Equine Services International Ltd.
Dr. Corinne Hills. PO Box 199, Pukekohe. 021-VET-MED (838-633). Email – vetmed@xtra.co.nz

Conformation in Horses – What is Correct?

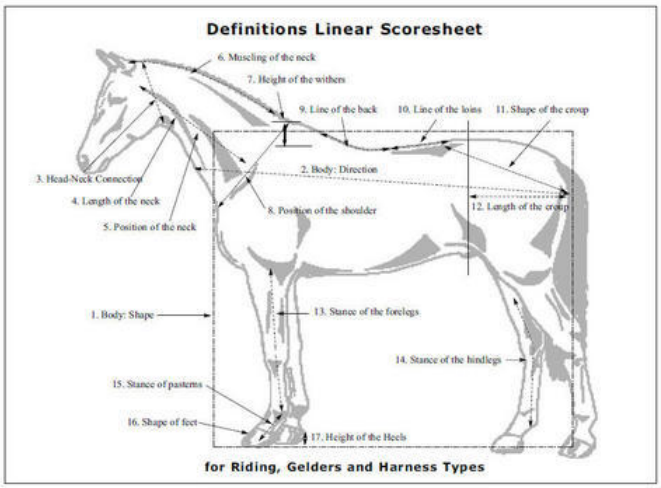
Definition: Conformation refers to the shape, dimensions, and proportions of a horse, created by its musculoskeletal structure.

Wider Definition: A more holistic definition considers the implications of form for dynamic function as well.

Beauty is in the eye of the beholder. The assessment of conformation is subjective, and different people will have different preferences, tolerances, and intolerances. In addition, different breeds and horses with different jobs to do may be compared to slightly different ideal conformation standards. For our purposes today, we will mostly talk about racehorses, and Standardbreds in particular. We will talk about the most common conformation flaws and why some might be quite tolerable in the Standardbred racehorse and why others aren't. As many racehorses will be evaluated and selected as foals or yearlings, I will also try to touch on a few developmental features of conformation.

When selecting yearlings at a sale, what we would really like to know is which individuals have the X-factor that will make them great racehorses. That, unfortunately, is an intangible factor that we have no measure for. Instead, we try to choose individuals that are likely to stand up to the physical stress of training. At least, we try to reduce the list of yearlings with bloodlines we are keen on, by eliminating the horses with significant conformational flaws that will predispose them to injury and reduce the likelihood they will ever make it to the races.

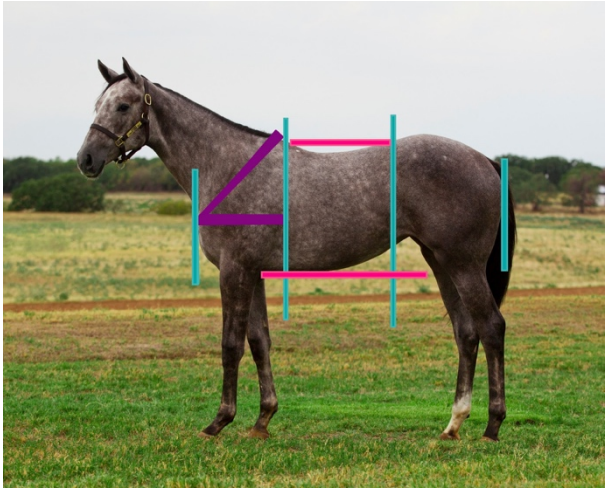
Overall and the Body Proportions:



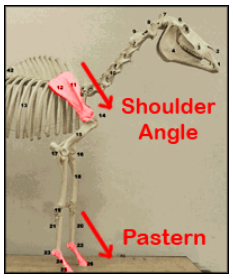
When you look through references on judging conformation, you will find a variety of "standard" measurements recommended for evaluating the overall shape of horses. Some suggest that the length of the head, neck, shoulder, back, and hip should be equal; others say that the height of the horse at the wither and the length, from point of shoulder to point of buttock, should be equal; and still others say that the shoulder, body, and hip should be of equal lengths. In general, these are reasonable rules of thumb to follow as they are all about overall good balance, and horses that depart significantly from these proportions are unattractive and may have difficulties with some types of work.

