A Guide to Lameness in Horses
# Table of Contents

**Introduction** 4

**Chapter 1** 5

**Joint Problems** 5
- Causes of Lameness 5
- Navicular 5
  - Signs of Navicular Syndrome 6
  - Treatment 6
- Pastern and Fetlock Joint Problems 8
  - Body Angles 9
  - Judging Confirmation 10
  - Ringbone 10
  - Sidebone 11
  - Splints 11
- Hock Problems 12
  - Bog Spavin 12
  - Bone Spavin 13
- Coffin Bone Problems 14
  - Laminitis 14
  - Fractures 16
- Knee Problems 16
  - Bone Chips 17
  - Congenital Flexural Deformities 18
  - “Popped” Knees 18
  - Fractures 19
    - Green Stick Fractures 19
    - Complete Fractures 19
    - Compound Fractures 19
    - Diagnosing Fractures 20

**Chapter 2** 21

**Ligaments and Tendons** 21
- How Ligaments and Tendons Function 21
- Causes of Injuries in Ligaments and Tendons 21
- Suspensory Ligaments 22
  - Desmitis of the Branch of the Suspensory Ligament 23
  - Suspensory Desmitis Secondary to Splints or Fractured Splint Bones 23
  - Suspensory Breakdowns 23
  - Avulsion of the Origin of the Suspensory Ligament 24
- Tendons 24
  - Bowed Tendons 24

**Chapter 3** 26

**Muscles** 26
Introduction

They say a horse is no good without healthy feet and legs. For many horses, this is very true and for some a leg injury is a career ending event, or worse a death sentence. The latter is true for horses all over the world as those horses are very expensive to keep around after an injury and many owners do not want the expense of surgery and keeping a horse who can no longer do its job. For horses in the show, rodeo and pleasure industries this is not necessarily the end of their lives, but the end of their careers in the show ring although many of them may become pasture companions to others or breeding stock.

This is another aspect that many in the horse industry fail to look at. Is it wise to keep injured horses for breeding purposes? Sure, it makes them productive and gives the owner a reason to keep feeding them and caring for them, but is if their injury was caused by poor conformation or other genetically derived reasons, should we pass on these genes? Are the foals that are produced not going to have the same potential for injury because it was inherited? Of course this is not true for all horses. In many cases injuries are simply accidents, a bad step taken out of the starting gate or trailer, etc. This is a very important thought to consider when you are preparing a horse that has been injured to be breeding stock.

Of course, the best way to not have to decide whether or not to put a horse down for a broken leg or decide whether or not the horse should be kept for other purposes is to keep leg injuries from occurring in the first place. This starts with hoof care, exercise, conditioning and nutrition to ensure that are horses have a good foundation at a young age and maintaining them through their adult lives. We all want to live happy, healthy and productive lives and we should want no less for our horses.

No matter if our horse is a multi-million dollar racehorse or a pleasure pony in our backyard, we should strive to keep our horses feet and legs healthy and strong so that we may enjoy them for years to come. A healthy racehorse with good legs may one day turn out to be a fantastic jumper or a producer of healthy foals. This book is designed to show you how the horse’s legs and feet function, what potential problems are and how we can both treat and prevent those problems.
Chapter 1

Joint Problems

Causes of Lameness

Lameness is commonly used as a “catch-all” phrase to describe a leg problem that a horse may have. Lameness can be caused by a variety of problems that keeps the horse walking with a normal stride and free of pain. Lameness is generally the period of time that a horse is unable to perform regularly and free from pain. When a horse is not lame, they are considered sound. There are a variety of joint problems that will cause lameness in a horse. Lameness may occur anywhere in a horse’s limb that has nerve endings. Many horses are put down because the lameness is so severe that they have become immobile and unable to move while other horses may take a bad step occasionally. More horses are lost to lameness than colic every year.

Forelimb lamenesses are easier for individuals to recognize. They tend to be more prominent and owners or trainers are able to pinpoint the problem more quickly. Upper forelimb lameness is more common in young horses as they are still developing bone structure and are capable of injuring those areas. Adult horses do not usually have upper forelimb lameness. Hind limb lameness is more difficult to diagnose as the massive muscles in the hind end make it more difficult to diagnose. A horse that is holding his hind leg up may either have a stifle problem or a fetlock problem, which makes it more difficult to diagnose.

Joint lamenesses are caused by bones that do not function properly. Many of these problems may be caused by pieces of bone that break away from the joint or bones that become dislocated. They may also be caused by tendons that are unable to withstand stress or those that may have ruptured from too much stress or bone chips. These problems will usually occur in the knees, the splint bones, fetlock and coffin bone joints.

Navicular

The navicular bone is a small bone that is located behind the coffin bone. This bone is held in place by tendons and ligaments. The bone functions as a valve for blood flow to the coffin bone and the inside of the hoof. He bone also functions as protection to the joint and tendons and prevents pressure and concussion. The bone acts as a pulley for the deep digital flexor tendon and aids in relieving stress that is placed on the coffin bone.

If the hooves are not properly cared for, the horse is more susceptible to suffering from navicular. The bone may become immobile and cause poor circulation in the hoof. Common hoof conditions that cause this problem include high heels, long toes,
overlaid bars and improper shoeing. This condition is called Navicular Syndrome or Caudal Heel Syndrome and is a degenerative process affecting the bone, bursa or tendon. The condition usually occurs only in the front feet and generally affects both feet.

Horses that are at a high risk are those that are stall-kept and have strong physical demands such as being overweight or those horses that are not conformationally correct. Quarter horses tend to be prone to the condition as well as Thoroughbreds, who tend to have small feet in proportion to their bodies.

Navicular has been diagnosed in horses as early as one year. The condition is gradual and causes progressive lameness in the front legs. Navicular is hard to detect early because the condition worsens over time and X-rays are not always able to detect a problem since the soft tissues are first affected.

**Signs of Navicular Syndrome**

- Horses place their weight on their toes to avoid placing pressure on the heel while walking. The heel becomes inflamed in the bone and the bursa. The bursa is the outer lining layer of the bone.
- Heels are contracted and smaller due to poor confirmation.
- Shortening of stride
- Shifting of body weight when resting
- Stumbling gait
- Uneveness in turns
- Reluctance to go forward or lengthen stride
- Resting with weight resting on the toe
- When pressure is applied to the hoof, the horse will indicate heel pain
- General irritability
- Sitting back on hind legs to avoid pressure on front feet (also common in horses that are foundering)

Different types of horses that are trained for different events may react differently to cues and commands when performing. Dressage horses may be reluctant to come onto the bit or may refuse to perform a maneuver they have never had problems with. Racehorses may quit during a race, slow down noticeably at the 3/4 pole and lose form. Jumpers may refuse jumps and take down rails due to the pain of landing on the front feet. Event horses may refuse jumps as well as have poor recovery including prolonged heart rate, respiratory rate and temperature. They may also slow down and have problems making times. Endurance horses will also show poor recovery and may not be able to finish rides. Pleasure horses may show general irritability such as tail swishing and head bobbing. They may also stumble in easy gaits.

**Treatment**

There are several options to choose from that will aid in keeping the horse more comfortable and help treat the condition. Many believe the condition will treat itself over
time. These horses will benefit from proper trimming, removal of shoes and a lot of time out to pasture.

Trimming procedures have been used to relieve the pain so that the horse is able to perform normally. The most effective treatment is good hoof care and there are several styles of shoes that will allow relief of pressure on the deep flexor tendon. Horses that are shod will need to be shod more frequently than other horses, anywhere from every four to eight weeks.

Raising the heel of the horse is commonly used in these shoeing procedures. Raising the heel allows less pressure to be exerted by the tendon. This may affect the rest of the hoof because it is placed at an improper angle. Wedge shoes and pads are used to raise heels.

Rounding the toe relieves pressure as the horse walks. A rocker shoe allows the horse to roll off his heels instead of forcefully picking up the hoof.

Setting the shoe under causes the hoof to go beyond the edge of the shoe and then rounding the toe to cause a rocker effect. The rounded hoof makes it easier for the horse to walk.

Medications are also commonly used to relieve the pain of the condition. These medications are not used long term because they may cause damage to the horse with prolonged use and they may also be illegal in competitions.

- Isoxuprine (Circulon) is used in mild or moderate navicular and helps to improve circulation and relieve pain. The drug does not decrease damage and is helpful in the early stages of the condition. Long-term therapy is very expensive and time consuming, although Isoxuprine therapy is an option.

- Warfarin is a blood thinner and decreases blood clotting and aids in circulation. Long-term therapy is an option but the horse will have to be watched for bleeding problems and injuries because they will not clot properly.

