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Review article on Medical and Regenerative Therapies for Managing Osteoarthritis in Equine

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Abstract

The most frequent cause of lameness in equine is osteoarthritis (OA), which severely reduces performance and causes significant economic losses for the equine sector. The disease has a complex etiology that includes aging, trauma, and continuous stress. It is characterized by gradual cartilage deterioration, subchondral bone alterations, osteophyte production, and synovial inflammation. Traditional medical therapies include non-steroidal and corticosteroid anti-inflammatory drugs and hyaluronic acid (HA). Although these methods temporarily alleviate symptoms, they are unable to stop the progression of the disease. Regenerative treatment approaches have attracted a lot of attention lately. Autologous blood products are used in hemoderivative therapies, such as Platelet-Rich Plasma (PRP) and Interleukin-1 Receptor Antagonist Protein (IRAP), to reduce inflammation and encourage tissue healing. PRP delivers a concentrated mixture of growth factors (GF), whereas IRAP counteracts key inflammatory cytokines including IL-1β. Moreover, a very promising approach is mesenchymal stem cell (MSC) therapy. MSCs may have disease-modifying properties due to their capacity for tissue regeneration, immunomodulation, and chondrogenic differentiation. Studies indicate notable success in returning horses to athletic performance following MSC treatment, especially when combined with HA. This review provides an overview of current medical and regenerative therapies for equine OA, comparing their mechanisms of action, therapeutic benefits, and limitations, and underscores the potential of regenerative strategies to enhance clinical outcomes in affected horses.

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Introduction

The equine, especially sport horses are more likely to damage and susceptible to injury due to the demands of increasingly training, activity, passing and tests so they are frequently suffer from musculoskeletal problems like osteoarticular anomalies, osteoarthritis, tendon inflammation and muscular diseases with a possibility of going back to exercising or performing at a previous level **(Reis *et al.* 2024).** The primary reason of lameness in most ages and breeds of equine is Osteoarthritis **(Ireland *et al.* 2013; van Weeren and Back, 2016).**

Osteoarthritis (OA) is a frequent generative disorder of the articular cartilage characterized by hypertrophic alterations in the bone **(Goodman 2005**).

In horses, OA-associated lameness is a major clinical issue **(Dyson and Ross 2011)** leading to reduced sportive skills, the incapacity to race, and the inability to compete in sport horse activities **(McIlwraith *et al.* 2012).** Equine patients may have lameness and functional incapacity as a result of osteoarthritis and the articular cartilage alterations associated it **(Thampi *et al.* 2022).**The equine sector is significantly impacted economically by OA **(Keegan 2007).**

Osteoarthritis is a disease which impacts synovial joint and is marked by periarticular tissue fibrosis, subchondral bone sclerosis, osteophyte production, cartilage degeneration, and various levels of synovial inflammation **(Kidd *et al.* 2001).** Approximately 50% of horses over 15 suffer from OA **(Van Weeren and Back 2016).**

Several predisposing factors, such as age, injury and repetitive stress, cause OA development so the variability in disease progression rate, severity and pathophysiologic mechanisms contributes to some of the challenges associated with equine OA diagnosis and treatment **(Secor *et al.* 2025).**

A good medication would be symptom- and disease- altering together through improving and extending an anti-inflammatory environment within the joint while preventing cartilage destruction and enhance its growth **(McIlwraith *et al.* 2012).** Using both local and systemic pharmaceutical therapy to manage symptoms of OA mainly through non-steroidal anti-inflammatory drugs (NSAIDs) and analgesics through is the primary aim of medications **(McAlindon *et al.* 2014)**, surgical techniques like chondroplasty and microfracture **(Gobbi *et al.* 2014)**, and regenerative medicine methods that use blood-derived **(Le *et al.* 2019; Garbin and Olver 2020; Garbin and Morris 2021; Khurana *et al.* 2021)** or cell-based techniques **(Brittberg *et al.* 2018**).

