

CENTER FOR EQUINE HEALTH

HorseReport

SCHOOL OF VETERINARY MEDICINE • UNIVERSITY OF CALIFORNIA, DAVIS

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*The Hoof
Health Issue*



UCDAVIS

VETERINARY MEDICINE

Center for Equine Health

DIRECTOR'S Message

Equestrians are familiar with the old adage, “No foot, no horse.” This saying originated in the mid-18th century and is just as relevant today. Proper hoof care is a top priority for keeping all of our equine partners healthy and sound.

At the [Center for Equine Health](#), our supported research has pioneered studies into a number of areas related to hoof health. [Dr. Susan Stover's laboratory](#), in particular, has generated valuable information on shoeing and footing for racing and performance horses and examined how these factors can impact equine health and performance.

We work closely with our farriers, Tex Gossett of Tex Gossett Farrier Service and Shane Westman, APF-I, the UC Davis veterinary hospital's resident farrier, as well as UC Davis veterinarians, to maintain comfort and soundness within our own teaching herd. We are extremely grateful for the teamwork and expertise available through the [UC Davis veterinary hospital](#).

In this hoof health issue of the Horse Report, you will find information about the innovative research in Dr. Stover's laboratory, as well as “Ten Things You Might Not Know About Horse Hooves,” courtesy of Westman. Special thanks to Dr. Stover, the members of her laboratory, and Westman for their contributions to this issue. We hope that you will enjoy this look into the latest information about equine hooves and find some “take home messages” that are applicable to your own horses.

Carrie J. Finno, DVM, Ph.D.
CEH Director



UC Davis Veterinary Hospital Farrier Shop

The veterinary hospital's farrier shop plays an integral role in providing superior diagnostics and cutting-edge therapeutic services to UC Davis clients. Resident farrier Shane Westman, APF-I, works closely with clinicians in the Equine Surgery and Lameness Service to design customized shoeing approaches to address a variety of issues. He also teaches veterinary students who rotate through the shop and is a sought-after speaker for continuing education and public outreach events.

◀ Shane Westman, APF-I, is the resident farrier at the UC Davis veterinary hospital.

Dr. Zavodovskaya Honored with **2019 WILSON AWARD**

Congratulations to Dr. Regina Zavodovskaya, the 2019 [James M. Wilson Award](#) recipient for her research publication describing signals of bone production in horses with silicate associated osteoporosis. Dr. Zavodovskaya is a board-certified veterinary pathologist pursuing a PhD in the [Integrative Pathobiology Graduate Group](#) under the mentorship of Dr. Susan Stover.

Osteoporosis is a debilitating disease in which bones are weakened and prone to disfigurements and fractures. Horses with fragile bones have been identified in regions of California with soils rich in naturally occurring toxic silicate crystals. These horses also suffer from a lung disease called silicosis as a result of breathing dust containing the crystals. Concurrent osteoporosis and silicosis is called silicate associated osteoporosis (SAO).



Dr. Zavodovskaya is the recipient of the 2019 Wilson award for her research publication on bone production in horses with silicate associated osteoporosis.

Since there are currently no markers for diagnostic testing, Dr. Zavodovskaya investigated the mechanism of bone loss by comparing tissue signal profiles in bones of horses with and without SAO. Computer programs assessed the signal patterns and constructed signal profiles differentiating SAO-affected and normal horses. The study results showed an unexpected pattern of increased bone production in SAO horses compared to the normal group. It is possible that affected horses produced more bone as compensation for the excessive bone destruction that they experienced.

These results provide signals specific to SAO that can be developed into a much-needed tool to detect affected horses early and slow the progression of SAO through appropriate treatment. This project was supported by the Center for Equine Health with funds provided by the State of California pari-mutuel fund and contributions by private donors.

