

# Rehabilitation of Tendon and Ligament Injuries

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A carefully controlled rehabilitation program combined with a regular ultrasound examination provides the best chance for equine athletes to return to full performance following tendon or ligament injury. Author's address: Dept. of Surgical and Radiological Sciences, School of Veterinary Medicine, University of California at Davis, Davis, CA 95616. © 1997 AAEP.

## 1. Introduction

Many owners and trainers of performance horses have regarded injuries to tendons and ligaments as being potentially more threatening to an equine athlete's future career than fractures. Reasons for this perception include the intermittent, subtle clinical signs frequently associated with soft-tissue injuries, which may delay recognition of a tendon or ligament injury until it is severe; the lack of suitable diagnostic equipment or experienced personnel to perform diagnostic ultrasonographic examinations; and a lack of information about tendon healing and the effect of different treatment regimens on tendon healing.

Since 1984, the use of diagnostic ultrasound to detect and monitor equine tendon injuries has greatly improved veterinarians' capacity to accurately diagnose the presence and extent of soft-tissue injury and to monitor the progress of healing, using measurable criteria such as the size of the lesion, the echogenicity of the lesion, and the quality of fiber pattern. The use of diagnostic ultrasound also allows the patient's rehabilitation program to be tailored to tendon healing as evidenced by direct visualization of tendon architecture by using the above-mentioned criteria rather than simply by attempting to evaluate the readiness of the tendon to

withstand increasing work loads based on the relatively insensitive clinical signs of pain, heat, and swelling.

Preliminary evidence indicates that small changes in ultrasonographic parameters of size, echogenicity, and fiber pattern are associated with a relatively large change in parameters associated with biomechanical strength.<sup>a</sup> It has been documented that tendon collagen type, tendon cellularity, and tendon fiber crimp pattern, all of which affect tendon strength, require a minimum of 6 months to return substantially toward normal.<sup>1</sup> Based on these considerations, any case of tendon or ligament damage can be presumed to require a minimum of 6 months of restricted athletic activity to allow sufficient time for the majority of healing to occur.

Human athletes report that tendinitis causes a relatively short duration of pain, ranging from 3 to 8 weeks, if rest is initiated.<sup>2</sup> The same appears to be true for equine athletes; therefore clinical signs of lameness should be absent after a short period of rest, and long before substantial tendon healing has occurred. Current trends in human athletic rehabilitation include an initial period of rest, nonsteroidal anti-inflammatory drugs, icing and heat therapy using therapeutic ultrasound, followed by early mobilization, passive or active, and a revised training

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schedule using incremental work to strengthen damaged tendon and to prevent reinjury. Attention is also paid to foot balance and athletic style, with adjustments made if possible to protect the injured tendon in the future.<sup>3-8</sup> In the equine athlete, many of these principles can be applied to help the patient return to athletic function as quickly as possible and to minimize the chance of recurrence of tendinitis.

## 2. Rehabilitation Protocols

Based on ultrasonographic findings and clinical experience with 2800 cases of tendon and ligament injury at the University of California at Davis, the following rehabilitation protocols have been developed.

At the initial examination, grade of lameness and clinical signs of pain on palpation, heat, and swelling are noted. The affected tendon (ligament) ultrasonographic changes in size (cross-sectional area, or CSA), echogenicity, and fiber pattern are recorded at the most proximal site of damage, at the most severely damaged site, and at the most distal site of damage. If a discrete core lesion is found, the CSA and echogenicity of the lesion are also recorded at the same sites. Tendinitis is graded as mild if the tendon CSA is less than 20% greater than the established normal range<sup>9</sup> for the affected site(s) or than superficial digital flexor (SDF) CSA of the opposite limb at the same site(s); if any core lesion seen is less than 15% of the total tendon CSA; and if the affected area extends less than 20% of the length of the tendon. Tendinitis is graded as moderate if the tendon CSA is 20–35% greater than the established normal range for the affected site(s) or than SDF CSA of the opposite limb at the same site(s); if any core lesion seen is 15–30% of the total tendon CSA; and if the affected area extends 20–35% of the length of the tendon. Tendinitis is graded as severe if the tendon CSA is greater than 35% above the established normal range for the affected site(s) or than SDF CSA of the opposite limb at the same site(s); if any core lesion seen is greater than 30% of the total tendon CSA; and if the affected area extends greater than 35% of the length of the tendon. An initial period of stall confinement and hand walking is then initiated. The amount of exercise and duration of protocol before re-examination are based on the severity of the tendon damage at initial examination (Table 1).