- Several different non-steroidal anti-inflammatory drugs (NSAIDs) are used to reduce pain and swelling in the joints. They will also reduce inflammation in higher doses. These do not prevent joint damage and may actually caused joint breakdown with prolonged use. They may also affect normal blood clotting as well as cause ulcers. Phenylbutazone (Bute) is the most common NSAID that is prescribed to horses, however, there are several other options available as well.

- Cortisone is a corticosteroid and is used to reduce inflammation and swelling. Horses will receive injections directly in the joint. Cortisone acts as the body’s hormone cortisol and has a more powerful anti-inflammatory effect. Relief is almost immediate in the joints.
Visco-supplementation is another injection but is a gel-like substance, which helps to decrease friction in the joint. The benefits are only temporary, so treatment is ongoing but reduces pain and allows greater mobility.

In rare and severe cases, surgery may be required. A neurectomy is a drastic procedure and is usually only used for long-term cases. The foot is numbed by clipping the two nerves that are located in the navicular area. Horses may stumble because they are unable to feel where their foot has been placed in walking. The nerve may grow back, but the procedure may be performed multiple times to keep the horse pain-free. Another surgery involves cutting the navicular suspensory ligament. Horses with advanced navicular syndrome should be retired and turned out to pasture. A more natural lifestyle promotes regular blood flow and healthy hoof growth.

Overweight horses should be placed on a diet to relieve stress on the joints. Horses should also be kept from becoming overweight. Exercise will help to reduce pain and will keep the muscles strong. Horses that have weak muscles will experience greater pain. Exercise should be frequent and in short bouts. Horses should also be allowed adequate rest to heal and the farrier should be alerted to the horse’s condition. They will be able to properly trim or shoe your horse to help relieve pain.

**Pastern and Fetlock Joint Problems**

Horses that experience fetlock joint lameness usually have poor conformation in their pasterns. The angle of the hoof and the angle of the pastern should be identical in alignment in a properly conformed horse. If the pastern is steeper the horse will be predisposed to lameness problems. The same is true if the pastern is sloping, as the joint will be strained. Many times proper shoeing is adequate in aligning the pastern and the hoof wall. If you have racehorses, jumpers, eventers, or dressage horses the pastern is a vital joint. The joint is responsible for shock absorption when the horse’s front leg is grounded which causes the elbow and knee to be locked. Together the fetlock and the pastern will absorb concussive forces involved with footfall.

Long pasterns may cause the horse to suffer from a variety of conditions including:

- Bowed tendons
- Sesamoiditis
- Fractures in the sesamoid bones in the back of the fetlock. Common in racehorses that are tired at the end of a race.
- Suspensory ligament injuries
• Ringbone caused by excessive pastern stress

Long pasterns are common in Thoroughbreds and Saddlebreds. Tendons and ligaments that go behind the joint may be stretched too much or even ruptured. Long pasterns do not support the fetlock enough and may even allow the fetlock to become hyper-extended. Long pasterns may be almost as long as the cannon bone. Long pasterns are often bred for because they allow the gaits to be more comfortable because shock absorption is increased. Dressage horses will require some slope in their pasterns to allow them the suspension and cadence necessary for smooth gaits, transitions and maneuvers.

Short pasterns are usually less than half the length of the cannon bone but may cause gaits to be jarring. Short and upright pasterns will also shorten the horse’s stride and cause the horse to be less efficient in stride. Conditions that result from short pasterns include:

• Navicular
• Ringbone
• Sidebone
• Splints
• Bucked knees and knee injuries
• Bucked shins
• Windpuffs

Draft horses that are used for pulling will typically be bred for short, upright pasterns. Short pasterns allow them to get more leverage and dig into the ground. Riding horses such as Quarter Horses, Warmbloods and Paints are more likely to have injuries to these joints because they work at higher speeds. They also do not absorb shock efficiently and may suffer from splints and bone chips, especially if worked and kept on hard surfaces.

Upright pasterns in a racehorse will lead to a higher occurrence in suspensory injuries. Upright pasterns are also more prone to pastern joint disease and this commonly occurs in jumpers and other performance horses.

**Body Angles**

The shoulder usually has the same slope as the pastern. The pastern should always match the angle of the hoof after being trimmed. A long toe will cause a bad angle in the pastern. Proper trimming will keep the pastern, coffin bone and other joints in proper alignment. Angles that are broken forward or back will often result in strain on bones, joints, ligaments and
tendons in the joint. If angles do not match after trimming, this is usually an indication of poor farrier work. The farrier should be constantly judging his work to ensure proper angle. Horses that have not been properly trimmed over a long period of time may require gradual and correctional trimming.

Judging Confirmation

Before purchasing a horse, you will want to ensure that the horse has an ideal pastern angle of 45 degrees. The angle may be slightly steeper at 47-55 degrees as it makes for a more comfortable riding mount. Pasterns in the hind leg should be shorter than in the front leg. Shorter pasterns in the hind legs will result in greater strength. Long pasterns in a hind leg will generally result in a horse breaking down in training. Properly angled pasterns will increase the chance of a horse having a long career and also helps the horse travel over uneven terrain. The best length of a pastern is that of 1/2 to 3/4 the length of the cannon bone.

Ringbone

Ringbone is bone growth in the pastern or coffin joint of the horse. This is usually the result of pastern misalignment. High ringbone occurs in the lower part of the large pastern bone or the upper part of the small pastern bone. Low ringbone occurs in the lower part of the small pastern bone or upper part of the coffin bone. Low ringbone usually occurs in the hoof and is not easily recognized. Severe cases will show a bony bump in the coronet of the horse. High ringbone is usually easily identified.

Ringbone is caused by excessive tension on the joint capsules, tendons and ligaments in the pastern area. The body will grow excessive bone to compensate for the stress. Strain may cause the joint to become unstable and results in the horse adding bone to the area to stabilize the joint. Poor shoeing and bad conformation will cause the horse to become unbalanced creating uneven stress on the pastern and coffin joint. Osteoarthritis is a degenerative joint disease and will cause articular ringbone. The joint becomes weak and bone growth occurs to immobilize the joint and to relieve chronic inflammation.

Ringbone typically occurs in the front legs and in mature horses or those in intensive training. High ringbone will exhibit a bony growth in the pastern area and the pastern will be less mobile. The horse will become gradually lame as the condition worsens. Low ringbone will cause moderate lameness because of the proximity to the hoof. A severe case will cause a bony growth in the coronet.

Treatment is used to slowdown the process of ringbone, as the condition is degenerative. The farrier should balance the hoof and support the heels. NSAIDs are used to alleviate pain and reduce inflammation in the joints. Arthrodesis is the fusion of the two pastern bones, which eliminates inflammation and lameness because the joint becomes stable. Arthrodesis of the coffin joint cannot be performed, as the horse needs to have mobility in the joint. This surgical procedure may cause bone growth that is cosmetically displeasing. Ringbone is degenerative and horses in intensive performance will not be
able to continue working at high speeds and intensity. Pleasure horses are usually fine for years unless the ringbone progresses rapidly. Ringbone that is near a joint is harder to treat.

**Sidebone**

Sidebone is similar to ringbone in that the condition is characterized by ossification of the bone. However, sidebone affects the collateral cartilages that are found in the coffin bone. The sesamoid bones that are affected are located on either side of the foot and protrude above the coronary band. The cartilage supports and cushions the heel. This condition usually only affects the front feet and occurs due to repeated concussion of the foot. Working on hard surfaces will cause this condition. The condition is also hereditary from poor confirmation and horses that have short pasterns.

Horses with sidebone do not always show lameness and many perform without being treated. Some horses require rest and anti-inflammatory drugs. Severe cases require that the palmar digital nerves be cut. X-rays and palpation are commonly used to diagnose the condition.

**Splints**

Splints are caused by the bone that was once a toe of the horse separating from the cannon bone. The bone narrows as it goes down the side of the bone and they form a small bump a few inches above the fetlock. These bones are attached by an interosseous ligament. The bone may be “hot” which means that the injury is recent and painful or the bone may be “cold” which means the splint has recovered and there is no longer pain associated with it.

Concussion is a common cause of a splint and may be due to poor conformation in the pasterns and fetlock joint. Working on hard surfaces will increase the concussion received by the bone. These occur on the inside of the leg a few inches below the knee. Direct trauma from kicks or interference may cause the periosteum to become damaged. Overworking young or unfit horses are typical causes of splints because the bones have less density.

Splints may cause mild lameness and they are will be hot, painful and inflamed. Blind splints are located between the splint bone and the cannon bone. These may be difficult to diagnose and pinpoint. Splints may not always cause lameness either. Blind splints will usually disappear on their own, as the body will lay down excess bone in the area to stabilize it.

