

The Treatment of Achilles Tendonitis Using Therapeutic Laser

Evidence supports considering therapeutic laser in the treatment and rehabilitation of Achilles tendonitis alone or in combination with more conventional therapies.



By William J. Kneebone, RN, DC, CNC, DIHom, FIAMA, DIACT

Achilles tendonitis is a commonly occurring painful condition. It affects about 11% of all running injuries. Achilles tendonitis can be quite debilitating, preventing the sufferer from running and causing great difficulty walking, especially when acute. Achilles tendonitis tends to occur more in middle-aged recreational athletes than other age groups. The Achilles tendons, like other body tissues become more rigid, less flexible, and more susceptible to injury as we age. It is usually caused from overuse and associated with over-pronation of the foot or changes in footwear or running routine.

The primary presenting symptom is posterior heel pain. Pain is usually worse when first ambulating following period of

inactivity. Diagnosis is made primarily from the symptom history and X-Rays are of little value. Palpatory exam will help locate the exact area of involvement (see Figure 1).¹

Repeated episodes of Achilles tendonitis can lead to the development of Achilles tendinosis, a chronic degenerative condition of the tendon that can lead to tendon tearing or rupture which usually requires surgical repair.

Conventional treatment usually consists of RICE self-care (rest, ice packs, compression, and elevation) and non-steroidal anti-inflammatory medication along with stretching and exercises.²

Studies of Tendinopathy Laser Treatment

Therapeutic laser has been shown to produce promising results based on the data obtained from several published research studies.

Tumitty et al³ reviewed twenty-five controlled clinical trials of the treatment of tendinopathy with low level laser therapy. There were twelve positive studies and thirteen inconclusive studies. Effective dosages were apparent in the positive studies and absent in the inconclusive studies. In a lateral epicondylitis study, the laser group demonstrated a 9.59 kg higher grip strength than control and a decrease in visual analogue scale of 13.6 mm. They concluded that therapeutic laser can potentially be effective in treating tendinopathy when recommended dosages are used.³

Bjordal and Couppe⁴ performed a randomized controlled clinical trial for tendonitis. They found eight clinical trials

that met the selection criteria out of seventy-seven. They, like Tumitty, found that adequate dosage was essential to achieving positive clinical results.

Bjordal and Couppe also conducted a separate review⁵ of four laboratory trials that investigated optimal doses for collagen inflammation reduction. They found that optimal doses were 3–8 joules/cm² with an intensity of 2–10 mW/cm². They also reviewed ten laboratory studies that investigated collagen proliferation and identified the optimal dose for stimulation of tendon regeneration as being from 0.2–4.0 joules/cm² and 2–10 mW/cm² intensity.⁵

Bjordal et al, in yet another study,⁶ observed the results of therapeutic laser in seven patients with bilateral Achilles tendonitis (14 tendons) who had aggravated symptoms after pain-inducing activity. A 904 nm GaAs laser was used to deliver 1.8 joules at each of three points along the Achilles tendon. Laser or placebo was applied randomly to each Achilles tendon with both the patients and therapists blinded. Inflammation was examined by minimally-invasive microdialysis for measuring PGE2 in peritendinous tissue, as well as Doppler ultrasound measurement of peri- and intra-tendinous blood flow, pressure algometry, and the single hop test. PGE2 was significantly reduced at 75, 90, and 105 minutes after active laser therapy as compared to the pre-treatment group or placebo group.⁶

Enwemeka et al⁷ observed the effects of therapeutic laser on twenty rabbits that had surgical transection and repair. Six rabbits had local treatment with a HeNe

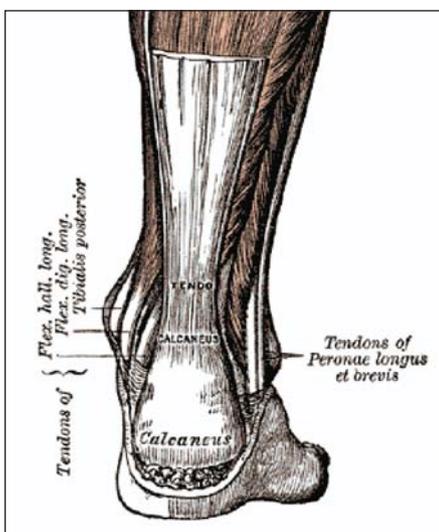


FIGURE 1. Illustration of the achilles tendon (source: Grey's Anatomy).