Medical Therapies

To properly treat OA, it is critical to comprehend the disease pathophysiology and synovial joints structure. Once the disease process is fully understood, the appropriate combination of intraarticular steroids, systemic non-steroidal anti-inflammatory drugs (NSAIDs), chondroprotectants and viscosupplementation can be applied to treat the condition and prevent the progression of surface cartilage degeneration **(Goodrich and Nixon 2006).**

Anti-Inflammatories

These groups of drugs involve steroids (SAIDs) and non-steroidal anti-inflammatory drugs (NSAIDs) as phenylbutazone, flunixin meglumine, ketoprofen, naproxen, and carprofen **((Goodrich and Nixon 2006).**

In musculoskeletal disease, The most commonly recommended and utilized medications are anti-inflammatory drugs, which taken orally or via intravenous (NSAIDs and SAIDs), though intramuscular (SAIDs), or administrated in articular joint (IA) (SAIDs) because those drugs reduce pain and inflammation by block cyclooxygenase enzymes (COX enzymes) responsible for pro-inflammatory prostaglandins production **(Reis *et al.* 2024)** which are hormone-like compounds that regulate several processes (as blood clots formation , flow of the blood & inflammation; markedly increased in inflamed tissue), play an important part in inflammatory response's production contributing to cardinal signs of acute inflammation (heat, pain, swelling& redness**) (Ricciotti and FitzGerald 2011).**

Anti-inflammatory drugs don't stop the disease's progression; they only relieve the pathological symptoms **(Frick 2010).** NSAIDs have the potential to inhibit mesenchymal stem cells' tenogenic development, shift them toward adipogenic differentiation, and adversely affect the healing process, which might lead in the creation of scar tissue and a reduction in functional outcomes (**Frick 2010).**

Injection of corticosteroids medication intra-articular (IA), frequently utilized as a first-line treatment for equine athletes OA may be rapid with moderately improving in function and pain but with short term around one week to three weeks (**Bellamy *et al.* 2006 and daCosta *et al.* 2016).**

Anti-inflammatory medication should be used with caution; therefore, they may be given for a short period of time (3–5 days) during acute stages of inflammation, however their long-term use is not recommended, because may be cause adverse effects, especially those that impact the kidneys and digestive system **(Arvind and Huang 2021).**

Uses of triamcinolone acetonide as intra-articular corticosteroids reduce osteoarthritis pain, but it may impair cartilage metabolism (**Guidoni *et al.* 2024),** so administration of corticosteroid remains controversial because they cause alteration of chondrocyte metabolism, cell death, mitochondrial malfunction, cellular toxicity and rise reactive oxygen species **(Sherman *et al.* 2015; Li *et al.* 2022).**

Hyaluronic Acid: (HA)

Sodium hyaluronate or hyaluronan, is a non-sulfated polymer consists of D-glucuronic and D-N-acetylglucosamine units that alternately repeat (A non-sulfated glycosaminoglycan GAGs) **(Huynh and Priefer 2020).**

All vertebrates, including humans and animals, contain HA, a naturally occurring biological substance that almost entirely originates in bodily fluids and tissues, including synovial fluid, the vitreous humor in the eye and hyaline cartilage **(Huynh and Priefer 2020).** Researchers discovered that variety of bacterial species, such as *Streptococcus zooepidemicus, Bacillus subtilis, and Escherichia coli*, could also ferment to produce this product **(Liu *et al.* 2011).** The characteristics and chemical composition of hyaluronan are the same in bacteria and the vertebrates **(Gupta *et al.* 2019).**

The synovial fluid in joints contain HA, which secreted by type-B synoviocytes (**Laurent *et al.* 1996).** Inflammation can lead to HA depolymerization, reducing its molecular weight and concentration (**Miossec *et al.* 1986)**, which decreases its lubrication capacity and contributes to cartilage and bone destruction (**Dahl *et al.* 1985**).

There are various molecular weights of HA; low (500–730 kDa), intermediate (800–2000 kDa), and high (2000–6000 kDa) **(Testa *et al.* 2021)**. The higher one of HA is produced in connective tissue plasma membranes and released through the synovial fluid arround joints, whereas it attaches the extracellular matrix **(Fraser *et al.* 1997)** exerts proteoglycan/ glycosaminoglycan synthesis, superior chondroprotection, anti-inflammatory and analgesic effects **(Cooper *et al.* 2017).**

The US Food and Drug Administration authorized HA injection Intra-articulary in 1997 as a therapy for knee osteoarthritis pain alleviation with no unknown post-marketing complications reported **(Newberry *et al.* 2015).**

The capacity of synthetic HA to make synovial fluid more viscous is a biologic reason for using it in knee OA **(Moreland 2003; Bannuru *et al.* 2009);** so, it supports the physiological role of the fluid as a buffer, stabilizer of hydrodynamics, and lubricant **(da Silva Xavier *et al.* 2021).**

HA provides some of protecting characteristics to joint synovial fluid like articular cartilage surface protection, shock absorption, lubrication and traumatic energy depletion **(Balazs and Denlinger 1993**).

