10e Congrès de médecine et chirurgie équine

10. Kongress für Pferdemedizin und –chirurgie

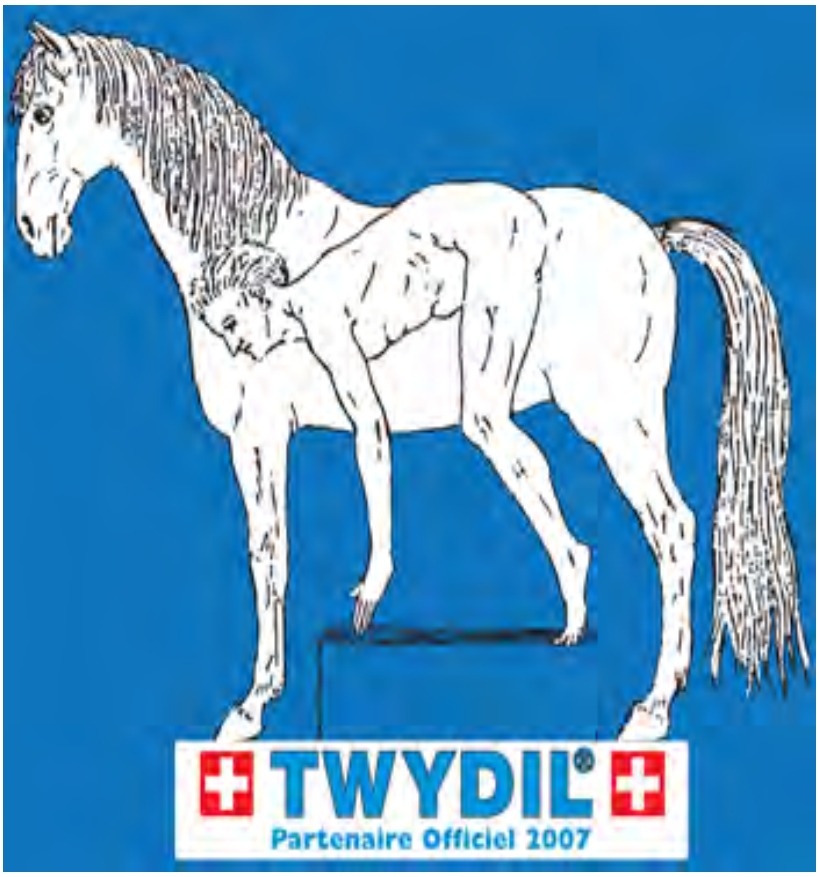
10th Congress on Equine Medicine and Surgery

Dec. 11-13, 2007 - Geneva, Switzerland

La pathologie du pied et son imagerie médicale

Hufpathologie und Deren Bildgebende Verfahren

Hoof Pathology and Medical Imaging



10th Geneva Congress of Equine Medicine and Surgery (Organization : Pierre A. Chuit, Founex; Dr Stephane Montavon, Avenches), Geneva (CH), 11-13 December 2007

PRACTICAL APPROACHES TO HEEL PAIN

Scott Morrison, DVM, Rood & Riddle Equine Hospital, Lexington, USA

INTRODUCTION

Heel pain tends to be common in all breeds, disciplines, and lower limb conformations. Lower limb imbalance and regional overloading or underloading is a common cause of heel pain. Understanding the anatomy and forces involved can help to formulate a plan to redistribute weight-bearing forces, rebalance a foot, and resolve many causes of heel pain. Heel pain can present many ways such as poor performance, obvious lameness, unwilling to stride out, neurological, neck pain, shoulder pain, and back pain. A proportion of heel pain horses will land toe first. This landing pattern compromises the shock absorbing function of the heel and probably creates a "snapping action" on the soft tissue supporting structures in the palmer aspect of the lower limb. Studies have shown that toe first landing causes a higher peak force on the deep digital flexor tendon and navicular bone[1.] Regardless of the presentation, a musculoskeletal examination should involve a through inspection of the foot.

Heel pain can be broken down into 3 general categories :

1) capsule/dermis
2) osseous
3) soft tissue (tendon/ligament/etc.)

