

ACHILLES TENDINOPATHY (mid-substance): Summary of the Evidence for Physical Therapy Interventions

PURPOSE, SCOPE & DISCLAIMER: The purpose of this document is to provide physical therapists with a summary of the evidence for interventions commonly used to manage mid-substance Achilles tendinopathy. This decision-making tool is evidence-informed and where there is insufficient evidence, expert-informed. It is not intended to replace the clinician's clinical reasoning skills and inter-professional collaboration. 'Acute' refers primarily to the stage with the cardinal signs of heat, redness, pain, swelling and loss of function and a very recent onset of symptoms.

INTERVENTION	STAGE OF PATHOLOGY	CLINICAL RESEARCH EVIDENCE	PUBLISHED EXPERT OPINION	TAKE HOME MESSAGE	CLINICAL IMPLICATION <i>*See final page for description of categories</i>
Manual Therapy - Joint mobs - Soft tissue techniques	Acute	No	Yes	There is no clinical evidence but there is expert level consensus to <u>support</u> the use of joint mobilizations in the acute stage if assessment reveals joint restriction.	<u>May consider</u> using manual therapy in the acute stage after undertaking a comprehensive biomechanical evaluation of the hip, knee, foot and ankle.
		No	No	The clinical evidence neither supports nor refutes the use of frictions in the acute stage.	
- Joint mobs - Soft tissue techniques	Chronic	Yes 1 CS	Yes	There is a small amount of clinical evidence and more substantial expert level consensus to <u>support</u> the use of joint mobilizations in the chronic stage if assessment reveals joint restriction.	<u>May consider</u> using manual therapy in the chronic stage after undertaking a comprehensive biomechanical evaluation of the hip, knee, foot and ankle.
		Yes 1 SR 2 CS	Yes	There is a small amount of clinical evidence to <u>support</u> the use of soft tissue techniques, such as frictions, in the chronic stage.	<u>May consider</u> a trial of soft tissue techniques, such as frictions, in the chronic stage. Combining with an eccentric exercise regime may produce superior results.
Exercise	Acute	No	Yes	There is a small amount of expert opinion to <u>support</u> the use of stretches in the acute stage.	<u>May consider</u> using stretching exercises in acute stage. No prescription parameters are provided. ACSM recommends 10-30 sec hold, 2-4 repetitions.
	Chronic	Yes 14 OS 7 SR 8 RCT	Yes	There is a large amount of clinical evidence to <u>support</u> the use of exercise in the chronic stage but the precise parameters to ensure effectiveness are not clear. Eccentric exercise in particular is supported although some protocols use both concentric and eccentric exercise. One RCT showed heavy slow resistance training is equally as effective as eccentric training.	<u>Strongly consider</u> using exercise in the chronic stage. <i>*See Appendix A for further details on exercise prescription.</i>

