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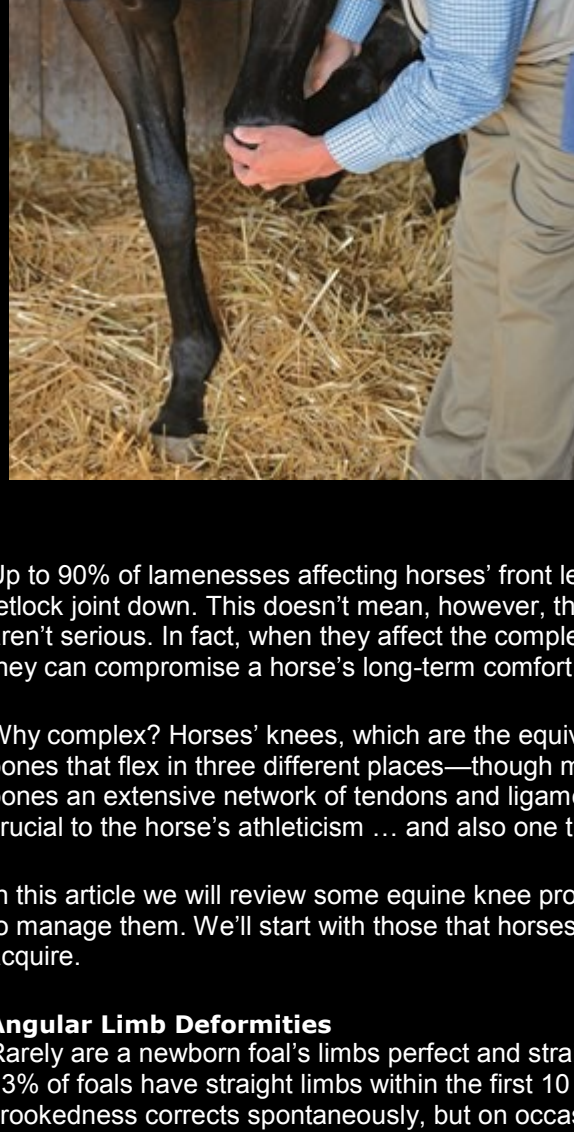
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## Horse Knees: The Crooked, Chipped, and Inflamed



Up to 90% of lamenesses affecting horses' front legs stem from bone and soft tissue found from the fetlock joint down. This doesn't mean, however, that the other 10% of injuries occurring higher up aren't serious. In fact, when they affect the complex knee (carpal) joints and surrounding soft tissues, they can compromise a horse's long-term comfort and athletic performance.

Why complex? Horses' knees, which are the equivalent to our wrists, are each made up of two rows of bones that flex in three different places—though markedly less in the bottom joint. Add to that stack of bones an extensive network of tendons and ligaments, and you have a sophisticated structure that's crucial to the horse's athleticism ... and also one that's susceptible to injury.

In this article we will review some equine knee problems owners and veterinarians encounter and how to manage them. We'll start with those that horses are born with and move on to ones they can acquire.

