Patient ratings in exercise therapy for the management of tendinopathy: a systematic review with meta-analysis.

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Abstract

Objective: To synthesise exercise therapy intervention data investigating patient rating outcomes for the management of tendinopathy.

Design: A systematic review and meta-analysis of randomised controlled trials investigating exercise therapy interventions and reporting patient rating outcomes.

Setting: Any setting in any country listed as very high on the human development index.

Participants: People with a diagnosis of any tendinopathy of any severity or duration .

Interventions: Exercise therapy for the management of tendinopathy comprising five different therapy classes: 1) resistance; 2) plyometric; 3) vibration; 4) flexibility, and 5) movement pattern retraining modalities, were considered for inclusion.

Main outcome measures: Outcomes measuring patient rating of condition, including patient satisfaction and Global Rating of Change (GROC).

Results: From a total of 124 exercise therapy studies, 34 (Achilles: 41%, rotator cuff: 32%, patellar: 15%, elbow: 9% and gluteal: 3%) provided sufficient information to be meta-analysed. The data were obtained across 48 treatment arms and 1246 participants. The pooled estimate for proportion of satisfaction was 0.63 [95%CrI: 0.53 to 0.73], and the pooled estimate for percentage of maximum GROC was 53 [95%CrI: 38 to 69%]. The proportion of patients reporting positive satisfaction and perception of change increased with longer follow-up periods from treatment onset.

Conclusion: Patient satisfaction and GROC appear similar and are ranked moderately high demonstrating that patients generally perceive exercise therapies positively. Further research including greater consistency in measurement tools is required to explore and where possible, identify patient- and exercise-related moderating factors that can be used to improve person-centred care. [PROSPERO ID=CRD42020168187]

[250 words]

Contribution of paper

- Patient rating of condition is one of the least measured core outcome domains in studies investigating exercise therapy.
- Patients are generally satisfied and report positive perceptions of change with exercise therapy for the management of tendinopathies.

Keywords

Exercise Therapy; Tendinopathy; Meta-analysis; Patient rating of condition; Patient Satisfaction; Global rating of change

Introduction

Tendinopathy is a musculoskeletal condition frequently experienced by a range of patients and characterised by discomfort, reduced function and disability [1]. Management of tendinopathy can comprise a range of interventions, with exercise therapy among the most common [2, 3]. The International Scientific Tendinopathy Symposium Consensus (ICON 2019) [4] established a core set of nine health-related domains to improve the use of standardised end-point outcome measurements in the management of tendinopathy. It was recommended that outcome measures used in future research and clinical practice should align with these core domains including overall measures of health status such as patient rating of condition. Based on information presented from a recent comprehensive scoping review of exercise therapy for the management of tendinopathy, it was identified that patient rating of condition was largely operationalised as patient satisfaction and perception of change [5]. Across tendinopathies, reporting of patient rating of overall condition was 15% compared to the 65% reported for disability, a more common primary health domain in randomised controlled trials [5]. Despite being less

commonly reported than other domains, patient rating of condition is arguably an important person-centred outcome. Therefore, this systematic review focussed on patient satisfaction and perception of change.

Assessing patient satisfaction generally comprises subjective measures of how well a patient's expectations of care are met and provides an important indicator of person-centredness [6]. In contrast to conventional patient-reported outcomes where the constructs of measurement are more easily defined (such as disability, function, or quality of life), the measurement of patient satisfaction is often complex and cannot be entirely captured by basic measurement constructs like visual analogue scales [7]. Patients may have differing levels of satisfaction with the process and outcome of their care based on a range of contextual factors including initial expectations, patient experience, and socioeconomic status [6-8]. Additionally, patient experience is likely to reflect a range of aspects of care as perceived by the patient including accessibility, waiting times and interactions with healthcare staff. Given the complexity and range of contributing factors, patient satisfaction may not always correlate with objective clinical outcomes or symptomatic improvements [7]. Both quantitative and qualitative approaches have been used to evaluate patient satisfaction. Quantitative methods including standardised single- or multi-item questionnaires (either self-reported or interviewer-administered) are the most common tools used to assess patient satisfaction in research studies [9]. However, there is extensive variation across patient satisfaction questionnaires (e.g., Patient Satisfaction Questionnaires-18, Roles and Maudsley satisfaction scale, and a 38-item patient satisfaction scale), each demonstrating varying degrees of validity and reliability.

The second most common measure of patient rating of condition within exercise therapy for the management of tendinopathy is perception of changes [5]. Frequently used tools include global

rating of change (GROC) scales or items asking whether current symptom levels are acceptable. GROC scales have become a popular outcome measure due to their ease of use, clinical relevance, and applicability across any musculoskeletal condition [10, 11]. The "global" aspect of the scales is important and sets them apart from dimension-specific outcomes such as pain and function. Patients can decide for themselves what constructs they consider as important in determining the response making it patient-focussed [10]. Previous research has identified strong correlations between patient satisfaction and global change measures (r = 0.56 to 0.77) which attest to its clinical relevance [12]. Whilst exercise therapy is the mainstay of conservative management of tendinopathy, no previous reviews have attempted to synthesise existing literature on patient rating of condition to guide the use of exercise therapy in clinical practice. The importance of this domain is further emphasised by findings that patients expressing satisfaction with their treatment are more likely to adhere, benefit from their healthcare, and experience higher quality of life [7, 9, 13]. Therefore, the purpose of this systematic review with meta-analysis was to synthesise the available research on exercise therapy in the management of tendinopathy from a person-centred perspective and investigate outcomes measuring patient rating of condition following exercise therapy.

Method

This review was part of a project funded by the National Institute for Health Research (NIHR) [Health Technology Assessment (HTA) 129388]. The review was conducted according to a project protocol registered on PROSPERO (CRD42020168187) [14] and a full review specific *a priori* protocol [15]. The review was guided by the PRISMA extension statement for reporting of systematic reviews [16] with accompanying checklist completed and included in the Supplementary information (SF-1).

Inclusion criteria

Participants

This review included people of any age or gender with a diagnosis of tendinopathy of any severity or duration and at any anatomical location. We accepted trial authors' diagnoses where a clearly verifiable group of clinical features was reported including: pathognomonic location of pain; a symptom altering response to applied load and/or stretch, with there being a specific test for most tendinopathies; imaging confirmation of structural change.

Intervention

The intervention was exercise therapy for the management of any tendinopathy. Exercise considered for inclusion comprised five different therapy classes: 1) resistance; 2) plyometric; 3) vibration; 4) flexibility and 5) movement pattern retraining modalities. Definitions for each therapy class are presented in Table 1. No restrictions were placed on settings, supervision, or person delivering the intervention for inclusion. To be included in the review, studies were required to report sufficient information regarding the exercise intervention to enable appropriate identification of treatment class and quantification of exercise dose.

Table 1. Definitions for each therapy class

Therapy Class	Definition	Therapy Treatment	Definition
Resistance	Exercise designed primarily to increase strength of muscles by causing them to produce substantive force against an applied resistance which can take several forms including the mass of the body or its segments, isoinertial resistance, elastic resistance, or strength training equipment such as isokinetic devices. In tendinopathy, the stimulus may also be intended to provoke tendon remodelling, reduce pain and improve function.	Concentric Only	Includes movements where force produced overcomes the resistance such that muscle shortening occurs.
		Eccentric Only	Includes movements where force produced is less than the resistance such that controlled muscle lengthening occurs.
		Concentric and eccentric	Includes movements where force produced exceeds the resistance in one phase and is less than the resistance in another such that controlled muscle lengthening and shortening occurs.
		Isokinetic	Uses specialised exercise equipment such that the resistance is adjusted in real-time to ensure joint angular velocity remains constant.
		Isometric	Includes muscular actions against a resistance such that joint angle remains constant.
Therapy Class	**Definition**	**Therapy Treatment**	**Definition**
Flexibility	Exercise designed to increase joint range of motion and extensibility of muscles and/or associated tissues. Also	Static	Joint range of motion actions where the movement is held at or near the end range of motion.

	referred to as range-of-motion exercises or stretching.	Dynamic	Joint range of motion actions where the movement is performed continuously into and out of the end range of motion.
		PNF	Proprioceptive neuromuscular facilitation is a technique combining passive stretching and isometric action to achieve maximum range of motion.
		Ballistic	Uses the momentum of a moving body or a limb to increase joint range of motion, bouncing into (or out of) a stretched position.
Proprioception	Exercise designed to enhance the sensation of the joint relative to body position and movement, sense of force, and to encourage muscular stabilisation of the joint in the absence of external stabilising devices e.g., ankle brace.	Sense of joint position and force	Exercise aimed at enhancing the ability to perceive joint position and force with minimal external cues.
		Balance	Includes exercise that require the person to keep or return the displacement of centre of gravity over the base of support through various environmental conditions and changes in body position.

		Movement pattern retraining	Exercise aimed at re-education of motor control and movement patterns that may involve specific retraining of under- or over-active muscles and alteration of kinematic rotation +- translation timing between body segments. May also be termed motor control or stabilisation.
Therapy Class	**Definition**	**Therapy Treatment**	**Definition**
Plyometric	Exercise where a resistance is overcome by a muscle rapidly stretching then shortening	Plyometric	Exercise where a resistance is overcome by a muscle rapidly stretching then shortening.
Vibration	Exercise where body segments are held stationary or actively displaced as per definitions for other treatment classes whilst applying a rapid oscillating resistance	Vibration	Exercise where body segments are held stationary or actively displaced as per definitions for other treatment classes whilst applying a rapid oscillating resistance

Comparator

No comparators were included, and all outcomes of patent ratings were based solely on the exercise therapy group data.

