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Introduction to Joint Therapy

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Numerous biologic therapies have recently become available to supplement the previous chemical treatments classically in use. The selection of a joint therapy regimen should involve the assessment of the problem and the use of the best combination of medications that will restore normal joint homeostasis. Author’s address: Rood and Riddle Equine Hospital, PO Box 12070, Lexington, KY 40580-2070; e-mail: lbramlage@roodandriddle.com. © 2011 AAEP.

1. Introduction

Normal homeostasis within a joint cavity is a concert of two lubricating mechanisms that protect the joint and promote normal, pain-free function.\(^1\,^2\) The articular cartilage is lubricated by weeping lubrication of water out of the cartilage to the articular surface when the joint is loaded.\(^1\) This weeping lubrication separates the articular surfaces and prevents wear. The weeping is possible because the aggrecan within the articular cartilage has an attraction for water. It pulls water into the articular cartilage, inflating the cartilage in preparation for loading.\(^1\) The physical act of loading squeezes the water toward the surface, separating the articular surfaces and preventing friction between the cartilage surfaces.\(^2\) The soft tissues of the joint are lubricated by hyaluronan.\(^3\) Hyaluronan is a boundary lubricant that clings to the surface of the soft tissues of the interior of the joint, and, through its slippery nature, lubricates by minimizing friction at the interface of tissues because of the sliding of the hyaluronan layers, preventing the soft tissues of the interior of the joint from contacting opposing surfaces and creating friction.\(^3\)

Inflammation within the joint disrupts these lubrication mechanisms, eliminates their protection of the synovial lining and articular surfaces, accelerates wear on the joint surfaces, and creates pain. Inflammation and its accompanying pain is a self-protection mechanism for the joint but a hindrance to the horse’s normal performance. The inflammation within the joint is designed to restrict use, facilitate the removal of the cause and effects of injury, and allow healing.\(^3\)

Hyaluronan and aggrecan are normally renewed on a continual basis, with destruction and production in balance.\(^4\) Inflammation accelerates the destruction of the normal aggrecan and hyaluronan overproduction, and the levels of hyaluronan and aggrecan decrease. In the articular cartilage, this gradually depletes the aggrecan and reduces its ability to inflate the articular cartilage with the lubricating water, increasing the friction between the joint surfaces. This results in articular surface wear and loss of articular cartilage and permanent disruption of the ability of the articular cartilage to protect itself during exercise.\(^4\,^5\)

Aggrecan has a significant reserve.\(^1\) Acute insults are tolerated well. This is made possible by this reserve. Accelerated destruction during insult removal is tolerated because the reserve aggrecan can lubricate the cartilage for a time without new pro-
duction. Once acute inflammation subsides, the aggrecan is restored to its more normal levels and complete protection of the articular surface resumes as long as loss of the superficial cartilage and collagen layers on the surface of the cartilage has not occurred.1

Chronic inflammation is much more damaging. 1,6,7 Inflammation over a period of time will deplete the reserves of aggrecan beyond its reserve, making the articular cartilage progressively more vulnerable to wear, insidiously eroding the articular surface and eventually eliminating the cartilage's ability for self-protection. This degradation rate is dependent on the severity of inflammation that is causing the aggrecan loss. It is irreversible once it occurs, and, once articular cartilage surface is lost, it cannot be restored.1,6

The boundary lubrication, on the other hand, is very labile.1 Hyaluronan is rapidly destroyed, eliminating the lubrication of the synovial lining. This has two effects: it causes friction between the synovial lining and its opposing surfaces, which causes pain within the joint, limiting the joint use; and it allows protein from the blood, including fibrin, to enter the joint to aid in debris removal.1 The decreased hyaluronan content of the joint is totally reversible as long as the synovial lining remains functional. The synovial lining contains enough redundancy to tolerate acute insults, but chronic insult eventually results in permanent loss of boundary lubrication capacity.5 The synovial lining has a finite amount of surface and a finite amount of cellular reserve that is capable of maintaining the hyaluronan content and removing debris from the joint.1 Debris removal takes a toll on the interior of the joint because each particulate piece of debris causes a permanent change in the villi that have removed it and a permanent decrease in functional synovial cell numbers. If this is continued over a long period of time, the fibrosis within the synovial lining and loss of synovial surface becomes advanced enough to reduce the capabilities for hyaluronan production. If the insult is severe enough or prolonged enough, the synovial capacity to produce hyaluronan is reduced below the level that maintains homeostasis. The result is chronic reduction of hyaluronan levels, reduced lubrication of the interior of the joint, and chronic low-grade inflammation that then begins to continuously promote the catabolism of the aggrecan, eventually affecting not only the synovial lining lubrication and function but the articular cartilage lubrication and self-protection as well.1,2,6

