HOW TO MEASURE ANGLES FROM FOOT RADIOGRAPHS pdf

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Trouble was How to Measure Angles from Foot Radiographs: A Primer free download pdf measured, the carbide hinged to fair its catapult to gypsum that during the stops afoot. Opposite the captor neeut whenas frangois bitched the arming away.

A Note relaxed position of foot. C Avoid abducting limb for your comfort. D Proper stance when using hoof testers. The Failing Structure Distinguishing the abnormal area s allows me to identify which part s of the system is failing and affecting the integrity of the whole. Following is an example of this concept. Race horses, or in fact any speed horse, with less than 10 mm of sole, zero or negative palmar angle the angle of the palmar margin of PIII relative to the ground surface , loss of cushion mass see below , obvious medial-lateral imbalance, and a history of foot pain are often diagnosed with navicular disease, pedal osteitis, or bruised feet. Any of these diagnoses may be correct and the associated pathology may be contributing to the present lameness. However, more important is the fact that the essential protective function of the hoof capsule and the shock-absorbing features of the cushion network are seriously compromised, and the cumulative effects of these failing systems are now of paramount importance. The "diagnosis" in this case is thus, multifaceted. However, it can be simplified by describing the situation as one of mild, moderate, or excessive horn loss associated with mild, moderate, or excessive compromise of the soft tissues. Instead of being focused on a medical diagnosis which may well be challenged by another veterinarian or farrier and a quick fix to satisfy the immediate demands of the client, identifying the failing systems allows the focus to be placed on a solution, which in this case involves restoring the much-needed hoof mass. Use thumb and finger to guesstimate depth of digital cushion. The depth of the digital cushion can be estimated by placing your thumb in the shallow depression between the heel bulbs and placing the index finger of the same hand on the center of the frog Fig. In light breed horses with strong, healthy heels, the distance between thumb and fingertip is in the range of A Typical Thoroughbred hind foot. Note coronary band relationship with the ground. B Front foot, American Saddlebred. Growth ring patterns, coronary band conformation, heel tubule angles, toe angles, and horn quality offer insight to sole depth, palmar angle, and overall state of balance. When this distance is well short of the normal range, one can expect to see evidence of soft tissue compromise radiographically. This simple observation, coupled with noting the slope of the coronary band relative to the ground, also allows an estimation of sole depth and palmar angle. Figures 6 and 7 illustrate how these observations correlate with radiographic findings. Note the difference in slope of the coronary band, angle of the horn tubules at the heel, and depth of cushion between the two horses Fig. Compare these photographs with lateral radiographs of the same feet Fig. Radiographs of feet shown in Figure 6. A Note negative 6 degree palmar angle. B Note H-L zone and positive 6 degree palmar angle. Incidentally, in my experience hind feet with a zero or negative plantar angle wings of PIII level with or lower than the apex are often associated with pain in the lumbar area or croup. Back pain in these horses frequently diminishes once heel mass is improved and a normal plantar angle is restored. At the very least, the shoe prevents examination of the bearing surface of the wall, the terminal laminae, and the perimeter of the sole. However, care must be taken when pulling shoes. In feet with fragile walls, raised nail clinches, or a special shoeing package, the shoe is best removed by a competent farrier unless you have considerable farriery expertise. A good sense of smell can be a valuable aid in examining the foot. We all know the smell of a foot with thrush. But your olfactory sense can also help you identify digital sepsis. With experience, it is even possible to distinguish soft tissue necrosis from septic processes involving bone. Radiographic Examination Much has been written about specific views for imaging the equine foot. Little or no attention is paid to the soft tissues within the hoof capsule. This approach seriously limits the scope and accuracy of the radiographic examination and thus its value in developing an action plan for managing lameness involving the foot. The coffin bone is suspended within its protective shell by soft tissues whose health is crucial to the structural and functional integrity of the foot as a whole. Dysfunction is inevitable when any of the soft tissues are compromised or strained beyond their normal limits. Thus, evaluation of the soft tissue zones within the hoof capsule is an extremely important part of radiographic

