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Education and Training:

PhD, Neurobiology, University of Pennsylvania, 1979
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Research Interests:

- Functional anatomy of pain mechanism
- Organization of descending pathways to spinal cord
- Transmitters and inflammation within synovial membrane, lungs and skin
- Equine foot
- Navicular disease

Physiological trimming for a healthy equine foot:

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More than ten years of intensive, scientific research at Michigan State University has resulted in new recommendations that are leading to relief from navicular syndrome, laminitis, and other chronic foot ailments in the horse.

Robert Bowker, VMD, PhD, director of the Equine Foot Laboratory at the College of Veterinary Medicine at Michigan State University is conducting this research on the physiological function of the equine foot.

Bowker earned his veterinary degree at the University of Pennsylvania's College of Veterinary Medicine in 1973 and later began additional PhD research in the anatomy department at the medical school there. He completed the PhD degree in 1979 and began his career at MSU in 1988.

As a result of teaching gross anatomy to MSU veterinary students, Bowker became interested in the equine foot, because he knew that the texts commonly used by students and veterinarians were often incorrect on this subject.

As his PhD training was in Neurobiology, Bowker began to look at the nerves of the foot, and the research expanded from there to blood vessels, cartilage, and bones of the foot, and more recently to hooves and their laminae in both health and disease.

Most of his research efforts are supported by the American Quarter Horse Association, the Grayson-Jockey Club Research Foundation, Inc., and private donations.

In the 1990s, Bowker began supplementing his scientific studies with observations in the field. He studied the foot of the wild horse in order to better understand the situation of the domestic horse.

Bowker's research in all these areas led to the discovery of a wholly different theory of how horse feet respond to ground impact. His research focused on the blood flow to and from the equine foot and the role it plays in energy dissipation.

The results of his research led Bowker to believe that the modern-day horse should be trimmed so that more of the back part of the foot—including the frog—will bear the initial ground impact forces and weight.

His research showed that if the foot was trimmed so that the frog rests on the ground, the back part of the foot would be stimulated to grow more fibrous and fibrocartilaginous tissue in the digital cushion, which appears to be protective of the more chronic foot problems.

The Physiological Trim

Bowker has studied the various components (the frog, sole, blood flow, etc.) of the equine foot and has determined the role they play together to make a "good" equine foot.

According to him, "The aim is to use this acquired knowledge to prevent and better treat cases of navicular syndrome and other chronic foot ailments."

Bowker and his students at the Equine Foot Laboratory, in close collaboration with other farriers and veterinarians, have developed guidelines for a "physiological trim." While some aspects of the trim are not new, they have been forgotten or have been underutilized by most hoof care professionals.

Bowker explains, "The physiological trim is a trim that permits the tissues of the foot to function optimally in dissipating impact energies during foot contact with the ground."

According to him, "This physiological trim is the result of the continuous evolution of our research. We've found that the back part of the foot and blood flow is a major mechanism for dissipating energy.

"Our research has shown that the equine foot is constantly adapting and responding to environmental conditions. Most feet are sculpted by their environment, rather than only by genetic influences.

"We have found that from a neuroanatomical point of view, the equine foot is designed to hit the ground heel-first. This concept of hitting the ground heel-first is seen in virtually all feral horses and the majority of sound domestic horses.

"We have also determined that the back part of the foot should be the largest surface, area-wise, for ground impact." Bowker explains, "This is very much like a human being wearing high-heeled shoes as opposed to sneakers. The more comfortable sneakers distribute the load over a larger surface area, versus the smaller area of a high-heeled shoe." An impact load distributed over a large surface area can be better supported with minimal stress by the foot tissues.

Bowker further explains that the horse has the additional energy dissipation mechanisms of the large blood flow through this same region. Together this large surface area—coupled with the frog and the blood flow—is what dissipates the energy.

When the back part of the foot and frog do not touch the ground, this impact energy is not dissipated but instead is transmitted to the bones and other tissues of the foot.

These tissues do not dissipate the impact energy well. The long-term result of insufficient energy dissipation is chronic foot problems and lameness. For example, in under-run feet, the ground contact area is usually under the coffin bone rather than under the back part of the foot.

Recommendations for Farriers

"What we are trying to do is work with Mother Nature, not fight her," explains Bowker. "We can do this by keeping the toe short and the back part of the foot on the ground. In other words, it's a matter of using a large dose of common sense."

The aim is to have a functional, physiologically sound foot.

The way to achieve this involves three essential ingredients: the frog, the sole, and the trim.

Frog on the Ground

Bowker's research has shown that the frog must be on the ground. He emphasizes that in order to get the frog resting on the ground, the farrier must gradually lower the heel. When the heel is not on the ground, the foot will start to contract and get smaller, similar to a woman wearing "high heeled" shoes.

