Horse Care

Concussion: Can the Horse Handle It?

by HEATHER SMITH THOMAS

Concussion—the impact and jar of a horse's feet and legs upon the ground as they travel—is a major cause of lameness, directly or indirectly. The trauma of hitting hard surfaces at high speeds may create acute injury under certain circumstances, while constant wear and tear on bones and joints over time may ultimately lead to breakdown within the foot or leg. Horses that have good conformation, with strong feet and legs, strong joints and proper angles, can withstand and distribute concussion without becoming lame with hard use.

Racehorses can run in bursts of speed up to about 45 miles per hour. This feat is quite remarkable for such a heavy-bodied animal with relatively small hoofs. The impact of a horse's weight times his speed creates a tremendous amount of concussion on those few square inches of hoof. How well a horse holds up under this trauma to feet and legs is the main factor determining the length of his athletic career. If foot and leg structure and body angles are good, the chances are that he will stay sound. If he has major conformation faults or flaws in the all-important concussion-distribution apparatus, there's a good chance he will break down.

The horse's legs have three main functions: support for the body, propulsion and shock absorption. With head and neck at the front, a horse's front legs carry about two-thirds of his weight, and are subject to more concussion than hind legs. Thus many types of lameness are more common in the front legs, and conformation faults are more serious in front legs than in the hind.

Concussion is offset and countered by many factors, including the way a limb is built and how it moves, distributing impact through several different structures so no one part suffers more than any other. Poor conformation always puts added stress and strain on certain parts, which may eventually lead to breakdown, lameness and unsoundness. The more nearly ideal the leg and joint conformation, the more uniformly the stresses of concussion will be distributed and absorbed.

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The movement within the compound joints of knee and hock, the pumping action of the foot, and the springy action of the fetlock joint are the major shock-absorbing factors in the horse's leg. These structures must be correct in conformation and movement. A horse must have proper length of bone and proper angulation between the bones for ideal motion—trueness of action—and ability to withstand stress and concussion.

The horse in motion is subjected to concussion, transmitted to his body through feet and legs, but nature has equipped him well for minimizing its effects. In the foreleg, several factors work together to overcome the effects of concussion. The foot expands, the plantar cushion acts as a buffer, and the pastern "gives," transferring strain from the leg bones to the more elastic tendons. If the pastern is too upright, a far greater amount of concussion is transmitted directly to the bones. The shoulder blade glides over the ribs and transfers any remaining shock (not taken up by the pastern) to the body muscles.

Concussion affects the front legs most, not only because of the extra weight carried but also because of the way knee and elbow joints are made; the front leg forms a solid column when ever weightis placed on the foot. The knee absorbs some concussion in its two rows of overlapping flattened bones (seven bones in the knee, just as in the human wrist). The knee bones are arranged in two rows between forearm and cannon bone. Each little bone is separated from those around it by a layer of cartilage, as well as by synovial membranes that lubricate the gliding surfaces. Thus these bones can move somewhat upon each other and absorb some of the force traveling up the leg.

But the knee cannot flex like the hock does. When taking weight, the knee must remain extended and rigid. In the front leg, the pastern joint alone is able to truly yield, and must absorb most of the impact transmitted upward from the foot. Thus the horse with a sloping pastern has more "give" and more concussion-absorbing ability than the horse with a very short, steep pastern.

You don't want the pastern too long and sloping (or it will be weak and apt to break down, with fetlock joint going clear to the ground when the horse is tiring after strenuous exertion), but it must have some slope to absorb the impact. The fetlock joint has a great degree of movement. This joint is subjected to the greatest stress, for at times the horse's entire weight is on one fetlock joint—which is in turn supported by the flexor tendons and suspensory ligament.

The pastern joint (between the long pastern and short pastern bones) has little movement. The coffin joint inside the foot has more movement and elasticity because of the way the navicular bone is placed, and its pulley action with the flexor tendon. Direct concussion to the coffin joint is avoided by transferring some of the weight from the short pastern bone to the navicular bone, and from it to the coffin bone. The navicular bone is well supported by the deep flexor tendon behind it and below it.

