

## Equine Health – January 2018 issue

### The role of radiography in foot balance.

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Every day farriery, of a high standard, consists of relying on observation, communication, experience and skill. The goal in the 'sound' horse is to trim, and possibly shoe the feet to enable it to efficiently and comfortably carry out its work for the next 4-8 weeks.

Dynamic assessment allows the farrier to judge how the horse places each foot on the ground. Then how the limb is loaded and how it moves forward into breakover. These observations are kept in mind for when trimming or shoeing the horse.

Communication may be as brief as 'How is he/she going? Great thanks' or additional information may be gained – such as increasing occurrence of tripping, refusal at jumps, initial reluctance/stiffness that improves as the animal warms up. Often these snippets of information can be disregarded, as a lazy horse, poor rider, a bad day, or it may be an issue out with the realm of the farrier and perhaps a paraprofessional e.g. a saddler is required.

The information gained should be combined with the initial observation, plus subsequent assessment of shoe wear and how the horse 'feels' when being shod by the farrier. These factors can signal something is beginning to bother the horse.

A horse experiencing pain or discomfort will often be unable to stand comfortably. Either the flexed limb is creating pain and the horse becomes resistant to the position or the loaded limb may be unable to withstand the extra load and the horse jumps away.

The goal of trimming or shoeing should be to obtain mechanical efficiency. This means that the foot comes in contact with the ground very slightly heel first, and level in the medial and lateral aspect. As the limb is loaded the joints should be engaged evenly, so that the fetlocks are seen to sink centrally to the base (not necessarily the hoof). The base should be centred round the point of articulation within the hoof capsule, with sufficient material to support the load placed upon the hoof wall and the frog, if appropriate. Excess material or horn, in the dorsal

aspect of the hoof exerts extra leverage against the tendons and ligaments. These are utilised to lever the horse forward through every stride and therefore constant overloading will create damage. Excessive material in the palmer/plantar aspect can create a sudden landing for the foot. The heels catch and bring the foot to the ground more rapidly than is desirable. This decreases stride length and increases the shock that has to be absorbed by the structures of the foot and limb.

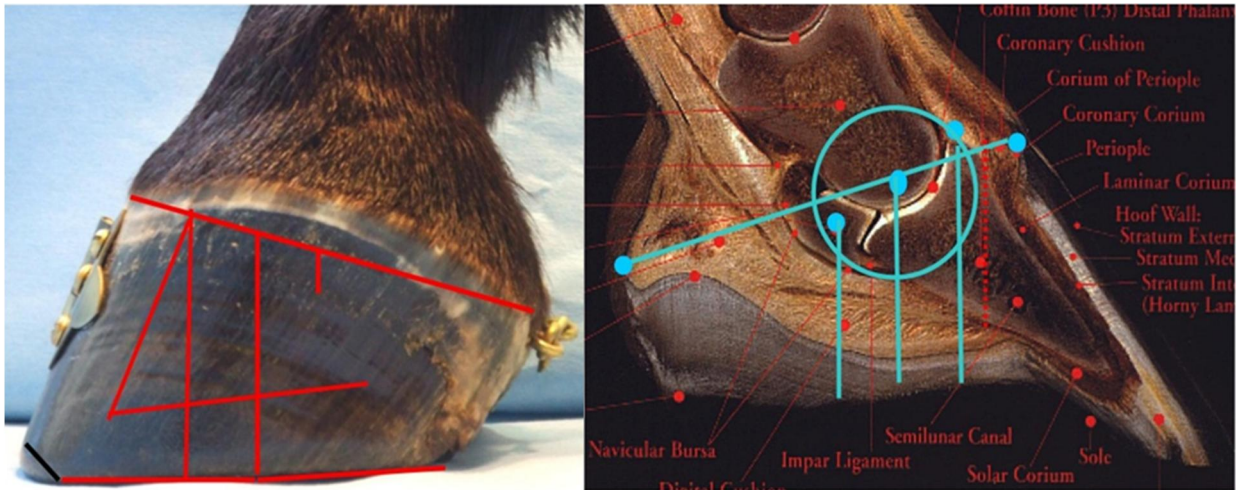
It should be remembered that the most well shod horse will only become less efficient through its shoeing period due to the direction of horn growth, and that conformation can only be accommodated and not corrected in the mature animal.

