

The effect of acupuncture therapy on the repair of the calcaneal tendon (tendo calcaneus communis) in dogs

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Abstract: The effect of acupuncture therapy on the healing process of the calcaneal tendon (tendo calcaneus communis) of the dog was evaluated after tendon splitting in 10 adult mixed breed dogs. Complete, full thickness splitting of the right Achilles tendon, 2 cm in length, was performed using a scalpel blade. The dogs were randomly divided into 2 groups (group 1 and 2) of 5 dogs each. The dogs in group 2 were subjected to acupuncture therapy 10 min/day for 2 weeks, starting on postoperative day 3. The acupuncture points used were GB30, BL40, and ST36. No treatment was given to group 1 (controls). Macroscopic and microscopic changes at 60 days showed that the dogs in group 2 had fewer peritendinous adhesions than those in the control group. Microscopically, there were fewer inflammatory cells, no tendonitis was evident, and the regular and parallel arrangement of collagenous fiber bundles of normal thickness of the epitendon and peritendon were observed in group 2. It was concluded that acupuncture, as a physical method of therapy, was quite effective in promoting tendon healing and faster remodeling of collagenous fibers.

Key Words: Acupuncture, calcaneal tendon, dog

Introduction

Injuries to tendons, ligaments, and other soft connective tissues may result in complications requiring long-term rehabilitation (1-3). Lesions produced in the tendon vary widely, from partial to complete disruption of the tissue, and renders affected limbs unable to function normally (4). Surgical repair of a severed Achilles tendon has been reported in dogs and cats (5), but efficient

physiotherapeutic techniques are necessary for the affected parts to regain normal functioning in a timely manner. Acupuncture regimens have been used for the treatment of various disorders in different animal species (6-8); however, its use in treating severed Achilles tendon injuries has not been explored in dogs. Therefore, the present study was undertaken to evaluate the macroscopic and microscopic effects of acupuncture therapy on the healing process of the Achilles tendon in

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dogs.

Materials and Methods

The experiment was conducted with 10 crossbred 2-3-year-old dogs (5 male and 5 female). Body weight of the dogs ranged from 25 to 35 kg. All dogs were clinically healthy with no signs of joint or tendon injuries. The study was performed with the approval of the University of Tehran Research Council Committee. All dogs were treated accordingly to animal welfare regulations.

Each dog was pre-medicated with acepromazine 0.05 mg/kg IM (2%, Karon Co, Iran) and ketamine hydrochloride 5 mg/kg IM (10%, Alfasan Woerden, Holland). General anesthesia was induced after premedication with using thiopental sodium 10 mg/kg IV (Sandoz GmbH, Kundl, Austria) and was maintained with halothane in oxygen in a semi-closed system.

Postoperative treatment included cefalexin 10 mg/kg IM (Pars Daru, Tehran, Iran), dexamethasone 0.6 mg/kg (Aburaihan Parma Co., Tehran, Iran), vitamin B complex 0.2 mg/kg, and tramadol hydrochloride 5 mg/kg IM bid (Iran Daru Company, Tehran, Iran) for 3 postoperative days.

The surgical site was prepared and a curvilinear incision was made over the dorsal aspect of the Achilles tendon. The fascia was dissected and the Achilles tendon was exposed and elevated with 2 curved artery forceps. The Achilles tendon was split longitudinally (2-cm length) to full thickness 10 times using a scalpel blade to assure full disruption of the fibers (Figure 1). The section of tendon was marked

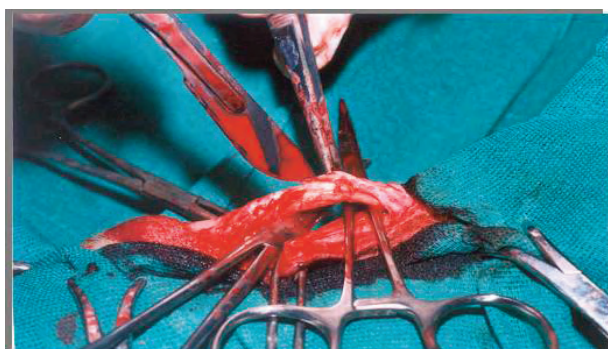


Figure 1. Splitting of the right Achilles tendon.

proximally and distally using a single silk ligature bite. The skin was sutured in a routine procedure and the animals were randomly divided into 2 groups: group 1 (control, n = 5) and group 2 (acupuncture treatment, n = 5).