Outcomes

Outcomes of patient rating of condition were extracted which included measures of patient satisfaction, patient experience scores, and perceived change of improvement or recovery measured by Global Rating of Change (GROC) scales. GROC scales ask the person to rate their change with respect to a particular condition over a specified time period and measure this change using either a Likert scale or Visual Analogue Scale. Measurements collected consisted of: 1) post-intervention binary and ordinal level data which were mostly expressed as proportions (e.g., proportion of responders who reported "complete recovery"); 2) continuous outcomes collected post-intervention that reflected changes across the treatment (positive scale only: e.g., 1 to 4; negative and positive scale: e.g., −4 to +4); and 3) continuous outcomes collected pre- and post-intervention with change scores reflecting change in general assessment of condition.

Types of studies

We included randomised controlled trials where at least one intervention arm comprised an exercise-only therapy to measure the impact of exercise therapy on a patient rating outcome.

Context

The context included primary care, secondary care or community locations in any developed nation (defined as the top 62 countries in the Human Development Index at the time of protocol development) [17] for the findings to be relevant to the UK context.

Search strategy

The search strategy used for this study was part of a larger search conducted to scope the entire tendinopathy and exercise therapy research base [5]. The search comprised three steps; Firstly, a limited search of MEDLINE and CINAHL using initial keywords was conducted to develop a full search strategy. Secondly, the full search strategy was adapted to each database and applied systematically to: MEDLINE, CINAHL, AMED, EMBase, SPORTDiscus, Cochrane library, JBI Evidence Synthesis, PEDRo, and Epistemonikos (search terms for each database are presented in the Supplementary information: SF-2). The following trial registries were also searched: ClinicalTrials.gov, ISRCTN Registry, The Research Registry, European Union Clinical trials Registry, Australia and New Zealand Clinical trials Registry. Finally, the third step involved conducting a search of cited articles using Scopus and hand-searching a total of 130 systematic reviews that were identified to include information relevant to exercise therapy and tendinopathy. No limit was placed on language. Searches were initiated from 1998 as (i) the heavy load eccentric calf-training protocol for Achilles tendinosis by Alfredson et al. was published in 1998 and may be considered seminal work in the field of tendinopathy,[39] and (ii) there has been a proliferation of research on exercise interventions for tendinopathies post 1998. The final date of the search was 18/01/21.

Study selection

Proquest® Refworks was used to manage references and remove duplicates, before importing to Covidence (Melbourne, Australia) to facilitate screening. Two levels of screening, (i) titles/abstracts and (ii) full-text, were conducted, independently, by two members of the research team. Conflicts were resolved by discussion or by a third reviewer.

Data extraction

Dual data extraction was conducted by members of the review team (PS/KC/LA/RM/LG/EP/JS/AP) into pre-piloted excel sheets. Data were independently coded as described in the accompanying codebook (SF-3) which provides in detail the extraction variables and options available. Data were classified into broad therapy and dominant classes of therapy, where dominance was determined according to the primary intervention of interest.

Risk of Bias

We used Cochrane's Risk of Bias (RoB) tool [18] to assess the potential for bias. RoB was recorded for each outcome and time point within each study. The Cochrane's RoB tool [18] was selected as a recent review of popular tools in tendinopathy management highlighted none were superior [19].

Confidence in cumulative evidence

Strength of evidence was assessed using the Grading of Recommendations Assessment Development and Evaluation (GRADE) guidelines [20, 21] and transparent reporting recommended in a recent review of how to improve reporting of evidence in tendinopathy management [22]. Overall strength of evidence was categorised as high/moderate/low/very low. Assessments began with a categorisation of high strength as evidence from randomised controlled trials and were downgraded one level for each of the domains (risk of bias, imprecision, inconsistency, and indirectness) that was not judged as low risk. Potential upgrading factors included the presence of large effects or evidence of dose-response [20, 21].

Statistical analysis

A series of meta-analyses were conducted to pool estimates for patient rating outcomes that comprised a range of tools and scoring scales requiring distinct transformations and analysis methods. All meta-analyses were conducted within a Bayesian framework enabling results to be interpreted more intuitively through reporting of subjective probabilities rather than null hypothesis testing with confidence intervals. Therefore, each of the outcomes was extracted and analysed as continuous measures whereby values can be described in a more probabilistic manner as small, medium, and large effect size estimates. The effect size is a magnitude of the difference between groups when comparing two interventions and therefore, indicates the practical significance of the findings. For all outcomes, a large effect size represents better clinical effect.

Outcome data were first split into 1) measures collected post-intervention only, and 2) outcomes collected pre- and post-intervention where change scores provided the relevant information. Post-intervention only data were further split into binary outcomes and outcomes measured on a scale that could be modelled as continuous. Data from binary outcomes were transformed into a "proportion of positive response" and meta-analyses were used to pool values across treatment arms to estimate the mean value as an effect size (ES_{PROP}). Heterogeneity in the data used for each meta-analysis was quantified by the between treatment group standard deviation (τ_{PROP}). Covariance between multiple outcomes reported in the same study were estimated through the intraclass correlation coefficient (ICC). The primary meta-analysis was conducted on all available binary outcomes, with a sub-group analysis comprising patient satisfaction outcomes only. A full analysis plan can be found in the Supplementary information which details the analysis for the continuous data (post-intervention) and logit transformation carried out for the meta-analyses (SF-4). Further details about the modelling of these meta-analyses can also be found in the

Supplementary information (SF-4). Analyses were performed using the R software package 'brms' interfaced with statistical programming language Stan to perform sampling [23].

Results

Study selection

The search strategy identified a total of 9246 potential studies, with 4635 remaining following removal of duplicates. After title and abstract screening, 4210 studies were removed leaving 425 studies for full text screening. Of these studies, 124 investigated exercise therapy for the management of tendinopathies but only a total of 34 studies reported patient rating outcomes and were subsequently included in the review (Table 2). Therefore, a total of 391 were excluded (SF-5). The overall study selection process and reasons for exclusion during full text screening are presented in Figure 1. The 34 included studies comprised 48 exercise therapy treatment arms, 110 outcomes and 1246 participants. A summary of the tendinopathy locations and dominant exercise therapy classes are presented in Table 3.

Table 2. Characteristics of included studies

Study (first author, year, country)	Design	Tendinopathy Location	Participants (number (n); sex (%female); mean (sd) age; mean (sd) symptom duration in months); Training status	Exercise Therapy Treatment arms	Number x (Exercise Therapy classes)	Findings
Bahr 2006 Norway [24]	RCT	Patellar	N= 40 % female 12 Age 30 (7.9) Symptoms 34 (28.7) Training status Other	1	1 x (Resistance)	No added benefit was observed for surgical treatment to eccentric strength training. Eccentric training should be offered for 12 weeks before tenotomy is considered for the treatment of patellar tendinopathy.
Breda 2020 Netherlands [25]	RCT	Patellar	N= 76 % female 24 Age 24 (3.9) Symptoms 99 (NR) Training status Performance	2	1 x (Plyometric, Resistance); 1 x (Flexibility, Resistance)	In patients with patellar tendinopathy, progressive tendon-loading exercises resulted in a significantly better clinical outcome after 24 weeks than eccentric exercise therapy. Progressive tendon-loading exercises are superior to eccentric exercise therapy and are therefore recommended as initial conservative treatment for patellar tendinopathy.
Brox 1999 Norway [26]	RCT	Rotator cuff – subacromial impingement	N= 125 % female 44 Age 48 (23-66) Symptoms NR Training status Other	1	1 x (Proprioception, Resistance)	At 2.5 years follow-up, both arthroscopic surgery and supervised exercises are better treatments than placebo with no significant difference between the 2 active treatments.
Chaconas 2017 United States [27]	RCT	Rotator cuff – subacromial impingement	N=46 % female 42 Age 46 (17.4) Symptoms 49 (80) Training status Other	2	2 x (Flexibility, Resistance)	An eccentric program targeting the external rotators was superior to a general exercise program for strength, pain, and function after six months. The findings suggest eccentric training may be efficacious to

						improve self-report function and strength for those with SAPS.
De Jonge 2008 Netherlands [28]	RCT	Achilles	N= 70 % female NR Age 45 (26-59) Symptoms 31 (2-204) Training status Other	1	1 x (Resistance)	Eccentric exercises with or without a night splint improved functional outcome at one year follow-up. At follow-up there was no significant difference in clinical outcome when a night splint was used in addition to an eccentric exercise.
De Vos 2007 Netherlands [29]	RCT	Achilles	N= 63 % female 41 Age 45 (8) Symptoms 31 (50.6) Training status Recreational	1	1 x (Resistance)	A night splint has no added benefit to eccentric exercises in the treatment of chronic midportion Achilles tendinopathy. There was no significant difference between the two groups in VISA-A score and patient satisfaction.
Gatz 2020 Germany [30]	RCT	Achilles	N= 42 % female 36 Age 50 (12.0) Symptoms 28 (23.8) Training status Other	2	2 x (Resistance)	No additional clinical benefits of adding ISOs to a basic EE program could be found in this preliminary randomized controlled trial study over a period of 3 months. SWE was able to differentiate between insertional and midportion tendon tissue and localize reported symptoms to sublocations but this did not correlate with better clinical scores (VISA-A) over a 3-month follow-up period.
Granviken 2015 Norway [31]	RCT	Rotator cuff – subacromial impingement	N=44 % female 48 Age 48 (9.9) Symptoms 15 Training status Other	2	1 x (Flexibility, Proprioception); 1 x (Resistance, Flexibility)	No significant differences in pain and disability were found between home exercises and supervised exercises of more than the first session of a 6-week exercise regime for people with subacromial impingement.
Hotta 2020 Brazil	RCT	Rotator cuff - subacromial	N=60 % female 70 Age 49 (9)	2	1 x (Resistance, Proprioception); 1 x (Resistance)	The inclusion of the isolated scapular stabilization exercises, emphasizing retraction

