Macro-Pathology of the Equine Foot
And
Consequences of Orthopaedic Balance

Introduction
To understand the complex interrelationships of hoof balance and the overall biomechanics requires carefully scrutiny of external hoof pathology as well as an understanding of what is happening to the internal structures of the foot. Recognising and placing emphasis on external macro-pathology maybe somewhat of a 'missing link' which is vital to gain a better outcome. Once this is achieved it is then necessary to consider the changes in the upper body of the animal. These can be dynamic reloading patterns resulting in muscle tension patterns, fatigue of the major muscles of the passive stay apparatus, and eventual chronic alteration of ligamentous tension and persisting pain issues. It is worth exploring this inter-relationship by considering misalignment of tissue structures more commonly encountered with problems in the forelimb.

Why is Equine Orthopaedic Balance so important?
All farriers are trained to look at the feet and balance them before placing a shoe on the foot. For centuries this is what has happened. When assessing horses that are showing signs of soreness or lameness the traditionally accepted approach has been to fit shoes to help increase break over as well as trying to change other aspects of the hoof flight. These methods do work on some horses, but not on all, and then it is only work for a limited time due to other related stresses that gradually accumulate in the body. Farriers work hard at fitting shoes that would bring the point of break over back to where it looks as though it should be. Making shoes that appear to fit the natural shape of the hoof should then return the balance to the foot (Fig.1). All of this is to no avail as the hoof never fully improves and noticeable changes can be seen in the upper body, such as asymmetrical muscle groups.

Fig.1 a modified shoe causing extreme upper body stress

When the internal hoof tissues are placed under stress, the biomechanics and muscular–skeletal alignment of the upper body are affected and all aspects of limb and hoof flight change. Recognition of these influences in the upper body is needed to realise that the manner in which the foot has to be trimmed and shod. This rebalancing of the foot is the single most influential thing that would change the biomechanics of the foot and upper body**.** The second most important procedure is a complete chiropractic treatment. Weight and energy is transferred directly through the limbs to the bone structure of the feet. The hoof capsule has to encapsulate the bones symmetrically or else the weight and energy cannot be transferred to the ground correctly. This incorrect weight transfer will cause the horse to change its flight pattern as well as its upper body muscles. Then long-term problems will manifest as hoof and / or upper body disorders, which will erode the performance of the horse.

Orthopaedic Balance of the Equine:
To understand the complex structural and functional podiatry problem the podiatrist needs to identify the external pathology of the foot, looking at the texture – size – colour – shape and alignment of each section of the foot to ensure it is coping with the stress placed upon it. Knowing how and why the problem has occurred and understanding the response of the horse is one of the keys to a broad range of equine problems. Clues to how the horse will cope with foot related issues are found throughout the entire equine body. Only a careful examination of the animal from a structural and functional perspective will reveal any changes in muscle tension – ligamentous tension and hoof pathology. As the ramifications of the animal dealing with dysfunction or imbalance it will develop subtle changes in movement patterns as it tries to avoid pain. If pain increases there can be dramatic

changes in behaviour as well as performance. There can also be changes in loading of limbs from one side to the other as well as from the front limbs to the hind limbs or a diagonal loading imbalance. With this loading imbalance, it increases the work certain muscle groups have to do and can cause muscle fatigue.

We need to take into consideration the role of muscle and ligamentous mechanoreceptors in the locomotion of the horse as well as the external and more importantly the micro pathology of the foot to fully understand the issues afflicting the animal.

Step 1: The whole horse
The first thing is to stand back at least 10-15 feet and look over the complete upper body of the horse because hoof or balance problems manifest themselves as upper body changes or misalignments. Look for things like asymmetrical muscle shapes, atrophy of the Longissimus muscle behind the scapula, no top line, a dip at the lumber or croup area or an awkward stance of the horse. One or all of these things could mean that the horse has changed its orthopaedic stance. Then work your way down the limbs, and feel for swelling, asymmetrical tendons or ligaments, knots in suspensory apparatus or swelling at the base of the proximal phalanx where the collateral ligaments of distal sesamoid attach. These signs will start to indicate if the orthopaedic stance of the horse is compromised.

