By Heather Smith Thomas

CONFORMATION AFFECTS MOTION

Conformation refers to body structures and how they are put together; body proportions and angles, leg angles, straightness or imbalance in limbs/feet. All of these factors play a role in how the horse moves, how his feet push off and strike the ground, how hooves wear and grow, and whether there will be limb interference while traveling. We try to select horses with the least conformational faults that might hinder racing performance. No horse is perfect, however, so we try to choose a good one and help him with proper foot care.

Observing a horse standing and in motion, assessing his action and conformation, is important in determining how his feet should be trimmed and shod, enabling him to travel most efficiently and stay sound, with the least stress on limb structures. Good trimming and shoeing can help most horses perform to their optimum potential.

Ideally, leg action should be free-flowing, with feet and legs moving forward in relatively straight lines. No horse travels perfectly straight, but exaggerated deviations will cause problems. A horse with crooked legs and crooked foot flight puts strain on bones, joints, tendons and ligaments and is less likely to stay sound. When working at speed, he's also likely to strike himself (especially when shod, since weight added to the feet accentuates any deviation in foot flight) and may injure his legs. A horse with well-formed feet and legs tends to handle the stresses of athletic activity with less risk for injury and is less apt to develop arthritic joints.

An experienced horseman can tell a lot about how the horse handles his feet just by "reading" feet and shoes (observing wear points), but some clues about how the horse moves become more obvious when you observe leg and body angles and also watch his limbs in motion.

Steve Norman, a Kentucky farrier who shoes a lot of racehorses, says there are basically three main types of leg structure: toed out, toed in, and "normal" (with feet moving in relatively straight lines). "If a horse doesn't have straight legs and feet, the foot flight will be altered," says Norman.

"The two basic toe-out structures are deviational (lower legs splaying outward from the knees—which may be knock-kneed—or from the fetlock joints) and rotational (the whole leg is rotated). If the leg is rotated, the horse's elbows are turned inward and the whole leg is turned outward," explains Norman.

If toes are turned outward due to deviational conformation, foot flight will arc inward. There will also be distortions in the hoof capsule due to uneven weight bearing. "Deviational conformation puts a lot of pressure on the inside quarters, which can create sheared heels. Rotational conformation won't put quite as much additional concussion on the inside of the foot, and if that foot is trimmed and balanced, both heels could possibly land at the same time; there won't be as much stress on just one heel," he says.

The horse with toed-out conformation will have a rolled-in heel and straight wall on the inside, and a flared or more angled wall on the outside. The hoof capsule is pushed outward. "This creates foot distortion that necessitates support on the inside corner when shod. The farrier may also need to eliminate a flare on the outside. Supporting the inside is especially important on a deviational conformation, because that heel will tend to roll under," explains Norman.

With a toed-in horse, effects are usually the opposite. The horse breaks over to the outside of the foot and wears the outside more. "We need to support the lateral side (outside) of the foot each time it's shod, to reduce pressure and concussion. A horse with this conformational defect generally lands off balance. There may be some differences in how you deal with this, depending on whether the horse has a short pastern or long pastern; you might have to give more hoof support to a Thoroughbred due to pastern length and foot angle," he says.

Conformation and movement, and how these are addressed when trimming or shoeing, must also be looked at in terms of the horse's

age. A foal has important considerations that will be different from the mature animal whose bones are no longer growing. Some corrections can be made in a foal, even up through yearling age. Changes are easier to accomplish when bones are growing fast, and cannot be accomplished after bones have stopped growing.

HOOF BALANCE

Conformation can be evaluated as static balance and dynamic balance (during movement). Static balance involves the way a horse is put together, the way he stands, and the way he loads his limbs, bones, joints and hoof capsule while standing.

There are two forces that affect that static balance. The ground force (opposing force of the ground against the foot/leg) balances/cancels out forces coming down the leg (the horse's weight). The other force is called the phenomenon of creep. We see this in wood structures that support weight (compression) or resist pulling forces (tension) over time. When something is under chronic compression, tension or torque, it will eventually yield and move.

The hoof capsule is affected by these forces. Toe grabs or calks affect the horse's static balance by causing the foot to load different than it was trimmed. The toe is elevated as the horse stands still (such as in a stall), overloading the heels (excessive compression) and slinging the sole off the ground. This puts excessive tension on the laminae at the toe, and compression on the sole.

This static imbalance can have two unhealthy results. It compromises blood supply to the heel area and slows heel growth. Second, it lifts the toe and sole off the ground, putting more tension on the front of the hoof wall. This can lead to dished toes, stretched white lines and flat soles, over time.

The hoof capsule is constantly growing. It is also elastic, and changes shape according to the weight it bears. With good conformation, limbs are proportional (without undo stress on any one part). As you look down the leg from a front or rear view, you want the joints to be directly under one another. If horse's legs are proportionately straight, the hoof capsules are also loaded proportionately for good balance.

STATIC BALANCE

Equine feet are rarely symmetrical. It's common to have a straighter wall on the medial side (inside) and a slightly more angled wall on the lateral side (outside of the foot). Not only are there differences between inside and outside wall, but front feet are not shaped the same as hind feet. Horses bear weight differently on fronts versus hinds.

When viewed from the side, you can see that most of the weight on the front feet is on the back half of the foot, especially when under load. On hind feet, most of the weight is on the front part of the foot, due to the leg's relationship to (and weight distribution of) the body. Consequently, as a general rule, we don't see as many underslung heels on hind feet as front feet.

