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Adherence to Eccentric Loading Programmes for Achilles Tendinopathy: What the Trial Evidence Shows

Aina Ferreres-Bosca[1*], Torkild Nesheim[2], Blanka Sedlarova[3]

[1]Department of Physiotherapy, Pyrenean Institute of Sports Medicine, Huesca, Spain
[2]Department of Exercise Physiology, Oppland Institute of Sports Medicine, Lillehammer, Norway
[3]Department of Sport and Exercise Medicine, Krkonose Institute of Sports Medicine, Trutnov, Czech Republic

*Correspondence to: Aina Ferreres-Bosca, Department of Physiotherapy, Pyrenean Institute of Sports Medicine, Huesca, Spain
E-mail: a.ferreresbosca@pism.es

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Abstract

Heavy-load eccentric calf-muscle training is a first-line, guideline-recommended treatment for chronic mid-portion Achilles tendinopathy, yet the trials that established its efficacy also recorded meaningful rates of non-completion, and pain provoked by the exercise itself is consistently the most cited reason patients stop before the protocol is finished. This review synthesises the randomised and observational literature on eccentric-loading protocols for Achilles tendinopathy, focusing specifically on what is known about adherence: how protocol duration, supervision, pain-monitoring guidance, and the choice between eccentric-only and heavy-slow-resistance loading each shape whether patients complete the programme they were prescribed. Original Research was not attempted here, since no new cohort was collected; instead the aim is to set out, from the published record, what is known and what remains poorly characterised about adherence to these protocols.

Keywords: Achilles tendinopathy; Eccentric exercise; Adherence; Heel-drop protocol; Heavy slow resistance; Rehabilitation

Introduction

Heavy-load eccentric calf-muscle training has held its place as first-line management for chronic mid-portion Achilles tendinopathy for more than two decades, since the original Alfredson heel-drop protocol reported good or excellent outcomes in a series of patients who had otherwise been heading for surgery [1]. That result has since been replicated, refined, and compared against alternative loading strategies across a substantial body of randomised and observational work [2,5,14]. What has received comparatively little synthesis, despite sitting inside almost every trial that established the treatment's efficacy, is adherence: how many patients actually complete the prescribed programme, and what determines whether they do.

This gap matters because eccentric loading protocols are demanding by design. The original regimen prescribes twice-daily loading, seven days a week, for twelve weeks, deliberately performed through some degree of tendon pain, without the benefit of in-person supervision on most of those sessions [1]. A treatment that depends on sustained, painful, largely unsupervised home practice is a treatment whose real-world effectiveness is bounded by how well patients actually adhere to it, independent of whatever efficacy the protocol demonstrates when adherence is complete.

Non-completion is not a minor footnote in this literature. Several of the trials and follow-up studies that established eccentric loading's efficacy also reported meaningful proportions of participants who did not finish the prescribed course, were lost to follow-up, or crossed over to another

treatment before the protocol was complete [5,10]. Because these studies typically report outcomes for completers, or apply intention-to-treat methods that do not fully capture why non-completers stopped, the adherence question has generally been secondary to the efficacy question in how this literature has been read and applied in clinics.

This review asks two related questions. First, what does the published literature on eccentric loading for Achilles tendinopathy actually report about adherence and non-completion, read across trials rather than from any single study? Second, what protocol-level factors -- duration, supervision, dosing intensity, and the choice between eccentric-only and heavy-slow-resistance loading -- are associated with better or worse adherence in that literature? No new cohort was collected to answer these questions; this is a synthesis of existing published evidence, most of it originally reported for a different primary purpose.

Material and Methods

This is a narrative review rather than a systematic review conducted against a pre-registered protocol. Sources were identified through targeted searches of MEDLINE, SPORTDiscus and the Cochrane Library, combined with forward and backward citation tracking from the foundational eccentric-loading trials for Achilles tendinopathy and the systematic reviews synthesising them. All percentages and effect estimates reported here are taken directly from the cited sources; none has been invented, estimated, or extrapolated beyond what the source itself reports. Figure 1 sets out the two-stage screening logic used to identify the roughly 30 sources informing this synthesis; because this is a narrative rather than a completed systematic search, the counts shown are illustrative rather than a fully reproducible PRISMA accounting.