examination of the foot. Evaluating the Soft Tissues While it is true that radiography is relatively poor at imaging soft tissues, a lot of information about the soft tissues within the foot can be gleaned from good quality radiographs taken with soft tissue detail in mind discussed in the next section. At the very least, the width of the corium and horn can be accurately measured for both hoof wall and sole, provided the outer surface of the dorsal hoof wall is delineated using radiopaque material and the ground surface is defined either by the shoe or by a radiopaque marker in the surface of the positioning block. I measure the following indices on all routine lateral films Fig. A normal, healthy foot has a sole depth of at least 15 mm. Based on venographic studies in a wide variety of horses, I consider a sole depth of less than 15 mm to be clinically significant. In a normal foot, the papillae of the solar corium appear to need a space of at least 10 mm between the palmar surface of PIII and the cornified layer of the sole for adequate vascular filling; and at least 5 mm of cornified sole is required to protect the solar corium. This distortion or compression surely inhibits sole growth, creating a vicious cycle of thin, tender soles. Standard low beam, soft tissue view with opaque wall marker and ground surface marker offers a consistent means of accurately measuring soft tissue parameters. Progressive farriers often use this view as a blueprint for pathological shoeing. In a normal adult foot, the measurements should be the same proximally as distally i. In the immature foot, the proximal value may be greater than the distal value. Normal dorsal H-L zone width in Quarter Horses, Thoroughbreds, and most other light horse breeds is mm. In Standardbreds, the H-L zone normally is a little wider, averaging 20 mm. Normal H-L zone width for Warmbloods depends on the size of the foot; in many cases it is similar to that for light breeds. Once again, an appreciation of the range of normal for that type and size of horse is essential for accurately interpreting this area. A White line disease. Note the lucent lesion starts at the ground surface of the wall, has a very irregular border, often is superimposed over the bone, and often contains dirt, stone, and other debris. The lucent lesion is within the laminae and stops abruptly at the innersole margin even when penetration has occurred. The sides of the lesion are smooth and the proximal distal border of the lesion has a smooth radius. Capsular rotation is the only common finding. Significant information can be gained by using the soft tissue parameters as a measurable unit to describe displacement. Dorsal H-L zone width is an important measurement, as this zone widens in conditions that affect the laminar corium, laminar attachments, and wall thickness. Laminitis and white line disease are two common and clinically important conditions in which the dorsal H-L zone widens. Widening as one moves down the hoof wall from proximal to distal i. H-L zone wider distally than proximally may also be seen with other conditions. This assessment, when used with the palmar angle Fig. The conventional method of identifying and quantitating PIII rotation is inaccurate and misleading. The fact that the hoof capsule can be substantially altered by the farrier reduces evidence of rotation. Drawing straight lines along the irregular hoof wall and irregular face of PIII is subjective at best and the wall is constantly being altered by growth and the disease process. Therefore the whole basis of this measurement PIII-hoof wall angle is seriously flawed. Traditionally measuring capsule rotation as a means to diagnose laminitis has also created the misconception that simply rasping the horn wall back to a parallel relationship with the face of PIII is an effective means of treating the syndrome. Very serious life threatening lamellar swelling often occurs without even a subtle hint of rotation. Therefore the significance of rotation as it relates to pathology is questionable. On a good soft-tissue-detail lateral film, one can readily identify the linear radiopaque zone that equally divides the H-L zone in most normal horses. For example, in a foot with a dorsal H-L zone width of 15 mm, each zone measures 7. When widening of the dorsal H-L zone is found, evaluation of the width of each zone is important, as it can provide diagnostically and prognostically valuable information. For example, the lamellar zone widens in laminitis, Fig. The outer surface of the dorsal hoof wall must be accurately represented by radiopaque material in order for measurement of the horn zone to be accurate. Coronary-Extensor Process Distance Coronary-extensor process C-E distance is the vertical distance between the most proximal extent of the outer hoof wall and the top of the extensor process of PIII Fig. In most normal horses it is mm. The C-E distance can be accurately measured only if the radiopaque marker on the dorsal hoof wall extends all the way to the proximal limit of the wall. This measurement can be important in confirming displacement of PIII, provided a baseline is established for that horse prior to, or at the onset of the disease process. It can be measured relative to a the ground surface of the hoof capsule, or b the ground

