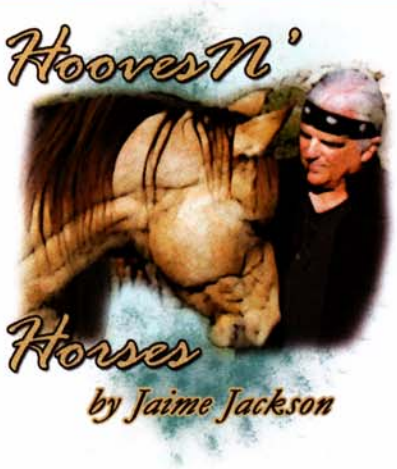

The Myth of P3 Rotation

Fear of P3 rotation - the painful tearing of the coffin bone from the hoof wall due to laminitis - looms large in the minds of many of those confronted with this dreaded pathology.

Conventional therapy often aims to stabilize P3's position to prevent the bone from plunging through the sole – and mitigating suffering through remedies such as "heart bar" shoes, "support" pads, drugs, lasers, resection of the hoof wall to remove any "shear forces" - and even tenotomy to prevent downward forces on the bone caused by the flexor tendon. But all are doomed to fail in my opinion. Why? Because 'P3 rotation' is neither the cause nor the source of any pain!

I wish to present a new weight bearing theory that provides a different perspective concerning P3 rotation or penetration. The horse is best served if we simply get down to the business of healing through natural hoof and horse care strategies!

PATHOPHYSIOLOGY OF P3 ROTATION

P3 rotation follows from a corruption of the inner hoof wall's lamellar "attachment and release" mechanism during laminitis. Dr. Christopher Pollit, Queensland University, has implicated (at the onset of laminitis) the proliferation of metalloproteinese enzymes at the basal membrane interface with the epidermal leaves. These enzymes are typically present to help break down the bonds during keritinization so that the hoof wall can move past P3 during normal growth. But during laminitis, this breakdown occurs faster than the cell-mending keritinocytes can repair the broken attachments. When this occurs, P3, purportedly under the full bore of the horse's body weight, is said to rip ("rotate") painfully away from the hoof wall and if the trigger is severe enough, "founder" or penetration of the sole may occur.

What I would like to bring into this discussion is the coffin bone's relationship to: 1) the "whole horse", particularly the skeletal superstructure; 2) how P3 is actually supported within the capsule; and 3) weight bearing forces — specifically, whether downward compressional forces actually impact the bone during support.

P3 AND THE WHOLE HORSE

P3 lies at the bottom of the horse's skeleton and is manipulated principally by the deep digital flexor and extensor tendons. Much has been written about the biomechanics of P3 movement in response to these tendons, and the muscles and nerves that activate and propel the whole system. So I won't go into detail here except to emphasize that muscles, tendons, and nerves are the driving force — not P3. Instead, let's look at the weight of the entire skeleton. It constitutes roughly 10 percent of the horse's total body weight. The balance consists of water and soft tissue mass (e.g., muscles, fat, tendons, etc.). Since the skeleton is such a "light weight", how much of the horse's entire body weight does it actually support? And what about P3, since his entire weight is 'supposedly' pressing down upon it? Before answering, let's first take a look at how P3 is supported inside the hoof.

Between the hoof and the capsule is the fibrous connective tissues (leaves) as well as a pressurized hydraulic system operating within the vascular system. An extensive network of valve-like shunts connect the arterial and venous channels, enabling pressurized blood flow to bypass the capillary beds, insuring continuous circulation, even during acute laminitis. As well, the fibro-fatty digital cushion provides yet another "brace" for resisting rotation in its position beneath and behind the digit. Most significant is the thick layer of moist, subcutaneous tissue that envelops the entire digit above and below the coronary band. As well, the bottom of the digital cushion is reinforced by the highly elastic frog corium. Arguably, the entire environment within the capsule is a very cushy affair!

The extensor and major flexor tendons - and their points of insertion in P3 - further brace the entire digit. The action of the muscle and tendon groups is, of course, to manipulate the bones and joints of the horse, including the digit, so that the hoof can provide support and disengage for flight. It's important to emphasize that the digit is not moving the muscle-tendon groups. It merely provides a "neutral" framework for them to act upon. It would appear that as long as there is muscular tension, the muscle and tendon groups are doing all the work, including weight-bearing. So, I conclude that P3 is also along for the ride. It basically sits down there in a state of relative "weightlessness" until acted upon by the muscle-tendon groups. So, what happens with P3 during laminitis or during P3 rotation? Or, penetration? Somehow the bone has found its way through the sole!

