

On the FOREHAND

BY LES SELLNOW

The foreleg of the horse is, for the most part, a model of good engineering. It is structured in such a fashion that the horse can move slowly or at speed with the concussion of each footfall minimized by a sophisticated shock absorbing system.

Most of a horse's weight is carried on its forelimbs. Good conformation will help ensure long-term soundness

The system works very well when the horse is doing what nature intended—wandering about over large expanses, grazing, drinking, breeding, and resting. But today's horse often soars over multiple six-foot jumps, runs at speed for a mile or more around an oval course, slides to a stop suddenly and spins, or performs intricate dressage movements.

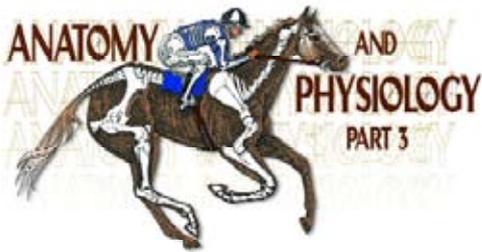
These disciplines often put undue stress on the legs that can render even a well-conformed horse unsound. A horse with improper conformation is at much greater risk for unsoundness when competing in arduous

Editor's Note

This is the third in a 12-part series of articles on equine anatomy and physiology. Future topics include the the hind limb, the hoof, the head and neck, the back, muscles, tendons and ligaments, the digestive system, the circulatory and respiratory systems, and the reproductive system.



DR. ROBIN PETERSON ILLUSTRATIONS



disciplines. This doesn't mean a horse with poor conformation will always become unsound or lame. What it does mean is that poor conformation is a warning sign that something might go awry.

It also should be noted that a horse puts more stress on its front legs than its rear limbs because it carries 60-65% of its weight up front. It seems incredible that when a horse is running at speed, there is a split second in every stride where all of the animal's weight, plus the additional impact involved when running all out, lands on one front leg.

We will take an in-depth look at just how the forelimb is constructed, what constitutes good conformation, and what can go awry when poor conformation is involved.

The information presented comes from many sources. A key source for researchers, veterinarians, and horse owners in the

study of equine limbs is the late O.R. Adams' book *Lameness In Horses*.

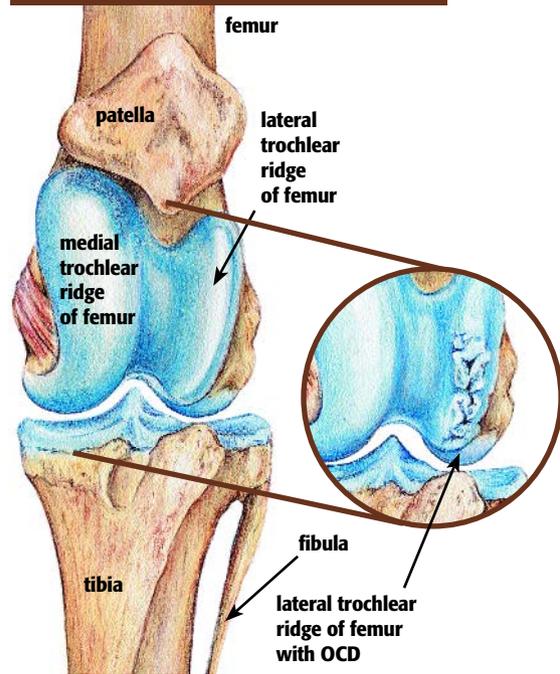
No Connections? Shocking!

An interesting aspect of front limb construction in the horse is that the front legs are not connected to the rest of the skeleton. If one were so inclined, one could amputate the entire front leg—from scapula (shoulder blade) on down—without the scalpel ever touching bone. Instead of bone and joints, the horse's front legs are connected to its body by a network of muscles, ligaments, and tendons. Basically, the horse's front legs help form a sling that supports the front part of the animal's body.

A prime purpose of the front leg is to serve as a shock absorber. If the impact of each stride were transmitted upward in a straight line, joints, muscles, tendons, and perhaps even bones would not remain healthy.