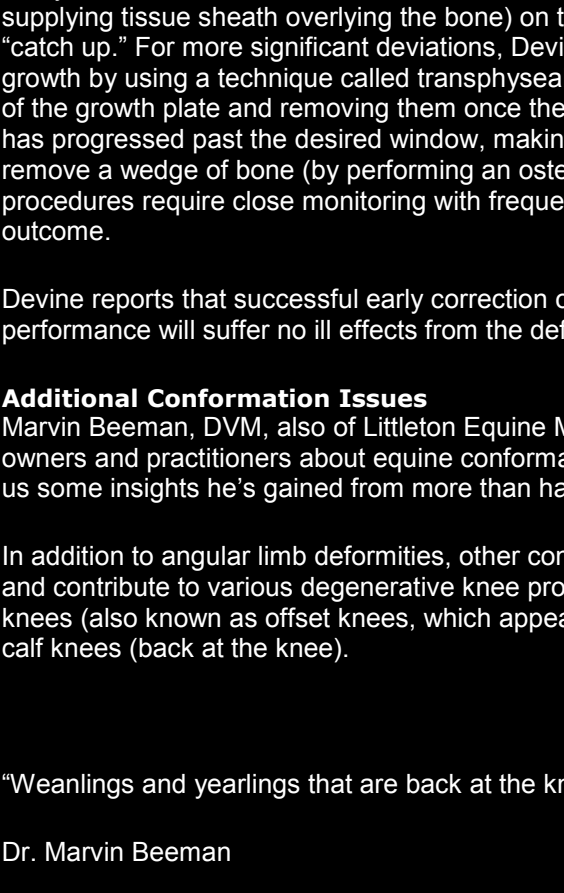
### Angular Limb Deformities

Rarely are a newborn foal's limbs perfect and straight; in fact, in one study researchers noted that only 13% of foals have straight limbs within the first 10 days of life. As the foal grows, most of that crookedness corrects spontaneously, but on occasion one or more limbs fail to align—this is referred to as an angular limb deformity (ALD).

Foals with narrow chests are most likely to have an ALD. Deformities can also result from nutritional imbalances, rapid growth, or excess exercise or trauma. There are two main types of ALDs that affect the knee: Carpus valgus, involving a limb that angles outward from the knee, and carpus varus, one that angles inward.

Dustin Devine, DVM, MS, Dipl. ACVS, staff surgeon at Littleton Equine Medical Center, in Colorado, is well-versed in equine musculoskeletal problems. "Angular limb deformities can be detrimental to future soundness if not appropriately addressed or corrected in a timely fashion," he says. "When the limb isn't straight beneath the horse's center of mass, uneven loading of the joints of the carpus, as well as the fetlock, pastern, and foot, can lead to premature development of osteoarthritis as well as a host of soft tissue musculoskeletal ailments."

He urges owners to address ALDs within the first few months of life for the best chance of correcting them and giving affected horses a chance at a successful athletic career. Early intervention includes appropriate hoof trimming and controlled exercise. Devine says exercise restriction is important during the correction period to reduce a horse's risk of injuring the carpal joints and distal (lower) limb.



As foals grow, much of their limb crookedness can correct spontaneously.

Photo: Thinkstock

"Mild deviations may not require surgical intervention," he adds, "whereas moderate and severe cases often require surgical treatment," performed in advance of a rapid growth phase and lower forearm growth plate (distal radial physis) closure for the best outcome—generally, before the foal is 3 to 4 months old. "Growth potential and, hence, correction potential, is greatly reduced as a foal approaches and/or passes six months of age," he adds.

The purpose of this corrective surgery is to either accelerate or retard growth, says Devine. To correct many knee conformation deviations, for instance, the surgeon will strip back the periosteum (nutrient-supplying tissue sheath overlying the bone) on the distal radius to allow the other side of the knee to "catch up." For more significant deviations, Devine likes to retard the convex (outer) side of the limb's growth by using a technique called transphyseal bridging—inserting screws and wires across the side of the growth plate and removing them once the deviation corrects itself. If long bone development has progressed past the desired window, making correction unlikely, then the veterinarian might remove a wedge of bone (by performing an osteotomy) to help correct limb alignment. These procedures require close monitoring with frequent checkups and radiographs (X rays) to evaluate the outcome.

Devine reports that successful early correction of an ALD can mean the horse's long-term athletic performance will suffer no ill effects from the deformities.

### Additional Conformation Issues

Marvin Beeman, DVM, also of Littleton Equine Medical Center, is well-known for his efforts educating owners and practitioners about equine conformation. With regard to the carpus, Beeman shares with us some insights he's gained from more than half a century in equine practice.

In addition to angular limb deformities, other conformation issues can occur in and around the carpus and contribute to various degenerative knee problems later in life, Beeman says. These include bench knees (also known as offset knees, which appear as such as you view the horse from the front) and calf knees (back at the knee).

"Weanlings and yearlings that are back at the knee have a low percentage of improving."

Dr. Marvin Beeman

"A horse that is 'over at the knee' is not predisposed to carpal degenerative joint disease, because the knee is designed to flex," Beeman says. "However, the condition can precipitate premature flexion of the carpus when the leg is fully weight-bearing. This can cause a sudden increase of tension on the superficial digital flexor tendon (SDFT), with the potential to stretch or tear tendon fibers to result in a bowed tendon. If severe the carpal canal becomes inflamed, causing a problem similar to carpal tunnel syndrome in humans." In other words, when the over-at-the-knee horse puts his full weight on the leg, the tendon that flexes the knee has to stretch further to compensate for the longer profile of the front of the knee, overwhelming the tendon fibers.