Step 2: Diagnosing hoof balance by tendon alignment.
Using the distal tendons and ligaments a consistent way to assess the imbalance or balance of the foot, as it is the horse indicating the individual loading of that foot or limb. Using the Deep Digital Flexor Tendon (DDFT) to indicate the loading on the distal sesamoid bone we can gain a great understanding of the effect of medial-lateral loading the horse is placing on the distal limb. Assessing the alignment of the distal cartilages we can gain an understanding of the loading of P3 and the anterior-posterior axis.

Starting with a front foot, slide your hand down the length of the third metacarpal palpating the DDFT and Superficial Digital Flexor Tendon (SDFT) to assess the alignment of the tendons with the third metacarpal and each of these tendons. Also palpate the sub carpal check ligament at the same time. The correct loading of the limb will ensure that the DDFT and SDFT are in line with each other and align in the centre of the third metacarpal and the sub carpal check ligament should be under little stain. If the DDFT tends to run out to one side of the SDFT then this is an indication that the distal sesamoid bone is out of alignment with P3. When SDFT tends to rotate to one side more than the other it is an indication that the imbalance is coming more from the proximal lower distal limb joints. The distal cartilages indicate the loading on each individual or both wings of P3 and the distal joint of P2 and P3. As a testing point for tension of the sesamoid bone you can apply a slight pressure to the distal point of DDFT in the hoof and if tension exists the horse will indicate by pulling the limb away. Testing for soreness in the DDFT is best carried out by holding the leg at the fetlock so the frog is perpendicular to the ground and by applying slight pressure to the DDFT at the incursion point of sub carpal check ligament will indicate any soreness.

Understanding tendon alignment when assessing the hoof before trimming, the position of DDFT will indicate the side of the hoof that needs to be lowered to relieve tension. With a standard lateral-medial (lateral high) imbalance the medial distal cartilage will also be raised and hard on palpation. On completion of the trimming process the tendon and distal cartilage tension will be more neutralised and the tendon alignment will return closer to normal.

Step 3: The hoof balance
When you pick up the front foot to check the balance (medial-lateral) you should hold the foot at the fetlock joint and let the foot adopt a natural position. Position yourself as close to the shoulder as possible (pulling the limb out from the body will twist the limb and you will get an incorrect hoof

balance). You can then look down the hoof-bearing surface to gauge the correct balance. The hind foot is to be cradled in your lap with the fetlock joint resting on your knees. Again position yourself as close to the body as possible and look straight down metatarsal 3. When the foot is left to take the natural position the hoof balance can be checked.

With the front legs if the rotation is so pronounced the leg will sometimes hang inside or outside the hind leg. The correct position for it is to be in line with the hind leg, so place your knee against the horse's knee and rotate the leg to face in line with the hind leg. Only this will give you the correct hoof balance and it is also a good way to determine how much pressure is being placed on the upper body.

With the hind legs it is harder to formulate correct alignment but if you have a lot of tension on the leg to keep it elevated (tight hamstrings, croup and buttocks area) it is usually a sign that the muscles are being strained.

Signs of a healthy hoof and a hoof under stress:
A healthy hoof should be symmetrical in shape with a smooth even cone shape exterior wall. The sole should be concaved from the outer wall to the junction of the apex of the frog and sole. The white line should be opaque in colour with an even width around the circumference of the wall and finish two-thirds the way down the length of the frog. The sole of the hoof should connect to the white line at the same height as the hoof wall and the bars are to be straight and in line with the frog. The frog is to be a healthy wedge or triangle shape whose ground surface finishes just below (viewed from underneath) the level of the heels. These are the signs of a healthy hoof and if this changes then there is usually a reason why and it is up to us to determine what is wrong, why it is wrong, and how to go about correcting it and returning the hoof back to a healthy state.

There are many signs of imbalance to look for in a hoof and not just the hoof and pastern axis analysis.
What are the signs in the hoof of misalignment?

