Digging For The Truth About Navicular Syndrome

12-28-05 Pete Ramey ***Copyright 2005***

One of the most mind boggling areas of hoof pathology for a farrier to attempt to research is navicular syndrome. Every old text contradicts the next, and mountains of new research are being done every day. The good news is that farriers studying the hooves of feral horses and trimming domestic hooves to a closer facsimile to what nature intended, have been routinely restoring soundness to hopeless navicular cases. Veterinary researchers have been studying in this new direction and are steadily unlocking all of the old mysteries about navicular problems.

As one of these farriers who has come to think of restoring comfort and usability to navicular horses as a routine task, I am writing this article in hopes of familiarizing others with the current and very successful ways we are dealing with the problem. Understanding what the real problems are is 99 percent of the battle.

At the forefront of veterinary research on the way naturally shaped hooves are supposed to function, is Dr. Bowker of Michigan State University. He has identified the heel first landing as the most important element of hoof function and more importantly; hoof development. He teaches that as the hoof impacts the ground heel first, the hoof expands and the solar dome descends, thus dramatically increasing the volume of the hoof capsule. This sudden increase in volume creates a vacuum, which sucks blood into the hoof capsule. The movement of blood not only nourishes the living hoof, but acts as a very important hydraulic shock absorber. [Hemodynamics; Bowker. You can link directly to his published works from my "Links" page if my lay interpretations don't suit your fancy] This is quite the opposite from the way most of us were taught. I was once taught to view the frog as something similar to a pump bulb for an outboard motor or a blood pressure cuff, with the frog squeezing out blood on impact. Either way, we've known for years that the hooves themselves aid in circulation, but the huge difference between the new and old theories, is that the expansion and function of the entire hoof capsule is harder to obtain than the simple squeezing of the frog, and since we now know how important this expansion is to shock absorption and longevity; much more important.

Enter Dr. James Rooney of the American College of Veterinarian Pathologists. He specializes in the post mortem study of horses. Although everyone I've ever known who owns more than ten horse books owns his book The Lame Horse, his startling findings on navicular bone changes have gone largely unnoticed by the farrier and veterinary communities. I hope to change that.

We've known for many years that some horses with navicular bone changes are perfectly sound, while many horses without such damage to the navicular bone show severe lameness at the back of the foot. It has long been assumed, though that damage to the navicular bone happened first, either because of a mysterious degenerative disease, a lack of circulation, or as I stated in my book (Making Natural Hoof Care Work For You) the result of the body reacting to unnatural pressure in that region. I can still buy two out of those three as being part of what's happening (the degenerative disease part is dead wrong for sure). It has long been assumed that the pain of navicular syndrome is being caused by the friction on the already damaged navicular bone by the deep flexor tendon. It was assumed that this friction with a rough surface then damaged the deep flexor tendon. I wondered years ago how this could be so. It would increase pain dramatically if this were the case, for a horse to voluntarily land toe first. The only way he could move this way, would be to hang all of his weight by the deep flexor in the very pulley system that is supposed to be hurting him!

[Edited by James R. Rooney]

In thousands of dead horses he examined, Dr. Rooney found that the fibrocartilages surrounding the flexor tendon and the navicular bone were ALWAYS damaged if bone remodeling was present. He found **not one single case** in which the damage to the bone was beginning, and the cartilages at the interface between the navicular bone and the deep flexor tendon were not yet damaged. Not one case in thousands. Read this again if your eyebrows didn't go up.

Specifically, the order in which damage occurs is; first the fibrocartilage surrounding the navicular bone (as will any arthrosis begin on the more convex surface), second the fibrocartilages surrounding the deep flexor tendon, then the deep flexor itself, and finally the navicular bone is damaged by the rough surface of the damaged deep flexor tendon. How? Why? Dr. Rooney wondered too. Simulating **a toe first landing** in test machines with dead horse legs, he was able to simulate this exact process that is the beginning of navicular bone remodeling.

During normal, heel first locomotion, the deep flexor tendon is quickly tightened by the descending fetlock joint. At the same time, the coffin joint is rotating forward toward breakover, and is loosening the deep flexor. In a toe first landing however, the descending fetlock joint is still tightening the tendon just after impact, but after the toe impacts the ground, then heel rocks downward, tightening the tendon at the same time. Understand that in a heel first landing we have one pulley tightening as the other is releasing tension, but with a toe first landing, both pulleys are tightening at the same time. Far greater force is directed to the navicular pulley than was ever intended by nature. This is a very big difference; adding greatly to the force applied to the tendon and navicular bone. This force is of course dramatically increased if the unnatural movement is occurring on a

hard surface. Greater force means greater friction, and the continued repeat of this insult causes damage to the region. These are major findings that Dr. Rooney has known and documented for years. (The earliest publication I have found was 1974!)

