

# THANKS TO OUR COLLABORATORS



Dr. Sarah le Jeune is the chief of the Equine Integrative Sports Medicine Service at the UC Davis veterinary hospital. Board-certified in Equine Surgery and Equine Sports Medicine and Rehabilitation, as well as certified in veterinary acupuncture and chiropractic, her research interests include general surgery and equine integrative sports medicine.



Dr. Jessica Morgan is a faculty clinician in Equine Field Service at the UC Davis veterinary hospital. Boardcertified in Equine Sports Medicine and Rehabilitation, her research interests focus on equine cardiology and sports medicine.



Anyone who spends time with horses will almost inevitably end up experiencing the challenges associated with equine rehabilitation. From minor illnesses to serious injuries, and everything in between, the rehabilitation process rarely proceeds in a straight line. As a horse owner myself, I have recently been bringing my 7-year-old Thoroughbred gelding, Chat, back to work after he sustained a coffin bone fracture in April. It is a very slow process!



Although equine rehabilitation can be frustrating, we are well on our way to better understanding not only how to

respond to equine health issues, but, perhaps more importantly, how to prevent them. As equestrian sports continue to grow locally, nationally, and internationally, the field of equine sports medicine and rehabilitation is essential to keeping our horses happy, healthy, and performing their best.

Sports medicine and rehabilitation is one of the newest veterinary specialties, and UC Davis is home to four diplomates of the American College of Veterinary Sports Medicine and Rehabilitation (ACVSMR), three who specialize in horses. We are grateful to ACVSMR diplomates Drs. Sarah le Jeune and Jessica Morgan for sharing their extensive expertise in this area for this issue of the Horse Report.

At UC Davis, we are especially excited for the future of this veterinary specialty. The proposed Equine Performance and Rehabilitation Center, part of the future UC Davis Veterinary Medical Center, will be an advanced hub for maintaining the health and fitness of performance and recreational horses. We are also looking forward to new teaching, research, and outreach opportunities in the future at Templeton Farms in central California.

This is a constantly advancing field, so please visit our website and check in with us on social media for updates and new information as it becomes available.

I hope that you will follow our progress through these new endeavors. We look forward to continuing to share how the Center for Equine Health is working towards a bright future for students, residents, faculty, and of course most importantly, horses everywhere.

Carrie J. Finno, DVM, Ph.D., Diplomate ACVIM

**CEH Director** 

### **EQUINE REHABILITATION -**

#### Personal Reflections from a UC Davis Veterinary Student

By Alessandra (Ally) Delucia, UC Davis School of Veterinary Medicine, Class of 2024

**One year ago,** I climbed aboard my 18-year-old hunter, George, and picked up a trot. My stomach sank almost immediately. He was obviously lame.

As a then second-year UC Davis veterinary student, I knew from my studies that the potential explanations for his sudden lameness were endless, and panicking would not do any good. I gave him some Bute, a couple of days off, and hoped for the best. A week later, he looked almost back to normal on the ground; however, he still didn't feel right under saddle.



After a successful rehabilitation for George's injury, he and Ally are back in the show ring.

UC Davis Field Service came out to our barn to examine him. Radiographs and an ultrasound found nothing. The pain blocked to his foot, so he was brought to the UC Davis veterinary hospital's Large Animal Clinic for a magnetic resonance imaging (MRI) scan. The MRI showed moderate inflammation of the lateral collateral ligament (desmitis) in his left front coffin joint.

All that I could think about was learning what I could do to help him recover, what the prognosis was, and if he would ever be the same jumping horse he was before the injury. I received mixed answers - from being told that he would never be able to jump again to anticipation of a full recovery with proper treatment and rehabilitation. Under the advice of experts in the UC Davis Equine Surgery and Lameness Service, Equine Field Service, and Equine Sports Medicine teams, we proceeded with shockwave therapy, shoeing alterations, and two months of stall rest, with 15 minutes of walking daily.

