin joint, entire foot, and even the pastern joint, potentially interfering with lameness assessment.

"Blocking of the coffin joint is also known to numb the sole and even the heel if sufficient volume is placed into the joint," he reported. "Blocking the coffin joint also blocks the navicular apparatus with incidental anesthesia of the palmar digital

ANNE M. EBERHARDT

Hoof problems create discomfort that alters a horse's gait and prevents him from performing at his best nerves (which feed the navicular region). However, anesthesia of the navicular bursa only has an effect on sole pain at the toe but does not desensitize the heel."

In summary, practitioners must conduct a thorough physical exam and use hoof testers and flexion tests to reach an accurate foot pain diagnosis. He or she can use digital anesthesia to rule out problems in higher limb structures, but this method has limited value in localizing an area of distal limb pain.

"Consequently," stressed Schumacher, "results from digital anesthesia must be interpreted with caution."

Biomechanics and Hoof Problems/Treatment

Lameness caused by foot problems is common in the horse, and it can significantly impact performance. Hoof bruising, heel soreness, and hoof cracks all create discomfort that alters a horse's gait and prevents him from giving his utmost to an athletic task. Nearly all equine foot diseases have their root in biomechanics, noted Andrew Parks, professor of Large Animal Medicine at the University of Georgia School of Veterinary Medicine, and veterinarians and farriers must take a biomechanical approach to treating these problems.

Parks recently reviewed important elements of equine foot anatomy.

He started with a bit of biomechanical anatomy review: While the long bones of the skeletal system, such as the radius (forearm) or the cannon bone, effectively transmit force from one end to the other, the distal phalanx (coffin bone, a short bone), acts as a shock absorber, transferring weight-bearing forces from the hoof to the skeletal system. This bone is also well-adapted for attachment to soft tissues (tendons and ligaments) that aid or resist movement.

"The principal forces acting on the foot are the weight of the horse, the ground reaction force (GRF), and the tension in the deep digital flexor tendon (DDFT, which runs from the underside of the coffin bone to the flexor muscles higher in the leg)," Parks explained.

The GRF matches the weight the limb bears, but it is exerted in the opposite direction. When a horse's foot stands on a flat, firm surface, the GRF distributes around the perimeter of the hoof capsule. But when standing on a conformable surface such as sand, the GRF distributes broadly across the bottom of the horse's foot. In both cases GRF pressure is greatest approximately in the center of the foot, just in front of the coffin joint.

The hoof is unique in that it comprises many different types of integument that continually grow, yet it functions as an extension of the musculoskeletal system. Parks said the hoof wall responds differently to forces depending on the rate at which they're applied.

"For example," he said, "a force applied rapidly and immediately removed, such as the foot landing on the ground at speed, causes elastic change of foot shape that then immediately returns to its prior shape. In contrast, a prolonged and slow force applied to the foot deforms the tissue, but when this force is removed, it takes much longer to return to its normal shape."

When Biomechanics Go Wrong

Prolonged abnormal loading or force on the foot, as occurs with improper hoof growth, trimming, or shoeing, has consequences—it might deform the hoof wall, causing flaring and the coronary band to move proximally (upward). Hoof growth slows as the body attempts to restore the hoof to a normal shape, resulting in growth ring spacing irregularities.

Parks commented, "The coffin bone is suspended in the hoof by the lamellae on three sides with the deep digital flexor tendon taking up tension on the fourth side. Interestingly, if the horse is lacking a functional hoof wall, he can't walk because of painful pressure between the sole and coffin bone. However, if lacking a functional sole, he walks tolerably well if sensitive tissues are protected from pressure because the lamellae and DDFT support the coffin bone off the ground."

Biomechanics and Treatment

As the horse begins each stride, associated shock waves can cause foot injuries.

"Normally there is natural damping of concussion by many structures such as the inner lamellae of the hoof wall, the digital cushion, collateral cartilages, the vascular plexus, and thick articular cartilage," Parks said.

Applying a plain steel shoe to the hoof increases frequency of impact vibrations and maximum acceleration of the foot. In addition, he said, a steel shoe increases pressure on the navicular bone (which acts as a fulcrum around which the DDFT passes), restricts hoof expansion, and causes the heels to wear more rapidly than the toes.

To reduce impact shock waves, Parks recommended that veterinarians and farriers, "change the concussion of impact via a plastic shoe or a viscoelastic pad."

He suggested other biomechanical modifications for improving foot function: Use a pad to distribute the force evenly, move the GRF's center of pressure, and move the point of breakover back. In the latter case, rolling the toe shortens the moment arm around which the coffin joint rotates and eases breakover.

In all cases, Parks urged, "A proper diagnosis of abnormal forces on the foot must be achieved in order to apply appropriate therapeutic shoeing strategies. This doesn't mean that horses shouldn't be shod, just that clinicians should be aware that adverse effects occur (with certain shoeing practices) and there may be a need to mitigate these effects." BH

HIND END LAMENESS

Lameness in horses originating in the pelvic limbs or "hind end" can be a bit intimidating at first mainly because it is difficult for most to recognize. Once we learn to identify that a pelvic limb lameness is present then the diagnosis of its source should be isolated to the limb exhibiting the greatest deficit. Once this has been achieved, the appropriate diagnostics or treatment to isolate the affected area of the limbs can be performed and therapy or appropriate treatment addressed.

The first thing that I always do is a thorough physical examination. This can possibly identify the primary and potential compensatory areas involved right away. Throughout the examination process I am looking for symmetry in joint effusion, soreness on palpation or flexion, or even atrophy in areas involved in cases of long-term or chronic lameness. This along with an accurate and comprehensive history of performance and treatments can many times eliminate doing repetitive procedures and expensive diagnostics that can "muddy" the case and further add to the costs.

