



Welfare and Safety of the Racehorse Summit

Sponsored by the Grayson-Jockey Club Research Foundation

Issue 2

September 2007

Horsemen's Update

This Issue's Feature: Shoeing and Hoof Care

Thoroughbred racehorses were bred for and are consistently acknowledged for their speed and track potential, but because of the demands of racing, the magnificent athletes' feet need regular and proper care to help them stay sound and healthy. While this facet of Thoroughbred maintenance is near-obvious to most involved in the racing industry, the impact of foot problems on the welfare of the racehorse is anything but an inconsequential conversation piece. Thus, the importance of proper shoeing and hoof care is the focus of this month's horsemen's update.

In This Issue:

The Equine Hoof and the Problems it Faces	1
Shoeing Horses with Mitch Taylor	5

Photos courtesy of Mitch Taylor

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The Equine Hoof and the Problems it Faces

The condition of a horse's feet is influenced by factors such as genetics, nutrition, environment, farriery and the use of the horse.¹ The hoof has evolved to adapt to its environment, but the natural hoof should be rounded or slightly oval, containing an outer wall of specialized keratin cells to yield a hard protective surface. The hoof contains a sole to protect underlying tissues, as well as a frog and digital cushion for shock absorption. The short pastern (second phalanx), the coffin bone (third phalanx), and the navicular bone are the three bones inside the hoof. The hoof is supplied with fresh oxygenated blood, and the hydrostatic pumping of the foot helps to circulate blood back toward the heart from the limb periphery.²

Variations in conformation exist for racehorses because of genetics, injuries, or shoeing. The deviations could cause a mild abnormality or contribute to catastrophic injury. Fatal musculoskeletal injury is a common cause of death at the racetrack, and research suggests that horseshoe characteristics may cause lameness and injury. For example, the suspensory apparatus of the forelimb is reportedly the most common site of catastrophic injuries, accounting for up to 91 percent of injury-related deaths, and high toe grabs affixed to the front of the racing shoe create a risk factor for fatal

forelimb suspensory apparatus failure.³ Shoeing can affect the flight of the hoof, which in turn influences the symmetry of the body. "If the angle (of the hoof) is allowed to remain incorrect, changes occur in the supporting structures as the body attempts to compensate. This compensation can lead to serious discomfort and lameness."²

Hoof Size, Shape, Balance as Risk Factors for CMSI

The size and form of the hoof are potential risk factors for catastrophic musculoskeletal injury (CMSI). Functional hoof shape and balance have been reported to affect lower limb kinetics and kinematics, and alterations in these components of locomotion have been implicated in the development of injury and lameness in racehorses.⁴

Long toes can cause strain on tendons, the suspensory ligament and the sesamoid bones while short toes combined with high heels can cause concussion to the hoof (putting the horse at risk for navicular disease, ringbone, and arthritis).² Low toe angles have been reported for horses with musculoskeletal and/or lameness problems.

In one California study, all groups of injured horses had acute toe and heel angles suggesting that decreasing the difference between toe and heel angles should decrease the risk of suspensory apparatus failure for Thoroughbred racehorses and should be considered to help prevent injury.⁴ These research findings have very significant implications to the practice of racehorse hoof trimming and shoeing. Says Dr. W. Moyer of Texas A&M, “If there are conformational and/or foot shape difficulties, the ability of a given foot or feet to accept the energy of impact may be exceeded and thus the hoof wall material may fail, or crack”.⁵

Common Types of Hoof Conditions/Injuries

Underrun Heels

“The single most frequently encountered abnormal foot configuration is the combination of the underrun (low) heel and long toe”.⁶

Heel angles at least 5 degrees lower than toe angles are commonly called underrun heels, run-under heels, or sloping heels, and have been linked to lameness in the Thoroughbred racehorse. Hoof tubules in the heel are bent and can no longer effectively withstand compression, so reduced surface area increases concussion in the heels, hyperextending joints (coffin, pastern and fetlock), and increasing loading on the limb.⁷

As previously noted, researchers generally agree that increased differences in toe-hoof angles in racehorses represent a strong biomechanical predisposition to suspensory apparatus failure (SAF) or other injury. The condition is surprisingly common. In one study, over 97 percent of racehorses examined postmortem presented underrun heels, and the case of underrun heels was much more common in those racehorses that experienced catastrophic suspensory apparatus failure.⁷ The high rate of occurrence in racing Thoroughbreds should not convince horse owners that the condition is normal; it is a “serious pathological deviation” that should not go without earnest attention.