The beginning months of rehabilitation were the most difficult for both me and George. It was incredibly hard to limit his activity so significantly since he was a fit show horse and was clearly not a fan of the approach. He's a big horse with a big personality, and in those early days, taking him out of his stall was an adventure. There was always a chance that he would try to bolt and take off (with occasional success). At the two month mark, we were able to start trotting in straight lines under saddle, which definitely made things easier. The rehabilitation process continued to get easier as his work increased over the next six months.

The entire eight month rehabilitation process was one of the most difficult things I have experienced. It was a challenge balancing what I knew was the right thing to do medically and making sure my horse was happy enough to want to keep going. There were especially frustrating times when none of it seemed worth it.

Now, one year later, I'm thrilled to be able to say that all of the hard work paid off and George is back doing what he loves to do. He is turning twenty soon and is completely sound, competing at the same level that he

was before his injury.

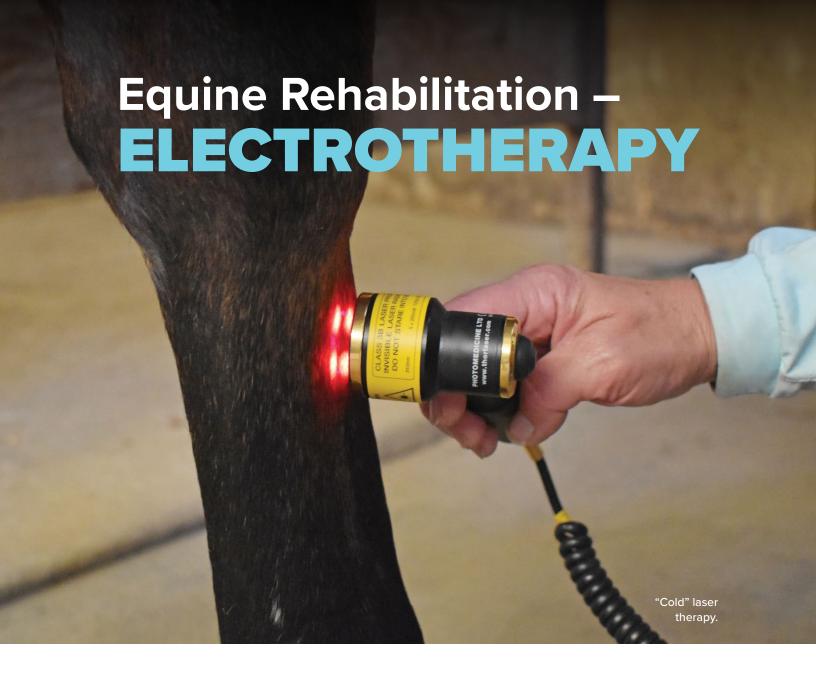
The UC Davis veterinary team played a vital role in George's diagnosis and recovery. His case was part of a research study using positron emission tomography (PET) scanning, pioneered in the horse at UC Davis, which determined exactly where the inflammation was in his foot and allowed for localized treatment and individualized rehabilitation. I owe George's recovery to the UC Davis veterinary team. I do not know where we would be today without their knowledge and guidance.

I plan to pursue a career in equine sports medicine and/or advanced imaging,

the veterinary specialties that played the greatest role in George's diagnosis and recovery. Seeing firsthand their importance and what they are able to accomplish makes me excited to be able to help others the way that these fields of medicine helped George.



Ally and her horse, George, at their home barn in Davis.



evolving field. It is important to work with your veterinarian to determine the best course of treatment for your specific situation.

**Electrotherapy, directing small currents of electricity through the skin for medical treatment,** has been widely used in human sports medicine and rehabilitation to treat injuries and optimize performance. Various modalities have made their way into sport horse medicine and rehabilitation.

Electrotherapies are built around energy sources that range from acoustics to vibrations.

#### **Electrical Stimulation**

Electrostimulation is commonly used for pain relief. Varying pulse durations and intensities mimic nerve patterns, causing muscles to contract.