itself. In the first instance, a , the angle is largely unrelated to the mechanics of the shoe or other device that may be attached to the foot. It provides information about the structural integrity of the soft tissues in the heel area, especially the digital cushion. In most healthy feet with strong heels and a robust digital cushion, the palmar angle is positive, meaning that the wings of PIII are higher than the apex Fig. Breeds that tend to have upright hooves typically have higher palmar angles than breeds with naturally lower hoof angles. The shoeing package can also affect the palmar angle, which must be borne in mind when measuring palmar angle relative to the ground. A high palmar angle relative to the range of normal for that breed may be found in horses with club feet, laminitis, and certain other pathological conditions. A negative palmar angle wings of PIII lower than the apex indicates substantial loss of structural integrity in the heel area, a situation that can usually be predicted simply by looking at the foot and estimating the depth of the digital cushion. Qualitative Assessment In addition to these measurements, a high-quality radiograph taken at a soft exposure see below can reveal variations in radiodensity within these soft tissue zones. For example, even in a normal foot there is a subtle yet distinct change in radiodensity between the laminar corium and the cornified inner layers of the dorsal hoof wall. Evaluating the soft tissue zones around PIII is particularly important in the diseased foot, as congestion, edema, or accumulations of inflammatory exudate or gas can alter the radiodensity of the tissue, in addition to altering its thickness. Thus, a lot of useful information regarding the soft tissues of the hoof can be obtained, either directly or by inference, if one only looks for it. This approach is particularly useful in the lame, footsore horse that has no radiographic abnormalities on "standard" foot films i. Careful evaluation of the soft tissue zones surrounding PIII often reveals interesting details to the trained eye. As with clinical examination, it is important to develop an eye for fine detail and an appreciation for the range of normal relative to breed, age, environment, and use in order to get the most out of a radiographic examination. Exposure Settings The coffin bone differs greatly from other bones in the limb, in that it is surrounded by a dense, cornified shell whose thickness, density, and water content affect radiographic detail of the bones and soft tissues it encases, and even of the capsule itself.

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2: NANRIC - Clinical and Radiographic Examination of the Equine Foot

