

# Field bilateral standing forelimb deep digital flexor tendon tenotomy for management of a case of chronic laminitis of two years duration



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## SUMMARY

Laminitis is a common cause of lameness in horses, often debilitating, which consists of disruption of the lamellar tissue that suspends the distal phalanx (P3) within the hoof capsule. The goals of treatment of laminitis are to alleviate the intense pain in both refractory acute and chronic conditions, and also to prevent displacement of P3, and to reestablish the functional relationship between the P3 and the hoof wall. Deep digital flexor tendon (DDFT) tenotomy is considered a salvage procedure when all routine treatments fail. This report describes a case of a 13-year-old Lipizzan mare presenting with chronic laminitis of two years duration, managed with continuous administration of NSAIDs, that consequently developed also enteropathy and nephropathy.

The mare underwent bilateral standing DDFT tenotomy in the field, with a mid-metacarpal approach, which improved movement and allowed suspension of NSAIDs administration and farriery interventions, which were impossible to execute before. At 18 months follow-up the horse is still alive and freely moving at all gates, and is capable of laying down and standing easily. This case report supports the previously introduced concepts that DDFT tenotomy can improve the quality of life in chronic laminitic horses, and also that the procedure is safely applicable in field conditions.

## KEY WORDS

Tenotomy, field surgery, laminitis, equine.

## INTRODUCTION

Laminitis is a common condition in horses, often debilitating, that causes lameness. It is characterized by disruption of the lamellar tissue that suspends the distal phalanx (P3) within the hoof capsule (1). Treatment of laminitis consists, not only in alleviating the intense pain in refractory acute and chronic conditions, but it is also based on preventing irreversible alterations with rotation or distal displacement of P3, and to reestablish a functional relationship between P3 and the hoof wall, when laminar destruction has already occurred (2). Several therapeutic modalities are described, including drug therapies, hoof support and surgical therapies.

In advanced cases, when pain is not adequately controlled and horses become depressed, anorectic, reluctant to stand, and resistant to exercise, euthanasia has to be considered (3). In fact, frequently it

is not possible to achieve proper analgesia and adverse effects with long-term anti-inflammatory drugs administration must be taken into account (4).

When therapeutic shoeing and supportive medical management fail, a decision must be made whether to discontinue treatment or to perform a deep digital flexor tendon (DDFT) tenotomy, which is considered a salvage procedure (5). This treatment is indicated when: a horse is severely painful and showing radiographic indication of progressive rotation in a short period of time (days); the patient has chronic laminitis that is refractory to other treatment options and is also showing radiographic signs of further rotation (6).

In this case report, a standing deep digital flexor tendon (DDFT) tenotomy at the level of the mid-metacarpal region was performed to treat debilitating chronic laminitis that was partially responsive to analgesic therapy, which had been administered for two years.

## CASE PRESENTATION

A 13-year-old Lipizzan mare was referred for chronic laminitis associated with severe pain, inability to move and partial-

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ly responsive to NSAIDs, which had been administered daily for two years. Acute onset of laminitis had been managed on the field with corrective shoeing, NSAIDs drugs (phenylbutazone 1.1mg/kg SID PO) and cryotherapy. After initiation of therapy, when NSAIDs were interrupted the horse experienced severe pain and inability to stand, therefore the owner continued the administration daily for two years. Subsequently, the mare developed NSAID-induced enteropathy and nephropathy. These complication manifested as diarrhea with multiple rectal prolapses and haematuria. This conditions were managed with specific supplements and suspension of NSAIDs, which resulted in multiple days of inability to stand, therefore administration was resumed. In order to manage the pain and discontinue NSAIDs administration, the horse was also treated with gabapentin (2mg/kg BID PO) but no improvement was observed. The horse also developed an hoof abscess in the right front foot which was treated with antibiotic for ten days (sulfamethoxazole trimethoprim 20mg/kg BID PO).

On presentation the horse was alert and standing, resting on its hindquarters against the wall. The animal showed marked reluctance to move and impaired ambulation. Facial expressions (ear position, scleral exposure, corners of the mouth, nostril tension) and posture (limb alignment, weight distribution) were consistent with signs of pain. The horse was tachycardic (80-60 bpm) and polypnoic (40 arm). The temperature was within the normal range (38,2°C). She had decubitus ulcers over the bony prominences. The nutritional status was poor and body condition score (BCS) was (3/9). The major organic functions were maintained.