Experimental and clinical studies show that HA treatment can reduce OA-related equine lameness **(Mahmoud *et al.* 2021)** by reducing cartilage fibrillation and synovial membrane inflammation **(Goodrich and Nixon 2006)**, in mild or moderate synovitis **(Goldberg and Buckwalter 2005).**

It possesses chondroprotective properties because it inhibits the breakdown of HA in synovial fluid and cartilage proteoglycans digestion, resulting in joint-repair impacts OA and lipopolysaccharide-induced synovitis **(Neuenschwander *et al.* 2019)** and enhances lubrication by preventing the synthesis of nitric oxide, which promotes chondrocyte death and cartilage deterioration. Additionally, it slows the progress of OA lesions by reduce the degradation of enzymes linked to degenerative arthritis and maintaining the stability of proteoglycan structure **(Strauss *et al.* 2009).**

Combination therapy of HA with SAIDs reduces lameness more effectively than HA alone **(da Silva Xavier 2021).** However, equine studies indicate intra-articular HA with or without corticosteroids offers temporary relief of symptoms and lameness reduction by ~40–56 **(da Silva Xavier *et al.* 2021; de Clifford *et al.* 2021; Nedergaard *et al.* 2024).**

HA is spontaneously broken down by hyaluronidases, reactive oxygen species, and lymphatic vessel endothelial cells. Hyaluronidases and reactive oxygen species break down about 30% of HA, whereas the lymph vessels systemically break down 70% of it **(Vigetti *et al.* 2014).**

In conclusion, HA is widely utilized because it is a drug that is both safe and economical for reducing the adverse effects of OA **(Strauss *et al.* 2009)** and clinically, it treats and manages acute OA and tendinitis in equine **(Oliva *et al.* 2021).**

Hemoderivative Therapies:

Recently, in equine orthopedics medicine, there is a greater variety of regenerative therapy techniques, particularly hemoderivative therapies like PRP and IRAP. These medicines' produced because they have anti-inflammatory abilities **(Godek 2022).**

Platelet-Rich Plasma (PRP):

Over the last few decades, one regenerative treatment that has demonstrated promise in accelerating articular cartilage healing and regeneration is platelet rich plasma (PRP) therapy **(Guidoni *et al.* 2024).** The application of platelet-rich plasma (PRP) was first used in veterinary medicine in the field of sports medicine to treat ligament and tendon injuries **(Sampson *et al.* 2008; Waselau *et al.* 2008; and Tambella *et al.* 2018).** PRP was used in horses with osteoarthrosis **(Tyrnenopoulou *et al.* 2016)**, depending on previously beneficial human outcomes **(Kon *et al.* 2010 ;Filardo *et al.* 2011; Patel *et al.* 2013 ; Cole *et al.* 2017).**

It is considered an interesting approach because it has fewer adverse effects and hazards compared to conventional pharmaceutical medications **(Liu *et al.* 2024).** Now, it is widely used as a regenerative therapy to manage musculoskeletal degeneration and damage **(Mehrabani *et al.* 2019; Everts *et al.* 2020).**

Concentrations of platelets in PRP, an autologous product obtained from centrifuged whole blood, are three to seven times more than those in whole blood **(Cho *et al.* 2010; Liu *et al.* 2024).**

Platelets and bioactive growth factors (GF) (TGF-β, PDGF, VEGF, IGF, and FGF) are concentrated in PRP, which can reduce inflammation, promote tissue repair, and stimulate anabolic mechanisms in mesenchymal stem cells, chondrocytes, and synoviocytes **(Xie, *et al.* 2014**; **Kennedy *et al.* 2018; Da Fonseca *et al.* 2021)**. PRP might act on several OA-related factors when injected intra-articularly, reducing pain and slowing the progression of the disease **(Testa *et al.* 2021; Gopinath 2025);** and may also promote the regeneration of articular cartilage **(Hildner *et al.* 2011).** The preservation of cartilaginous glycosaminoglycans and a variety of anti-inflammatory mechanisms are biological pathways that aid in preventing the degradation of cartilage **(Hsieh *et al.* 2008; Vun *et al.* 2023; Wang *et al.* 2023).**

After 23 weeks, PRP-treated tendon exhibited extensive healing and increased metabolic activity **(Bosch *et al.* 2010)**. Also, computerized examination of ultrasonographic pictures revealed an improvement in collagenous matrix organization **(Bosch *et al.* 2011)**.

