Research-Based Advances in Equine Orthopedic Therapies

The past 15 years have brought significant science-backed advancements in treatment options for equine musculoskeletal injuries

LUCILE VIGOUROUX, MSC

In the realm of equine health, few challenges capture the attention of veterinarians and scientists quite like orthopedic disorders. These conditions are not limited to osteoarthritis (OA)—one of the top causes of lameness, poor performance, and loss of use in equine athletes—but also encompass issues affecting related soft tissues. Fortunately, a wave of innovative orthopedic therapies is reshaping how these issues are managed, offering hope for improved recovery and longevity in equine athletes.

For instance, "veterinarians worldwide are making major strides in regenerative therapeutics research," says Catherine Thurston, VMD, Dipl. ACVS-LA, an equine surgeon at the Mid-Atlantic Equine Medical Center, in Ringoes, New Jersey.

Let's take stock of the recent research studies on orthopedic therapies and how findings are enhancing the health and performance of sport horses today. We'll focus mainly on osteoarthritis but also touch on related soft tissue.

Where Do We Stand with Equine Orthopedic Therapies Today?

Last year a group of Spanish researchers published a comprehensive review of regenerative medicine applications in equine musculoskeletal injuries[1]. The authors established that tendons, ligaments, and cartilage—all of which have a restricted ability to self-heal—are the tissues horses most commonly injure.

In their review of seven different clinical studies, they determined that three distinct therapies—autologous conditioned serum (ACS), platelet-rich plasma (PRP), and mesenchymal stem cells (MSCs)—have emerged as the leading innovations in equine orthopedics. (Technically, all three approaches are autologous, which means originating from the patient, though MSCs can also be allogeneic, or obtained from a donor horse.) "Autologous protein solution, IRAP (interleukin-1 receptor antagonist protein, generated through ACS production), and stem cells are the intra-articular regenerative therapies I am most likely to reach for," says Thurston.

Leah Walker, DVM, Dipl. ACVSMR, of Cave Creek Equine Hospital, in Phoenix, Arizona, applies many of the same orthopedic therapies. Her practice commonly uses stem cells, PRP, IRAP, and ACS. She also has experience with an allogeneic regenerative product that combines PRP and IRAP with other proteins and growth factors from equine amnion, designed to facilitate healing and tissue repair.

"The progress equine veterinarians have seen with regenerative joint therapies in recent years is extraordinary," says Walker. Thanks to these advancements, today's sport horse can benefit from reduced recovery time and improved healing. More specifically, researchers have suggested that regenerative therapies are disease-modifying agents because they promote better regeneration of fibrocartilaginous tissue, improved cellular organization, and improved joint functionality over symptom-modifying agents such as corticosteroid injections. "The use of these (regenerative) treatments early on in the healing process can make a real difference in the career longevity of these athletes," says Thurston.

A Look at the Past 13 Years in Equine Orthopedics

In a 2022 survey of 407 U.S.-based equine veterinarians, triamcinolone acetonide and methylprednisolone emerged as

SHELLY PAULSON

Equine practitioners are increasingly well-equipped to manage osteoarthritis with novel treatment options, changing the way we look at equine orthopedic disorders altogether.

SHELLEY PAULSON PHOTOS

Continued research has guided veterinarians in making more educated steroid selections based on the type of joint they are treating and the degree of disease or damage present.

the most commonly used corticosteroids for treating high-motion and low-motion joints, respectively. These drug choices align with the 2009 survey results. However, "continued research has guided practitioners in making more educated steroid selections based on the type of joint they are treating and the degree of pathology present," says Walker. "And while adding hyaluronic acid (HA, to intra-articular injections) is still very common, I'm seeing a trend where more practitioners are combining corticosteroids with either an orthobiologic agent or polyacrylamide gel instead."

Indeed, the 13-year gap between surveys brought unprecedented innovation in equine regenerative medicine, with a substantial increase in the use of orthobiologics[2]. Regenerative therapies quickly became a game-changer for veterinarians treating horses and ponies for which steroids are contraindicated because of underlying conditions such as insulin resistance (IR), equine metabolic syndrome (EMS), laminitis, or pituitary pars intermedia dysfunction (PPID, once known as equine Cushing's disease). Orthobiologics increasingly replace corticosteroids in the syringes destined for horses' joints.

