



Track Footing and Leg Injuries

by **HEATHER SMITH THOMAS**

Racehorses often suffer foot and leg injuries, and some of these injuries are directly or indirectly related to footing. Different types of track surfaces can lead to different types of problems. A firm track may create a different set of injuries than a soft, deep track. A dirt track produces a different type of footing than a grass (turf) track.

Rhonda Rathgeber, PhD, DVM, at Hagyard, Davidson and McGee Equine Associates in Lexington, Kentucky, investigated track surfaces and footing as part of her doctoral work. "Classically, you see more soft tissue injuries (tendons, ligaments and muscles) with the deeper types of footing such as muddy or sandy ground, and more bony problems with harder surfaces, all due to the concussive forces."

Hard ground or a firm surface creates more concussion to the lower leg—the coffin joint and other structures within the hoof capsule, the pastern joint, and the fetlock joint. The added concussion puts more stress on the entire bony column and can lead to injury, especially in young horses with immature bones. Concussive forces and overtraining on hard surfaces can create splints, shin splints, bucked shins and joint problems.

Another problem sometimes associated with firm footing is higher incidence of speed/fatigue-related injuries. Firm footing enables horses to run faster because they stay on top of the ground better—there is no wasted motion or effort due to sinking in. By running faster, they often sustain more injuries, especially if soft tissue structures are not conditioned for the speed.

"My PhD was in locomotion. I did a thesis on surfaces, changing the moisture content of a particular surface and measuring the track recoil and impact

resistance of that surface—actually quantitatively measuring it with a device made by the engineering department and then running horses across it with different force transducers on their shoes. Different piezo electric crystals and cinematography measured characteristics of their stride. In a galloping horse, those dynamics change a bit if footing is dry, with very little moisture content," says Rathgeber.

"My thesis was on different track surfaces, measuring them to determine the impact and the recoil of the track. The impact measurement determined how hard it was, and the recoil is how much bounce it gives back to the horse's stride. We measured it at different moisture contents and then made recommendations to race tracks as to the appropriate moisture content for best footing. This works well, unless it rains or there's drought or some other unusual weather conditions," she says.

"We found that the kinematics of the stride, measured with force plates and cinematography, was very much the same for a very, very dry track as it was for a very, very wet track. Basically, when it's very wet (16 percent moisture content) the horse steps clear down through the mud—the mud is very sloppy. The foot goes on down to a very hard surface underneath. The impact and hardness of the track is therefore the same. The very wet surfaces (16 percent moisture) are very muddy—the horse sinks down and slips around. On a turf surface, you get a little more recoil (not quite so much impact resistance)," explains Rathgeber.

"In other sports, the stride of those horse would be a little bit different than for a racehorse. Horses in other sports are usually going at a slightly slower pace—not a full gallop. If a horse is just doing a good canter, he will have two feet on the ground at the same time rather than just one that is taking all the force," she says. The racehorse has more stress on his legs.

"From a science point of view, this is the only study—to my knowledge—that's been done on track moisture content. Dr. David Nunnemaker did quite a bit of study on bark surfaces, and he felt that those surfaces reduced injuries while training horses. He is a surgeon now at New Bolton Center in Pennsylvania. He did those studies on track surfaces about 10 years ago," she says. "Classically, the thinking has been that wetter surfaces lend themselves to more soft tissue injuries because of having to pull the leg up out of the mud. After the study we did, however, we realized that's not always the case. With the very wet surface you can have just as much high impact force—as measured on an engineering machine—due to the hard surface underneath," she adds.

Mud is also less stable when the horse's feet do reach the bottom (the hard base underneath). There is more slipping and sliding. Horses experience more pull on certain parts of the leg because of the extra slip, and may suffer injuries to collateral ligaments, stifle ligaments and suspensory branches, or muscle pulls. Deep footing can lead to fatigue and thus more risk for an injury caused by a misstep. When the horse is not as fresh, he doesn't handle himself with peak strength and agility, and is more apt to stumble or put a foot wrong. A horse running in deep footing, or mud, has to work harder at each stride to pull the leg up out of the footing. There is more effort involved with each step.

When the horse starts to tire, muscles become less elastic and more of the stress comes on tendons and other support structures of the leg. The greatest number of breakdowns in racehorses occur when horses becomes fatigued, such as near the end of a race, and soft footing can lead to greater fatigue of leg muscles. It takes a lot more work to pull the feet out of the deep, heavy going.