We've known for many years that horses can have serious caudal foot pain and no changes to the navicular bone. We've also known for many years that horses can have dramatic changes to the navicular bone, but show no lameness. Dr. Rooney proved and published that it was actually the unnatural toe first movement (usually caused by avoiding heel pain) that causes navicular remodeling; not the other way around as most professionals thought. Understandably, Dr. Rooney is one of the most frustrated people I know of. Thousands of navicular horses have been needlessly destroyed since his groundbreaking research. He was just 40 years ahead of his time.

This lost information goes neatly hand in hand with the newer research from Dr. Bowker. He has studied the back of the equine foot extensively. When a horse is born, all four feet are the same microscopically. Their development is incomplete; physical stimulation is supposed to finish the job.

The foundation of the front half of the foot is the coffin bone. The sole and hoof walls are rigidly attached to it, resulting in a firm structure to push from during locomotion. The lateral cartilages form the foundation of the rear half of the foot. This provides a yielding area to dissipate much of the initial impact energy; like the tires on your car. When a foal is born, the lateral cartilages are tiny, like the rest of the foot. They are less than 1/16th inch thick, and don't even extend across the bottom of the foot underneath the frog, yet. As the foot grows, expansion, flexion and twisting of the hoof capsule develops the lateral cartilages. By adulthood, feral horses have developed the lateral cartilages to almost an inch thick and a solid floor of cartilage has been formed between the frog corium and the digital cushion.

At the same time, the digital cushion is continuing to develop as well. The digital cushion is a very important nerve center in the foot. In fact, most of the proprioceptors in the foot lie within the digital cushion. When the foal is born, the digital cushion is comprised of fat. It offers the right amount of exposure so the nerves can "feel", but the right amount of protection so the lightweight foal doesn't feel pain when the back of the foot slams into the ground.

Every time the foot hits the ground, pressure and release to the frog causes a bit of fibrocartilage to grow from the front of the digital cushion and spread toward the back. By the time the wild horse reaches adult weight, the digital cushion should have transformed into a solid mass of fibrocartilage. This offers the right amount of protection of the nerves for the impact force of an **adult** horse.

In domestication, however, we tend to keep foals on soft terrain. The hoof capsule can't twist and distort, so the development of the digital cushion falls behind. Then we tend to shoe horses at two years old and ensure the hoof cannot twist and flex, effectively putting the brakes on the development completely. The result is very commonly, adult-sized hooves that still have lateral cartilages as thin as 1/8th inch, rather than the natural inch they are supposed to have.

At the same time, the soft terrain we traditionally raise our foals on limits frog pressure. We also tend to provide for the foals every need, so they have little reason to move the twenty miles a day that is natural to the horse. We tend to neglect foal hooves; allowing the heels to grow long and over-protect the frogs, further reducing frog pressure throughout the growing foal's life.

The result is that very consistently, in domestic horses, the digital cushion development falls behind. The back of the foot is too sensitive to be the "landing zone" it was supposed to be so our horses start the pattern of loading the toes first to avoid the pain. This movement stops the development of the back of the foot in its tracks.

[You can easily learn to feel complete digital cushion development with your fingertips. If you pick up a foot and press the area above the bulbs; between the lateral cartilages, you will find a much more firm, dense feel in a well developed digital cushion. The easiest way to develop this feel is to go around comparing the feel of fronts and hinds. Pay particular attention to the different "feels" on horses with beautiful, sound hind feet and poor front feet.]

By the time many domestic horses are first ridden, the back of their feet are practically useless, and cause pain on rocky terrain. This problem shows up worse in the front feet than the hinds. Most of us were taught that the horse has more problems on the front feet than the hinds, because 60% of the horse's weight and almost all the rider's weight is on the front feet. In a standing horse, this is true, but once the horse steps into motion, the back end does a far greater amount of work.

From the time our foals hit the ground, they are gloriously moving off their hindquarters during their spirited play. Very consistently, domestic horses thus develop the hind feet more completely. This is important to know. It is the only reason the hardest working feet on the horse (the hinds) have increased resistance to founder, navicular disease and just generally tend to be tougher and healthier. Not in spite of the fact they do harder work than the fronts, but because of it!

So when we discuss the pathology behind navicular disease, we must understand that the real problem lies in the fact that most domestic horses are incapable of landing on their heels in soft footing and surely not in the rocky terrain they were born to roam. When a horse is sensitive on rocky terrain, most people blame the soles, but watch closely how they move. Almost every time they will shorten their stride, landing on their toes, and lean forward. They are keeping their sensitive frogs and underlying digital cushions out of harms way. Dr. Bowker has established that the longer they try to move this way, the weaker the structures become.