[32]		impingement	Symptoms 29 (24) Training status Other			and depression of the scapula, to a progressive general periscapular strengthening protocol did not add benefits to self-reported shoulder pain and disability, muscle strength, and ROM in patients with subacromial pain syndrome.
Johansson 2005 Sweden [33]	RCT	Rotator cuff - subacromial impingement	N=85 % female 69 Age 49 (7.5) Symptoms NR Training status Other	1	1 x (Flexibility, Resistance)	Acupuncture was more effective than ultrasound when applied in addition to home exercises.
Jonsson 2005 Sweden [34]	RCT	Patellar	N= 15 % female 13 Age 25 (8.2) Symptoms 18 (13.2) Training status Performance	2	2 x (Resistance)	Eccentric, but not concentric, quadriceps training on a decline board, seems to reduce pain in jumper's knee.
Knobloch 2008 Italy [35]	RCT	Achilles	N= 92 % female 35 Age 48 (11.0) Symptoms NR Training status Recreational	1	1 x (Resistance)	Patients with tendinopathy of the main body of the AT experienced improved clinical outcome with both management options. Although tendon microcirculation was optimized in the combined group of eccentric training and AirHeel Brace, these micro-vascular advantages do not translate into superior clinical performance when compared with eccentric training alone.
Kromer 2013 Germany [36]	RCT	Rotator cuff - subacromial impingement	N= 90 % female 51 Age 52 (11.2) Symptoms 8 (9.8) Training status Other	1	1 x 1(Flexibility, Proprioception, Resistance)	Individually adapted exercises were effective in the treatment of patients with shoulder impingement syndrome. Individualized manual Physiotherapy contributed only a minor amount to the improvement in pain intensity.

Ludewig 2003 United States [37]	RCT	Rotator cuff - subacromial impingement	N= 85 % female 0 Age 49 (2.1) Symptoms NR Training status Other	1	x (Flexibility, Resistance)	Home exercise programme are more effective in reducing symptoms and improving function (Shoulder Rating Questionnaire, shoulder satisfaction score) than the control group in construction workers with shoulder pain.
Marzetti 2014 Italy [38]	RCT	Rotator cuff - subacromial impingement	N= 48 % female 61 Age 62 (12.5) Symptoms NR Training status Other	2	1 x (Flexibility, Resistance); 1 x (Proprioception)	Neurocognitive rehabilitation is effective in reducing pain and improving function in patients with shoulder impingement syndrome, with benefits maintained for at least 24 weeks.
McCormack 2016 United States [39]	RCT	Achilles	N= 15 % female 69 Age 54 (38-69) Symptoms 10 (NR) Training status Other	1	1 x (Resistance)	Soft tissue treatment (Astym) plus eccentric exercise was more effective than eccentric exercise alone at improving function during both short- (26 weeks) and long-term (52 weeks) follow-up periods.
Mulligan 2016 United States [40]	RCT	Rotator cuff – subacromial impingement	N=50 % female 65 Age 50 (10.7) Symptoms 8 (7.4) Training status Other	1	1 x (Proprioception, Resistance)	Patients with SAIS demonstrate improvement in pain and function with a standardized program of physical therapy regardless of group exercise sequencing.
Nishizuka 2017 Japan [41]	RCT	Lateral elbow/tennis elbow	N=110 % female 39 Age 54 (11.8) Symptoms 2 (1.77) Training status Other	1	1 x (Flexibility)	A forearm band may have no more than a placebo effect and is not recommended based on its effectiveness.
Nørregaard 2007 Denmark [42]	RCT	Achilles	N= 35 % female 49 Age 42 (2.0) Symptoms 28 (8.8) Training status Other	2	1 x (Resistance); 1 x (Flexibility)	Symptoms gradually improved during the 1-year follow-up period and were significantly better assessed by pain and symptoms after 3 weeks and all later visits. However, no significant differences could be observed between the two groups.

Østerås 2010 Norway [43]	RCT	Rotator cuff - subacromial impingement	N=61 % female 21 Age 44 (13) Symptoms 40 (56.3) Training status Other	2	2 x (Flexibility, Resistance)	In long-term subacromial pain syndrome, high dosage medical exercise therapy is superior to a conventional low dosage exercise programme
Paavola 2018 Finland [44]	RCT	Rotator cuff - subacromial impingement	N= 186 % female 70 Age 51 (5.0) Symptoms 20 (18.9) Training status NR	1	1 x (Flexibility, Proprioception, Resistance)	Arthroscopic subacromial decompression provided no benefit over diagnostic arthroscopy in patients with shoulder impingement syndrome.
Reyhan 2020 Turkey [45]	RCT	Lateral elbow/tennis elbow	N= 40 % female 82 Age 42 (9.9) Symptoms 4 (0.78) Training status Other	1	1 x 1(Flexibility, Resistance)	MWM plus exercise and cold therapy is safe and effective at improving elbow pain, functional capacity, and grip strength.
Rompe 2007 Germany [46]	RCT	Achilles	N= 75 % female 61 Age 49 (10.6) Symptoms 11 (8.5) Training status Other	1	x (Flexibility, Resistance)	At 4-month follow-up, eccentric loading and low-energy shock-wave therapy showed comparable results. The wait-and-see strategy was ineffective for the management of chronic recalcitrant Achilles tendinopathy.
Rompe 2009 Germany [47]	RCT	Achilles	N= 68 % female 56 Age 50 (9.9) Symptoms 15 (6.0) Training status Other	1	1 x (Resistance)	The likelihood of recovery after 4 months was higher after a combined approach of both eccentric loading and shock-wave therapy compared to eccentric loading alone.
Rompe 2009 Germany [48]	RCT	Gluteal (including GTPS)	N= 68 % female 56 Age 50 (9.9) Symptoms 15 (6) Training status Other	1	1 x (Resistance)	Both corticosteroid injection and home training were significantly less successful than was shock wave therapy at 4-month follow-up. Corticosteroid injection was significantly less successful than was home training or shock wave therapy at 15-month follow-up.
Rompe 2008 Germany [49]	RCT	Achilles	N= 50 % female 60 Age 40 (11) Symptoms 26 (9.45)	1	1 x (Resistance)	Eccentric loading as applied in the present study showed inferior results to low-energy shock wave therapy as

			Training status Other			applied in patients with chronic recalcitrant tendinopathy of the insertion of the Achilles tendon at four months follow-up.
Roos 2004 Sweden [50]	RCT	Achilles	N= 44 % female 52 Age 45 (26-60) Symptoms 6 (1-180) Training status Recreational	1	1 x (Resistance)	Eccentric exercises reduce pain and improve function in patients with Achilles tendinopathy.
Silbernagel 2001 Sweden [51]	RCT	Achilles	N= 47 % female 22 Age 44 (12.5) Symptoms 31 (40.7) Training status Recreational	2	1 x (Flexibility, Proprioception, Resistance); 1 x (Flexibility)	The eccentric overload protocol used in the present study can be recommended for patients with chronic pain from the Achilles tendon. More patients achieved full recovery, improved pain and ROM in the Exp group compared to the control group.
Steunebrink 2013 Netherlands [52]	RCT	Patellar	N= 33 % female 24 Age 33 (10) Symptoms 11 (8) Training status Recreational	1	1 x (Resistance)	Continuous topical GTN treatment in addition to an eccentric exercise programme does not improve clinical outcome compared to placebo patches and an eccentric exercise programme in patients with chronic patellar tendinopathy.
Stevens 2014 United Kingdom [53]	RCT	Achilles	N= 28 % female 61 Age 49 (10.8) Symptoms 7 (4.0) Training status Other	2	2 x (Resistance)	Performing a 6-week do-as-tolerated program of eccentric heel-drop exercises compared to the recommended 180 repetitions per day, did not lead to lesser improvement for individuals with midportion Achilles tendinopathy, based on VISA-A and VAS scores.
Van Ark 2016 Australia [54]	RCT	Patellar	N= 19 % female 7 Age 23 (4.7) Symptoms 36 (33.8)	2	2 x (Resistance)	This study found favourable results for athletes with patellar tendinopathy without modification of the training. Both isometric

			Training status Recreational			and isotonic exercise programs reduced pain and improve function in athletes with patellar tendinopathy during a season.
Vuvan 2019 Australia [55]	RCT	Lateral elbow/tennis elbow	N= 39 % female 28 Age 49 (9) Symptoms 4 (NR) Training status Other	2	2 x (Flexibility, Resistance)	Unsupervised isometric exercise was effective in improving pain and disability, but not perceived rating of change and pain-free grip strength when compared with wait-and-see at 8 wk. With only one of the three primary outcomes being significantly improved, it is doubtful if isometric exercises can be an efficacious standalone treatment.
Werner 2002 Germany [56]	RCT	Rotator cuff - subacromial impingement	N=20 % female 50 Age 52 (NR) Symptoms 28 Training status Other	2	1 x (Flexibility, Resistance); 1 x (Proprioception, Resistance)	Strengthening of the centering muscles around the humeral head lead to positive outcomes for subacromial impingement. Self-training after instruction showed no difference to physiotherapist-supervised exercises.
Yelland 2011 Australia [57]	RCT	Achilles	N= 43 % female NR Age 47 (NR) Symptoms 17 (NR) Training status Other	1	1 x (Resistance)	Prolotherapy and particularly eccentric loading exercises combined with prolotherapy gave more rapid improvements in Achilles tendinosis symptoms than eccentric loading exercises alone. Long term VISA-A scores were similar.