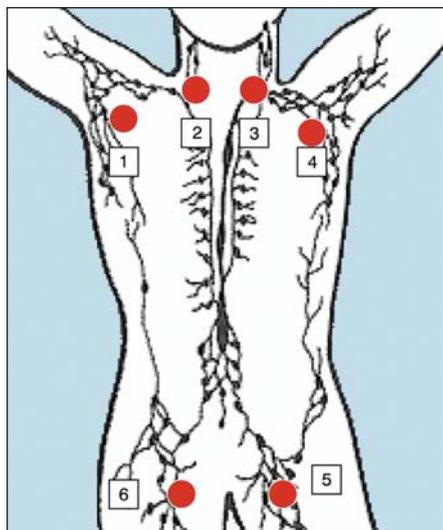


FIGURE 2. Diagram of lymph nodes: 1-lymphatic duct, 2 – right scalene node, 3 left scalene node, 4 – thoracic duct, 5 – left inguinal node, 6 – right inguinal node.

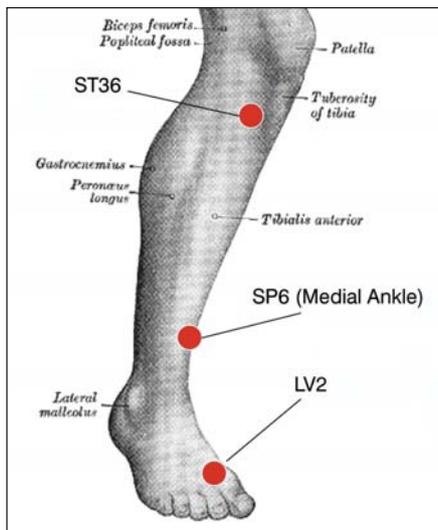


FIGURE 3. Illustration of the lower leg with red dots approximating the location of acupoints that affect the lower extremity (source: Grey's Anatomy).

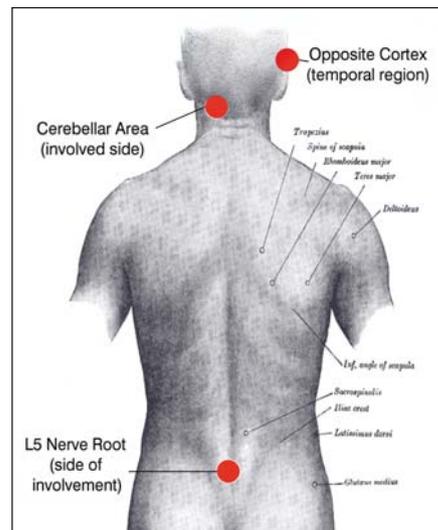


FIGURE 4. Illustration of the back with red dots representing systemic reflex areas for irradiation of the nervous system (source: Grey's Anatomy).

laser, seven with a GaAs laser and seven were controls. The tensile strength of the tendons were evaluated after fourteen days. The mean value of the HeNe group was 251, the GaAs group was 233, and the control group was 154.

Reddy et al⁸ performed a study in which two parameters were observed in tenectomized rabbit Achilles tendons: early mechanical loading and HeNe laser. The findings indicate that the combination of these two approaches increased collagen production with marginal biomechanical effects on the repaired tendons.

Reddy et al, in another study,⁹ examined the effects of HeNe laser on rabbits that had their Achilles tendon tenectomized and repaired in fourteen days. The treatment group had considerably higher collagen content in the tendon than the control group. Collagen extraction from the regenerating tissues yielded significantly higher concentrations of soluble and insoluble salts from the laser group as compared to the control group.

Parizotto and Baranauskas¹⁰ performed tendectomies on the Achilles tendons of 32 rats and then repaired them. A laser group was treated with a HeNe laser daily for ten days after the first twenty-four hours. Dosimetry was 0.5, 5, and 50 joules/cm². Enhanced intra- and intermolecular hydrogen bonding in the collagen molecules were observed in the laser group. The treated tendons were more organized than the control group.