There are recommended proportions for heads and for the relationship between the size of the head and the length of the neck, but I'm sure we have all known pretty decent Standardbreds with roman noses or relatively long heads that would be considered poor

specimens by these measurements. On the whole, if the horse has to be a riding horse that must engage the hind quarters and lighten the front end for jumping or dressage, a big head makes that more difficult and it could be considered a flaw. For Standardbreds, it probably doesn't affect balance and performance to the same extent, and whether these proportions are considered a flaw or not largely comes down to personal preference. In fact, the only conformational flaws of the head I worry about involve the eyes and mouth. Horses with narrow foreheads and small eyes can have some difficulty seeing, and parrot mouthed horses (where the upper jaw protrudes beyond the lower jaw) or monkey mouthed horses (where the lower jaw is longer) will have more dental issues than average that must be looked after regularly. The neck shouldn't be too short as it is important for balance, but a slightly longer neck isn't a disaster, so long as it is not set on too low, shifting weight bearing towards the front and loading joints in front legs. In running quarter horses, researchers found correlation between longer necks and an increased incidence of knee chips. Jumpers, on the other hand, need a relatively long neck for balance over jumps.

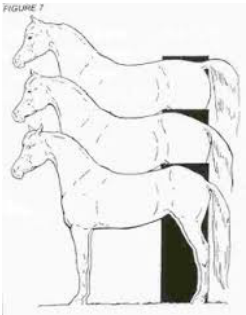


The shoulder should be relatively sloping, forming an angle of 45 degrees or so with the ground. A more vertical shoulder often goes hand in hand with a shorter humerus and a lower neck set. The upshot of all of this is a shorter stride.



It is also worth noting that the pastern angle, when viewed from the side, is generally the same as the slope of the shoulder. An overly sloping shoulder, therefore, often comes along with a long, sloping pastern, low heels, and a whole host of problems associated with that. *This reminds me of the song…the hip bones connected to the thigh bone, the thigh bones connected to the leg bones...and so on.*

For most breeds, a short back is considered ideal, and one standard suggests that the shoulder, back, and hip should all be of equal length. In the picture with the grey horse above, the three sections, while similar, are not quite the same. If the back was really the same length as the shoulder, it would really be too short, in fact. Horses with very short backs may be predisposed to interference problems. Horses with long backs, in contrast, are susceptible to injury due to weakness.



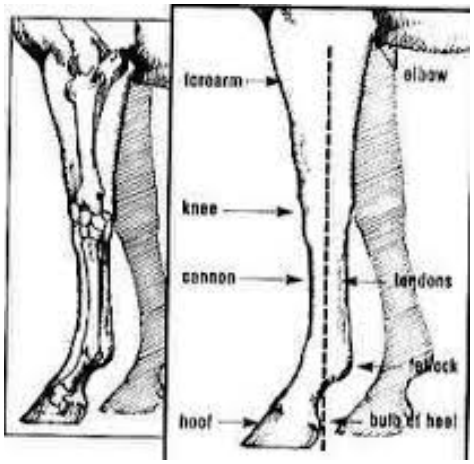
The croup in some breeds should be relatively flat, and in others, a moderately sloping croup is ideal as it allows for easier engagement of the hindquarters. A very sloping croup or a very flat croup are not ideal in Standardbreds, as both conformations limit the power generated by the hindquarters. Arabians shown at halter have quite flat croups, while Arabian flat race horses look like slightly smaller thoroughbreds with moderately sloping croups and well-developed hind quarters.