RCT = Randomised Controlled Trials; NR = Not Reported; SAIS = Subacromial impingement syndrome; AT = Achilles Tendinopathy; VISA-A = Victorian Institute of Sport Assessment-Achilles; VAS = Visual Analog Scale; GTN = ; ROM = Range of Motion; SAP = Subacromial Pain Syndrome; MWM = Mobilization with Movement; ISO = Isometric; EE = Eccentric Exercise; SWE = Shear Wave Elastography

Table 3. Tendinopathy locations and associated dominant exercise therapy classes and treatments.

Tendinopathy type	Dominant exercise therapy class and treatment	Number (%) of treatment arms
Achilles	Resistance: Eccentric only	14 (74%)
	Resistance: Concentric and eccentric	3 (16%)
	Resistance: Isometric	1 (5%)
	Flexibility: Static stretching	1 (5%)
RCRSP	Proprioception: Movement pattern retraining	6 (35%)
	Resistance: Concentric and eccentric	6 (35%)
	Flexibility: Dynamic stretching	2 (12%)
	Resistance: Eccentric only	1 (6%)
	Resistance: Isometric	1 (6%)
	Proprioception: Joint position sense	1 (6%)
Patellar	Resistance: Eccentric only	3 (38%)
	Resistance: Isometric	2 (25%)
	Resistance: Concentric only	2 (25%)
	Resistance: Concentric and eccentric	1 (12%)
Lateral elbow	Resistance: Isometric	1 (33%)
	Flexibility: Dynamic stretching	1 (33%)
	Flexibility: Static stretching	1 (33%)
Gluteal	Resistance: Concentric and eccentric	1 (100%)

Confidence in cumulative evidence

RoB for individual studies are presented in the Supplementary information (SF-6), with a summary across all treatment arms presented in Figure 2. RoB was highest for "other bias" (55% high Rob) followed by blinding of participants and outcome assessors (25% and 10% high RoB, respectively). Reporting quality was also identified as a potential limitation with high percentages of unclear risk of bias identified for selective reporting (62% unclear RoB) and blinding (participants: 33% unclear RoB; outcome assessors: 33% high RoB). Generally, the RoB due to randomisation, allocation concealment, and incomplete outcomes were low. Strength of evidence assessment across the different meta-analysis models are presented in Supplementary information: SF-7. In general, strength of evidence assessments were low to moderate due to risk of bias and inconsistency. There were few occurrences of small study-effects skewing effect size estimates and imprecision in estimates.

Patient Rating Outcomes

Across the 110 outcomes extracted, 65 were from binary outcomes measured post-intervention (28 treatment arms), 36 were from continuous or Likert scale data measured post-intervention (17 treatment arms), and 9 were from continuous scales conduced pre- and post-intervention (6 treatment arms). Of the 65 binary outcomes, 26 consisted of counts of patient satisfaction measurements dichotomised as satisfied or not satisfied with treatment. The breakdown of the data across tendinopathy locations included 9 outcomes for the Achilles, 8 outcomes for the patellar, 4 outcomes for lateral elbow, and 5 outcomes for RCRSP. The remaining 39 binary outcomes consisted of GROC scales of recovery (17 outcomes), symptom status (20 outcomes), and global impression of change (2 outcomes). These commonly took the form of Likert scores that were dichotomised at certain cut-offs to obtain groups of responders (completely recovered or much improved) and non-responders (unchanged or slightly improved). For the GROC

scales, the breakdown of the data across tendinopathy locations included 32 outcomes for Achilles, 3 outcomes for the lateral elbow, 3 outcomes for gluteal tendinopathy, and 1 outcome for RCRSP. Meta-analysis of the binary outcomes to estimate the pooled proportion of 'positive response' was $ES_{PROP_{0.5}}$ = 0.57 [95%CrI: 0.49 to 0.64]; standard deviation $\tau_{PROP_{0.5}}$= 0.56 [75%CrI: 0.51 to 0.62]; $ICC_{PROP_{0.5}}$=0.07 [75%CrI: 0.01 to 0.24]; with moderate certainty according to GRADE assessment (Table 4). The low ICC correlated with potentially high variance between sample populations which is to be expected for a meta-analysis of multiple tendinopathies. Taken as a whole, these studies provided consistent evidence of a moderate effect size (between 0.53 and 0.61) as shown in Figure 3. A sub-analysis of binary outcomes restricted to tools measuring patient satisfaction only was also conducted. The analysis comprised 26 outcomes from 17 treatment arms and estimated that the pooled proportion of positive responses was $ES_{PROP:Satisfaction_{0.5}}$ = 0.63 [95%CrI: 0.53 to 0.73], with high certainty. Findings from the moderator analyses found a higher proportion of positive response for outcomes assessed over a medium duration compared to short duration, but limited evidence of a difference between region of the tendinopathy (further details are provided in the Supplementary information: SF-8).)

A total of 36 outcomes measured post-intervention on various measurement scales were obtained from 17 treatment arms quantifying patient satisfaction and perceptions of condition and recovery. Fourteen outcomes (9 treatment arms) were obtained from tools with positive only scales each quantifying patient satisfaction (e.g., a 4-point scale ranging from 1 to 4. 1 represents minimal or no improvement and 4 represents significant improvement). Additionally, 22 outcomes (9 treatment arms) each measuring patients' perception of change were obtained using scales with zero as a neutral point and values below and above this point representing negative and positive changes, respectively (e.g., a 15-point ordinal scale range from –7 to + 7. -7 represents a "very great deal worse", 0 represents no change in status, and +7 represents a "very

great deal better"). Expressed as a proportion of the maximum score, the pooled estimate of the positive only scales measuring patient satisfaction was $ES_{0:1_{0.5}}$ = 0.63 [95%CrI: 0.45 to 0.82] with moderate certainty (Table 4). Similarly, the pooled estimate of symmetric scales with a neutral point measuring patients' perception of change was $ES_{-1:1_{0.5}}$ = 0.53 [95%CrI: 0.38 to 0.69] with higher certainty (Table 4). Overall, the values for patient satisfaction and perception of change were fairly consistent across the studies (Figure 4). There were insufficient data to conduct moderator analyses across both outcome types. Finally, a total of 9 outcomes from 6 treatment arms quantified patients perception of change based on differences in pre- to post-intervention values measuring tendinopathy symptoms. The pooled estimate of the standardised mean difference was $ES_{Pre_{0.5}}$= 1.7 [95%CrI: 0.54 to 2.8] with low certainty (Table 4). The forest plot indicated a consistent and sizeable effect size in pre- to post-intervention measurement of symptoms (Figure 5).

Table 4. Effects of exercise therapy on patient rating outcomes

atient Rating Outcomes	Number of outcomes	Parameter Estimate [95% CrI]	Between study SD (τ) [75%CrI]	Intraclass Correlation Coefficient [75%CrI]	Gra
y outcome data:					
ortion of positive response ($ROP_{0.5}$)	39	0.57 [0.49 to 0.64]	0.56 [0.51 to 0.62]	0.07 [0.01 to 0.24]	Mode
ortion of positive response tient satisfaction only ($tisfaction_{0.5}$)	26	0.63 [0.53 to 0.730	0.59 [0.52 to 0.67]	0.16 [0.01 to 0.49]	Hig
inuous outcome data:					
nate of positive only scales ($1_{0.5}$)	14	0.63 [0.45 to 0.82]	0.16 [0.04 to 0.32]	0.65 [0.23 to 0.98]	Mode
nate of change with tive to positive scales ($1{:}1_{0.5}$)	22	0.53 [0.38 to 0.69]	0.19 [0.13 to 0.29]	0.24 [0.10 to 0.53]	Hig
and post-intervention rences in symptom severity ($re_{0.5}$)	9	1.7 [0.54 to 2.8]	0.83 [0.25 to 1.6]	0.23 [0.01 to 0.89]	Lo

SD: Standard deviation; CrI: Bayesian credible interval.

Discussion

This review synthesised exercise therapy intervention data investigating patient rating outcomes for tendinopathy, which have been recommended for use as a core outcome measure for trials and have been advocated for improving clinical applicability of studies. Our pooled findings demonstrated substantive improvements were observed, with constructs measuring patient rating outcomes ranging between moderate and high. Standardised mean differences of pre- to post-intervention change in patients' evaluation of their condition were likely to be at least moderate and potentially very large. Together, these findings suggest that engaging in standard exercise therapies for the most common tendinopathies is likely to lead to appropriate levels of satisfaction and perceptions of improved change.