There has been plentiful research into using the external structures to identify key anatomical features within the hoof capsule. 'Ducketts Dot' was identified as the point representing the centre of articulation (3/8" behind the tip of the true frog). Dr M Caldwell FWCF, has done extensive work on 'hoof mapping' (Caldwell, 2010, 2016) (Figure 1) and Mr. J. Ferrie FWCF uses external references referring to the coronary band (Figure 2) to locate the internal structures (Ferrie, 2007).



**Figure 1:**

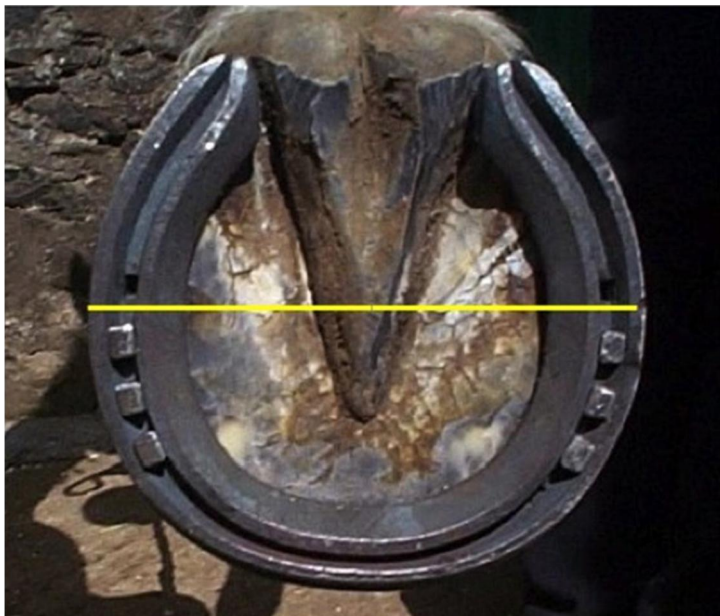
**An example of shoe placement on a foot that has been 'mapped'. The intersection of lines in the centre of the foot is directly below the coffin joint. With kind permission Dr M.Caldwell FWCF.**



**Figure 2: The use of external reference points allows the internal structures to be located. With kind permission of Mr J.Ferrie FWCF.**

These 'mapping' techniques allow the foot to be trimmed to put these structures in an optimum position (Figure 3). Other studies have been carried out using the 'barefoot' model, and in the authors opinion they all have their place, but experience allows the farrier to apply the method most appropriate to the individual.

Experienced farriers can now recognise, with the use of these proven hoof mapping methods, how feet should be trimmed and where a shoe should be placed. However all of these external references do not allow the condition of the internal structures to be assessed.



**Figure 3:**

**The widest part of the foot, locates the centre of the coffin joint rotation. This reference point should be used when trimming/shoeing, with the aim of creating a 'circle' around it. With kind permission of Mr J.Ferrie FWCF.**

The addition of radiography to the farriers' assessment means that bone alignment and joint spacing can be assessed and the condition of the bones can be scrutinised, this can make the difference between a horse being sound or lame.

For example; a horse that stumbles intermittently or that is stiff to start but warms up out of it. It may initially appear to have good well balanced feet with 'normal' landing. Over time they may begin to show abnormal shoe wear at the toe and perhaps the heels grow faster as the horse attempts to relieve pressure in the heel region. The conscientious farrier will attempt to mimic the shoe wear to 'ease' the breakover, and help the tripping. The problem may then progress until lameness is noticeable, and at that point x-rays are taken which show changes to the navicular bone. These changes may implicate the navicular bursae and the deep digital flexor tendon, although assessing these structures require different imaging techniques such as MRI. So now rather than having to just react to the information from the horse, the use of x-rays can help the farrier adjust the balancing and shoeing to account for the individuals pathology.