The horse presented a clubfoot-like posture, characterised by dorso-flexion of the fetlocks in all four limbs, more severe in the forelimbs. However, due to the severity of the pain the farrier was unable to lift the limbs for shoeing and farriery was discontinued one year before presentation. The horse was still receiving NSAIDs. Radiographs of the right and left foot were obtained. Major findings were rotation of P3 in both feet. Sinking was not observed and the sole thickness was 20 mm.

Because of the worsening of the clinical condition and the impossibility of moving the horse to a clinic, it was decided to perform a DDFT tenotomy on the field.

Before surgery, an abaxial sesamoid nerve block was performed to relieve pain and let the farrier apply tenotomy shoes on both forelimbs (Fig. 1).

The procedure was performed standing at the level of mid-metacarpal region as described by Burba and colleagues (6). The patient was sedated with detomidine (0.01mg/kg, IV) and butorphanol tartrate (0.01 mg/kg, IV). The hair on the metacarpal region was clipped, the skin was surgically prepped and the foot was aseptically draped. After a high 4-point nerve block was performed, a 3-cm skin incision was made over the lateral aspect of the DDFT. In this procedure klemmer forceps were used to dissect the soft tissues over the tendons. It was decided to do the tenotomy distally to the union between the distal accessory ligament and the DDFT. The skin was kept distant from the site of the cut with the use of manual retractors. In this case a Debaquey Derra clamp was used to isolate the DDFT from the superficial digital flexor tendon (SDFT) and neurovascular bundle and suspensory ligament (Fig. 2a). The more the fetlock dorso-flexed the easier it was to enter between tendons with the Debaquey Derra clamp. The clamp was inserted in a horizontal fashion to protect the surrounding soft tissues during the cut. A number 10 scalpel blade was used to tran-



**Figure 1** - Tenotomy shoes applied before surgery. Note the marked dorsoflexion of the fetlocks.

sect the tendon transversely. As soon as the cut was completed the two tendon segments moved obviously away from each other (Fig. 2b). A subcutaneous simple continuous suture with a 2-0 absorbable monofilament was performed, whereas the skin was closed with simple interrupted stitches with an absorbable 0 monofilament. The procedure was then repeated on the contralateral limb. A wound dressing was placed on the sutures and support light cast bandages were made and maintained for four weeks. The bandages were renewed every four weeks for three times.

Penicillin (22.000 UI/kg IM) and flunixin meglumine (1.1 mg/Kg IV) were administered for three days after surgery. Thio-colchicoside (20 mg/Kg IM) was administered twice a week for two weeks to improve general myorelaxation and hindlimbs condition.

