

ACHILLES TENDINOPATHY IN SPORT: ANATOMICAL SITE, COMPLETED LOADING AND RETURN TO PERFORMANCE

George Havenith

School of Design and Creative Arts, Loughborough University, United Kingdom

Received: 02/8/2024 Revised: 12/10/2024 Accepted: 29/11/2024 Published: 20/12/2024

Correspondence: G.Havenith@lboro.ac.uk

ABSTRACT

Persistent Achilles tendon pain requires assessment of anatomical location, completed exercise and the sporting activity that remains restricted. This study examines adult nonoperative care. Treatment comparisons are interpreted by eligibility criteria, dose, adherence, comparator and follow-up; no meta-analysis or formal certainty grading was undertaken. A 58-patient trial found improvement with both eccentric exercise and heavy slow resistance, with adherence of 78% and 92%, respectively. In 40 recreational athletes, Alfredson and Silbernagel programmes produced an adjusted VISA-A difference of 2.4 points (95% CI -8.5 to 13.3). Insertional disease requires separate interpretation: a 119-patient trial found no added 24-week benefit from radial shockwave treatment during eccentric exercise. Injection comparisons also differed. Six-month or 24-week VISA-A contrasts were -2.7 points (95% CI -8.8 to 3.3) for platelet-rich plasma, 0.5 (-17.8 to 18.8) for high-volume saline/lidocaine, and 17.7 (8.4 to 27.0) for corticosteroid plus exercise. The corticosteroid comparison included three months without running or jumping and measured differences in improvement rather than endpoint scores. VISA-A change, unrestricted sport and restoration of previous performance are distinct outcomes. Treatment escalation should follow assessment of the exercise completed, anatomical diagnosis and residual sporting limitation, with each intervention interpreted under the conditions tested.

Keywords: Achilles tendinopathy; insertional disease; progressive loading; treatment escalation; VISA-A; return to performance.

INTRODUCTION

Achilles tendinopathy denotes persistent tendon pain and loss of function related to mechanical loading (Scott et al., 2020). The Dutch guideline distinguishes insertional symptoms within 2 cm of the calcaneal attachment from midportion symptoms approximately 2–7 cm proximal to it. Diagnosis combines pain location, activity-related symptoms, local thickening and tenderness. Imaging is indicated when the diagnosis or clinical course remains uncertain (de Vos et al., 2021). These distinctions affect exercise range and the applicability of treatment comparisons.

Treatment duration alone does not describe rehabilitation exposure. Calf resistance, ankle range, progression, frequency and completed sessions determine the exercise delivered; running and jumping contribute additional tendon loading. An athlete who has completed strengthening but cannot tolerate repeated accelerations has a different residual limitation from an athlete whose insertional pain prevents the prescribed exercise range. Reassessment should identify that limitation before selecting another intervention (de Vos et al., 2021; Silbernagel et al., 2020).

Here, persistent symptoms mean continuing load-related pain and functional restriction. The injection trials required at least two months or more than three months of symptoms, and previous care varied. These entry criteria should remain distinct from the Dutch guideline's recommendation for at least 12 weeks of education, load management and

calf exercise (de Vos et al., 2021). A network meta-analysis of 29 randomized trials examined comparative treatment effects (van der Vlist et al., 2021). but neither symptom duration nor a questionnaire score establishes that an athlete has completed an appropriate rehabilitation dose.

METHODS

CLINICAL APPRAISAL AND NUMERICAL COMPARISONS

Appraisal addressed symptom duration, prior treatment, allocation, masking, comparator, exercise delivery, adherence, attrition, adverse events and sporting outcomes. Full texts were consulted when accessible; otherwise assessment was limited to the indexed abstract. Undocumented allocation or masking procedures were not assumed.

This was a narrative review without a registered protocol, duplicate independent screening, a complete database screening record, RoB 2 assessment or GRADE evaluation. Treatment estimates and confidence intervals were checked against the trial articles or abstracts. Endpoint differences and differences in improvement were retained as separate quantities. No pooled estimate, indirect ranking or individual-level analysis was calculated. Figure 1 displays group means and confidence intervals from Johannsen et al.; it does not combine injection trials.