STAR STUDENT Studies Fractures in Racehorses

The proximal sesamoid bones are small, rounded bones at the back of the fetlock. When the fetlock extends, the bones are stressed from ligament tension and cannon bone compression. Since they are stressed with each step, fractures in sesamoid bones are the most common catastrophic breakdown in Thoroughbred racehorses.

Veterinary student Natalia Sachs spent the summer studying causes of sesamoid bone fractures in Dr. Susan Stover's laboratory as part of the [Students Training in Advanced Research \(STAR\) program](#). Through the program, veterinary students gain experience in laboratory research and insights into careers in research. Sachs, a second year veterinary student, grew up riding, participated in a foal manager internship as an undergraduate, and worked on sport horse farms. She is considering a career in equine sports medicine and the STAR program offered an opportunity to get a taste of this field.

"The STAR program is a great way to learn in great depth about a topic you're interested in and gain research experience. I would not have looked at radiographs in such detail, but now I am more familiar with fetlock anatomy than I ever realized I would be," reflects Sachs. "For students who don't have research experience or who want to pursue research in their careers, this is a great program because they teach you about the research process in general."

*STAR student support for Natalia Sachs was provided by the Dolly Green Endowment and the Center for Equine Health with funds provided by the State of California pari-mutuel fund and contributions by private donors.

Veterinary student Natalia Sachs performs an experiment to evaluate the stress on sesamoid bones while horses are galloping as part of her STAR research project. ▶



About **THOSE SHOES**

Investigating Causes of Underrun Heels in Racehorses

If we learned nothing else from Cinderella and Dorothy, it's that shoes can change your life. Shoes affect weight distribution, influencing impacts on legs and backs. It is not surprising, then, that horseshoes affect the distribution of the 78 psi that horses exert on the ground. Having the right shoes could mean the difference between a long career and one cut short by injury. Horseshoes protect horses' hooves, but they also transfer forces between ground surfaces and hooves. Understanding these interactions between hooves and shoes could optimize the transfer of forces between them, preventing injuries.

Underrun Heels

When horses' hooves hit the ground, the heels expand to accommodate the horse's bodyweight (load). A common hoof issue is underrun heels, where the heel angle is less than the toe angle by 5 degrees or more. This limits the hoof's ability to absorb concussion and forces more of the load onto the back of the limb, increasing the risk of injury. Vanessa Dahl, a graduate student in Dr. Susan Stover's laboratory, is investigating causes of underrun heels by examining shoeing techniques.

"Shoeing can impact hoof growth, which can potentially lead to this long toe/low heel conformation," says Dahl.

"Application of horseshoes can be easily managed and could be a viable method to prevent injury."

Nail Placement

Most horseshoes are rigid and don't expand with the hoof during loading. Nail placement can further restrict natural hoof movement. Nails are usually placed between the toe and the widest part of the hoof to allow for heel expansion. In racehorses, nails are often placed closer to the heels to prevent horses from pulling shoes while running. Dahl looked at wear patterns in racehorse shoes and found the shorter the distance between the last nail and the heel, the less wear on the shoe. This suggests that nails close to the heel may interfere with the hoof's ability to expand during loading. She is currently studying the effect of nail placement on hoof expansion, distortion and fetlock extension.

Horseshoe Length

The researchers are also studying the impact of shoe length on hoof growth and shape. Shoes shorter than the length of the hoof (common in racehorses to prevent them from catching the front shoe with their hind feet) cause abnormal loads on the heels and bending of the hoof wall, which promotes elongation of the toe and deformation of the heels.



A normal hoof (left) with similar toe and heel angles and a hoof with an underrun heel (right) where the heel angle is less than the toe angle by more than 5 degrees.



Short shoe (top) and full-length shoe (bottom). The short shoe does not fully support the heel bulb, whereas the full-length shoe does.

Dahl evaluated short (9 percent shorter than the length of the hoof) and normal (extend to the heels) horseshoes. No performance changes were noted between horses with each shoe type and none of the horses with full-length shoes pulled them off while running. Preliminary analysis shows that a fuller shoe positively affects hoof angles compared to a short shoe.