Transcutaneous electrical nerve stimulation (TENS) operates at <250 hertz (Hz), with the nerves closest to the surface of the skin activated first. Treatment occurs over 20-30 min, continuously or intermittently throughout the day. Use in humans is well researched, but evidence for use in horses is limited.

Neuromuscular electrical stimulation (NMES), commercially available as functional electrical stimulation (FES) units, is used to contract large muscles. Similar to TENS, it has longer pulse durations, variable amplitude and a frequency >50 Hz. Repetitions are increased over 3-5 weeks, with 1-5 sessions per week. One study reported that FES improved contraction and decreased muscle spasms in equine epaxial muscles, those located on the back directly under where the saddle sits (Schils et al. 2014).

Since these modalities involve placing electrodes on the skin, irritation can occur at the contact points if left on for too long. Minimal complications have been reported with proper use.

#### **Magnetic Waves**

Pulsed electromagnetic field therapy (PEMF) uses low-frequency magnetic waves to generate electrical currents in tissues. These units are found as blankets and wraps with built-in coils and batteries, with the size of the coil determining the size and strength of the magnetic field. Treatment protocols vary by manufacturer and side effects are rare. Research has not shown any significant soft tissue benefits for horses or humans. However, evidence suggests that the best application may be to bone healing, such as in cases of slow healing fractures (Schlacter and Lewis, 2016).

## Sound and Pressure Waves

Therapeutic ultrasound uses vibration frequencies of 1-3 megahertz (MHz) to generate waves of acoustic energy (inaudible to humans) that can reach deep tissues, effectively a tissue micromassage. It is used for pain relief, to decrease muscle spasms, and to increase blood flow. Treatments occur daily for seven to ten days, can be pulsed

or continuous, and may include the application of heat. Research has shown that equine tendons are effectively heated with therapeutic ultrasound, but heating of muscle has not been reported.

Extracorporeal shockwave therapy uses pressure waves that increase as they move through tissues. This results in microdamage caused by the generation and collapse of tiny air bubbles, leading to the formation of new blood vessels and increased blood flow. Protocols consist of 3-6 treatments at 2-3 week intervals to allow for proper healing of the microtrauma. Unlike therapeutic ultrasound, which can reach deep tissues, shockwaves only penetrate 50-110 mm. Studies have reported improved healing and reduced lameness in cases of front and hind limb sensory desmitis (Caminoto et al., 2005); McClure et al., 2004). Another study showed reduced lameness in horses with induced osteoarthritis, but no beneficial effects were identified in the synovial fluid, tissue, or cartilage of the affected joint. Since pain relief has been reported to last several days, masking a horse's pain level, organizations such as the Fédération Équestre Internationale (FEI) have withdrawal time regulations prior to competition. Under California Horse Racing Board (CHRB) regulations, horses in California are unable to race or work until ten days after shockwave therapy.

Good skin contact is required as neither shockwaves nor ultrasound waves function through air. Patients must be clean, and clipped if possible. Gel is used to maximize contact.

#### Lasers

Laser therapy can reduce pain and inflammation. It has comparable benefits to acupuncture and is often used on similar trigger points. Low

(power output <500 mW) and high (output >500 mW) power lasers have been used in horses. Daily, weekly, or monthly treatments of 5-30 minutes are performed based on the location and type of injury. Tissues can overheat if the therapy is not properly applied. Studies suggest that lasers are beneficial for tendon healing (Pluim et al. 2018). Research into the effects of laser therapy on wound healing is ongoing.

