



# Superficial Digital Flexor Tendon Contracture in a Dog with Gastrocnemius Tendon Avulsion

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## Abstract

### Keywords

- tenotomy
- Achilles tendon
- superficial digital flexor tendon
- contracture
- arthrodesis
- dog

Avulsion of the gastrocnemius component of the Achilles tendon is a well-documented condition in dogs. The most common treatment is to restore tendon function with surgical reattachment to the tuber calcanei. However, repair can fail. Pantarsal arthrodesis cannot only salvage a failed repair but is also a first-line treatment that may have a more predictable outcome. We describe a case of contracture of the superficial digital flexor tendon (SDFT) in the hindlimb of a dog with avulsion of the gastrocnemius component of the Achilles tendon, treated previously by pantarsal arthrodesis. Digital flexion and lameness persisted despite non-surgical treatment, and tenotomy of the SDFT was performed at the level of distal calcaneus to allow digit extension. The dog was re-examined 2 weeks and more than 2 years after surgery. No complications occurred, and the dog maintained an excellent long-term improvement in limb function.

## Introduction

Spontaneous partial disruption of the Achilles tendon—avulsion of the gastrocnemius tendon from the tuber calcanei—is a recognized condition in dogs.<sup>1</sup> The clinical presentation includes lameness, swelling of the tendon insertion, hyperflexion of the tarsocrural joint and flexion of the digits caused by stretching of the superficial digital flexor tendon (SDFT).<sup>1,2</sup> The most common treatment that aims to restore tendon function is surgical reattachment to the tuber calcanei using locking-loop or modified three-loop pulley suture patterns.<sup>3</sup> These tendon repair techniques are reported to achieve a good or excellent outcome in 70 to 94% of cases.<sup>3</sup> Most complications are associated with the method used to maintain tarsocrural extension, especially with external skeletal fixation.<sup>1</sup> Where repair fails, options are limited. Pantarsal arthrodesis is a salvage procedure that effectively treats the tarsal hyperflexion associated with avulsion of the gastrocnemius tendon. The current authors have experienced subjectively greater rates of repair failure than those

reported and offer pantarsal arthrodesis as a primary treatment for avulsion of the gastrocnemius tendon, where owners wish to avoid the risk of repair failure and the need for a second surgery. We understand others take a similar approach, and in a recent retrospective study of pantarsal arthrodesis, 12 of 30 arthrodeses were performed to treat avulsion of the gastrocnemius tendon.<sup>4</sup> Reported complications following pantarsal arthrodesis are implant loosening or breakage, calcaneal fracture, persistent lameness, deformity of the limb, distal limb swelling, pressure sores, sepsis, wound dehiscence, metatarsal fracture, plantar necrosis and gastrocnemius tendon pain causing ongoing lameness.<sup>4–7</sup>

Musculotendinous contractures in dogs are usually caused by overstretching or overuse of the muscle, or by trauma, and are characterized by a pathological shortening of the musculotendinous unit.<sup>8</sup> Clinical signs include swelling, lameness, weakness, firmness through the muscle, characteristically abnormal gait and pain in the muscle.<sup>8</sup> Contracture has been reported to affect the teres minor, supraspinatus, infraspinatus, brachialis, quadriceps, the

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deep digital flexor tendon (DDFT) and SDFT of the thoracic limb.<sup>8–10</sup>

Superficial digital flexor tendon contracture in the canine hindlimb has not been reported in isolation, in dogs with gastrocnemius tendinopathy, or as a complication of pantarsal arthrodesis. Here we describe a case of contracture of the SDFT in a dog with chronic avulsion of the gastrocnemius tendon from the tuber calcanei (treated by pantarsal arthrodesis) and its successful surgical treatment.

