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TENOSCOPY OF THE DIGITAL FLEXOR TENDON SHEATH

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Non-infected tenosynovitis of the digital flexor tendon sheath (DFTS) is a common finding in warmblood horses used as a dressage horse or as a show jumper. Chronic inflammation of the DFTS can lead to constriction of the annular ligament. The underlying cause, in many of these horses suffering from chronic distension of the DFTS, is a longitudinal tear or marginal cleft in the border of the deep digital flexor tendon.

The superficial digital flexor tendon (SDFT) and suspensory ligament are a more commonly injured in performance horses in comparison to the deep digital flexor tendon (DDFT). Lesions in one of the lobes of the DDFT are a common diagnosis following MRI examination of the front foot.

DDFT lesions within the digital flexor tendon sheath (DFTS) are almost always associated with chronic (non-infected) tenosynovitis. The most common presentation of DDFT lesions within the DFTS, are longitudinal tears in the lateral border of the DDFT (Wright and McMahon 1999, Wilderjans et al. 2003, Smith and Wright 2006). Central core lesions, dorsal or palmar/plantar lesion in the DDFT are seen but are less common. Manica flexoria (MF) tears, longitudinal and branch tears of the SDFT, desmitis of the palmar annular ligament (PAL) and tears in the DFTS itself can also result in a chronic tenosynovitis of the DFTS.

Anatomy of the digital flexor tendon sheath and its content:

The DFTS surrounds the SDFT and DDFT palmar or plantar to the fetlock joint. The DFTS begins 4 to 7 cm proximal to the proximal sesamoid bones and extends distally to the middle third of the middle phalanx. At this level a thin wall separates the DFTS from the proximal recess of the podotrochlear bursa and the proximopalmar recess of the distal interphalangeal joint (Denoix JM 1994). The DFTS is surrounded by the PAL, the proximal and the distal digital annular ligament. The PAL attaches on the palmar/plantar aspect of the sesamoid bones and creates an inelastic canal between the sesamoid bones, intersesamoidean ligament and the PAL. The proximal digital annular ligament is a thinner quadrilateral sheet located over the palmar/plantar aspect of the proximal phalanx. This ligament is mostly adherent to, and very difficult to differentiate from, the DFTS in normal limbs. The distal digital annular ligament is located distally in the pastern and is adherent to the palmar/plantar surface of the distal part of the DFTS (Denoix JM 1994). Just proximal to the proximal sesamoid bones the SDFT encircles the DDFT forming a ring called the MF. The distal aspect of the MF is located underneath the PAL (personal observation). Proximal to the MF the DDFT is attached to the DFTS by a medial and lateral band. This band is called the mesotendon. It can easily be recognised on a transverse ultrasound image especially if the tendon sheath is distended (Dik et al, 1995). On the palmar aspect of the fetlock, the SDFT is also attached sagitally (palmar/plantar midline of SDFT) with a mesotendon to the DFTS (Dik et al, 1995; Nixon 1990). This band can clearly be visualised on an ultrasound image of a distended DFTS when there is no important constriction of the PAL (personal observation). The mesotendon of the SDFT, both medial and lateral mesotendon of the DDFT and the MF can also clearly be visualised by tenoscopy of the DFTS (Wright and McMahon 1999, Wilderjans et al. 2003).

Surgery - Tenoscopy of the digital flexor tendon sheath + tenoscopic desmotomy of the annular ligament:

We perform all tenoscopies under general anaesthesia with the horse placed in lateral recumbency and the affected site of the limb placed uppermost. An Esmarch bandage and tourniquet at the proximal metacarpus/metatarsus is used in all cases.
Tenoscopy is performed with a 4 mm 30° forward oblique arthroscope with the limb in extension. The technique for tenoscopy of the digital flexor tendon sheath and desmotomy of the PAL has been described by Nixon (1990 and 1993). We modified this approach slightly for the treatment of longitudinal tears and tenoscopic desmotomy of the palmar annular ligament.