At the first recheck examination, progress toward healing is regarded as good if lameness, pain on palpation, heat, and swelling are absent, and if any core lesion has filled in with collagen to the extent that it is faintly visualized (type I) or not visualized ultrasonographically, the CSA of the tendon has decreased, and the fiber pattern has improved one level (for example from poor to fair). Progress is regarded as fair if clinical signs are absent, and ultrasonographically any lesions are faintly visible (type II), the CSA is the same or slightly increased, and the fiber pattern has improved one level. Progress is regarded as poor if any clinical signs are

Table 1. Exercise Protocol Following the First Examination<sup>a</sup>

Injury	0–30 Days	30–60 Days	60–90 Days
Mild	Hand walk 15 min twice daily	Hand walk 40 min daily	Ride at walk 20–30 min daily
Moderate	Hand walk 15 min twice daily	Hand walk 40 min daily	Hand walk 60 min daily
Severe	Hand walk 15 min twice daily	Hand walk 30 min daily	Hand walk 40 min daily

<sup>a</sup>The exam is at 0–90 days; the horse is confined to a stall or equivalently sized paddock.

still present, and ultrasonographically any lesion is clearly visible (type III or IV), and the fiber pattern has not improved. The amount of exercise and duration of protocol before reexamination are based on the degree of improvement (Table 2).

At the second recheck examination, progress toward healing is regarded as good if clinical signs are absent and ultrasonographically any lesions are no longer visualized, the CSA is stable, and the fiber pattern is good. Depending on length of rest before return to midlevel work, some tendons will have responded to exercise by a small increase in CSA; progress is still regarded as good if the increase is 10–12% or less and other parameters are good. Progress is regarded as fair if clinical signs are absent and ultrasonographically any lesions are faintly visible, the CSA has increased 12–15%, and the fiber pattern is fair to good. Progress is regarded as poor if any clinical signs are present and ultrasonographically any lesion is type II or less echogenic, the CSA has increased more than 15%, and the fiber pattern is less than fair. The amount of exercise and duration of protocol are based on the degree of improvement (Table 3).

At the third re-examination, progress is regarded as good if clinical signs are absent and ultrasonographically no lesions are visible, the CSA is stable and within the normal range, and the fiber pattern is good. Progress is regarded as fair if clinical signs

Table 2. Exercise Protocol Following the Second Examination<sup>a</sup>

Progress	90–120 Days	120–150 Days	150–180 Days
Good	Ride at walk 30 min daily	Ride at walk 45–60 min daily	Add 5 min trotting every 2 weeks
Fair	Ride at walk 30 min daily	Ride at walk 45–60 min daily	Ride at walk 60 min daily
Poor	Hand walk 60 min daily	Ride at walk 20–30 min daily	Ride at walk 60 min daily

<sup>a</sup>The exam is at 90–120 days. The horse is confined to a stall and equivalently sized paddock.

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Table 3. Exercise Protocol Following the Third Examination<sup>a</sup>

Progress	180–210 Days	210–240 Days	240–270 Days
Good	Add canter 5 min every 2 weeks	Add canter 5 min every 2 weeks	Full flat work; no racing speed work or jumping
Fair	Add canter 5 min every 2 weeks	Add canter 5 min every 2 weeks	Full flat work; no racing speed work or jumping
Poor	Re-evaluate case; discuss further treatment options		

<sup>a</sup>The exam is at 180–270 days. The horse is confined to a stall and equivalently sized paddock.

are absent and ultrasonographically no lesions are visible, the CSA is stable although enlarged, and the fiber pattern is fair to good. Progress is regarded as poor if any clinical signs are present or ultrasonographically a lesion is visible, the CSA has increased, and the fiber pattern is fair or less. The amount of exercise is based on the examination results (Table 4).

### 3. Tendon and Ligament Injuries

A retrospective survey of 50 Thoroughbred racehorses with superficial digital flexor tendinitis examined clinically and ultrasonographically at the University of California at Davis between 1991 and 1996 was conducted as part of a larger survey of 525 cases.