The knee supports weight only when fully extended (front leg straight), and the elbow joint locked. Thus the front leg, when taking weight, is a solid column except for the pastern. Force travels up the leg to the shoulder joint, and hence to the shoulder blade. There's a small degree of flexion in the shoulder joint—you can see the point of the shoulder drop very slightly when the front foot hits the ground—but it is the shoulder blade that gives the main buffering effect where the leg meets the horse's body.

The body is slung between the front legs by muscle attachments holding the shoulder blade to the backbone and ribs. The shoulder blade is loosely attached to the ribs by fibrous tissue. The muscular attachments are somewhat flexible and stretchy, absorbing some of the concussion which would otherwise be thrown upon the skeletal system. The flat surface of the shoulder blade can glide upward and back over the ribs whenever weight is taken on the leg. This gliding action absorbs a lot of concussion, protecting the body from jarring. The more upright the shoulder blade, however, the shorter it is, with less gliding action and less shoulder joint flexion. A horse with upright shoulders and pasterns transmits a great deal more jar to the body and front legs.

In the hind leg, the flexible hock joint, accompanied by stifle action and flexion, absorbs most of the concussion. There is not the degree of movement in the hock bones as there is in the knee bones, but this isn't crucial since the partial flexion of the hock at all times helps in diminishing concussion.

In front, the horse's body is suspended between the forelegs; there is no bony attachment. But in the hindquarter, the pelvis is attached to the backbone at the sacrum which is capable of very limited movement. Thus, any concussion not absorbed by the hind leg itself is transferred to the skeletal structure, and has to be taken up by the disks between the vertebrae. If these have already suffered jarring and over-compression or have become fused due to concussion and inflammation (and subsequent calcification), any buffering effect they once had will be gone. Too much concussion in the hind limbs can lead to a painful backbone.

Concavity of the sole in the hind foot helps diminish effects of concussion; there is more give to the sole. The horse's foot is remarkably made for counteracting effects of concussion, but this works best when the foot is of proper size and shape, with strong, deep heels. The hoof wall is not solid and unyielding, but expands when weight is placed on it. The heel and quarters spread a bit, and the plantar or digital cushion (fibrous tissue above the frog) compresses, expanding outward—pushing the elastic cartilage outward and back—as the foot takes weight. Thus the concave sole flattens and descends as weight is put on the foot, with all structures working together to distribute and absorb concussion.

Frog and sole movement in a normal, healthy foot are very instrumental in reducing concussion, as is the spreading of heel and quarters. An improperly shod foot, with nails too far back at the quarters, limits and hinders this expansion.

The long pastern bone and the navicular bone are perhaps the weakest links in the leg structure. But the unique arrangement of tendons and pulley-like surfaces created by the sesamoid and navicular bones make it so there is little direct strain upon the pastern if the horse has a good sloping pastern that is not too upright. Short, steep pasterns (and feet too small for the weight of the horse) put more strain on these bones. Extra weight and pressure is also put on the navicular bone if the horse has low heels and a long toe.

No two horses are built alike. It's not easy to determine which one will hold up under hard use and which will break down, just by looking at conformation. There is another factor involved, that for want of a better term we could just call "structural integrity"—the strength and soundness of the stay apparatus and all other factors that hold joints and bones together.

Structural integrity is as crucial as good conformation, for without it a horse won't hold up. Some horses with serious faults still manage to go the distance—holding up well with hard use. These horses have structural integrity, the "good leather" that holds them together and enables them to stay sound and perform well even with the handicap of not-so-perfect leg structure.

So when judging a horse, we can evaluate conformation, but only guess at durability. Most horses with poor conformation do eventually break down from stress and concussion, especially when used hard. But there are exceptions—those few who can fool you because they have strength of structure to hold together in spite of great odds against them. As a general rule, however, it's a safer bet to go with the well-constructed horse than one with crooked legs, too-small feet, or bad joint angles. Well built feet and legs are more apt to stay sound, for they can handle the concussion.