Evidence was also obtained to indicate that satisfaction and perceptions of change measured by GROC may be increased as follow-up duration increases from short to medium time frames (up to 12 months). This finding reflects the results from individual studies that included serial patient rating of condition measurements. Nishizuka et al. (2016) [41] evaluated a 6 month exercise intervention for lateral epicondylitis with a 12-month follow-up period reported progressive improvement in patient satisfaction over assessment durations of 1, 3, 6, and 12 months following baseline [41]. The authors acknowledged that the study comprised a longer treatment period and a high proportion of patients with acute symptoms (symptom duration of less than 8 weeks), suggesting that this combination may provide superior results. Generally, our review demonstrates that most people with tendinopathy experience benefits with exercise therapy, reported as improvement in their condition or satisfaction. It is a limitation of our research that it is based on the broader context of patient rating of outcomes combining multiple patient-centred constructs. Future studies may need to measure these constructs more frequently to be able to disentangle satisfaction and perception of change. However, our sub-group analysis

comprising of patient satisfaction only outcomes also showed comparable effects. The inclusion of outcome measures reflecting the broad range of tools used in the literature also explain the heterogeneity identified, but overall, the findings for satisfaction are relatively consistent across different outcome measures within tight confidence intervals and fairly small margins of error.

The present study identified 124 studies investigating exercise therapy for the management of tendinopathies; however, only 34 of the 124 studies identified reported outcomes within the patient rating of condition domain. The majority of the data pertained to resistance exercise (75%) across a range of tendinopathies; with Achilles (41%) being the largest contributor followed by RCRSP (32%), patellar (15%), elbow (9%) and gluteal (3%). Positive overall response included proportion of individuals who are satisfied and positive responders according to GROC data. The GROC allows for individuals to indicate the direction of change (i.e., improvement or deterioration) and the degree of change (i.e., small to large) using a Likert scale anchored by negative to positive affect scores (e.g. −7 "a very great deal worse", to 0 "no change", to +7 "a very great deal better"). The GROC was proposed as a means to indirectly establish a minimum clinically important difference, which may be used as a threshold that patients must surpass to qualify as responders [58]. When normalised to lie on a -1 to 1 scale, the estimated pooled mean of +0.55 in the present study can be interpreted as a 75% effect size (considering its shift from the negative affect to the mid-point of the positive scale) which qualitatively would be considered moderate to high.

Across the tendinopathy literature there is considerable variability in GROC scales, with the most common including the Patient Global Impression of Change (PGIC) scale [59], Global Scale [60], and Global Perceived Effect scale [61]. The present review also identified variation in scale designs including the range of scores and the qualitative terms used as anchor points.

Additionally, it was identified that some GROC scales included in this review are more reflective of patients' satisfaction with overall treatment or recovery, while others are reflective of improvement or deterioration in symptoms, depending on the construct chosen by the assessor. When extracting data for the current review, it was identified that GROC scales were often described in insufficient detail to enable full reproducibility. Such limitations in reporting makes it difficult to make comparisons between studies and ultimately, establish clearer treatment hierarchies.

In a recent large scoping review of exercise therapies for the management of tendinopathy, it was identified that the majority of interventions lasted 12 weeks or less with patient rating of condition measures obtained at an average of 27 weeks to follow up [5]. The potential for recall bias must therefore be considered. It has been argued that GROC has better validity with shorter recall periods and therefore, for chronic conditions like tendinopathy, serial measures may be preferable to single self-reported retrospective change when transition times stretch over months [10, 62, 63]. In contrast, retrospective measures more readily capture the patient's overall experience of a change in symptom or health state over time, which has greater relevance to the patient. Taking the patient's views into account is associated with greater satisfaction with care, better treatment adherence, and ensures productive interactions between clinical team and patient [64, 65]. These are sufficient reasons for including the patient's retrospective assessment in studies. Measurement of complex subjective constructs such as treatment satisfaction or recovery is an inherently difficult process. Recognising that no singular instrument completely captures this construct [6], it is important to then consider data from any outcome measure not in isolation but within the wider clinical context.

Current literature suggests that patient satisfaction is affected by a variety of factors including medical staff's service attitude, medical services technology, hospital convenience [66], waiting times [67], and continuity of care [68]. Capturing these factors when assessing patient experience with their tendinopathy care can assist towards developing a better understanding of the key areas where improvements are needed.

Clinical and research implications:

Although results suggest that patients are generally satisfied and report positive perceptions of change with exercise therapy as a treatment for tendinopathy (~ 50 to 75%), it is recommended that more focus on these outcome domains be applied in future. The current and other recent reviews [69, 70] demonstrate that patient rating of condition is one of the least measured outcome domains in studies investigating exercise therapy for management of tendinopathies. In addition, the domain is among the most complex, measured by a wide variety of tools and scales, and affected by poor quality reporting that limits future evidence syntheses and clinical interpretation. We propose that further research investigating satisfaction and GROC is required to obtain more consistent tools and ultimately, progress to exploring patient and exercise-related moderating factors that can improve the quality of tendinopathy care.

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Ethical Approval

Ethical approval was not required for this evidence synthesis.

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Conflicts of interest

The authors declare no conflict of interest.

Figure 1. Flow chart of study selection.

