

Return to Agility after Achilles Tendon Injury

COURTESY OF DEBORAH LOZUPONE

By Lauri-Jo Gamble, DVM and Debra Canapp, DVM, CCRT, CVA, DACVSMR

Case Study

In November 2011, Pilot (an 18-month-old male Whippet) became entangled in a line at a lure coursing event. Initially, the only notable finding was a laceration over the right hock. His gait was normal, but by the next morning he was non-weight-bearing and significant swelling was noted over his right tarsus. He was first examined at an emergency clinic where the wounds were cleaned. Since the superficial digital flexor tendon was visualized and palpated intact, the skin was closed with sutures. The next day Pilot was seen at Veterinary Orthopedic & Sports Medicine Group, in Annapolis Junction, Maryland, where a rupture of the Achilles tendon was suspected based on physical examination and diagnostic musculoskeletal ultrasound. Due to the severe amount of inflammation and swelling, a second ultrasound (one week later) and magnetic resonance imaging (MRI) were recommended to maximize the diagnostic findings and develop a plan consisting of either surgery, regenerative medicine, and/or physical rehabilitation. In the meantime, a bandage with a lateral splint was applied to provide support, restricted activity was recommended, and pain control medications were prescribed.

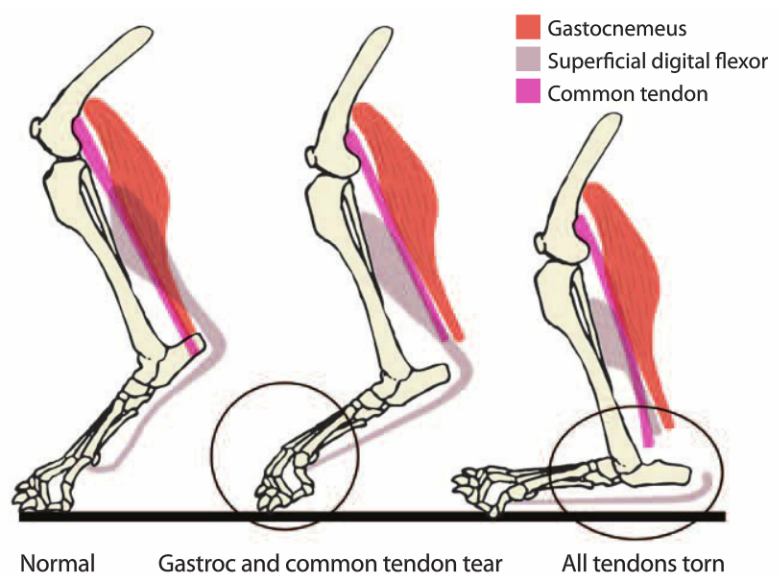
Achilles Tendon Injuries

Tendons are fibrous cords of tissue that attach muscles to the bone. The Achilles tendon or common calcanean tendon is made up of three components (three separate tendons made of five muscles attaching to the tuber calcanei of the

calcaneus): the gastrocnemius tendon, the superficial digital flexor tendon, and the common tendon (combined tendons of gracilis, semitendinosus and biceps femoris).

Achilles tendon rupture is a common tendon injury among dogs. Mature medium to large-breed active dogs seem to be most commonly affected by this type of injury. Disruption of the Achilles tendon can be complete (all components) or partial (leaving the superficial digital flexor tendon intact). See **Figure 1**. When the Achilles tendon is completely ruptured, the dog will be initially non-weight-bearing and swelling may be noted at the point of the tarsus (calcaneus). In some cases, a skin lesion/laceration may be evident and there may be a palpable tendon defect. With more chronic lesions, the hock will sink to a hyperflexed position with associated hyperextension of the knee and plantigrade stance (walking on the soles of the paws; flat footed). The dog will have a progressive completely dropped tarsus and a stance resembling that of a human foot instead of normal canine paw placement. For a partial tear, the toes are curled downward (crab claw stance; digital knuckling). The toes curl with a partial tear of the Achilles because the superficial digital flexor tendon tries to keep the tarsus elevated which results in tension on the toes causing them to curl.

1 Anatomy of the Achilles tendon and posture based on injury type



Achilles tendon rupture tends to be associated with an acute traumatic episode, either an impact injury resulting in avulsion of the tendon from the calcaneus or a direct sharp trauma to the musculotendinous unit (cut, laceration). Chronic degeneration of the Achilles tendon is also possible and is more frequently seen in Labrador Retrievers and Doberman Pinschers. However, those active dogs can also have a chronic to acute presentation (chronic degeneration exacerbated by an acute injury).

Diagnosics

Physical examination findings and the recognition of the classic gait associated with Achilles tendon injury are the first steps to diagnosing this condition.

Radiographs can also be helpful; thickening or swelling of the tendon, mineralized fragments, or avulsion may be noted in the area of the calcaneal attachment. However, minimally invasive diagnostic modalities such as diagnostic musculoskeletal ultrasound and MRI can be used alone or in conjunction not only to confirm the diagnosis but also to grade the level of injury.