- concaved or convexed hoof walls
- flares in the hoof wall
- misalignment of coronet line (pushed up or waves)
- shelly hoof walls
- cracks in hoof walls (stress cracks)
- bleeding from coronet band
- heel bulbs extending out the back
- underrun heels
- distal cartilage alignment

The external signs that we can see when viewing the hoof on the ground are only telling us half the story. We must look closely at the pathological changes-taking place in the hoof. Changes such as:

- hoof shape
- texture (hoof, sole, frog, white line)
- pigmentation changes (white line, frog, sole)
- frog shape
- extra layering down of sole
- hoof capsule thickness and wear
- abnormal fusing of frog and sole
- bruising or bleeding through the sole or white line
- size of white line
- Sole alignment with the white line and wall.

All the above signs start to give us an in-depth checking system as to the healthiness and correct alignment of the internal structure of the hoof.

External signs one by one:

Coronet Band;
Is it in a straight line or does it have waves or push-ups? The coronet should be in a straight line sloping down from the dorsal wall to the bulbs of the heels as this is the origin of the new tubulures (they also grow from the epidermis layer behind the hoof wall) and it needs to be in correct alignment and if it contains waves or push-ups then the new horn tubulures will not align themselves side by side as they should, and the tubulures will not be capable of coping with the stress placed on them. The other important area of the coronet band is at the bulbs of the heels. If it turns under then the tubulures that are not in alignment will also break down and form cracks and become brittle.

Distal Cartilage;
Palpate the distal cartilage (between the distal and middle phalanx, just above the coronet line) to see if it is soft and pliable. If it is hard and raised up then this usually means that the distal phalanx is being forced up out of alignment. This misalignment causes the cartilage between P3 and P2 to become hard and raised and will restrict blood flow and expansion of the foot.

Collateral Ligaments of Distal Sesamoid;
Check the attachments of this ligament at the base of the proximal phalanx for swelling or tension because if its alignment is incorrect it usually shows up here. This will tell us if distal sesamoid is under strain or out of alignment.

Dorsal Wall Dish and Medial Lateral Flares;
Looking at the external hoof walls can tell us if the alignment between the distal phalanx and the hoof capsule are in correct alignment. When flares and dished walls are present then this will indicate that the sensitive laminae are under stress. To me this means that the hoof capsule has moved away from the bone structure and at the commencement of the dish or flare (near the coronet band) will be the last point of correct alignment of the hoof capsule and the internal bone structure.

Cracks and Brittle walls;
This indicates incorrect pressure on the hoof capsule (cellular level) and a substandard blood flow through the foot and is a sign that the hoof balance is incorrect.

Toe in or out of the Hoof Capsule;
Looking at the hoof area and it looks like the hoof is not on square to the bone structure and the foot is toeing in or out, more than likely the hoof capsule is out of alignment with the bone structure (P1, P2, P3). This happens when the medial-lateral balance is out and the hoof capsule is twisting due to the uneven pressure placed on it. The hoof capsule comes under pressure from two ways. One being the foot twisting to the high side when the limb is loaded and this causes the hoof capsule to move around that way and the low side is moved away from the frog. The other pressure comes when the hoof rolls to the low side and places more pressure on this side so the hoof tubulures tend not to grow as fast, but the high side under less pressure, grows quicker, with this causing the hoof to either toe in or out. This is seen when you look at the underside of the foot and the hoof wall is closer or joining the frog on one side and away on the other. Note: the side that is closer or joining the frog is the high side and the side that is away from the frog is the low side. Some bulbs of the heels will extend back further on the high side as well.

Bulging Heels;
If the bulbs of the heels are extending out the back of the foot the digital cushion is out of place and under a lot of pressure. A long toe usually accompanies it or should I say more foot in front of the apex of the frog. This mechanically places more pressure on the digital cushion from P3, P2 and Distal sesamoid causing it to breakdown and move backwards placing pressure on the corium of the sole and digital cushion. It is at this point that digital cushion cannot do its job of supporting the limbs and the sole becomes dropped. Middle phalanx and distal sesamoid do place a lot of pressure on digital cushion at full flexion.

