Tenoscopic Debridement or Surgical Repair for Longitudinal Tears of the Equine Deep Digital Flexor Tendon Within the Digital Flexor Tendon Sheath?

A Knowledge Summary by

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KNOWLEDGE SUMMARY

PICO question

In horses with longitudinal tears of the deep digital flexor tendon within the digital flexor tendon sheath, is surgical repair as effective as tenoscopic debridement alone for returning to previous level of performance?

Clinical bottom line

Current literature on the efficacy of surgical repair or tenoscopic debridement is limited. Criteria to define and evaluate performance outcomes is not uniform and confounded with multiple variables, merely representing low quality evidence that is difficult to draw meaningful conclusions from. However, the literature suggests tenoscopic debridement alone has been associated with improved outcomes. A more definitive conclusion cannot be made until higher quality evidence is made available on this topic.

The Evidence

The quality of the evidence comparing both treatment modalities is low and insufficient. Primarily, two authors provided data on performance outcomes for both treatment modalities, highlighting surgical repair as an inferior technique associated with reduced performance. Other authors solely assessed tenoscopic debridement alone, or may have included a very limited number (n=2) of surgical repair cases that were unresponsive to previous tenoscopic surgery. Case selection may have introduced significant bias into these results as tenoscopic debridement alone is the preferred surgical technique, whilst surgical repair has been reserved for more extensive tears, or tears unresponsive to tenoscopic debridement. No randomised controlled trials are available to compare the efficacy of these treatment modalities.

Summary of the evidence

Arensburg (2011)	
Population:	Horses with non-septic tenosynovitis of the Digital Flexor Tendon Sheath
Sample size:	N=130
Intervention details:	• All horses were examined tenoscopically under general anaesthesia between 1999 and 2009. • Palmar annular ligament desmotomy was performed on cases with evidence of chronicity or obvious thickening of the ligament. Before 2003, desmotomy was performed in all cases. • Torn tendon fibrils and granulomata were resected using a motorised synovial resector and suction punch ronguers. • In some cases further debridement and smoothing of the fibrillated edge was achieved using a coblation probe on a low energy setting and in no contact mode. • In other cases manual debridement rather than mechanical

	debridement was selected using an arthroscopic punch and Ferris-Smith rongeurs.
Study design:	Case series
Outcome studied:	Semi-objective To evaluate the effect of different treatment modalities, post-operative distension and duration of clinical signs prior to presentation on the final functional outcome.
Main findings: (relevant to PICO question):	• Of 130 horses with chronic tenosynovitis of the digital flexor tendon sheath (DFTS) that had tenoscopic surgery, 101 horses were diagnosed with 115 longitudinal tears (LTs) affecting a digital flexor tendon in 104 digital flexor tendon sheaths. Palmar-plantar annular ligament (PAL) desmotomy was performed in 71/104 DFTS (68%). • Follow-up on 98 horses revealed that 37 horses (38%) returned to a previous level of work or higher. 27 horses (27%) returned to a lower level of work and 34 horses (35%) remained lame. • Coblation was associated with a lower level of performance and cosmetic outcome (increased distension). • Manual debridement of LTs (no resector or coblation) was associated with a better functional outcome.
Limitations:	• Retrospective case-series study. • Multiple confounding variables affecting final functional outcome. • Poorly defined outcome assessment.

Wilderjans (2003)	
Population:	Warmblood horses with chronic tenosynovitis and annular ligament constriction syndrome.
Sample size:	N=25
Intervention details:	• All horses were examined tenoscopically under general anaesthesia between 1999-2000. • Desmotomy of the palmar annular ligament was performed in all horses with a hook knife. • In all cases, the torn fibres were resected using a motorised synovial resector.
Study design:	Case Series
Outcome studied:	Semi-objective To evaluate the incidence of longitudinal tears as the underlying cause of chronic tenosynovitis and annular ligament constriction syndrome in Warmblood horses. To evaluate the final outcome after tenoscopic debridement and palmar annular ligament desmotomy. Postoperative distension, ultrasonographic findings and level of performance were assessed.