PRP prepared from a blood sample of a patient taken during therapy, this blood sample added to citrate dextrose A as anticoagulant, to stop activation of platelets before using it **(Dhurat and Sukesh 2014**). The blood is then centrifuged twice: the 1st rotation separates RBCS and the buffy coat from the plasma, and the 2nd rotation concentrates the platelets in a tiny amount of plasma **(Dhurat and Sukesh 2014).** When platelets are activated with citrate, the α-granules in their cytoplasm degranulate, releasing the bioactive substances **(Abu-Seida 2015).** The whole preparation process is simple, takes about 15 minutes with by using portable centrifuge, and can be done easily in a clinic. Within the first hour following platelet activation, the majority of growth factors (GFs) are released, and their half-life activity typically ranges from a few minutes to several hours **(Reis *et al*. 2024).**

There are several methods for preparing PRP, including the buffy-coat method and the PRP

method **(Dhurat and Sukesh 2014**), In equine practice, the more common manual technique uses two centrifugation steps to concentrate platelets into a tiny amount of plasma (about 2–5 mL), which is then injected into tendons or joints for treatment **(da Fontoura Pereira *et al.* 2019).**
PRP is available for purchase in commercial horse kits : ACP™ (Arthrex GmbH, Munchen, Germany), Restigen PRP® (Zoetis, Lincoln, NE, USA), Angel PRP™ (Arthrex GmbH, Munchen, Germany) **(Reis *et al*. 2024).** Commercial PRP kits are more expensive than manual preparation, which limits their use in a wider population **(Dhurat and Sukesh 2014**). In addition, the platelet concentration obtained with commercial kits is usually slightly lower compared to that achieved with the double-centrifugation method **(Fukuda *et al.* 2020).**
Fresh platelets can only be stored for 5 days at cooled temperatures **(Aubron *et al.* 2018),** but most patients require multiple PRP treatment sessions **(Görmeli *et al.* 2017),** storage at −80 °C is preferred, as it preserves growth factor (GFs) concentrations for at least 6 months **(Liu *et al.* 2024**).
Many studies have evaluated single PRP injections; however, in patients who respond initially well then symptom recurrence after 9–12 months, a second injection may be recommended **(Glinkowski *et al.* 2025).** While PRP shows antioxidant effects in joints, it can also increase PGE2 levels and reduce hyaluronic acid quality in synovial fluid within 48 hours of therapy (**Machado *et al.* 2019**). To improve outcomes, PRP can be combined with hyaluronic acid (PRP-HA) for potential synergistic effects **(Tan *et al.* 2020).** Better results may also be achieved when PRP therapy is used alongside physical therapy and nonpharmacological approaches, as weight management, muscle strengthening and exercise **(Glinkowski *et al.* 2025**).
The amount of platelets in PRP can be influenced by many factors, including the horse's breed and age, the kind of anticoagulant used, the method of blood drawing, and the clinician's technical skills **(Giraldo *et al.* 2013; McCarrel, 2023).** In addition, variables in PRP preparation techniques may result in variations in cellular and cytokine composition, which may affect its therapeutic effectiveness **(Bosch *et al.* 2010 ; Garbin *et al.* 2021).**
To sum up, PRP is considered low-risk treatment choice and a cost-effective, with minimal risk of rejection or disease transmission (**Hur *et al.* 2014).** It delivers a concentrated source of growth factors that support cellular repair in musculoskeletal diseases **(Bosch *et al.* 2010; Peng *et al.* 2024).** Additional advantages of PRP include its natural autologous, simple and quick preparation, and non-invasive collecting method **(Reis *et al.* 2024).**

IRAP (Interleukin-1 Receptor Antagonist Protein):

