The Natural Angle
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Static & Dynamic Assessment

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Overview

I would like to go over a couple terms we hear a lot. Static and dynamic balance. What do they mean, why are they important to us? Is one more important than the other? Is this something we need to fix? What are they and what do we do with them? Many questions. I would like to use this article to give them some definitions, why they are important, and how an understanding of them can help us come up with a better shoeing plan.

The simple definition is that we are assessing how force courses down the leg and puts load into the hoof. First is static balance, what we are assessing is the direction of force going into the foot as load when a horse is standing. Dynamic balance is an assessment of the change of direction of force going into the hoof as load when the horse moves through the stance phase.

Let's call this a static and dynamic assessment rather than balance. Static assessment for the most part, gives us information on assessing a trim. Dynamic assessment for the most part, gives us information on shoe placement and shoe mechanics. Let's take a closer look at each and see what we can do with the information.

Static Assessment

Static assessment is done with the horse standing square. I'm going to use the term vector. A vector is simply a straight line. A force vector has both direction and magnitude. A load is force exerted on a surface or body or in this case, the hoof. When we look at a static horse, we want to visualize the force vector coming down the leg and to see where this vector goes into the hoof. This tells us where the load is. Ideally it should be centered into the foot, medial/laterally (M/L), and dorsal/palmar (D/P). But this will be complicated by various conformations, offset pastern ***(fig. 1a, b)***, and normal pastern ***(fig. 1c)***.

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1a


1b


1c

For M/L assessment look at the front of the leg, or dorsal view, and determine if the force vector is bisecting the hoof capsule. A T-square sighting method between the cannon bone and bottom of the hoof can also be used, although this will not work on the hind feet and is less accurate as conformational deviations of the limb increase.

2

For D/P assessment try to visualize the Hoof Pastern Alignment (HPA) *(fig. 2)*. With this method we are trying to assess where P1, P2, and P3 are lined up. Our external markers of the pastern angle going into the hoof capsule can be helpful but are not always reliable. Flexor tension: contraction and laxity, and coffin bone shape can confound this assessment along with hoof capsule conformation/distortions.

When assessing the bony column look for toed-in toed-out, carpus valgus/varus. Base wide/narrow, cow-hocked, offset knees, fetlocks, and coffin joints. Along with various angular and rotational deviations in the long bones from the shoulder on down. This will help you to determine which direction the force vector is coming down the leg and entering the hoof capsule. We will use the information we gather from our static assessment to determine a trim plane. Think of these dotted lines as approximate force vectors, *(fig. 3)*.

Evidence of a proper static load trim can be evaluated with radiographs. Equal joint spacing on the D/P view can be evidence of uniform load across the joints mediolaterally *(fig. 4)*. It can also be subjectively assessed by looking at the hoof. The hoof is viscoelastic. This means it is resilient and shock absorbing, but it deforms over time. We see this in flares and dishing. We can use this information to assess how load goes into the foot over time. We can look at growth rings, the direction of the horn tubules, flaring, and heel growth and direction to help us fine tune our trim. Less distortion is usually letting you know you are on the right track to a proper trim for that particular hoof. Remember the most important trim is the next trim. Which is to say we use all the information we see to come up with a proper trim plane. Then we see how the hoof responds through the cycle. Then we reassess and do it all over again. That means when we come out to do the next trim in six weeks that will be the most important trim because we will be assessing the work we did today and fine tuning it to make it better the next time.