With this data, the group is hopeful that management changes may be able to correct or prevent underrun heels in racing and performance horses.

**Support for these projects was provided by the AQHA Foundation, Veterinary Orthopedic Society, and Center for Equine Health with funds provided by the State of California pari-mutuel fund and contributions by private donors.*

ARENA FOOTING: Finding the Sweet Spot

Designing and maintaining arena footing is not an exact science – at least not yet. Hard footing causes greater impacts on hooves and legs and soft footing can cause soft tissue injuries. But that’s just scratching the surface, literally. From the arena base to the cushion, climate, materials, management, drainage, and amount of “hoof traffic,” numerous factors influence how a surface behaves. Specific disciplines have unique demands, but surfaces affect all sport horses, whether they are galloping, spinning, sliding, or jumping.

Dr. Susan Stover’s team at the [J.D. Wheat Veterinary Orthopedic Research Laboratory](#) conducts research to identify desired surface characteristics and design and management approaches to avoid injuries. Their goal is to find the “sweet spot” where injuries are prevented and performance optimized. Studies initially compared dirt and synthetic racetrack surfaces and found that fetlock extension was greater on dirt, which may translate to greater risk of injury.

This is a good starting point, but Stover warns that no two surfaces are exactly alike. Labels like “dirt” and “synthetic” are useful for general

discussions, but the depth of the surface, how it is maintained, the actual composition (including the size and angularity of grains of sand), and how much traffic it sees all impact its mechanical behavior.

“The bottom line,” says Stover, “is that you can have good or bad dirt surfaces and good or bad synthetic surfaces.”

There are no uniform standards, largely because the optimum footing—that “sweet spot”—is unknown. The team is investigating footing for dressage and jumping horses to identify the best ways to put arena components together to achieve desirable surface behavior that horses like but that also balances climate considerations. Eventually, footing standards will likely be discipline- and region-specific. Stover is hopeful that surfaces will be able to be built and managed around the “sweet spot” to keep them in a safe range while allowing horses to perform as efficiently as possible.

**Support was provided by the Grayson Jockey Club Research Foundation, United States Equestrian Federation and Center for Equine Health with funds provided by the State of California pari-mutuel fund and contributions by private donors.*

10 THINGS

You Might Not Know About Horse Hooves

We have all heard the saying, “No hoof, no horse.” Hoof care is a vital part of ensuring horse health, but the best ways to keep hooves healthy are often hotly debated. We worked with UC Davis veterinary hospital farrier Shane Westman, APF-I, to share ten things you might not know about horse hooves.



1

It's never *just* a trim. The trim is where it all begins. Your farrier is assessing your horse's conformation (hoof/pastern axis, heel angle/length, digital axis, palmar/plantar angle, center of rotation, dorso-palmar/plantar balance, hairline) and trimming to keep everything in proper alignment.

2

Horses in hard work aren't the only ones that need shoes. A shoe is anything that covers the foot for protection (boots are shoes). Shoes can be used for a variety of purposes, including protection, traction, support, and therapeutic applications. A farrier can use shoes to manipulate the forces acting on a hoof, positively or negatively. Shoes can move the weight load around and leverage can be reduced or added to ease stress on tissue or to change movement.

3

Wild horses have many of the same hoof problems as domestic horses. Research on feral horse hooves identified abnormalities similar to those seen in domestic horses, including long toes, medial/lateral imbalances, dorsal and quarter flare, laminar rings, cartilage changes, frog abnormalities, and contracted and underrun heels. In one study, more than 75 percent of specimens from the *Equus* fossil record (~1-3 million years old – i.e. well before domestication) exhibited pathology consistent with chronic laminitis.

4

White hooves are not softer and do not have more problems than black hooves. A comparative study of horseshoe fixation versus hoof color concluded that color did not appear to have a strong effect on the resistance to nail extraction, and hence shoe fixation. Other studies found that hoof pigmentation had no detectable effect on hoof wall stiffness/elasticity, moisture content, or hoof hardness.