The key to proper shock absorption here is angle. The proper angle of the fetlock, for example, makes it possible for a large portion of the shock forces to be dissipated before traveling up to the knee, forearm, and shoulder. The rest of

LEFT STIFLE JOINT: NORMAL AND WITH OCD



Osteochondritis might lead to OCD or subchondral cystic lesions. OCD normally shows up in one joint rather than multiple joints. However, bilateral involvement (of both front or hind limbs) is sufficiently common that the opposite joints should always be radiographed.

the force is absorbed along the way, but much of it is absorbed at the fetlock level.

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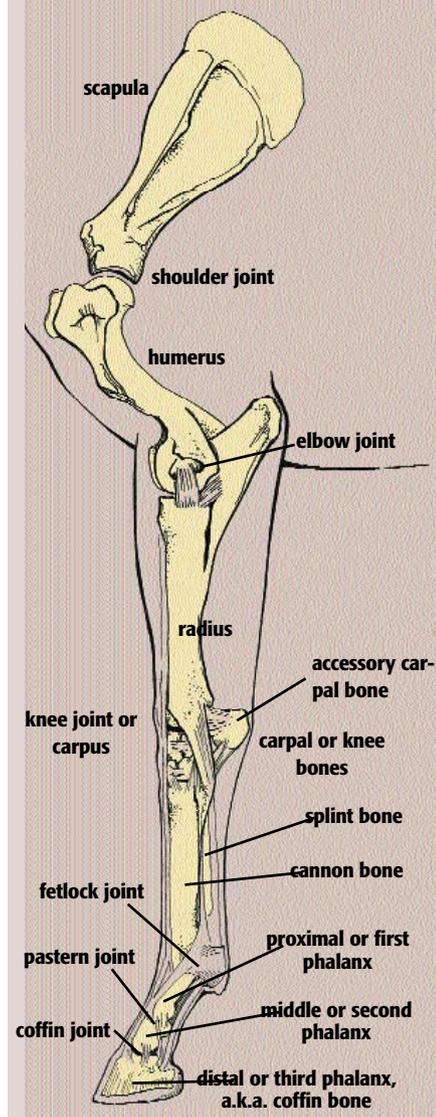
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will have a straight or upright pastern. The straighter the pastern, the less shock absorbed during each stride.

Dem Bones

Let's look at each of the forelimb bones, traveling from top to bottom. We start with the shoulder bone or scapula. This is a broad bone that connects to the next in line—the humerus, which is analogous to the human upper arm bone. This bone angles down and rearward until it joins up with the radius (forearm) at the elbow.

The radius extends downward to the knee or carpus, which compares to the human wrist. One can almost liken the many little bones of the knee to building blocks arranged in two rows. The radius connects at the upper portion of this structure and the metacarpus (cannon bone) connects to the lower or distal aspect. The cannon bone extends downward to the pastern.

The fetlock joint connects the cannon with the first of three pastern bones. The first pastern bone is known as the first phalanx or P1. It fits into the second

The Right Angles

Forelimb angles begin at the shoulder (see illustration on the next page). If the animal has good conformation, the shoulder will be angled back at an appropriate degree. Just exactly what that "appropriate" degree is will vary from horse to horse, but the angle is key to the horse's stride.

If the shoulder is aligned appropriately, the horse will step out with a long, even stride that is comfortable for the rider and produces the least amount of concussion. But if the shoulder angle is steep, the horse's stride will be short and choppy. This will make for an uncomfortable ride, but worst of all, it means the front feet will hit the ground more often over a prescribed course and each time they do, the force of concussion will be greater than for a horse with a properly angled shoulder. This is because the shoulder angle dictates other angles involved in dissipation of concussion. For example, a straight shoulder normally means a horse

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pastern bone via the pastern joint, with the second bone known as the second phalanx or P2. The second phalanx fits into the third

phalanx (P3 or coffin bone) at the coffin joint. The coffin bone is housed completely within the hoof capsule.