Dynamic Assessment

Dynamic assessment is done with the horse walking away and back towards yourself. What we are assessing is how the foot lands, which way the fetlock drops, and how the force vector courses through the joints during the stride. The variables that affect this assessment are angular deviations of the joints on flexion, rotational and angular deviations of the radius, cannon bone, pastern

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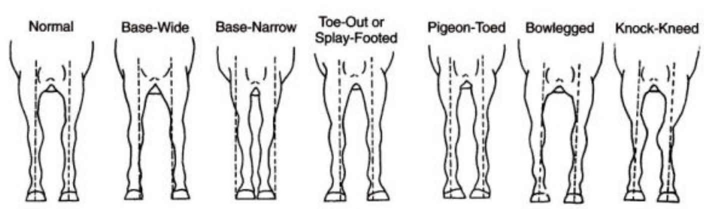

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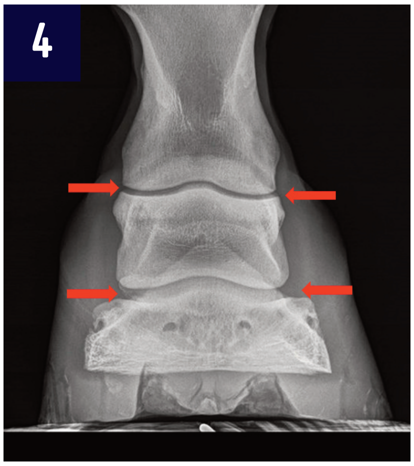

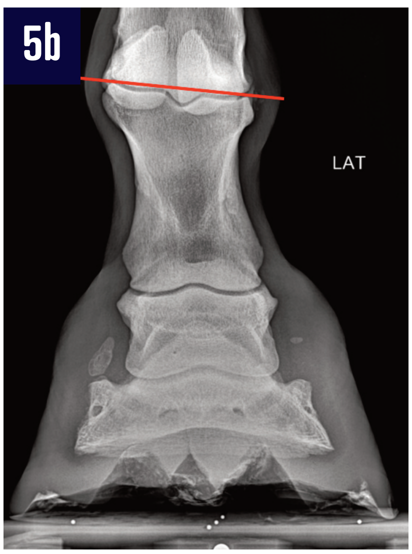

bones and the coffin bone. Assessed individually and taken as the whole limb ***(fig. 5 a,b,c)***.

Fetlock drop is one of the most important things to look at. The direction of the force vector is shown by the direction at which the fetlock drops to the ground. When this happens, it can be because at a D/P view the fetlock joint is not parallel to the ground. It is higher on one side than the other. This fetlock joint angle and/or offset between the cannon bone and P1 seems to be what gives the fetlock direction as to whether it is going to drop between the heel bulbs, or medially, or laterally to the heel bulbs ***(fig. 6a landing, 6b loaded)***. When this happens, it's going to affect whether the foot is going to land flat or not. What happens as the leg is coming out of flexion and back into extension is that it is unfolding back into position. Evidence for this can be supported by radiographs that show even joint spacing even though the hoof is not landing flat. This uneven hoof landing can also be caused by a whole limb lateral rotation the whole leg is swinging back into place sideways, so it must land laterally first before the leg comes back underneath the body ***(fig. 5c)***. These are things we cannot change with a trim. Studies have shown chasing a flat landing on these types of limbs have not been beneficial for static loading even if they can get the horse to land flat. Some limbs line up well, and the hoof can land flat. If these feet are landing unevenly, we can trim them back to a flat landing. We always need to be aware of what we can and cannot change.

Turning static and dynamic assessment into a shoeing plan

Trim for alignment, shoe for mechanics. This is the best way I found to tie these two assessments together. We trim for alignment. Remember the hoof is viscoelastic, it is resilient but deforms over time. If we don't have alignment correct the hoof will deform. We are not just shoeing for the hour or two a day the horse works or weekend rides. We must shoe for the whole cycle. If we can't bring the foot in to good static alignment, we need to put something in the shoe to help it out. This usually comes in the form of a wedge for the D/P alignment, or low heel is what we commonly deal with. We can't always leave enough heel to correct the HPA. We can also add a medial or lateral wedge as

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conditions warrant. We can make both these adjustments until the hoof capsule can hold a proper position on its own.