Horses are usually allowed increased rest and a reduced workload for one to three weeks. The splint will continue to worsen if the horse is not allowed rest. To keep the splint from becoming cosmetically displeasing, many owners and trainers will hand walk and stall horses until the splint has resolved. Horses will return to full work after
inflammation and pain has gone. Blind splints may take longer to heal as the ligament must calcify completely.

Hock Problems

Proper hock angles may vary depending on what type of performance the horse is involved in. A racehorse may have superior ability if the hocks are more angled and wider ranges of angles are acceptable for jumpers and soundness.

Hocks that are less than 150° are termed sickle-hocked. These are more likely to develop disease and problems, but many may remain sound when managed effectively. Extremely angulated racehorses will have problems and develop bruising in the ergot region.

Hocks that are greater than 170° are more prone to develop thoroughpins, which are caused by strain on the flexor tendon sheath. These hocks are often called post-legged. They may also damage the upper portion of the suspensory ligament. If the horse also has long pasterns the horse may damage the middle and lower portions of the suspensory ligament. This condition is common in older broodmares. This condition can also end the careers of middle-aged performance horses.

Hocks that have been termed “cow hocks” are those horses that stand with the feet wider than the hock or the horse’s hocks are closer together but the cannon bones are vertical. This is often termed “knocked-kneed” or “x-legged.” These horses are not generally a cause for concern in everyday use but they are unlikely to be very collected. As collection is increased, the horse will receive more stress on the hocks.

Bog Spavin

Swelling in the hocks or “bog spavin” is related to osteochondrosis dissecans (OCD) lesions. This condition is often inherited and most horses will grow out of any OCD problems they have when they are young. They may come back due to stresses from poor conformation. Bog spavins characteristically caused by an increase in synovial fluid in the tibiotarsal joint of the hock.

Bog spavins do not usually cause lameness themselves. The joint may have a degenerative disease, OCD, or excessive strain on the joint capsule. Horses that are used for hard stops in events such as reining, calf roping, barrel racing and similar events may be more prone to developing hock joint problems or swelling. The bog spavin is swelling and does not change the bone structure in any way. Bog spavins may be present with or without lameness.
A vet will usually x-ray the hocks affected to check for bone abnormalities. The underlying cause of the swelling must be alleviated in order for the bog spavin to go away. If drained, it will simply refill. Some horses may receive injections of corticosteroids or hyaluronan to reduce inflammation in the area. The veterinarian will also prescribe rest and controlled exercise.

**Bone Spavin**

Bone spavin is similar to ringbone in the pasterns. This is a bony growth that develops in the lower hock joint of the horse and is caused by osteoarthritis. Bone spavins may end careers of high performing horses. Bone spavin is the final phase of degenerative joint disease in the lower hock joints. The tarsometatarsal and the distal intertarsal joints are the most commonly affected joints. There is more than one type of bone spavin.

Jack spavins are those large lesions on the tarsal and carpal bones. If the lesion occurs higher in the joint than usual, it is called a high spavin. Those that are on the small tarsals are called occult spavins and those that do not affect the bone directly are called bog and blood spavins.

Cartilage compression causes the cartilage between the upper and lower tarsal bones to become compressed and eroded. Similar to what happens in humans with their knees and spinal discs. The joint spaces shrink as new bone grows to stabilize the joint. Uneven loading of pressure can also cause excess compression of the cartilage and bone on either side of the joint or the area that receives the most stress. If a joint is stressed on the bone surface, bone spurs may occur in the joint.

Poor hock conformation, poor hoof trimming, and certain types of activities may cause bone spavins. The same types of events that cause bog spavins may result in bone spavins as well. Other events include dressage, jumping and Standardbred racing may cause bone spavins due to concussion and hock flexion. Young horses may develop juvenile spavins from doing too much work to early.

Bone spavins are typically signaled through sporadic and vague hind limb lameness. The horse will typically land on the toe first, which may wear quickly as well as swelling and short strides in the one leg.

The bone changes are irreversible but proper management of the proper can reduce the progression of the bone spavin. NSAIDs will help relieve pain and lameness and hocks may also be injected with corticosteroids. These injections are temporary and many horses will receive them on a regular basis. Injections are especially popular with horses in rodeo or reining performance. Cutting horses may also require hock injections. Some associations will not allow horses to compete if they have been injected. Hyaluronic acid may also be used to alleviate pain.

Corrective shoeing will help horses with heel support. Horses should be lightly exercised daily, but lunging should be avoided as it puts uneven strain on the joints. Pasture
turnout does not always help these horses if they do not move around and exercise themselves. In some cases, surgery may be required and the joint will be fused to stabilize the joint and relieve inflammation. The majority of these horses will not be able to maintain high performance activities.

**Coffin Bone Problems**

The coffin bone is a wedge shaped bone that conforms to the wall of the hoof. The coffin joint allows flexion and extension. This bone is completely enclosed inside the hoof. Damage to this bone can cause numerous other problems to develop in the horse that will affect soundness.

**Laminitis**

Laminitis is a serious condition that is characterized by the loss of attachment between the lamellae of the inner hoof wall and the coffin bone. This is also known as founder; however, laminitis may be caused by other instances than overloading on starch from grains. There are three phases of laminitis and progression may occur over time or very quickly depending on the severity.

There are thousands of finger-like projections called lamellae attached to the inner hoof wall. In laminitis, the weight of the horse and the forces of movement move the coffin bone down until has caused damage to arteries and veins that are located in the inner hoof wall. The tissues of the coronary band and sole are also damaged. This causes sever and unrelenting pain for a horse. This is also a pain that they cannot easily escape because they stand on their feet. These horses will typically sit back on their rear end like a dog in order to relieve the pressure on their front hooves.

There are three phases of laminitis including developmental, acute and chronic. The developmental phase is when the horse experiences some sort of problem with one of the following systems:

- GI
- Reproductive
- Respiratory
- Kidneys (Renal)
- Hormonal (Endocrine)
- Musculoskeletal
- Skin
- Immune

This problem exposes the lamellae to trigger factors. These factors reach the lamellae through the circulation of the horse and the separation from the coffin bone begins. This phase may not be apparent at all and the horse may move into the acute stage with no
warning. This is true in the case of grass founder. Grass founder is very rare and is not something that is commonly worried about, but under certain conditions such as very cold nights and very sunny days, the grass may produce enough sugar to cause fermentation in the horse’s hindgut, which produces trigger factors. Specific problems that cause trigger factors include grain overload, retained placentas and tying up. The feet may not even be thought of until the first sign of foot pain in the acute phase.

The acute phase is the onset of the foot pain caused by movement of the coffin bone. X-rays are usually obtained to determine movement of the coffin bone. If the laminitis was caused by disease, the horse will be at risk of death during this phase. Those that survive have the opportunity for complete recovery. Some horses are not able to recover completely depending on how much movement has occurred in the coffin bone. The horse will become what is known as a “sinker.”

A horse that is a “sinker” exhibits complete loss of attachment to the inner hoof wall and the coffin bone has dropped to the bottom of the hoof. This is the chronic phase of laminitis and signs can range from mild lameness to severe pain. The horse may suffer further breakdown of the lamellae, a sloughed hoof wall or the inability and the horse may even go down. It is important to remember that the breakdown begins prior to the first sign of pain. Foot pain is the outward sign that lamellar destruction is occurring.

The destruction of the lamellae is caused by the body producing certain enzymes in response to stresses of normal equine life. This enzyme is referred to as MMP and is used to maintain the correct shape and structure of the lamellae. When MMP is not inhibited, the enzyme dislodges the cells that make new lamellae from the basement membrane of the hoof. The basement membrane begins to peel away in sheets and causes the lamellae to become separated from the coffin bone.

Another component of this process is circulatory changes in the hoof because the capillaries the feed the hoof are sloughed away with the basement membrane as well. The loss of capillaries causes the blood to travel only through the arteries and large veins in the hooves and causes the pulses that are felt during the acute phase.
The only true prevention of laminitis is proper management of the horse. The horse must not be allowed to self-feed; as they have no mechanism in their brain that tells them they are full (this is why horses always act hungry). If the horse does begin to show signs of laminitis call your veterinarian immediately. Vets also suggest that you keep the feet cold as the blood vessels are constricting. Horses do not seem to regard extremely cold feet as uncomfortable and they may even be placed in an ice bath. Laminitis does not occur if the blood vessels are constricted, which suggests that the trigger factors will only cause laminitis if they reach the lamellae when blood vessels are dilated, they are at a high concentration and the occur over a long enough period of time. Keeping the blood vessels constricted with cold water will help prevent the laminitis or keep it at a lower level then if it was left unattended until treatment begins.

Fractures

Fractures of the coffin bone can occur for various reasons. These are fairly uncommon and are commonly caused by trauma such as kicking something hard or large force placed on the bone. Force may be from something as simple as running on hard tracks or ground. They can also occur from a penetrating object or stepping on something that causes pressure on the bone. Standardbreds, Quarter Horses and Thoroughbreds commonly get fractures and they may also occur in foals. Front legs are more commonly affected.