## Case Description

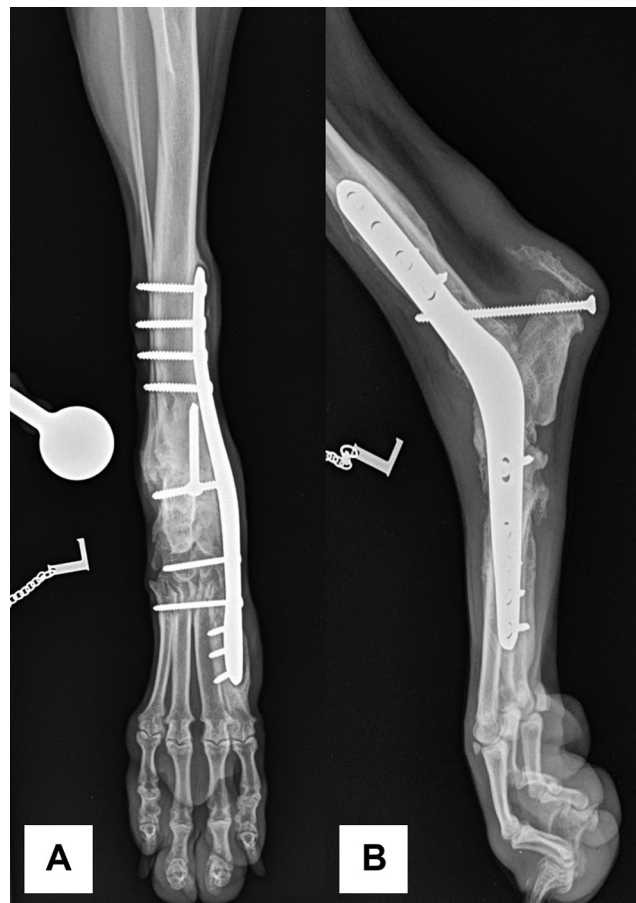
A 7.5-year-old female neutered Weimaraner presented to the University of Glasgow Small Animal Hospital with persistent left hindlimb lameness of 4 months duration. The dog displayed hyperflexion of the tarsus and flexion of the digits, characteristic of avulsion of the gastrocnemius tendon from the tuber calcanei (►Fig. 1). The gastrocnemius was severely mineralized radiographically and pantarsal arthrodesis was performed as the risk of failure of a sutured repair was considered high. Pantarsal arthrodesis was performed through a standard medial approach<sup>11</sup> and stabilized using a 3.5/2.7 mm medial plate and 3.5 mm calcaneotibial screw. The calcaneotibial screw was placed through the tuber calcanei after reflection of the SDFT laterally. There were no intraoperative or immediately postoperative complications; however, moderate left hind lameness caused by hyperflexion of the digits persisted, despite consistent weight-bearing on the affected limb, progressively increasing controlled exercise, non-steroidal anti-inflammatory medications and physiotherapy. By 7 months postoperative-

ly, the foot posture was unchanged, despite a stable pantarsal arthrodesis. Radiographically the tarsus showed replacement of all joint spaces with bone, consistent with complete fusion, there was new bone surrounding the plate proximally and distally, and lucency surrounding the calcaneotibial screw within the tuber calcanei. The calcaneotibial screw protruded caudally a few millimetres from the tuber calcanei due to the density of soft tissue overlying it. We believe this tissue prevented the screw head from seating on the bone (►Fig. 2).

Because digital flexion and lameness persisted despite non-surgical treatment, contracture of the SDFT was diagnosed. Tenotomy of the SDFT to allow digit extension and removal of the calcaneotibial screw (which appeared loose radiographically) were recommended. The dog was pre-medicated with medetomidine (5 µg/kg) and methadone (0.3 mg/kg), induced with propofol to effect and maintained under general anaesthesia using isoflurane in oxygen. The degree of metatarsophalangeal extension (extending all digits as a unit) was reassessed under anaesthesia and measured around 15 degrees goniometrically (►Fig. 3 and ►Video 1). The dog was positioned in sternal recumbency and the left hindlimb extended caudally. The tarsus was prepared aseptically. A vertical incision was made over the SDFT, on the plantar aspect of the distal portion of the calcaneus and proximal portion of the metatarsal bones.