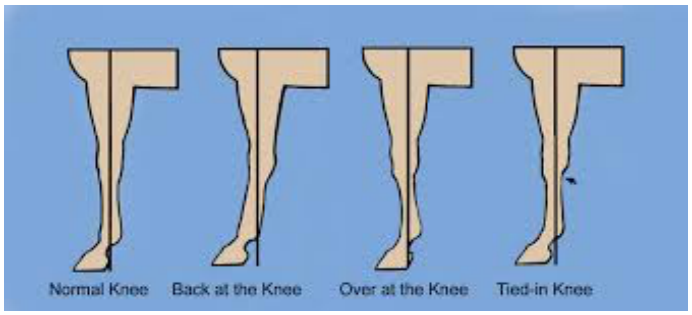
Feet and Legs:

While "ideal" body conformation varies quite significantly for horses of different breeds and purposes, standards for legs and feet apply quite uniformly across breeds. While not many horses are perfect specimens, those that come closer to the ideal, generally have the right biomechanics for correct and athletic movement. They will suffer the least abnormal forces on feet, legs, and body; hopefully preserving soundness and health during training and racing. In this section, I'm going to address the significance of conformation flaws while discussing normal conformation to help you to decide which flaws you might tolerate and which you really shouldn't.

Front legs:

When a horse, standing square, is viewed from the side, a plumb line, dropped from the top of the leg along the middle of the forearm (elbow joint), should fall straight through the middle of the knee (carpus), down the back of the cannon bone, pass through the middle of the fetlock, through the back of the heel bulbs, and end up on the ground just behind the heels. If the knee falls to the front of middle, the conformation is referred to as buck-kneed or over-at-the-knee, and if the knee falls more to the back of the midline, then the conformation is referred to as back-at-the-knee.

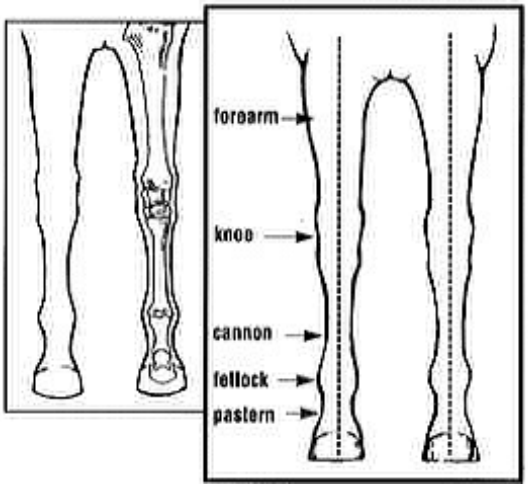




The back-at-the-knee conformation is an interesting one. Depending on the breed and work a horse does, it may or may not be significant. You could well imagine that horses with a back-at-the-knee conformation would be a greater risk for fracture, or at least lameness, as the joint appears to be partially hyperextended, even when at rest. Interestingly enough, research says that for most breeds, unless the flaw is severe, there is little impact on the incidence of chip fractures or lameness. This may be because the back-at the knee conformation is created when the top row of bones in the knee is set slightly back of the bottom row. In the normal horse, these rows of bones are arranged so that the front faces are lined up with each other. Some evidence does exist of increased incidence of lameness in racehorses, but it isn't the same for all types. Thoroughbreds and trotters appear to have a bigger problem with slight back-at-the-knee conformation than pacers do. A slightly back-at-the-knee conformation is pretty common in Standardbreds, and if the shoeing is right, pacers, at least, can generally be managed. (Research has demonstrated an increase in carpal chips and synovitis in horses with long toes in combinations with a slight back-at-the-knee conformation.) In more significant cases though, it should be avoided for any racehorse.

The over-at-the-knee conformation in young racehorses is associated with a reduction in risk for carpal chips, but the incidence of tendonitis is clearly increased. Bowed tendons are best avoided, and any conformation that predisposes a horse to this injury is best avoided. In older jumping horses (steeplechasers, show jumpers, and eventers), the over-at-the-knee conformation can be aquired and this acquired form does not appear to be correlated with lameness or instability, despite all appearances.