The frog;
Look at the frog to see if it is a good width, good texture and no deep cracks. Also check the height to see if it sits just below the ground surface of the foot, and the frog should never overhang the medial lateral grooves of the frog. The frog should only come into contact with the ground when weight is placed on the limb. The apex of the frog should also be in the centre of the foot and should not give the appearance that it is lying to one side.

The Sole;
The sole should be concaved starting at the hoof wall and coming down to the junction of the frog and sole, if the sole is flat then it will not allow the distal phalanx the room to move and the corium of the sole will become trapped between the ground and distal phalanx. There should be no pitting, bruising, cracking or decaying of the sole. The sole height should join the white line at the hoof wall all the circumference of the hoof. Note: the sole always sits lower on the low side of the hoof. This is due to the extra pressure being placed on that wall. Also look for any bruising at the seat of corn, bars of the foot, and the sole itself. Bruising or in some cases bleeding indicate internal pressure being placed on the corium of the sole and the circuitry system of the foot causing leeching of blood into the surrounding area and changing the pigmentation of the tissue. Note: to check if the bruising is from external forces or internal forces look at the pathology of the bruised tissue. Bruising from external forces has the origin of blood closer to the surface. You will find bruising from internal areas will become more pronounced as you start to resect that area. If the bruising is old you will note a dried orange look to the area, but if the bruising is still fresh the texture will have a filled look. The more the bleeding the more the texture will be engorged with blood.

White Line;
The white lines function is to allow for expansion between the hoof wall and the sole as well as preventing infection from entering the inner hoof, as well as being a great tool to gauge the alignment of the hoof capsule and P3. It is also a window as to the strain on the sensitive laminae or the sensitive lamina is under. It can also tell us if the corium of the lamina have the correct blood supply, because if the blood supply is incorrect then the white line shows signs of necrosis. The white line should follow the circumference of the hoof wall, down the bars and finish two-thirds of the way down the frog. It should be opaque in colour with a width at about 3mm. The texture of the white line should be tight so you cannot easily see lines in it. If you have a white line that is not opaque, but yellow or red in colour then this is a sign of blood leeching into it from the sensitive laminae. Meaning the connection between the hoof capsule and P3 is under stress. When we see a white line incomplete in an area this will indicate stress in that area and a weak spot between the wall and sole, plus an entry point for infection. When the white line is wider at one point (usually the toe area or site of a hoof wall flare) this indicates a stretching of the sensitive laminae. When the white line is more than 6mm it will be possible to see the separation on x-rays.

Bulbs of the Heels;
These areas along with the digital cushion and bars of the foot are one of great interest. The bulbs give the indication as to the integrity of the digital cushion. Bulbs that are protruding out the back of the foot are caused by the misplacement of the digital cushion. Bulbs that are spread tightly apart and on palpation of the area between them is hard, it is again due to misplacement of the digital cushion. On palpation the area between the bulbs of the heels should feel firm but soft and smooth and should not be raised up into the back of the distal cartilages. If the digital cushion is starved of blood then it becomes cartelised and if the lack of blood continues then it becomes jelly like and cannot do its job. The digital cushion is the key to supporting the inner bone structure allowing for proper hoof expansion and developing a good concave sole of the hoof. It is also a point of pain if it pushes on distal sesamoid and the bursar of deep flexor tendon.

The Bars;
This area along with the digital cushion holds the key to a sore or sound horse. The bars are what give support to the back of the hoof through the flight and stance stages of the foot. When the bars are

contracted up inside the foot, then they are arched up inside the capsule putting pressure on the digital cushion, deep flexor tendon and flexor bursar. When the bars are not in correct alignment then they fold over and place pressure of the palmar section of the hoof. When cracked or broken they cannot support the weight of the limb. This then leads to navicular syndrome, palmar pain, bruised heels etc. All or some of these symptoms are signs of a hoof under stress. Some hooves will even have variations to these signs, such as: Vibration, concussion, incorrect blood supply or pressures will all cause dying off of the white line around the nail holes and shoe clips. Remoulding of the white line at the centre of the toe, this is due to P3 placing extreme pressure in that area and affecting the blood supply and the internal apex of the bars pulling back from its dorsal connection point.