#### Vibration

Vibration plates create energy in an up-and-down or side-to-side direction, with amplitude and speed determining the magnitude of the vibration. Vibrations are thought to improve circulation through involuntary muscle contractions. Vibration plates may also promote joint stability by stimulating and strengthening associated muscles. Sessions are typically 10 to 15 minutes. To date, no undesirable effects have been reported. One study showed no changes in bone markers for horses that underwent vibration therapy (Carstanjen et al., 2013). However, maintenance of bone density was reported in stalled horses (Hulak et al. 2015) and muscle was increased (Halsberghe et al. 2016) in horses that underwent vibration therapy for 60 days. Whole body vibration therapy may also be beneficial for increasing hoof growth rate (Halsberghe 2018).

Electrotherapy is an evolving field. Although many applications are noninvasive, individual horses may not tolerate certain approaches. Many modalities are unregulated and, although research is ongoing, available peer-reviewed studies are minimal. It is important to work with your veterinarian to determine the best course of treatment for your specific situation.

# **HEALING WATERS?**

# **Equine Underwater Treadmills, Swimming Pools, and Spas**



A horse walking on an in ground underwater treadmill.

Hydrotherapy, the use of water to treat medical conditions, was first practiced by ancient Egyptians, and pools, saunas, baths, and tanks have historically been used to treat health concerns from arthritis to ulcers. Muscles have to work harder to move in water than on land, while the buoyancy of water reduces weight-bearing on bones, joints, and soft tissues and the pressure exerted by water reduces swelling and inflammation.

Equine hydrotherapy has become popular, with increasing investments in equipment and facilities. There are pros and cons to various approaches, but hydrotherapy generally allows for patient-specific approaches to rehabilitation and training. Swimming pools, underwater treadmills and spas have potential benefits, but more scientific studies are needed to document outcomes and inform guidelines and regulations.

#### **Swimming Pools**

Swimming pools have been the most common hydrotherapy system for equine training and rehabilitation. Pools are circular or linear, with a water depth of at least 12 feet to ensure complete buoyancy. Swim programs are associated with improvements in cardiovascular function, reductions

in musculoskeletal injuries, and improved aerobic capacity. Swimming is ideal for maintaining fitness without loading limbs.

Although some horses enjoy swimming, horses are not natural swimmers. They tend to use their front legs for balance and propel themselves through the water with their hind legs. This can result in extreme ranges of motion for joints in the hind end (hip, stifle, hock). Many horses also adopt an inverted posture, especially when entering the water, which should be taken into account for horses with neck, back, or hip injuries. It is difficult to modify speed and intensity in swimming pools, as the pace is usually self-determined by the horse.

#### **Underwater Treadmills**

Underwater treadmill exercise is associated with improved muscle and core strength, and increased joint range of motion. Varying water depths promote increased range of motion for specific joints, with forelimb range of motion lowest, and hindlimb range of motion highest, when the water level is at the stifle. Impact shock is also reduced with increased water depth, with a roughly 30% reduction reported when the water is at stifle level.

Underwater treadmills include below and above ground units. In-ground units can hold a larger amount of water, thus creating more buoyancy. Above-ground units are able to alter the depth of the water between patients to support targeted protocols. Both types may be equipped with hydrojets to add current and increase resistance. Most units also have the ability to alter the speed of the treadmill, as well as the temperature and solute concentration of the water.

#### **Saltwater Spas**

Cold saltwater spas use cold running water with a high salt content to reduce lower leg inflammation and treat minor injuries such as bruises and strains. Similar to underwater treadmills, the water level can be adjusted to alter pressure on various tissues. A study of 27 cases of tendonitis, suspensory desmitis, or lower limb injury reported fast recovery times and successful return to competition in the majority of horses after hypertonic cold spa bath hydrotherapy (Hunt et al., 2001). Saltwater spas are also used to aid recovery after exercise.

Hydrotherapy protocols should be tailored to each individual patient, taking into consideration injuries and conditions, body condition and fitness level, and goals for future athletic performance. Small adjustments in speed or water depth can have large effects. If a horse is not moving properly, decrease the water depth, speed, and/or session duration.

It is important to prioritize safety for horses and handlers during hydrotherapy. Pay attention to the horse and adjust the session accordingly. Aquatic therapy with a fearful or fractious animal should be avoided. Work with an equine rehabilitation specialist to ensure the safest and most successful outcomes.