Now we need to build a shoe for mechanics. Here we combine our static and dynamic assessments. When a horse enters the stance phase, first contact with the ground, the direction of the force vector will enter the hoof going a direction, then move past its static position, then stay on this course until it reaches maximum load. It will then settle back into its static position as the horse stops moving. This track will range around its static position based on its conformation, weight, footing, and speed. This force vector can be vertical or oblique. This becomes more important as the stride cycles increase. This will be noticed in any type of performance horse that is working regularly. The more stride cycles there are, combined with a force vector producing load in the hoof at different angles will increase deformation.

Don't forget that a shoe has two interfaces. One on the hoof side, one on the ground side. For the horses that are landing on the outside and rolling into static alignment, we can help them with a lateral roll. This lateral roll will help on the ground side. If we have a horse with a sheared heel, we can float the heel to help that out. This will help on the hoof side. For a horse with a long toe and a low heel where we need to shorten the lever in front of the toe within conformational limitations, we can set the shoe back or put a long roll into the shoe to get the break over point where we need in relation to the center of rotation of the coffin joint.

Practical application on an upright heel

Here is how both assessments will help me come up with a shoeing plan for an upright hoof. I look at the horse standing to determine if there's any angular deviations that are going to cause load to not be centered in the hoof. Then I will walk the horse to see if there are any angular deviations in the joints that show up on flexion that would cause the force vector to course lateral to medial in the loading phase. Then I will walk the horse past me to see how much heel strike there is. I am using my dynamic assessment to help determine my D/P trim plane, I will trim enough heel so that the hoof is landing flat. When there is heel strike it indicates there is laxity in the flexor system, so I am safe taking the heel down to landing flat without putting tension in the flexor system while the horse is standing (*fig. 7*). I will use my static assessment to set my M/L trim plane.

I will set my M/L trim so that the horn tubules in the dorsal section of the hoof wall are perpendicular to the ground. I have found this is a good starting point for this hoof conformation. I will now make and apply a shoe based on the center of rotation of the coffin joint with 50% in front and 50% behind the center of rotation (*fig.8*). This can be done with a rocker toe, rolled toe, or a set-back toe. Whatever is appropriate for the particular horse, ground surface, and usage. This will take the tension off the flexor system when the horse starts the break over period of the stance cycle. Too much tension at this point in the cycle can cause the toe of the hoof to dish.

What about when there is lameness or pathology?

When there is lameness or pathology the rules still apply. You just must adjust the weight given to each assessment. If protocol for a particular pathology includes stall-rest then more weight can be put in to changing static alignment to help without having to worry about harm caused by movement. For example, raising or lowering heels in a laminitis case or changing M/L alignment for a collateral ligament injury. Then once a horse moves into a rehab phase where there is more movement, the dynamic

Continued on page 5

assessment comes back into play. The question that needs to be asked for each lameness, and shoeing cycle, during the lamness/rehab period is: will my adjustment of the static alignment cause more harm than benefit when this horse is moving? This of course will be a case-by-case assessment but by using this guideline each time will increase the chance of a proper recovery.

Summary

I have gone over the definitions of static and dynamic assessment. We know it is not static and dynamic balance, these are assessments used to find a trim plane and shoeing protocol. Static assessment mostly helps define trim plane. Dynamic assessment is mostly used to determine mechanics and placement of a horseshoe. We have gone over what a force vector is and how it differs from load. A force vector is a direction that force is going down the leg and is evidenced by the amount and direction of load going into the hoof.

Using these assessments appropriately we can determine a trim plane and a shoe protocol for a particular limb. The weight we give each assessment is going to be based on whether we're working on a lame horse or a sound horse or a performance horse and the pathology, confirmation, and ground surface that are related.

Alignment is only achievable for a moment. What shoeing protocol we come up with is only good on the day we apply it. It starts changing immediately, leaving the parameters of alignment. How long it holds is limited by shoeing cycle, ground surface reaction, hoof growth, and the amount of loading cycles.