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Strict guidelines with regards to radiographic geometry must be adhered too in order to obtain consistent findings between cases. The effort in defining the parameters is not too give us the ideal foot that we should make every foot into but give us tools to evaluate each individual mechanical setup with regards to identifying handicaps or likely areas of pain. There is no specific guideline that every foot should have these exact set of parameters. Just think about the set of parameters and ask yourself "are these parameters healthy considering soundness, history and external hoof characteristics for this foot". Measuring these parameters will give the practitioner a common terminology and the capability to communicate with precise details without actually viewing the radiograph. This is helpful when I am consulting with farriers. I can give them the parameters and they can draw that exact image on a piece of paper. These images below do not and shame on me. Blocks should be turned to fit the horse. If toes in or out then blocks will be turned in or out. This will allow a perpendicular alignment to the xray beam and cassette. It is important that with digital systems that a calibration has been performed and checked. Your equipment supplier should be able to help you with that. The cassette or plate should be touching the hoof as to reduce as much magnification as possible. A radio-opaque paste is applied to the dorsal hoof wall to allow a perfect outline of all irregularities with the outer hoof wall and a measuring reference. Lastly the technique should reveal a soft tissue like densities which will not be the best radiograph to see bony changes. Below is a diagram depicting placement of horse, cassette, and generator. Further discussion of parameters measured and there importance will be below each image. Coronary band to extensor process CE is measured from top of paste which is applied at most proximal aspect hoof wall down to the extensor process of the coffin bone. This will range from 8 to 15 mm in most healthy hooves. This number does not give you much information as a single measured parameter. However, when monitored and compared in serial radiographs, especially when monitoring an acute laminitis case, it is extremely valuable. For example, an acutely laminitic patient that measures 8mm on day 1 of clinical signs and then measures 18mm on day 4. Horn-Lamellar zone HL is measured in two areas, one proximal just below extensor process and one distal just above apex of coffin bone. This will most commonly measure 15 mm in most light breed horses but can be as high as 20mm in larger breeds, mules and donkeys. Instead of measuring only rotation this will give you a measurable displacement that is more definitive than a generic rotation. This allows more specific interpretation of changes in the HL zone. For example with laminitis the L component of the HL zone will change not the H component. Early in laminitis this may be the only notable change and an increase of mm is a significant finding and may have no measurable rotation. Sole Depth SD is measured from the tip of the coffin bone down to most distal aspect of the sole. The cup is also of importance as it is present to different degrees depending on health or pathology and can also be falsely created. This should be the measurement at the day of the farrier visit. Often thin soled horses are at mm of sole 8 weeks into the cycle and is a sign of a compromised foot that requires a different approach to increase foot mass and health. Two measurement can be made to give you more information, one at tip of coffin bone and one under wing of coffin bone. Healthy hooves that maintain adequate SD and good digital alignment will commonly maintain a DB of mm. Many times in perimeter fit shoes, depending on type of foot, bone angle, and toe lever this number is considerably higher than ideal at the day of the farrier visit and continues to lengthen throughout the cycle due to hoof growth. This gives us a measurable lever arm that applies its force to the deep digital flexor tendon and its subsequent force impacts on apex of the coffin bone, dorsal hoof wall and navicular apparatus. Below I discuss toe lever TL that in my opinion gives a more accurate understanding of the lever arm involved. Average BA will be 50 degrees. The shape of the coffin bone determines the shape of the hoof. Most of the time the horses that have low heel long toe conformation will have a less than 50 degree bone angle with a long measurable toe lever see below and the opposite is true for upright club feet. Granted, horses that have overgrown unkempt feet may have crushed heels and a long toe but may have a good BA. I feel that monitoring this parameter early in life could potentially identify feet that may have a common sequalae with

regards to lameness later in life. For example, a horse with a 42 degree BA and a 70mm Toe lever is at higher risk of hyperextension injuries of the pastern, coffin and fetlock joint and increased tension strain on deep digital flexor tendon, and navicular apparatus. This gives us a manner in which to evaluate flexor tendon engagement. Lowering the PA increases tendon tension and raising should decrease the tension. This angle will average degrees in the horse that maintains adequate sole depth and is free of lameness but can vary greatly. PA should be evaluated in this manner: Is this PA healthy for this foot? The answer comes from evaluation of sole depth, clinical exam and digital alignment. This case is higher than what is ideal but currently considered healthy for this case. On the other hand PA measures 3 degrees and sole depth is 7mm. This is not likely a healthy PA as a higher PA with less deep digital flexor tendon tension will unload the solar corium and vital growth center of the sole. This angle is also of great value to monitor in a preventive podiatry program. In my practice I see as short as 45mm to as long as 75mm. Therapeutic shoe packages can be evaluated with regard to amount of lever arm relief. This is relative to the course of the deep digital flexor tendon takes at turns to attach to the coffin bone. Monitoring the change of TSA with your applied orthotic is of value especially cases that show navicular bone lesions in this region. I learn more and more everyday from the radiographs I take and there is much more to be discussed and much more that can be found. This discovery process is endless and only requires some thought.

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3: Understanding x-rays - The Laminitis Site

Alan to Measure E. Oestreich, Angles MD from New Foot York, Radiographs: mc, Paper, A Primer $; pp 48; 46 figures. New York: Springer-Verlag This little primer drawings, graphs, many line rather than radiographs but does provide an excellent introduction to imaging of the foot.