Diagnostically these 3 different sources can be differentiated with the use of a good physical exam of the foot, hoof tester exam, radiographs, bone scan, ultrasound or MRI. Some cases can have a combination of pain sources. The majority of cases, which present with heel pain, have an imbalance in the sagital plane (high heel or low heel). Studies show that a foot with a lower angle puts more force on the heel. A foot with a higher angle puts more force on the toe. A normal foot shares the load proportionally between the heel and toe[2,3.] Simply stated a low heel foot overloads the heel region and underloads the toe region and a high heel (club) foot underloads the heel and overloads the toe.

A balanced lower limb has a harmony between the soft tissue supporting structures and the bone column. As a foot becomes more upright (i.e., clubfoot) the bone column becomes more loaded as the bones appear almost stacked upon one another. This conformation overloads the bone column and underloads the soft tissue supporting structures. It is my clinical experience that these horses usually present with ringbone, osteoarthritic form of navicular disease, contracted heels, side bone, etc., whereas the low heel foot underloads the bone column and overloads the soft tissue supporting structures. These cases are predisposed to dermis corium pain in the heel region, tendon/ligament injuries (tendinous, ligamentary form of navicular disease). Often times treatment of any heel pain horse involves improving the sagital plane imbalance.

Before we can understand the different shoeing/trimming techniques to improve this, we must first understand how a foot takes on a given conformation. To simplify, the coffin bone is held in place in the sagital plane via the laminae and extensor tendon, which supports vertically the anterior region of the bone and the deep digital flexor tendon, which, in turn, supports the posterior aspect of the coffin bone. (If the anterior laminae are diseased the coffin bone rotates forward and if the deep digital flexor tendon is severed, the coffin bone rotates backward.)

What gives a foot a given conformation when all structures are healthy and intact ? The deep digital flexor tendon is a major influence on the conformation of the lower limb (in the sagital/lateral plane). A clubfoot has a deep digital flexor tendon contracture or shortening. A low-heeled foot has lengthening (or laxity in some cases) of the deep digital flexor tendon-muscular unit. This can be seen in the upright pastern and broken forward hoof pastern axis in the clubfoot and the long sloping pastern and often broken back hoof pastern axis in the low heel conformation. This phenomenon is also displayed in the anterior wall conformation of the low-heeled feet (convex bull nose) and clubfeet (dished, concave, dorsal wall).

THE ADULT CLUB FOOT

Since the clubfoot overloads the toe and bone column arthritis, sidebone, pedal osteitis of the apex of the P3, navicular bone sclerosis, osteoarthritis, and contracted heels are common pathologies seen. These feet often have increased wall growth in the heels and slow wall growth at the toe. This is the foot's attempt to raise the heels and unload or accommodate the pull of the deep digital flexor tendon. The foot remodels to accommodate all phases of the stride. Since the deep digital flexor tendon is under the most tension just before heel lift off (breakover), it is this phase of the stride, which must be addressed when re-balancing the clubfoot. It has been my experience that significantly enhancing/easing breakover can allow these feet to return to a normal appearance. Most clubfeet can achieve equal toe/heel growth and resolve the anterior dish with these simple mechanics. It is important to realize that we are not "fixing" or resolving the contracture, we are merely accommodating it with simple shoeing mechanics and allowing the foot to return to a more normal shape, with even wall growth, no dish, good anterior sole depth, and therefore be a stronger, healthier foot. High speed video and gait analysis studies are needed to better understand how these club feet respond to shoeing but it appears to me from observing these horses and talking to owners, these horses stride out and load the heels more. It is my hypothesis that they don't have to take a "short step" to accommodate the tendon in the caudal phase of the stride. Since the breakover is eased they lengthen the caudal phase and thus take longer strides. The other possibility is that they are just more comfortable in this style shoe and change their gait for the better. So when presented with any lower limb lameness which may be secondary to the contracture, my first approach is to re-balance the club foot by trimming the heels down and moving the breakover point back beneath the anterior coronary band. This makes the foot behave or function more like a normal foot and often times the secondary lameness resolves or greatly improves. As these feet load the heels, the heel contracture tends to improve with time and use, however, in cases with atrophied frogs and robust bars, I encourage heel spreading by thinning out the bars, unhooking the point of the heels, and loading the frog, sulci, and bars with elastic impression material. These feet even benefit from building the material up slightly above the ground surface of the shoe almost creating a "bumper" or an artificial frog. This technique helps engage the foot's shock absorbing structures. Occasionally these horses benefit from coffin joint injections and joint supplements but shoeing is the majority of the formula.