While the above could be described as the key bones in the front limb, others serve equally important functions. For example, just behind the cannon bone, where it joins the long pastern bone, are two proximal sesamoid bones. They serve as pulleys for the flexor tendons as the tendons bend around the fetlock joint; these tendons help

flex the legs and generate propulsion.

Another bone completely encapsulated by the hoof is the distal sesamoid bone, more commonly called the navicular bone. It is located at the junction of the short pastern bone and the coffin bone and provides another pulley-type surface for the deep digital flexor tendon as it angles towards its end on the bottom of the coffin bone.

Two other bones in the front leg must be mentioned—the splint bones that extend

FORELIMB CONFORMATION PROBLEMS

Much as we would like to believe otherwise, it is very rare to find a perfectly conformed horse. Most have at least one deviation from what is considered “ideal” conformation, and many have two or more. Horses can still be successful riding or working horses with most of these abnormalities if they are not very severe. This depends on the particular problem and the horse’s intended use.

When viewed from either the front or the side, a line bisecting the horse’s limb should be straight. Here, the green lines show the angles of the horses’ bones with normal conformation and various problems.

NORMAL FRONT END



BASE NARROW



BASE WIDE



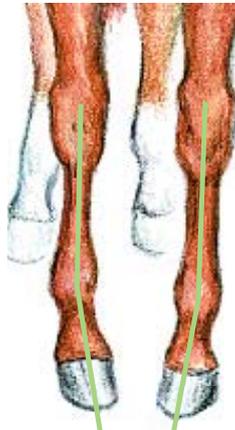
KNOCK KNEES



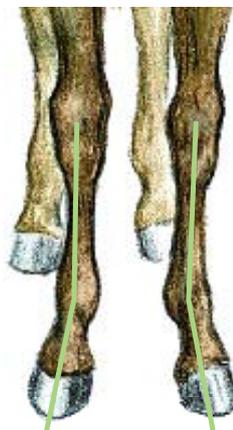
BOW LEGS



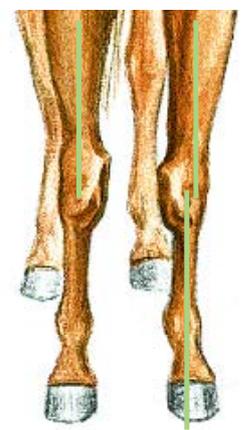
TOED IN



TOED OUT



BENCH KNEE



NORMAL FRONT END



BUCKED KNEE



CALF KNEE



LONG, WEAK PASTERN



SHORT, UPRIGHT PASTERN



downward from the knee. Known as the second and fourth metacarpal (front legs) or metatarsal (hind legs) bones, these help support the cannon bones. Most authorities speculate they are evolutionary remnants from the prehistoric three-toed horse. Splint bones can be fractured or broken, causing pain and unsightly blemishes.

Good, Bad, and Ugly

We have mentioned “good” conformation and “bad” conformation several times in this article. Let’s define just what is meant by those terms. To do that, we must examine a front leg from at least two vantage points—from the front and from the side.

First, we stand in front of the horse and look at the front leg. In our mind’s eye, we will superimpose a vertical line that travels in a straight path from the point of the shoulder down through the middle of the forearm, through the middle of the knee, and down the center of the cannon bone, fetlock, and hoof.

The purpose of superimposing this line is to determine how much deviation there is to one side or the other. If, when we study our superimposed line, we find that

it truly does run through the center of the limb, we likely have a horse with the basics of good forelimb conformation.

But what if it doesn’t? What are we dealing with? Let’s look at some of these conditions and what they might mean, noting as we do so that few, if any, horses have perfect forelimb conformation:

Toeing Out—If this is the case, the horse’s front feet will literally be pointed outward and our superimposed line will run down through the inside or medial aspect of the foot. These horses will put extra stress on the inside of the knees and fetlocks with every stride. Of course, stress increases when the horse travels at speed or lands after a jump. In addition, as the horse travels, it will tend to wing inward with each foot during each stride, particularly at the trot. When this is the case, the horse is in danger of striking the sesamoid and splint bones of the opposing limb.