Researchers evaluating conformational changes in growing foals and weanlings have discovered that individuals that are over at the knee at an early age are likely to remain that way, whereas those that are back at the knee are more likely to improve considerably between weanling age and 3 years old. However, in Beeman's experience, "Weanlings and yearlings that are back at the knee have a low percentage of improving," he says. "Back-in-the-knee (conformation) puts a great deal of pressure on the front margins of the carpal bones, often resulting in fractures or degenerative joint disease at those sites." He urges owners to consider this when planning a horse's future use—"the lesser the degree of stress, strains, and concussion, the better."

Many of these conformation variations are genetic in origin, so consider mare and stallion selection for producing offspring with well-structured knees.

### Acquired Knee Problems

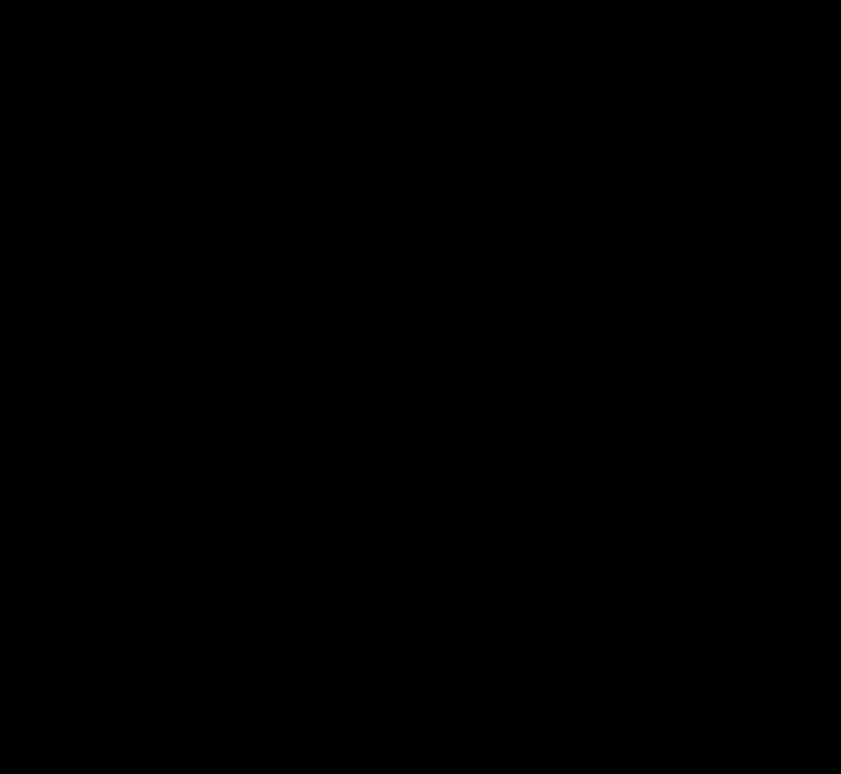
Other notable knee issues are acquired with injury or spontaneously.

**Hygroma** This is a common cause of carpal swelling over the front of the knee (see page 50 for an illustration). Technically, a hygroma is an "acquired bursa," meaning a pocket forms with a secretory lining that produces serummilike fluid. "Hygromas typically result from trauma," Devine explains. "A horse that is kicked, falls on its knees, or suffers an impact (e.g., hitting its knee hard on the stall or trailer walls) can develop this swelling. Also, trauma from entrapment in paneling, feeders, or fencing, or uncoordinated attempts to rise during anesthetic recovery, can result in hygroma development if the front of the carpus is injured."

Most hygromas are cosmetic blemishes that rarely affect soundness or become infected. Devine says he has had moderate success managing these acute hygromas via drainage, corticosteroid infusion, and compression bandaging, and that they respond best to prompt attention. "Reduced range-of-motion of the knee usually has more to do with underlying osteoarthritis, fibrous joint capsular restriction, or previous carpal injury and/or surgery rather than the presence of a hygroma," he adds.

In other cases, hygromas that connect to underlying tendons or joints might continually secrete fluid and recur despite drainage and treatment.

**Chip fractures** Knee chips, usually accompanied by swelling within the affected joint, are another common carpal injury. Rood & Riddle Equine Hospital surgeon Larry R. Bramlage, DVM, MS, Dipl. ACVS, has remarked that about 15% of young horses have chip fractures in their joints simply from frolicking and playing in the field before training begins. Repetitive trauma that proceeds at a rate or manner exceeding bone's capacity for adaptive remodeling is the more common cause, says Devine. This can occur in any breed or discipline due to incorrect bone development, unbalanced loading, or trauma that places uneven pressure across the bone.