Palmar section of the foot:
The palmer section of the foot the most important part to understand and recognise changes.
In this portion of the foot lies the main support system for the entire horse as well as the key to correct hoof function. There are several parts that are integral to the dissipation of energy in the foot (digital cushion, internal bars and collateral cartilages) and when working in unison reduce wear and tear on the foot, limbs and upper body of the horse. It is when this relationship between soft tissue architecture and the bony column structure of the limb becomes strained, that the internal soft tissue of the foot starts to change its texture and then its alignment. The digital cushion does play one of the most important parts of supporting the limb and maintaining hoof and limb alignment along with reducing excess movement and concussion on the distal limb and then the upper body. But if the digital cushion is not housed correctly by the internal bars of the hoof and held in place by the collateral cartilages then its alignment within the hoof capsule will change and along with that its ability to function correctly.

The internal bars of the foot are one of the first pieces of apparatus in this chain that begins to breakdown. When this happens it can no longer correctly contain the digital cushion, help support the bony column of the limb or allow the hoof capsule to maintain correct internal relationship with the distal bones of the limb.

Fig 2: Inner bars in good

When the internal bars of the foot (fig 2) are incorrectly loaded they start remodelling according to the pressure, they quickly change
their alignment moving forward and protruding out to the side, along
with their tissue makeup. A healthy internal bar viewed laterally; a triangle shapes with the apex starting at the apex of the frog and having its base at the palmar section of the foot. The inner wall against the digital cushion is straight and smooth with a slight concave area at the distal palmar area collaterally, the outer wall being slightly concaved thinner at the proximal boarder and thicker more developed at its distal boarder. This is to allow for correct alignment of the wings of distal phalanx and containing digital cushion to be under the main structure of the limb.

Fig 3: Collateral distal branches of the digital cushion

The small inner concavity of this allows for a small amount of digital cushion (I call this the Collateral Distal Branches Of the Digital Cushion fig 3.**)** to form in this area thus helping to support the internal bar and giving that area of the foot for first contact with the ground better impact absorbing ability and starting the process of hoof expansion.

Fig 4: Changes to the inner bars

The collateral distal branches of the digital cushion are one of the first areas to come under stress and the first to break down. It is paramount that the

collateral distal branches of the digital cushion should be there to aid in correct hoof function and this in turn would reduce upper body stress. Incorrect pressure along with reduced vascular flow to the internal bars cause the tissue to undergo degeneration. The bar now starts to reduce in height (fig 4). The distal palmar section builds up more fibro cartilaginous like material and becomes more prominent and encroaching on the wings of P3. The proximal palmar area of the bar now starts to roll under causing the entire internal bar to move dorsally. These changes mean that the digital cushion is forced to carry more than its share of weight and this extra loading along with the compression alters the tissue alignment and vascular flow causing tissue breakdown. This is the start of the podiatry problems visible on the external hoof capsule (underrun heels / medial –lateral flares / concaved dorsal walls / extruded bulbs of the heels etc.)

The tissue of a healthy digital cushion now goes from looking like what is often described as the head of a cauliflower, all tightly formed cellular structure collectively supporting the upper body weight of the horse and counteracting the forces of ground impact. The digital cushion starts to resemble individual layers of elongated tissue unable to maintain its overall wedge shape with very little supporting ability.

Fig 5: Distal cartilage sending out fibrous attachments to the digital cushion

At this stage the digital cushion splits. The distal section, which is below the heel bulb alignment, diminishes in size and the proximal section extends backwards forcing the remodelling of the heel bulbs. With the digital cushion now unable to maintain correct alignment or support, the weight is transferred to the DDFT, navicular bone – bursa - impar ligament and collateral ligaments. This changes the internal relationship between the hoof capsule, bone structure and alters the orthopaedic balance of the horse.