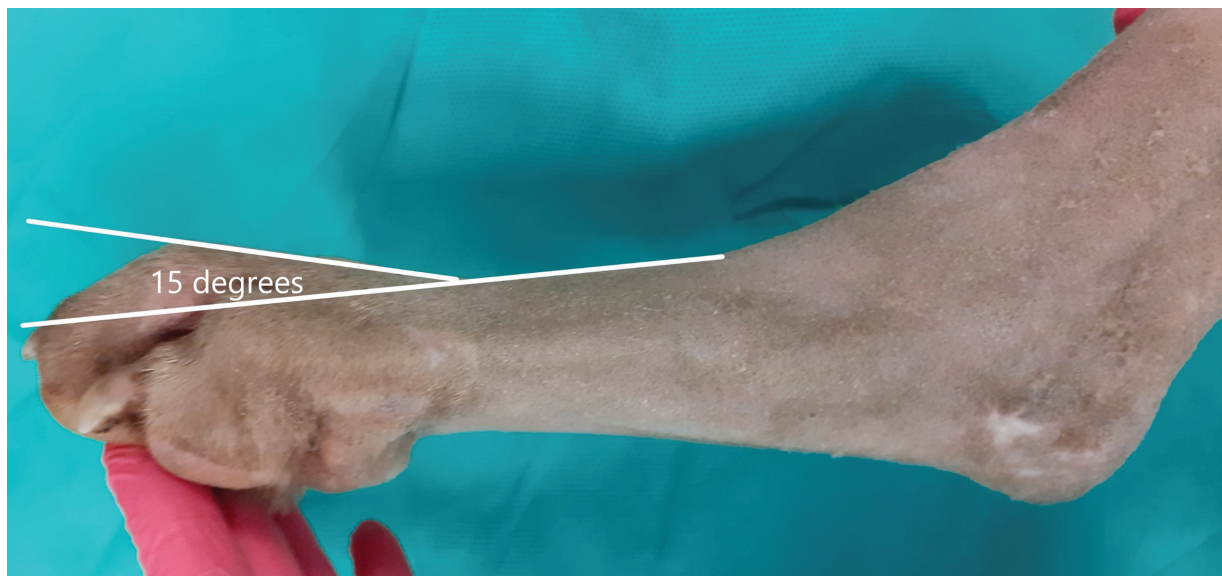


**Fig. 1** Hyperflexion of the tarsus and flexion of the digits consistent with superficial digital flexor tendon contracture.

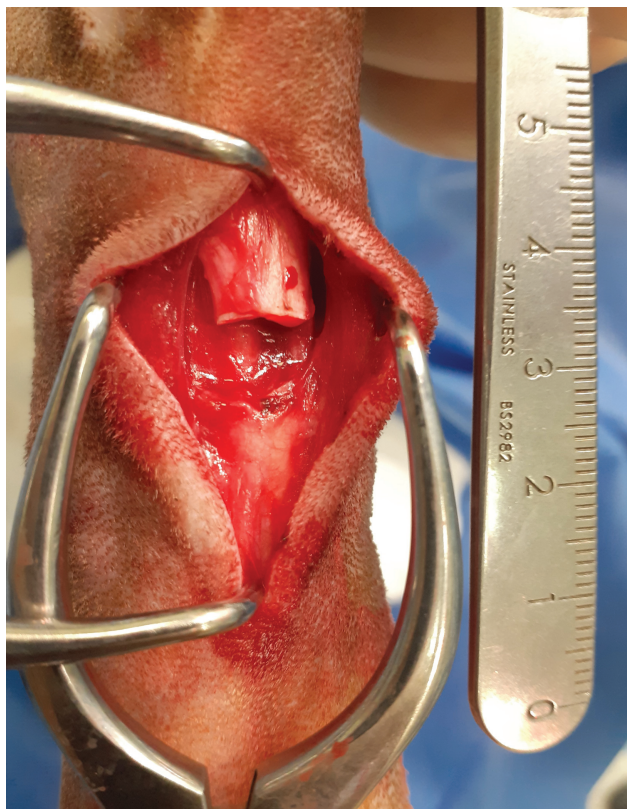


**Fig. 2** Plantarodorsal (A) and mediolateral (B) radiographs 7 months following pantarsal arthrodesis.





**Fig. 3** Extension of the digits measured around 15 degrees goniometrically, before tenotomy surgery.



**Fig. 4** Transected superficial digital flexor tendon at the level of the distal calcaneus.

The SDFT was isolated and transected at the level of distal calcaneus (►**Fig. 4**). Extension of the digits was notably improved immediately and measured around 40 degrees goniometrically (►**Fig. 5** and ►**Video 2**). A separate small incision was made directly over the head of the calcaneotibial screw and it was removed. The incisions were closed routinely and the dog made a good recovery

from anaesthesia. Postoperative analgesia was provided using buprenorphine (0.02 mg/kg) and meloxicam (0.1 mg/kg).