Continued toe first landing stresses and tears the attachment of

the impar ligament (the attachment of P3 and navicular bone). The navicular bone is a part of the articulating surface of the joint between P2 and P3. When the horse lands on its toes, the weight of the horse then slams back into the navicular bone as the heels rock down. This constantly tears away at the impar ligament. 80% of the blood supply to the navicular bone goes through the impar ligament. Bowker blames a loss of circulation through the impar ligament for many of the navicular bone changes, as well as the attempts to repair this attachment leaving ossifications on P3 and the navicular bone.

Dr. Bowker has also found that the bone loss often diagnosed as navicular disease is the result of a **lack** of natural pressure (think of the bone loss suffered by astronauts during extended stays in space) in the region from continued toe first landing, and Dr. Bowker is consistently finding much more damage to the coffin bone in navicular horses, with 40-60% bone loss in P3 being common. Specifically he blames peripheral loading, or loading the walls only without the aid of natural sole support and toe first landings. Either situation robs P3 of the natural pressure it requires to maintain health and function.

Although Dr. Rooney and Dr. Bowker have discovered differing causes of navicular bone changes, both are adamant that it is the result of long term toe first landing or lack of use of the back of the foot. Wild horses of the high desert slam the back of the foot first into all terrain. Most of their domestic brothers jump with pain when a hoof pick is scraped along their frog or through the central cleft and this should be starting to really scare the owner of such a horse.

In the past (and in many places the present as well, unfortunately) when a horse was pointing or landing toe first with a shortened stride, navicular syndrome would be suspected. The nerves at the back of the foot would be blocked to see if this made the horse temporarily sound, or perhaps hoof testers would be used to check for pain along the heels and frogs. If it was confirmed that the back of the foot was in pain, radiographs were taken to check for changes to the navicular bone. If this was positive, the choice given to the owner was to put down the horse, or use orthopedic shoeing to squeeze another year or two out of the doomed horse. I see every day that weak digital cushions and thrushy frogs cause enough sensitivity to force a toe first landing. Dr. Rooney and Dr. Bowker have established that favoring a toe first landing causes the damage to the fibrocartilage of the navicular bone and the deep flexor, and that the bone changes of true navicular disease occur later. In other words it is heel pain that cause navicular disease. I have personally seen that when the real problems causing pain for the horse are addressed, the presence of the navicular bone changes cause no pain for the horse (noticeable by us). It is sobering to think of all of the horses that may have been put down for chronic thrush.

When faced with this situation we are left with two options. First, we can cover up the problem with bar shoes and pads, ensuring that the frog never touches the ground. This would be just fine, if not for the destructive forces at work when we do this. For one, the more we protect the frog and digital cushion, the worse they will fall out of function. Masking the true problems by attacking symptoms will catch up to us every time in the end. Worse yet, by doing this we stop the natural expansion and hydraulic shock absorption. When we raise heels to protect the painful frogs, shock can't be properly absorbed by the suspensory apparatus either, and from a skeletal standpoint (which is what matters to the horse), a toe first landing is being forced anyway (try running in high heeled shoes or cowboy boots and you will see exactly what I mean). **Understand that all this talk of heel first landings is about the natural alignment of the bones during locomotion; NOT the outer heel we see. If a horse's heels are artificially raised and they (heels) happen to hit the ground first, P3 may STILL be toe first on impact and causing the same unnatural forces.** All of this research can be summarized by saying that the long held notion that raising the heels provides "slack" to the deep flexor tendon and thus decreases stress on the navicular bone, is untrue. While it may be true in the standing horse, it works the opposite way for the horse in motion. A low heel, a short breakover, a healthy functioning hoof and a heel first landing minimize stress to the deep flexor tendon and thus the navicular region.

The result of this unnatural movement and loss of natural energy dissipation, is the fact that most people think that it is normal for horses to have joint or back problems, and just be plain old by the time they reach ten years of age. The truth is that horses in nature are healthy and vibrant on average at least three times longer than in domestication. [Jaime Jackson] One of the big causes of this dramatic difference is the wear and tear we put on their bodies with the very unnatural movement we are talking about here.

I don't mind debating "shod versus barefoot" with people. An educated farrier can come up with compelling arguments for shoeing horses and a spirited debate keeps my juices flowing. However, in light of modern research on hoof development, I humbly think that veterinarians should step in and throw a raging fit if someone shoes a horse before the development of the inner structures of the foot is complete!

So what is the other option when faced with a navicular horse? Fix the real problems. This is done by bringing the frogs and the digital cushions back into work. (I hope no one will try to learn to trim from this article alone). The sole of the horse must be left alone while the heels are gradually brought down to increase frog pressure as the horse can stand it. This is like walking a tightrope. If you go too slowly, you will make no progress. If you do it too fast, the horse will be over-sensitive at the back of the foot and walk on his toes anyway, and you will make no progress (read "Heel Height: The Deciding Factor" on www.hoofrehab.com). Skill at walking this tightrope separates the masters from the hackers in hoof trimming. Avoid trimming the frog, other than removing any tissue already destroyed by disease. It should be allowed to pack into dense callous just like the sole. Keep breakover back where it should be, relative to the coffin bone (read "Breakover" on www.hoofrehab.com).