This extra weight is now transferred bi-laterally at the quarters of the foot causing extra loading on the laminae. The result is the laminae detaches its connection with the outer hoof capsule. This is the start of hoof flares. The hoof capsule now keeps sliding forward stretching the dorsal toe and causing internal miss alignment and increased pressure on the dorsal and distal corium areas of the hoof. This is often the beginning of seedy toe. The foot now tries to fuse all part together and lay down extra sole material to reduce internal movement and prolong soundness.

Fig 6: Blood supply of the digital cushion

As the palmar section of the foot reaches critical point the hoof starts to work against its self and instead of expanding on landing it implodes on itself. This causes the distal cartilages to be pulled in instead of moving outwards. This inward movement of the distal cartilage places pressure on the distal phalangeal artery reducing the vascular flow to the hoof. A palmar digital neuropathy develops due to the pressure changes from the collapsing distal cartilages. This incorrect biomechanics and vascular flow of the hoof all translate into foot pain and the horse then changes its posture. Once the orthopaedic stance of the horse is compromised then the muscular- skeletal system must adapt due to the incorrect pressure it is faced with.

Assessing the digital cushion:
Realising the importance of this major component of the hoof, I have been working on formulating a procedure for checking the alignment and vascular volume of the digital cushion. The only way to do this without being invasive to the horse is through palpating the area for alignment and tissue for texture. To carry out this palpation place your thumb on the same angle as the pastern at the back of the foot between the bulbs of the heels, and using your fore finger as a set of hoof testers place it on the frog and palpate this area.

On palpation the digital cushion should have a pliable, smooth and slightly raised centre, and when pressured it should apply a slight outwards pressure on the distal cartilage. An unhealthy digital cushion would palpate as either a hard or jelly like consistency that sits medial laterally protruding into the area of the distal cartilage. With this being the case when pressure is placed on the digital cushion through normal hoof function it will collapse drawing the distal cartilage inwards. Placing pressure on the corium of the sole and other sensitive internal structures of the foot, this in return causes the horse palmer hoof pain with the horse responding by changing its orthopaedic stance. It is due to this reduced ability of the palmar section of the hoof to be able to maintain its correct internal relationship with the hoof capsule that we have so many orthopaedic problems in the today equine.

"It is for this reason that the digital cushion should be considered more when determining lameness or hoof pain in the horse."

Part 2: Consequences of Orthopaedic Balance

It is vital to be able to recognise the changing stance of the equine and the changes in the muscular skeletal alignment of the upper body. The equine has the ability to transfer weight from side to side and forward and backwards and it is this inherent ability that will affect loading through the feet. We must recognise that the muscles used to power the locomotion of the equine are a long way above the feet and that a well-developed system of tendons, muscles and ligaments are connecting the feet to the upper body. These systems need to be strong and in correct alignment to allow for correct function, optimal coordination and proprioception. This capability for weight transfer can be influenced by hoof capsule alignment or muscular skeletal stress. It is challenging to find out whether the dysfunction is transferred from the feet to the upper body structure or from the upper body to the feet (Fig 7).

Fig 7 .Stress signs in the fascia from incorrect orthopaedic balance

In case of any dysfunction in the horse, the stress related changes in the animal will cause modification in the foot shape and/or notable shifts in the muscular skeletal system as well as locomotion. The stress in either system, being hoof or upper body, intensifies the tissue and structure changes and these changes can be seen by the naked eye on the external surface of the animal. These changes are termed pathological, meaning that there is an alteration in tissue structure and shape, which can be readily identified.

As with all pathology, it is hard to know what is behind the signs shown externally, because external pathology is really a change in the cellular makeup of the underlying tissue or structure. This is usually known as histopathology. Prof Robert Bowker has studied the histopathology in the hoof extensively. It is this pathology change internally that presents itself as a change in the external tissue that will give us guidance to understand the forces at play. It is this understanding of the changing pathology that allows the author to form an opinion as to what tissue and structures are under stress and the changes needed to return function to the cellular level for an optimal outcome.