VISA-A CHANGE AND SPORTING FUNCTION

The Victorian Institute of Sports Assessment–Achilles questionnaire combines pain, function and activity in a total score; higher values indicate fewer limitations. The score does not directly measure calf strength, tendon mechanical properties or capacity for unrestricted competition.

Comins and colleagues identified weaknesses in item development and psychometric properties of the Danish VISA-A version (Comins et al., 2021). Korakakis and colleagues found very-low-quality evidence for content and structural validity, alongside more favourable evidence for some reliability and responsiveness properties (Korakakis et al., 2021,?). A treatment-related score difference therefore requires interpretation alongside the function actually assessed.

Lagas and colleagues estimated meaningful within-person changes of 14 VISA-A points at 12 weeks and 7 points at 24 weeks in physically active patients receiving exercise and an injection (Lagas et al., 2021). These estimates depend on population, treatment and assessment time. They describe individual improvement and cannot automatically serve as thresholds for a mean difference between randomized groups.

Clinical reassessment should record VISA-A change, the sporting task completed and the exposure sustained over successive sessions. A higher score during restricted running does not establish tolerance of full training. Likewise, symptom improvement without recovery of repeated heel-rise or jumping capacity does not establish restoration of previous sporting performance (Silbernagel et al., 2020).

EXERCISE DOSE AND ANATOMICAL SITE

INSERTIONAL LOADING AND ANKLE RANGE

Insertional loading combines tensile force with compression near the posterior calcaneus. Cook and Purdam describe tendon contact with bone as a reason to examine compressive loading (Cook and Purdam, 2012). In a case-control investigation involving 20 participants, Chimenti and colleagues found altered regional transverse compression and reduced axial tensile strain during dorsiflexion in insertional tendinopathy (Chimenti et al., 2017). The investigation did not test exercise dosing or establish a harmful dorsiflexion threshold.

The Dutch guideline advises initially considering calf exercise on a flat surface for insertional symptoms (de Vos et al., 2021). Range can then be adjusted according to pain response and the activity being restored. Dakin and colleagues identified inflammatory signalling in Achilles tendon tissue (Dakin et al., 2018). but tissue findings alone do not establish the clinical effect of an anti-inflammatory treatment.

ECCENTRIC, HEAVY SLOW RESISTANCE AND COMBINED LOADING

Beyer and colleagues randomized 58 patients with chronic midportion tendinopathy to 12 weeks of eccentric exercise or heavy slow resistance. Both groups improved through 52 weeks. Adherence was 78% with eccentric exercise and

92% with heavy slow resistance (Beyer et al., 2015). The trial supports both prescriptions, while the adherence difference identifies a practical consideration in exercise selection.

Stevens and Tan compared standard eccentric loading with a lower-volume, do-as-tolerated programme in 28 nonathletic patients. Final pain and function comparisons at six weeks did not differ significantly (Stevens and Tan, 2014). The small sample and short follow-up limit conclusions about small treatment differences or sustained competitive sport.

Habets and colleagues compared Alfredson eccentric loading with Silbernagel combined concentric–eccentric loading in 40 recreational athletes. The adjusted VISA-A treatment effect was 2.4 points (95% CI –8.5 to 13.3); pain during sport did not differ significantly. Mean adherence was 74.1% and 77.3%, respectively. Recruitment was below the planned 86 participants (Habets et al., 2021). The interval remains compatible with differences in either direction and does not establish equivalence.

A quasi-randomized trial found no immediate analgesic advantage from the isometric prescriptions tested (van der Vlist et al., 2020). Its acute observation period does not determine longer-term loading effects. Maetz and colleagues' review of randomized exercise trials also does not establish a universally superior loading prescription (Maetz et al., 2023).

HEEL LIFTS AND SHOCKWAVE TREATMENT

Kedia's insertional trial combined several physical therapy components, so improvement cannot be assigned separately to heel lifts, stretching or eccentric exercise (Kedia et al., 2014). The HEALTHY trial instead compared heel lifts with eccentric exercise in midportion disease. Its 12-week adjusted VISA-A difference of 9.6 points (95% CI 1.8–17.4) favoured heel lifts. The point estimate was below the prespecified 10-point important difference, while the interval included effects above that value (Rabusin et al., 2021). The comparison does not test heel lifts added to heavy slow resistance or treatment of insertional disease.