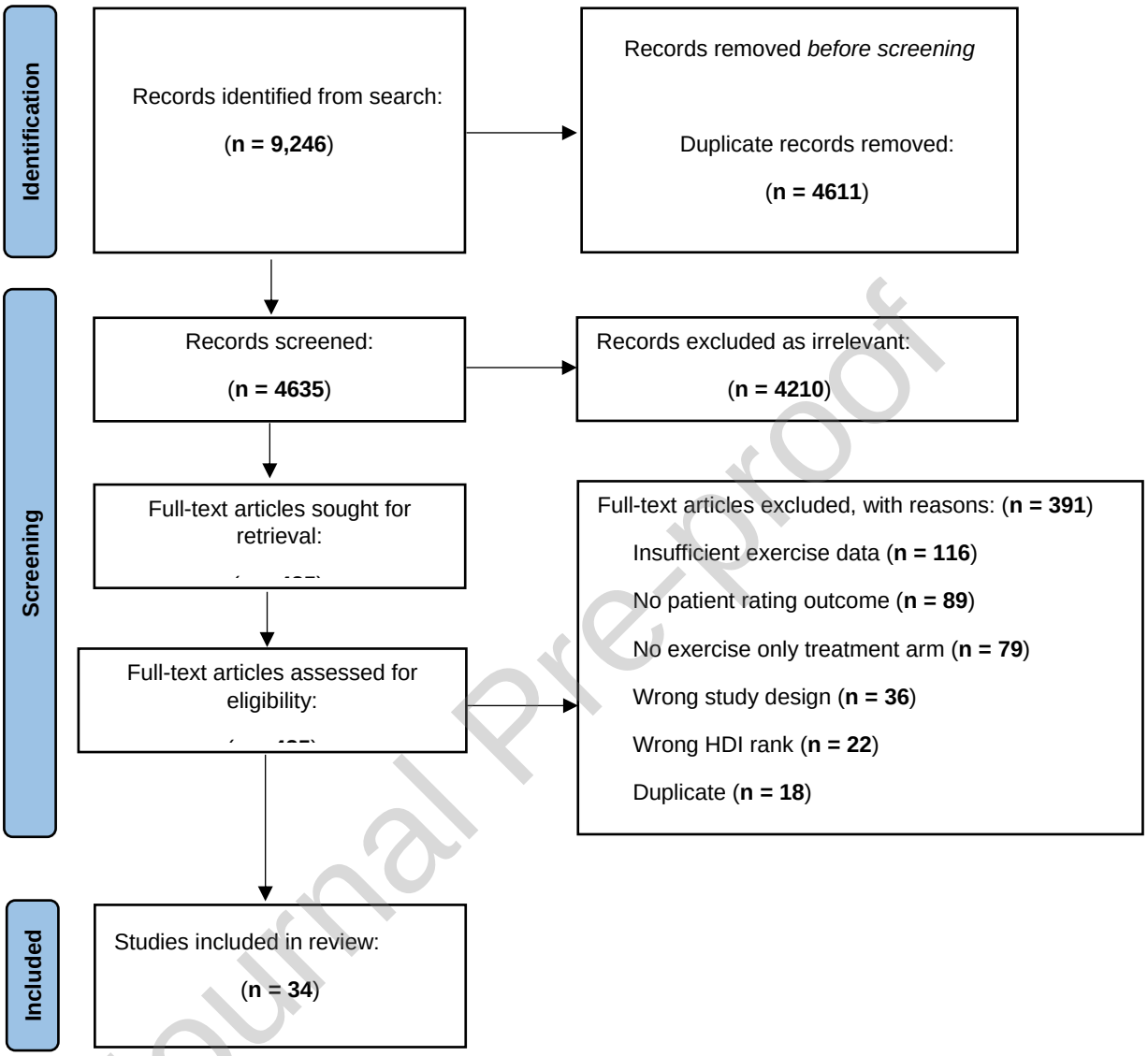
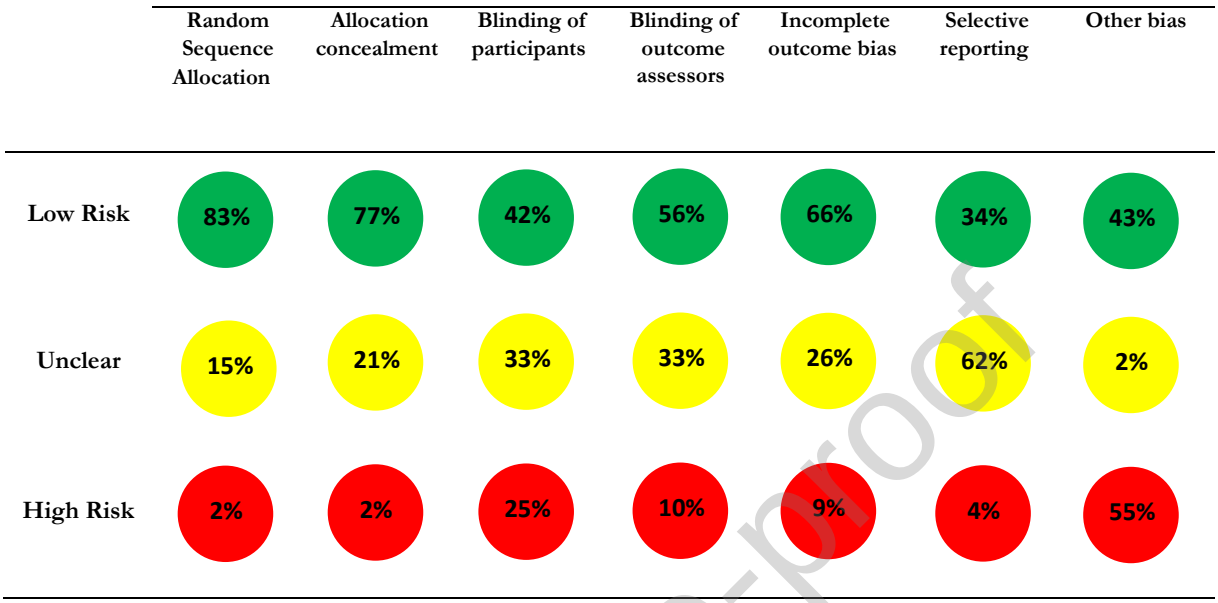
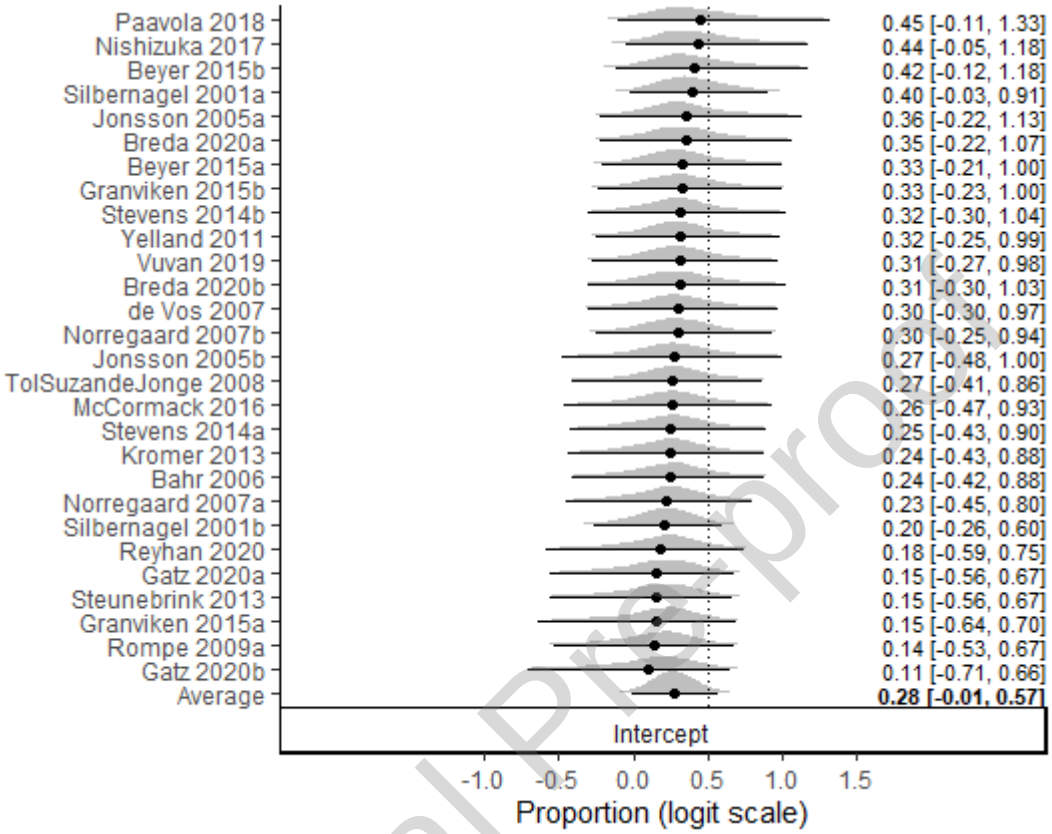


Figure 2. Risk of bias assessment with percentages of low-, unclear- and high-risk evaluations expressed relative to the number of treatment arms.



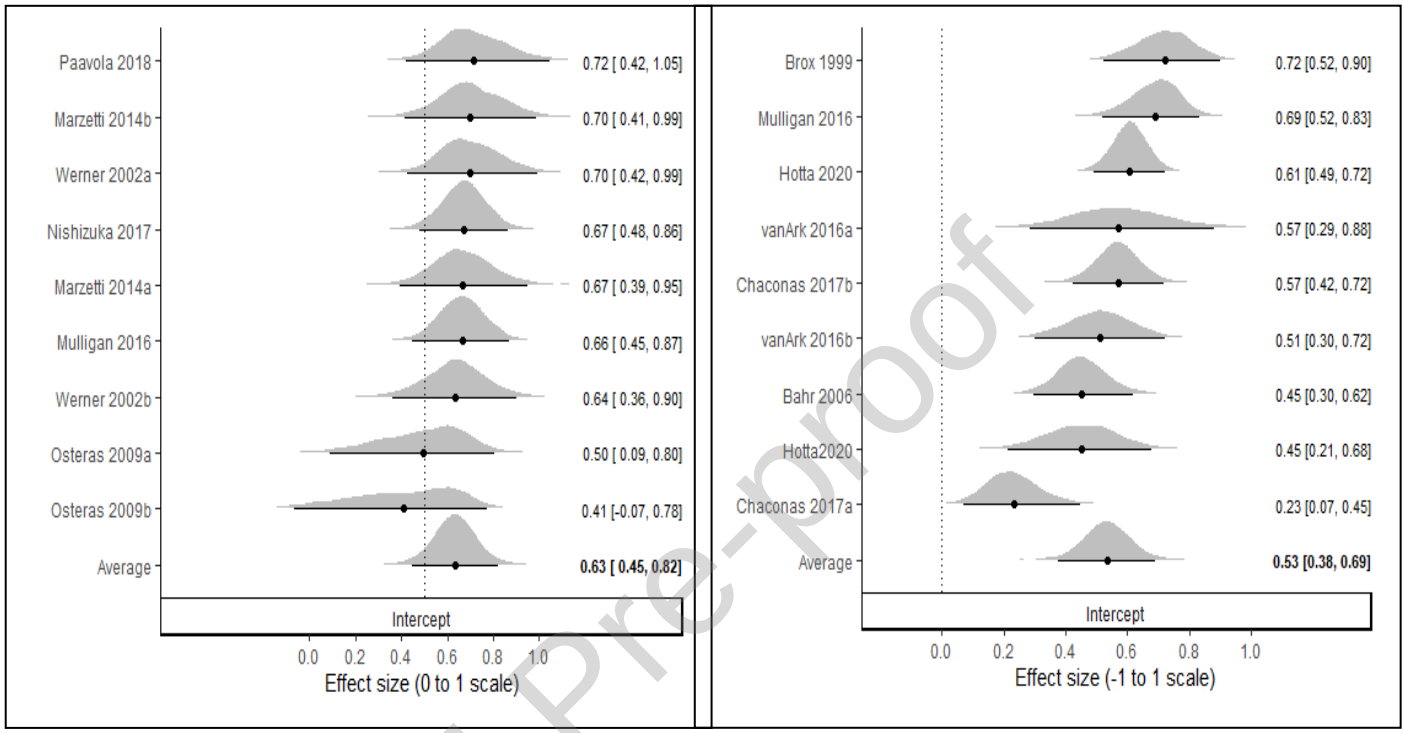
Green: Risk is low risk; Yellow: Risk is unclear; Red: Risk is high

Figure 3. Bayesian forest plot of binary post-intervention outcomes quantifying overall proportion of positive response. **Analysis conducted on the logit scale.**