The Pro-inflammatory cytokines (such as IL-1, IL-6, TNF-α), number of potential mediators act an important role in the beginning and development of articular cartilage damage by interfering with the dynamic articular balance between anabolic and catabolic processes **(Wojdasiewicz *et al.* 2014).**
The main cause of OA is thought to be interleukin-1β (IL-1β), a pro-inflammatory cytokine which causes joint tissue to release a number of proteases involved in cartilage destruction (**Tortorella and Malfait 2003**).
IL-1β, in joints, is produced from osteoblasts, synoviocytes, mono nuclear cells & chondrocytes and does its action through linking to membrane receptor IL-1receptor (IL-1R)1 **(de Lange-Brokaar *et al.* 2012; Wojdasiewicz *et al.* 2014 ;Torrero & Martínez 2015).** Increased IL-1β levels are found in the cartilage, synovial membrane, synovial fluid and subchondral bone layer in OA. Additionally, there is an increase in IL-1R1 expression on the surface of chondrocytes and synoviocytes **(Smith *et al.* 1998**). Moreover, IL-1β causes apoptosis in chondrocytes by depolarizing their mitochondria, producing reactive oxygen species, and deregulation of enzymatic antioxidant defenses **(Héraud *et al.* 2000; Mathy-Hartert *et al.* 2008).**
Also known as Autologous conditioned serum **(ACS) (Frisbie *et al.* 2007).** IRAP is therapeutic agents which modify the activities of the pro-inflammatory cytokines (**Evans and Robbins 1999; Muzzonigro *et al.* 1999)** therefore called anticytokine therapy because it is one of the potential pharmacological treatment of OA **(Zdravko *et al.* 2012).**
The mechanism of action of IRAP is blocking

IL-1 receptors, which prevents IL-1 activity and stops IL-1β from having a negative impact on articular tissues in the pathophysiology of OA **(Santangelo *et al.* 2012; Hopper 2015).**

The therapeutic effects of IRAP are based on increasing the interleukin-1 receptor antagonist (IL-1Ra) concentration, In addition, autologous serum contains high levels of growth factors including IGF-1, PDGF, and TGF-β as well as anti-inflammatory interleukins 1, 4 and 10 (IL-1, IL-4, and IL-10) **(Zhao *et al.* 2020; Xu *et al.* 2021).**

Although there are several preparation methods, they all essentially involve incubating whole blood in a syringe filled with borosilicate medical glass beads then centrifuged to produce an IL-1Ra enriched serum which can be administered intra-lesionally or intra-articularly to treat the tendons , joints , muscles and ligaments disorder **(Reis *et al.* 2024).** The commercial kits of IRAP are a natural anti-inflammatory product used for equine OA treatment as IRAP Pro EAS® (Arthrex, Naples, FL, USA) and Orthokine® vet IRAP (Dechra, Overland Park, KS, USA) **(Reis *et al.* 2024).**

Tendon IRAP treatment results in a considerable early decrease in lameness, which improves histological and biomechanical healing and temporarily improves the ultrasonographic parameters of repair tissue **(Genç *et al.* 2018; Geburek *et al.* 2015).** There was a notable decrease in cartilage degradation in knees that received the IL-1Ra gene **(Zhang *et al.* 2004).** Lameness significantly improved and synovial membrane hyperplasia significantly decreased in horses treated with ACS treatment **(Frisbie *et al.* 2007).**

Regenerative Therapies:

The primary aim of regenerative medicine is to replace or regenerate tissues and cells in order to return the damaged tissue or organ to its normal structure and function **(Fortier and Smith 2008; Ortved, 2018)**.

Stem Cell Therapy:

Regenerative medicine is still interested in stem cell therapy, and transplanting multipotent stem cells is a beneficial approach for stimulating organ and tissue healing by returning function following tissue damage **(Trounson and McDonald 2015).** Specifically, mesenchymal stem cells (mesenchymal stromal cells; MSCs), which can modulate the immune system and possess multipotent capacity to differentiate into chondrocytes, are considered a promising source for regenerative therapies in OA **(Zhu *et al.* 2021).** MSCs are non-hematopoietic tissue precursors capable of differentiating into several kinds of non-hematopoietic tissues, such as adipose, cartilage, bone as well as others **(Emin *et al.* 2008; Çelebi *et al.* 2010; Baykan *et al.* 2014; Beşaltı *et al.* 2016).**

Mesenchymal stem cells (MSCs) were extracted from the bone marrow of rat and particularly significant due to their capacity to decrease host immune responses and reduce inflammation **(Abdelmawgoud and Saleh, 2018)**. MSCs are highly useful in cell therapy due to their easy availability, simple preparation, and bio-preservation with little loss of efficacy **(Broeckx *et al.* 2019**).

