Exercise therapy for tendinopathy: a mixed-methods evidence synthesis exploring feasibility, acceptability and effectiveness

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Scientific summary

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Scientific summary

Background

Tendinopathy refers to a spectrum of changes in damaged or diseased tendons leading to pain and functional impairment, often chronic or recurrent in nature. Tendinopathy can affect any muscle-tendon unit in the body but is most reported in the Achilles, patellar, lateral elbow, rotator cuff and hip tendons. Tendinopathy is common, affects all age-groups and, although often associated with athletic populations, it is also prevalent in non-athletic and sedentary populations.

Tendinopathy is primarily managed conservatively using exercise therapy that may consist of one or more types of exercise including resistance, flexibility, proprioception, balance and whole-body exercise.

A substantive number of studies and systematic reviews have been conducted on various aspects of exercise for tendinopathy. These mostly comprise efficacy studies, with a growing trend towards qualitative studies of lived experience. Previous systematic reviews have typically focussed on individual tendinopathies and included small numbers of homogeneous studies.

Driven by the need for clear evidence-based guidance to inform clinical practice in this field, the current mixed-methods evidence synthesis project was designed to comprehensively map the research conducted to date, and to take an inclusive approach to synthesising the evidence on efficacy, feasibility and acceptability of exercise for tendinopathy, to make recommendations for practice and research.

Review questions

The specific review questions were as follows: (1) What exercise interventions have been reported in the literature and for which tendinopathies? (2) What outcomes have been reported in studies investigating exercise interventions for tendinopathies? (3) Which exercise interventions are most effective across all tendinopathies? (4) Does type/location of tendinopathy or other specific covariates affect which are the most effective exercise therapies? And (5) how feasible and acceptable are exercise interventions for tendinopathies?

Methods

We conducted an initial scoping review to address questions 1 and 2, followed by an efficacy workstream consisting of three systematic reviews with meta-analyses to address questions 3 and 4, and a convergent segregated mixed-method systematic review to address question 5. All reviews are reported according to the PRISMA 2020 statement and relevant extensions.

Scoping review: Using Joanna Briggs Institute (JBI) methodology and an a priori protocol made publicly available on Open Science Framework (OSF) and published in JBI Evidence Synthesis, we searched for studies and systematic reviews on any exercise therapy for any tendinopathy experienced by people of any age or sex. Inclusion was limited to studies published in any language from 1998 onwards and conducted in countries with very high human development (as defined by the United Nations Development Programme). In April 2020 we searched MEDLINE, CINAHL, AMED and SPORTDiscus via EBSCOhost, EMBase via Ovid, the Cochrane library (controlled trials, systematic reviews), JBI Evidence Synthesis, PEDRo and Epistemonikos. We also searched six trial registries, five grey literature databases and Google Scholar. Search results were deduplicated in Proquest® RefWorks. They were then imported to Covidence systematic review software (Melbourne, Australia) where title/abstract followed by

full-text screening was conducted by two reviewers independently, with conflicts resolved by a third reviewer. Data were extracted from included studies using a bespoke data-extraction tool developed by the review team using Microsoft Excel®.

Efficacy reviews: Using effectiveness review methodology and a priori protocols registered on PROSPERO (overarching methodology) and OSF (review-specific methods), three efficacy reviews were conducted. Efficacy review 1 quantified efficacy through calculation of a range of effect sizes from exercise-only interventions. In efficacy review 2, pairwise effect sizes were calculated to quantify comparative efficacy between different exercise therapies based on their dominant therapy class (e.g. resistance, flexibility, proprioception) and their dominant therapy type (e.g. eccentric-only, static stretching, joint position sense). In efficacy review 3, pairwise effect sizes were calculated between exercise-only therapies, non-exercise therapies (e.g. surgery, injection, manual therapy (MT)) and combined therapies to quantify comparative efficacy across a range of therapy classes frequently used in the management of tendinopathy. Studies were identified from the scoping review search, a search update (19 January 2021) and reference and citation searching of systematic reviews included in the scoping review. Screening was conducted as described above. Risk of bias and data extraction were completed by two independent reviewers. The Grading of Recommendations, Assessment, Development and Evaluations framework was used to assess the strength of evidence.