THE LOW HEELED FOOT

When discussing heel pain we are more familiar with its relationship to the low heeled, sloping pastern horse for obvious reasons. Just as upright feet are probably genetically related so is the low-heeled foot. I see foals and weanlings already showing subtle signs of developing a low heel (bull nose, underrun heels, etc) however most low heel problems don't manifest themselves until the horse is put into work, carries more weight, and has its lifestyle and foot care regimen greatly altered. Some low heels are transient as in the premature or dysmature foal; however, most are part of the horse's given conformation and must be appropriately managed throughout the horse's career or life. In the low-heeled scenario we are dealing with the opposite problem from that of the clubfoot. This limb has a lengthened deep digital flexor tendon-muscular unit. This allows the coffin bone to carry a low angle or even a negative angle within the hoof, as the tendon does not vertically support the caudal aspect of the bone as much as in a normal foot.

This lower limb conformation predisposes to many diseases such as chronic heel bruising or corns, pedal osteitis of the wing of the third phalanx, collapsed or crushed horn tubules in the heel buttress, quarter cracks, and various tendon/ligament injuries[4] as these structures are overloaded and poorly supported. My approach to any of these secondary problems is to rebalance the foot so it can function properly and offer sufficient support to the structures inside the hoof and further up the limb. Low heeled feet can be classified into different categories in order to help understand and treat them effectively. The classic low-heeled foot has the long sloping shoulder and pasterns and subsequent low heels. The second type is the horse with upright pasterns, broken back hoof pastern axis and low heels. This type probably has some degree of superficial digital flexor tendon contraction which pushes the fetlock forward, thus giving the deep digital flexor tendon less distance to travel (essentially giving it more length) thus creating a low heel. Additionally low heels can be broken down into underrun heels or collapsed heels. Underrun heels, the heels and bars are of good structure they are just migrated forward. Collapsed heels (in which the heels are usually underrun to some degree) also lack good structure and fail to provide support. These heels are folded over, crushed and oftentimes have poor or no bar structure and extremely thin sole depth in the heel region. The frog is also very prominent and appears prolapsed.

TREATMENT OF THE LOW HEELED FOOT

Treatment of the low-heeled foot can be difficult and problematic. In this case we are combating compressive forces in the heel region by the palmer coffin bone dropping down unlike the club foot in which we are relieving tensile forces of the tendon contracture. As the low heel develops the foot migrates further in front of the limb, thus putting more force on the heels setting up a cycle of heel overload, structural collapse and further overload. The underrun low-heeled foot is fairly easy to manage as this foot has good depth. The heel can be trimmed back to increase the base of support. Ideally these heels should be trimmed back to the widest part of the frog. If there is not enough depth to achieve this desired heel position the shoe is fit at least to the widest part of the frog to provide support. Since these feet are elongated or stretched, the elongated toe creates a lever, which creates strain on many structures during breakover. These feet benefit from a heavy rolled toe to ease these strains and promote the formation of a more

rounded foot. The crushed or collapsed heel type is notoriously difficult to treat. It is probably the most mistreated and inappropriately managed foot. Commonly these feet are shod with over fit bar shoes and wedge pads for support of the soft tissue structures. This is okay if you are temporarily treating a soft tissue lesion but long-term indiscriminate use causes further hoof capsule damage and pain. If we artificially prop up the heel we create more laxity in the tendon and more heel compression. A proportion of horses in wedges often improve for a few months then become sore from secondary capsule pain. This overloading of the capsule can be seen by the growth rings on the hoofwall (slowed growth at heels, increased growth at toe.) In order to rehabilitate these feet we need a plan to distribute the weight over more surface area and to decrease compressive forces on the compromised heel region. This is done with a full roller motion shoe and some form of axial support (heartbar, heel plate, sole support, onion heels). The roller motion shoe creates airspace between ground surface of the shoe and the ground at the toe and heel regions. This probably eases the heel into weight bearing during the landing phase as to not create a sudden jolt like a conventional bar shoe. The airspace may decrease some ground reaction forces at the heels (to my knowledge, this shoe has not been tested on a force plate, strain gauges, etc. to fully evaluate its effects.) My clinical experience with this shoe has been extremely favorable. Low heeled feet can become rebalanced and improved by acquiring even balanced wall growth, increase sole depth in heels, and by an increase in coffin bone palmer angle. The addition of axial support is imperative for a successful outcome in these cases, especially in the heavier bodied horses. This foot type has weak supporting heel structures and the frog often appears to be prolasping through the shoe. Axial support can be in the form of a heartbar, sole support materials, heel plate, onion heel, pad, and impression material. The decision to use each of these depends on the foot, environment, discipline, and pathology.