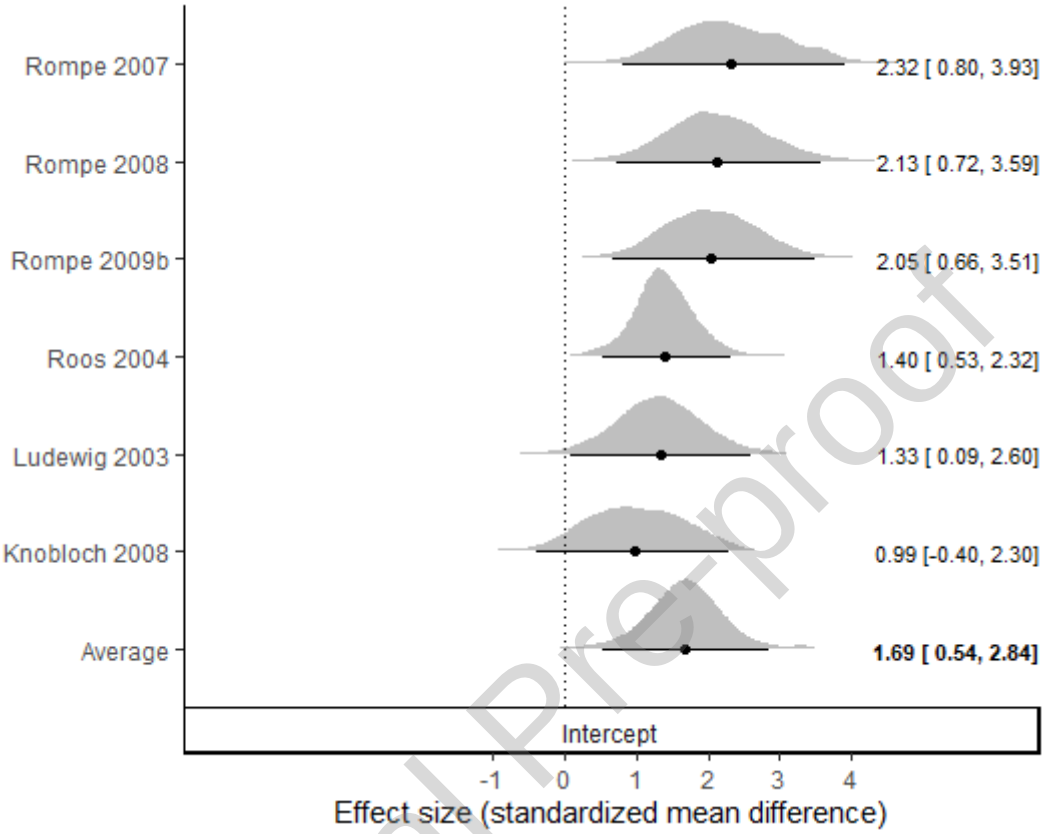
Distributions represent "shrunken estimates" based on all relevant effect sizes, the random effects model fitted, and borrowing of information across studies to reduce uncertainty. Black circles and connected intervals represent the median value and 95% credible intervals for the shrunken estimates. Vertical line at 0 represents proportion of 0.5 on the standard scale. Logit was used as the unit analysis for the meta-analysis and values were back-transformed and expressed as a proportion. Therefore, a pooled average of 0.28 on the logit scale equates to a probability proportion of 0.57; $\mathbf{ES_{PROP_{0.5}}} = \frac{exp(x)}{1+exp(x)} = \frac{exp(0.28)}{1+exp(0.28)}$**, where *x* represents the logit value and *exp* is the exponential.**

Figure 4. Bayesian forest plot of post-intervention patient satisfaction outcomes standardised on a zero to one scale (Left) and perception of change outcomes standardised on minus one to one scale (Right).



Distributions represent "shrunken estimates" based on all relevant effect sizes, the random effects model fitted, and borrowing of information across studies to reduce uncertainty. Black circles and connected intervals represent the median value and 95% credible intervals for the shrunken estimates. Vertical line at 0.5 (left) or 0 (right) represents a response half-way up the given scale.

Figure 5. Bayesian forest plot of pre- to post-intervention standardized mean difference effect sizes of patient perception of change.



Distributions represent "shrunken estimates" based on all relevant effect sizes, the random effects model fitted, and borrowing of information across studies to reduce uncertainty. Black circles and connected intervals represent the median value and 95% credible intervals for the shrunken estimates. Vertical line at 0 represents no change pre- to

Reference List

1. Fu, F.H., J.-c. Wang, and B.B. Rothrauff, *Best Practice Tendinopathy [Internet]*. BMJ, 2019. **2019**.
2. Abat, F., et al., *Current trends in tendinopathy: consensus of the ESSKA basic science committee. Part I: biology, biomechanics, anatomy and an exercise-based approach.* J Exp Orthop, 2017. **4**: p. 18.
3. Lim, H.Y. and S.H. Wong, *Effects of isometric, eccentric, or heavy slow resistance exercises on pain and function in individuals with patellar tendinopathy: A systematic review.* Physiother Res Int, 2018. **23**(4): p. 4.
4. Vincenzino, B., et al., *ICON 2019—International Scientific Tendinopathy Symposium Consensus: There are nine core health-related domains for tendinopathy (CORE DOMAINS): Delphi study of healthcare professionals and patients.* British journal of sports medicine, 2019. **54**(8): p. 444-451.
5. Alexander, L.A., et al., *Exercise therapy for tendinopathy: A scoping review mapping interventions and outcomes.* SportRχiv, 2021.
6. Graham, B., *Defining and measuring patient satisfaction.* The Journal of hand surgery, 2016. **41**(9): p. 929-931.
7. Smith, M.J. and T.J. Choma, *Patient satisfaction in musculoskeletal medicine.* Current Reviews in Musculoskeletal Medicine, 2017. **10**(22): p. 207-211.
8. Batbaatar, E., et al., *Determinants of patient satisfaction: a systematic review.* Perspectives in Public Health. **137**(2): p. 89-101.
9. Hush, J.M., K. Cameron, and M. Mackey, *Patient Satisfaction With Musculoskeletal Physical Therapy Care: A Systematic Review.* Physical Therapy, 2011. **91**(1): p. 25-36.
10. Kamper, S.J., C.G. Maher, and G. Mackay, *Global rating of change scales: a review of strengths and weaknesses and considerations for design.* The Journal of manual & manipulative therapy, 2009. **17**(3): p. 163-170.
11. Garrison, C. and C. Cook, *Clinimetrics corner: the Global Rating of Change Score (GRoC) poorly correlates with functional measures and is not temporally stable.* 2012. **20**(4): p. 178-181.
12. Fischer, D., et al., *Capturing the patient's view of change as a clinical outcome measure.* Jama, 1999. **282**(12): p. 1157-1162.
13. Kennedy, G.D., S.E. Tevis, and K.C. Kent, *Is there a relationship between patient satisfaction and favorable outcomes?* Annals of Surgery, 2014. **260**(4): p. 592-8; discussion 598-600.
14. Cooper, K., et al. *The effectiveness of exercise interventions for tendinopathy.* 2020; Available from: https://www.crd.york.ac.uk/prospero/display_record.php?ID=CRD42020168187.
15. Swinton, P.A., et al., *Empirically derived guidelines for interpreting the effectiveness of exercise therapy for tendinopathies: A protocol.* SportRxiv PrePrint, 2021.
16. Page, M.J., et al., *The PRISMA 2020 statement: an updated guideline for reporting systematic reviews.* BMJ, 2021. **372**: p. n71.
17. United Nations Development Program, *Human Development Reports [Internet]*. New York: United Nations;, 2020. **2019**.
18. Higgins, J.P.T., et al., *The Cochrane Collaboration's tool for assessing risk of bias in randomised trials.* BMJ, 2011. **343**: p. d5928.
19. Challoumas, D. and N.L. Millar, *Risk of bias in systematic reviews of tendinopathy management: Are we comparing apples with oranges?* TRANSLATIONAL SPORTS MEDICINE, 2021. **4**(1): p. 21-37.
20. Schünemann, H.J., et al., *GRADE guidelines: 21 part 1. Study design, risk of bias, and indirectness in rating the certainty across a body of evidence for test accuracy.* Journal of clinical epidemiology, 2020. **122**: p. 129-141.
21. Schünemann, H.J., et al., *GRADE guidelines: 21 part 2. Test accuracy: inconsistency, imprecision, publication bias, and other domains for rating the certainty of evidence and presenting it in evidence profiles and summary of findings tables.* Journal of clinical epidemiology, 2020. **122**: p. 142-152.