Fractures may cause moderate to severe lameness, the lameness severity will depend on the location of the fracture. A veterinarian will perform several tests to check for fractures such as using hoof testers and nerve blocks. Hoof testers apply pressure to the bottom of the hoof where the coffin bone is located. X-rays will also be taken to positively identify a fracture. If the fracture is located in a hard to find area, the vet may also use bone scans to determine the location of the fracture.

Coffin bone fractures may occur in seven different types and severity depends on location and whether or not the joint is involved. Fractures that also involve the joint tend to have a worse prognosis. Arthritis may develop in the joint and low ringbone may develop. Those that do not involve the joint tend to have a better prognosis.

Treatment usually involves stall rest and the use of bar shoes with multiple quarter clips or a forged rim and a full pad. The rim or clips keeps the hoof from expanding with each step is a sort of natural cast for the bone. Horses become more comfortable within a month. Bute can also be used to alleviate pain and to prevent laminitis in the other leg while the horse is resting. The quicker the fracture is found, the better the prognosis and a good farrier will be able to create a shoe that will encourage the bone to heal and remain sturdy. There is also a chance that the horse may develop navicular syndrome after the coffin bone has been damaged.

Knee Problems
Injuries to the knee can be difficult for the novice to recognize. As with other lamenesses, the horse with a knee injury will have an altered gait. Flexing the knee is also a good way to identify knee problems. If the horse reacts to flexing, there may be a bone injury in the knee. A horse with an injured knee will throw the leg out to the side and will impact the ground on the inside of its hoof to avoid pain. Horses may also dip their head down on impact. Knee injuries tend to be very serious and vet should be alerted.

**Bone Chips**

Bone chips or chip fractures commonly occur in the joints of horses, especially those that are intensive training and exposed to high performance conditions. These fragments cause irritation in a horse’s joints. Chips may occur for two reasons:

1. The bone has developed defectively such as in OCD and the bone fragments under normal conditions
2. Uneven weight loading or trauma to a normal where the bone is fragments are under uneven pressure

Chips that break off completely will usually find their way into a joint, such as a knee joint. The chips are then trapped and then isolated by scar tissue. If this happens at a young age, the chip will be surrounded by scar tissue and will be smoothed over so that it is non-irritating. Painful inflammation is caused by chips that are in the joint and irritate the joint. Debris shedding is a common cause for this and if the debris shedding can be stopped the joint will heal. Arthritis is the result of chronic debris shedding.

Chips may range in size, but it is not necessarily the size of the chip that matters. What matters is the amount of debris that is shed into the joint. The American Association of Equine Practitioners estimate that between 20 and 50 percent of horses will have a chip fracture at some point in its life. About 15 percent of horses will acquire chips during adolescent play.

The debris shedding causes painful inflammation resulting in lameness and poor performance. The majority of chips do not break off completely and only pieces will be rubbed off of the area. This results in debris shedding in the joint and possibly painful bone-to-bone rubbing.

To treat a chip that cases lameness, the chip may be removed by arthroscopic surgery and rest after surgery. Chips that are irritating the joint and causing fluid build-up can be controlled through the use of hyaluronic acid and anti-inflammatories.
Congenital Flexural Deformities

This occurs in foals that may have been malpositioned in the womb, genetic predisposition, poor nutrition or exposure to toxins. These usually occur in the knee and fetlock joints of the foal and may keep the foal from being able to extend a joint completely or the restriction of the joint in a flexed position. The severity ranges from mild flexion to extreme flexion. Some foals may respond well to therapy if they have severe flexion of the fetlock, however, severe flexion of the knee has a poor prognosis.

First, the veterinarian must determine whether or not the foal can stand without assistance. If the foal can stand, the deformities do not need specific treatment. These foals will benefit from exercise in a controlled environment. The tissues, ligaments and joint capsules will begin to stretch and become normal. If the foal is unable to stand on its own, the vet will apply splints to help stretch the leg and load the tendons. The splints are left on for a maximum of eight hours. Corrective shoeing may be used for toe extensions that will aid in fetlock flexion. Most of these flexion problems will go away as the foal grows and uses the tendons and ligaments. Even those that require surgery of the accessory ligaments have been used for riding, racing and competition.

“Popped” Knees

“Popped” knees occur when the front of the carpal joints enlarge and the knee appears to be “popped out.” This enlargement is commonly due to the synovial structures being inflamed. This inflammation may occur from chips in the joint, developmental abnormalities, infection and ruptured tendons in the knee. Treatment varies depending on which structures are inflamed and affected. An early and accurate diagnosis is key in determining the cause and the treatment.

For inflamed tendon sheaths and anti-inflammatory, icing, bandaging, sweating and rest will allow the horse to recover soft tissue.

For infections, the area will be drained and flushed. Horses will receive antibiotics and rest.

For foals that have developmental abnormalities, the leg may be put in a half-cast for a couple of weeks. After removing the cast, the leg will be bandaged and the foal will be stalled for a couple of months.

Bone chips may be removed if they are causing major irritation. Otherwise, many horses live with them. Horses that suffer from slab fractures may require surgery and screws.
Overtraining is the number one cause of knee problems such as this in horses. Try to reduce the situations that cause trauma to the knee joint. Young horses that are not capable of withstanding the weight of a rider may experience ruptured tendons and knee problems.

**Fractures**

Equine fractures pose a very specific problem in the equine industry. Unlike humans and small animals, horse fractures are difficult to repair and heal much more slowly. Thirty years ago, most horses were euthanized because of the problems that occur when trying to repair the fracture. Horses are extremely large and their limbs are very fragile. You cannot expect an animal of this size to keep the weight off a fracture long enough to heal. Our technology of repairing fractures has increased dramatically.

Today, we are able to operate on horses and use screws and plates to repair fractures. These allow the horse to stand while the bone heals. What was once a life-threatening event is now something that can be operated on and fixed. Due to the high demands we impose on our horses, fractures have also become more prevalent. The chance of repair depends on how the horse was transported and managed prior to arrival on the operating table. If the horse is allowed to walk on the broken bone or transported without proper support, the fracture may become irreparable.

**Green Stick Fractures**

These fractures occur because of stress and are incomplete fractures. These fractures occur when the bone only splits or cracks without breaking into pieces. These fractures are usually caused by long-term and repeated stress. The bone becomes weak and cracks. These are common in performance horses.

**Complete Fractures**

These are fractures in which the bone has broken into pieces. A simple complete fracture is when the bone only breaks into two separate pieces. A comminuted fracture occurs when the bone breaks into more than two pieces. These types of fractures occur during intense exercise, from a kick or severe accident.

**Compound Fractures**

A compound fracture is when the broken bone penetrates the skin. Because equine skin is thin, this is very common in severe fractures involving sharp bone fragments.
Diagnosing Fractures

The site of most fractures swell quickly and horses show immediate pain and distress. The leg might hang in an awkward position or the bone might penetrate the skin. A horse with a complete fracture may attempt to move on three legs, however, this should be avoided, as they cannot function on three legs. A horse with a fracture will often have considerable anxiety and panic. If the horse is allowed to continue to move, the horse may damage the leg beyond repair.

Any lame horse should be examined for incomplete fractures. Stress fractures are difficult to detect, even through x-rays. Nuclear scintigraphy is commonly used to detect these hidden fractures. Horses should be stabilized as quickly as possible because they will frantically try to stabilize themselves on the broken bone. Movement of jagged bones can cause damage to muscles and nerves as well. Stabilizing and splinting a fracture limb will help to reduce anxiety because he can regain control of his leg even though no weight can be applied. Most horses will rest the leg after it has been stabilized. Some horses may require sedation in order to splint the leg and perform tests.

Treating the fracture involves maneuvering bone fragments into proper alignment. Once aligned, the leg is fixed in position with casts, pins, screws or plates. Simple fractures may only require a fiberglass cast to hold the bones in place. Frequent cast changes may be required and the horse has to be put under general anesthesia for this process. The duration of a cast depends on how the horse reacts to the cast. The skin may become sensitive and the muscle weak. External and internal pins may be used to fix compound fractures. Bone density may also suffer because horses requiring plates do not absorb as much weight in the bone, as the weight is passed to the plate.
Chapter 2

Ligaments and Tendons

How Ligaments and Tendons Function

Ligaments and tendons are what hold a horse together so to speak. They are responsible for a horse being able to move and perform in a variety of different activities. Tendons and ligaments are composed of collagen, a fibrous protein that is capable of great strength. The tendons and ligaments bear almost 70 percent of the horse’s weight. Many tendon and ligament injuries can be overcome with proper treatment and rest and the horse is able to return to normal activity. Many other horses suffer severe injuries that are career ending.