# THERAPEUTIC PROPERTIES OF WATER

**Buoyancy** is a lifting force exerted by a fluid that counteracts gravity (i.e. floating). This reduces weight-bearing stress (load) inversely proportional to the water depth. In horses, water at hip level results in a 75% reduction in weight bearing, whereas a 10% - 15% reduction is reported when water is at elbow height.

Viscosity is a measure of a fluid's resistance to flow. The viscosity of water is twelve times that of air, so moving through water requires greater effort than moving through air. This increased effort causes increased muscle activity which improves muscle strength, motor control, and joint stability.

Hydrostatic pressure is the constant force exerted by a fluid over all surfaces of an immersed object. With hydrotherapy, this pressure can promote blood flow and lymphatic drainage, resulting in decreases in swelling and edema, thereby decreasing pain and improving joint mobility.

The **temperature** of water can produce different therapeutic effects. Cold water (cryotherapy) is used to decrease inflammation, swelling, and pain, especially at the site of soft tissue injury. Warm water immersion causes dilation of blood vessels, which may reduce local pain and inflammation.

Osmolality refers to the number of particles of solute per kilogram of solvent. Water that is higher in solute concentrations has been associated with reduced pain and inflammation. Equine studies have reported improved clinical signs in horses with tendonitis and desmitis after hypertonic cold water therapy (Hunt et al., 2001).



**Immobilization or stall rest** is sometimes necessary for an injury to heal, especially in cases of severe tissue damage (such as tendon or ligament damage and fractures), but other times keeping horses moving is actually a better approach. The key is choosing the right exercise for the type and location of the injury. We cannot just tell horses, for example, to engage their

The key is choosing the right exercise for the type and location of the injury.

core. We have to design exercises that achieve the desired result.

The goals of therapeutic exercise are to increase tissue strength, improve range of motion and quality of tissue healing, and prevent scar tissue formation.

Although controlled exercise is an important part of equine rehabilitation, there are few well-designed, randomized studies investigating therapeutic effects on musculoskeletal injuries. As with many other equine rehabilitation approaches, treatments are often based on what is known from human physical therapy.

#### Steady beginnings - walking

Controlled exercise often begins with walking activity, which can include hand walking or walking on an automated horse walker or exerciser. A 2018 international study regarding the use of rehabilitation modalities in horses reported that 97.3% of respondents utilized controlled hand walking and 56.7% used automated horse walkers (Wilson et al 2018). The goal of walking is to improve mobility, reduce swelling, facilitate tissue repair, and promote cardiovascular fitness and bone strength. In some cases, this can be achieved on a land or underwater treadmill, which may be preferred if turning or circling is not advised based on the injury.

As horses progress through the healing process, new, targeted exercises may be introduced.

#### On the way up - inclines

Inclines may be incorporated into rehabilitation programs to facilitate activation of abdominal muscles and strengthen other muscles, particularly in the hind end. Exercises may include walking up and down hills or utilizing inclines on a land treadmill.



Stall rest is sometimes necessary for an injury to heal.

#### Up and over - poles and pedestals

Walking or trotting over ground poles and raised cavaletti activates the full range of motion of the front and hind limbs. These exercises are useful for rehabilitation of neurological cases by training proprioceptive skills and visuomotor coordination. It is also beneficial for improving or restoring joint range of motion through increased flexion (Brown et al., 2015). Trot poles strengthen propulsive muscles including hip flexors, without overloading musculoskeletal tissues or increasing the extension of fetlock joints. Importantly, beneficial effects persist throughout the course of the exercise, unlike the use of proprioceptive stimulation devices in which the effects decrease over time.

Obstacle work may also include pedestals. Horses can be asked to walk up onto and over a pedestal, or to stand on the pedestal, simulating collection. Similar to poles and cavaletti, this strengthens abdominal muscles and proprioceptive skills.

