Equine Research News

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Providers of Equine Research From 1940 thru 2016

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Cationic Contrast-Enhanced CT for the Detection of Cartilage Injury

Dr. Chris Kawcak, Colorado State University

Osteoarthritis is the most commonly encountered musculoskeletal problem in horses causing lameness, decreased athleticism, cost to owner and early retirement. Osteoarthritis is defined by the breakdown of articular cartilage and because of its limited ability to repair following injury, this often leads to a progression of the disease. Consequently, early diagnosis and treatment can improve prognosis for recovery. Routine imaging methods used to detect osteoarthritis, including x-rays and ultrasound, are incapable of detecting early stages of the disease. Although considered the gold standard method of cartilage imaging, MRI is limited in detecting injury until significant degeneration has already occurred.

Dr. Chris Kawcak

Articular cartilage is composed of cells embedded within a matrix. The matrix is composed of glycosaminoglycans (GAGs), which attract water and provide for structural support within the tissue promoting normal joint motion. Detection of GAG changes in the early stages of disease can improve diagnosis of cartilage injury.

Exploiting the presence of the negative charges on GAG molecules, our group has investigated the use of a positively charged contrast agent (CA4+) that diffuses into the cartilage in proportion to the amount of GAGs present within the matrix. Similar to the attraction of opposing poles on two magnets, the negative charges on GAGs attract the positively charged CA4+. Then, when the joint is imaged with computed tomography (termed cationic contrast-enhanced computed tomography), the amount of contrast agent that enters the cartilage is proportional to the amount of GAGs in cartilage. This gives us the opportunity to estimate the amount of GAG molecules within cartilage using diagnostic imaging. While preliminary laboratory experiments have shown that this technique works in predicting the amount of GAGs in normal cartilage, further investigation is needed using degenerative cartilage in order to determine if this technique works with degenerative cartilage tissue.

We used a cartilage impact model in the equine stifle joint to evaluate this technique, and determined mechanical and biochemical changes in the articular cartilage, which indicate early changes in articular cartilage. Each of these analyses (mechanical and biochemical) were compared to the imaging data to determine if cationic contrast-enhanced computed tomography could predict these measurements of cartilage quality, and hence give an indication of its effectiveness for characterizing early articular cartilage damage.

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SHARE THE WINS

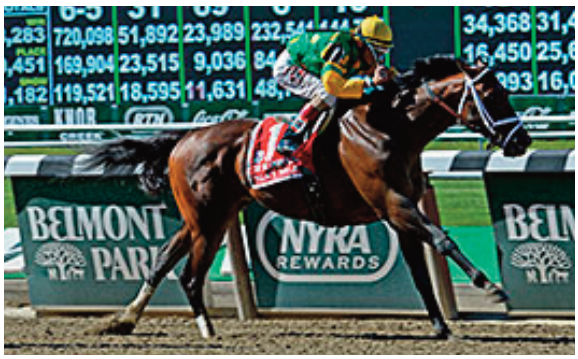
Grayson-Jockey Club Research Foundation offers a "Share the Wins" program that allows owners and fans to make tax-deductible donations to the Foundation based on performances by designated horses.

The Breeders' Cup presents a perfect opportunity to share the success of you own horse(s) or your favorite(s), while helping research for the future. Remember, no win, no expense!!

Anyone can make a pledge of whatever mount and connected to whichever horse, horses or stables they choose.

Collected winning the Lexington Stakes

Participants have included Collected,owned by Speedway Stables, winner of the Lexington Stakes and Sham Stakes, and Palace Malice, campaigned by Dogwood Stables, with pledges from wins in the Metropolitan. New Orleans, and Gulfstream Park Handicps as well as the Westchester Stakes.



Palace Malice winning the Metropolitan

For more information on participating in our "Share the Wins" program ***click here.***

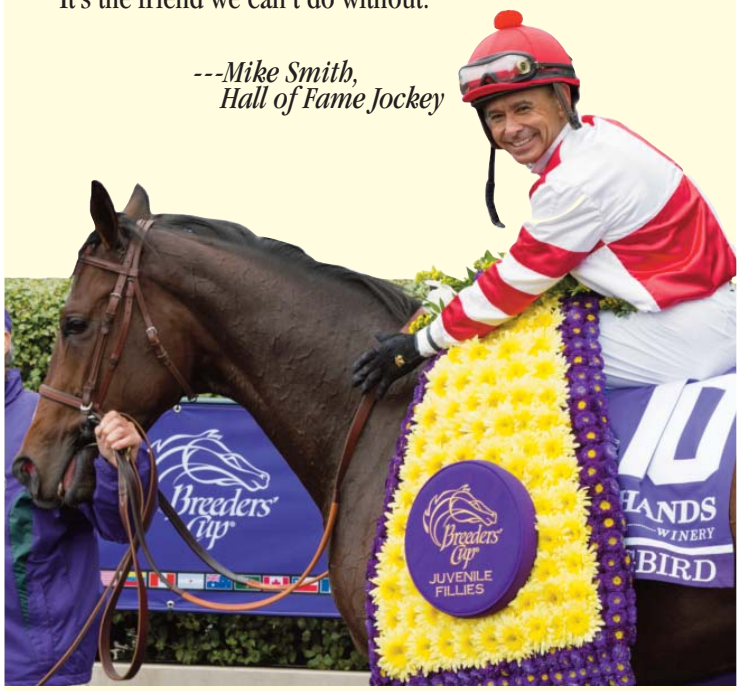
The Friend You Can't Do Without

"When I think about all that horses have done for me, it seems natural to help give back to them through my support of the Grayson-Jockey Club Research Foundation.