Main findings: (relevant to PICO question):	• Of 25 horses, 17 were diagnosed with a longitudinal tear. • After 12-24 months, 10 horses (59%) were sound and resumed their previous level of work. Four horses (24%) returned to their previous level of work but needed intrasynovial treatment of the DFTS and reduced competition frequency to remain sound. Three horses (18%) remained lame.
Limitations:	• Retrospective case-series study. • Ambiguous definition of previous level of performance. • Surgical repair was not considered by the author because the tear edges were always in close apposition. • The author states suture repair requires a large open approach which are prone to a greater risk of post-operative complications, such as partial wound dehiscence and leakage from the tendon sheath, although no references are provided to support this.

Wilderjans (2006)	
Population:	Horses with non-infected tenosynovitis of the DFTS.
Sample size:	N=108
Intervention details:	• All horses had diagnostic tenoscopy under general anaesthesia between 1999 and 2005. • Desmotomy of the PAL was performed from 1999 to 2003 using a hook meniscectomy knife. From 2003, PAL desmotomies were performed only if there was an obvious thickening of the PAL. • Longitudinal tears were debrided with a motorised synovial resector, followed by further microdebridement in some cases using coblation wands. Arthroscopic Ferris-Smith rongeurs were used to remove the larger masses of torn tendon fibres, fibrin, and to remove synovial adhesions. • Fibrillation of the palmar/plantar surface of the superficial digital flexor tendon (SDFT was smoothened with coblation.
Study design:	Case Series
Outcome studied:	Semi-objective To evaluate the final functional outcome and performance of horses suffering from longitudinal tears in one or more flexor tendons. To evaluate the relation between final outcome and treatment with synovial resector, coblation, PAL resection, length of the tear, presence of post-operative distension and duration of clinical signs.
Main findings: (relevant to PICO question):	• 71 horses were diagnosed with LTs in 73 DFTSs examined tenoscopically. • Follow-up on 69 horses (71 DFTS) revealed that 26 horses (38%) returned to their previous level of work or higher. 26

	horses (38%) returned to a lower level of work, and 17 horses (25%) remained lame. • Surgical repair was performed on 2 cases with LTs of the lateral edge of the DDFT unresponsive to tenoscopic debridement. One horse returned to previous level of work and the other one to a lower level of work. • Desmotomy of the PAL and the use of coblation do not seem to affect the final outcome.
Limitations:	• Retrospective case-series study. • Limited statistical analysis. • Insufficient analysis and discussion of the outcome studied. • Multiple confounding variables affecting final functional outcome.

Smith (2006)	
Population:	Horses with non-infected tenosynovitis of the digital FTS.
Sample size:	N=76
Intervention details:	• All horses were evaluated tenoscopically under general anaesthesia between 1st January 1996 and 31st December 2003. • 65 horses underwent treatment with tenoscopic techniques only. • Large masses of torn tendon tissue and granulomata were dissected free with arthroscopic scissors or meniscectomy knives before removal with Ferris-Smith arthroscopic rongeurs. • Tendinous defects were also debrided with a motorised synovial resector in an oscillating mode with suction applied. • PAL desmotomy was performed in 2 horses using an endoscopically assisted 'freehand' technique using a curved meniscectomy knife. • Partial tears of the manica flexoria (MF) were debrided (n=5) and the MF was removed in its entirety when one margin was disrupted completely (n=18). The opposite, intact margin was divided from the SDFT using arthroscopic scissors and/or meniscectomy knives. • 11 horses underwent open surgery for repair or removal of lesions identified at tenoscopy. Repair of torn DDFT, SDFT and MF was performed with simple continuous sutures of 2 or 3 metric polyglactin 910 (Vicryl). Incision closure involved repair of sectioned MF, PALs and sheath walls with simple continuous sutures of 3 metric polyglactin 910. This was followed by a subcuticular layer of the same material and by stainless steel staples in the skin. • A total of 7 cases with LTs of the DDFT were repaired via open surgical approach.

	• Tenoscopy skin portals were closed with simple interrupted sutures of monofilament polyamide.
Study design:	Case Series
Outcome studied:	Semi-objective To evaluate the clinical features, diagnoses, treatment and outcomes of a series of horses with non-infected tenosynovitis of the DFTS. To identify significant associations between the 3 dependent variables (lameness; performance; distension) and the clinical variables.
Main findings: (relevant to PICO question):	• 46 longitudinal tears of the DDFT were identified in 44 horses. Tears of the DDFT occurred in combination with tears of the MF (n=5) and SDFT (n=1). Two further cases had thickening of the PAL. Adhesions were present between the torn surface of the DDFT and the DFTS wall in 4 cases. • Follow-up information (>6 months) post-surgery was available for 61 horses. • Follow-up on 33 horses with longitudinal tears of the DDFT revealed that 14 horses (42%) returned to their previous level of performance. • LTs of the DDFT and open surgical repair of the DDFT lesions were associated with reduced post-operative performance.
Limitations:	• Retrospective case series study. • Selection bias represented in some cases with severe lesions of the DDFT having surgical repair. • Multiple factors confounding treatment outcomes.