Ligaments connect bone to bone while tendons connect muscle to bone. Both play a significant role in the biomechanics of the horse. The tendon is also surrounded by a tendon sheath that is comprised of synovium and synovial fluid for fluid movements. At certain points on tendons, ligaments surround parts of the tendon sheath. They may either act as pulleys when muscles contract or as tendon guides. An example of this is in the joints where a tendon needs to be guide so that the joint can bend. Because tendons connect from muscle to bone they are able to create movement. Ligaments essentially help the tendons function properly and act as anchors.

Causes of Injuries in Ligaments and Tendons

Tendon injuries are most common in the superficial digital flexor tendon and the deep digital flexor tendon. Suspensory ligament injuries and bowed tendons are common injuries in racehorses. Tendon injuries can be extremely small and minor or severe ruptures. Mild tendon injuries can cause intermittent lameness and causes your horse to feel “off” one day or in one direction and then not the next day.

Tendons are usually injured through a sudden increase in weight load, extreme stretching and those horses that are used in high performance activities are more susceptible to these problems. Many horses that are suffering from a tendon injury will begin to show pain and discomfort immediately. Tendon injuries characteristically have swelling, bleeding into the lesion and swelling from inflammation.

There are several things happening at the cellular level during a tendon injury. The injury will leak fluid and blood, which cause the remaining normal fibers to weaken and separate. The body is also trying to fix the problem and will try to clean up the damaged tissue. The body releases hydrolytic enzymes that consume damaged tissue and breaks it
down into smaller sizes that can be carried through blood circulation. These enzymes may actually do more damage than good because it will cause more damage to the fibers and glue of the tendon. The injury may also cause damage to blood vessels which can lead to cell death.

Recognizing tendon and ligament injuries can be difficult if you don’t know what your horse’s normal tendon looks and feels like. A good routine to get into is feeling your horse’s legs before and after riding so that you will be able to find any abnormalities in the future.

Signs of a tendon or ligament injury include:

- Lameness
- Swelling
- Heat
- Pain on touch

By checking your horse’s legs everyday, you will be able to detect moderate to severe injuries on your own. Mild injuries are more difficult to detect, as horses may not even limp or appear lame. Horses with intermittent lameness should be seen by a vet to determine the cause of the “off and on” nature of the injury.

**Suspensory Ligaments**

The suspensory ligaments are located behind the cannon bone between the knee and the fetlock of the front legs. In the hind legs, the suspensory ligament is attached from the stifle to the hock. On the hind leg it is divided into medial and lateral branches that are attached to the sesamoid bones of the fetlock joint. This ligament is a modified muscle. The ligament is made up of tendon fibers and residual muscle fibers. Some horse breeds have more muscle fibers than others. For example, the Standardbred has a higher proportion than Thoroughbreds. This ligament functions to support the fetlock during the weight-bearing phase of a stride.

Several injuries are due to uneven weight loading of the ligament. This occurs on uneven ground surfaces or because of poor foot balance. Overloading the ligament will cause the collagen fibers to tear as well as small blood vessels. The term used for inflammation of the suspensory ligaments is *desmitis*.

**High Suspensory Disease (Proximal Suspensory Desmitis)**

The suspensory ligament can be divided into three separate regions. The proximal part is the upper part of the ligament. This ligament is capable of getting Proximal Suspensory Desmitis (PSD) and this disease may occur in both the front and hind limbs or both at the
same time. Lameness can be sudden and can be remarkably temporary. The duration of lameness depends on how hard the horse is worked within 24 hours. Lameness is usually mild unless the lesion in the ligament is severe. This condition occurs mostly in racehorses, as mild lameness in one limb may not be quickly recognized.

Lameness is often more easily observed on soft ground and when working in circles. The affected limb on the outside of the circle will show obvious lameness. Riders may also feel the lameness while an observer may not see it. Working a horse hard to reproduce lameness may cause additional damage. Lameness may not be seen in a working trot but may be apparent at an extended trot.

Nerve blocks are often very effective and alleviate lameness with about ten minutes. Pain in other structures may also be alleviated. If the injection is not placed into the ligament and in a structure near the ligament, the lameness may persist.

Ultrasonography is the only accurate method of diagnosing PSD. The limb will be affected in two different planes and high quality images will be necessary to locate lesions. Measurements of the ligament as well as knowledge of previous injuries will aid in detecting any abnormalities in the ligament.

In most cases a forelimb PSD case will respond to stall rest and walking exercise for three months. Correct foot balance is also essential to keep horses from re-injuring themselves. Horses that are brought back to work too quickly will have a higher chance of recurrent injury. Most horses will come back to their full athletic ability.

Desmitis of the Branch of the Suspensory Ligament

This injury is the easiest ligament injury to diagnose. The ligament has obvious swelling, which fills the hollow between the ligament and the cannon bone. The branch is always painful to touch, however, the horse may not show lameness. These horses will benefit from rest, anti-inflammatories and controlled exercise. The prognosis is usually poor for these injuries.

Suspensory Desmitis Secondary to Splints or Fractured Splint Bones

Splints occur in many horses and especially in young horses. This injury occurs when the splint bone causes damage to the adjacent ligament. Often the blind splints cause most of these ligament injuries.

Suspensory Breakdowns

During high-speed performances such as racing or eventing, the suspensory ligament may suffer complete failure. This occurs due to acute over-loading of the support bones in the fetlock during the weight-bearing phase of a gallop. The suspensory ligament or the sesamoid bones may break depending on the fitness level of the horse. A fit horse is more likely going to break a sesamoid bone, as the ligament is strong from training. The
horse will suffer acute lameness and extreme pain when the horse lands on the fetlock joint. This is especially devastating to horses that have high-performance careers. If possible the horse is usually salvaged for breeding.

**Avulsion of the Origin of the Suspensory Ligament**

This condition is common in the forelegs of a horse. This injury involves the tearing of the attachment of the ligament at the back of the metacarpus bone. The signs vary from acute and severe lameness to chronic lameness. Swelling is not obvious because the ligament is surround by the canon and splint bones. Horses that suffer from this injury will usually be lame when trotted in a circle with the injured leg on the outside. The diagnosis involves blocking nerves, ultrasound and radiography. The injury is treated by stall rest for 4-6 weeks and paddock rest afterwards for 6-8 months. After the proper amount of rest, the horse is usually able to return to competition.

**Tendons**

**Bowed Tendons**

This injury of the superficial digital flexor tendon is due to tearing. The tendon is located in the middle of the cannon bone region. The tear causes a curved and bow-like swelling on the back of the leg. The swelling is usually located behind the cannon bone but may also be behind the knee. This injury is most common in racehorses but can occur in any horse that is used in performance. The tendon heals very slowly and the torn area becomes covered in fibrous scar tissue. The tendon will heal but will be less elastic and may be easily reinjured.

When the tendon tears, the area begins to bleed and will develop acute swelling and pain. The horse may or may not appear to be lame and many horses with serious damage are not lame, but they are definitely not sound. The area begins to accumulate fluid and swells. Icing or cold hosing and bandaging help to reduce inflammation and swelling temporarily.

The only true manner of diagnosing a bowed tendon is through ultrasound. A normal tendon will appear to be bright white while an abnormal tendon will be various shades of gray or black. A veterinarian is able to determine the presence and severity of tendon damage through ultrasound. If the injury is very serious, the tendon may be rupture and have complete loss of tendon fibers. This usually results in loss of support in the limb.

Most horses will receive stall rest for two months to eight months depending on the severity of the injury. Exercise will slowly be increased and horses may be jogged up to five minutes or turned out into a small paddock. Exercise will gradually increase over a period of months depending on the healing of the tendon as determined by additional
ultrasounds. Tendon rehabilitation takes a considerable amount of time and owners will want to prevent as much re-injury as possible. The horse’s healing process is monitored by regular ultrasounds. Most horses will be able to return to an active lifestyle, however, serious injuries may require that a horse pursue a less strenuous career. Many young horses will suffer from breakdowns such as ruptured tendons during intense race training.
Chapter 3

Muscles

There are several causes for muscle problems in horses. The main reason is because the horse is either worked too hard or not properly conditioned. Overworking and training a horse can cause him to become stiff and sore. This is similar to when humans go to the gym. Have you ever noticed how sore you are the next day if you haven’t worked out in awhile? This is the same feeling your horse has if he is not properly conditioned prior to strenuous muscle use. Many horses may feel stiff to the rider. If the horse is a jumper, they may be sloppy over fences or refuse them all together. The majority of these horses only need rest and to be worked gradually until their bodies are ready for more strenuous use.