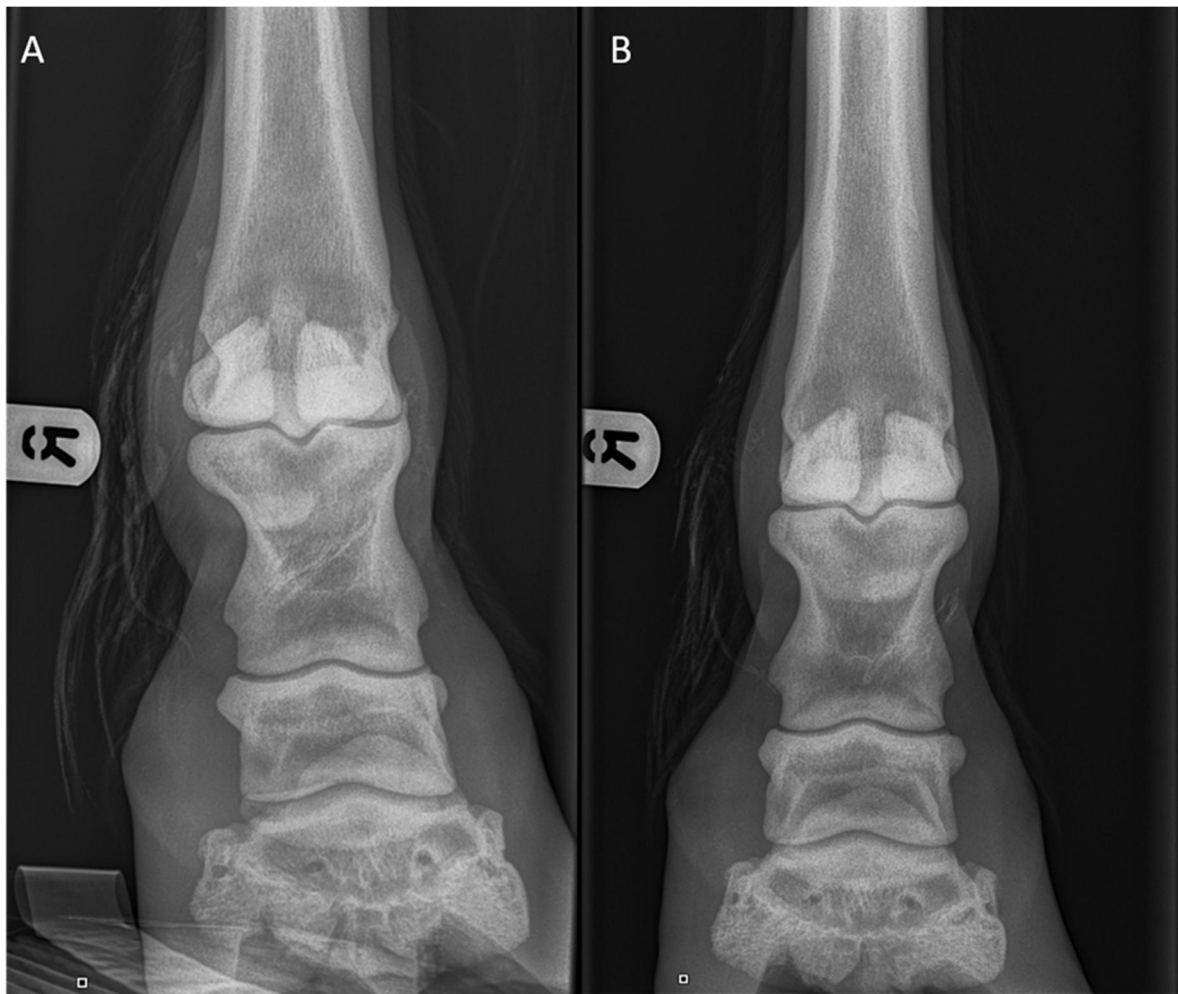
The use of x-rays is very dependent on the quality of the images taken and although the majority of practises now have digital technology which removes the need to recognise common faults such as over/under exposure, and double images can cause misinterpretation.

The horse must be stood square with the pair of feet at the same height, if not the horse will adjust its weight and create the image of an unbalanced foot in relation to the limb.

Aligning the view with the bones and not the hoof capsule is important as the hoof capsule is a very malleable, deformable structure. Farrier Scott Lampert, product development manager at Delta Mustad Hoofcare Centre, advocates using the direction of the central sulci of the trimmed frog to show where the pedal bone is pointing within the hoof capsule. He uses the 'Proportional Hoof Balance™' shoeing protocol and has used x-ray imaging to verify his research.