INTERVENTION	STAGE OF HEALING	CLINICAL RESEARCH EVIDENCE	PUBLISHED EXPERT OPINION	TAKE HOME MESSAGE	CLINICAL IMPLICATION <i>*See final page for description of categories</i>
Low level laser therapy (LLLT)	Acute	Yes 2 SR	Yes	There is no clinical evidence, but there is a physiological rationale, to <u>support</u> the use of LLLT in the acute stage.	<u>May consider</u> a trial of LLLT in the acute stage at the doses recommended by the World Association for Laser Therapy (www.walt.nu) i.e., 2-4 J/point (not per cm ²)*, minimum 2-3 points. <i>*See Appendix B for further details on calculation of dosage.</i>
	Chronic	Yes 1 MA 6 RCT	Yes	There is <u>conflicting</u> clinical evidence and conflicting expert opinion to support the use of LLLT in the chronic stage.	<u>Consider</u> a trial of LLLT in the chronic stage at the following parameters: 0.9 J/point (not per cm ²)*; 6 points on tendon. <i>*See Appendix B for further details on calculation of dosage.</i>
Ultrasound (US)	Acute	No	No	There is no clinical evidence, but there is physiological rationale, to <u>support</u> the use of US in the acute stage.	<u>May consider</u> a trial of US in the acute stage at a low to moderate dose (0.5 - 1.0 W/cm ² , pulsed 1:4-1:1, 3 MHz, 5 mins for each treatment area equivalent in size to transducer head).
	Chronic	No	No	There is no clinical evidence and no physiological rationale to support the use of US in the chronic stage.	<u>Consider NOT</u> using US in the chronic stage.
Extracorporeal shock wave therapy (ESWT) <i>Focused or radial SWT (low energy)</i>	Acute	No	Yes	There is expert opinion which suggests that ESWT be reserved for chronic stage.	<u>Consider NOT</u> using Extracorporeal Shock Wave for the acute stage.
	Chronic	Yes 4 RCT 1 Cohort 1 SR	Yes	There is <u>conflicting</u> evidence to support the use of ESWT in the chronic stage. There is evidence suggesting that the outcomes are dependent upon the <u>dosage</u> of the shock wave energy (EFD - energy flux density = mJ/mm ²), rather than the <u>type</u> of shock wave generation (focused vs. radial ESWT). There is also evidence that the use of anesthetic required in high energy protocols decreases the effectiveness of ESWT. Therefore, using low energy ESWT protocols without the need for anesthetic are recommended as more practical, more tolerable, and less expensive with equivalent results. Low energy ESWT protocols can apply to both focused and radial ESWT.	<u>Consider</u> a trial of ESWT in the chronic stage, especially if other interventions have failed, at the following parameters: Low energy ESWT: EFD = 0.18 – 0.3 mJ/mm ² (2-4 Bars) 2000-3000 shocks 15-30 Hz 3-5 sessions, weekly intervals. ESWT may enhance outcomes compared to exercise alone, therefore patients should be instructed to continue with a well-designed exercise program.

INTERVENTION	STAGE OF HEALING	CLINICAL RESEARCH EVIDENCE	PUBLISHED EXPERT OPINION	TAKE HOME MESSAGE	CLINICAL IMPLICATION <i>*See final page for description of categories</i>
Iontophoresis using dexamethasone	Acute	Yes 1 RCT 1 review	No	There is a small amount of evidence to support the application of iontophoresis using dexamethasone in the acute stage. The role of iontophoresis is still <u>investigational</u> .	<u>May consider</u> , in the acute stage, a trial of iontophoresis, 0.4% dexamethasone (aqueous), 80 mA-min; 6 sessions over 3 weeks. A program of concentric-eccentric exercises should be continued in combination with iontophoresis, if exercise loading is tolerated.
	Chronic	No	No	There is no evidence that anti-inflammatory intervention with iontophoresis using dexamethasone has a useful role in the chronic stage.	<u>Consider NOT</u> using iontophoresis using dexamethasone in the chronic stage.
Taping	Acute	No	Yes	There is expert opinion to <u>support</u> the use of antipronation taping in the acute stage.	<u>May consider</u> using antipronation taping in the acute stage.
	Chronic	Yes 3 CS 1 SR	Yes	There is expert opinion and a small amount of clinical evidence to <u>support</u> the use of controlled pronation taping in the chronic stage.	<u>May consider</u> using antipronation taping in the chronic stage.
Orthotics	Acute	Yes 2 CS	Yes	There is a small amount of clinical evidence to <u>support</u> the use of orthotics in the acute stage.	<u>Consider</u> using orthotics – perhaps using taping first, in the acute stage.
	Chronic	Yes 3 CS 2 RCT 1 SR	Yes	There is a moderate amount of clinical evidence to <u>support</u> the use of orthotics in the chronic stage.	<u>Consider</u> using orthotics in the chronic stage.
Night splints and braces	Acute	No	Yes	There is expert opinion to <u>support</u> the use of night splints and braces in the acute stage.	<u>Consider</u> a trial of night splints and braces in the acute stage.
	Chronic	Yes 3 RCT 1 SR	Yes	There is a moderate amount of evidence <u>against</u> the use of night splints and braces in the chronic stage in conjunction with eccentric exercise.	<u>Consider NOT</u> using night splints and braces in the chronic stage in conjunction with exercise.