#### On the line - ropes, lines, and bands

Systems of bands or ropes that are positioned across a horse's back and/or around their hindquarters have become popular in equine rehabilitation. Some are used while longing and others are used while riding. These include the Pessoa training aid and Equiband®. When using these tools, it is important to avoid inducing hyperflexion of the neck (i.e. the head needs to stay in front of the vertical).

The Pessoa training aid is an array of ropes, pulleys, and straps intended to assist with building muscle and increasing the horse's use of its back muscles during longing. While working in this rig, horses are collected, with a raised poll and decreased stride length. The system allows for different positions that put horses in various frames, from "long and low" to an upright frame. It may improve posture, stimulate core muscle activation, and improve gait quality without increased load on lower limbs.

The Equiband® system is comprised of abdominal and hindquarter resistance bands attached to a saddle pad. It is used to promote hindlimb engagement and may aid dynamic stabilization of back muscles (Simmons et al. 2015), as well as strengthen core muscles.

Tissue healing is a complex and variable process, but it does follow predictable phases. An appropriate exercise program complements and enhances the healing process of the injured tissue.

Many horses suffer complex injuries, so it is important to have a full, accurate diagnosis prior to starting a controlled exercise program. Rehabilitating one injury while neglecting another can lead to incomplete healing or reinjury. It is important to work with a veterinarian and equine sports medicine and rehabilitation specialist throughout your horse's rehabilitation.



#### A NOTE ON STRETCHING

Stretching exercises may be indicated to decrease pain, improve range of motion (Haussler et al. 2020), strengthen muscles (Stubbs et al. 2011), and prevent injuries. Research suggests that passive stretches held for 30 seconds provide optimal results. Dynamic mobilization exercises (i.e. "carrot stretches") are useful for horses with back pain or on stall rest to help maintain core strength. Research has shown improved joint movement, improved muscle symmetry, increased core strength, and improved lateral bending.



# 10 THINGS YOU MIGHT NOT KNOW ABOUT SPORT HORSE MEDICINE AND REHABILITATION

Equine sports medicine and rehabilitation is a comparatively new veterinary specialty. Sarah le Jeune, DVM, DACVS, DECVS, DACVSMR, certified equine acupuncturist, and Jessica Morgan, DVM, PhD, DACVSMR, both specialty clinicians at the UC Davis veterinary hospital, provided some insights into this topic.

The American College of Veterinary Sports Medicine and Rehabilitation (ACVSMR) is one of the newest specialty colleges, with sports medicine and rehabilitation becoming a fully recognized veterinary specialty in 2018.

"Rehabilitation" in horses is the equivalent of physical therapy in people. Just as human athletes can receive treatment and care from highly trained specialists, the ACVSMR now provides certified specialists for horses and other animals. Diplomates of the ACVSMR complete extensive specialized training in veterinary sports medicine and rehabilitation to improve an animal's quality of life and athletic performance. An important goal of the college is to generate science-based research studies to expand knowledge and improve protocols for equine rehabilitation.

**2** Rehabilitation approaches developed for use in humans are not always effective in

**horses.** Physical therapy in human medicine has been successful partly because the science behind the healing processes, including healing rates for various structures, is well understood. There is currently a lack of randomized clinical trials with large numbers of horses to describe evidence for the effectiveness of different approaches. More science and clinical-based information is needed to inform effective protocol development for equine rehabilitation.

A rehabilitation program is only as good as its underlying diagnosis. Clinical signs generally drive the initial treatment plan. Functional assessments and global measures related to pain, proprioception, range of motion, strength, motor



control, endurance, and neuromuscular function contribute to the overall diagnosis. Clear identification of the issue(s) leads to the most effective rehabilitation plans and successful outcomes.