Cracked Heels

A crack that extends from the coronary band down the rear quarter of a hoof is known as a quarter crack, and the condition can be painful and incapacitating in the racehorse, even if lameness does not immediately result.

Improper loading of the foot can lead to conditions that cause quarter cracks, such as abnormal hoof configuration, pre-existing damage or trauma to the corium, foot imbalance, or abnormal loading pattern.⁵ Cracks in the

hoof are directed at an angle, so while the crack may appear superficial, it may actually entail extensive separation of the hoof wall. Many farriers will suggest the use of bar shoes to manage quarter cracks because they support the hoof and prevent unnecessary movement in the rear hoof, and the cracked hoof must be trimmed.⁵

Because cracked heels — like most hoof conditions — differ for every horse, a farrier and/or veterinarian should assess the state of the hoof in order to address the source of the quarter cracks and work to prevent them from recurring.

Shelly Feet

A foot with chipped, brittle walls that often flare on the sides or toe is referred to as a shelly hoof. The condition is generally predetermined in part by a long foot relative to the coffin bone, which causes the long wall of the hoof to take on more load than it is meant to bear.¹

Shelly feet are associated with circulatory problems in the hoof and can eventually lead to abscess, pain, and white line disease. The hoof doesn’t grow due to lack of an adequate blood supply. “First, the circulation under the coffin bone is compressed then the sole stops growing ... and the walls get thin and shelly.”¹ “To have healthy, protected circulation under the coffin bone a horse needs about fifteen millimeters of sole.”⁸ One of the first recommendations for the shelly foot is a trim, and the best diagnostic tools for diagnosing shelly feet, along with most hoof conditions, is a radiograph and venograph.

Shoes

Modifications to the equine hoof through shoeing have been noted to both treat and precipitate hoof abnormalities and injuries, including those aforementioned conditions. Characteristics of a shoe can affect the kinetics of a racehorse’s movement, alter limb and hoof angles, and may bring about imbalance in gait, which is correlated with limb fracture and injury.⁹

Modifications of the basic design of horseshoes have been made to promote traction, alter gait, minimize concussion and aid treatment of limb injuries.¹⁰ The shoe as the interactive boundary between the ground surface and the horse’s hoof can influence the force distribution and patterns of movement of the equine limb. Imbalances in these components of equine movement could cause serious injury or lameness in a horse moving at racing speed.¹¹ Research suggests that a correlation exists between particular horseshoe characteristics and risk of lameness or even musculoskeletal injury in Thoroughbred racehorses.

“The single most frequently encountered abnormal foot configuration is the combination of the underrun (low) heel and long toe.”

While many modifications are applied to racehorse shoes in the United States, one particular horseshoe characteristic that has been recently implicated with serious risk of fatal injury and lameness is the use of toe grabs. According to Bill Casner, chairman, Winstar Farm, and chairman, Welfare and Safety of the Racehorse Summit Shoeing and Hoof Care Committee, toe grabs are among the documented contributions to injury in the racehorse. Scientific backing from research shows that toe grabs increase the risk of injury. Some 90.5 percent of horses experiencing catastrophic injury wore toe grabs.¹² Some figures from a presentation by Casner on the detrimental effects of toe grabs:

Toe Grabs

- Increase the chance of suspensory apparatus failure by 15.6%
- Increase the odds of a catastrophic injury in racehorses by 1.5x

Low Toe Grabs / Regular Toe Grabs

- Increase odds of fatal musculoskeletal injury by 1.8x / 3.5x
- Increase suspensory apparatus failure by 6.5x / 15.6x
- Increase cannon bone condylar fracture by 7x / 17.1x

Results of a previous study by Kane et al found that postmortem data collected indicated that horses that died from a fatal musculoskeletal injury were two times as likely to have horseshoes with toe grabs

than without.¹³ Studies have also indicated that the magnitude of associations between toe grabs and injury increase with increasing height of the toe grabs.⁹

How do Toe Grabs Affect Foot Function?