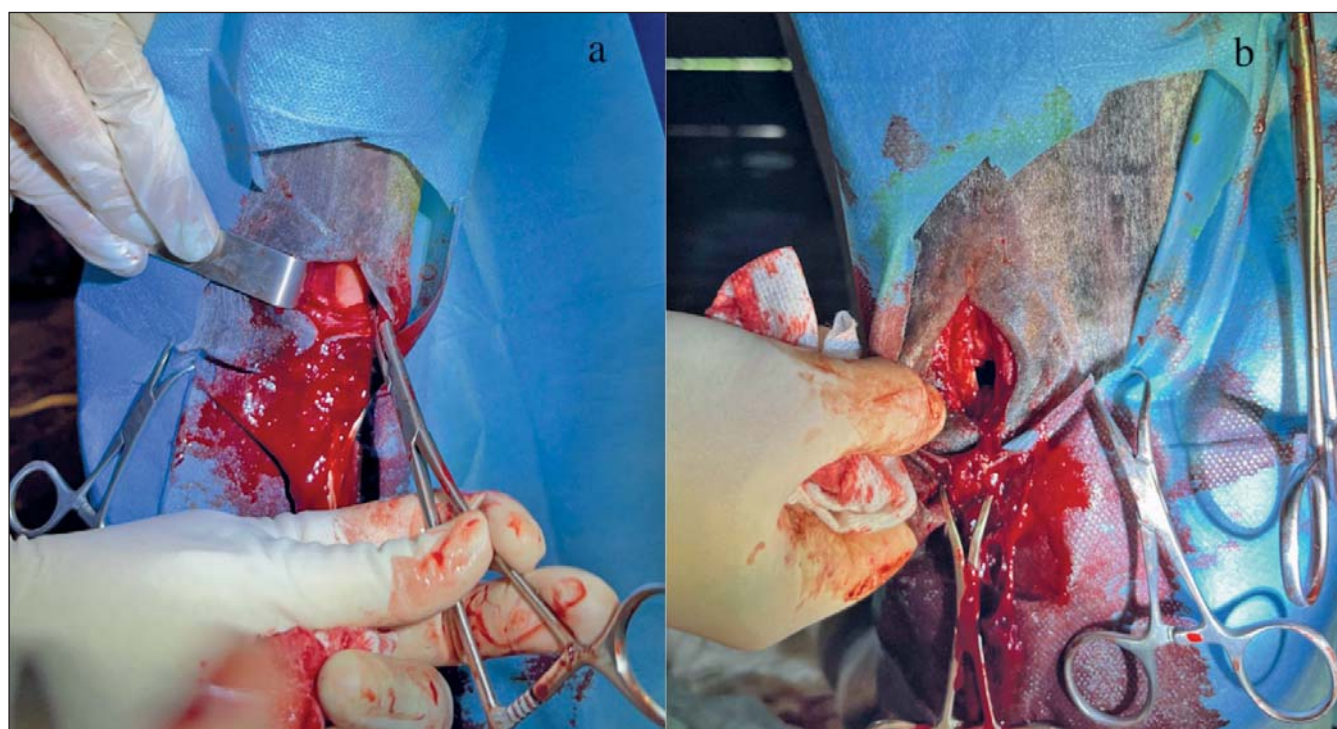
Since the day following the tenotomy, the horse demonstrated a marked improvement in deambulation, with progressively reduced signs of discomfort. NSAIDs therapy was discontinued after three days, as the horse no longer exhibited pain, and additional analgesic management was deemed unnecessary. Control radiographs were taken after 28 days and showed an improved palmar angle.

Regular shoeing could be continued after the surgery. At 18 months follow-up the horse is still off any medication and is able to move at any gait and to lay down and stand. Return to soundness, however, was not accomplished and a mild degree of fetlocks dorso-flexion was maintained (Fig. 3).

## DISCUSSION

NSAIDs are frequently used in equine medicine, despite the narrow margin of safety and potentially adverse and fatal side effects. Several toxicities have been associated in both humans and animals and it is described individual sensitivity to NSAIDs toxicity, even when recommended dose ranges are followed (7). In acute laminitis conditions, protocols for multimodal analgesia are well described in hospital settings, typically based on continuous rate IV infusions. However, treatment of chronic laminitis in an outpatient setting is often limited to oral formulations, particularly anti-inflammatory



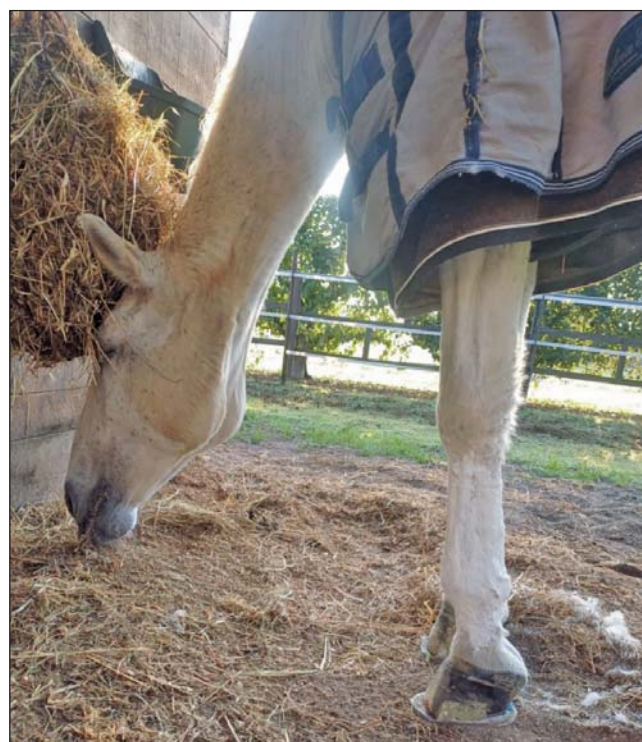


**Figure 2** - Pictures taken during surgery. a) showing how the DDFT was isolated with the Debaquey Derra clamp. b) the aspect after the tendon was completely transected.