5

Hooves may grow slower in the winter, but not because of the weather. Hoof growth is dependent on many factors, including genetics, nutrition, environment, regular professional hoof care, proper weight management, and regular movement/exercise, that can be impacted by seasonal changes (for example, colder weather and shorter days may mean less exercise).



An 8-week trimming/shoeing cycle may not be ideal. Hoof care cycles depend on a number of factors. There is no one set rule that works for all horses and all situations. Studies show that visiting the farrier every five to six weeks is an optimal schedule to maintain proper balance, especially for horses in work. However, it is important to talk with your farrier to come up with the best schedule for your horse.



Horses do not get thrush from standing on wet ground. Thrush is a fungal (*Fusobacterium necrophorum*) infection of the frog and may spread to the white line, sole, and sensitive layers of the hoof. The hoof is under constant assault from anaerobic bacteria and fungi, but balanced, healthy hooves have a natural cleaning mechanism. The presence of urine and feces seems to be a causative factor for thrush. Hot shoeing can kill bacteria and fungi between the shoe and the hoof, and regular cleaning and topical treatments can help keep bacterial and fungal invaders at bay. The best way to avoid thrush is to clean your horse's feet regularly.



Hot fitting a shoe does not hurt the horse. The hoof is an amazing insulator and can sustain extremes of cold and heat. Heating the shoe makes the metal softer and easier for the farrier to fit to the hoof. Hot fitting kills microbes and can help dry the hoof, making for stronger-holding nails.



Flared hooves usually indicate underlying issues. Flared hooves do not cause problems; they are the result of problems. The flaring is a sign of uneven load, and it is important to figure out the underlying cause. Removing the flare does not solve the problem; it just removes the evidence.



Overrunning water troughs so horses stand in wet ground will not moisturize their hooves. There is 100 percent relative hydration inside the hoof, where the blood supply is located. Moisture drops from the inside to the outside of the hoof, all the way to 2 percent at the outer hoof wall, which is almost impermeable. The hoof actually gets its moisture from the blood supply, not the external environment. Standing in water might actually dry out the hoof, having the opposite effect of the one intended. One study found that moisture content in the hoof remains at about 30 percent regardless of the environment.

Hot fitting shoes ►

This information was presented as part of the [School of Veterinary Medicine's "An Evening with Vet Med"](https://healthtopics.vetmed.ucdavis.edu/health-topics/equine/farrier-services-hoof-care-myths-and-truths) lecture series. See the full presentation, which contains more things you might not know about hooves, along with information about how to choose a farrier that is a good fit for you and your horse, at <https://healthtopics.vetmed.ucdavis.edu/health-topics/equine/farrier-services-hoof-care-myths-and-truths>.




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Supporting Our Teaching Herd

The CEH teaching herd horses provide valuable hands-on learning opportunities to undergraduates, veterinary students, residents and graduate students. These horses all have stories that are as unique as their personalities, and they are at the heart of everything we do. Please consider giving to the [CEH Teaching Herd Fund](#), which supports the daily and specialized care (including hoof care) of our teaching herd horses. To make a gift, visit give.ucdavis.edu/VCEH or contact our Advancement team at 530-752-7024 for more information.



Getting Back on the Right Hoof

Last year, CEH teaching horse Driftin, a 13-year-old Quarter Horse, began exhibiting front limb lameness. Radiographs showed navicular changes and osteoarthritis. [Equine Field Service](#) worked with farrier Shane Westman on a shoeing package customized to her needs. Today, Driftin is comfortable, sound, and doing what she loves to do – teach veterinary students. We are so grateful for the expertise and collaborative efforts that help ensure that our herd horses, like Driftin, are happy and healthy.

◀ CEH teaching herd horse Driftin visits UC Davis veterinary hospital farrier Shane Westman for customized horseshoes that keep her comfortable.



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