“Strain” is a broad term used to describe an injury to a muscle and/or tendon. Similarly, a “sprain” is an injury involving the stretching or tearing of a ligament (tissue that connects bones and provides joint stability). The degree of damage or strain to the Achilles tendon will dictate the treatment recommendation. See **Table 1**.

In Pilot’s case, the repeated ultrasound of his right Achilles tendon revealed a significant disruption of the gastrocnemius tendon (grade 3 strain) and common tendon (grade 2 strain) with only the superficial digital flexor tendon component remaining completely intact. A grade 3 sprain of the lateral collateral ligament of the tarsocrural joint was also noted. In 2011, diagnostic ultrasound was not as specific as it is today; hence an MRI was also performed to confirm the diagnosis, particular area affected and percent of disruption. Please note that for the last few years, VOSM has relied on musculoskeletal ultrasound only to diagnose Achilles tendon injury since this technique is relevant, accurate, and does not require anesthesia.

Table 1: Strain grading scale

	Definition	Description	Treatment
Grade 1 (mild)	Overstretching of the tendon, without a tear or loss of function	<ul style="list-style-type: none"> • Simple stretch • Minimal structural involvement • Microscopic tears, no fiber disruption • Inflammation 	Neoprene bracing and rehabilitation therapy
Grade 2 (moderate)	The general continuity of the tendon is intact though its strength is significantly reduced	<ul style="list-style-type: none"> • Minor fiber disruption/partial tear • Painful 	Secondary healing with bracing and possible help from regenerative medicine (stem cell therapy/PRP)
Grade 3 (severe)	Complete disruption, avulsion or tearing of the tendon	<ul style="list-style-type: none"> • Complete tear • Results in tendon dysfunction 	Surgical fixation, regenerative medicine (stem cell therapy/PRP) in addition to post-operative immobilization (bracing) and physical rehabilitation



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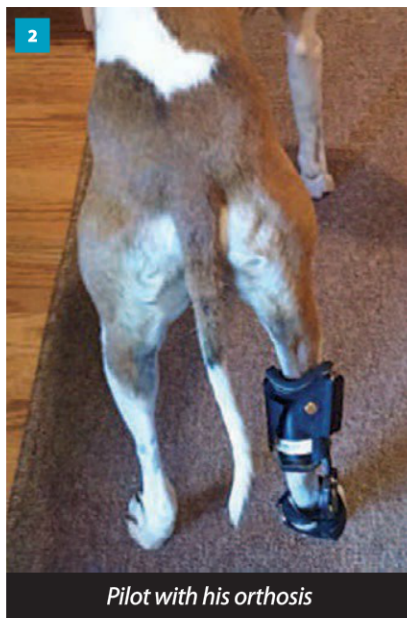
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Treatments

Low-grade strains can be managed conservatively with regenerative medicine, immobilization, and physical rehabilitation. The objective is to protect the tendon by supporting the tarsus joint in extension. However, surgical correction is recommended for all Achilles tendon avulsions or lacerations. Primary repair is accomplished via bone tunnels through the calcaneus and specialized suture patterns with nonabsorbable suture.

Surgical exploration of Pilot's right hock revealed a complete tear of the gastrocnemius tendon proximal to the insertion on the calcaneus. The remaining components of the Achilles tendon appeared to be intact. The fibrotic ends of the gastrocnemius were debrided and a tenorrhaphy (suture of a tendon) was performed using braided composite suture material.

Post-operative immobilization of the hock joint is essential for several weeks to facilitate healing of the Achilles injury. Initially, the hock will be immobilized in extension with a cast, a splint or a custom made hinged tarsal orthosis. Overtime, motion limitations will be eased to allow more flexion and eventually a soft neoprene brace will be used. Controlled, gradual reloading is needed to facilitate tendon fiber alignments and strengthening. Pilot was immobilized in a bandage with a lateral splint while a custom made hinged tarsal brace was being made by a certified orthotist. See **Figure 2**.



Pilot with his orthosis

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Regenerative medicine is part of standard of care at VOSM and has become increasingly popular in veterinary medicine to aid in tissue healing. This treatment is often used in conjunction with surgery and physical rehabilitation program for Achilles tendon injury. Regenerative medicine consists of platelet rich plasma (PRP) and/or stem cell therapy. PRP is an autogenous fluid concentrate (blood) composed primarily of platelets and growth factors. Stem cells are the body's progenitor cells from which all other cells are derived. Stem cells can be obtained from numerous sources from a pet's own body (autologous adult-derived mesenchymal cells). The most common places to harvest adult-derived mesenchymal cells are either from the dog's bone marrow or adipose tissue. PRP therapy and stem cell therapy have a synergistic effect when combined. They can regenerate and heal injured tissue, decrease inflammation, stimulate new blood supply to support healing, activate resident stem cells, create a scaffold for healing tissue, protect cells from death, and break down scar tissue.

Pilot was seen three weeks following his initial surgery for an ultrasound-guided adipose-derived progenitor cell (ADPC) and platelet rich plasma (PRP) injection into his Achilles tendon.