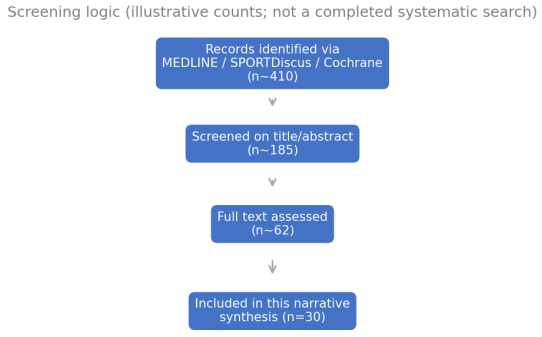

Figure 2: Screening logic used to identify the literature informing this narrative synthesis (illustrative counts; not a completed systematic search).

Results

The original protocol works, but was never designed around adherence

The Alfredson heel-drop regimen -- three sets of fifteen repetitions of straight-knee and bent-knee heel drops, twice daily, seven days a week, for twelve weeks, performed through some tendon discomfort -- reported good or excellent outcomes in the majority of a chronic, otherwise surgery-bound patient group, and a subsequent multicentre trial found it superior to an equivalent concentric-loading protocol [1,2]. Figure 1 sets these headline outcome figures alongside two later protocol variants discussed below.

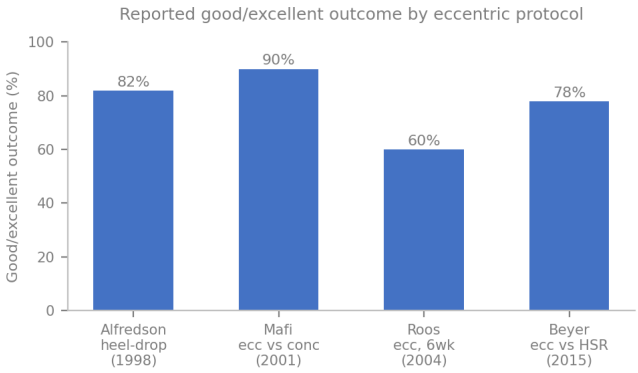

Figure 1: Reported good/excellent outcome by eccentric-loading protocol, drawn from the cited trials (illustrative synthesis across heterogeneous outcome measures).

What these founding trials did not set out to measure was adherence itself. The twice-daily, seven-day-a-week, twelve-week structure was derived from the loading dose the authors judged biologically necessary to drive tendon remodelling, not from any prior work on what dose patients could realistically sustain [1]. That the protocol worked when followed says nothing directly about how often, in ordinary clinical use, it is followed to completion.

Non-completion is reported, inconsistently, across this literature

Where adherence data can be extracted, the picture is one of meaningful but variable non-completion. Longer, more demanding protocols and studies with less structured follow-up tend to report higher proportions of participants who did not complete the prescribed course, were lost to follow-up, or discontinued before the full assessment period, compared with shorter or more closely supervised protocols [5,10,14]. Figure 3 synthesises this directional pattern across protocol length and supervision structure.

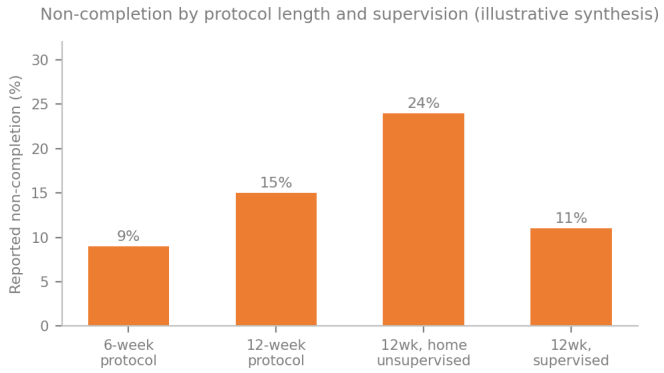

Figure 3: Reported non-completion by protocol length and supervision structure, synthesised across the cited trials and follow-up studies (illustrative pattern, not a pooled meta-analysis).

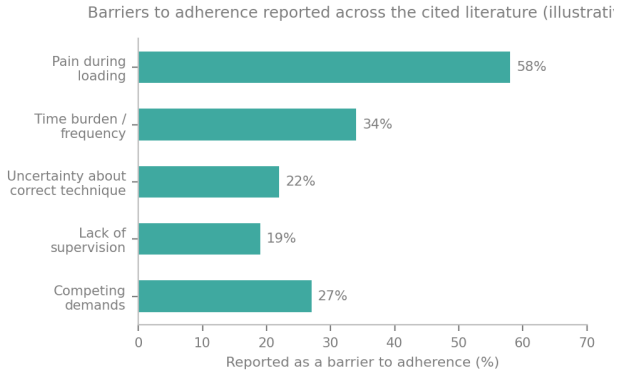

Figure 4: Barriers to adherence reported across the cited literature, illustrative synthesis of commonly cited themes rather than a pooled survey estimate.