Therapy in my opinion should be done with symmetry. For example, I almost without exception inject both hocks and/or stifles when I have diagnosed a primary hock/stifle problem. I feel the same way about hind ankles. The exception to this rule would be a gluteal tear. Typically once I have diagnosed that problem, I inject only the affected side, which in almost all racehorses in North America is the left.

Pelvic limb lameness can be puzzling, but putting the puzzle together a piece at a time can give a clear picture and revitalize a racing career.

Dr. Steven C. Allday

For more information, visit www.lubrisyn.com or www.re-borne.com.

TRADE ZONE *Lameness*

Racetrack surface and hind limb fetlock, hoof kinematics

COURTNEY V. BEARSE

A recent study showed horses' hind fetlocks flexed 15 degrees more while galloping on dirt than on a synthetic surface

BY ERICA LARSON AND DR. STACEY OKE

Just as in the performance horse realm, racetrack surface can have a major impact on horse health. For instance, some anecdotal reports suggest synthetic track surfaces could be more associated with some musculoskeletal injuries when compared to dirt and turf tracks. However, exactly how racing surfaces affect horses' legs—specifically the lower portions of the limb—remains unclear. To better understand this interaction, a research team recently evaluated Thoroughbreds' hind limb motion on dirt and synthetic surfaces.

Jennifer E. Symons, a PhD student in Biomedical Engineering at the University of California, Davis, J.D. Wheat Veterinary Orthopedic Research Laboratory, and colleagues applied kinematic markers to specific points on five Thoroughbred racehorses' lower limbs before sending the animals out to gallop on a dirt surface and a synthetic surface. The team used high-speed video analysis to evaluate joint angles during workouts.

Their key findings included:

■ When horses galloped on the dirt track, their hind fetlocks flexed 15° more than the when the animals worked on the synthetic track (maximum hyperextension was greater on the dirt track).

■ When working on the dirt track, the horses experienced greater horizontal hoof slide—approximately 4 inches—than when breezing on the synthetic track, where hooves slid approximately 1.5 inches (i.e., hooves slid more readily on a dirt track than on a synthetic track).

Symons and colleagues found that horses working on dirt surfaces similar to the study track appear to place greater forces on their proximal sesamoid bones and greater strain on their suspensory ligaments than horses working on the synthetic surfaces similar to that studied. Horses would be more likely to injure their hind fetlock on the dirt surface than on the synthetic.

"Anecdotal reports suggest that the incidence of musculoskeletal injuries in the hind limbs has increased on synthetic surfaces," Symons said. "Trainers hypothesize that these injuries are due to decreased hoof slide. The results of this study did confirm lesser hoof slide seen on synthetic surfaces. However, we currently have no data that supports a causal relationship between less hoof slide and increased injury."

Symons noted that further studies are needed to help achieve the ultimate goal of reducing injury incidence with different surfaces.

"Ultimately, we wish to design consistent race surfaces that reduce the incidence of racehorse musculoskeletal injury," Symons concluded. "In the interim, altering horseshoe design by removing or adding traction devices like caulks or stickers may allow trainers to increase or decrease hoof slide for horses training or competing on different race surfaces."

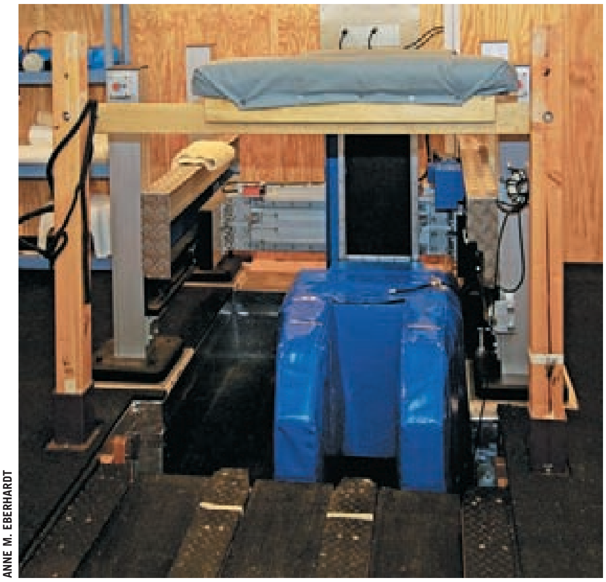
MRI for Evaluating Suspensory Ligament and Sesamoid Injuries

Equine practitioners use MRI extensively to help diagnose even the most subtle lameness causes.

"One region of the horse's body that is a common site for injury is the lower (distal) aspect of the suspensory ligament near the fetlock joint," explained Dr. Alexander Daniel of Colorado State University's Veterinary Teaching Hospital.

The suspensory ligament originates near the top of the cannon bone at the back of the knee and hock, travels down the back of the leg, and splits into two branches that insert onto a sesamoid bone.

"It is known that injury to the suspensory ligament near the fetlock can occur either in isolation or combination with injury to the one or both sesamoid bones," Daniel said. What wasn't known was whether the suspensory ligament's size or position changed following injury to the sesamoid bone(s). So Daniel and colleagues from the Alamo Pintado Equine Medical Center, near Los Olivos, Calif., reviewed the MRI scans of 26 horses diagnosed with injury to one branch of the suspensory ligament near the fetlock joint (either fore- or hind limb).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A standing MRI machine

"We found that the dimensions of the suspensory ligament injury measured on MRI were different between horses that did or did not have concurrent sesamoid bone issues," relayed Daniel.

This means the cross area of the suspensory ligament was significantly larger in horses that had injury/damage to the sesamoid bone compared to horses without sesamoid bone injuries. The researchers suggested that MRI was an invaluable diagnostic tool for identifying suspensory ligament lesions in the fetlock as well as sesamoid bone damage. BH

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