Eighteen of the 50 patients had acute (<6 weeks' duration) tendinitis, 10/50 had subacute (6–12 weeks' duration) tendinitis, and 22/50 had chronic (>12 weeks' duration) tendinitis. The lesions were distributed as follows: 19/50 left forelimb, 24/50 right forelimb, and 7/50 both forelimbs. Location on the limb included the proximal third of the metacarpal region (3/50), midmetacarpal region (22/50), the distal third of the metacarpal region (8/50), two or more locations in the metacarpal region (14/50), and pas-

tern (3/50). Lesions were graded mild (9/50), moderate (27/50), or severe (9/50) based on previously stated criteria.

Twenty-eight of 50 horses underwent a controlled exercise program, 6/50 (with mild tendinitis) followed an abbreviated (3–5 month) rehabilitation schedule, and 16/50 were turned out in pasture to recuperate from tendon injury. Eight of the 16 horses turned out to pasture were retired without an attempt to return to previous use, including six mares who became broodmares, and two geldings. Forty-two horses were trained for racing following tendon injury. Of these, 26/42 were able to complete five (range 5–40, average 14) or more races. Races were categorized as claiming, allowance, stakes, and graded stakes. Of the 26 successful horses, 4/26 were previously unraced, 8/26 remained in the same race category, 12/26 decreased one or more categories, and 2/26 improved at least one category.

Several factors influenced return to racing, including severity of tendon injury, injury to more than one limb, and type of rehabilitation. Limb affected was not a significant factor except that horses with both forelimbs injured had a decreased return rate of 2/7. The severity of the lesion was a significant factor: 6/9 mild lesions, 16/27 moderate lesions, and 4/9 severe lesions healed sufficiently to allow return to use. The type of rehabilitation was also a significant factor. Of the 16/50 horses kept in pasture, eight were tried at racing and 2/8 succeeded. Of the 28/50 horses kept in a controlled exercise regimen, 20/28 succeeded. Of the 6/50 horses placed in an abbreviated rehabilitation program (<5 months to return to full work), 4/6 succeeded.

Although horse numbers in the initial study are small, the results concur with a review of 230 cases of suspensory ligament desmitis, which revealed that 117/173 of horses managed by controlled exercise were able to return to their intended use, whereas only 29/57 of horses managed by 3 months of initial confinement followed by pasture turnout were able to do so.<sup>10</sup> A third study of biceps tendinitis showed that 3/14 of horses treated with pasture turnout returned to intended use, whereas 8/16 of horses treated with controlled exercise were able to do so.<sup>11</sup> It appears from these results that controlled exercise is an important factor in the return of horses with tendon and ligament injuries to athletic use.

### 4. Discussion

Successful cases usually require 8–9 months of rest and rehabilitation to return to their previous full work load. Advancing too quickly often results in worsening of the lesion; advancing too slowly results in a loss of productive athletic use of the horse. The basic purpose of controlled exercise rehabilitation is to initially encourage resolution of inflammation and maintenance of tendon gliding function through rest

Table 4. Exercise Protocol Following the Fourth Examination<sup>a</sup>

Progress	270–300 Days	300–330 Days	330–360 Days
Good	Begin work at racing speed; jumping	competition	competition
Fair	Begin work at racing speed; jumping	competition	competition
Poor	Re-evaluate case; discuss further treatment options		

<sup>a</sup>Exam is at 270–360 days.

and walking. Gradually increasing the work load provides stimulation to the tendon to continue the healing process, as the tendon is relatively weak after injury and gains strength over many months' duration.

The tables included provide general guidelines for exercise; the method of achieving similar workloads at the various stages of healing may be tailored to suit the behavior and training level of the horse and rider. For example, a racehorse might be exercised in a controlled manner by ponying (being led by another horse and rider) rather than being ridden. It is important that the increase in exercise be graduated, so that fatigue or overload injury to the healing tendon does not occur. Owners or trainers should be advised that there is an increased risk of injury to the affected tendon or ligament and that an ultrasonographic examination should be performed if at any time during the rehabilitation program clinical signs recur. Although controlled exercise requires time, effort, and money, if coupled with the accurate interpretation of regular clinical and ultrasonographic examinations, it provides the best opportunity for a successful resolution of tendon injury.

#### References and Footnotes

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