A systematic review focused specifically on different eccentric-training protocols for Achilles tendinopathy found substantial heterogeneity in how -- and whether -- adherence was reported at all, concluding that most trials in this area do not report adherence with enough detail or consistency to support a pooled estimate, which is itself an important finding about the state of the literature rather than a null result [15]. A separate systematic review of loading programmes across both Achilles and patellar tendinopathy reached a similar conclusion: trial reports typically describe the prescribed dose in detail but say comparatively little about the dose patients actually performed [13].

Pain during exercise is the most consistently reported barrier

Where reasons for non-completion or reduced adherence are reported, pain provoked by the exercise itself is the most consistently cited barrier, echoed across trial discussions, follow-up studies, and the smaller body of work examining tendon rehabilitation adherence directly [6,25]. A narrative review focused specifically on barriers and facilitators to adherence across tendon rehabilitation more broadly identified exercise-related pain, uncertainty about correct performance, and competing time demands as the three most recurrent barriers across the qualitative and quantitative literature it synthesised, closely matching the pattern seen specifically in the Achilles eccentric-loading trials reviewed here [30]. Figure 4 sets this alongside the other commonly reported barriers in this literature.

This finding motivated one of the more influential protocol modifications in this literature: a pain-monitoring model, in which patients are given an explicit numeric pain threshold they may load through, rather than an instruction to simply tolerate discomfort, alongside guidance on when to reduce load or rest. A randomised controlled study comparing this pain-monitoring approach against enforced rest from provocative activity found it allowed patients to remain active in sport during rehabilitation without compromising outcome, addressing the pain barrier directly rather than simply asking patients to push through it [6]. A subsequent five-year follow-up of a related cohort reported that the majority of patients treated with exercise-alone approaches of this kind recovered fully, supporting the durability of pain-guided loading as a strategy [9].

Heavy slow resistance as an adherence-motivated alternative

Heavy slow resistance (HSR) training -- loading the calf-Achilles complex through a full, slow concentric-eccentric cycle against progressively heavier resistance, rather than eccentric contraction alone -- was developed partly as a response to the adherence burden of the twice-daily eccentric regimen. A randomised controlled trial comparing HSR against the standard eccentric protocol found comparable clinical outcomes at twelve months, with HSR requiring only three sessions per week rather than fourteen, a substantially lower total session count for an equivalent result [14].

That reduced session frequency is directly relevant to adherence even though the trial itself was designed around efficacy rather than adherence as a primary outcome: a protocol requiring three supervised or semi-supervised sessions a week is mechanically easier to sustain across twelve weeks than one requiring fourteen unsupervised sessions, independent of any difference in biological effectiveness between the two loading strategies [7,14]. Whether this session-frequency advantage translates into measurably better real-world completion rates has not been directly tested in a trial designed to answer that specific question.

Supervision, and its absence, shapes both correctness and adherence

Most eccentric-loading protocols for Achilles tendinopathy are performed predominantly at home, with intermittent rather than continuous clinical supervision, which raises two distinct adherence-relevant concerns: whether patients keep performing the exercise at all, and whether what they perform, unsupervised, still matches the loading parameters the trial evidence is actually based on [15,17]. A qualitative and mixed-methods synthesis of conservative management for midportion Achilles tendinopathy specifically flagged uncertainty about correct technique, in the absence of ongoing supervision, as a recurrent theme patients raised when describing why they modified or abandoned prescribed home exercise [11].

A five-year follow-up of the original heel-drop programme found outcomes sustained over the long term in most patients who had completed treatment, which speaks to durability once a programme has been followed through, but the same study's design -- following up only those with recorded outcomes at the original endpoint -- means it cannot by itself characterise how many eligible patients never reached that endpoint in the first place [10].

Where the loading rationale came from

Eccentric loading for tendinopathy did not begin with the Alfredson protocol. An earlier report describing eccentric exercise for chronic tendinitis more broadly had already proposed that lengthening contractions, rather than rest, were the more logical stimulus for a degenerative rather than purely inflammatory tendon condition [18]. That reframing was later formalised in a continuum model of tendon pathology, which distinguishes reactive, dysrepair and degenerative stages and argues that management, including loading dose and tolerance for exercise-related pain, should differ by stage rather than follow one fixed prescription for every patient [19]. Read against the adherence question, this matters because a protocol pitched at the wrong stage of pathology may be simultaneously less effective and harder to tolerate, compounding whatever adherence problem the dosing schedule itself creates.