The hoof is constantly under pressure whilst accomplishing its function as shock absorber, protection of the internal architecture of the hoof and supporting the weight of the horse. The system works extremely well if the forces travel through correct body alignment. However an imbalance in these forces can and will cause a breakdown or reactionary misalignment in the internal structure of the hoof. Many of the responses to this pressure can be found in a close examination of the external foot structure, a further consequence is undue loading of the muscular-skeletal system as it attempts to

compensate. This is becoming known as “Equine Orthopaedic Balance”® because it refers to the entire musculoskeletal system in motion and at rest and not just the hoof pastern axis alignment.

It is very important to have an understanding of the fulcrum effect on the distal sesamoid bone and distal phalanx along with other associated structures of the lower limbs when assessing the muscular-skeletal system of the horse. The farrier has a lot to consider, when looking at the forces on the internal structures of the feet and the related forces acting on the orthopaedic stance of the animal. The forces placed on pain sensitive structures, being bones – distal cartilages – ligaments – laminae and vascular components of the hoof, can cause the horse to alter its stance and movement.

Upper body areas affected by incorrect hoof balance or axis: (Fig 8&9)

Fig 8. Tension in the thoracic inlet

Horses that have incorrect hoof balance or axis in their front feet have problems with their thoracic-lumber area causing the horses’ top line to drop away. The hind feet usually show up in the lower-lumber and sacral areas causing the horse to change its stance. They also change their stance on the hind if the front section is so sore that they need to share the weight more with the hind end. If the front limbs rotate inwards they tend to have problems in the ribs and chest area and this does not allow for correct suspension of the vertebral column between the scapulas. With a high head carriage you tend to place a lot of tension to the upper body attachments at the base of the neck and withers of the horse, this will have an effect on the skeletal muscles and ligaments of the front limbs. In some cases the hind feet tend to travel outside the front legs due to tightness of the loins area caused by the misalignment of the front limbs.

Fig 9. Changes to the scapular and withers region

It is therefore very important to look over the horse to establish the conformation of the animal and if there is any rotation of the bones supporting the lower limbs. If you find the main conformation of the horse is sound you should then start looking at the alignment of the limbs. Look at the front leg first and see if the radius is in line with the body and does the ulna face into or away from the body, do the hooves toe in or out, is the knee pushed forward (check each leg individually). Do the same with the hind legs, look and see if the hocks face in or out, is the patella in line with the body or not, do the toes turn in or out. Misalignment in the bone of the hind leg (femur/tibia/pelvis) can cause things like locking stifles, shorting of the hamstrings and pressure being placed on the spinal column. If you find the bones of the limbs are misaligned then you can usually trace it back to the hoof balance or axis, as the stress placed on the bones and joints from the feet not striking the ground equally will cause some amounts of bone rotation and muscle tension throughout the body. At the point of muscle attachment to the bones and over long periods it can cause abnormal muscle development. We should keep in mind that the horse’s weight has to transfer down through the legs to the ground and if the legs are not positioned in alignment with the body then the weight is transferred to the ground unevenly and you could notice swelling at the coronet and/or fetlock joint or even the lower limbs of the leg.

Conclusion

Unfortunately, the problem in the foot is just the start of the problems and the ramifications of how the animal deals with these issues are seen throughout the entire horse as changes in the orthopaedic balance. These changes can be subtle movement patterns to avoid pain along with dramatic changes in locomotion, performance and behaviour. The clues to how the equine copes with foot problems are found throughout the animal’s body and careful examination of the changing muscular tension is needed in association with the hoof pathology.

To understand the complex structural and functional podiatry problem the podiatrist should rely on identifying external pathology of the foot, looking at the texture, size, colour, shape and alignment of each section of the foot and ensuring it is coping with the stresses placed upon it. Considering how and why the problem has occurred and understanding the response of the horse is one of the keys to a broad range of equine problems.

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