Mansur and colleagues enrolled 119 patients with insertional tendinopathy. After three radial shockwave or sham sessions with eccentric exercise, 24-week VISA-A means were 63.2 and 62.3, respectively, without an added shockwave benefit (Mansur et al., 2021). Paantjens and colleagues found moderate-quality evidence supporting shockwave added to loading for midportion disease, but substantially less certain evidence and no established insertional benefit (Paantjens et al., 2022). Anatomical site and the exercise comparator therefore remain essential to interpreting shockwave treatment.

Before changing treatment, exercise delivery should be documented as resistance, ankle range, progression, completed sessions and concurrent sport exposure. The clinical distinction is between an exercise prescription that was not completed and persistent limitation after the intended dose was completed. Either may require further assessment, but the treatment history differs.

INJECTION EFFECTS UNDER THE CONDITIONS TESTED

PLATELET-RICH PLASMA AND HIGH-VOLUME INJECTION

The PRP trial's six-month adjusted endpoint difference was –2.7 VISA-A points (95% CI –8.8 to 3.3) (Kearney et al., 2021). This comparison does not support routine use of that single leukocyte-rich preparation in the enrolled population. The high-volume saline/lidocaine comparison yielded 0.5 points at 24 weeks (95% CI –17.8 to 18.8) (van der Vlist et al., 2020). It did not establish benefit, and its wider interval remains compatible with appreciable effects in either direction. Neither result establishes equivalence between active treatment and control.

The high-volume trial required an unsatisfactory response to six weeks of exercise. That entry criterion is shorter than the Dutch guideline's initial management period of at least 12 weeks (de Vos et al., 2021; van der Vlist et al., 2020). Its eligibility therefore cannot define failure of a fully completed longer rehabilitation programme.

CORTICOSTEROID WITH RESISTANCE EXERCISE

Johannsen and colleagues found a 17.7-point greater improvement at six months with corticosteroid plus exercise than with placebo plus exercise (95% CI 8.4–27.0) (Johannsen et al., 2022). Both groups avoided running and jumping for three months. The treatment effect consequently applies to an anterior peritendinous injection combined with resistance exercise and that restriction; it does not establish faster competitive return.

The improvement contrast favoured corticosteroid at six and nominal 24 months, but was not significant at 12 months. Figure 1 displays the actual group means: initial VISA-A values were 43 and 50, and six-month means were 82 and 72. These raw means are distinct from the adjusted difference in improvement. Two-year assessments occurred between 22 and 32 months (Johannsen et al., 2022).

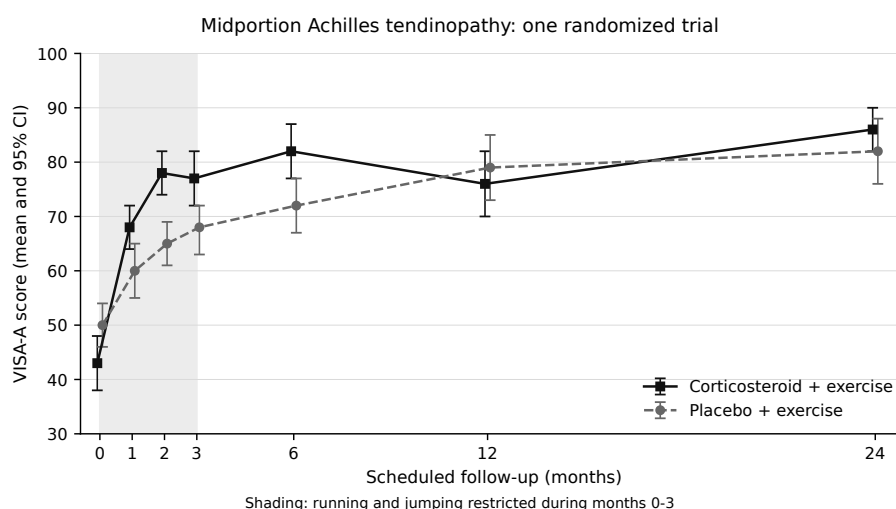


FIGURE 1. VISA-A SCORES DURING CORTICOSTEROID OR PLACEBO INJECTION WITH RESISTANCE EXERCISE IN JOHANNSEN ET AL. (2022). POINTS SHOW GROUP MEANS AND BARS SHOW 95% CONFIDENCE INTERVALS. SHADING MARKS THE THREE-MONTH RESTRICTION ON RUNNING AND JUMPING. INITIAL MEANS WERE 43 AND 50; SIX-MONTH MEANS WERE 82 AND 72. THE NOMINAL 24-MONTH VISITS OCCURRED AT 22-32 MONTHS.