A narrowing of the leg, just below the knee, is the feature of the tied-in-below-the-knee conformation. For some reason that is not obvious to me, researchers have found this problem to be of bigger concern in pacers than trotters. Again, there appears to be some correlation with increased incidence of tendonitis, so I think it is best avoided in racehorses of any type.



When viewed from the front, a plumb line dropped from the point of the shoulder should bisect the forearm, knee, cannon, fetlock, and foot. Deviations indicate a conformation flaw.

Toe in and toe out conformations both place extra stress on the fetlocks and coffin joints. The toe in conformation places the stress on the outside of the joints, and the toe out conformation places extra stress on the inside.

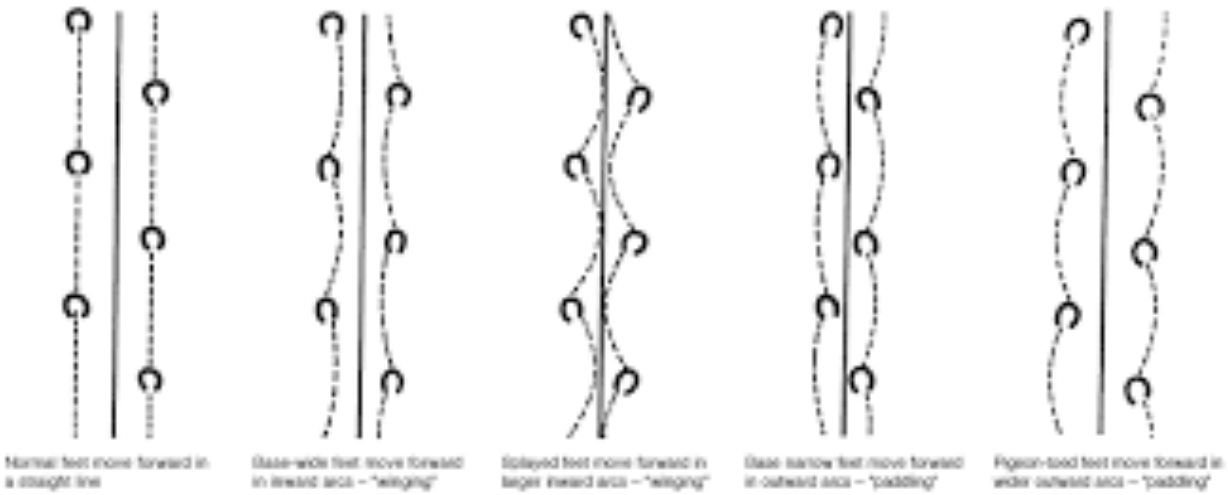
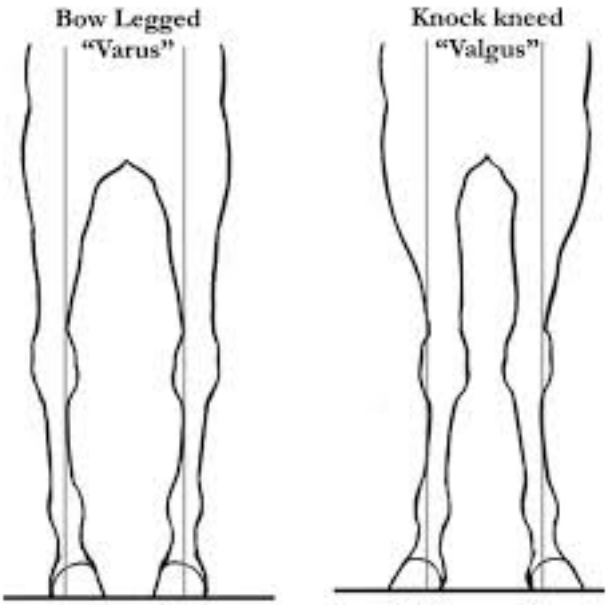