According to Bowker, "Once the frog is on the ground, the bars will contribute in supporting weight and much of the load will be supported by the sole."

This load is transmitted to the sole around the frog apex via the dirt that accumulates from the ground. "Dirt should be left in the foot," explains Bowker. In other words, don't clean your horse's feet unless they have been standing in a lot of manure.

Bowker further states that a foot that has a high-cupped or dished-out sole and frog that is not on the ground will not be able to support its weight with the frog and solar surface.

This goes back to the analogy mentioned earlier about high heels and a small surface area for weight bearing. This small surface area results in high loads being placed upon the foot and will result in significant stress changes to the foot tissues.

"In a nutshell, what we want when the farrier is finished trimming the equine foot is that when viewing the solar surface of the foot, one-third of the foot will be in front of the apex of the frog, and two-thirds behind it. This creates a short toe and encourages a 'heel first' landing."

Gradually Lower the Heel

Bowker emphasizes that any changes to a horse's feet should be done gradually. He explains that, "If the frog is on the ground, the foot will do what Mother Nature intends it to do. When the frog is on the ground, the heel will be low (not an under run heel)—this is what the farrier should aim for.

"But if the frog is not on the ground, the heel should be lowered gradually over a period of several weeks. This is important, as it will allow the foot to adjust to the changes.

Again, this is a matter of common sense: **do these adjustments gradually**, as opposed to all at once, as the foot will better adapt to these changes."

Bowker explains that a good way to check to see if the frog is touching the ground is to try to insert a thin plastic ruler under the frog at the rear of the foot while the horse is standing on cement or asphalt.

He states that, “If the frog is on the ground, you shouldn’t be able to slide the ruler under the frog. If you can, it means that the frog is not bearing a lot of weight, which is contrary to what it was designed to do.”

Bowker emphasizes, “The farrier should not trim much, if any, of the frog—especially the cushion —the swollen area that is four to five centimeters (one and one-half to two inches) behind the apex of the frog. Farriers tend to remove this by trimming straight back and removing it. This cushion area, as well as the rest of the frog, should not be trimmed.”

According to Bowker, “The farrier, when looking at the solar surface of the foot, should not trim and remove much of the frog, as the goal is to trim the foot so that the frog is resting on the ground.”

Bowker’s observations of the trimming methods used on today’s horses are that in most cases you can slide not only a ruler but your fingers and even part of your hand under the frog.

Shorten the Toe

One of the most important things the farrier can do is keep the toe short, as most domestic horses have a very long toe which increases break-over and contributes to white line disease and other problems in the front part of the foot.

It would be best for the horse owner to have the farrier and veterinarian work together. The owner should have the veterinarian take a lateral radiograph of the foot in question.

It would be most beneficial to have markers placed--a thumbtack at the apex of the frog and a wire along the dorsal hoof wall from the coronet to the ground. This will enable the veterinarian to translate information from the radiograph to the live horse.

If the farrier can measure three-eights of an inch in front of the coffin bone and draw a line perpendicular to the sole, he/she can begin to form the breakover from this point.

However, most farriers and veterinarians see this point as being inside the white line and are apprehensive about removing any sole or hoof wall behind the white line.

So an alternative is to gradually shorten the toe over a three- to five week period. The farrier can select a point between the thumb tack and the front part of the foot, then cut that distance in half, and begin the breakover or bevel from there.

The effects of this will gradually shorten the toe and reduce under-run heels, as it will move the foot caudally back underneath the boney column of the horse as well as decrease the breakover for the foot.

Both of these effects are very beneficial in reducing white line disease, the effects of under-run heels and foot problems in front of the frog.

The Sole

According to Bowker, “The farrier’s goal should be to trim the foot to increase the surface area of the weight-bearing surface of the solar part of the foot.

“When the farrier is trimming, he/she should try to get to the sole plane (the grayish, waxy part of the sole that will appear

after the dry, scaly superficial part of the sole has been flaked off). This should be done on the edge of the sole by the quarters of the hoof wall."

The result: this reveals the plane of the live sole in relationship to the rest of the foot.

Once this has been established in the foot, then in the future, the farrier should not remove any of the sole or frog as rasping the underside of the foot contributes to thin soles. The farrier's goal should be to leave as much of the sole as possible.

Bowker states, "In the feral horse, the sole thickness is twice as thick as that of the domestic horse, which is why the feral horse can run and walk over most all surfaces without any tenderness."

Don't Touch the Sole!

Bowker explains, "Once the farrier has established the sole plane (the live sole remains constant to the rest of the foot), he/she should not have to remove much sole at all in future trimming.

"The goal in future trimming is to leave as much sole as possible. Therefore, once the farrier is satisfied with the sole plane and coffin bone alignment, he/she shouldn't have to touch the sole or the frog very much, if at all."