The Steroid Controversy

Corticosteroids might be potent, fast-acting, and effective anti-inflammatory drugs, but they are not entirely harmless—for two main reasons. Firstly, the laminitis risk associated with corticosteroid joint injections in metabolically normal horses continues to spark debate. The 2022 survey found that intra-articular use of triamcinolone acetonide was very likely to contribute to laminitis[2]. On the flip side, in a 2023 study, researchers found contrasting results, concluding the drug did lead to increased insulin concentrations in the horse's blood, but those never reached levels high enough to trigger the debilitating hoof disease[3].

Cartilage degradation ranks as the second major pitfall of repeated corticosteroid injections. "Corticosteroids primarily decrease inflammation and provide pain relief but don't have the same healing benefits" as regenerative therapies, notes Thurston. Researchers on numerous studies have shown that with multiple uses over time, corticosteroids can contribute to the progression of OA and the breakdown of joint cartilage.

That's not to say corticosteroids will go away anytime soon. Both our experts continue to see these drugs' value for managing synovitis and arthritis. "Steroids remain a very good option for pain relief when progressive OA is the primary diagnosis," Thurston says.

"There are some cases where corticosteroids are actually the best option," Walker adds. "Steroids are a potent anti-inflammatory. We know exactly what response to expect from their administration. They are available immediately (no processing required), and there is no question of the

Corticosteroid joint injections should be avoided in horses with conditions such as IR, EMS, and PPID. Regenerative therapies became a game-changer for treating these individuals.

Popular Equine Orthopedic Therapies in Veterinary Medicine Today

THERAPY	COMMON BRAND NAME(S)	PRIMARY AIM
Platelet-rich plasma (PRP)	Arthrex ACP, ProVet APC, Restigen PRP	Deliver autologous concentrated platelets that release growth factors to joints, tendons, and ligaments.
Autologous conditioned serum (ACS)	IRAP ProEAS, Orthokine	Reduce inflammation and slow the progression of OA by concentrating pro- and anti-inflammatory proteins, one of which is interleukin-1 receptor antagonist (IRAP, which blocks the cytokine interleukin-1).
Autologous protein solution	Pro-Stride APS	Combine anti-inflammatory proteins from ACS and growth factors from PRP to combat OA from multiple angles.
Mesenchymal stem cells (MSCs)	N/A	Provide anti-inflammatory and immunomodulatory properties and stimulate resident cells to make new tissues in damaged joints, tendons, and ligaments.
Viscoelastic therapy (hyaluronic acid [HA], polyacrylamide hydrogels [PAAG])	Hyalovet, Legend HA, NextHA, Arthramid, Noltrex	Restore the natural lubrication and cushioning of joint synovial fluid.
Polysulfated glycosaminoglycan (PSGAG)	Adequan (labeled for systemic administration, though veterinarians also use it intra-articularly)	Naturally occurring molecule that is part of normal cartilage, used as a disease-modifying approach for managing inflammatory and degenerative damage in OA.
Hyaluronan, sodium chondroitin sulfate, and N-acetyl-D-glucosamine (HCSG)	Polyglycan	Provide molecules present in normal cartilage and synovial fluid to improve cartilage healing and pain.
Bisphosphonates (clodronic acid, tiludronic acid)	Osphos, Tildren	Systemic medications that inhibit the activity of osteoclasts (cells responsible for removing bone) and target bone pain, and are approved for use in navicular syndrome.
Pentosan polysulfate sodium injection	Zycosan	Control clinical signs associated with OA in horses.

chemical composition of the product—a consistency and guarantee we may not get with autologous blood products."

