

The Testing of the Screw

A headless, tapered screw made out of tough, lightweight metal may put a new twist on surgical implants used in pastern arthrodesis.

By David Shield

For years, riders in western performance events such as reining, cutting and barrel racing have encountered a serious problem with their horses' pastern joints. Thanks to all those quick starts and stops that are required in western-style events, older horses can develop a condition known as *chronic osteoarthritis* of the pastern joint.

Much like arthritis in humans, the condition causing chronic inflammation in the pastern joint — the joint that connects the long and small pastern bones. Horses that suffer from chronic osteoarthritis of the pastern joint experience a great deal of pain, and in many cases, the condition can end a horse's performance career.

Specialists have developed a number of different treatments to help relieve the pain. One of the most successful is *arthrodesis* (joint fusion) that's based on techniques used in human medicine. Veterinary surgeons generally use a combination of small screws and plates to fuse the horse's pastern joint.

However, the exact combination of surgical implants has been the subject of a considerable amount of debate in veterinary surgery circles. "Early on, there really wasn't any objective biomechanical assessment of these implants available to equine practitioners," explains Dr. David Wilson.

The large animal surgical specialist at WCVM is a veteran researcher who has conducted a number of biomechanical studies on surgical implants with research teams in Canada and the U.S. "We got involved in testing these products because we wanted to shed some objective light on what we can expect mechanically from these different repairs."

Screws: going headless

Over the past several months, Wilson and his surgical resident, Dr. Ryan Wolker, have been evaluating the strength and effectiveness of one particular implant: a headless, tapered titanium screw.

With the use of equine cadaver legs and biomechanical testing equipment at the University of Saskatchewan's College of Engineering, the researchers have been examining whether these new screws are comparable to other screws with heads that are available to surgical specialists.

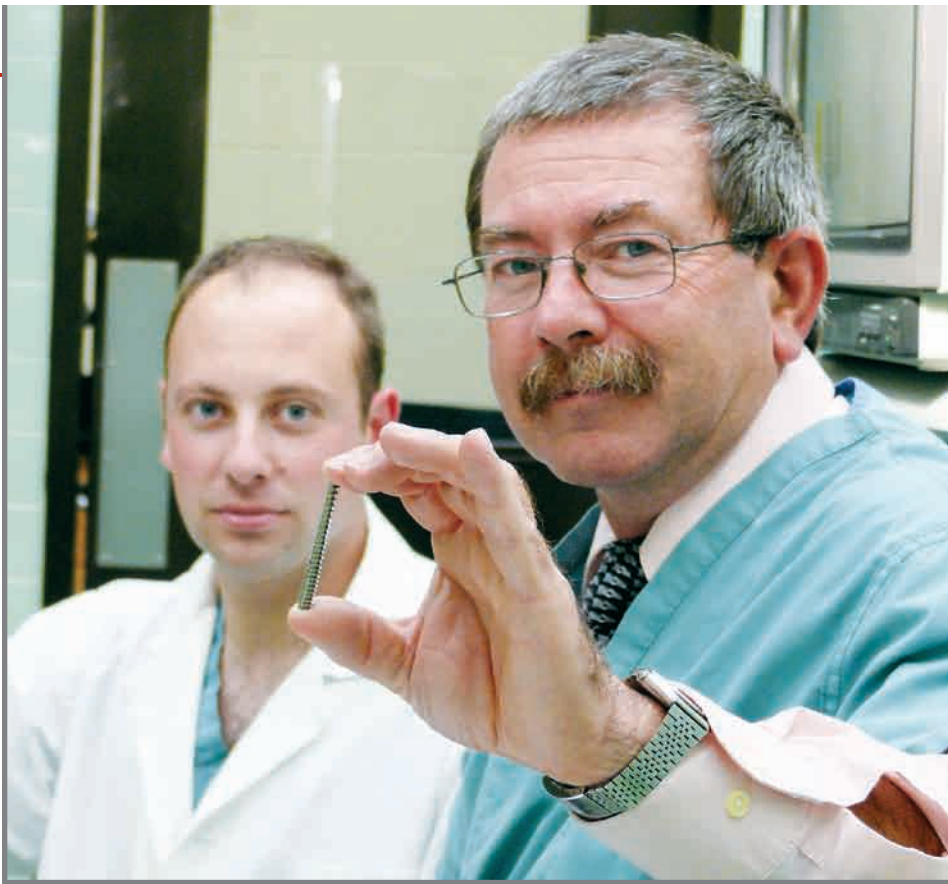
If they stand up to the strain, that could be a good thing for horse owners. Wolker says studies have shown that titanium causes less inflammation inside the body than traditional stainless steel screws. As well, he says headless, tapered screws have been shown to decrease tissue irritation.