These assessments are something I use in my daily practice on every horse, on every limb, reassessing each time. I like to think of each shoeing protocol I come up with as a question that I'm asking the hoof. I'm going to come back in six weeks and see what answer the horse gives me. I will then come up with another question for the hoof, reassess and repeat. I will do this until the hoof tells me through minimal distortions, good sole depth, even growth, and a healthy frog, etc., that I asked the right question. Then, that becomes the trimming and shoeing protocol for that limb. Don't forget that the hoof is the ultimate decision maker over what is correct. ■

PRO TIPS

Venous Plexus Engagement with Frog Support Illustrated with CAD

By Austin Edens, CJF

SHOEING WITH FROG SUPPORT HAS GAINED TRACTION IN THE PAST FEW YEARS WITH ITS PRIMARY BENEFIT FOR CAUDAL SUPPORT OF THE HOOF CAPSULE. We have many tools at our disposal to combat caudal failure in the hoof capsule, such as heart bars, frog-support pads, DIM, pour-ins, etc. Anecdotally, I often observe an extra amount of hoof growth after applying these measures. This accelerated growth can be explained by the additional frog support increasing engagement of the venous plexus in the caudal region of the hoof.

Horses evolved with the frog as a weight-bearing structure. On a barefoot hoof, the frog synchronously engages the ground with the heels during the loading phase of the stride. One negative effect of shoeing horses with a regular shoe is that the frog of a shod hoof bears less weight and has less ground contact than its barefoot counterpart. For the vast majority of horses, this slight decrease in frog function has a negligible effect on the health of the foot. However, there is a substantial portion of the sport horse population that experience caudal collapse of the structures that are vital for nurturing blood flow in the venous plexus. These compromised feet can benefit from the additional frog and caudal support by increasing blood flow via the venous plexus and its supporting structures of the hoof capsule.

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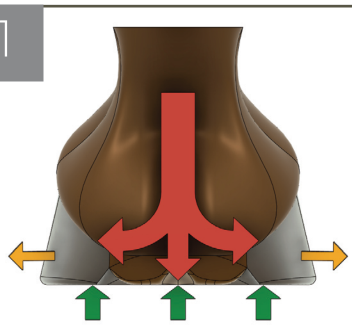

UNSHOD HOOF
The load of the bony column (red arrows) colliding with the ground reaction forces (green arrows), and creating outward pressure on the heels (yellow arrows) due to the increased hydraulic pressure of the caudal region. On a barefoot hoof, compression of the frog and digital cushion initiate simultaneously with the heels when contacting the ground, thus maximizing the hemodynamic function of the venous plexus.

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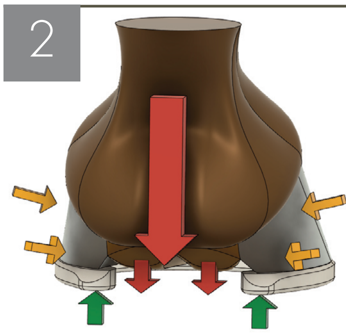


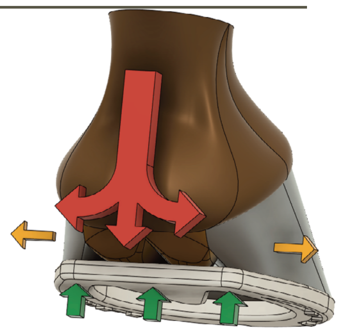
SHOD HOOF WITH A REGULAR SHOE
The load of the bony column (red arrows) shearing against the ground reaction forces (green arrows), and creating inward and forward pressure on the heels (yellow arrows) due to the higher GRF on the heels. There is a delayed and reduced GRF on the frog and digital cushion.

3

SHOD HOOF WITH A WELD-IN FROG PLATE
A weld-in frog plate on a Kerckhaert DF with FootPro™ DIM 20 is one of my go-tos for increasing caudal support and optimizing venous plexus function.

