Originally published in the European Farrier's Journal, 2018.

Long Term Case Study of Onychomycosis in a Friesian Gelding

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Onychomycosis is fungal infection that attacks nails. 'Onycho' means finger nail or toe nail, 'mycosis' means disease caused by fungus. In the case of the equine hoof, onychomycosis [1,2] is normally referred to as white line disease (WLD). Despite its name, WLD involves the non-pigmented inner hoof wall and not the white line of the hoof. The white line (or zona alba, stratum Internum) is the junction between the wall and sole [3].

A 17 hand, 1800 lb, 14 year old Friesian gelding (Yerke) came to us after clinical evaluation ruled out metabolic issues. All four hooves were affected with WLD with the front hooves showing most of the damage. The initial shoeing method consisted of hoof wall resection, elevating the heels via wedge pads and application of banana (rocker) shoes along with gluing and casting material. The fungal infection was no longer active at the time of my initial shoeing at the end of July 2017. The exact cause for the WLD onset was not determined.

Upon initial arrival at my facility, Yerke was very reluctant to move. After shoe removal, the four hooves showed signs of unresolved damages due to WLD -- the right front being the most affected. I have chosen to show only the right front hoof for this article but Yerke's entire case study can be viewed at www.EponaMind.com/yerke-case-study. All four hooves had abnormally high heels. For such cases, my approach is to gradually lower the heels to the level of the exfoliated frog. I then remove toe length while assessing how and when to

remove damaged walls. I tend to work in increments. My goal is to find a balance between removing impaired tissues and leaving some in order to provide strength and support to the hoof while healing. Full debridement is not always necessary.

Trimming and shoe placement are done by using an orthographic (perpendicular) projection after palpating the coronary gaps (figure 1). The capsule -- being a three dimensional asymmetric object -- is not always easy to assess.

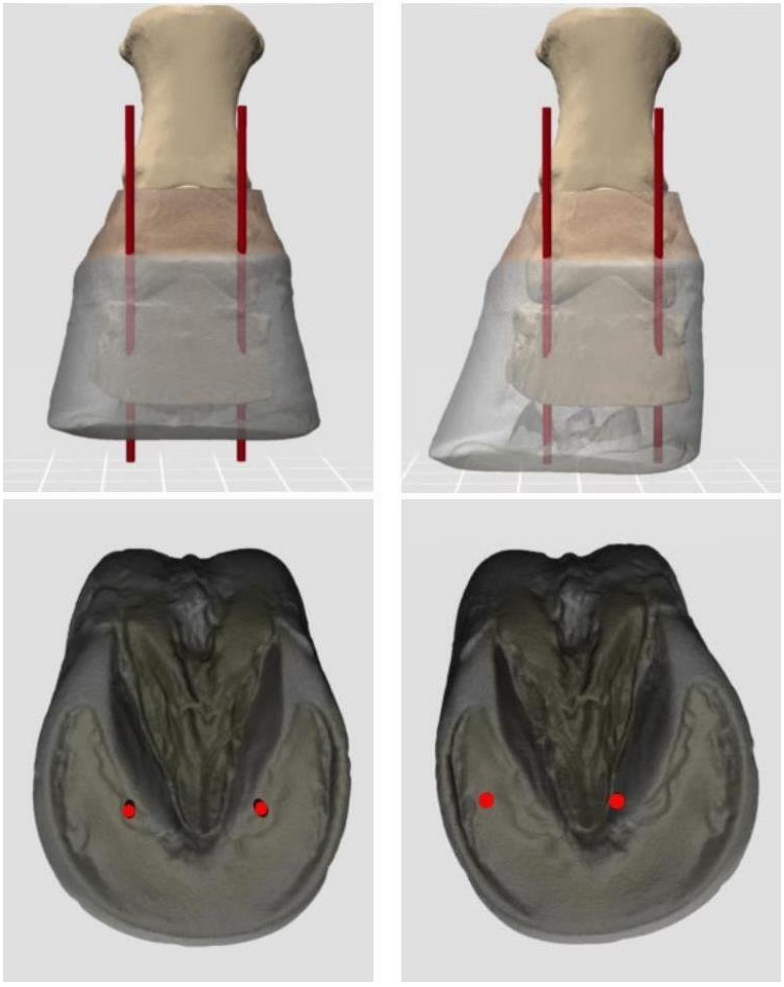


Figure 1: Soft spots, called the "coronary gaps" are palpated and mapped to the sole: This gives a bone reference to aid in trimming and shoe placement and is particularly useful in the case of distorted hooves (e.g. the right hand column).