Tying Up and Stiffness

Tying up is muscle tension that is chronic. This is often due to overworking a horse. When a muscle is actively working, it produces lactate as part of their normal metabolism. Too much lactate will cause lactate acidosis, which is a lowering of the pH in the muscles and the body. The lowering of the pH in the body causes general fatigue in the body. Excess lactate causes the muscles to not be able to relax after contracting. Large muscles group may seize up and remain in contraction.

Areas that suffer from this constant contraction are the neck, back, shoulders and areas that have been previously traumatized or have attempted to compensate for the condition. In mild tying up, the horse is extremely sore and stiff. In a full-blown case, the horse is unable to move at all. Prolong muscle fatigue is capable of affecting other systems of the horse including the skeletal, circulatory and respiratory systems.

Symptoms that indicate tying-up include:

- Discomfort and irritability
- Very short strides
- Profuse sweating
- Contracted muscles and stiffness
- Difficulty in moving
- Elevated pulse
- Labored breathing
- Brown urine from the kidneys filtering myoglobin from the blood. Myoglobin indicates severe muscle damage.
- Inability to sleep

Treatment is generally rest. The horse should be allowed to rest in a warm and dry area that is quite. The horse should not lie down and should be offered water to help cleanse
the kidneys. If the stiffness is not as prevalent the next day, the horse should be walked slowly to encourage the horse to loosen up.

Chronic tying up is called rhabdomyolysis or extreme cramping of the muscles. These horses benefit from a change in diet. Good quality hay and minimum levels of carbohydrates to maintain the right energy level will help these horses. A higher level of fat in grain can also provide enough energy without a high carbohydrate level. Many horsemen have also reported that proper levels of electrolytes have kept horses from tying up frequently. These horses should also be exercised on a daily basis to keep their muscles working properly.

“Ace” (acetylpromazine) popular tranquilizer is often used in these horses to encourage them to relax. This tranquilizer also helps to reduce muscle contractions. Phenylbutazone or “Bute” is a common pain reliever that also encourages the horse to relax. If a horse is dehydrated, they may require intravenous fluids and electrolytes. DMSO is also used to help contracted muscles.

Tying up is more prevalent in young Quarter Horses and Thoroughbreds that are not conditioned. Horses that are conditioned and well-trained are able to deal with higher levels of lactate and do not tie up as frequently. Horses that are trained at a gallop but not allowed to reach full racing speeds seem to tie up more frequently.

**Hyperkalemic Periodic Paralysis (HYPP)**

This condition is widely known throughout the United States because one of the most popular American Quarter Horses in the country suffered from this condition. A world champion halter horse, Impressive suffered from periodic muscle paralysis. This condition has often been called “Impressive Syndrome” and is seen in numerous offspring of this beautiful stallion. Halter horse breeders strive for excellent muscling and this is the one trait that Impressive was especially known for. This excellent musculature is the signature trait of this disease that many of the horses suffer from. Because of the condition, many horse owners and breeders avoid horses with Impressive bloodlines even though the horses are excellent prospects for the show ring. The disorder is genetic and not only affects horses, but also affects humans.

HYPP causes the skeletal muscles of the horse to stiff and relax involuntarily. The nerve cells send a signal to the muscle to contract but the cell tries to contract numerous times. This causes the muscles to become stiff, paralyzed weak, collapse and even die. Many horses have been known to collapse during training and competition. This can be an extremely dangerous situation for both horse and rider.

The cause for this seems to be related to the sodium channels in the muscle cell membrane. These membranes allow sodium to flow in and out of the cell. When the electrical signal from the nerve arrives at the cell, the change in voltage opens the sodium channels and sodium flows into the cell causing the cell to contract. In a normal muscle cell, the channel would immediately close, however, with HYPP the sodium channel is
unable to shut itself, which causes numerous electrical signals to be sent to the cell. This seems to be a genetic defect.

Drugs such as anesthetics and anti-epilepsy medications have been used in these horses. These medications help the cell function almost normally.

**Reasons for Muscle Loss**

There are various reasons that a horse may lose muscle mass. Generally, this occurs in horses that suffer from chronic muscle problems and conditions. There are numerous infections that can cause muscle atrophy. These problems may also be caused by poor nutrition, diet, and conditioning. Horses that are allowed to stand in a stall for prolonged periods of time with no exercise will lose muscle mass and may also lose bone density making the horse prone to fractures as well.

**Equine Motor Neuron Disease**

Equine Motor Neuron Disease is a neurodegenerative disease in adult horses that is similar to Lou Gherig’s Disease in humans. There are two forms of this disease that have been found in horses.

The subacute form is characterized by trembling, spontaneous muscle contractions, lying down frequently, frequently shifting weight in the rear legs and abnormal sweating. The horse may also hold its head unusually low. The appetite and the gait of the horse may not be noticed, however, horses have lost weight and muscle prior to the beginning of the trembling.

The chronic form is characterized by the horse stabilizing and not trembling or having muscle contractions. There are also various degrees of muscle atrophy. The horse may regain some muscling, but the tail head is frequently held in an abnormal position.

Vitamin E deficiency has been found to be an underlying cause of the condition. The lack of vitamin E is believed to have caused by an oxidative disorder. Vitamin E is an antioxidant and supplemented horses have not shown symptoms of this condition. The condition typically appears in horses that have been off pasture for a long period of time. Pasture contains natural amounts of vitamin E that is necessary in a healthy diet. This condition may be prevented by allowing horses access to pasture and green forage.

**How to Regain Muscle Mass**

Muscle mass may be regained by a gradual increase in exercise. Horses that have suffered from muscle conditions should be brought back slowly. Many of these horses may require daily exercise, which should help prevent loss of muscle. Horses that are stalled because of injuries such as fractures should be brought back into condition slowly.
The loss in condition not only affects the horse’s large muscles but their heart as well. Just a human would not go out and run ten miles in one day, do not expect your horse to be able to do this as well if they have not been receiving adequate exercise and condition. Horses should be brought back slowly by allowing them access to pasture or paddocks so that they may exercise themselves at first. Horses may also be hand walked or lunged slowly at first. They should be allowed time to rebuild their cardiovascular strength as well.

When lunging in a round pen to regain muscle mass, be sure that you work in both directions as lunging causes uneven loading in the muscles. Horses that have been suffering from tendon or fracture injuries should not be lunged in circles. Instead try lunging them down the rails of the arena or in very large circles in an arena. When horses can be ridden after an injury, be sure to allow them time to warm up prior to more strenuous work and have a cool down period as well. If the horse is able to trot, trotting is an excellent warm-up with interspersed walking. The actual training period may contain faster gaits if the horse is able to perform them.

**Equine Massage Therapy and Other Treatments**

Equine massage therapy has become very popular in recent years. Many professional trainers have turned to massage therapy as a means to keep their horses relaxed and to prevent tying up and muscle stiffness. Horses that have not responded to other treatments have often responded favorable to massage techniques.

Equine massage is used in many cases to provide healthy muscle function. In many cases, you may be able to uncover and treat muscle soreness before it becomes too serious and before the horse injures himself because of it. Massage therapy is not meant to correct muscle problems or rehabilitate horses but to enhance athletic performance. The U.S. Equestrian team regularly uses massage methods on their horses and massage has also become popular in the horseracing industry. Recently, amateur horse show competitors have also begun to use massage on their horses.

There are various organizations that offer equine massage therapy certification. There are also numerous individuals who are trained and have received this certification. Before seeking massage therapy, horses should be checked by a veterinarian for underlying causes of muscle soreness and stiffness. In some instances, massage may actually make the condition worse rather than helping the horse. If massage is a viable option and the horse is sore, the vet will tell you whether or not massage will help the horse.

In addition to massage, there are various supplements and treatments that are available to horse owners to employ in their horse’s diet. Owners should consult their veterinarian before employing any of these supplements. There are various weight gainer and muscle mass supplements that are not necessarily healthy for the horse and just provide the horse with a large amount of unnecessary calories.
1. Levator nasolabialis  
2. Zygomaticus  
3. Buccinator  
4. Facial vein  
5. Levator labii sup. proprius  
6. Masseter  
7. Scutularis  
8. Parotido-auricularis  
9. Rhomboideus  
10. Jugular vein  
11. Splenius  
12. Sterno-cephalicus  
13. Brachiocephalicus  
14. Serratus cervicis  
15. Trapezius  
16. Pectorals, deep  
17. Supraspinatus  
18. Deltoid  
19. Pectorals, superficial  
20. Biceps brachii  
21. Brachialis  
22. Ext. carpi radialis  
24. Deep flexor  
25. Ulnaris lateralis  

26. Serratus thoracis  
27. Triceps brachii  
28. Latissimus dorsi  
29. Obl. abdominis ext.  
30. Aponeurosis of obl. abd. ext.  
31. Lumbodorsal fascia  
32. Gluteal fascia  
33. Tensor fascia latae  
34. Gluteus superficialis  
35. Fascia lata  
36. Biceps femoris  
37. Semitendinosus  
38. Long digital extensor  
39. Soleus  
40. Lat. digital extensor  
41. Gastrocnemius  
42. Saccrococcygeus
Proper care of the hooves is essential in the horse. Problems in the feet of the horse are often the cause of the numerous other lamenesses that horses endure. They are also the cause of numerous other conditions that make a horse unsound. Problems with the feet can cause a horse to be worthless and can often be career ending.

