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Tendon Cutting Procedures for the Treatment of Corns in Dogs

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Mini Review

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ABSTRACT

A corn is a hard area of hyperkeratisation found on the digital paw pads of sight hounds causing severe, chronic lameness. Historically, no treatment has produced consistently good, long-term results and the aetiology has been speculative. The innovative digital flexor tendon cutting procedures rapidly improve lameness scores and demeanor by unloading the pad allowing the corn to exfoliate. It supports the theory that corns are caused by repeated mechanical trauma. The surgery is benign with minimal aftercare.

Keywords: Corn; Dog; Greyhound; Digital flexor tendon; Tendonectomy; Tenotomy

INTRODUCTION

A corn, also known as a paw pad keratoma, is a focal circular area of hyperkeratisation found primarily in the digital paw pads of the sight hound breeds (greyhound, whippet and lurcher) occurring in racing dogs and pets. Visual presentation is varied from a large circular, extruding area of thickened pad as shown in Figure 1 to barely discernible changes as shown in Figure 2. The area of hyperkeratinisation may extend internally having the appearance of a hollow root to the underlying Deep Digital Flexor Tendon (DDFT) causing pathological changes to the surrounding tissues. Mediolateral digital examination of the pad may detect a thickened hard area, and digital pressure applied in orthogonal directions across the corn usually produces a pain response. Corns are a common cause of severe, chronic lameness typically worse when the dog is walking or trotting on hard surfaces. The foot may be intermittently held off the ground. There is an unwillingness to exercise and a depressed demeanour is often reported, rapidly reversed after successful surgery. Many dogs have suffered these signs for several years often having had numerous veterinary interventions.

Figure 1. A large corn on digital pad 3 (arrow). There is a smooth, worn central area surrounded by hyperkeratinisation of the pad through lack of wear.

Figure 2. A less obvious corn with subtle changes to the pad surface (arrow). Enhanced digital images are useful for detecting changes. Note that the pad appears larger in area when compared to the other central pad.

The distribution, taken from two studies found that 86%-90% occurred in the digits of the thoracic limbs and 89%-92% were in digits 3 and 4 [1,2]. Multiple corns occurring singularly on different pads are common having, in a study

of 505 corns in 303 dogs, an overall incidence of 42% with 30% present at the initial consultation and a further 12% developing subsequently (unpublished data by the author). The lesion is analogous to heloma durum (hard corn/clavus) in man caused by poor-fitting footwear, foot deformity such as hammer toes and abnormal foot function. Multiple aetiologies have been proposed in the dog. Papilloma virus was isolated from two greyhounds with corns while a case series of 18 greyhounds failed to find evidence of the virus supporting the notion that a viral aetiology is unlikely [3,4]. Foreign body penetration has been proposed but there was a failure to find a primary foreign body in the histological examination of 1000 corns although plant material was found in the soft core of 4.5% and was thought to be a secondary penetration.

The theory of repeated mechanical trauma predominates as in man. In greyhounds there is an over-representation of the main weight-bearing central digits and the thoracic limbs where the peak vertical forces are higher than in the pelvic limbs [5]. Concomitant anatomical deformity was found in 40% of cases but the significance of many deformities is unclear. The report of the resolution of 2 corns after distal digital ostectomy together with the subsequent success of the digital flexor tendon cutting procedures that unload the pad, firmly support a mechanical aetiology. Historic treatments either center on conservative management or surgical intervention. The former includes protective boots, regular paring of the surface keratin and various topical medications. Surgery comprises of hulling with the attempted removal of the core, or full surgical excision.

However, until the pioneering of the digital flexor tendon cutting procedures there was no one treatment giving consistent, satisfactory outcomes. Surgical excision gave good short-term results but 50% recurred within one year [1]. The reason for the poor results was that the primary problem of excessive pad loading had not been addressed.