The hooves are then thoroughly disinfected and cleaned prior to packing the caudal aspect of the hoof with dental impression material. I rarely pack hooves forward of the apex of the frog.

At the time of the first application, and after careful hoof testing, the area around the apex of the frog showed signs of pain on all four hooves. The shoes were ground on the sole side adequately to avoid any chance of sole pressure. I tend to support such hooves progressively, at first with a more cushioning approach, and later, as the pain disappears, with somewhat firmer support.

It is always advisable to use caution while providing sole support and packing hooves since no two hooves are the same. The ground side of the shoes were also prepared to provide adequate rolling at the shoe periphery. Rolling is done at the heels and toes, and the pitch is adjusted as called for by the situation.

Figure 2: The shoe is beveled all around. I generally don't top dress the entire capsule since I want to see how the tubules align as they relate to the articular area between P2 and P3.

A light roll was also applied to medial and lateral sides of the shoes which helps to ease the mechanics of limb ad/abduction (figure 2). A small ribbon of glue was applied onto the shoes. I limited the amount of glue on some areas of the hooves to allow better air circulation to certain regions. Finally, four nails were applied to further secure the shoes. My goal is to make the horse as comfortable as possible so that it starts to move as much as possible. Natural range of motion is an important key to healing. By December 2017 there was only a very small indication of wall damage and by March 2018 there was no longer any signs of damage (figures 3 and 4). The gelding was videoed after each shoeing, and we noted that its gaits and comfort kept improving after each shoeing. This gelding was given to me in November of 2018 for reasons unrelated to the horse and is now under my full care. Yerke is actually also being ridden by me, so far so good!

Figure 3: Frontal photos: July 2017, Dec 2017, March 2018, May 2019

Figure 4: Lateral photos: July 2017, Dec 2017, May 2019

A Few Details…

It is interesting to keep in mind that the hoof capsule can be considered as a specialized form of skin [4, 5]. Skin healing is not significantly different in horses than in other mammals such as humans. Skin has a high amount of plasticity and responds to physical stimuli (mechanobiological stimuli) which in turn are converted into biochemical responses. These responses can be healing or, if the stimuli is too severe, can be harmful.

There is also a subtle distinction between repair and regeneration. Repair is an incomplete tissue repair whereas regeneration is a complete replacement of damaged tissues to their initial qualities. Excessive hoof debridement which includes invading soft tissues can create scars which may impair the long term full function of the hoof.

In this example, the hoof seems to have regenerated but it may not be the case for all hooves depending on the general health, hoof care history and genetics of a particular horse. Unfortunately, hoof quality seems to not be a priority in breeding programs. Riding horses at too young an age may also not be conducive to quality hooves.

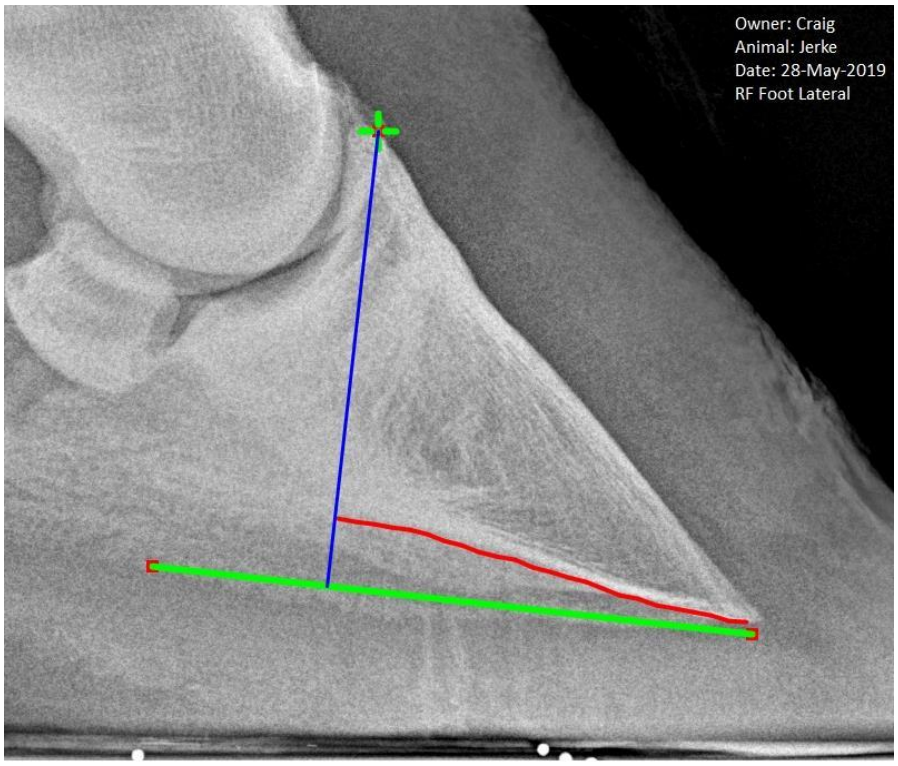
It is important to keep in mind the innate function and evolution of the hoof [6]. For instance, the equine digital cushion is not just a vestigial leftover from the early four toed horses -- it still functions as a pad to some extent, hence the hoof capsule should be maintained under the bony column to allow some loading from the limb onto it.