Hooves should be trimmed on a regular basis. If the horse does not require shoes, it is not recommended the horse be shod. Many horses live healthy and active lives when left unshod. Despite beliefs by many people, unshod horses are able to be ridden on a variety of footings and often perform in a variety of different competitions without shoes. Granted, there are several conditions that a horse may develop and treatment may require corrective shoeing to make the horse more comfortable. When the horse is shod, the hooves should be trimmed and shoes reset on a regular basis to encourage a healthy foot.

**Reasons for Lameness Caused by Hoof Injuries**

There are several causes for lameness caused by hoof injuries. A poor balanced hoof can lead to misalignment in the bones and uneven loading in muscles. Other injuries include punctures and penetrating wounds. There are several factors that help a veterinarian and a farrier determine proper treatment. In many cases, a veterinarian will work with a farrier to correct a problem that a horse may have. This is common in conditions such as navicular, founder and coffin bone injuries.

**Hoof Balance**

Proper hoof balance may actually depend on the conformation of the horse as well as the event the horse competes in. Dr. David Hood of Texas A&M University recently spoke at the American Farriers Association Convention on this subject and said, “The horse’s
conformation allows peak mechanical stability. For every horse, there is a conformation that maximizes performance. The most mechanically sound foot is not necessarily the most athletic foot.” Texas A&M has done extensive research on hoof balance and found that no foot is perfectly symmetrical. He also found that a horse will shift its weight over one hundred times in an hour. Research also found that a horse with laminitis will shift its weight constantly but tends to favor one foot over the other. They may keep weight on one foot longer than the other. The horse tends to bear most of its weight at 28 percent on the front feet and 22 percent on the hind feet. This shows that horses naturally have uneven loading on the front versus the hind feet. Hoof balance should consider the amount of weight that the horse bears on the front feet versus the hind feet. As owners, we should do our best to make this more comfortable for the horse through proper hoof care.

Another consideration to be made in balancing the horse’s feet is that the hind feet are not under the hocks. Rather they are inside the hocks and have what is called a “base narrow” conformation. According to Dr. Jay Merriam of Tufts University, “Applying geometric balancing goals to such hind feet would be a disservice to the horse.” Merriam has performed extensive research on the leg bones and the symmetry of the hoof. In many cases, the bones of the horse may differ and therefore the feet and other joints are affected differently. The hoof should be balanced so that the alignment of these bones are not skewed, otherwise the balancing of the hoof alone causes potential for stress and injury in the joints.

**Club Feet in Foals**

Farriers are often in disagreement on whether or not the clubfoot of a foal should have the heels raised or lowered. In some instances, you may need to do either one or the other and there is not necessarily a right answer to this argument. In some cases, the heels are lowered and the foot gets worse, in other cases, the heels are raised and they get worse.

In many cases, the clubfooted foal is not examined until it is too late. The check ligament has become contracted and cannot be re-lengthened without surgery. This also means that they original source of pain for the foal is gone because the body has tried to fix itself. The key to helping the clubfooted foal is to get to the problem early. For foals, the source of pain tends to be in the foot or the growth plate. The foal has pain in the lower leg such as the fetlock or pastern joints. When the foal is in pain, the muscle begins to contract and pulls the foot up onto the toe. The muscle pulls the tendon up and the check ligament begins to shorten.

The best method is to treat the pain. When there is pain in the laminae, pulling on the laminae makes the pain worse. Lifting the heel will rest the laminae but the ligament will remain contracted. If you lower the heel and extend the toe, the pain will be in the foot and cause more contraction. Many foals will require surgery to fix the contraction and allow the pain to be treated. This is necessary if the hoof is deformed or if the condition remains after shoeing has been attempted. After surgery, the pain must be treated to keep
the condition from reoccurring. Cutting the check ligament allows the tendons and muscles to stretch but proper hoof care is necessary to stretch the tendon and muscle before healing occurs.

A healthy limbed foal will be in at the knee and toed out in proportion. The foal does not have to have totally straight legs until the foal is eight to ten months old.

White Line Disease

White line disease is the deterioration of the inner part of the hoof wall. The white line is the area of distinct non-pigmentation on the inner layer of the hoof wall. This line lies where the hoof wall joins the sole.

White line disease is characterized by a small powdery area along this junction of the hoof wall and sole. The disease may be found in one foot or all four feet. The condition is found in all different breeds of horses. The disease can also affect only certain areas of the hoof wall/sole junction. The deterioration and separation allows fungus and bacteria to grow in the foot. This can lead to further deterioration of the hoof wall.

There are several factors that can cause this disease. Exposure to excessive moisture, unbalanced feet, acute hoof angle and improper trimming are a few. Other more serious conditions such as flexural deformities, clubfoot, hoof cracks, chronic infection and direct trauma. It may also appear with chronic laminitis.

There is no threat to the soundness of the horse until extensive damage has been done. Early signs include tender soles, occasional heat, flat soles, dish forming on one side of the hoof, a bulge on the opposite side of the affected area, slow hoof wall growth, hollow sound when tapped with a hammer and poor consistency in the hoof wall. If the disease goes undetected, the horse will begin to show discomfort. X-rays can determine the extent of damage to the hoof wall.

Many veterinarians and farriers recommend trimming the feet and leaving them unshod. The decision depends on various circumstances such as how much deterioration has occurred in the hoof wall and if there is significant loss of ground surface. Many practitioners choose to use a fitted heartbar shoe as it helps to relieve secondary laminitis.
Several medications are used to help relieve pain and to draw infection out of the hoof. Merthiolate is generally accepted as the most effective medication as well as Formalin mixtures, Fungidye and Medicated Equilox. Cleansing of the hoof is also important and there are several treatments available. Avoid soaking hooves excessively because moistness is often a contributing factor in hoof degeneration.

**Thrush**

Thrush is an infection of the frog. This bacterium causes the horn of the hoof to rot and produces black residue and produces a strong unpleasant smell. The bacteria is “Fusiformis” and lives in the soil where there tends to be a lack of oxygen. Dirt that collects under the hoof is ideal because the oxygen levels of the dirt drop when it is not removed from the hoof. Thrush is also found in horses that are exposed to wet conditions in pastures and are unable to find a dry place to stand.

Poor hoof care is the main cause of thrush. Footpads can also lead to thrush, especially if dirt is able to build up beneath the pad. Thrush rarely occurs in horses that have good foot care and are kept in a dry environment. This is also the best way to control thrush. The frog should be trimmed on a daily basis and scrubbed each day. The owner should look for any cracks on either side around the frog.

The following treatments are commonly used in treating thrush:

- Iodine solution
- Formalin
- Copper Sulphate
- Antibiotics

Persistent thrush may cause a weak immune system or poor hoof growth. Picking the feet out on a daily basis is the best prevention of thrush.

**Abscesses**

Hoof abscesses are inflammation of the corium where pus builds up between the corium and the hoof. This causes extreme pain and lameness. These may occur in both shod and unshod horses. There are two instances in which a horse may develop an abscess. The first may be caused by the sole becoming pierced with a foreign object and the abscess occurs through an infection from the outside of the hoof. This is actually rare and the majority of abscesses are caused by the corium or lateral cartilage areas. This area has usually been depressed for a long time and die off. When circulation is returned to these areas, the dead
tissue is removed from the living tissue and is carried to the outside by the pus. The dead pieces of tissue cannot be transported away through the microscopically small blood vessels of the corium. This process commonly occurs when transitioning a horse from being shod to barefoot.

When contracted hooves are allowed to open, the sole and heel may abscess. These abscesses are commonly found in the heels and bars of the hoof and they may also develop in the tip of the frog. Shoe clips, rearmost nails and excessively long bars often cause abscess to form.

Pain can be prevented if they are found and opened by a veterinarian or farrier. A small, round hole will allow the fluid to drain. The abscess will then be cleaned and closed with a clean healing earth, loam or clay. Bandaging should not be applied as it may restrict circulation and cause more damage to the hoof. The horse should be allowed to live on soft and level pasture or paddocks. Movement will help to increase blood flow into the hoof and helps the hoof to heal more quickly. Twenty-four hours later, the hoof should be cleaned and the hole closed again. The hoof is then left alone for two days and after three days the corium will be covered with the beginnings of newly formed sole. A week later, the horn will be thick enough for the horse to walk on even ground without any stones. After two weeks the horse will be able to walk on uneven ground.