By raising the toe, toe grabs decrease the functional angle of the shod hoof, delay the break-over phase of limb kinetics, and increase the ground reaction force on the fetlock, thus increasing strain in the suspensory apparatus and predisposing horses to injury.⁹ Injured horses in research have often been known to have lower heel angles in comparison to non-injured horses.

According to Casner, toe grabs result in a broken-back hoof pastern axis, increase the degree that the sole flattens, cause the hoof wall to distort more, facilitate underrun heels, and magnify hyperextension of the fetlock joint.¹²

Regulation

The findings in California that suggested the use of toe grabs increased the risk of catastrophic musculoskeletal injury has drawn considerable attention in the racing industry. If the association between injury and toe grabs is in fact causal, then discontinuing their use should have the result of thinning the incidence of catastrophic musculoskeletal injuries.¹⁴ Solutions to the problem involving the use of toe grabs call for continuing quantifiable research in equine lameness, supporting continuing education and certification for farriers, and banning the use of toe grabs in Thoroughbred racehorses.¹²

Shoes With and Without Toe Grabs (Same Foot Loaded Equally)



300 pounds



3,000 pounds

Effective in April, such a rule began to be enforced at United States racetracks. The rule limits the toe grab height on racetracks to 4 mm on the front shoes, and regular toe grabs no longer satisfy the requirement. To ensure the racing rule is imposed, official positions at racetracks now entail a horse shoe inspector to measure the height of toe grabs with a jig pre-race or at the receiving barn.

After May 25 of this year, any horse wearing shoes that did not comply with the regulations on toe grabs was prohibited to race. According to Rick Arthur, DVM, equine medical director, California Horse Racing Board, the regulations on toe grabs have gone smoothly since their enforcement, with very few infractions and essentially no real problems on the racetrack with implementing the 4 mm or less requirement.

Dr. Arthur noted that several years ago, toe grabs were banned from some turf courses for the sake of the track. "It is ironic that it has taken this long for the ban to be for the sake of the horses," he said.

Summary

Musculoskeletal injuries in racehorses are associated with several varied factors, such as age, sex, hoof

conformation, limb conformation, track- and race-related factors, pre-race physical examination findings, previous extended periods of time with no high-speed workouts or races, exercise intensity, and fatigue.¹⁰ Further, regional differences in track design, soil material, slope, maintenance, and shoeing/trimming techniques in farriery can cause deviation from the natural hoof balance and are correlated to the incidence of musculoskeletal injuries due to hoof condition and horseshoe characteristics.

With so many compounding factors that may play a role in racehorse injury, it is necessary to do as much as possible to ensure the vitality of the horse's feet. In terms of shoeing and hoof care, this means reducing exercise intensity for horses with moderate lameness, evaluating the condition of feet with radiographs or venographs if necessary, establishing a solid relationship with a competent farrier, and following a routine of consistent, proper hoof care that includes a trimming/shoeing plan for each individual horse.

There are not many quick remedies that will turn problem feet around. Maintaining the health of the feet is necessary to establish a strong foundation for the racehorse to excel at what it was really bred for.

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³ Hill, Ashley E., Ian A. Gardner, Tim E. Carpenter, and Susan M. Stover. "Effects of Injury to the Suspensory Apparatus, Exercise, and Horseshoe Characteristics on the Risk of Lateral Condylar Fracture and Suspensory Apparatus Failure in Forelimbs of Thoroughbred Racehorses." *American Journal of Veterinary Medicine* 65 (2004): 1508-1517.