4

SHOD HOOF WITH FROG SUPPORT (HEART BAR)
This is the best of both worlds. The foot has the protection and support of a shod foot and the hemodynamic function of the venous plexus of a barefoot hoof.



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CAUDAL CROSS-SECTION
Caudal cross-section view with digital cushion and collateral cartilages.

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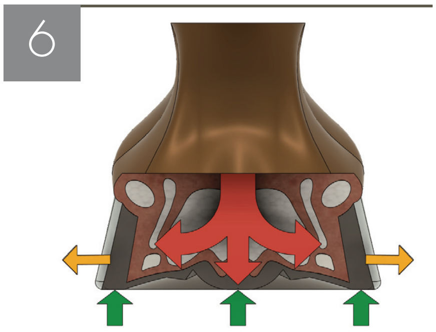

LOADING FORCES ON AN UNSHOD FOOT
Caudal cross-section view of loading forces on an unshod foot. Compression of the frog and digital cushion push against the collateral cartilages to pump blood up through the venous plexus.

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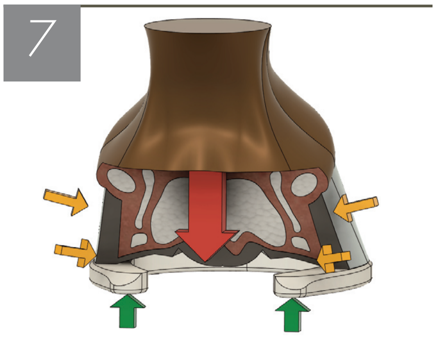

LOADING FORCES ON FOOT WITH A REGULAR SHOE
Caudal cross-section view of loading forces of a foot with a regular shoe. Some frog and digital cushion compression is lost due to less GRF on its palmar structures.

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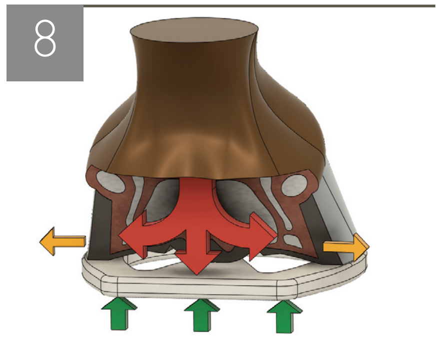

LOADING FORCES ON A FOOT WITH A HEART BAR SHOE
Caudal cross-section view of loading forces of a foot with a heart bar shoe. Frog and digital cushion compression is restored on a shod foot with the addition of frog support (heart bar).

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Find These Quality Products at Montana Farrier Supply

Bellota Top Level

The Bellota Top Level is 12% wider and 10% thinner than regular rasps, for perfect leveling balance and control. The 8 tooth rasp side pattern offers an easy cut, ideal for trimming. The intermediate file side yields an excellent and efficient finish.

Kerckhaert SX-Roller

With features similar to the Classic Roller, this shoe is an excellent choice for horses needing additional ease of breakover, whether for movement in performance, or simply more comfort because of injuries or chronic ailments. While this half round style boasts more ground surface than a true half round, it allows the ease of breakover half round shoes are noted for. The crease gives traction while not taking away from the rollover effect of the shoe. Punched for 5 City, 5 Slim or 5 Combo.

Liberty Combo Series

Combo nails are a modification of the City or Slim nail. The heads are slightly larger but yet the shank is still similar to the City or Slim. They are often used for resetting when nails holes have enlarged or with shoes that have a wide crease. Available in Steel and Cu Shield.

FootPro™ DIM - The Impression Material You Need

A non-toxic, non-allergenic, dental grade silicone that is hand mixed to a moldable consistency and applied to the bottom of the equine foot with a pad to provide either a soft cushion (DIM20), or a firm supportive material (DIM40) when needed. Available in 2lb or 4lb kits.

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