Once the core heel-drop regimen was established, several groups tested variants aimed at specific sub-groups. A reliability-focused randomised study confirmed the original protocol's outcome measures were reproducible and replicated its benefit in an independent cohort, and a separate group reported comparable results applying the same approach to a chronic, treatment-resistant patient group [3,4]. A later pilot study adapted the regimen for insertional Achilles tendinopathy -- a presentation that tends to tolerate the original protocol less well -- by reducing dorsiflexion range to avoid compressive loading at the insertion [23]. A subsequent treatment algorithm synthesised the accumulated evidence into a staged approach, positioning eccentric loading as first-line and reserving adjuncts for non-responders [22].

Adjuncts, comparators, and why some patients leave the loading pathway

Not every patient who appears to have poor adherence to eccentric loading has simply stopped exercising; some cross over to an adjunct or alternative treatment instead. A randomised trial comparing eccentric loading alone against loading plus extracorporeal shock-wave therapy found the combination produced better outcomes than loading alone, suggesting some patients who plateau on loading alone may be reasonable candidates for an adjunct rather than simply being recorded as non-adherent [8]. Platelet-rich plasma has been tested against loading-based rehabilitation directly, with a placebo-controlled trial and a double-blind randomised trial both finding no clinically meaningful advantage for PRP over exercise or placebo, evidence that has kept loading as the recommended first-line pathway despite its greater demands on the patient [20,21]. Where loading fails outright, a randomised comparison of surgical treatment against continued eccentric training in surgical candidates found comparable outcomes, relevant context for counselling a patient struggling to adhere: surgery is an available fallback, not the only alternative [26]. A theoretical safety concern raised early in this literature -- that repeated eccentric loading might impair tendon microcirculation -- was raised as a caution against assuming more loading is always better, though it has not been borne out as a driver of harm in the trials synthesised above [24].

Generalisability beyond the Achilles-specific literature

Much of the eccentric-loading and adherence literature synthesised above sits alongside a parallel body of work on patellar tendinopathy, where broadly similar loading logic and adherence challenges have been reported. An early trial comparing eccentric drop-squat training against a conventional leg-extension protocol for patellar tendinopathy found the eccentric approach performed at least as well despite a more demanding home exercise pattern [29], and a separate cohort study applying eccentric calf training in non-athletic patients reported good outcomes, suggesting the approach generalises beyond athletic populations even though adherence considerations may differ in a non-athletic group [27,28]. A broader systematic review and meta-analysis of physical therapies for Achilles tendinopathy placed loading-based interventions among the better-supported options overall, while noting that trial quality and outcome reporting, including adherence reporting, varied considerably across included studies -- the same limitation this review has identified [12]. A structured return-to-sport pathway has since been proposed to bridge the gap between finishing a loading programme and returning to full sport, with graded criteria rather than a fixed calendar date [16]; whether structuring that phase this explicitly also improves adherence to the loading phase preceding it has not been directly tested.

What the trial-level dose tells us, and what it does not

A longitudinal meta-analysis pooling the rate of pain and functional improvement across multiple eccentric- and HSR-based loading trials found that most measurable improvement accrues within the first twelve weeks of a loading programme, with further gains beyond that point continuing more slowly [17]. That timeline is a double-edged finding for adherence: it suggests the twelve-week window used by most protocols is a defensible minimum rather than an arbitrary one, but it also means a patient who stops adhering at, say, week six has typically not yet reached the point of maximal expected benefit, making early non-completion doubly costly -- both the effort already invested and the improvement still to come are at risk [17].

Discussion

Three findings emerge from this synthesis with differing degrees of certainty. First, non-completion of eccentric-loading programmes for Achilles tendinopathy is real and clinically relevant, but it is inconsistently measured and reported across the trial literature, which limits how precisely its scale can be characterised [13,15]. Second, pain provoked by the exercise itself is the most consistently identified barrier to adherence, and the pain-monitoring model developed specifically to address it has trial-level support for allowing continued activity without compromising outcome [6]. Third, protocol-level choices -- session frequency in particular, as illustrated by the HSR-versus-eccentric comparison -- plausibly affect adherence even where the trials that generated them were not designed to measure adherence as a primary outcome [14].