INTERVENTION	STAGE OF HEALING	CLINICAL RESEARCH EVIDENCE	PUBLISHED EXPERT OPINION	TAKE HOME MESSAGE	CLINICAL IMPLICATION <i>*See final page for description of categories</i>
Heel raise inserts	Acute	No	Yes	There is some expert opinion to <u>support</u> the use of heel raise inserts in the acute stage.	<u>May consider</u> a trial of inserts in the acute stage.
	Chronic	Yes 2 RCT	Yes	There is <u>conflicting</u> evidence for and against the use of heel inserts in the chronic stage.	<u>Consider</u> a trial of inserts in the chronic stage.
Needling techniques Acupuncture (Traditional Chinese medicine, anatomical, electrical) and Intramuscular stimulation	Acute	Yes 1 CS	No	There is a small amount of evidence to <u>support</u> the use of Traditional Chinese Medicine electro-acupuncture in the acute stage. There is expert opinion to <u>support</u> the use of other needling techniques in the acute stage.	<u>Consider</u> a trial of electro-acupuncture in the acute stage. <u>May consider</u> a trial of other acupuncture-related needling techniques in the acute stage.
	Chronic	Yes 1 CS	No	There is a small amount of evidence to <u>support</u> use of Traditional Chinese Acupuncture in the chronic stage. There is expert opinion on the use of other needling techniques in the chronic stage.	<u>Consider</u> a trial of Traditional Chinese Acupuncture in the chronic stage. <u>May consider</u> a trial of other acupuncture-related needling techniques in the chronic stage.

CS - Case studies; MA - Meta-analyses; OS - Observational studies; RCT - Randomized controlled trials; SR - Systematic reviews

<p>For any intervention selected by the clinician, it is strongly recommended that the clinician use one or more of the following outcome measures:</p> <p>A. Patient reported outcome measure such as:</p> <ul style="list-style-type: none"> A global measure of lower extremity function: e.g., The Lower Extremity Functional Scale (LEFS) - not specific to Achilles tendinopathy <ul style="list-style-type: none"> http://www.phyther.net/content/79/4/371/F1.large.jpg Detailed questionnaire, specific to Achilles tendinopathy e.g. the VISA-A questionnaire <ul style="list-style-type: none"> http://bism.bmi.com/content/suppl/2001/11/09/35.5.335.DC1/01055_Fig_1_data_supplement.pdf (click on 'view questionnaire') <p>B. Patient specific functional outcome measure such as:</p> <ul style="list-style-type: none"> How much weight can be applied to the plantar flexed foot on a weighing scale before the onset of pain The number of heel raises before the onset of pain The number of heel drops before the onset of pain The number of heel drops with a specific weight in a backpack before the onset of pain How far can the client walk or run before the onset of pain 	<p>Explanation of Clinical Implications</p> <ul style="list-style-type: none"> Strongly consider: High level/high quality evidence that this should be included in treatment. Consider: Consistent lower level/lower quality or inconsistent evidence that this should be included in treatment. May consider: No clinical evidence but expert opinion and/or plausible physiological rationale that this should be included in treatment. Consider NOT: High level/high quality evidence that this should not be included in treatment.
--	---

Developed by the BC Physical Therapy Tendinopathy Task Force: Dr. Joseph Anthony, Allison Ezzat, Diana Hughes, JR Justesen, Dr. Alex Scott, Michael Yates, Alison Hoens. April 2012.

Updated by Alexandra Kobza, Dr. Alex Scott. June 2015

A Physical Therapy Knowledge Broker project supported by: UBC Department of Physical Therapy, Physiotherapy Association of BC, Vancouver Coastal Research Institute and Providence Healthcare Research Institute.

REFERENCES

Please see *Appendix C Achilles Tendinopathy: Details of Individual Articles* for the specific details on each of the articles referenced in this document.

MANUAL THERAPY

Case Studies

Christenson RE. (2007). Effectiveness of specific soft tissue mobilizations for the management of Achilles tendinosis: Single case study- Experimental design. *Manual Therapy*,12; 63-71.

Voorn, R. (1998). Case report: can sacroiliac joint dysfunction cause chronic Achilles tendonitis? *JOSPT*. 27(6); 436-443.

Woodman RM, Pare L. (1982). Evaluation and treatment of soft tissue lesions of the ankle and forefoot using a Cyriax approach. *Physical Therapy*. 62 (8); 1144-47.

Expert Opinion

Carcia CR, Martin RL, Houck J, Wukich DK. (2010). Achilles pain, stiffness, and muscle power deficits: achilles tendinitis. *J Orthop Sports Phys Therapy*: 40 (9) A1-A26.