An AP image that is correctly aligned will show the extensor process in the middle of the articular surface of middle phalanx (P2) and in a balanced foot the nutrient foraminae of the distal phalanx will be parallel with the floor. Images of the same foot taken with a few degrees

difference can give a very different view of alignment, which could then influence the work carried out (Figure 4).



**Figure 4: During a farriery cpd course it was demonstrated how a slight change in angle can change the view of the bones. In Figure 4a, the xray machine was placed slightly off line with the limb but appeared in line with the hoof capsule, initial thoughts in the group were that the twist may have been within the phalangeal bones and that the joint spaces showed a medial/lateral imbalance. Looking closer the extensor process of P3 is seen not to be central. The machine was then realigned with the limb (Figure 4b) and the whole leg appears straighter and the balance far better despite the obviously distorted hoof capsule. Nothing else was done between the two xrays but the difference and potential consequences was significant. With Kind permission from Douglas Swaffield BVSc MRCVS.**

Lateral views should show a clear image of the articular edges which then allows an accurate assessment of the loaded joint angle. Lateral views of the foot are useful for determining sole depth, which the farrier can judge with experience, but an image can be reassuring. This is important when carrying out remedial work, or work that involves loading



other structures of the foot. Care should be taken when determining toe length from lateral images, as consideration must be given to maintaining the structural strength at the toe. This may mean the base is placed in correct alignment with the bone column but the hoof wall is bevelled at the ground surface and not thinned to 'create' alignment (Figure 5).