This organization has great past performances in identifying and funding research projects designed by experts to help keep horses sound and healthy and to treat them when they do have problems.

I encourage anyone who cares about horses to contribute to Grayson. It's the friend we can't do without."

---Mike Smith, Hall of Fame Jockey



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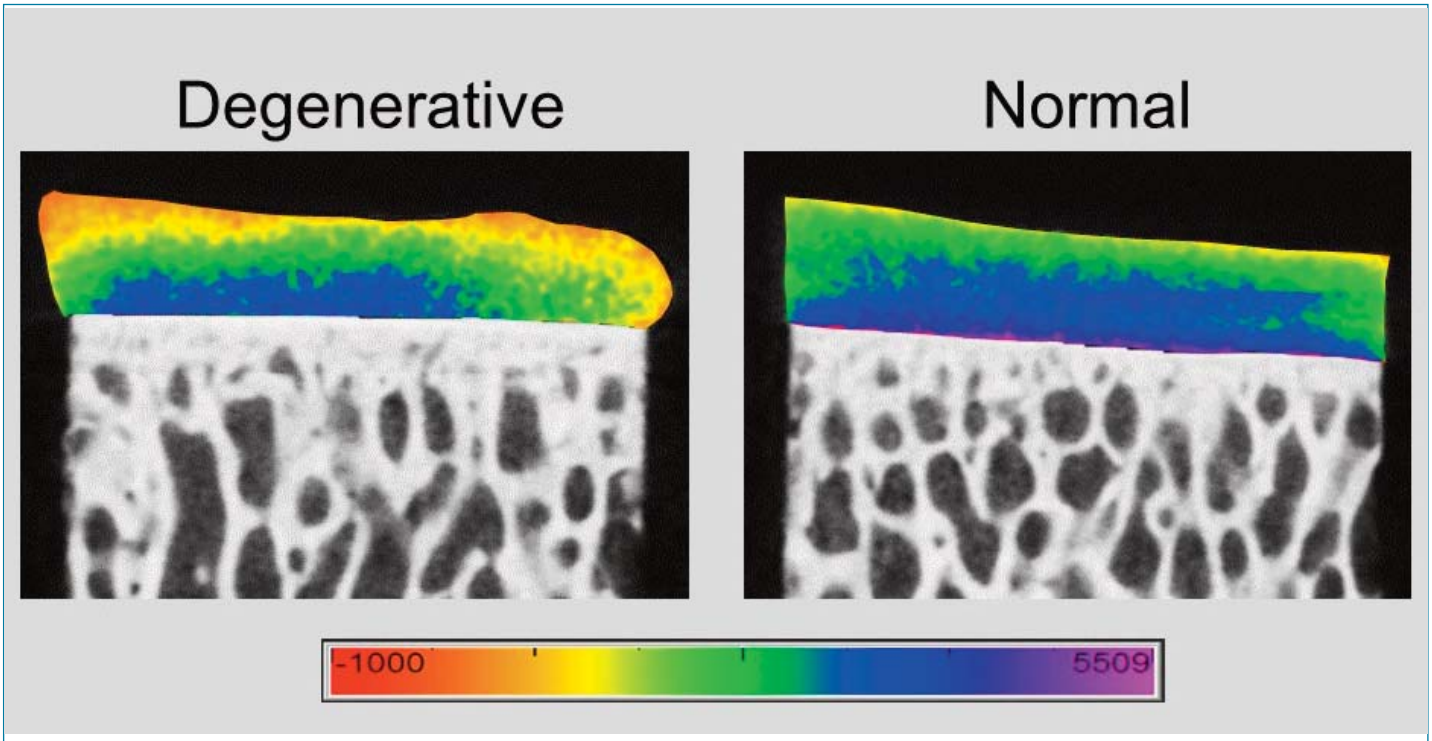
In the degenerative cartilage samples, there was a significant connection between the measurements obtained with cationic contrast-enhanced computed tomography and the mechanical and biochemical properties of that cartilage. When compared to normal cartilages that had increased imaging signal (more CA4+), higher amounts of GAGs and higher strength, the degenerative cartilage that had lower imaging signal, GAG, and strength. Using this cationic contrast-enhanced computed tomography method, we could predict the biochemical and mechanical properties of degenerative cartilage (*Figure*). This is an important step in determining the capabilities of this imaging method. This technique has great potential in being able to detect cartilage injury early before significant degeneration has occurred and may be useful by instituting therapies earlier in the disease process and improving the outcomes of horses with osteoarthritis.

Figure:



Cartilage samples imaged with cationic contrast-enhanced computed tomography. The left image is from cartilage collected at the site of injury (degenerative), while the right image is from a non-impacted (normal) location. The cartilage is highlighted with a color map to show changes in computed tomography signal throughout the tissue and the white is the underlying bone. The higher amounts of imaging signal are blue-green, while lower signal is represented by the yellow-orange colors. The color bar shows the range of imaging signal values. In addition to having a lower imaging signal, the cartilage sample on the left image also had a lower amounts of GAGs and was weaker when compared to the cartilage in the right image.

Equine Research News is the digital newsletter of the **Grayson-Jockey Club Research Foundation** *501(c)(3) organization*

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