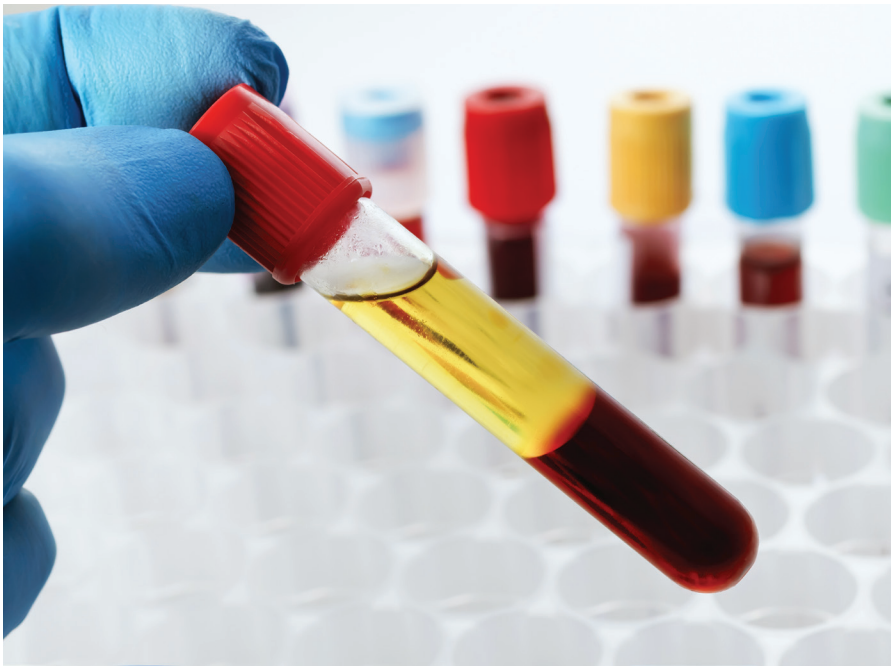
Corticosteroids also offer one irrefutable advantage over orthobiologics: affordability. "The financial situation of some horse owners may allow for joint therapy with corticosteroids when regenerative biologic therapy is not within the budget," Walker says. "Quieting down an angry, inflamed joint with a corticosteroid injection is preferable to continuing to ride the horse while allowing the inflammatory cascade to progress unchecked."

Orthopedic Treatments: The Options Are Multiplying

Both the literature and clinical practice suggest a growing interest in exploring alternatives to traditional corticosteroid joint injections. "Admittedly, the number of products on the market often makes it difficult for practitioners to know which one to use," Walker says. "We need research efforts to determine what these products do within the joint or injured tissue rather than creating yet another type of product." The table above briefly overviews commonly used equine orthopedic therapies in veterinary medicine today.

Zooming In On the Research

Both Thurston and Walker agree a major



ADOBE STOCK

Advancements in regenerative therapies—many of which are autologous (originating from the patient)—mean horses can benefit from reduced recovery time and improved healing.

benefit of regenerative therapies involves their dual ability to relieve pain and inflammation in the joint while improving the quality of healing. Let's take a closer look at specific orthopedic treatments, regenerative and otherwise, that have been the subject of equine research in recent years:

Platelet-rich plasma (PRP)

- What it is: An approach that consists of collecting, processing, and concentrating platelets (thrombocytes) from the horse's own blood and injecting them into injured tissues to reduce inflammation while accelerating and improving healing quality.
- What the research says: Scientists have seen PRP's beneficial effects on healing and return to function of suspensory desmitis in both Standardbred racehorses[4] and Thoroughbred racehorses[5]. Back in 2009 a research team also found that PRP-treated superficial digital flexor tendon (SDFT) injuries healed stronger and with a better organization of the collagen network than nontreated injuries[6]. On the other hand, in a 2021 systematic review, researchers found no significant difference in tendon or ligament healing between PRP and control groups[7].

Regarding joint health, the data on PRP appear encouraging, as a meta-analysis of 21 studies published between 2013 and 2023 showed PRP products are likely efficacious for intra-articular treatment of equine OA[8]. "Specifically, the combined use of PRP and MSC within lesions in tendon and ligament injuries has been shown to reduce significantly the reinjury rate as horses come back into work," says Thurston, referring to a meta-analysis published in 2024[9].

Autologous conditioned serum

- What it is: A therapy that involves processing the horse's blood to concentrate IRAP along with other pro- and anti-inflammatory proteins. It binds to the receptor of the inflammatory cytokine interleukin-1, proactively blocking its harmful effects.
- What the research says: In a 2019 study evaluating the effects of different ACS treatments, researchers concluded that IRAP contributed to controlling joint inflammation[10]. Likewise, in a 2021 clinical study, scientists also found lameness score and digital flexion test response significantly improved six months post-IRAP administration compared to baseline in horses with fetlock joint OA[11]. Despite the clinical improvement, IRAP was unable to control the radiographic progression of the disease.