The tendon sheath is distended in the pastern, between the proximal and distal digital annular ligament, to facilitate entrance of the arthroscopic sleeve using a blunt trocar. The arthroscope is inserted just distal to the PAL almost halfway between the digital neurovascular bundle and the ergot. The lateral or medial entrance portal is positioned lateral or medial to the respective edge of the SDFT. The position is checked with a needle before making the stab incision. Correct positioning allows both easy passage between the SDFT and the PAL, between SDFT and DDFT and dorsal to the DDFT. A complete inspection of the tendon sheath and its contents is then performed. The instrument portal is made 5 to 10 mm proximal to the PAL almost lateral to the SDFT. A hook probe or curette is introduced through the instrument portal to palpate the flexor tendons. The LT’s themselves are not always easy to be recognised by only viewing the tendons. The edge of the SDFT is covering the DDFT. Palpation of the edge of the flexor tendons is absolutely necessary to view and to appreciate the full depth and extend of the LT’s. In all cases torn tendon fibrils protruding from the edge of the DDFT or SDFT indicated the presence of a LT. Palpating the edge of the DDFT within the MF, using the above described instrument portal just proximal to the PAL, is only possible if a small stab incision is made through the MF. At this level the MF still surrounds the DDFT. This precludes visualisation and free passage of instruments to the lateral edge of the DDFT. To gain access to the most proximal part of the LT, a third instrument portal is made as proximal as possible in the tendon sheath between the deep and superficial flexor tendon. This portal allows full access to the LT, not only within but also distal to the MF. For long tears extending further distal to the “fetlock” canal, arthroscope and instrument portals are switched to gain better access to the most distal part of the LT. The MF was never cut to gain access to the most proximal part of the tear.

Desmotomy of the PAL can be performed tenoscopically and the easiest way to do this is by using a hook meniscectomy knife. PAL desmotomies should be performed if there is an obvious thickening of the PAL or constriction of the PAL. The PAL can easily be transected in a distoproximal direction using a hook knife. A slotted canula as described by Nixon (1993) is not needed. Complete division of the PAL often resulted in an important separation of both edges of the cut ligament. Because the most distal part of the PAL is located close to the arthroscope portal, switching portals is recommended to check for complete division of the most distal aspect of the PAL.

General comments on distended digital flexor tendon sheaths in warmblood horses.

Non-infected tenosynovitis caused by LTs are common in the warmblood show jumper. Longitudinal tears affect the forelimb more frequently than the hind limb and the right forelimb is more affected than the other limbs. The reason for this is unclear. Smith and Wright 2006 also identified more marginal tears of the DDFT in the forelimb. The precise aetiology of those LTs is unknown but stress or trauma is very likely to be the cause. Longitudinal tears will mainly affect the lateral border of the DDFT. Distension of the DFTS is almost always present but can disappear temporarily in acute cases with some rest. Lameness and a positive flexion of the Mc/Mt phalangeal joint are often present. Ultrasound examination is the best non-invasive diagnostic tool to identify longitudinal tears in the border of the DDFT. Ultrasonography can predict the lesions identified at tenoscopy in ± 54% of the cases.

With growing experience and based on case history, clinical and ultrasound examination, an experienced examiner is able to suspect LT’s as the underlying cause of tenosynovitis in ± 70% of the cases. Smith and Wright (2006) predicted marginal tears of the DDFT with a sensitivity of 71%, specificity of 71%, a positive predictive value of 71% and a negative predictive value of 55%.

Typical but non specific changes on ultrasonographic examination of distended DFTS’s are thickening of the tendon sheath wall, increased synovial fluid, thickening of the PAL, thickening of
the mesotendons of the DDFT and thickening the soft tissue palmar/plantar to the SDFT (synovium, PAL, subcutaneous tissue).

Irregular outlining, hypoechoic lesions and echogenic masses at the margin of the DDFT are strongly indicative for longitudinal marginal tears (P < 0.001)

These changes are often best visible just proximal to the proximal border of the PAL. At this level the DDFT is still surrounded by the MF. Slightly oblique views can help identifying the LT’s.