⁴ Kane, A., S. Stover, I. Gardner, J. Case, B Johnson, D Read, and A. Ardens. "Hoof Size, Shape and Balance as Possible Risk Factors for Catastrophic Musculoskeletal Injury of Thoroughbred Racehorses." *American Journal of Veterinary Research* 57 (1996): 1147-1152.

⁵ Caudill, Andrea. "Cracked: the Cause and Repair of Quarter Cracks." *The American Quarter Horse Racing Journal* (2007): 40-41.

⁶ Moyer, W, and J Schumacher. "Hoof Balance and Lameness: Commentary." *Equine Med. Review* 6 (1996).

⁷ Balch, O, R.g. Helman, and M.a. Collier. "Underrun Heels and Toe Grab Length as Possible Risk Factors for Catastrophic Musculoskeletal Injuries in Oklahoma Racehorses." *AAEP* 47 (2001).

⁸ Thomasan, J.J. "Variation in Surface Strain on the Equine Hoof Wall At the Midstep with Shoeing, Gait, Substrate, Direction of Travel, and Hoof Shape." *Equine Vet. Journal Supplier* 26 (1998): 86-95.

⁹ Kane, A, and S Stover. "Horseshoe Characteristics as Possible Risk Factors for Fatal MSI of Thoroughbred Racehorses." *AVJR* 57:8 (1996).

¹⁰ Gross, D, S Stover, A Hill, and I Gardner. "Evaluation of Forelimb Horseshoe Characteristics of Thoroughbreds Racing on Dirt Surfaces." *AJVR* 65 (2004).

¹¹ Boden, Lisa Et All. "Postmortem Evaluation of Homotypic Variation in Shoe Characteristics of 201 Thoroughbred Racehorses." *AAEP.Com* (2007).

¹² Detrimental Effects of Toe Grabs. Bill Casner: (2007)

¹³ Gross, D, S Stover, A Hill, and I Gardner. "Observer Variation in Visual Assessment of Forelimb Horseshoe Characteristics on Thoroughbred Racehorses." *AJVR* 65 (2004).

¹⁴ Hernandez, J. Et All. "Evaluation of Horseshoe Characteristics and High-Speed Exercise History as Possible Risk Factors for Catastrophic Musculoskeletal Injury in TB Racehorses." *AJVR* 66 (1996).

Shoeing Horses with Mitch Taylor

Teach people how to shoe horses the long, hard, slow way,” Mitch Taylor explains while describing the methods he finds work best at the Kentucky Horseshoeing School. Tucked back in the hills of Mt. Eden, Ky., the school was established in 1978. Taylor, a Colorado native, has been there since 1989 and has been working with horses since the age of 17. With a degree in biology and chemistry and extensive work experience in equine biomechanics under James Rooney, Ph.D., Taylor believes in teaching a combination of tradition and modern research.

While there is a general desire for a fast fix in most aspects of life, Mitch insists that there is no quick and easy way to go about horse-shoeing, and it seems his students understand that. “They dedicate themselves early on and put a lot of effort into making it really work,” he says.

“There is no real horseshoeing system in our country. No standard, no officially accepted way of doing things in the business.” But Taylor is trying to change things. He believes that thoroughness is key not only when it comes to teaching, but especially when it comes to shoeing. While the norm for shoeing classes is six to eight weeks, the course at Kentucky Horseshoeing School lasts up to six months.

His students dissect legs, study anatomy, functional anatomy, the dynamics of the foot and different types of feet while taking written tests, shoe boards, and turning in their own shoes for grading. What’s more, “They don’t shoe one foot until they have been through two months of school. They have to test out on cadaver legs first so they can really develop the tools they need to be successful.”

While most courses are taught by those that grew up in the system and pass on the anecdotal knowledge they have acquired as practicing farriers, Taylor contends there is underestimated value in a foundation of scientific knowledge from which to build new approaches and adaptations for each individual case. He wants students to develop an appreciation for education and professionalism, and to take advantage of the scientific resources available to them.

“The lack of a credible standard and requisite minimum level of skill presents huge problems,” he states. “Without them, when a horse owner has an issue, three of five horseshoers he asks for help will look at the horse and say different things.” When the horse owner turns to someone for an answer, that someone is often an equine veterinarian (who isn’t necessarily an expert on the equine foot in terms of horseshoeing).