Recheck Diagnostic Ultrasound

Typically, diagnostic ultrasound recheck evaluations are recommended 30, 60, and 90 days post-injections to assess healing of the Achilles tendon. In Pilot's case (at 8 weeks post-operative recheck and 5 weeks post regenerative medicine) less inflammation was noted within the affected site, the braided composite suture material was intact and there was increased normal fiber pattern within the prior surgically corrected and stem cell injected defect in the gastrocnemius tendon. Five weeks later there was significant amount of new normal fiber pattern in the right Achilles tendon in addition to less inflammation in the other tendons.

Physical Rehabilitation and Return to Competitive Sport

Function following surgical repair is generally good to excellent. However, physical rehabilitation is essential to obtain a great outcome. A dedicated rehabilitation therapy program is often recommended for 12-16 weeks following the initial injury. Rehabilitation therapy decreases inflammation and swelling and improves muscle mass, range of motion and overall function of the limb. Modalities such as laser therapy and therapeutic ultrasound may aid tendon healing. Efforts are focused on managing the delicate balance between protecting the tendon and minimizing the damaging effects of immobilization. Formal physical rehabilitation therapy session should be performed weekly in conjunction with daily at-home exercise program. Therapy sessions often include cryotherapy, therapeutic ultrasound, laser therapy (IIIb or IV), manual therapy, massage, progressive tarsal passive range of motion (PROM) and standard isometric exercises. Typically, 12 weeks after surgery the custom-made orthosis is replaced by a neoprene wrap. At the 14-16 week mark, the tarsal support is completely removed and underwater treadmill therapy is started. Based on patient's progression and recheck diagnostic ultrasound, the reconditioning phase can be initiated at the 14-16 week mark.

Follow-up on Pilot's Case

Manual therapy, massage, PROM, stretching, joint mobilization, and class IIIb laser were performed for the first 8 weeks following surgery with Pilot. Therapeutic ultrasound was then added to Pilot's treatment plan. When regenerative medicine has been used, cryotherapy, therapeutic ultrasound and class IV laser should be avoided for the first 8 weeks of the recovery period. This is due to lack of research evidence on the impact of those modalities on stem cells growth. After 8 weeks, these modalities are incorporated into treatment. At 14 weeks after surgery, Pilot was placed in a neoprene tarsal wrap and underwater treadmill therapy began at the 15 week mark. Pilot returned to full function 16 weeks after surgery. There was no evidence of lameness, he had symmetrical hind limb muscle circumference, and he was comfortable on manipulation of his right hock.



COURTESY OF DEBORAH LOZUPONE

Pilot in action

Pilot is now taking weekly novice obedience classes along with weekly agility classes and performs flyball box work a few times a week. Pilot is even working toward his Flyball Master Champion title! 🐕

A special thanks to Deborah Lozupone for allowing VOSM to share Pilot's story.

Resources

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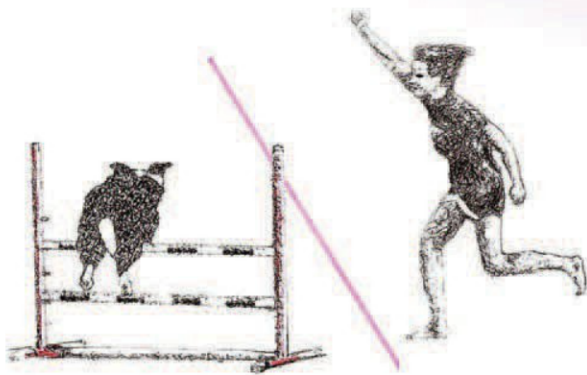
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Lauri-Jo Gamble, DVM grew up in Montreal, Canada, and earned her Doctor of Veterinary Medicine at the University of Montreal. Afterwards, Dr. Gamble completed a small animal rotating internship at Carolina Veterinary Specialists in Charlotte, North Carolina. She is currently completing an internship in sports medicine and rehabilitation at Veterinary Orthopedic & Sports Medicine Group in Annapolis Junction, Maryland, as well as working toward a certificate in Canine Physical Rehabilitation with the University of Tennessee (CCRP). Her professional interests include gait analysis, pain management, regenerative medicine, and physical rehabilitation.

Debra Canapp, DVM, CCRT, CVA, DACVSMR obtained the next level of expertise in her field in 2012 by becoming board certified in the new American College of Veterinary Sports Medicine and Rehabilitation. Her area of interest, clinical work, lecturing and research, has revolved around sports medicine and rehabilitation therapy, specifically canine sports-related injury, sport rehabilitation and performance. She has completed advanced courses in canine rehabilitation, hydrotherapy, acupuncture, sports medicine, orthopedics, and stem cell therapy. Currently she is practicing sports medicine, acupuncture, musculoskeletal ultrasound and rehabilitation at Veterinary Orthopedic & Sports Medicine Group in Annapolis Junction, Maryland, where she is the medical director.

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