Do everything you can to dry up the situation for the horse. Well scraped paddocks and stalls or paddocks with deep pea gravel should be provided as all or part of the horse's daily routine if you live in a wet region. It is surprisingly cheap and easy to maintain. (Dr. Bowker takes it a step farther and says, "You must bed your horse on the surface you wish to ride.", but he is in a position to be a bit more bold than I, isn't he) Allow plenty of free roaming exercise with other horses and ride often on terrain the horse can currently land heel first in. Use hoof boots (I favor the Easyboot Epics for most situations) for riding when terrain forces a toe first landing or causes tenderness. The rest of the time, let the horse be barefoot. The ground will strengthen the back of the foot, and lifting the frogs higher off the ground and impeding stimulation and circulation with a permanent shoe can only work against us.

Often, horses with reduced health of the frogs and digital cushions will show lameness and/or a voluntary toe first landing on all terrain, and even in hoof boots or metal shoes. I have found that by adding foam padding inside the boot under the frog, the horses immediately move comfortably and correctly. Since the boot alone very effectively relieves pressure on the frogs and the addition of the pad dramatically increases pressure to the region, I can only assume that the original pain is being caused by vibration, rather than pressure. Perhaps vibration dampening is an important purpose of the frog and digital cushions and the pad artificially imitates this effect. The horses described here make very dramatic healing progress when exercised often in this setup.

I use Easycare Epic boots for this, and cut neoprene saddle pads for the padding. (A new pad will be available from Easycare by Jan '06 that lasts much longer than the saddle pads.) If the boot is a perfect fit for the horse, I cut a frog shaped triangular wedge, tape it in place on the foot with a single piece of duct tape, then put the boot on. If the boot is a bit too large for the horse, I cut the pad to fit the entire bottom of the boot and use it as an insole. This creates a right and left boot, though, and they should be marked accordingly.

You can play around with different pad combinations and almost always find a combination that makes these horses comfortable when nothing else will. Miles of exercise in this setup will develop the inner structures faster than any method I know of and get you on the horse when nothing else will work. It's truly like magic for a navicular horse! (Please read the article "Boots and Pads" on www.hoofrehab.com for more detailed descriptions and pictures)

Very quickly, the frogs and digital cushions will toughen up and the horse will get comfortable. If there is navicular bone damage it will remain there long after the horse appears comfortable, but the horse probably won't know it. Some say the damage can be repaired over time by the body, but no one seems to care when the horse feels better, so I've never heard of anyone proving or documenting this. I was very excited to find out that Dr. Bowker is methodically documenting the increase in hoof health over time in many navicular horses. I can't wait for him to publish his results.

Dr. Rooney still maintains that once the bone damage of true navicular disease begins, it is irreversible. I, on the other hand have seen these horses returned to use and apparent happiness with my own eyes with shocking consistency. As we bounced this disagreement back and forth I was starting to think we were going to have to "agree to disagree". Then I realized we were talking about two different things. I use myself as an example. I got in the wrong car one night as a teenager and earned four vertebrae in my lower back that are now fused into one mass by surgeons. My wrists are permanently damaged from hanging by my fingertips during my rock climbing days. Dirt bikes claimed my shoulders. Running in dry river beds got my knees. Would it be possible to make me clinically sound? No. My x-rays will always reveal the errors of my past and a good flexion test would probably cripple me for three days. I'm very happy though, and I perform one of the most physically demanding jobs known to man every day with a big smile on my face. That's good enough for me and probably for most navicular horses as well.

When navicular bone changes are treated as **a symptom of** simple loss of function and sensitivity at the back of the foot, restoring soundness is usually an easy task. I have personally seen many horses with confirmed navicular changes that have endured years of pain while the owners footed the bill for orthopedic shoeing, only to watch them become completely sound within days of a correct trim and a chance to go barefoot. Sometimes it is a longer process of course, but I have yet to experience failure on one single navicular case. (Yes, I know my time will come, but I wrote the same thing in my book five years ago. I'm still waiting.) The very best thing the reader can get out of all this is that everything we have discussed is preventable. We are setting back the lifespan and the athletic potential of our foals at a very early age. Take care of your babies' hooves, provide them with lots of exercise, and allow them some time on dry, rough footing. Be sure the frogs and digital cushions of your horse are tough enough to allow extension and a heel first landing in all situations. It will pay big dividends down the road.

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