# Rehabilitation is a process; plans and schedules often need constant readjustments.

Appropriate rehabilitation programs seek to provide the best possible treatment to each individual horse during different stages of healing. It is important to consult a trained specialist (see #1) to ensure the safest and most effective outcomes for individual situations. Successful rehabilitation programs involve teamwork and collaboration from owners, veterinarians, farriers, nutritionists and others involved in equine care. No one-size-fits-all approach meets all patient needs.

Equine rehabilitation historically involved prolonged periods of rest (i.e. stall rest), but research has shown that immobilization can have detrimental effects on muscle function, joint flexibility, cartilage degeneration, and the formation of scar tissue in some cases. New

approaches provide alternatives that can keep horses moving while still allowing injuries to heal. Controlled exercise programs tailored to the diagnosis are important components of rehabilitation. This is especially important for horses that have other injuries or conditions, such as osteoarthritis, that may worsen during periods of confinement.



Dietary issues are drivers of decreased performance. It is important to evaluate weight and body condition score, especially after an injury or illness. As a horse's weight and activity level change during the rehabilitation process, nutritional assessments may be recommended. Rehabilitation approaches can also be employed to manage issues such as obesity by providing targeted exercises that increase muscle and fitness under controlled conditions to limit the risk of injury.

Rehabilitation programs are not just for sport horses. Maintaining appropriate levels of physical fitness is important for all horses, especially as they age. Rehabilitation programs can be tailored to horses of any age or activity level to maintain function, facilitate performance, and ensure optimal quality of life over time. Preventative approaches to equine health can lead to early diagnoses and successful targeted treatments.

Horses hold their breath when swimming.

Horses experience periods of apnea (breath-holding) in which they flatten their nostrils during swimming exercise.

This is thought to aid buoyancy and may be a manifestation of the mammalian dive reflex (MDR). All air-breathing

vertebrates possess the MDR, which slows the heart rate and redirects blood to the heart and brain to conserve oxygen during extended submersion. This should be taken



into consideration when evaluating hydrotherapies to avoid exacerbating any existing respiratory conditions.

Boots and leg wraps are used to protect the lower limbs during exercise, but research indicates that they cause increased surface temperatures that may be detrimental to underlying tendons. A study that evaluated neoprene boots, cross-country boots, and polo wraps, with bare legs as controls, found higher temperatures in all booted/wrapped legs compared to the bare leg. The highest humidity was 94% under the polo wrap. The researchers concluded that boots and wraps may impair evaporative cooling of the legs (Brock and Spooner, 2022).

Riders and tack are part of the rehabilitation equation. Rider asymmetries and poorly fitting tack can exacerbate existing conditions and influence the risk of reinjury. Saddle fit, in particular, should be evaluated throughout the rehabilitation process as the horse's shape can change significantly with alterations to workload and body condition. It is good practice to address these factors on a regular basis, ideally several times over the course of a year as the recovering horse gets stronger and develops more muscle.







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#### **EQUINE SPORTS MEDICINE AT UC DAVIS**

UC Davis is committed to providing horses with the highest levels of innovative care through cutting-edge clinical treatments and solution-oriented research. Future plans include expanding equine sports medicine and rehabilitation services, offering a dedicated equine sports medicine and rehabilitation residency program, and providing opportunities for advanced research to inform protocols and guidelines in these areas.

The Equine Performance and Rehabilitation Center, part of the future Veterinary Medical Center, will feature world-class services, including gait analysis with videography and force plate technology, advanced diagnostic tools such as the MILEPET standing equine PET scanner, an equine underwater treadmill, vibration plate therapy, a covered Eurociser, and more. Through this center, UC Davis is working to reimagine equine veterinary medicine with innovative teaching, research, and Olympic-level approaches to equine health.

In addition, we recently announced the Center for Equine Health's expansion to Templeton Farms near Paso Robles, California. Designed and operated as a premier sport horse facility, our vision includes sport horse medicine services and training opportunities in this central California location.

These new facilities will propel UC Davis equine medicine into the future, enabling us to graduate highly-trained specialists whose veterinary careers will significantly impact horses in California and beyond.