Group 1 did not receive acupuncture treatment, whereas group 2 received acupuncture therapy 10 min/day for 15 days after locating the acupoints—GB30, BL40, and ST36 (Figure 2) (WQ-6F-57-6F electronic acupunctoscope, Beijing Haidian District Dounghua Electronic Instrument Factory, China). The wound was bandaged for the first 3 days and then allowed to heal without the bandage. Diluted povidone iodine was applied to the wound every other day for 10 days. The sutures were removed after 12 days. The dogs were euthanized using an overdose of intravenous thiopental sodium (Sandoz GmbH, Kundl, Austria). For light microscopic evaluation, a biopsy sample from the split area was collected from each case at 60 days. They were fixed in a 10% solution of buffered formalin, sectioned (5 µm thick), and stained with H&E.

Results

No complications were observed during or after surgery in any of the dogs. During the clinical



Figure 2. Lateral recumbency position of each case and insertion of acupuncture needles. Electronic Acupunctoscope, Model WQ-6F (57-6F).

manipulation and examination that was conducted during the postoperative period, pain and local tenderness with slight limping was observed in the right hind limb in all the dogs when walking during the first postoperative week. In the treated group there was full weight bearing at the end of the second postoperative week, with complete skin wound healing. All dogs were sound before euthanasia. Macroscopically, the site of Achilles tendon splitting was a pale-yellow straw color, with glistening and an uneven surface in all of the animals in both groups. The Achilles tendons in group 2 had fewer peritendinous adhesions than those in group 1. Slight palpable thickness was observed at the site of splitting on postoperative day 60 in group 1.

Microscopic Changes

A histological section of a normal Achilles tendon had a compact and parallel bundle of collagen fibers with less cellularity (Figure 3), whereas in the control animals (group 1) there were fibroblastic activity and immature collagen fibers at the healing site. The collagen fibers were arranged irregularly with neovascularization in some parts of the tendons (Figure 4). In the treated animals (group 2) healing of the tendon was much more organized—old and new tissues were homogeneous. The newly formed tendon was covered with an epitenon and a peritenon, which were not attached to the underlying tendon (Figure 5).

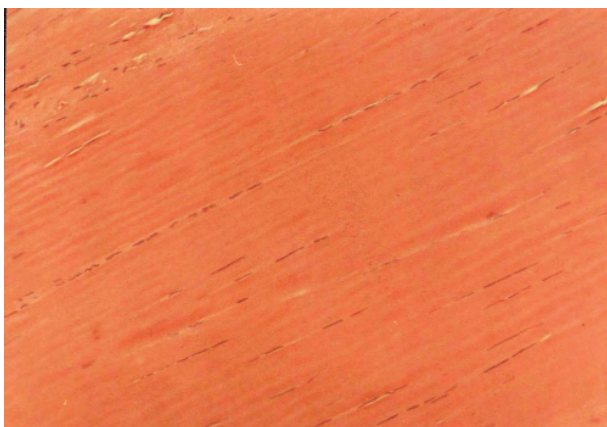


Figure 3. Longitudinal normal section of the Achilles tendon on day 0, showing (a) bundles of tendon fibers and (b) parallel tenocytes with nuclei.

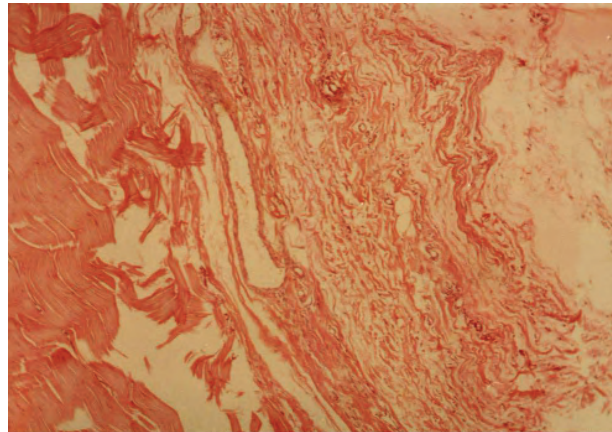


Figure 4. Longitudinal section of the Achilles tendon of a control dog (group 1) 60 days after splitting shows (a) irregular fibers in healing tissue, (b) irregular arrangement of fibroblast, and (c) the presence of inflammatory cells.

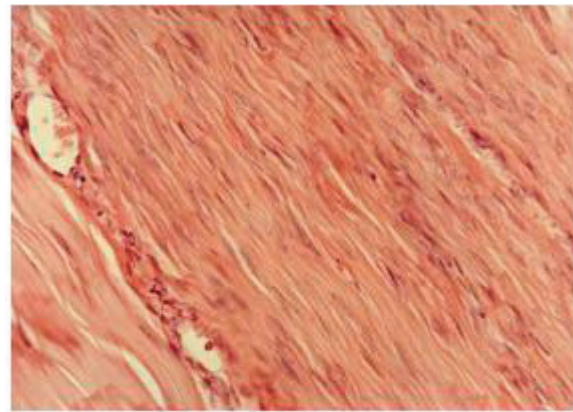


Figure 5. Longitudinal section of the Achilles tendon of a treated dog (group 2) 60 days after splitting shows (a) relatively regular fibers in fibrous tissue, (b) relatively parallel arrangement of tenocytes and their nuclei, and (c) normal tissue tendon.