The first peer reviewed publication compared the outcomes of Superficial Digital Flexor (SDF) tenotomy at the metacarpus/tarsus and a combined superficial and Deep Digital Flexor (DDF) tenotomy under the palmar/plantar aspect of the first phalanx (P1). There were 161 corns in 100 sight hounds in the study. In the SDF+DDF tenotomy group two dogs developed a painful hyperextension of the Proximal Inter-Phalangeal (PIP) joint and the assumption was that the tenotomised digit requires the support of the adjacent digits. Therefore, if two digital pads had corns on one foot, one digit would have a SDF+DDF tenotomy and the other SDF tenotomy.

113 corns were treated with the SDF+DDF tenotomy and 48 corns by SDT tenotomy. Follow up was by telephone at 7 days, 8 weeks and where possible from 6 to 12 months. Results were remarkable consistent between the two groups with both showing a good improvement in lameness at 7 days and by averaging the two groups, 78% showing no lameness and 17% slight lameness at 8 weeks. 95% of corns had exfoliated at 8 weeks. The long-term lameness scores were similar. Apart from the PIP joint hyperextension in the SDF+DDF tenotomy group the other major complications were failure of lameness resolution and recurrence of the corn after successful initial surgery occurring at any time from 3 months to several years from the initial surgery attributed to the tendons re-joining and contracting, a fact confirmed by revision surgeries. Consequently, the SDF tenotomy procedure was extended to a tendonectomy, removing where possible 1 to 2 centimetres of tendon. Revision of both complications was by either a further tendonectomy at the metacarpus/tarsus or SDF+DDF tenotomy at the level of P1, the latter now being the author's preferred revision procedure. In a case series of 22 dogs undergoing SDF+DDF revision surgery 20 dogs were reported as having no lameness after I year (unpublished data).

LITERATURE REVIEW

Anatomy

The SDF and DDF tendons track down the palmar/plantar metacarpus/tarsus to insert on the phalanges maintaining the digits in flexion as shown in Figure 3. The SDF tendon inserts on the proximal aspect of the second phalanx (P2) and the DDF tendon inserts on the flexor process of the third phalanx (P3). Severance of the SDF tendon results in reduced flexion of the PIP joint with a cranially extended nail that remains in contact with the ground as shown in Figure 4. A degree of flexion is maintained by the DDF tendon that is constrained to P1 and P2 by annular ligaments. Severance of the DDF tendon results in dorsal rotation of P3 from the pull of the dorsal elastic ligament. Severance of both tendons produces a flattened digit with dorsal rotation of P3 as shown in Figure 5. A small degree of flexion of the PIP joint remains from the anatomical configuration of the joint.

Figure 3. A representation of the relevant anatomy of the distal limb.

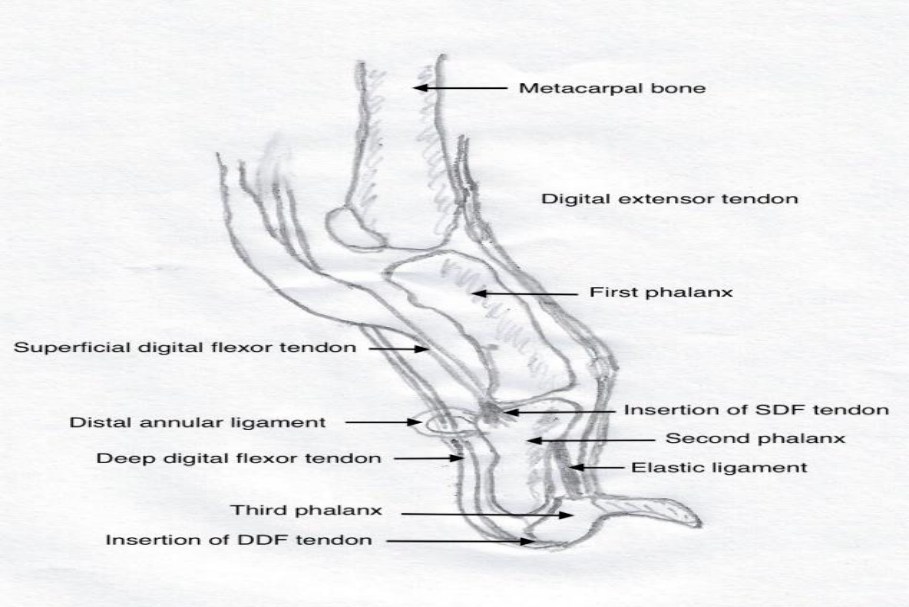

Figure 4. The digit (arrow) has had a superficial digital flexor tendonectomy at the metacarpus. The PIP joint has reduced flexion and the nail protrudes cranially but remains in contact with the ground.