An important heel structure, which often goes, unmentioned is the bars. In light of Dr. Bowker's dissections and observations the functional significance of these structures cannot go unmentioned. It is hypothesized that the bars not only have an important stabilizing effect on the heels but they are probably an integral part of the foot's shock absorbing mechanism. As the foot impacts the ground, the vibrations generated during ground impact are received by the bars (as they are a weight bearing structure - or should be). The bars transfer this energy to the collateral cartilages, which lie directly above them. The collateral cartilages are rich with an abundant vascular system; it is here where these vibrations are transferred to a reservoir of blood thus we have external vibrations transferred to moving fluid, a very efficient way to rid the foot of these harmful vibrations. Healthy efficient feet have good bar structures and thick collateral cartilages. Weak fragile feet, which commonly have secondary lameness issues often, have weak or non-existent bars, thin collateral cartilages and are, therefore, inefficient poor shock absorbers. Some feet can have their bar structures rehabilitated and improved. The best way of doing this is by getting feet barefoot; however, this is not always possible especially in horses that are aggressively campaigning and competing. The use of arch supports and sole supports to load the bars has "mimicked" the bare foot condition. In some instances we have gradually loaded the bars with onion heel shoes and actually improved the quality of the bars and health of the palmer part of the foot. In our practice, this is most commonly done in the Thoroughbred racehorse, by welding onions into the race plates and using soft packing between the onion and bar. This controlled loading or stimulation of the bars eventually rehabilitates and strengthens these structures. Often times once the bars of a foot are healthy, sole depth and stability in the heel region improves.

SUMMARY

- Heel pain tends to be common in all breeds, disciplines and lower limb conformations.
- Lower limb imbalance and subsequent regional overloading or under loading are common causes of heel pain.
- In the sagital plane the deep digital flexor tendon has an influence on the conformation of the lower limb.
- The low-heeled foot overloads the heel region and the soft tissue supporting structures of the palmer/plantar lower limb and under loads the toe region.
- The upright lower limb overloads the bone column and under loads the soft tissue supporting structures. Therefore, it is common to see arthritic type diseases. The toe is overloaded and the heel structures are under loaded.
- Trimming and shoeing should address the deep digital flexor tendon in sagital plane imbalances. Artificially propping up a low heeled foot with bar shoes and wedges does not make it function like a normal foot with a higher angle,
- Bar shoes and wedges are used to provide posterior support and treat some soft tissue injuries; however, overuse and indiscriminate use can cause secondary overloading and pain of the hoof capsule in the heel region.
- Not only are the bars important to stabilize the hoof capsule but also recent studies suggest their importance for shock absorption. The bars should be preserved and loaded appropriately to help the heel function as efficiently as possible.

REFERENCES

1. WILSON A, MCGUIGAN P, PARDOE C. The biomechanical effect of wedged, eggbar, and extension shoes in sound and lame horses. *AAEP Proceedings* 2001; 47: 339-43.
2. THOMPSON KN, CHEUNG TK, SILVERMAN M. The effect of toe angle on tendon, ligament and hoof wall strains in vitro. *J of Equine Vet Science* 1993; 13: 651-53.
3. BARREY E. Investigation of the vertical hoof force distribution in the equine forelimb with an instrumented hoofboot. *Equine Vet J* 1990; 9: 35-8.
4. BOWKER R. Contrasting structural morphologies of good and bad footed horses. *Proceedings.* 49th Annual American Association of Equine Practitioners Convention 2003; 186-209