Review

Brosseau L, Casimiro L, Milne S. et al. (2002). Deep transverse friction massage for treating tendinitis. *Cochrane Database Systematic Reviews*. 4.

EXERCISE

Observational Studies

Alfredson H, Pietila T, Jonsson P & Lorentzon R. (1998). Heavy-load eccentric calf muscle training for the treatment of chronic Achilles tendinosis. *American Journal of Sports Medicine*. 26(3), 360-66.

Gaerding A, Movin T, Svensson L & Shalabi A. (2010). The long-term clinical and MRI results following eccentric calf muscle training in chronic Achilles tendinosis. *Skeletal Radiology*. May, 39(5), 435-42.

Knobloch K, Schreibermueller L, Kraemer R, Jogodzinski M, Vogt, PM & Redeker J. (2010). Gender and eccentric training in Achilles mid-portion tendinopathy. *Knee Surgery, Sports Traumatology, Arthroscopy*. May, 18(5), 648-55.

Ohberg L, Lorentzon R & Alfredson H. (2004). Eccentric training in patients with chronic Achilles tendinosis: normalised tendon structure and decreased thickness at follow-up. *British Journal of Sports Medicine*, February, 38(1), 8-11; discussion 11.

Petersen W, Welp R & Rosenbaum D. (2007). Chronic AT: a prospective randomized trial comparing the therapeutic effect of eccentric training, the AirHeel brace, and a combination of both. *American Journal of Sports Medicine*, October, 35(10), 1659-67.

Richards PJ, McCall IW, Day C, Belcher J & Maffulli N. (2010). Longitudinal microvascularity in Achilles tendinopathy. *Skeletal Radiology*. June, 39(6), 509-21.

Roos EM, Engstrom M, Lagerquist A & Soderberg B. (2004). Clinical improvement after 6 weeks of eccentric exercise in patients with mid-portion Achilles tendinopathy: a randomized trial with one year follow-up. *Scandinavian Journal of Medicine and Science in Sports*. October, 14(5), 286-95.

Shalabi A, Kristoffersen-Wiberg M, Aspelin P & Movin T. (2004). Immediate Achilles tendon response after strength training evaluated by MRI. *Medicine and Science in Sports and Exercise*. November, 36(11), 1841-6.

Silbernagel KG, Brorsson A & Lundberg M. (2011). The majority of patients with Achilles tendinopathy recover fully when treated with exercise alone: a 5 year follow-up. *American Journal of Sports Medicine*. March, 39(3), 607-13.

Silbernagel KG, Thomee R, Eriksson BI & Karlsson, J. (2007). Full symptomatic recovery does not ensure full recovery of muscle tendon function in patients with Achilles tendinopathy. *British Journal of Sports Medicine*. April, 41(4), 276-80; discussion 280.

Verrall G, Schofield, S & Brustad T. (2011). Chronic Achilles tendinopathy treated with eccentric stretching program. *Foot Ankle International*. September, 32(9), 843-9.

Westh E, Kongsgaard M, Bojsen-Moller J, Aagaard P, Hansen M, Kjaer M & Magnuson, S.P. (2008). Effect of habitual exercise on the structural and mechanical properties of human tendon, in vivo, in men and women. *Scandinavian Journal of Medicine and Science in Sports*. Feb;18(1):23-30.

RCTs

Backman LJ, Andersson G, Wennstig G, Forsgren S & Danielson P. (2011). Endogenous substance P production in the Achilles tendon increases with loading in an in vivo model of tendinopathy - peptidergic elevation preceding tendinosis-like tissue changes. *Journal of Musculoskeletal and Neuronal Interactions*, June, 11(2), 133-40.

Beyer, R., Kongsgaard, M., Hougs Kjaer, B., Ohlenschlaeger, T., Kjaer, M., & Magnusson, S. P. (2015). Heavy Slow Resistance Versus Eccentric Training as Treatment for Achilles Tendinopathy: A Randomized Controlled Trial. *Am J Sports Med*. doi: 10.1177/0363546515584760

Rompe JD, Furia J & Maffulli N. (2009). Eccentric loading versus eccentric loading plus shock-wave treatment for mid-portion Achilles tendinopathy: a randomized controlled trial. *American Journal of Sports Medicine*, March, 37(3), 463-70.