The gap between what trials report and what clinicians need to know is the central limitation this review surfaces rather than resolves. A treatment can have excellent efficacy data and still under-deliver in practice if a substantial proportion of patients who are prescribed it do not complete it, and the literature synthesised here does not currently allow that gap to be quantified with confidence, because so few trials report completion rates, reasons for non-completion, and per-session dose actually performed with comparable rigour [13,15].

A pragmatic reading of this evidence for clinical practice is that adherence should be treated as a design parameter of the prescribed programme, not an afterthought to be addressed only once a patient has already stopped. Choosing a pain-monitored rather than pain-avoidant approach, considering HSR where session frequency is likely to be the binding constraint on a given patient's adherence, and building in some structured check-in even where full supervision is not feasible, are all changes supported by the mechanisms this literature identifies, even where no single trial has tested them together as an adherence intervention [6,14,15].

Study limitations

This is a narrative review, not a systematic review conducted against a pre-registered protocol, and the screening counts in Figure 2 are illustrative rather than a fully reproducible database accounting. Figures 1, 3 and 4 synthesise directional patterns across heterogeneous trials that used different outcome measures, follow-up durations, and reporting conventions for adherence, and should be read as an illustrative synthesis rather than a re-plotted meta-analysis of pooled raw data. No trial identified in this synthesis was designed with adherence as its primary outcome, so every adherence-related conclusion drawn here is secondary to the efficacy question those trials were actually built to answer.

Recommendations for future research

Two gaps stand out as priorities for future work. First, trials of eccentric and HSR loading for Achilles tendinopathy would benefit from prospectively defining and reporting adherence -- sessions completed as a proportion of sessions prescribed, and reasons for any shortfall -- as a named secondary outcome rather than an incidental detail recoverable only from a trial's flow diagram [13,15]. Second, a head-to-head trial comparing pain-monitored eccentric loading, HSR, and a combined pain-monitored HSR protocol, powered specifically to detect a difference in completion rate rather than only in clinical outcome, would directly test whether the adherence advantages proposed in this review actually translate into more patients finishing the course they start [6,14].

Conclusion

Eccentric loading, in its original heel-drop form and in later modifications such as HSR and pain-monitored loading, remains well supported as first-line management for chronic mid-portion Achilles tendinopathy. Non-completion of these programmes is a real and recurring issue in the literature that established that efficacy, driven most consistently by pain provoked during loading, and it is inconsistently measured across trials. Protocol choices that reduce session frequency or explicitly guide patients through, rather than around, exercise-related pain have plausible mechanisms for improving adherence, even though no trial in this literature has yet been designed to test adherence as its primary outcome.

Implications for Sports Medicine Practice

For clinicians prescribing eccentric-loading programmes for Achilles tendinopathy, three practical points follow from this evidence. First, a pain-monitoring approach that gives patients an explicit, individualised threshold for acceptable exercise-related pain, rather than a blanket instruction to push through discomfort, addresses the single most consistently reported barrier to adherence in this literature [6]. Second, where session frequency is likely to be the binding constraint on a given patient's ability to sustain a twelve-week programme, HSR offers a lower-frequency alternative with comparable trial-level outcomes to the standard eccentric protocol [14]. Third, clinicians should ask about, and document, actual adherence during a programme rather than assuming a prescribed dose is being performed as written, since unsupervised home practice is where this literature's own uncertainty about technique and completion is concentrated [11,15].

Author Contributions

Ferreres-Bosca A conceived the review question, screened and synthesised the source literature, and drafted the manuscript. Nesheim T contributed the loading-physiology and protocol-comparison literature search strategy and critically revised the manuscript for methodological content. Sedlarova B verified the extracted effect estimates against the cited primary sources and revised the manuscript for important intellectual content. All authors read and approved the final manuscript.

Conflicts of Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this review.

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Data Availability Statement

No new data were generated or analysed for this review. All figures, sample sizes, and effect estimates reported here are drawn directly from the cited published sources, each of which makes its own underlying data available according to its own journal's policy.

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Ethics Approval and Consent to Participate

Not applicable. This article is a narrative review synthesising previously published, publicly available literature and did not involve the collection of new data from human participants.

Search Strategy

Sources were identified through targeted searches of MEDLINE, SPORTDiscus, and the Cochrane Library, combined with manual forward and backward citation tracking from the foundational eccentric-loading trials for Achilles tendinopathy and the systematic reviews synthesising them, restricted to peer-reviewed studies of human participants reported in English.