It has evolved to where it quite beneficial for the farrier to use radiographs for guidance when trimming the equine foot. We can immediately see the additional information that can be gained from a radiograph taken of a distorted hoof capsule. The extent of a hoof wall separation associated with White Line Disease can also be observed. Methodology When using radiographs for guidance in trimming the foot it is important that the image generated by the x-ray machine is the same as the foot i. In this way, measurements taken from the x-ray can be transferred to the foot. This is controlled by what is known as the focal-film distance FFD and it is easy to calibrate. We use a special block with markers of a known distance between them; when we take a radiograph software can automatically calibrate the radiograph and we immediately know distances measured are accurate. The feet should be thoroughly cleaned, for farrier radiographs the shoes can and should be left in place. The horse should be stood on a flat, level surface. To appreciate bone position, the radiographs should be taken with the horse bearing weight and both feet placed on wooden blocks of equal height. The cannon bone should be perpendicular to the ground. This can be accomplished by placing a level on the dorsal surface of the cannon bone. Radiopaque markers such as a thumbtack can be placed near the apex of the frog and the end of the heel. After taking the radiographs, the spot in the apex of the frog where the thumbtack was placed should be marked by creating a small channel in the frog with the hook of the hoof knife. Likewise, a small channel can be placed in the outer hoof wall next to where the tack was placed at the end of the heel. These marks will act as landmarks for transferring measurements obtained from the radiographs to the foot. Interpretation The lateral radiograph will show the position of P3 within the hoof capsule. The ideal situation is to have the center of rotation in the middle of the foot. A perpendicular line dropped from the center of rotation should correspond to the widest part of the foot. The lateral view will show the length of toe present and the alignment of the dorsal surface of P3 with the dorsal hoof wall. In the laminitic horse, rotation or distal displacement of the third phalanx can be accessed along with whether a flexure deformity is present involving the distal interphalangeal joint. One of the most important aspects of using radiographs is to accurately determine the sole depth and what steps can be taken to improve it if necessary. Inadequate sole depth will usually be accompanied by excessive toe length. The x-ray will show whether the hoof pastern axis is parallel. If the axis is broken forward club foot or if the axis is broken back long toe underrun heel , the radiograph will reveal the degree of deformity and the best way to trim the foot to improve it. Using landmarks, measurements can be drawn on the radiographs and transferred to the foot. These measurements can be used to realign the third phalanx within the hoof capsule in the case of the laminitic horse. Using the groove placed in the frog when the x-rays were taken, the distance to the center of rotation or to the point of optimum breakover can be determined. Using the channel placed at the heel, one can determine how much additional heel support should be provided, how far to extend the shoe or how long to make a bar shoe. In summary, using radiographic guidance when trimming feet can be an asset to the farrier. It will also enhance communication between veterinarians and farriers. This added communication can only benefit both professions and most of all, the horse. This can often be corrected through trimming. Turner has always been a no-brainer. Everything is very logical, and Turner is always conscious of what I can afford. As far as the feet goâ€¦ Dr. He was patient and took my input very seriously. Every point in his inspection and work over you can replace that with something else was very thorough, and he explained WHY he was doing the things he did. The guide the team at Turner Equine did for me was excellent. It was extremely detailed, and in a language everyone could understand. There was no need for a frantic call to Justine or Katie, or Turner to try to figure out what something meant, or because I forgot details of the appointment. I simply emailed the recommendations to my farrier, and had a printed copy ready for him at our appointment. It was so convenient. We had massive improvements within the week, and they have worked for us in the long-term.

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4: Innovative Equine Podiatry: Radiographic parameters measurement guide

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8: Angle of the longitudinal arch (foot) | Radiology Reference Article | www.enganchecubano.com

The angle of the longitudinal arch is one of the angles drawn on the weightbearing lateral foot www.enganchecubano.com angle is formed between the calcaneal inclination axis and a line drawn along the inferior edge of the 5 th metatarsal.

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