Rompe JD, Nafe B, Furia JP & Maffulli N. (2007). Eccentric loading, shock-wave treatment, or a wait and see policy for tendinopathy of the main body of tendo Achilles: a randomized controlled trial. *American Journal of Sports Medicine*, March, 35(3): 374-83.

Silbernagel K, Thomee P & Karlson J. (2001). Eccentric overload training for patients with chronic achilles tendinopathy - a randomized controlled study with reliability testing of the evaluating methods. *Scandinavian Journal of Medicine and Science in Sports*, 11: 197-206. Silbernagel KG, Thomee R, Eriksson BI & Karlsson J. (2007). Continued sports activity, using a pain-monitoring model during rehabilitation in patients with Achilles tendinopathy: a randomized controlled study. *American Journal of Sports Medicine*, June, 35(6): 897-906.

Stevens, M., & Tan, C.-W. (2014). Effectiveness of the Alfredson protocol compared with a lower repetition-volume protocol for midportion Achilles tendinopathy: a randomized controlled trial. *Journal of Orthopaedic & Sports Physical Therapy*, 44(2), 59-67.

Yu, J., Park, D., & Lee, G. (2013). Effect of Eccentric Strengthening on Pain, Muscle Strength, Endurance, and Functional Fitness Factors in Male Patients with Achilles Tendinopathy. *American Journal of Physical Medicine & Rehabilitation*, 92(1), 68-76. doi: 10.1097/PHM.0b013e31826eda63

Reviews

Kingma JJ, de Nijkerk R, Wittink HM, & Takken T. (2007). Eccentric Overload Training in Patients with Chronic AT: A systematic review. *British Journal of Sports Medicine*. June, 41(6): e3.

Kraemer R, Lorenzen J, Vogt PM & Knobloch K. (2010). Systematic review about eccentric training in chronic achilles tendinopathy. *Sportverletz Sportschaden*. December, 24(4): 204-11. [Article in German, Abstract translated]

Magnussen RA, Dunn WR & Thomson AB. (2009). Nonoperative treatment of midportion Achille tendinopathy: a systematic review. *Clinical Journal of Sport Medicine*. January, 19(1): 54-64.

Malliaras, P., Barton, C., Reeves, N., & Langberg, H. (2013). Achilles and Patellar Tendinopathy Loading Programmes. *Sports Medicine*, 43(4), 267-286. doi: 10.1007/s40279-013-0019-z

Meyer A, Tumilty S & Baxter GD. (2009). Eccentric exercise protocols for chronic non-insertional Achilles tendinopathy: how much is enough? *Scandinavian Journal of Medicine and Science in Sports*. October, 19(5), 609-15.

Wasielewski NJ & Kotsko KM. (2007). Does eccentric exercise reduce pain and improve strength in physically active adults with symptomatic lower extremity tendinosis? A systematic review. *Journal of Athletic Training*. Jul-Sep, 42(3): 409-21.

Woodley BL, Newsham-West RJ & Baxter GD. (2007). Chronic tendinopathy: effectiveness of eccentric exercise. *British Journal of Sports Medicine*. April, 41(4): 188-98; discussion 199.

Expert Opinion

Magnusson SP, Langberg H & Kjaer M. (2010). The pathogenesis of tendinopathy: balancing the response to loading. *Nature Reviews Rheumatology*. May, 6(5): 262-8.

LASER

RCTs

Bjoridal, JM. (2006). A randomised, placebo controlled trial of low level laser therapy for activated Achilles tendinitis with microdialysis measurement of peritendinous prostaglandin E2 concentrations. *British Journal of Sports Medicine*, 40(1): 76-80.

Darre E, Klokker M & Lund P. (1994). Laserbehandling af akillesenettendinit. *Ugeskr Laeger*. Nov 7; 156 (45): 6680-3. Danish.

Stergioula A, Stergioula M, Aarskog R, Lopes-Martins RAB & Bjoridal JM (2008). Effects of low-level laser therapy and eccentric exercises in the treatment of recreational athletes with chronic achilles tendinopathy. *The American Journal of Sports Medicine*, 36(5): 881-887.