drugs (4). In this patient, prolonged therapy with these agents was associated with clinical manifestations consistent with drug-induced enteropathy and nephropathy, which however were reversible after discontinuation of the drug administration. To the authors' knowledge, there are no published records of patients receiving NSAIDs that are not COX-2 selective for such a long period of time. DDFT tenotomy combined with realignment of P3 through farriery is a procedure described for the treatment of chronic laminitis and has been reported with variable success rates in previously published papers (8). The aim of DDFT tenotomy is to reduce the tension exerted by the DDFT, whereas the realignment of P3 is achieved through trimming and shoeing (9). Furthermore, the purpose of the tenotomy procedure is to remove pain associated with the laminar separation (10).

DDFT tenotomy may be performed either at the level of the mid-metacarpus or at the level of the proximal interphalangeal (PIP) joint, in the mid pastern. The first described DDFT tenotomy, was performed at the level of PIP joint, on the palmar aspect of the flexor tendon and the surgery was executed with the horse under general anesthesia. Subsequently, a DDFT tenotomy procedure was developed in which the surgery is performed at the level of the mid-metacarpus with the horse standing (3)(2). The mid-metacarpal tenotomy has been widely used as the preferred technique: it can be easily performed, it is associated with fewer complications than the PIP joint approach (instability or subluxation of DIP joint) and does not require general anesthesia. The increased degree of tension release after the mid-pastern procedure (6-10 cm of release) compared with the mid-metacarpal technique (2 cm of release) is likely to play a major role in the increased subluxation (1). In addition, the mid-metacarpal region is devoid of synovial structures unlike the pastern region where a tendon sheath must be entered to transect the DDFT (11). We performed the cut distal to the union of the accessory ligament to the DDFT. The teno-

tomy in the mid-metacarpal region can be performed proximally or distally to this site, and in the first case the degree of release of P3 is less compared to the second option. Besides, PIPJ approach can be performed in standing as described by Waguespack and colleagues (12) but due to the severity of the pain it was not possible to lift the limbs in our case.



**Figure 3** - The mare at 18 months follow-up showing mild degree of dorso-flexion of the fetlocks, nevertheless she was moving comfortably.

Cestari and colleagues (9) described an improvement in clinical and radiographic parameters after DDFT tenotomy in the metacarpal region with the animal in a quadrupedal position as treatment of chronic laminitis not responsive to drug and hoof support therapies.

In a paper of Eastman and colleagues, in horses treated for laminitis with DDFT tenotomy, 77% of them survived  $\geq 6$  months, and 59% survived  $> 2$  years. Degree of P3 rotation had no effect on 2-year survival or the ability of horses to be used for light riding and this technique can be considered a viable alternative for horses with laminitis refractory to conventional medical treatment (11). Other studies showed that horses subjected to the tenotomy procedure couldn't return to athletic activity but they may have a good quality of life when loose on pasture without the use of orthopedic horseshoes (9)(2). In the previously described procedure (6), Metzebaum scissors were used to create the tunnels between the DDFT and the SDFT, and between the DDFT and neurovascular bundle/suspensory ligament. Furthermore, it is reported that two sterile broad-blade butter knives with curved tips can be placed to isolate the structures. In this case we used a Debaquey Derra clamp to protect the surrounding tissue during the cut, and the procedure was carried out successfully without complications. Limitations to this paper include relatively short follow-up compared to other studies.

## CONCLUSION

This case report demonstrates that standing tenotomy at mid-metacarpal region in patients with laminitis refractory to analgesic treatments is a valid technique to manage the pain and P3 rotation. The patient had no longer need of analgesic treatment and with hoof support deambulation improved. This technique has been proven to be feasible in field conditions and is a viable alternative for horses with laminitis refractory to conventional medical treatment (13).

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