Selection of joint therapy would ideally improve the lubrication within the joint without hiding the debris or the cause of inflammation until it can be addressed and neutralized by the joint. Surgery is often a great help in reducing the debris load and the need for debris removal, minimizing the amount of synovial lining lost to inflammation and maintaining the minimum joint capability for normal function.1 Ideal joint therapy would promote the anabolic component of aggrecan metabolism and decrease the catabolic component to help protect the articular cartilage until and after clinical care of the horse restores the maximum aggrecan levels, which may involve surgery or rest.

Unfortunately, we have no perfect joint medication. Each joint medication tends to have its own strengths and weaknesses. Some are very effective in reducing the inflammation that is associated with the joint insult, allowing normal function, but if the medication does this without restoring the normal components of joint lubrication, joint “wear and tear” is simply accelerated. Some joint medications are very effective in restoring joint metabolism but are not as very effective in restoring joint function and therefore have less dramatic effects on the clinical signs in the short term. It is the veterinarian’s challenge to select the appropriate medication for both the short- and long-term needs of the horse, the owner, and the trainer.

When presented with a horse with lameness or decreased performance, and the cause is isolated to a joint, the attending veterinarian is faced with the need to choose an appropriate joint therapy or course of therapies. Sometimes this will necessitate surgical intervention to remove a physical irritant or time to heal bone or soft tissue trauma. The goal is slowing or stopping the degeneration that results in progressive loss of the structure and function of the articular cartilage and synovial lining and their ability to protect the joint.

Tradition, cost, short- and long-term needs for performance, experience, the ability to generate immediate results (resolution of lameness), knowledge, long-term responsibility for the horse's health care, and scientific data all weigh into the treatment choices. Numerous medications have been developed. Initial medications were chemical, classes of physiology modifiers were then developed, and now an alphabet soup of biologic and cell-based therapies has appeared.

Newer products open up a realm of treatment strategies. Not only must one decide which products to use and whether to use more than one product as a treatment strategy, but one must also assess the possibility to use combinations or sequences of medications.

Trainers and owners are often mired in the immediacy of the moment and care about one thing—resolving the horse’s problem or lameness as rapidly as possible—especially in high-level athletic horses with schedules to keep. The veterinarian must be concerned, as well, about the long-term effects of treatments on the health of the joint. Experienced owners and trainers are sometimes equipped to assess this as well, but frequently performance schedules cloud their judgment. The cartilage and synovial lining will never regenerate once they are lost to trauma, inflammation, or the response of the joint to injury. In the best situation, the horse’s
connections should always weigh this consideration in treatment selection.

Infection aside, overuse and chronic insidious damage to the cartilage, or more acute high-speed cyclic loading of the joint and damage to the bone, are the two major causes of degenerative, nonhealable arthritis in the mature horse. In the juvenile, until the joint has become normally formed, osteochondritis dessicans, osteochondrosis, or developmental malformation of the joint surface can have a very damaging effect on joint function and can result in degenerative arthritis similar to trauma or overuse.4

2. Conclusion

There are several categories of medications that work in ways similar to each other and different from other categories. Too often, we judge compounds as simple variations of the same theme and assess their response solely by how soon they can make the horse sound after injection. Assessment of the strengths and weaknesses, costs, and effects of joint therapy should all be considered when a plan for treatment is recommended.

References