Stupinska¹¹ treated fifty patients suffer-

ing from Achilles tendon injuries with a GaAs laser alone or in combination with a HeNe laser. Evaluation of patient responses were based on information gathered from patient examinations and interviews as well as Laitinen Pain Questionnaires. The results proved an analgesic effect.

Demir et al¹² performed a study on eighty-four male Swiss albino rats utilizing therapeutic ultrasound, GaAs laser, or both together. There were twenty-eight rats in each of three groups utilizing the left foot as a treatment side and the right foot as a sham or control side. The ultrasound was applied at 0.5 W/cm² with a frequency of 1MHz continuously for five minutes daily. The laser was 904 nm in wavelength with a 6 mW average power output at 1 joule/cm² at 16 Hz frequency for one minute. All groups were treated

for nine days except for the group that had biochemical testing performed. The latter were treated for four days. Hydroxyproline was measured on the 4th, 10th, and 21st days following initiation of the treatment program. Seven rats were sacrificed in order to obtain biochemical information. Hydroxyproline levels were found to be significantly increased in the treatment groups on the 10th and the 21st days of treatment. The combined ultrasound and laser groups were slightly higher than each one individually. Tendon tensile strength was significantly stronger in both ultrasound and laser groups. Ultrasound and laser therapy were found to be equally effective.¹²

Stergioulas et al¹³ observed enhanced outcomes in twenty subjects (twelve male and eight female) who received both GaAIAs laser and concentric exercises

TABLE 1. Irradiation of the Spinal Nerve Root Technique
World Association of Laser Therapy Guidelines Suggested Dosages

Area	Laser	Application	Energy
Cervical spine	GaAs Laser	4 areas/points	Minimum 1 Joules per point (4 Joules total)
Lumbar spine	GaAS Laser	4 areas/points	Minimum 1 Joules per point (4 Joules total)
Cervical spine	GaAIAs Laser	4-12 areas/points	Minimum 4 Joules per point (16 Joules total)
Lumbar spine	GaAIAs Laser	4-8 areas/points	Minimum 4 Joules per point (16 Joules total)



FIGURE 5. Irradiation of the left medial Achilles tendon with a GaAs IR laser.

when compared to a group of twenty subjects (thirteen males and seven females) that received eccentric exercise and placebo laser treatment. Age, height, symptom duration, quantity of active ankle dorsiflexion, and weight was statistically similar. Treatment consisted of twelve sessions over an eight-week period in a blinded fashion. Six points were treated along the painful achilles tendon in all subjects by the same therapist. An 820 nm wavelength infrared laser was used with an intensity of 0.9 joules/cm² per point. There was no statistical difference in perceived pain at the start of the study but a significant difference was reported at 4, 8, and 12 weeks. Secondary measure such as tenderness to palpation, crepitation, morning stiffness and active dorsiflexion also improved.¹³

Therapeutic laser can be effectively applied to injured Achilles tendons locally to the injury site or systemically (indirectly) to spinal nerve roots, lymph nodes, and/or acu-reflex points.¹⁴

There appears to be a synergistic effect when all of the above techniques are used together. Together, they seem to have an effect greater than each alone.

Application Techniques

The first technique is to irradiate the primary lymph node that drains the area of complaint. Example: The lymphatic duct drains the right arm and shoulder (see Figure 2) The inguinal lymph node would be irradiated in the case of Achilles tendonitis as it drains the lower extremity.

The second technique is laserpuncture stimulation. This may be applied to body acupuncture points (see Figure 3), ear acupuncture points, or hand acupuncture points. It is convenient to start with body acupoints. You can progress to auriculotherapy or Korean hand therapy points

TABLE 2. Irradiation of the Left Medial Achilles Tendon
World Association of Laser Therapy Guidelines Suggested Dosages

Laser	Application	Energy
GaAs laser Maximum output 100mW/cm ²	2-3 minutes/area	2 Joules minimum dose
GaAlAs laser Maximum output 100mW/cm ²	2-3 minutes/area	8 Joules minimum dose

if stimulation of the body points do not provide the desired effect.

The third technique is irradiation of the spinal nerve root that supplies the area of complaint, the cerebellar area, and the contra-lateral cortex (see Figure 4). The area over the L5 nerve root on the side of involvement should be irradiated followed by irradiation over the cerebellar area on the side of involvement and finally the area over the opposite temporal cortex.