#### Video 1

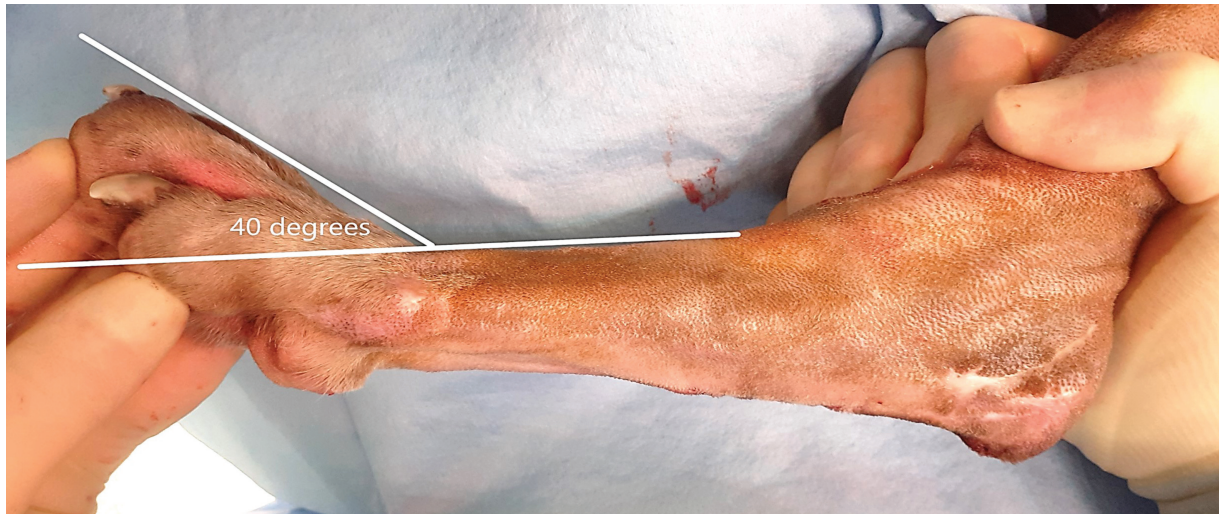
Poor range of digital extension before superficial digital flexor tendon tenotomy. Online content including video sequences viewable at: <https://www.thieme-connect.com/products/ejournals/html/10.1055/s-0043-1778094>.

#### Video 2

Improved range of digital extension intraoperatively after tenotomy. Online content including video sequences viewable at: <https://www.thieme-connect.com/products/ejournals/html/10.1055/s-0043-1778094>.

The dog was discharged with meloxicam daily for 1 week (to be extended if necessary). The owner was advised to restrict exercise to 10 minutes on a short lead, two to three times daily for 2 weeks. It was advised that once the skin incision had healed, exercise could be slowly increased over 2 more weeks.

A follow-up video was sent by the owners 2 weeks after surgery (►**Video 3**). The dog's owner reported a significant improvement in foot posture, lameness and ability to exercise. We re-examined the dog 2 years postoperatively and found a good long-term functional outcome (►**Video 4**). The owner reported minimal lameness, though the nails of the affected digits would drag on the floor at



**Fig. 5** Extension of the digits measured around 40 degrees goniometrically, after tenotomy.



**Fig. 6** Flat left hind foot, 2 years after tenotomy surgery.

times. The dog was able to exercise normally. On examination there was a mild mechanical lameness, the left hind foot was flat (► **Fig. 6**) and the nails of digits 3 and 4 were shorter than those of 2 and 5. There were no abnormalities of the pads or interdigital skin and manipulation was well tolerated.

#### Video 3

Follow-up video 2 weeks after tenotomy surgery. Online content including video sequences viewable at: <https://www.thieme-connect.com/products/ejournals/html/10.1055/s-0043-1778094>.