22. Challoumas, D. and N.L. Millar, *Do we need to improve the reporting of evidence in tendinopathy management? A critical appraisal of systematic reviews with recommendations on strength of evidence assessment.* BMJ OPEN SP EX MED, 2021. **7**(1): p. e000920.
23. Bürkner, P.C., *brms: An R Package for Bayesian Multilevel Models Using Stan.* J Stat Softw, 2017. **80**: p. 1.
24. Bahr, R., et al., *Surgical treatment compared with eccentric training for patellar tendinopathy (jumper's knee): a randomized, controlled trial.* JBJS, 2006. **88**(8): p. 1689-1698.
25. Breda, S.J., et al., *Effectiveness of progressive tendon-loading exercise therapy in patients with patellar tendinopathy: a randomised clinical trial.* British journal of sports medicine, 2020.
26. Brox, J.I., et al., *Arthroscopic surgery versus supervised exercises in patients with rotator cuff disease (stage II impingement syndrome): a prospective, randomized, controlled study in 125 patients with a 2 1/2-year follow-up.* Journal of shoulder and elbow surgery, 1999. **8**(2): p. 102-111.
27. Chaconas, E.J., et al., *Shoulder external roator eccentric training versus general shoulder exercise for subacromial pain syndrome: a randomized controlled trial.* International Journal of Sports Physical Therapy, 2017. **12**(7): p. 1121-1133.
28. de Jonge, S., et al., *One-year follow-up of a randomised controlled trial on added splinting to eccentric exercises in chronic midportion Achilles tendinopathy.* bjsm.bmj.com, 2008.
29. De Vos, R.J., et al., *The additional value of a night splint to eccentric exercises in chronic midportion Achilles tendinopathy: a randomised controlled trial.* British journal of sports medicine, 2007. **41**(7).
30. Gatz, M., et al., *Eccentric and Isometric Exercises in Achilles Tendinopathy Evaluated by the VISA-A Score and Shear Wave Elastography.* Sports health, 2020: p. 1941738119893996.
31. Granviken, F. and O. Vasseljen, *Home exercises and supervised exercises are similarly effective for people with subacromial impingement: a randomised trial.* Journal of physiotherapy, 2015. **61**(3): p. 135-141.
32. Hotta, G.H., et al., *Effects of adding scapular stabilization exercises to a periscapular strengthening exercise program in patients with subacromial pain syndrome: A randomized controlled trial.* Musculoskeletal Science and Practice, 2020. **49**.
33. Johansson, K.M., L.E. Adolfsson, and M.O.M. Foldevi, *Effects of acupuncture versus ultrasound in patients with impingement syndrome: randomized clinical trial.* Physical Therapy, 2005. **85**(6): p. 490-501.
34. Jonsson, P. and H. Alfredson, *Superior results with eccentric compared to concentric quadriceps training in patients with jumper's knee: a prospective randomised study.* Br J Sports Med, 2005. **39**.
35. Knobloch, K., et al., *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.* Disability and rehabilitation, 2008. **30**(20-22): p. 1685-1691.
36. Kromer, T.O., R.A. de Bie, and C.H.G. Bastiaenen, *Physiotherapy in patients with clinical signs of shoulder impingement syndrome: a randomized controlled trial.* Journal of Rehabilitation Medicine, 2013. **45**(5): p. 488-497.
37. Ludewig, P.M. and J.D. Borstad, *Effects of a home exercise programme on shoulder pain and functional status in construction workers.* Occupational and environmental medicine, 2003. **60**(11): p. 841-849.
38. Marzetti, E., et al., *Neurocognitive therapeutic exercise improves pain and function in patients with shoulder impingement syndrome: a single-blind randomized controlled clinical trial.* European journal of physical and rehabilitation medicine, 2014. **50**(3): p. 255-264.
39. McCormack, J.R., et al., *Eccentric Exercise Versus Eccentric Exercise and Soft Tissue Treatment (Astym) in the Management of Insertional Achilles Tendinopathy.* Sports health, 2016(1941-0921 (Electronic)).
40. Mulligan, E.P., et al., *The Effect of Axioscapular and Rotator Cuff Exercise Training Sequence in Patients with Subacromial Impingement Syndrome: a Randomized Crossover Trial.* International Journal of Sports Physical Therapy, 2016. **11**(1): p. 94-107.

41. Nishizuka, T., et al., *Efficacy of a forearm band in addition to exercises compared with exercises alone for lateral epicondylitis: A multicenter, randomized, controlled trial.* Journal of Orthopaedic Science, 2017. **22**(2): p. 289-294.
42. Nørregaard, J., et al., *Eccentric exercise in treatment of Achilles tendinopathy.* Scandinavian Journal of Medicine & Science in Sports, 2007. **17**(2): p. 133-138.
43. Østerås, H., et al., *Dose-response effects of graded therapeutic exercises in patients with long-standing subacromial pain.* Advances in Physiotherapy, 2009. **11**(4): p. 199-209.
44. Paavola, M., et al., *Subacromial decompression versus diagnostic arthroscopy for shoulder impingement: randomised, placebo surgery controlled clinical trial.* BMJ (Clinical research ed.), 2018. **362**.
45. Reyhan, A.C., D. Sindel, and E.E. Dereli, *The effects of Mulligan's mobilization with movement technique in patients with lateral epicondylitis.* Journal of Back and Musculoskeletal Rehabilitation, 2020. **33**(1): p. 99-107.
46. Rompe, J.D., et al., *Eccentric loading, shock-wave treatment, or a wait-and-see policy for tendinopathy of the main body of tendo Achillis: a randomized controlled trial.* The American Journal of Sports Medicine, 2007. **35**(3): p. 374-383.
47. Rompe, J.D., J. Furia, and N. Maffulli, *Eccentric loading versus eccentric loading plus shock-wave treatment for midportion achilles tendinopathy: a randomized controlled trial.* The American Journal of Sports Medicine, 2009. **37**(3): p. 463-470.
48. Rompe, J.D., et al., *Home training, local corticosteroid injection, or radial shock wave therapy for greater trochanter pain syndrome.* American Journal of Sports Medicine, 2009. **37**(10): p. 1981-1990.
49. Rompe, J.D., J. Furia, and N. Maffulli, *Eccentric loading compared with shock wave treatment for chronic insertional achilles tendinopathy: A randomized, controlled trial.* Journal of Bone and Joint Surgery - Series A, 2008. **90**(1): p. 52-61.
50. Roos, E.M., et al., *Clinical improvement after 6 weeks of eccentric exercise in patients with mid-portion Achilles tendinopathy -- a randomized trial with 1-year follow-up [with consumer summary].* Scandinavian Journal of Medicine & Science in Sports 2004 Oct;14(5):286-295, 2004.
51. Silbernagel, K.G., et al., *Eccentric overload training for patients with chronic Achilles tendon pain--a randomised controlled study with reliability testing of the evaluation methods.* Scandinavian Journal of Medicine & Science in Sports, 2001. **11**(4): p. 197-206.
52. Steunebrink, M., et al., *Topical glyceryl trinitrate treatment of chronic patellar tendinopathy: a randomised, double-blind, placebo-controlled clinical trial.* British journal of sports medicine, 2013. **47**(1): p. 34-39.
53. Stevens, M. and C.-W. Tan, *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, 2014. **44**(2): p. 59-67.
54. Van Ark, M., et al., *Do isometric and isotonic exercise programs reduce pain in athletes with patellar tendinopathy in-season? A randomised clinical trial.* Journal of science and medicine in sport, 2016. **19**(9): p. 702-706.
55. Vuvan, V., et al., *Unsupervised Isometric Exercise versus Wait-and-See for Lateral Elbow Tendinopathy.* Medicine and science in sports and exercise, 2020. **52**(2): p. 287-295.
56. Werner, A., et al., *Self-training versus conventional physiotherapy in subacromial impingement syndrome.* Zeitschrift fur Orthopadie und ihre Grenzgebiete, 2002. **140**(4): p. 375-380.
57. Yelland, M.J., et al., *Prolotherapy injections and eccentric loading exercises for painful Achilles tendinosis: a randomised trial.* Br J Sports Med, 2011. **45**(5): p. 421-8.
58. Jaeschke, R., J. Singer, and G.H. Guyatt, *Measurement of health status. Ascertaining the minimal clinically important difference.* Controlled clinical trials, 1989. **10**(4): p. 407-415.
59. Ferguson, L. and J. Scheman, *Patient global impression of change scores within the context of a chronic pain rehabilitation program.* The Journal of Pain, 2009. **10**(4, Supplement): p. S73.
60. Busner, J. and S.D. Targum, *The clinical global impressions scale: applying a research tool in clinical practice.* Psychiatry (Edgmont), 2007. **4**(7): p. 28-37.

61. Kamper, S.J., et al., *Global Perceived Effect scales provided reliable assessments of health transition in people with musculoskeletal disorders, but ratings are strongly influenced by current status.* Journal of clinical epidemiology, 2010. **63**(7): p. 760-766. e1.
62. Guyatt, G.H., et al., *A critical look at transition ratings.* Journal of clinical epidemiology, 2002. **55**(9): p. 900-908.
63. Schmitt, J.S. and J.H. Abbott, *Patient Global Ratings of Change Did Not Adequately Reflect Change Over Time: A Clinical Cohort Study.* Physical Therapy, 2014. **94**(4): p. 534-542.
64. Wagner, E.H., B.T. Austin, and M. Von Korff, *Improving outcomes in chronic illness.* Managed care quarterly, 1996. **4**(2): p. 12-25.
65. Cleary, P.D. and B.J. McNeil, *Patient satisfaction as an indicator of quality care.* Inquiry : a journal of medical care organization, provision and financing, 1988. **25**(1): p. 25-36.
66. Fang, J., L. Liu, and P. Fang, *What is the most important factor affecting patient satisfaction - a study based on gamma coefficient.* Patient preference and adherence, 2019. **13**: p. 515-525.
67. Farzianpour, F., R. Byravan, and S. Amirian, *Evaluation of Patient Satisfaction and Factors Affecting It: A Review of the Literature.* Health, 2015. **7**(11): p. 1460-1465.
68. Saultz, J.W. and W. Albedaiwi, *Interpersonal continuity of care and patient satisfaction: a critical review.* Annals of family medicine, 2004. **2**(5): p. 445-451.
69. Clifford, C., et al., *Effectiveness of isometric exercise in the management of tendinopathy: a systematic review and meta-analysis of randomised trials.* BMJ open sport & exercise medicine, 2020. **6**(1): p. e000760-2020-000760. eCollection 2020.
70. dos Santos Franco, Y.R., et al., *Exercise therapy in the treatment of tendinopathies of the lower limbs: a protocol of a systematic review.* Systematic Reviews, 2019. **8**(1): p. 142.