Both the hoof capsule and bones of any horse are somewhat asymmetric [7, 9] and also the capsule deforms due to applied loads. It is therefore not always obvious how to map a hoof adequately. Using an orthographic projection of the articular area between the

second and third phalanges (see figure 1) gives a means to do a 3D analysis of the hoof and may prevent trimming to distortions [7].

Figure 5: Lateral radiographs: July 2017, Dec 2017, March 2018, May 2019.

The last layer of the epidermal capsule (stratum corneum) has a very complex architecture with specific mechanical properties. This layer is made up of dead keratin cells. I therefore prefer the use of flexible shoes which are closer to keratin's mechanical properties to enhance healing. Finally, it is important to have radiographs not only to rule out pathologies, but also to assess bone morphology. A flat pedal bone will not have the same needs as an upright one. Understanding the amount of concavity of the palmar aspect of the pedal bone [7,8] is important when applying shoes but it is even more crucial for therapeutic cases (figure 6). The shape of P3 and its angle will define my shoe placement and amount of rolling (or not) at the shoe.



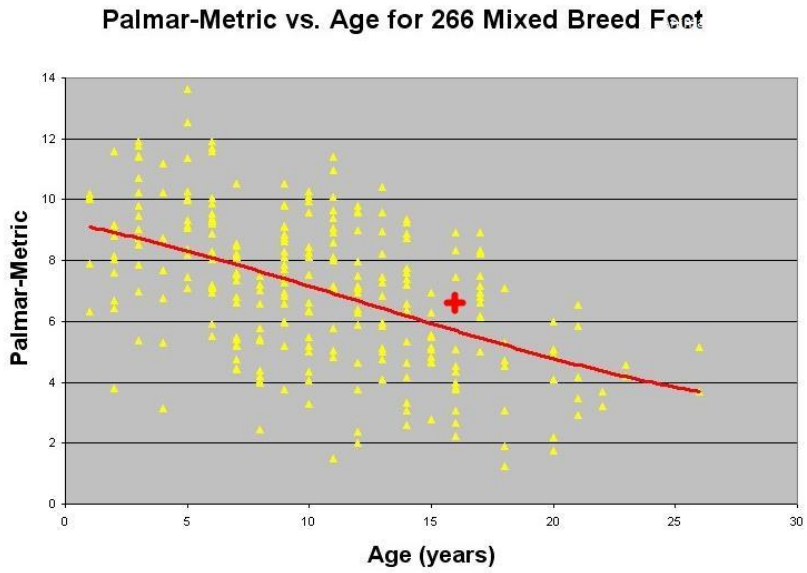


Figure 6: The palmar metric [8] measures the concavity of the palmar aspect of P3. This measure gives a way to track bone loss over time. This image shows the palmar curve for Yerke's right front, and the plot shows that it's concavity is slightly above the norm for a horse of his age.

Conclusion

This case demonstrates a favorable outcome even in a severe case of WLD by allowing the hoof to regenerate. Hooves regenerate like skin which has adaptive capacity to heal or not. Aggressive debridement is not always indicated.

No single approach can guarantee a spectacular outcome every time, but in most cases the ideas and approach outlined here will be effective. I have been applying this approach (and documenting it) for over 22 years while using metal shoes, composite shoes and/or leaving horses barefoot.

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