"Some reports in the 1980s and mid-1990s have suggested that with the two parallel screw technique (one of the recommended techniques for pastern arthrodesis), you get some irritation of the soft tissues around the joint and that can lead to excess bone deposition," explains Wolker.

"Our thought is that if we can bury the headless screws entirely within the bone so there's nothing exposed, we might be able to avoid those problems. The headless screws might turn out to be a good alternative to the traditional ones."

Wilson agrees. "Because the screw is buried below the surface of the bone, there may be less potential for the tendon to be interfered with as it passes over the screws. It's one suggestion that often comes up when people talk about why some horses don't do well after pastern arthrodesis surgery."





However, because of the conical shape of the screws, the procedure for drilling the holes to insert them can be challenging. “The traditional screws are basically cylinders, so they have the same diameter from top to bottom. But these tapered screws are conical, so the hole you drill is conical. There’s a bit of a learning curve to perfect that procedure, and it’s something that will need to be worked out when these screws are used in live horses,” says Wolker.

Limiting factor: bone density

Wilson and Wolker have finished the trial portion of their study, and after conducting a preliminary analysis of their data, the bending strength and stiffness of the tapered screws are not statistically different from other screws.

While he’s satisfied with their study’s preliminary findings, Wilson admits that he’s become skeptical of any “stronger and better” claims after testing a range of surgical implant products. Instead, he points to the density of horses’ bones as a possible limiting factor when it comes to the stability of bone fusion surgeries — not the screws themselves.

“Some of the screws have greater holding power: the screws are stiffer, they’re stronger and there should be a difference. Yet when we test our samples biomechanically, the screw type doesn’t appear to make a difference. The implant may be better constructed, but since everything relies on the strength of the horse’s bone, that’s the limiting consideration.”

As preliminary results of this study indicate, headless titanium screws appear to be similar to other screws in terms of bending strength and stiffness. But if this particular screw reduces inflammation and tissue irritation in clinical cases after pastern arthrodesis procedures, that would definitely attract more interest in the surgical implant, acknowledges Wilson.

Can the headless titanium screw deliver on those benefits? Answering that question will take more time — plus future studies involving live horses — to determine whether these screws have more to offer than a unique shape. **H**

David Shield has written for many Saskatchewan-based publications including Planet S Magazine, U of S On Campus News, Pulsepoint Magazine and Eagle Feather News. He works as a casual reporter for CBC Radio News in Saskatoon, Sask.

PREVIOUS PAGE: An enlargement of the headless titanium screw that underwent biomechanical testing at the U of S. Bottom left: Dr. Ryan Wolker indicates on a patient’s leg where he placed traditional screws during the horse’s pastern arthrodesis procedure. **Above:** Large animal surgery resident Dr. Ryan Wolker (left) and Dr. David Wilson with one of the headless titanium screws.

Wolker’s Constants: Horses and Surgery

Horses — especially horses in action — are at the heart of what Dr. Ryan Wolker likes about his work in the profession of veterinary medicine.

“Basically, I like sports medicine, and that fits in well with my interest in horses,” says Wolker, who is originally from Wawanese, Man. “I like all the different western performance sports and the Thoroughbred racing, and I just think it’s amazing that these animals can perform so well.”

Wolker studied animal science for three years at the University of Manitoba before coming to WCV in 2000. During his fourth-year clinical rotations, Wolker worked alongside equine surgeon Dr. Peter Fretz — an experience that heightened his interest in horses over other large animals. After finishing his veterinary degree in 2004, Wolker’s penchant for horses led to a one-year clinical internship at Moore & Company, a private equine referral clinic in Calgary, Alta.

“That was where I decided that (a) I just wanted to work with horses, and (b) I just wanted to do surgery,” he says. Once his internship

was done, Wolker headed south for a clinical fellowship at Oregon State University and then returned to WCV in 2006 to begin his residency in large animal surgery.

As part of his Master of Veterinary Science degree program, Wolker is focusing his research on joint problems experienced by horses — but he’s also interested in minimally-invasive therapies.

The two fit together nicely in another pastern arthrodesis project that he’s working on with Dr. David Wilson, his residency supervisor. With this approach, researchers inject ethyl alcohol into the affected joint to dissolve the cartilage in the joint. Afterwards, veterinary surgeons would only need to make two stab incisions for placement of the screws — a less invasive approach to pastern arthrodesis.

What’s next after Wolker completes his residency and a Master’s degree in 2008? A PhD program might be in his future, perhaps with a focus on minimally invasive procedures in laparoscopic surgery.

Wolker’s future plans may take him elsewhere, but one thing he knows for sure: horses and surgery will remain the constants in his career.