Looking at just front feet, or just hind feet, they should match and be a mirror image of one another, but they're not perfectly symmetrical. Regarding front legs, if we look at a normal horse from the front, his body mass is slung/suspended on the inside of the front legs. As a result, as the foal grows, there is always a little more weight on the inside of the leg and foot than there is on the outside. That's why there's asymmetry in the coffin bone (front to side) and we see this reflected in the hoof capsule.

The compressive forces on the foot as it lands and impacts the ground will also influence hoof shape. Front legs generally bear a little more weight on the inside of the limb. As the limb begins to bear weight during movement, the fetlock joint usually bends inward as well as downward. This puts more force on the inside of the legs. There must be compensating factors to address this force.

Although a foal is born with very symmetrical coffin bones, as he grows and the foot bears more weight, the inside of the coffin bone remodels to handle the load and concussion and becomes straighter up and down. The outside has a little more angle. Consequently the inside of the hoof is a little straighter and the outside wall a little less straight, and this is normal. Taken to extreme, however, this outside angle becomes a flare. But front feet should be matched pairs, even though they are not perfectly round.

On hind feet, if you look at horses from behind, some horses tend to be more base narrow behind than they are in front. As a result, the leg compensates by having a little more outward rotation when standing. Hind legs are not set outside the frame of the body (as they are in the front); they go right into the pelvis. There's a major grouping of muscles on the hindquarters, and often the legs are set on the inside of that mass, rather than outside.

Even if a horse's hind legs rotate

slightly outward, with his toes pointing slightly off center to the outside (which is the most common/normal hind leg conformation) he can be fairly correct behind. When you look at his footprints as he stands squarely, his toes are pointing to 11 o'clock and 1 o'clock, rather than what conventional halter horse conformation would dictate (toes pointing straight forward at 12 o'clock).

When we look at the horse standing, if conformation is a problem, we see it in the way the hoof wall remodels. If that remodeling continues unchecked, we find unhealthy coffin bone remodeling. The "creep" we see in the feet of horses with conformation faults who stand all day in stalls is a result of disproportionate weight on the feet beyond normal physiological limits. Areas of the foot that are more loaded will grow less. Areas that are not loaded grow more. If there is a conformation fault, it puts the limb and ultimately the foot into an unequal loading pattern and the horse needs a shorter shoeing cycle (more frequent trim) to prevent major imbalance. Feet get out of balance much more quickly if they have a conformational fault.

When horses with correct conformation grow long feet, even if the long toe becomes a little dished or the heels roll under, all we have to do is trim away excess growth, re-sculpt the hoof shape, and they are fine. But if a horse has a medial-lateral imbalance (base wide or base narrow) the feet will be flaring and there's a lot more hoof capsule warping we must to try to correct.

Growth on a normal foot (with straight limbs) is not as detrimental as the extra growth on a conformationally-challenged foot. A very correct horse, even if his feet grow long and neglected at pasture, when the long feet break off they will still be relatively well balanced.

DYNAMIC BALANCE

The way a horse moves (dynamic balance) is directly related to static balance. The less correct a horse's conformation, the more faulty the gait. Normal movement of horses is not two-dimensional. Because of the design and function of joints, limb movements are three-dimensional. As the conformationally-correct horse moves and gains more speed, there is subtle medial to lateral variation as the front foot bears weight, and more weight on the lateral (outside) toe than the center of the toe.

The timing of each phase of the stride changes with speed and gait, but these phases are present in all gaits. Phases of the stride are generally referred to as impact phase (heel strike), slide phase, loading phase (mid-stance is when the fetlock joint is fully loaded and the cannon bone perpendicular to the ground), heel up and break-over phase, and swing phase when the limb is in the air.

It's critical for athletic soundness that these phases of stride occur in organized and sequential manner. Faulty conformation tends to affect the normal timing of the stride phases, which in turn can result not only in faulty gait but lameness in some cases. As lameness progresses it will also affect timing and placement of the foot and leg during these phases of the stride.

In gaits faster than a walk, some phases of the stride are accelerating and some are decelerating the speed of the limb. For example, when the foot leaves the ground the whole limb is protracted forward, gaining speed. When the limb is fully extended it retracts or pulls down to the ground in a steeper angle, slowing its speed, getting ready for impact.

When the foot is pulled back down to the ground, it doesn't land flat. It's more common for the outside of the foot to land a fraction of a second before the inside. Some people think that if horses land outside heel first, they slap the inside heel down. But high-speed videos show that normal horses land outside heel first and by the time the foot gradually comes to a slide and stops, the inside heel is loaded, a smooth transference of weight and loading.

There's some rotation of the hinge joints and other joints in the leg. They all function and articulate around a rotation; they don't articulate on just one plane like a machine. Almost all joints have some rotation. Also, as the horse pulls the leg back down--to land the hoof on the ground--the extensor and flexor muscles work together to make this a smooth transition.

The extensor muscles are on the outside of the forearm. As the horse is pulling the leg down and preloading the joint so it's in a closed/packed position (to bear weight) and ready to hit the ground, the muscles tend to pull the leg outward slightly in a lateral motion. If you watch the horse's legs in motion, they are never moving in an absolutely straight line. There's always a little medial/lateral deviation as the foot makes its flight, and this is never a problem unless the inward or outward swing is excessive.