Wright (1999)	
Population:	Horses with tenosynovitis associated with longitudinal tears of the DDFT.
Sample size:	N=20
Intervention details:	• All horses were evaluated surgically under general anaesthesia. • Diagnosis was established by tenoscopy in 9 horses. • 2 horses evaluated tenoscopically subsequently had an open surgical approach to the DFTS. • In 7 horses torn tendon fibrils were removed tenoscopically with a motorised synovial resector. • In 13 horses, 14 DFTSs were explored surgically. • Identification of the proximal extent of the deep digital flexor tendon lesions necessitated section of the enclosing manica flexoria in 9 limbs. • Torn tendon fibrils were removed by sharp dissection. Where present, granulomata and adhesions were also excised. • 11 horses had surgical repair of DDFT lesions in 12 limbs. In 10 limbs the repair was performed with simple continuous

	sutures of 2 or 3 metric polyglactin 910 (Vicryl) and in 2 horses simple interrupted sutures of 1.5 metric polydioxanone (PDS). • Torn (n=2) or sectioned manica flexoria were repaired by simple continuous sutures of 2 metric polyglactin 910. • The tendon sheaths and palmar/plantar annular ligaments were closed with simple continuous sutures of 3 metric polyglactin 910. This was followed by a subcuticular layer of similar material and stainless steel staples in the skin. • Tenoscopic portals were closed with simple interrupted sutures of monofilament polyamide.
Study design:	Case Series
Outcome studied:	Semi-objective To evaluate clinical characteristics of horses with tenosynovitis associated with longitudinal tears and ability to return to work.
Main findings: (relevant to PICO question):	• 19 tears of the DDFT and 2 tears the manica flexoria were identified in 20 horses. • Follow-up information was obtained by telephone from owners and, or, trainers. • Five horses were re-examined post-operatively; 3 at 4 months, 1 at 7 months and 1 at 10 months after surgery. 3 of these were sound and 2 were lame. • Of 7 horses with DDFT lesions treated tenoscopically, 4 were sound and in work, 3 were in controlled exercise programmes. • Of 11 horses with surgical repair of DDFT lesions, 5 were sound and in work, 1 was sound and in controlled exercise, 5 were lame. • The prognosis for horses with tears of the DDFT which are treated by tenoscopic removal of torn tendon fibrils is better than that for animals treated by subsequent repair of the defect. The repaired tears in the DDFT were, on the whole, considered to be more extensive. It is not yet possible to determine whether the apparently inferior prognosis results from the extent of the lesion, the surgical technique used or the repair process.
Limitations:	• Retrospective case-series study. • Selection bias for surgical repair of DDFT lesions. • Subjective outcome assessment used to determine post-operative performance. • Multiple factors confounding treatment outcomes.

Appraisal, application and reflection

The five relevant identified studies discussing the outcome of tenoscopic debridement alone, versus surgical repair of LTs, are retrospective case series. This represents evidence of low quality and reliability.

Cases within and between studies have been managed using different treatment modalities. Diagnostic tenoscopy is often performed to assess the severity and extent of the lesions affecting the border of the DDFT. Criteria for treatment selection is poorly defined and primarily based on the surgeon's experience and preference. Torn tendon fibrils and granulomata are resected using a motorised synovial resector, or by manual debridement with an arthroscopic punch, Ferris-Smith rongeurs, and in some cases arthroscopic scissors or meniscectomy knives. Further debridement was pursued in several cases with the use of coblation.

Surgical repair has been reported using an open approach subsequent to initial tenoscopic debridement to gain complete access to the longitudinal tear (Smith et al., 2006; Wright et al., 1999). In some cases, this necessitated sectioning of the manica flexoria to gain access to the proximal extent of the tear. Tear repairs were performed with a simple continuous suture of 2 or 3 metric polyglactin 910 or polydioxanone. Less frequently, repairs have been performed with simple interrupted sutures of 1.5 metric polydioxanone. Incision closure involves repair of sectioned manica flexoria, palmar or plantar annular ligaments and sheath walls with simple continuous sutures of 2 or 3 metric polyglactin 910, followed by a subcuticular layer of the same material and stainless steel staples in the skin.