Autologous protein solution (APS)

- What it is: A product that involves processing the horse's blood to produce a product rich in growth factors and anti-inflammatory proteins, combining the benefits of PRP and IRAP.
- What the research says: While recent studies on APS are admittedly not plentiful, in 2014 Bertone et al. concluded that intra-articular administration of APS can be considered an effective treatment option for equine OA, with the potential for disease-modifying effects[12]. In 2019 another group showed APS effectively concentrated IRAP without an incubation period and media from APS-treated chondrocytes (cartilage-producing cells) increased concentrations of chondroprotective and modulatory cytokines, which might be beneficial in the treatment of inflammatory conditions such as post-traumatic OA[13].

Mesenchymal stem cells (MSCs)

- What it is: Cells originating from the

NSAIDs and Regenerative Therapies: A Safe Combo?

Veterinarians commonly administer non-steroidal anti-inflammatory drugs (NSAIDs) to horses receiving intra-articular autologous conditioned serum (ACS) but have expressed concerns that phenylbutazone (Bute), flunixin meglumine (Banamine), or ketoprofen could negatively affect cytokine or other growth-factor concentrations in samples. To address this, researchers conducted a new study and found that a single-dose NSAID is unlikely to significantly alter the final product (Brown et al., 2024).

ADOBE STOCK

When assessing a horse for orthopedic treatments, numerous factors come into play, and it's essential to evaluate each horse on an individual basis.

equine body (bone marrow, adipose tissue, or umbilical cord) that have been studied for their potential regenerative capacities. Veterinarians often combine stem cell therapy, one of the top innovative advances of the 21st century in both human and veterinary medicine, with PRP and APS in equine orthopedics. "Based on what we know so far, MSCs affect cell signaling and therefore the production of cytokines that help with healing, but they don't directly regenerate tissue by transforming into different cell types," Thurston says. Rather, injected MSCs recruit resident stem cells to the injured area, which differentiate into the cell type needed.

- What the research says: Scientists report that MSCs used in equine tendinitis, OA, and cartilage healing have consistently yielded positive results[14]. In a 2022 study, scientists found significant improvement in both clinical lameness (59.1%) and imaging structure (76.9%) of horses with diverse musculoskeletal lesions treated with MSCs. They found applying other therapeutic methods (i.e., anti-inflammatory medication, shock wave, laser, icing) statistically more effective than using MSCs alone. They also found no difference in the effectiveness of MSCs, whether autologous or allogeneic[15].

Viscoelastic therapy

- What it is: Hyaluronic acid is a natural component of synovial fluid—viscous liquid the synovial membrane produces to lubricate the joint—and the newer polyacrylamide hydrogels (PAAG) are synthetic products designed to restore joint capsule elasticity and synovial fluid viscosity.
- What the research says: In recent years PAAGs have been in the research spotlight. In a 2022 clinical trial, researchers reported a significant decrease in lameness in 82.5% of 43 horses two years post-treatment with 2.5% PAAG[16]. In another study, scientists compared 2.5% PAAG with a triamcinolone acetonide/HA combination and found 83% of PAAG-treated joints were "lame-free" six weeks post-injection versus only 40% for the corticosteroid/HA group[17].

Bisphosphonates

- What they are: FDA-approved systemic medications that inhibit the activity of osteoclasts (cells responsible for removing bone) and target bone pain, and are approved for use in navicular syndrome. They are also often used off-label for OA.
- What research says: In a 2021 clinical study, scientists found that tiludronate appeared to stop the radiographic progression of OA through inhibition of subchondral bone remodeling in the high-motion joints of Standardbred racehorses. However, the researchers say it's unclear whether this effect was associated with worsening of progressive cartilage damage. They also noted the drug did not affect the synovial inflammatory response.

Final Thoughts

Equine orthopedic health is complex, affecting various tissues associated with the joint capsule. Our experts stress there's no one-size-fits-all solution for every case of orthopedic disease.

"When evaluating a horse for a choice of intra-articular therapies, many factors come into play, and each horse and each joint need to be considered individually," says Thurston. With numerous orthobiologic and synthetic treatments available, veterinarians are turning to the literature to navigate the ever-evolving world of equine orthopedic therapies.

References

1. Fraile AP, González-Cubero E, Martínez-Flórez S, Olivera ER, Villar-Suárez V. Regenerative Medicine Applied to Musculoskeletal Diseases in Equines: A Systematic Review. *Vet Sci.* 2023;10(12):666.

2. Zanotto GM, Frisbie DD. Current joint therapy usage in equine practice: Changes in the last 10 years. *Equine Vet J.* 2022;54:750–756.