Tumilty, S., McDonough, S., Hurley, D. A., & Baxter, G. D. (2012). Clinical Effectiveness of Low-Level Laser Therapy as an Adjunct to Eccentric Exercise for the Treatment of Achilles' Tendinopathy: A Randomized Controlled Trial. *Archives of Physical Medicine and Rehabilitation*, 93(5), 733-739. doi: <http://dx.doi.org/10.1016/j.apmr.2011.08.049>

Tumilty S, Munn J, Abbott JH, McDonough S, Hurley DA & Baxter GD. (2008). Laser therapy in the treatment of Achilles tendinopathy: a pilot study. *Photomedicine and Laser Surgery*, 26(1): 25-30.

Tumilty S, Munn J, Abbott JH, McDonough S, Hurley DA, Basford JR & Baxter G.D. (2010). Laser Therapy in the Treatment of Achilles Tendinopathy: A Randomised Controlled Trial. *AIP Conf. Proc.* May 31. Volume 1226, pp. 163-169.

Reviews

Bjordal J & Couppe C. (2001). Low Level Laser Therapy for Tendinopathy. Evidence of A Dose-Response Pattern. *Physical Therapy Reviews*, 6: 91-99.

Bjordal JM, Lopes-Martins RAB, Joensen J & Iversen VV. (2010). The anti-inflammatory mechanism of low level laser therapy and its relevance for clinical use in physiotherapy. *Physical Therapy Reviews*, 15(4): 286–293.

Peplow PV, Chung TY & Baxter GD. (2010). Application of low level laser technologies for pain relief and wound healing: overview of scientific bases. *Physical Therapy Reviews*, 15(4): 253–285.

Meta-analysis

Tumilty S, Munn J, McDonough S, Hurley D A, Basford JR & Baxter GD. (2010). Low level laser treatment of tendinopathy: a systematic review with meta-analysis *Photomedicine and Laser Surgery*, 28(1): 3–16.

EXTRA-CORPOREAL SHOCK WAVE THERAPY – LOW ENERGY (FOCUSED AND RADIAL)

Cohort

Lakshmanan P, O'Doherty D. (2004). Chronic Achilles tendinopathy: treatment with extra-corporeal shock wave therapy. *Foot and Ankle Surgery*. 10: 125-130.

RCTs

Costa ML, Shepstone L, Donell ST, Thomas TL. (2005). Shock Wave Therapy for chronic Achilles tendon pain: a randomized placebo controlled trial. *Clinical Orthopedics and Related Research*. 440: 199-204.

Rasmussen S, Christensen M, Mathiesen I, Simonson O. (2008). Shock wave therapy for chronic Achilles tendinopathy: a double-blind, randomized clinical trial of efficacy. *Acta Orthopaedica*. 79(2): 249-256.

Rompe J, Nafe B, Furia J. (2007). Eccentric loading, shock wave therapy or 'wait and see' policy for tendinopathy of the main body of tendo achillis: a randomized controlled trial. *American Journal of Sports Medicine*. 35(3): 374-383.

Rompe J, Furia J, Maffulli N. (2009). Eccentric loading vs eccentric loading plus shock wave treatment for mid-portion Achilles tendinopathy. A randomized controlled trial. *American Journal of Sports Medicine*. 37(3): 463-470.

Review

Al-Abbad, H., & Simon, J. V. (2013). The effectiveness of extracorporeal shock wave therapy on chronic achilles tendinopathy: a systematic review. *Foot Ankle Int*, 34(1), 33-41. doi: 10.1177/1071100712464354

IONTOPHORESIS WITH DEXAMETHASONE

RCTs

Neeter C, Thomee R, Silbernagel K, Thomee P, Karlson J. (2003). Iontophoresis with and without dexamethasone in the treatment of acute Achilles tendon pain. *Scandinavian Journal of Medicine and Science in Sports*. 13(6): 376-382.

Review

Brown CD, Lauber CA. (2011). Evidence-based guidelines for utilization of dexamethasone iontophoresis. *International Journal of Athletic Therapy and Training*. 16(4): 33-36.

TAPING

Case Studies

Lee, J.-h., & Yoo, W.-g. (2012). Treatment of chronic Achilles tendon pain by Kinesio taping in an amateur badminton player. *Physical Therapy in Sport*, 13(2), 115-119. doi: <http://dx.doi.org/10.1016/j.ptsp.2011.07.002>

Riddle DL & Freeman DB. (1988). Management of a patient with a diagnosis of bilateral plantar fasciitis and Achilles tendinitis. A case report. *Phys Ther*. Dec; 68(12): 1913-6.