There are many different sources of MSCs; adipose tissue MSCs (AD-MSCs) and bone marrow MSCs (BM-MSCs). These are the most common culture-expanded MSCs utilized; in the veterinary industry, BM-MSCs are more frequently used than Ad-MSCs in research and clinical applications (**Fortier and Travis 2011).**

BM-MSCs are aseptically extracted from the sternum or ilium of horses using a Jamshidi needle **(Arnhold *et al.* 2007; Kasashima *et al.* 2011);** however, it was discovered that samples taken from the sternum of middle-aged horses had a higher density of MSCs than those taken from the ilium **(Delling *et al.* 2012).** For this reason, the sternum is frequently chosen as the ideal harvest location for horses that are middle -aged to older. In order to get bone marrow-MSCs, the bone marrow aspirate can either be cultivated for two to three weeks or immediately centrifuged to produce bone marrow concentrate (BMC). Both platelets and stem cells are concentrated in bone marrow concentrate **(Fortier *et al.* 2010).** The most practical way to introduce MSCs into an osteoarthritic joint is by intra-articular injection **(Mahmoud *et al.* 2021)** where their implantation into cartilage lesion has demonstrated significant promise for the regeneration and repair of both cartilage and subchondral bone **(Hassanzadeh *et al.***

2023).
MSCs have the ability to differentiate into several cell types, such as osteoblasts and chondrocytes **(Zippel *et al.* 2012**). Additionally, MSCs have great motility and migration capacity and can release cytokines to promote the injured tissues repairing; so, MSCs are being applied in treatment of many diseases in clinical trials **(Salem and Thiemermann 2010).**
It is believed that MSCs have the ability to manage both acquired and congenital bone degenerative disorders, as well as regenerate damage bone tissues, leading to improve clinical outcomes for skeletal tissue repair and regeneration **(Saeed *et al.* 2016).**
It has been shown that MSCs are able to adjust autoimmune responses because it prevents dendritic cells growth (DCs) and natural killer (NK) cell activation; inhibiting T and B cells proliferation and differentiation as well as stimulate the production of T regulatory cells (Tregs) **(Ansboro *et al.* 2017).**
Horses receiving MSC treatment have demonstrated improving in their ability to resume sports, especially when they suffer meniscal damage after a stifle injury (**Ferris *et al.* 2014)** and fetlock OA **(Broeckx *et al.* 2019).**
In briefly, MSCs can treat OA in a number of ways, including promoting chondrogenesis, chondrocytes proliferation, decreasing apoptosis, autophagy maintenance, controlling the synthesis and breakdown of the extra cellular matrix (ECM), regulating immune response and reducing inflammation **(Xiang *et al.* 2022).**
A better synergistic effect of HA and MSCs has also been suggested by a number of experimental OA animal models **(Moyer *et al.* 2007).** Combining MSCs with HA has been proposed to enhance chondrogenic development, mobilization, and adhesion to the joint injury site in horses in especially **(Ferris *et al.* 2014; McIlwraith *et al.* 2011).**

Conclusion
One of the main causes of equine lameness, osteoarthritis, has significant clinical and economic implications and can be treated with a variety of methods. Hyaluronic acid and nonsteroidal and corticosteroid anti-inflammatories are examples of conventional medical treatments that help reduce pain and inflammation, but they can't stop the progression of the disease. By promoting cartilage repair, lowering inflammation, and improving long-term joint function, regenerative therapies—such as PRP, IRAP, and MSCs—offer novel opportunities. Nevertheless, issues like inconsistent results and protocol variability still exist. The most promising method for improving the treatment of equine osteoarthritis is a combination strategy that incorporates traditional and regenerative techniques supported by additional research and established criteria.

Recommendations
Early and accurate diagnosis of equine osteoarthritis is essential to prevent irreversible joint damage and to improve prognosis. Although anti-inflammatory medications (NSAIDs and corticosteroids) are still helpful for managing acute inflammation and providing temporary pain relief, their use should be restricted because of possible adverse effects and their inability to alter illness. For short-term lameness relief, lubrication improvement, and inflammation reduction, hyaluronic acid (HA) is a safe and economical treatment. Clinical results may be improved by combining HA with corticosteroids or regenerative treatments. Hemoderivative treatments that reduce inflammation and promote cartilage repair, such PRP and IRAP, have encouraging outcomes. However, variations in preparation techniques may impact effectiveness; for this reason, standard operating procedures are recommended. Among the most promising restorative methods for horses OA is mesenchymal stem cell (MSC) therapy. Intra-articular MSCs can enhance athletic performance recovery; modify the immune system, and promoting cartilage regeneration. Compared to single therapies, combination therapies (such as MSCs + HA, PRP + HA, or IRAP with supportive medical management) may provide greater long-term results and synergistic effects**.** In addition to pharmacological and regenerative therapies, rehabilitation strategies, regulated exercise, weight control, and routine monitoring should all be part of the long-term management of equine OA. To identify the best treatment regimens, dosages, and combinations for equine OA, more clinical trials and comparative re-

search are highly recommended.

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