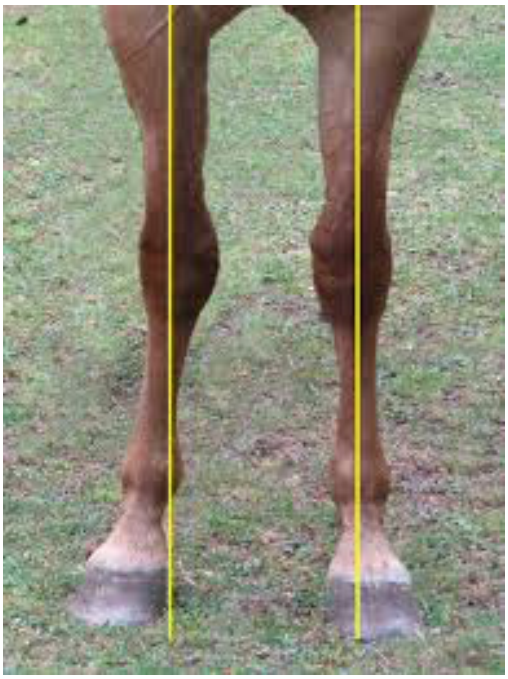
Figure 5. Path of Foot as Seen from Above

The toed-in conformation results in a paddling gait in which the foot swings outward while the toed-out conformation results in winging-in, with the toe at risk of contacting the other front leg. The toed-out conformation, therefore, is a very undesirable one in Standardbreds as they will be at greater risk for hitting a knee or splint.

The toed in conformation often goes hand in hand with offset knees. This conformation is associated with increased incidence of synovitis and capsulitis in the fetlocks and coffin joints, and the greater the offset, the greater the incidence of problems in the lower joints.



When the lower limb deviates outwards from the midline, the conformation is sometimes referred to as knock-kneed. It is actually an angular limb deformity called a Valgus deviation. The opposite condition in which the lower limb deviates inwards, is correctly termed a Varus deviation.



The valgus deformity is common at birth, but most foals straighten up within a few days. Those that don't can be corrected with a surgery that slows the rate of growth on the inside of the leg and increases it at the outside.

You would guess, by looking at the valgus deformity, that additional stress would be put on the inside of the lower limb, and you would also probably expect some knee problems to go along with this. Oddly enough, research has demonstrated the opposite. The incidence of carpitis and fractures actually decreases in Thoroughbreds with a valgus deformity.

Pastern angle and foot conformation are closely related to one another, so we will discuss these together. The angle of the foot should be the same as the angle of the pastern. Both will be fairly similar to the angle of the shoulder, though not necessarily exactly the same. Generally, a foot angle of 50 degrees or so would be considered ideal for front feet. With a foot and pastern angle of 50ish, the pastern will be neither too short and upright, which would place extra stress on the fetlock, pastern, and coffin joints, nor too long and sloping, which will place extra stress on the coffin joint, pastern, fetlock, knee, and the flexor tendons. From a soundness perspective, I would rather a horse be slightly more upright than have long, sloping pasterns that place the foot way in front of the leg. This conformation frequently results in crushed and underrun heels, and maintaining a healthy foot will be an ongoing battle. The long pastern/long toe/low heel conformation has been associated with an increased incidence of front leg fractures in general, and carpal chips in particular. While more upright pasterns are associated with an increased incidence of fetlock chips, it is a very slight increase that I think is a better risk to take.