Constriction of the PAL can be present and it is mainly a problem in chronic long-standing tenosynovitis of the DFTS. Constriction of the PAL is, in most cases of tenosynovitis of the DFTS, a secondary problem with LT’s in the DDFT being the primary problem. If synovial fluid is present between the SDFT and the PAL we consider the PAL not to cause constriction of the sesamoidean canal. Only low pressure should be applied on the ultrasound probe to allow visualisation of this fluid and to avoid pushing the PAL against the SDFT.

Torn tendon fibrils protruding from the edge of the flexor tendons, as seen during tenoscopic inspection of a DFTS, always indicates the presence of a LT. However the tenoscopic appearance can vary from subtle fraying of the margin of the tendon to large pieces of torn tendon bundles floating in the irrigation fluid. In some cases a large mass of tissue is sitting in the distal or proximal end of the tear representing retracted and curled up tendon bundles often adhered to the surrounding synovial membrane. Palpation of the tendon border and placing the arthroscope in the tear is necessary to appreciate the depth of the tear.

Disrupted collagen fibrils protruding from the tendon are the most likely cause of chronic irritation of the DFTS, creating distension of the sheath, thickening of the sheath wall, synovial hypertrophy and annular ligament constriction syndrome (ALCS) in chronic cases. Within a tendon sheath there are no mechanisms available that can remove disrupted collagen fibres (Wright and McMahon 1999). The results after suturing the tear with an open approach were inferior to tenoscopic debridement and second intention healing (Wright and McMahon 1999).

PAL desmotomy can be performed when there is indication of constriction. PAL desmotomy is not free of complication and should be restricted to those cases showing clear signs of annular ligament constriction syndrome (ALCS).

We noted extensive adhesions between the sectioned PAL edge and the SDFT during tenoscopy of 2 cases that had PAL desmotomy before referral.

We introduced coblation in combination with resection of the torn tendon fibres to further minimise the exposure of torn collagen tissue. Motorised synovial resectors are not capable to create a smooth surface and careful use of radiofrequency energy in saline is capable of gently dissolving the remaining fibres. Coblation wands were used in “no contact mode” after first debriding the bulk of fibres with a motorised synovial resector.

Tenoscopy of the DFTS is the only way to confirm and accurately describe the morphology of the longitudinal tears. The length of the LT and the reduction of distension of the DFTS after the tenoscopic surgery will affect the outcome. Horses suffering from long tears have less chance to return to previous level of work (± 40% chance to return to previous level of work). This is in agreement with the findings of Smith and Wright 2006.

The long-term prognosis for horses following tenoscopic treatment of longitudinal tears is guarded.

We found the following outcome in 96 cases suffering from longitudinal tears in the DFTS:
- 38% return to an equal or higher level of work
- 38% return to a lower level of work
- 24% remains lame.
Our results are in accordance with the findings of Smith and Wright (2006) who reported 14 of 33 horses (42%) with marginal tears of the DDFT returning to previous level of work. Longer tears and horses operated after 15 weeks seemed to carry a worse prognosis. Early diagnosis and treatment seems to improve the final outcome.

Persistence of post-operative distension of the DFTS is normal but marked distension after surgery indicates incomplete healing and increased chance of permanent lameness.

A long and controlled postoperative program is considered to be important in the final outcome of the cases. Controlled exercise is started 10 days after the surgery but return to normal work is postponed until 8 months after surgery. In most cases clinical symptoms improved quickly after surgery but a final evaluation is only possible after resuming the intended work level.

It is important to note that even after a successful surgery the cosmetic result is seldom completely perfect. In most cases a firm non-painful distension will remain visible and palpable. The typical non-specific ultrasonographic changes will improve but never disappear completely.

Chronic tenosynovitis of both digital flexor tendon sheaths left and right front.

Ultrasound image of the deep digital flexor tendon (DDFT) within the digital flexor tendon sheath. Note the irregular lateral border of the DDFT (left side DDFT). This is a typical ultrasound image caused by a longitudinal tear in the lateral border of the DDFT.
Tenoscopic view of the lateral border of the deep digital flexor tendon. Note the very deep marginal cleft or longitudinal tear. The tip of the instrument disappears in the tear.

Tenoscopic view of the lateral border of the deep digital flexor tendon. Synovial resector is used to “clean up” the loose tendon fibres protruding from the longitudinal tear.
References