About 15% of young horses have chip fractures just from frolicking in the field.

Photo: Anne M. Eberhardt/The Horse

"Horses with more correct, 'protective' conformation that are conditioned appropriately and/or asked to perform jobs with less arduous physical impact are at lower risk of development of OC fragmentation," Devine says. In contrast, he says that cyclic loading, fatigue, and hyperextension—repetitive trauma typically tied to activities such as racing, jumping, or sports with sharp turns—can precipitate osteochondral (OC) fragments, no matter the horse's conformation. "Once OC fragmentation occurs, inflammation of the synovial membrane (that of the joint lining, called synovitis) along with the irregular cartilage surface and fragment debris elicit a cascade of events that potentially lead to osteoarthritis," he says.

"Most cases of carpal osteochondral fragmentation benefit from surgery, particularly if a horse's performance is suffering," Devine continues. "OC fragments left in the joint act as an inflammatory nidus (origin) that perpetuates premature degeneration of the joint. However, large fragments like slab fractures or those surrounded by scar tissue are often best left alone." He notes that some of these larger fragments might require arthroscopy (using a small camera to explore and repair damaged joints).

**Acute carpalitis** An acute injury to any of the eight joints within the carpus can set off a cascade of inflammatory events known as carpalitis. It is important to address this inflammation as quickly as possible to reduce joint damage inflammatory enzymes cause. Veterinarians use radiographs and ultrasound to determine the extent of underlying bone and soft tissue injuries fueling the inflammation.

"If noninvasive diagnostic imaging doesn't reveal a need for arthroscopic intervention, then treatment with cold therapy, systemic and local non-steroidal anti-inflammatory drugs (NSAIDs), and rest are useful to manage acute inflammation," Devine says.

**Soft tissue injury** As we noted earlier, there are many soft tissue structures within and around the carpus that can incur injury. These include the SDFT (as in the over-at-the-knee injury example), the carpal canal and digital sheath, the proximal suspensory ligaments, and the intercarpal ligaments that bind the carpal joint bones to one another, to name a few.

Veterinarians typically identify soft tissue injuries of these structures using diagnostic ultrasound and/or MRI imaging.

**Carpal osteoarthritis (OA)** One of the reasons veterinarians urge owners to pay prompt attention to carpal injuries is that cascade of inflammation that leads to osteoarthritis. "The unfortunate reality of osteoarthritis is that it is a progressive, degenerative condition," Devine says. "Our best and most effective efforts at management of OA in the horse are aimed at modification of the disease process and helping the horse deal with the symptoms of debilitation. This objective is constantly evolving to include physiologically 'safer' anti-inflammatory medications and advanced treatment options for systemic and intra-articular (IA, within the joint) administration."

When the carpus reaches a point of end-stage osteoarthritis, veterinarians are often confronted with simply finding ways to keep a horse pasture-sound. The many joints in the knee are not as amenable to treatment for continued athleticism as are other joints. "The 'best' management strategy is often multimodal (made up of a variety of therapeutic approaches) and tailored to the individual case at hand," says Devine. Approaches might include NSAIDs, IA corticosteroids, and/or chondroprotective (cartilage-protective) agents such as hyaluronic acid and polysulfated glycosaminoglycans, as well as other agents that improve the synovial fluid's characteristics, such as injectable regenerative therapies or autologous (derived from the patient) blood or stem cell-derived treatments. Veterinarians might also suggest pursuing nutritional supplements, surgery, or alternative or naturopathic medicine to help keep affected horses comfortable.

One last treatment when other options fail, says Devine, is surgical fusion of all or part of the carpus to manage comfort.

### Take-Home Message

The horse's carpus plays an important role in both basic locomotion and athletic prowess. It is also susceptible to damage stemming from a variety of causes, including conformational abnormalities, repetitive use, and traumatic impact. Ideally, owners and veterinarians should aim to recognize and address any inflammatory condition within the carpal area as early as possible to waylay the onset of osteoarthritis. Learn what your horse's normal carpal looks like so you can recognize the earliest signs of a problem and work with your veterinarian to treat the source of the problem as promptly as possible.