Figure 5. The digit (arrow) has had a combined superficial and deep tenotomies at the level of P1. The digit is flat to the ground with only a minimal degree of PIP joint flexion. The nail and P3 are rotated dorsally from the pull of the elastic ligament.

Superficial digital flexor tendonectomy.

With the dog anaesthetized and surgically prepared, lateral recumbence enables access to the surgical site. An assistant holds the affected digit in full extension allowing the visualization and palpation of the SDF tendon. A linear skin incision approximately 1 centimeter in length is made along the tendon at the distal third of the metacarpus/tarsus. The fine tendon sheath of the white SDF tendon is incised enabling the tips of fine curved mosquito forceps to be placed under the tendon avoiding adjacent blood vessels. By running the forceps under and along the tendon about 1 to 2 centimeters can be freed enabling its removal as shown in Figure 6. The site is inspected to ensure complete removal. Minor haemorrhage is common and easily controlled with digital pressure. The skin is closed by the preferred method and a pressure dressing is applied. Pain relief with a non-steroidal anti-inflammatory drug is given for a few days. The dressing is removed after 24 hours, and the owner instructed to commence lead walking with free exercise allowed after 10 days. Multiple corns, on the same foot or other feet, can have surgery in the same operating session and in the author's opinion, there is no limit to the number of digits treated on any one foot.

Figure 6. Intraoperative view of SDF tendonectomy at the metacarpus. Small curved, mosquito forceps, placed under the tendon allow a small length to be excised.

Combined superficial and deep digital flexor tenotomy

The dog is held as in the SDF tendonectomy procedure with the digit in full extension. The taut tendon is observed and palpated between the metacarpal/tarsal pad and the digital pad. A linear skin incision is made beginning about 2 millimetres from the metacarpal/tarsal pad exposing a large tendon mass. The thin tendon sheath is incised, and the curved mosquito forceps are positioned between the multiple tendon bundles and P1 enabling their severance as shown in Figure 7. The site is inspected to ensure all have been cut, and the skin sutured. Aftercare and recovery times are similar to the SDF tendonectomy procedure. The clinical techniques are reported in Veterinary Dermatology [6].

Figure 7. Intraoperative view of a combined SDF and DDF tenotomy with the forceps isolating the bundle of tendons.

The increased loading of the pad results in pressure-related hyperkeratosis where the integument responds by producing extra layers of keratin to protect damaged areas. The cause of the increased loading is multifactual and has genetic and physical components. Sight hounds having thinner skin and pads than comparable breeds, are thought to have less pad cushioning. Genetics can influence conformation, possibly a component where corns occur in symmetrical digits in the contralateral limbs, and in the hyperflexion of the PIP joints common in the whippet. Some physical components listed as shown in Table 1, will result in focal scarring within the pad producing less cushioning with increased pressure.

Table 1. A list of some anatomical deformities and conditions associated with corns.

Physical components
Malunion from distal limb fractures and pancarpal arthrodesis
Fracture of the flexor process of P3
Hyperflexion of the PIP joint • Conformational hyperflexion • SDF tendon strain with subsequent contracture
Previous foreign body penetration
Pad sebaceous cyst

CONCLUSION

Foreign body penetration often precedes a corn even after its successful removal and the author now combines removal with SDF tendonectomy. However, in most corns the cause is unclear. The presence of a corn is self-perpetuating as the production of the keratin results in a further increase in pad loading forces. The advantages of the tendon cutting procedures over historic treatments include higher proportion of long-term resolution, simple benign surgery, minimal aftercare and rapid recovery. These surgeries have transformed for the better the lives of many dogs.

CONFLICT OF INTEREST

Authors declare no conflict of interest.

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