3. Boger BL, Manfredi JM, Loucks AR, Salamey MZ, Kapeller LE, Fricano AG, et al. Intra-articular triamcinolone acetonide injection results in increases in systemic insulin and glucose concentrations in horses without insulin dysregulation. *Equine Vet J.* 2024; 56(2):326–331.

4. Waselau M, Sutter WW, Genovese RL, Bertone AL. Intralesional injection of platelet-rich plasma followed by controlled exercise for treatment of midbody suspensory ligament desmitis in Standardbred racehorses. *J Am Vet Med Assoc.* 2018;252(6):752–761.

5. Griffin LV, Bathe AP, Riggs CM, et al. Intralesional platelet-rich plasma for the treatment

of proximal suspensory desmitis in National Hunt racehorses: A double-blind, placebo-controlled, multicentre clinical trial. *Equine Vet J*. 2022;54(1):96–105.

6. Bosch G, Cadby JA, Barneveld A. Effects of platelet-rich plasma on the quality of repair of mechanically induced core lesions in equine superficial digital flexor tendons: A placebo-controlled experimental study. *J Orthop Res*. 2010;28(2):211–217.
7. Wynne-Edwards KA, Ortved KF, Clarke AF. The effectiveness of platelet-rich plasma for musculoskeletal conditions in horses: A comprehensive review. *Vet Sci*. 2021;8(4):55.
8. Peng C, Yang L, Labens R, Gao Y, Zhu Y, Li J. A systematic review and meta-analysis of the efficacy of platelet-rich plasma products for treatment of equine joint disease. *Equine Vet J*. 2024;56(5):823–1086.
9. Cloud WRC, Guzmán KE, Panek CL, Colbath AC. Stem cells and platelet-rich plasma for the treatment of naturally occurring equine tendon and ligament injuries: a systematic review and meta-analysis. *J Am Vet Med Assoc*. 2024;262(S1):S50–S60.
10. Machado TSL, Massoco CO, Silva LC, Fülber J, Moreira JJ, Baccarin RYA. Effects of blood-derived products and sodium hyaluronate on equine synovial fluid cells and on synovial fluid from osteochondrotic joints of horses after arthroscopy and administration of treatment. *Am J Vet Res*. 2019;80(7):646–656.
11. Bertuglia A, Basano I, Pagliara E, Bottegaro NB, Spinella G, Bullone M. Effect of intravenous tiludronate disodium administration on the radiographic progression of osteoarthritis of the fetlock joint in Standardbred racehorses. *J Am Vet Med Assoc*. 2021;259:651–661.
12. Bertone AL, Ishihara A, Zekas LJ, Wellman ML, Lewis KB, Schwarze RA, Barnaba AR, Schmall ML, Kanter PM, Genovese RL. Evaluation of a single intra-articular injection of autologous protein solution for treatment of osteoarthritis in horses. *Am J Vet Res*. 2014;75(2):141–151.
13. Linardi RL, Dodson ME, Moss KL, King WJ, Ortved KF. The Effect of Autologous Protein Solution on the Inflammatory Cascade in Stimulated Equine Chondrocytes. *Front Vet Sci*. 2019;6:64.
14. Aimée C, Colbath DD, Frisbie SW, Dow JD, Kisiday C, McIlwraith W, Goodrich LR. Equine models for the investigation of mesenchymal stem cell therapies in orthopaedic disease. *Oper Tech Sports Med*. 2017;25(1):41–49.
15. Bernardino PN, Smith WA, Galuppo LD, Espinosa-Mur P, Cassano JM. Therapeutics prior to mesenchymal stromal cell therapy improves outcome in equine orthopedic injuries. *Am J Vet Res*. 2022;83(10):ajvr.22.04.0072.
16. McClure S. How to use polyacrylamide hydrogel as an intra-articular therapy. *Proceedings of the 68th Annual Convention of the American Association of Equine Practitioners*. 2022.
17. De Clifford LT, Lowe JN, McKellar CD, McGowan C, David F. A double-blinded positive control study comparing the relative efficacy of 2.5% polyacrylamide hydrogel (PAAG) against triamcinolone acetonide (TA) and sodium hyaluronate (HA) in the management of middle carpal joint lameness in racing Thoroughbreds. *J Equine Vet Sci*. 2021;107:103780.