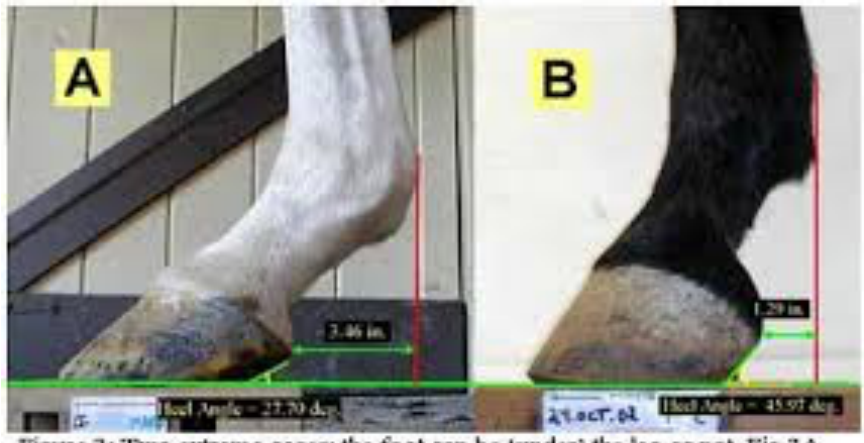
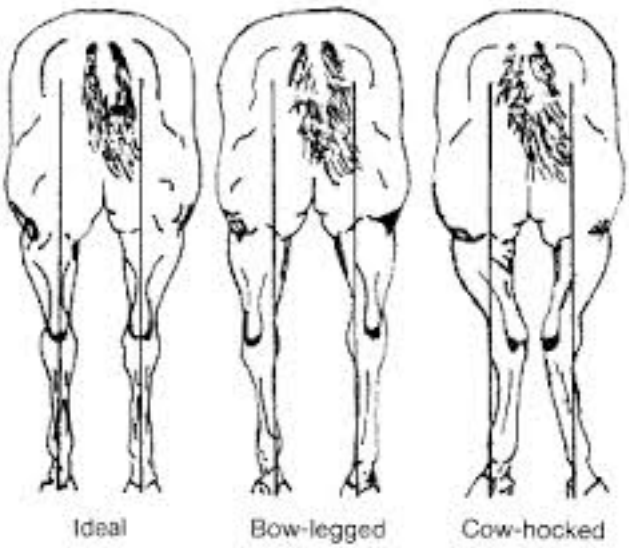
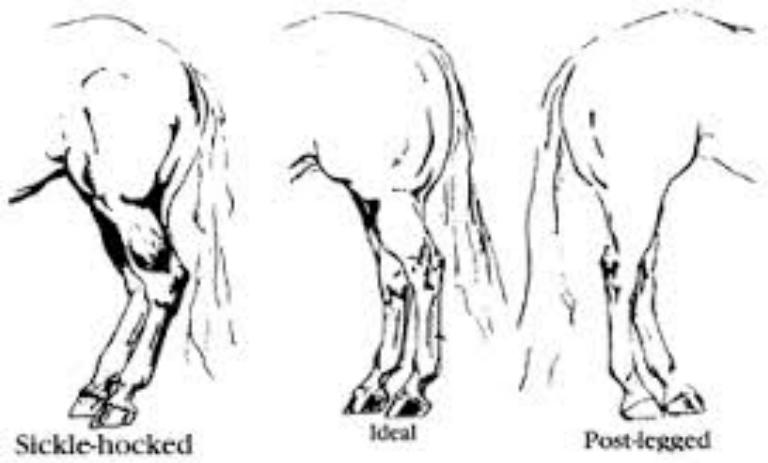


Figure 3: Two extreme cases: the foot can be 'under' the leg or not. Fig 3A shows not only a poor stance but bad heel angle (27.7 deg.). Image courtesy www.eponatech.com .

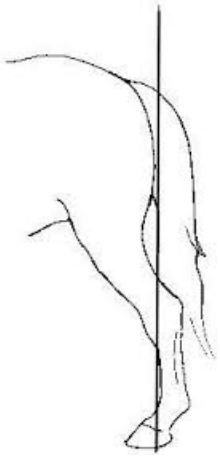
Hind Legs:



To evaluate conformation of the hind legs when viewed from behind, imagine a plumb line dropped from the point of the rump. It should run down the middle of the hock and bisect the canon and foot. If the hocks deviate to the outside of the line, the horse is considered to be bow-legged, and if the hocks deviate to the inside, they are called cow-hocked. In fact, few horses are dead straight behind. The majority have a very slightly cow-hocked conformation. If either deviation is significant, it should be avoided.