Often there is a tendency to remove much sole creating a high arch. While this lessens the chance of the horse landing on small rocks and therefore having tender feet, it encourages significant stress in the coffin bone.

But, in a "bad-footed" horse (a horse with chronic lameness), the farrier will have to get to the sole plane, and then he/she can trim the sole in relationship to that sole plane. That will level the plane of the sole in relationship to the plane of the coffin bone.

Bowker believes that the foot should be trimmed regularly and often to keep the toe short—at five- to six-week intervals rather than the eight to ten weeks that is commonly used by horse owners.

Again Bowker states that this is a matter of common sense—to maintain the foot in as perfect condition as you can by trimming more frequently, rather than trimming at very long intervals (eight to ten weeks).

Don't Touch the Bars, Either

Bowker also emphasizes that the bars of the foot should not be removed. "They are there for a reason! Leave the bars so they are a little bit lower (shorter) than the hoof wall—with 'a little bit' meaning a fraction of a millimeter. But obviously, if the bars have overgrown the horn, they need to be trimmed, but not removed—again this is a matter of common sense."

Trimming for 1/3-2/3

Keep in mind that one of the goals of the "physiological trim" is that one-third of the foot should be in front of the apex of the frog and two-thirds should be behind it.

According to Bowker, "If you have a foot where one-half to two-thirds of the foot are in front of the apex of the frog, you now have a foot in which the sole and foot relationships are out of balance (i.e. the toe is much too long)."

He explains, "You can trim the foot back to approach this one-third to two-thirds ratio. The farrier, in consultation with a veterinarian, may request radiographs to discover where the coffin bone is in relationship to the hoof wall if this one-third/two-thirds ratio is out of alignment. Lateral radiographs, marking the apex of the frog with a thumbtack and a wire on the dorsal hoof wall, will demonstrate the relationship of the coffin bone to these external foot structures.

When it is deterimined where the tip of the coffin bone and the frog apex are, the farrier can generally measure 1-1/4 to 1-1/2 inches in front of the apex of the frog to locate where the new toe will be. In horses with long toes, the farrier will be trimming behind the white line. Gradually shortening the toe over a three- to five-week period is probably best.

Bowker adds, “Once you are confident where these internal structures are in relationship to the hoof and sole, the farrier can prepare the foot to this one-third/two-thirds trim. (Once the farrier becomes aware and experienced with the sole callus and other sole features, radiographs may not always be necessary). Then it is okay to trim the toe area by rounding it off. Again, another common sense note is that if you are unsure where internal structures are located, consult with a veterinarian to obtain radiographs.

Increase Movement

Horses should be permitted to move as much as possible. Confinement to a stall is detrimental to the growth and sustenance of the foot, as the lack of movement contributes to white line disease and thrush. Stall confinement, especially during the daytime decreases the amount of movement as compared to putting the horse in a stall at night. Movement is critical to a good foot.

Shoes

To shoe or not to shoe, that is often the question. Bowker explains, “If the horse must have shoes on, the problem results in the frog being elevated from the ground. Therefore, it isn’t touching the ground and doing its job of bearing weight. Physiological function of the foot is compromised and the foot begins to contract.

“Some farriers have started trimming the foot so the frog is as close to the ground as possible—and even touching the ground—when the horse has shoes on. Therefore, if the horse has to have shoes on, this is the next best option.”

What about barefooted horses with tender feet? Bowker explains, “It is simply a matter of ‘whatever you ride the horse on is what you should bed the horse on.’ The foot will adapt to whatever environmental surface the horse is standing on. The problem arises when we bed them on soft surfaces (straw, shavings, rubber mats, etc.) and then expect them to walk/trot/gallop on rocks.

“There are hundreds of barefoot endurance horses that are housed and trained on hard-packed surfaces (hard dirt, gravel, small rocks, etc.) without tender feet. The environment is the major determinant of a healthy foot rather than genetics. Again, it is a matter of common sense, as the foot will adapt to its environment. However, I do not recommend that horses be kept on cement.”

How to Gradually Turn a Bad Foot Into a Good Foot

Bowker recommends the farrier use these trimming techniques conservatively to gradually turn a bad foot into a good foot and allow the foot time to adjust.

“We do know that such a physiological trim as described here and greater movement—rather than stall rest—are critically important to producing a good foot, regardless of the breed of horse.”

Bowker has received dozens of letters and emails from owners and veterinarians asking about their horses’ prognosis with navicular syndrome. Most of these horses have been through all sorts of pads/bar shoes, acupuncture, and pain management therapy, with little or no improvement.

However, with using this “physiological trim” (removal of the shoes and lowering the heels to get the frog on the ground), the horse owners and veterinarians have communicated back to Bowker that the feet responded and began to become sound within a short time period (six to eight weeks).

For additional information on Bowker’s research, see New Theory May Help Avoid Navicular and A New Theory About Equine Foot Physiology.

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