In deep footing there are usually more

soft tissue injuries such as torn tendons, pulled tendon sheaths, damaged suspensories, damaged collateral ligaments and stifle ligaments, as well as more serious breakdown injuries, due to the lack of support to the legs when the muscles get tired. In a tired horse, the support system is compromised and the fetlock joints may descend clear to the ground, for instance, putting the horse at risk for a fracture.

“When you compare racing injuries in American horses with injuries in European horses, there is a different group of injuries they get. The ground is definitely a lot softer and a lot deeper on many European courses—they have more soft tissue injuries rather than bone problems. Here, in young

horses, we get a lot of shin splints and bucked shins and a few more bony problems from concussion.” Firmer tracks lead to more concussion problems and also lend themselves to more speed, since the horses can run more on top of the ground without sinking in so much. The speed itself can create its own set of injuries.

One key to preventing injuries is to train horses properly on the type of surface they’ll be running on,” says Rathgeber. “If the bones and soft tissue structures are not ready for the racing surface and stress, the race will obviously be harder on that horse than the training was,” she adds.

“Dr. Nunnemaker has done a lot of work on bone stress and bone remodel-

ling and he determined that the bones need that speed—the speed at which the horses will be performing—and the endurance as well. The horses must train and build their physiological systems and their anatomical structure to be prepared for it,” she says.

“The Swiss have done a lot of work on different types of track surfaces, and on banking the surfaces on curves. A Swiss vet, Dr. Fredrickson, did a lot of work on track surfaces—different types of surfaces and how they affect a horse’s stride. These people have some quantitative numbers, as far as how different surfaces affect locomotion, bone strain, etc.” she concludes. The footing is a major factor in preventing or contributing to injuries in racehorses.



Grass Tracks Versus Dirt Tracks



Natural turf is a great cushion, and most horses like to run on it. It has a certain amount of firmness, unlike a dirt track that’s more unpredictable when too wet or dry, yet has enough cushion to prevent most types of concussion injuries.

William H. McCormick, VMD, at Middleburg Equine Clinic (Middleburg, Virginia) says “there are some Thoroughbred lines that are said to be turf runners. To me, that usually means they have a genetic propensity to hind end soreness. Good to fast turf is easier on the hind end than dirt—the horses don’t have to work as hard behind. They can go along on top of the ground, without as much sinking in. As long as they can run on top of the ground, they do better,” he says. “In the U.S. the turf racing at the flat tracks will always be on good to firm courses, whereas in Europe the conditions are dependent on rainfall. At the major Thoroughbred races in the U.S., if it rains, the races are taken off the turf to preserve the course surface. In an ideal world, horses would run on good, well-watered turf because it’s the best footing. The dirt track surface was invented to provide a cushion when the turf became too hard to train on. Dirt tracks have a different set of prob-

lems, such as insufficient moisture and very low compactibility,” he says.

“A comparison can be made to the sand at the beach. Where the sand is wet, it has a certain compactibility and supports a runner. But farther up the beach where the sand is dry or cuppy, it breaks away and the foot sinks in. Ideally, the moisture content of a sand track should be between six and eight percent, but this is a difficult level to maintain. Anything deeper than three inches, for a horse, is too much and it becomes harder for them to handle. If the foot breaks through the surface, the result is a stressful snapping effect on the tendons,” says McCormick.

“The reverse, which is also detrimental, is when we have too much water, and a sloppy track. All the cushion is gone. There is so much water in the dirt that the foot goes right through it, directly to the base of the track which may be slippery. The resultant loss of traction can lead to injuries,” he says.

“A turf course can generally absorb quite a bit of moisture, whereas on a dirt track, when there is too much moisture, the safety margin is reduced. They make tracks now as best they can, so that all the water drains off, but it is still not ideal footing under sloppy conditions. A turf course inside a dirt track is a small-

er, tighter circle, putting greater torque on horses’ legs. If a turf course is not perfectly maintained, it can become rough, with divots and holes. Some places, such as Hong Kong, have great turf courses and they can run a lot of races on a single day, week after week. I think they have some kind of polyethylene nets that are near the turf surface. The grass grows up through the net and the horses do not cut up the course so badly. There are various types of prescription turf that are available, depending on the geographic location,” he says.

Shoes can be a factor on certain types of footing. Basically you want shoes that don’t allow the horses to slip, yet the least amount of traction device that will do the job. Too much traction can create its own set of injuries. For instance, studs and calks will concentrate the concussion into a smaller area. “Also, there are rules about how severe a traction device you can have and on what courses you can use them. You are generally not allowed to use toe grabs on turf courses. It’s a challenge to have the horse shod for the best traction under a variety of conditions. Hard turf tends to be more slippery, and therefore some kind of calks may be needed,” concludes McCormick.