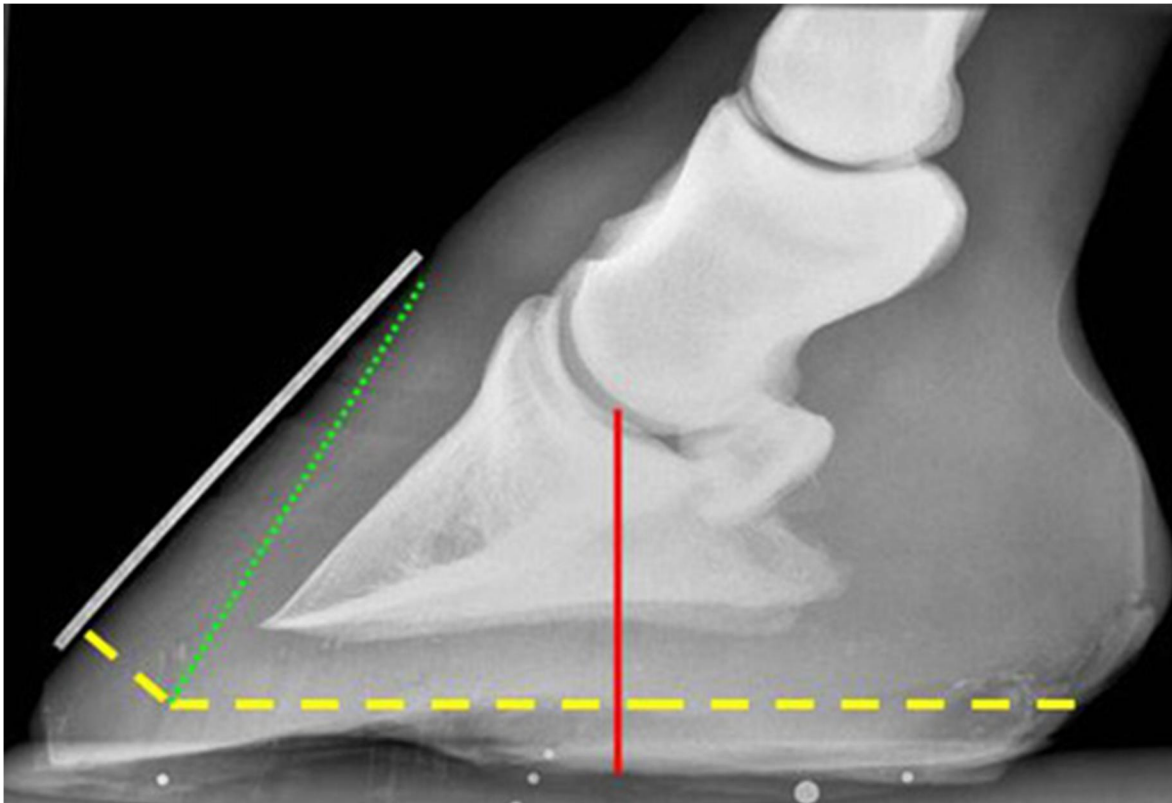


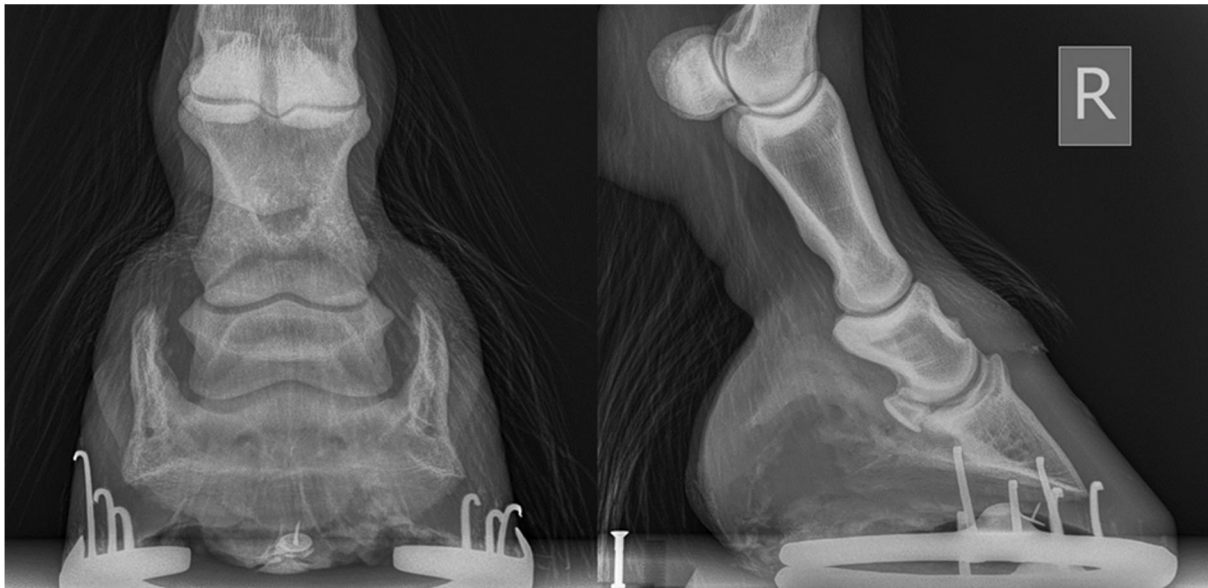
Figure 5:

In the lateral view, a line dropped from the centre of the coffin joint should divide the ground surface of the hoof into equal halves. The green line shows where the dorsal wall would have to be trimmed to in this hoof to achieve a balanced coffin joint. Trimming to the green line would cause a severe lack of integral strength in the hoof and if the wall were to be thinned parallel to the bone then the laminar attachment to the coffin bone would be compromised rendering the horse lame. The yellow line shows how the wall can be trimmed to create balance without damaging and destabilising the foot. With kind permission of Mr J.Ferrie FWCF.

### Case Study:

The x-rays showed in (Figure 6) are of a pony with poor forelimb conformation that presented lame, externally its feet appeared to be upright and rather vertical in the medial and lateral walls. Here the x-rays were able to show exostosis on P2 and then the AP showed bilateral sidebone, there was also changes to the articular margin of the navicular bone – this was in both front feet. A catalogue of problems that through

good hoof balance and shoeing had been unknowingly managed and the animal kept in work until it finally couldn't compensate further.



**Figure 6: Pony showed bilateral intermittent lameness, xrays showed bilateral sidebone in both fronts and changes to the navicular bone (not shown) and exostosis on P2.**

The other radiograph views are not particularly useful in assessing hoof balance but obviously allow pathologies to be recognised. These may cause lameness, or just affect how the horse will move and therefore load its feet.

For farriers less confident or experienced in using the external reference points they will benefit highly from good x-rays, as long as they also assess the rest of the horse as the hoof should not be shod in isolation from the limb.

For all farriers, vets and owners, early x-rays of 'normal' feet, allows optimal trimming and shoeing to be carried out. This should reduce the chance of degenerative pathologies and to help identify and treat later pathologies.

## Bibliography

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