Treatment selection should include the injection site, product, number of procedures, exercise prescription, adverse events and compatibility of the activity restriction with the athlete's training schedule. Changing these conditions requires caution because the randomized effect does not directly describe the altered treatment.

RETURN TO SPORT AND PREVIOUS PERFORMANCE

The Bern consensus distinguishes return to participation, return to sport and return to performance (Arden et al., 2016). In Achilles rehabilitation, modified training, unrestricted sport and restoration of previous output should therefore be recorded separately.

Habets and colleagues identified 35 studies describing return to sport, of which 19 specified return criteria; definitions and operational detail varied (Habets et al., 2018). Clinical rehabilitation guidance emphasizes progressive loading and functional assessment because deficits can persist after pain decreases (Silbernagel et al., 2020). The evidence does not establish a universal Achilles clearance threshold.

Assessment should match the athlete's intended exposure. For running, the record should specify duration, pace and terrain. For jumping sports, it should specify repeated take-offs and landings, session volume and symptom response. These are clinical assessment tasks, not validated numerical clearance rules. Tolerance of one session does not establish tolerance of the full training schedule.

An 11-year observational investigation in elite male football associated earlier return after Achilles tendon injury with recurrence (Gajhede-Knudsen et al., 2013). The timing of return was not randomized; the association does not prove that delaying return prevents recurrence or establish a mandatory waiting period. Its sport- and sex-specific population also limits transfer to other athletes.

The return decision should state the participation level achieved, the exposure sustained and any remaining restriction. VISA-A improvement contributes to this assessment but does not establish recovery of tendon mechanical properties or eliminate recurrence risk.

REASSESSMENT BEFORE TREATMENT ESCALATION

Table 1 identifies the information needed to distinguish incomplete exercise delivery, persistent limitation after completed care and inability to sustain sporting exposure. These questions support clinical assessment; they have not been validated together as a treatment-selection instrument.

A cohort investigation associated lower socioeconomic status with worse treatment outcomes, but only 58% completed the 24-week questionnaire (Sleeswijk Visser et al., 2024). Confounding and incomplete follow-up limit causal conclusions. Feasibility should be assessed directly rather than inferred from socioeconomic category.

TABLE 1. CLINICAL INFORMATION TO ESTABLISH BEFORE CHANGING TREATMENT OR INCREASING SPORT EXPOSURE.

Clinical question	Information to document	Treatment implication
Does the diagnosis fit the current symptoms?	Pain location, activity-related symptoms, examination and atypical clinical course (de Vos et al., 2021)	Reassess an uncertain diagnosis before applying a treatment comparison.
What exercise was completed?	Resistance, ankle range, progression, completed sessions and concurrent sport exposure (Beyer et al., 2015; Habets et al., 2021; Silbernagel et al., 2020)	Distinguish incomplete delivery from persistent symptoms after the intended dose.
Does the adjunct match the anatomical site?	Insertional or midportion diagnosis; exercise comparator; adjunctive or alternative treatment (Rabusin et al., 2021; Mansur et al., 2021; Paantjens et al., 2022)	Midportion benefit does not establish insertional benefit.
Can the treatment conditions be followed?	Injection product, site, number, exercise prescription and activity restrictions (Kearney et al., 2021; van der Vlist et al., 2020; Johannsen et al., 2022)	Interpret the treatment effect under the conditions tested.
What sporting exposure is sustained?	Modified participation, unrestricted sport or previous performance; task, session volume and repeated-session response (Arden et al., 2016; Habets et al., 2018)	Do not infer unrestricted performance from VISA-A change alone.
Can the patient complete the prescription?	Access to care, available time, equipment and practical barriers (Sleeswijk Visser et al., 2024)	Adjust delivery to the patient's circumstances without assuming that socioeconomic associations are causal.