Toeing In—As the name implies, this is the direct opposite of toeing out, and it often has less severe consequences. A toed-in horse often will paddle, which means the feet rotate outward or laterally as it travels, especially at the trot. This is a waste of energy and means the horse does not

travel forward efficiently. Its danger of self-injury is limited, but this defect does cause additional strain on the ligaments of the fetlock and pastern joints; problems such as ringbone and sidebone can result. In this case, when examining the leg from in front, the bulk of the foot will be inside or at the medial aspect of our superimposed line.

Bench knee—In these horses, the forearm enters the knee on the medial side and the cannon bone exits the knee on the lateral side, so they don’t line up. They are believed to be prone to knee injuries or problems, especially if exposed to stressful competition. However, some studies have found that mildly affected racing Thoroughbreds can do quite well, depending on what other conformational problems are present.

Base-wide—These horses stand with their hooves farther apart than the legs are at the chest. They often have narrow chests, toe out, wing in, and excessively wear the inner side of the foot.

Base-narrow—These animals stand with their hooves closer together than the legs are at the chest. They usually have wide chests, toe in, paddle out, and wear the outside of the foot lower than the inside.

Carpal valgus—Also called knock knees,



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this angular limb deformity occurs when one or both carpi (knees) deviate medially (inward) when viewed from the front. If left uncorrected, this results in a great deal of stress placed on the ligaments and small bones of the knee, especially on its medial or inner side. Toeing out often accompanies this problem.

Carpus varus—Also called bow legs, this occurs when one or both knees deviates laterally, or outward, when viewed from the front. Abnormally high stresses on the lateral or outer side result from this problem, as does toeing in.

The last two problems occur commonly in foals, but are usually easily corrected either with rest and trimming/shoeing or surgery while the limbs are still growing.

These are seven basic conformational faults that can be observed when viewing the leg from the front. Sometimes they are combined with other conformational faults of the front limb, and that increases the potential for lameness problems.

Now, let's step to the side and look at that same front limb. Again, we will superimpose, in our mind's eye, a vertical line that runs down the center of the limb perpendicular to the ground, reaching the ground

just behind the heel. Here are some poor conformations that might be observed:

Calf knee—Horse owners familiar with cattle can easily envision this condition. It also is referred to as "behind at the knee." The knee appears to bend backward from our superimposed line when viewed from the side. These knees place a great deal of stress on ligaments and tendons as well as on the knee joint. A calf-kneed horse would be poorly suited for jumping or racing.

Buck knee—Also called "over at the knee," this is the opposite of calf knee. When viewed from the side, the knee protrudes over our line as if it is always bent to some degree. It isn't as severe as calf knee, but is a definite fault that will put excess stress on joints, ligaments, and tendons.

Standing under—In this conformation, the entire forelimb from elbow on down is consistently placed back too far under the body, behind our superimposed line. Overloading of the front limbs and more frequent stumbling result.

Camped in front—This is the opposite of standing under, with the forelimb from the body to the ground being consistently placed too far forward—in front of the superimposed line. It often occurs with

bilateral navicular disease and laminitis.

Short, upright pasterns—In this condition, there is little or no angle to the pastern, which means little dissipation of concussion as the horse travels.

Long, sloping pasterns—This can be a severe problem if the pasterns are so long, sloping, and weak that the fetlock strikes the ground as the horse travels. Neither pastern fault is unique to the forelimbs; they can occur in the hind limbs as well.

Take-Home Message

The key to good front limb conformation is balance, with all parts flowing smoothly together so that there is both appropriate propulsion and adequate shock absorption. Since no horse has perfect conformation, it is necessary to rely on experts to determine which conformation is best suited to a particular discipline or use. 🐾

ABOUT THE AUTHOR

Les Sellnow is a free-lance writer based near Riverton, Wyo. He specializes in articles on equine research, and he operates a ranch where he raises horses and livestock. He has authored several fiction and non-fiction books, including Understanding Equine Lameness, Understanding The Young Horse, and The Journey of the Western Horse, published by Eclipse Press and available at www.ExclusivelyEquine.com or by calling 800/582-5604.



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