Smith M, Brooker S, Vicenzino B & McPoil T. (2004). Use of anti-pronation taping to assess suitability of orthotic prescription: case report. *Aust J Physiother*.; 50(2): 111-3.

Review

Scott, L., Munteanu, S., & Menz, H. (2015). Effectiveness of Orthotic Devices in the Treatment of Achilles Tendinopathy: A Systematic Review. *Sports Medicine*, 45(1), 95-110. doi: 10.1007/s40279-014-0237-z

ORTHOTICS

Case Studies

Greene BL. (2002). Physical therapist management of fluoroquinolone-induced Achilles tendinopathy. *Phys Ther*. Dec; 82(12): 1224-31.

Riddle DL & Freeman DB. (1988). Management of a patient with a diagnosis of bilateral plantar fasciitis and Achilles tendinitis. A case report. *Phys Ther*. Dec; 68(12): 1913-6.

Smith M, Brooker S, Vicenzino B, McPoil T. (2004). Use of anti-pronation taping to assess suitability of orthotic prescription: case report. *Aust J Physiother*. 50(2): 111-3.

Case Series

Donoghue OA, Harrison AJ, Laxton P & Jones RK. (2008). Orthotic control of rear foot and lower limb motion during running in participants with chronic Achilles tendon injury. *Sports Biomech*. May; 7(2): 194-205.

Gross ML, Davlin L & Evanski PM (1991). Effectiveness of orthotic shoe inserts in the long-distance runner. *Am J Sports Med* 19: 409–412.

RCTs

Mayer F, Hirschmuller A, Muller S, Schuberth M & Baur H. (2007). Effects of short-term treatment strategies over 4 weeks in Achilles tendinopathy. *Br J Sports Med*, 41(7): e6.

Munteanu, S. E., Scott, L. A., Bonanno, D. R., Landorf, K. B., Pizzari, T., Cook, J. L., & Menz, H. B. (2014). Effectiveness of customised foot orthoses for Achilles tendinopathy: a randomised controlled trial. *Br J Sports Med*. doi: 10.1136/bjsports-2014-093845

Review

Scott, L., Munteanu, S., & Menz, H. (2015). Effectiveness of Orthotic Devices in the Treatment of Achilles Tendinopathy: A Systematic Review. *Sports Medicine*, 45(1), 95-110. doi: 10.1007/s40279-014-0237-z

BRACES AND NIGHT SPLINTS

RCTs

de Vos RJ, Weir A, Visser RJ et al. (2007). The additional value of a night splint to eccentric exercises in chronic midportion Achilles tendinopathy: a randomised controlled trial. *Br J Sports Med*; 41: e5.

Knobloch K, Schreibermueller L, Longo UG et al. (2008). Eccentric exercises for the management of tendinopathy of the main body of the Achilles tendon with or without the AirHeel Brace. A randomized controlled trial. A: effects on pain and microcirculation. *Disabil Rehabil* 30: 1685-91.

Petersen W, Welp R & Rosenbaum D. (2007). Chronic Achilles tendinopathy: a prospective randomized study comparing the therapeutic effect of eccentric training, the AirHeel brace, and a combination of both. *Am J Sports Med*; 35: 1659-67.

Review

Scott, L., Munteanu, S., & Menz, H. (2015). Effectiveness of Orthotic Devices in the Treatment of Achilles Tendinopathy: A Systematic Review. *Sports Medicine*, 45(1), 95-110. doi: 10.1007/s40279-014-0237-z

HEEL RAISE INSERTS

MacLellan GE & Vyvyan B. (1981). Management of pain beneath the heel and Achilles tendonitis with visco-elastic heel inserts. *Br J Sports Med*. Jun; 15(2): 117-21.

Lowdon A, Bader DL & Mowat AG (1984). The effect of heel pads on the treatment of Achilles tendinitis: a double blind trial. *Am J Sports Med*. Nov-Dec; 12(6): 431-5.

NEEDLING TECHNIQUES/ACUPUNCTURE

Jens Foell S (2010). Is electro-acupuncture a safe and cost-effective treatment for Achilles tendonopathy in a primary care setting? *International Musculoskeletal Medicine*. 32(2) 51-54.

Fagan N & Staten P. (2003). An audit of self-acupuncture in primary care. *Acupunct Med*; 21 :28-3