For this technique, the World Association of Laser Therapy guidelines suggest the dosages listed in Table 1.

The fourth technique is local treatment to the area of complaint. Start by palpating the region in order to locate the area of maximum tenderness and initiate irradiation there followed by irradiation of all the additional tender points (see Figure 5).

For this technique, the World Association of Laser Therapy guidelines suggests the dosages listed in Table 2.

Conclusion

Evidence supports the proposition that therapeutic laser be utilized in the treatment and rehabilitation of Achilles tendonitis alone or in combination with more conventional therapies. ■

William J. Kneebone, RN, DC, CNC, DIHom, FIAMA, DIACT, studied nursing at Cook County Hospital in Chicago graduating as an RN in 1972. He completed an anesthesia program at St. Francis Hospital in La Crosse, Wisconsin in 1974. Dr. Kneebone practiced anesthesia until he graduated from Palmer College of Chiropractic in 1978. He has been in a complimentary medicine practice in the San Francisco Bay area since 1978. He has post graduate certification in nutrition and homeopathy. He is also a Fellow of the International Academy of Medical Acupuncture and a Diplomate of the International Academy of Clinical Thermology. Dr. Kneebone has been using

therapeutic lasers in his practice for over seven years and has been teaching laser seminars for the past four years. He teaches Cutting Edge Laser Seminars™ all around the US. He can be contacted at drknee@pacbell.net

References

1. <http://orthopedics.about.com/cs/ankleproblems/a/achilles.htm> Accessed 5/10/10.
2. <http://www.mayoclinic.com/health/achilles-tendinitis/DS00737/DSECTION=treatments%2Dand%2Ddrugs>. Accessed 5/10/10.
3. Tumitty S, Munn J, Hurley DA, Basford JR, and Baxter GD. Low level laser treatment of tendinopathy: a systematic review with meta-analysis. *Photomed Laser Surg.* Feb 2010. 28(1): 3-16.
4. Bjordal JM and Coupe C. *Low level laser therapy can be effective for tendonitis: a meta-analysis.* University of Bergen, Dept. of Physiotherapy Science. Bergen, Norway. 2008.
5. Ibid. ref 4.
6. Bjordal JM, Iverson V, Brandao Martins Lopes RA. Low level laser therapy reduces: Inflammation in activated Achilles tendonitis. *Progress in biomedical optics and imaging.* 2006. 7(26).
7. Enwemeka C et al. *Effect of HeNe photobiostimulation on tendon fibroblast protein synthesis: preliminary report.* Proceedings of the Ninth Congress of the International society for Laser Surgery and Medicine, Anaheim, Calif, USA. 2-6 Nov 1991.
8. Reddy GK et al. Biochemistry and biomechanics of healing tendon: Part II. Effects of combined laser therapy and electrical stimulation. *Med Sci Sports Exerc.* 1998. 30(6): 794-800.
9. Reddy GK et al. Laser photostimulation of collagen production in healing rabbit achilles tendons. *Lasers in Medicine and Surgery.* 1998. 22: 281-287.
10. Parizotto NA and Barankauskas V. *Structural analysis of collagen fibrils after HeNe laser photostimulated regenerating rat tendon.* Proceedings of the 2nd Congress World Assoc for Laser Therapy, Kansas City, September 1998.
11. Strupinska E. *Low power laser used in tendon damage. Lasers in Medicine.* Proceedings of SPIE. 1996. Vol. 2781: 177-183.
12. Demir H, Menku P, Kirnap M, Calis M, and Ikizceli I. Comparison of the effects of laser, ultrasound, and combined laser and ultrasound treatments in experimental tendon healing. *Lasers Surg Med.* 2004. 35(1): 84-89.
13. Stergioulas A, Stergioula M, Aarskog R, Lopes-Martins RA, and Bjordal JM. Effects of low- level laser therapy and eccentric exercises in the treatment of recreational athletes with chronic achilles tendinopathy. *Am J Sports Med.* 2008.; 36: 881-887.
14. Tuner J and Hode L. *The laser therapy handbook.* Prima Book AG. Grangesberg, Sweden. 2007. p 84.