Even among experienced researchers or academics, it is difficult to come down to one opinion on the debated topics of horseshoeing: how old to shoe, how often to shoe, what is an unhealthy foot, and what is the best way to deal with it?



Kentucky Horseshoeing School classroom

Without some kind of standard of reference, the ones suffering from the discrepancy are likely to be the horses.

The need for veterinarians and farriers to work together with horse owners is central to solving lameness problems and extending the health and welfare of race-horses. “Any veterinarian working with lameness would probably agree that most lameness is a result of chronic imbalanced foot care. Foot problems are at the root of a majority of lameness conditions.”

For this reason, Taylor has always tried to involve the American Farriers Association and has been involved in developing a program whereby the AFA can go to veterinary schools and work with the

American Association of Equine Practitioners for a short course on understanding the basis of the profession and establishing a mutual interest in the wellbeing of the horse.

“To manage our profession and to establish it as a strong, credible line of work, these types of things need to be done to implement some mandated standard for farriers in America.” Taylor supports continuing education and re-licensing for horseshoers, and has met with some opposition from the slow-changing profession.

Nonetheless, he continues to practice what he is passionate about and what he is good at. “I seem to have a knack for teaching and I can teach people how to shoe horses,” he says.



A student shapes a shoe

According to Taylor, racehorses should be shod every three to four weeks and most other breeds every five to six weeks, though these sorts of decisions depend on age, environment, and workload. And while he admittedly believes racehorses may be shod too young at times, and that a bare foot is healthier for the horse under natural circumstances, he states that shoeing is best put as a necessary evil. “The hoof is a dynamic, elastic structure that moves and temporarily distorts and takes up imbalanced terrain and uneven abrasive dirt tracks,” Taylor says. Shoes are necessary because of the lifestyle of the horse.

Taylor contends that horses are shod for three reasons. First, “We shoe for protection, when the rate of wear exceeds the rate of growth”. Second, the horse is shod for support. “Imagine going on a run barefoot,” Taylor says. “Even if you could have something tough on the underside of your foot, you’d be remarkably sore-footed afterward. A horse in the wild is fine without shoes, but we work our horses hard so we need to protect and support the hoof capsule. This is done with the hard,

rigid, uniform shoe.” Third, shoeing is done for therapeutic reasons, such as when a horse needs help post-injury or to prevent injury due to imbalance or lameness.

“Because horses live in this restricted environment, their feet must be managed. Trim the feet right, with the right shoe and for the right size and dimension for the discipline of the horse and the size of the horse’s foot, with the correct placement of nails based on the workload of the horse.”

Furthermore, the farrier must have an eye to evaluate bone column and to achieve congruency to ensure a shoe fits an individual horse well. “When we put shoes on horses, we really have to be responsible for doing it correctly. If it is done responsibly and accurately we have maximum advantage and minimal negative impact on the foot.”

To study some of the effects of different racing surfaces and different types of shoes, Taylor used a single horse on polytrack and on dirt while breezing and shot high speed video to look at the interaction between the ground and the hoof. When analyzed with on-track motion software, there was much less slide on the polytrack surface than on dirt. Taylor wants to film about six horses with similar conformations on polytrack and dirt while they are shod differently: barefoot, with a queen’s plate, with regular toe grabs, and with a square-toed shoe. This will show how shoes affect the interaction and how it changes between dirt and polytrack surfaces.

As always, Taylor relies on his basics to build and maintain such a strong work ethic when it comes to horse-shoeing. Understanding that the foot of each horse is significant and highly varied, the value lies in being able to take a piece of material and make a shoe out of it, whether it be for protection, support, therapeutic reasons or all three. According to Taylor, “Trimming feet and understanding just how important proper foot care is for the health and wellbeing of the equine athlete are the most important aspects of our trade. And anybody and everybody would agree with that.”

For more information on the Kentucky Horseshoeing School, check out: <http://www.kyhorseshoeing.com>

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