The hind legs should also be viewed from the side, and you must take care to ensure that they are standing up square, with either the canon bone vertical or the point of the hock lined up under the point of the rump. A plumb line dropped from the point of the rump should run just behind the point of the hock and run straight down the back of the flexor tendons. Horses that stand too straight behind, post-legged, will have the plumb-line fall behind the leg, and a sickle-hocked horse, with too much angulation through their hind joints, will stand out behind the plumb line.



Some diagrams will show two additional conformations; camped under and camped out. These are not really different conformations but are, instead, positions. If a sickle-hocked horse stands with the point of the hock under the point of the rump, then the cannon bone will slope forwards. This is the usual depiction of the "sickle-hock" conformation. If that same horse stands up with the canon bone vertical, then they stand camped-out behind. The post-legged horse, in contrast, generally stands camped-under.

Post legged horses do not have enough angulation through their joints. These horses are predisposed to stifle and hock problems, and they are generally weak behind. They are unable to engage their hind ends sufficiently, and they should be avoided for jumping.

The sickle-hocked conformation is reasonably common in Standardbreds, and it has been associated with speed in some families. Sickle-hocked horses are predisposed to hock joint problems and curbs. From a soundness perspective, significantly sickle-hocked individuals should be avoided.

Dr. James R. Rooney wrote some very interesting text books about the biomechanics of lameness that are worth reading if you would like to know more about how form affects function and dysfunction. He explained that the sickle-hock conformation allowes horses to get underneath themselves and use their hind quarters for more power. As a result, draft horses should be slightly sickle-hocked, and so should be old-time Standardbreds who pulled heavier carts and drivers and who were required to race multiple heats in a single day, but were not required to pace or trot as fast as horses must now. As Standardbreds have had to go faster and faster, a straighter hind leg conformation has been selected for. I'm not convinced the straighter hind leg conformation is necessarily related to more speed, but it certainly helps horse stay sound enough to race successfully for a longer term. If sickle-hocks allow a horse to generate more power behind, then they should also provide for more speed. Soundness would certainly suffer, though, and lameness will almost always reduce speed in the end.

Conformation Changes from Birth:

Researchers have found that only 13% of foals can be considered to have straight legs during their first 10 days of life, however, only a few require any sort of intervention to help them to straighten up. The deviations notable at this early stage in life include angular limb deformities and rotation of limbs, mostly to the outside. After the first few days, weaknesses begin to correct, and many of these legs begin to straighten up. Rotational abnormalities of from the elbows start to straighten as pectoral muscles develop.

Between two weeks and 6 months of age, valgus deformities are improved as is a toed-out conformation. The base wide stance also corrects. Varus deviations, toed-in conformations, and offset knees can worsen, however.

By the yearling sales, leg conformation is permanent. The stage of growth, however, can mean the the croup is higher and yearlings can look poorly balanced. I would generally expect that Standardbred yearlings who have narrow chests and who toe out will have major interference problems, but many Thoroughbred trainers will overlook these flaws, believing that yearlings will straighten out as the pectoral muscles continue to develop with training and growth.

Conclusion:

While there will always been exceptional creatures who become champions despite dreadful legs, most will break down before they can distinguish themselves on the racetrack. It is an integral part of a horse trainer's job, therefore, to select horses for purchase that will stand up to training and racing. To do this successfully, they must become students of conformation; learning how to evaluate it, how it affects function, and how it might lead to dysfunction.

For more information, I would recommend reading Dr James R Rooney's books, "The Lame Horse" and "The Biomechanics of Lameness". It can be hard going if you aren't fond of physics, but I think his books are fascinating. Dr W. McIlwraith wrote an article, "Conformation and Musculoskeletal Problems in the Racehorse" that is also worth a read as it talks about development of foals and the incidence of injury relating to conformation. Kobluk, C. N.; Robinson, R. A.; Gordon, B. J.; Clanton, C. J.; Trent, A. M.; Ames, T. R. have written "The Effect of Conformation and Shoeing: a Cohort Study of 95 Thoroughbred Racehorses". This is about feet and their effect on lameness.