#### Video 4

Follow-up video 2 years after tenotomy surgery. Good functional outcome. Online content including video sequences viewable at: <https://www.thieme-connect.com/products/ejournals/html/10.1055/s-0043-1778094>.

### Discussion

This is the first case report describing SDFT contracture alone in the hindlimb, and a successful surgical treatment. We have re-examined the dog more than 2 years after the surgery, and she has maintained an excellent improvement in her gait. No minor or major complications occurred with this procedure.

The action of the SDFT is to flex the digits, extend and fix the tarsus and flex the stifle joint.<sup>12</sup> It is, therefore, logical that contracture of the SDFT could cause flexion of one or more digits, as in the case described. It was expected that after restoration of a more normal tarsal flexion angle through pantarsal arthrodesis, and with use of the limb after surgery, the foot posture would return to normal. The aetiology of the SDFT contracture in this case is uncertain, but we speculate that the chronicity of the gastrocnemius avulsion and resulting prolonged repetitive strain injury to the SDFT may be significant. Also, the pantarsal arthrodesis surgery may have caused the significant injury to the SDFT. If there is damage to a muscle and/or associated tendon, with replacement of normal tissue by fibrous connective tissue, the fibrosis causes permanent shortening of the musculo-tendinous unit. This will limit the range of movement in any joints that the unit crosses.<sup>8</sup> Other differentials for the presenting signs must also be considered. Contracture of the DDFT or both SDFT and DDFT could have caused the persistent flexion of the digits.<sup>9</sup> Ankylosis of the metatarso-phalangeal joints was also a differential, but there was no radiographic evidence of this. Finally, the suboptimal



positioning of the calcaneotibial screw, with the screw head elevated from the bone surface, may have interfered with the function of the SDFT, though we think this unlikely because the SDFT was reflected, and the screw placed deep to it. It is true that our presumed diagnosis was only confirmed when tenotomy of the SDFT permitted extension of the digits.

Musculotendinous contractures may be treated non-surgically with non-steroidal anti-inflammatories, or steroids, and rest.<sup>8</sup> Surgical treatment is recommended for the treatment of specific muscle tendinopathies, such as teres minor myopathy, supraspinatus, infraspinatus, brachialis, and quadriceps contracture.<sup>8</sup> Deep digital flexor tendon contracture has been diagnosed in one dog after combined tibial plateau levelling osteotomy and cranial closing wedge osteotomy for the treatment of cranial cruciate ligament disease. This case was treated with a z-plasty procedure which resolved the flexion of the digits. This case did have a similar clinical presentation to ours, and at surgery the SDFT was described as 'mildly taut', but the pathology primarily affected the DDFT and no surgery of the SDFT was performed.<sup>9</sup> Superficial flexor tendinopathy was reported to affect the forelimb of a dog and an idiopathic aetiology was suspected. The surgery performed was lengthening of the tendon using a modified z-tenotomy technique.<sup>10</sup> In a case series and recent case report of cats with digital flexor muscle contracture in the forepaws, tenectomy surgery was successful.<sup>13,14</sup> Tenotomy of the SDFT is also reported for the treatment of chronic corns in sighthounds, unloading the pad and reducing pain when weightbearing, and in many cases causing the corn to exfoliate.<sup>15</sup> Tenotomy of the SDFT tendon for the treatment of corns is typically performed on individual digits. In our case, all four digits were abnormally flexed. The tenotomy was performed at the level of the proximal metatarsus, before the SDFT divides into four branches, releasing the contraction of digits II, III, IV, and V. Tenotomy was not expected to adversely affect the other function of the SDFT (extension of the tarsus) since an arthrodesis had been performed.

In conclusion, we have described for the first-time contracture of the SDFT tendon in a dog with avulsion of the gastrocnemius tendon, and a simple surgical technique that managed it successfully.

#### Authors' Contributions

Laura Marques da Costa created the figures and edited the videos, obtained long-term follow-up, and wrote the manuscript. William Marshall performed the surgery, obtained short-term follow-up, and edited the manuscript.

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#### Conflict of Interest

None declared.

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