Current evidence from published literature, suggests that tenoscopic debridement, without repair of longitudinal tears, is the preferred treatment method. Open surgical repair of DDFT lesions have been associated with reduced post-operative performance. Although tenoscopic debridement has been associated with improved functional outcomes, animals treated by surgical repair were considered to have more extensive DDFT tears, or tears unresponsive to tenoscopic debridement. Case selection inherently added significant bias to the results, which is identified in more than one study. Since the repaired longitudinal tears were, on the whole, considered to be more extensive, it is not yet possible to determine whether the inferior prognosis results from the extent of the lesion, the surgical technique used or the repair process (Wright et al., 1999). Some cases with severe lesions were repaired based on the observation that intrinsic tendon repair mechanisms, derived primarily from the epitenon, promoted tendon healing following surgical repair in experimental conditions (Gelberman et al., 1983, cited in Smith et al., 2006). Another study also reported that surgical repair was only performed on 2 cases with LTs of the lateral border of the DDFT unresponsive to tenoscopic debridement (Wilderjans et al., 2006).

Although outcomes following surgical repair were less successful than tenoscopic debridement, there are likely many confounding factors in these case series which need consideration. Some of these include prior medical or surgical treatment, duration of clinical signs prior to presentation, severity and extent of the tear, concomitant pathology, treatment modality and technique, rehabilitation, intrinsic mechanisms of repair, and outcome assessment.

Until randomised controlled trials directly comparing tenoscopic debridement and surgical repair are made available, drawing meaningful conclusions from the current literature is limited.

Methodology Section

Search Strategy	
Databases searched and dates covered:	CAB Abstracts on the OVID platform; 1973 to 05/2017 Pubmed via the NCBI website; 1910 to 05/2017
Search terms:	CAB Abstracts: 1. (equine* or horse* or equus or thoroughbred*) or equus/ or horses/ or thoroughbred/ 2. ((tear* or laceration* or 'longitudinal tear*' or 'marginal tear*' or LT or LTs or defect) and ('deep digital flexor tendon' or 'DDFT' or 'flexor tendon' or 'tendon' or 'digital flexor tendon sheath' or DFTS or 'tendon sheath' or sheath*)) 3. 1 and 2 4. ('suture repair' or 'surgical repair' or sutur* or repair* or

	surgery) 5. ((tenoscop* or 'tenoscopic surger*' or 'diagnostic tenoscopy' or 'tenoscopic exam*' or 'tenoscopic technique*') and ('mechanical debrid*' or debrid* or 'motorised shaver*' or shaver* or 'motorised synovial resector*' or 'motorised resector*' or 'synovial resector*' or resector* or 'radiofrequency device*' or 'radiofrequency energy device*' or 'coblation wand*' or coblation or 'coblation treatment*' or coblation-treat* or 'monopolar radiofrequency device*' or 'monopolar radiofrequency energy device*' or 'monopolar device*' or 'manual debrid*' or manual or 'synovial resector*' or resector*)) 6. 3 and (4 or 5) Pubmed: 1. ((((equine OR horse OR thoroughbred) AND ((tear OR longitudinal tear OR marginal tear OR LT OR LTs OR defect) AND (deep digital flexor tendon OR DDFT OR flexor tendon OR tendon OR digital flexor tendon sheath OR DFTS OR tendon sheath OR sheath)))) 2. ((tenoscopy OR tenoscopic OR debridement) OR (suture repair OR surgical repair OR suture OR repair OR surgery)) 3. 1 and 2
Dates searches performed:	30/5/2017

Exclusion / Inclusion Criteria	
Exclusion:	Non-English language publications, studies performed in other species, articles not relevant to the PICO.
Inclusion:	Studies available in English relevant to the PICO

Search Outcome

Database	Number of results	Excluded – Studies in other species	Excluded – Non-English articles	Excluded – Not relevant to PICO	Excluded – Duplicates	Total relevant papers
CAB Abstracts	72	0	13	54	0	5
Pubmed	46	3	1	38	4	0
Total relevant papers						**5**

CONFLICT OF INTEREST

The authors declare no conflicts of interest.

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