If the hoof abscess cannot be found, then the horse should have a poultice of warm linseed mush and bandaging applied, as this will help draw the infection to the outside of the hoof. The hoof can then be drained and pain will subside when the pus comes out of the coronary band. This process may take a few days. For several days after, the hoof should be bathed daily in water with fruit vinegar. Natural hooves are to regenerate very quickly.

**Sole Bruises**

A sole bruise is no different than a bruise that a person might get after you sustain trauma to an area on your body. In humans, however, we don’t feel pain at the site unless we touch it or hit it against something. In horses, they are constantly on their feet and they have constant pain from the bruise. There are some breeds that are more susceptible to bruising. The Thoroughbred and Quarter Horse has been bred for lower heels, longer toes and flat soles. These features all contribute to a weaker hoof. In addition to the weak hoof, the horses are bred for bulkier and heavier bodies and they have small hooves.

In many cases of the sole bruise, the horse will show lameness by resting the hoof on its toe. The veterinarian will test the hoof with a hoof tester. A sole bruise is caused by the crushing of blood vessels between the horn of the hoof and the internal bones. The crush occurs when a sharp object like a dirt clod or rock. The crushing can be caused by a farrier who places a shoe that is poorly fitted on the hoof. Horses that have poor conformation may also have a higher risk of sole bruises. Some horses have pigmented coloration because of the substantial bleeding in the hoof.
Prevention of sole bruises appears to be the best treatment and management. Stone bruises may go away quickly because the horse does not continue to hit the bruised area. Bruising caused by improper foot conformation such as low heels, flat feet, long toes and thin soles. Corrective shoeing is the best way to help horses with bruised soles. Depending on the conformation of the horse, corrective shoeing and custom made shoes will be better for the horse as they can meet the specific needs of your horse. Soaking and foot packing helps to speed up the healing process and relieve pain.

**Cracks**

The main cause of cracking in the hoof caused by the environment is due to a cycle in which the hooves are soaked and dried out on a regular basis. Just as a wet and dry cycle will cause cracks in your driveway, the same process occurs in the hoof. Horses that are in wet pasture at night and a dry stall during the day will have problems with cracks. Horses that are also bathed on a daily basis and then kept in a dry stall during the day will also have cracks. Cracks can be prevented by keeping the hooves as dry as possible. Horses should not be kept in excessively wet pasture for prolonged periods of time. To protect the hooves, a hoof sealer can be applied twice a week to protect them from excess moisture. This sealant is different from greases or creams that are applied to the surface of the hoof. Sealants are a thinner liquid that penetrates the hoof to provide a moisture barrier.

The hoof wall material is very flexible, but it does have a breaking point. The breaking point in the hoof is at a vertical shear. There are several different types of corrections that are used to repair a cracked hoof such as:

- Bar shoes and side clips
- Burning or rasping a horizontal notch to limit the cracking
- Full rubber or plastic pads to take weight of the crack
- Removing a portion of the hoof wall at the crack site
- Use of screws, wires, suture material, clamps and shoeing nails
- Prosthetic hoof wall repair materials such as epoxies, acrylics, fiberglass, rubber, etc.

Toe cracks are usually the result of underlying hoof wall damage. The toe will separate from the underlying softer tissues due to mild rotation of the coffin bone, white line disease, past hoof trauma and other problems. The best way to recognize these problems is to have X-rays of the foot taken.
The goal to repair is to stabilize the cracked hoof wall and protect the damaged wall in such a way to eliminate pain, bleeding motion at the site of the crack and to prevent further progression in the crack. No two horses will have the same underlying cause of a crack and each case is unique.

The location of the crack depends on the type of repair as well as how effective the repair will be. Cracks can appear in various locations including:

- Toe-wall
- Quarters
- Heels
- Toe
- Bar

Cracks that are further back are more difficult repair. There is not as much hoof horn available to work with and they are subject to greater motion. The depth and the height of the crack is also a concern. The simplest cracks to work with are those that are the result of the hoof management. Horses that have long feet and are overdue to be reshod, for example, are susceptible to superficial wall quarter cracks. Those that are the result of poor conformation are more difficult to deal with. The most difficult hoof to manage is the hoof that has the classic low heel, long toed, thin walled and flat soled individual.

There are a variety of ways that the hoof may be repaired and those methods are determined upon the willingness of the owner to spend money and time on the procedure. A veterinarian and farrier will work together to determine the best repair of the hoof that is within the budget of the horse owner. Those cracks that need repair are those that cause lameness and pain in the horse. These cracks tend to extend to the coronet and may cause chronic laminitis. A horse may experience several superficial and small cracks throughout its life that may be easily repaired through regular hoof care and maintenance. A farrier will be able to alert you to any problems that may be potentially hazardous to the soundness of your horse.

**Cold and Hot Shoeing**

The shoe is designed to protect the hoof of the working horse. The shoe prevents the hoof from being worn away more quickly than the hoof can grow. The farrier is able to protect the hoof by using shoeing techniques that not only prevent the hoof from wear and tear but to help correct any conformation problems as well. Corrective shoes helps the horse remain sound throughout its working life.

The hoof grows between $\frac{1}{4}$ inch and $\frac{3}{4}$ inch per month. The horse needs to be reshod every four to six weeks to remove excess hoof growth. A new set of shoes is fitted to the old shoes if they are worn. The hoof is prepared for either
cold or hot shoeing by leveling the surface of the hoof and removing excess growth. Rasping removes dirt and dead layers of horn so that the shoe may be fit to the correct shape of the hoof.

The shoe is then placed on the hoof through either cold or hot shoeing. Hot shoeing involves the forming of the shoe and heating it until it is red hot. The shoe is then placed on the hoof for a few seconds to allow it to burn a rim where the shoe touches. The rim will show how and where the shoe will lie. If the rim is incomplete, the hoof is rasped again to ensure the surface is level. A well-made shoe will follow the rim of the hoof wall and will be in proportion to the hoof. Hot shoeing offers many advantages as it allows the horse to have a well-fitted shoe that mirrors the hoof wall. The shoes are often more sturdy and stable.

Cold shoeing is when the correctly shaped shoe is nailed to the prepared hoof without being heated. Cold shoeing is the most convenient method for farriers who travel from farm to farm because they can place shoes on a horse wherever they are located. Convenience is the main advantage to cold shoeing, but is also good for horses that do not need a large amount of corrective shoeing because of no hoof problems and good conformation.

Once the fit is perfect, the shoe is nailed to the hoof wall. A farrier will try to use as few nails as possible to avoid causing the hoof wall to become weak and crumble. Six nails per shoes is usually the ideal.

Horses that require extensive corrective shoeing will usually be worked on by a farrier who has the tools to use hot shoeing as they are able to form a shoe that will help the horse remain sound and prevent cracking.

**Corrective Trimming and Shoeing**

Corrective trimming and shoeing has long been a part of curing lamenesses and unsoundness issues in horses. Often times, the veterinarian and farrier will work together to design a shoe or technique that will help a horse become more comfortable and pain free. There are several types of corrective shoeing that are used for various hoof ailments.
**Egg Bar Shoes**

Egg bar shoes have long been used as a corrective shoeing method for horses suffering from navicular syndrome. These shoes are often difficult to be kept on horses suffering from this disease because the hoof horn is not always of best quality. This should be taken into consideration when these shoes are being used on horses. For heels that are collapsed forward, veterinarians recommend that the shoe be fit from the widest point of the foot back and the nails should be placed as far forward as possible. This allows as much heel expansion as possible for the horse.

A common mistake with these shoes is that the shoes fit well in the heels but there is too much toe that it is hard to break over. It is suggest that the foot be trimmed back as far as possible so that the toe can be rolled over. Leaving the toe long defeats the purpose of the shoe and a shorter and rounded toe allows a horse with navicular to rollover in the gait and lessens the concussion the horse feels in his feet.

**Pre- and Post-Operative Farriery**

When it comes to equine fractures, equine hospitals are employing various pre- and post-operative techniques. In many cases, shoes are used to protect a cast and to prevent the leg from moving inside the cast. Shoes have also been used to reduce stress on fractures and to support structures inside the cast. Many horses that are in casts for prolonged periods of time will develop navicular or other stress injuries on the opposite healthy leg. This stress may also be relieved by corrective shoeing.

Limbs that are in a cast will often move and may develop skin irritations. Special cast shoes can be placed on the cast and hoof to protect the end of the cast from wear, reduce movement inside the cast and to prolong the life of the cast. In many cases, a tabbed glue-on shoe may be used and then screwed on through the cast and into the hoof wall. Another type of shoe is applied with a plastic collar and riveted to the cast.