The network meta-analysis of 29 trials and 1,640 participants classified none of its included trials as low risk of bias (van der Vlist et al., 2021). This assessment applies to that trial set, not automatically to later comparisons. It limits confidence in a universal treatment hierarchy.

The Dutch guideline recommends education, load management and calf exercise for at least 12 weeks. Surgery should be considered only after at least six months of active treatment without recovery (de Vos et al., 2021). Elapsed time should be accompanied by a record of the care completed; it does not establish adequate exercise delivery or predict surgical benefit.

CONCLUSION

Persistent Achilles tendinopathy requires assessment of anatomical site, completed loading and the sporting activity that remains restricted. Exercise comparisons support several loading prescriptions but do not establish equivalence or a universally optimal dose. Heel lifts and shockwave findings depend on anatomical location and comparator. Injection effects must be interpreted with the actual product, injection site, exercise and activity restriction. Treatment escalation is justified by a documented residual limitation and evidence applicable to the patient's condition. VISA-A change, unrestricted sport and recovery of previous performance should remain separate outcomes.

DECLARATIONS

CONFLICT OF INTEREST

The author declares that there are no conflicts of interest related to this study.

DATA AVAILABILITY

The data supporting the findings of this study are available from the corresponding author upon reasonable request.

FUNDING

This research received no external funding.