Discussion

Tendon lesions usually heal with excessive formation of poorly organized scar tissue (9). Results of the present study show that during the early stages of tissue repair collagen fibers responded well to the acupuncture treatment, similarly to the results obtained with therapeutic ultrasound (10-12). Acupuncture therapy accelerated tendon healing in the treated group. Different kinds of neuropeptides can be released from the CNS during stimulation and are delivered via circulation to the affected tissue,

which subsequently reduces the sensation of pain and tenderness at the site of swelling (13). It has been postulated that an electrical current can trigger tissue regeneration in underlying lesions in mammals and that electrical stimulation causes cells to differentiate, leading to the formation of masses of the blastocytes that must form before regenerative growth can occur (1). These cells then re-differentiate at the site of healing. An important key in this process is the specific characteristic of the electrical current, as the optimal current for tissue regeneration is 3-6 nanoamperes (2,8).

There were fewer peritendinous adhesions in the animals treated with acupuncture, which suggests that acupuncture therapy may have played a role in the prevention of adhesions. In general, immobilization also contributes to mild or moderate formation of peritendinous adhesions, which is observed once a splint is removed (14); however, there was no such complication in the present study's cases. The present study's clinical and histopathological results show that acupuncture treatment had a positive effect on the early organization of regular and parallel collagen fibers in the split area of the Achilles tendon in dogs.

References

1. Enwemeka, C.S.: Inflammation, cellularity and fibrillogenesis in regenerating tendon: implications for tendon rehabilitation. *Phys. Ther.*, 1989; 69: 816-825.
2. Enwemeka, C.S., Spielholz, N.I.: Modulation of tendon growth and regeneration by electrical currents and fields. In: Nelson, R., Currier, D.P. Eds., *Dynamics of Human Biologic Tissues*. F.A. Davis Publishers, Philadelphia, 1992; 231-254.
3. Gigia, P.P.: *Physiology of wound healing*. Clinical Wound Management. Thorofare, NJ: SLACK Incorporated. 1995; 1-12.
4. Early, T.D.: Tendon disorders. In: Bojrab, M.J. Ed., *Pathophysiology in Small Animal Surgery*. Lea and Febiger, Philadelphia, 1981.
5. Mughannam, A., Reinke, J.: Avulsion of gastrocnemius tendon in three cats. *J. Am. Anim. Hosp. Assoc.*, 1994; 30: 550-556.
6. Agarwal, F., Kumar, H.: Clinico-physiological effect of electroacupuncture anaesthesia of limbs in dogs. *Indian J. Anim. Sci.*, 1995; 65: 148-152.
7. Christensen, B.V., Iuhl, I.U., Vilbek, H., Bülow, H.H., Dreijer, N.C., Rasmussen, H.F.: Acupuncture treatment of severe knee osteoarthritis. A long-term study. *Acta Anaesthesiol. Scand.*, 1992; 36: 519-525.
8. Janssens, L.A.A., Demoor, A.: General acupuncture with special reference to therapeutical and analytical aspect in domestic animals cited by Janssens. L.A.A. 1983. In: *Vet. Med. Small Anim. Clin.*, 1980; 78: 1580-1583.
9. Strömberg, B., Tufvesson, G.: An experimental study of autologous digital tendon transplants in the horse. *Equine Vet. J.*, 1977; 9: 231-237.
10. Guerino, M.R., Luciano, E., Goncalves, M., Leivas, T.P.: Aplicacao de ultrason pulsado terapeutico sobre a resistencia mecanica na osteotomia experimental. *Rev. Brasil Fisioter.*, 1997; 2: 63-66.
11. Fukada, E., Yasuda, I.: On the piezoelectric effect of bone. *J. Phys. Soc. Jpn.*, 1957; 12: 1158-1169.
12. Yasuda, I.: On the Piezo-electric activity of bone. *J. Jpn. Orthop. Surg. Soc.*, 1954; 28: 267-271.
13. Kramer, J., Gerwing, M., Schimke, E.: Diagnosis and therapy of selected tendon and muscular disease in dogs. Part I. *Kleintier praxis*, 1993; 38: 703-711.
14. Mathews, P., Richards, H.: Factors in the adherence of flexor tendon after repair. *J. Bone Joint Surg.*, 1976; 58: 230-234.