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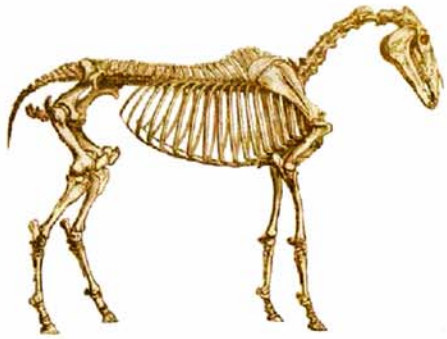
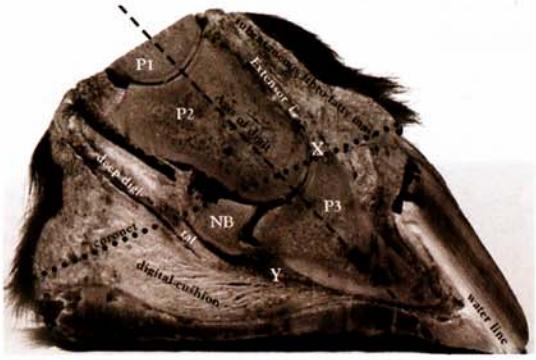


The 210 bones that comprise the horse's skeleton only constitutes about 10 percent of the horse's entire weight.



This cross section can give readers a glimpse inside the hoof.

The lamellar and solar attachment mechanisms have been completely destroyed in the hoof of this four-year-old Quarter Horse suffering from acute laminitis.

This horse's hoof has grown a protective lamellar wedge and, if managed under the protocols of Natural Horse Care, will recover just fine.

THE MYTHOS OF P3 ROTATION

First of all, I think any pain in conjunction with laminitis is from inflammation (heat and swelling) of the dermal lamina due to toxicity caused by triggers such as unnatural diets or pharmaceuticals. During laminitis, the Supercorium (the vascular network) is too sick to create normal attachments. Instead of a "tight" white line formed between the hoof wall and the sole, it is poorly formed. If the causality of the laminitic episode is arrested, the pain will go away. And many horses become sound even if their white lines are still "stretched". But, if the trigger is not eliminated, the pain and "stretching" will continue along with the characteristic "lamellar wedge," "dropped sole", and exaggerated "laminar rings" around the outer wall.

The sole, like the hoof wall, is both sloughing and growing away from the horse. Its arched, concaved conformation is now gone. And the weight-bearing, soft tissue mass surrounding P3 also descends, and with P3 firmly in its grip, the bone may now be tilted anteroposteriorly due to normal interphalangeal joint rotation - following the loss of indirect connectivity to the hoof wall. It is in this position, relative to the flat, weakened sole, which the latter may "split" along its sharp, distal edge and allows the coffin bone to pass through the sole. But more often than not, this does not happen. Often, the hoof attempts to "build" a "mound" of protective horn (lamellar wedge) over this edge (located just forward of the point-of-frog) to spare itself the consequences (such as infection) of being opened to the environment. The soft tissue mass remains, essentially, biodynamically "operational" and this normally precludes P3 from piercing the sole.

We should not obsess with P3 rotation or penetration. Instead, get right down to the business of naturalizing the diet, living conditions, and hoof care. Nature will then take care of the

rotation. If he is shod, we must remove his horseshoes— as his barefoot movement unleashes latent, internal healing forces. The fixed shoe suppresses them by weakening the structural integrity of the hoof, deforming its growth patterns, and preventing natural wear. Nails, especially those driven into the water line, or worse, the white line, alert the Supercorium to environmental intrusion, causing it to contract to protect itself. No doubt, circulation is also compromised. In short, P3 rotation is not the real threat. The horse simply needs to grow a new hoof to protect its sensitive structures from environmental intrusions, to enhance its hydraulic and cushioning systems, and to facilitate natural movement. It will do this entirely on its own, if we allow it.

Jaime Jackson is the author of 5 books, a hoof care professional & natural horse care consultant. He is the founding member of the non-profit equine advocacy organization, Association for the Advancement of Natural Horse Care Practices (www.aanhcp.net) & the principle instructor for the Institute for the Study of Natural Horse Care Practices (www.isnhcp.net), which he and his business partner, Jill Willis, created in 2009. He can be contacted at jacksonaanhcp@gmail.com and his website is www.jaimejackson.com