REFERENCES

1. Ardern CL, Glasgow P, Schneiders A, et al. 2016 consensus statement on return to sport from the First World Congress in Sports Physical Therapy, Bern. *Br J Sports Med.* 2016;50(14):853-864.
2. Beyer R, Kongsgaard M, Hougs Kjaer B, et al. Heavy slow resistance versus eccentric training as treatment for Achilles tendinopathy: a randomized controlled trial. *Am J Sports Med.* 2015;43(7):1704-1711.
3. Chimenti RL, Bucklin M, Kelly M, et al. Insertional Achilles tendinopathy associated with altered transverse compressive and axial tensile strain during ankle dorsiflexion. *J Orthop Res.* 2017;35(4):910-915.
4. Comins J, Siersma V, Couppe C, et al. Assessment of content validity and psychometric properties of VISA-A for Achilles tendinopathy. *PLoS One.* 2021;16(3):e0247152.
5. Cook JL, Purdam C. Is compressive load a factor in the development of tendinopathy? *Br J Sports Med.* 2012;46(3):163-168.
6. Dakin SG, Newton J, Martinez FO, et al. Chronic inflammation is a feature of Achilles tendinopathy and rupture. *Br J Sports Med.* 2018;52(6):359-367.
7. de Vos RJ, van der Vlist AC, Zwerver J, et al. Dutch multidisciplinary guideline on Achilles tendinopathy. *Br J Sports Med.* 2021;55(20):1125-1134.
8. Gajhede-Knudsen M, Ekstrand J, Magnusson H, Maffulli N. Recurrence of Achilles tendon injuries in elite male football players is more common after early return to play: an 11-year follow-up of the UEFA Champions League injury study. *Br J Sports Med.* 2013;47(12):763-768.
9. Habets B, van den Broek AG, Huisstede BMA, Backx FJG, van Cingel REH. Return to sport in athletes with midportion Achilles tendinopathy: a qualitative systematic review regarding definitions and criteria. *Sports Med.* 2018;48(3):705-723.
10. Habets B, van Cingel REH, Backx FJG, van Elten HJ, Zuithoff P, Huisstede BMA. No difference in clinical effects when comparing Alfredson eccentric and Silbernagel combined concentric-eccentric loading in Achilles tendinopathy: a randomized controlled trial. *Orthop J Sports Med.* 2021;9(10):23259671211031254.
11. Johannsen F, Olesen JL, Ohlenschlager TF, et al. Effect of ultrasonography-guided corticosteroid injection vs placebo added to exercise therapy for Achilles tendinopathy: a randomized clinical trial. *JAMA Netw Open.* 2022;5(7):e2219661.
12. Kearney RS, Ji C, Warwick J, et al.; ATM Trial Collaborators. Effect of platelet-rich plasma injection vs sham injection on tendon dysfunction in patients with chronic midportion Achilles tendinopathy: a randomized clinical trial. *JAMA.* 2021;326(2):137-144.
13. Kedia M, Williams M, Jain L, et al. The effects of conventional physical therapy and eccentric strengthening for insertional Achilles tendinopathy. *Int J Sports Phys Ther.* 2014;9(4):488-497. PubMed PMID: 25133077.
14. Korakakis V, Kotsifaki A, Stefanakis M, Sotiralis Y, Whiteley R, Thorborg K. Evaluating lower limb tendinopathy with Victorian Institute of Sport Assessment (VISA) questionnaires: a systematic review shows very-low-quality evidence for their content and structural validity—part I. *Knee Surg Sports Traumatol Arthrosc.* 2021;29(9):2749-2764.
15. Korakakis V, Whiteley R, Kotsifaki A, Stefanakis M, Sotiralis Y, Thorborg K. A systematic review evaluating the clinimetric properties of the Victorian Institute of Sport Assessment (VISA) questionnaires for lower limb tendinopathy shows moderate to high-quality evidence for sufficient reliability, validity and responsiveness—part II. *Knee Surg Sports Traumatol Arthrosc.* 2021;29(9):2765-2788.
16. Lagas IF, van der Vlist AC, van Oosterom RF, et al. Victorian Institute of Sport Assessment-Achilles (VISA-A) questionnaire-minimal clinically important difference for active people with midportion Achilles tendinopathy: a prospective cohort study. *J Orthop Sports Phys Ther.* 2021;51(10):510-516.
17. Maetz R, Dube MO, Tougas A, Prudhomme F, Dubois B, Roy JS. Systematic review and meta-analyses of randomized controlled trials comparing exercise loading protocols with passive treatment modalities or other loading protocols for the management of midportion Achilles tendinopathy. *Orthop J Sports Med.* 2023;11(5):23259671231171178.
18. Mansur NSB, Matsunaga FT, Carrazzone OL, et al. Shockwave therapy plus eccentric exercises versus isolated eccentric exercises for Achilles insertional tendinopathy: a double-blinded randomized clinical trial. *J Bone Joint Surg Am.* 2021;103(14):1295-1302.
19. Paantjens MA, Helmhout PH, Backx FJG, van Etten-Jamaludin FS, Bakker EWP. Extracorporeal shockwave therapy for mid-portion and insertional Achilles tendinopathy: a systematic review of randomized controlled trials. *Sports Med Open.* 2022;8:68.
20. Rabusin CL, Menz HB, McClelland JA, et al. Efficacy of heel lifts versus calf muscle eccentric exercise for mid-portion Achilles tendinopathy (HEALTHY): a randomised trial. *Br J Sports Med.* 2021;55(9):486-492.
21. Scott A, Squier K, Alfredson H, et al. ICON 2019: International Scientific Tendinopathy Symposium Consensus: Clinical Terminology. *Br J Sports Med.* 2020;54(5):260-262.
22. Silbernagel KG, Hanlon S, Sprague A. Current clinical concepts: conservative management of Achilles tendinopathy. *J Athl Train.* 2020;55(5):438-447.
23. Sleeswijk Visser T, Brul S, Deng J, et al. Low socioeconomic status is associated with worse treatment outcomes in patients with Achilles tendinopathy. *Br J Sports Med.* 2024;58(11):579-585.
24. Stevens M, Tan CW. Effectiveness of the Alfredson protocol compared with a lower repetition-volume protocol for midportion Achilles tendinopathy: a randomized controlled trial. *J Orthop Sports Phys Ther.* 2014;44(2):59-67.
25. van der Vlist AC, van Oosterom RF, van Veldhoven PLJ, et al. Effectiveness of a high volume injection as treatment for chronic Achilles tendinopathy: randomised controlled trial. *BMJ.* 2020;370:m3027.

26. van der Vlist AC, van Veldhoven PLJ, van Oosterom RF, Verhaar JAN, de Vos RJ. Isometric exercises do not provide immediate pain relief in Achilles tendinopathy: a quasi-randomized clinical trial. *Scand J Med Sci Sports*. 2020;30(9):1712-1721.
27. van der Vlist AC, Winters M, Weir A, et al. Which treatment is most effective for patients with Achilles tendinopathy? A living systematic review with network meta-analysis of 29 randomised controlled trials. *Br J Sports Med*. 2021;55(5):249-256.