Mixed-method review: Using JBI methodology and an a priori protocol (PROSPERO) we searched for quantitative, qualitative and mixed-methods studies exploring any aspect of feasibility or acceptability of exercise for tendinopathy from patients' or providers' perspectives. Studies were identified from the scoping review and effectiveness update searches, and a further search (29 March 2021) to locate additional studies. Screening was conducted as described above and methodological quality was assessed by two reviewers independently using JBI critical appraisal tools, with conflicts at each stage resolved by discussion or a third reviewer. Data were extracted from quantitative studies using a bespoke data-extraction tool developed by the review team in Microsoft Excel®. Data were extracted from qualitative studies using the data-extraction tool in JBI SUMARI software. Data extraction for both data types was conducted by two reviewers independently with conflicts resolved by discussion or a third reviewer. A convergent segregated approach to data synthesis was applied, where each data type was synthesised independently, followed by integration of findings from the quantitative and qualitative syntheses using comparative analysis. Data synthesis was an iterative process involving four reviewers.

Results

Scoping review: The search identified 13,729 unique studies. Following screening, 555 studies were included in the review, 119 of which were systematic reviews. A range of exercise interventions were reported across multiple tendinopathies, with Achilles, lateral elbow, patellar and rotator cuff-related shoulder pain (RCRSP) the most studied. Strengthening exercise was most frequently reported (84%), with eccentric exercise the most common mode for Achilles (89%), patellar (85%) and lateral elbow tendinopathies (44%). Flexibility exercise was more commonly reported in the upper (≈60%) than lower limb (≈25%). Exercise therapies for RCRSP showed the greatest range with respect to mode of exercise. Reporting of exercise interventions was highly variable such that few were identified as being replicable. A range of health domains and outcome measurement tools were reported, with lack of consensus a key finding in this review. Disability was the most common primary health domain for RCRSP (65%), Achilles (68%) and patellar tendinopathies (75%), and physical function capacity was most common for lateral elbow tendinopathy (49%). Impairment-based outcome measures were dominant across tendinopathies, with psychosocial outcomes rarely reported. Few true effectiveness studies were identified, with most studies being conducted under controlled circumstances. Therefore, efficacy, rather than effectiveness, was explored in the contingent reviews.

Efficacy reviews: 204 studies comprising 467 treatment arms (TAs) and 12,081 participants were identified that met the inclusion criteria to be included in at least one of the reviews (review 1: 125 studies/188 TAs; review 2: 55 studies; review 3: 201 studies). In the context of low and often very low strength of evidence, the efficacy reviews concluded that exercise therapy is safe and efficacious, and that patients are generally satisfied with the outcome and perceive their improvements to be substantive. RCRSP may benefit from exercise interventions that focus on flexibility and proprioception more than strengthening. Resistance training that combines both concentric and eccentric exercise may be most beneficial given the intensities and frequencies commonly adopted in practice. Combining exercise with a non-exercise adjunct such as electro-therapy, injection or taping may be most beneficial and could be considered in the early phase of management.

Mixed-method review: 96 reports from 94 studies were included in the review (85 quantitative, 11 qualitative). *Quantitative findings:* For feasibility, measures of adherence, attendance and fidelity were reported in 75, 13 and 3 studies respectively. Self-reported exercise adherence was good (at least 70%) and attendance to supervised exercise sessions excellent (90%). Different approaches to measuring fidelity were used in the three studies, with a range of findings reported. Acceptability was reported in 17 studies as tolerability (n = 15), satisfaction with exercise (n = 2), willingness to do the exercise (n = 2), helpfulness (n = 1) and how easy it was to fit into daily activities (n = 1), with some studies including more than one measure. The findings provide evidence that exercise for tendinopathy is acceptable, but heterogeneity in defining, measuring and reporting the various dimensions of acceptability combined with the limited number of studies reporting acceptability limits our ability to draw firm conclusions.

Qualitative findings: 68 findings from 11 studies generated two synthesised findings: (1) patients and healthcare professionals report a range of highly personalised experiences and opinions of exercise therapies along with several barriers and facilitators to adhering to exercise; therefore, a person-centred, individualised approach should be used when delivering such interventions to people with tendinopathy; and (2) patients and healthcare professionals place value on appropriate and timely patient education facilitated by an effective 'therapeutic alliance' between patient and physiotherapist, to promote motivation and confidence in the exercise therapy being undertaken.

Integration of quantitative and qualitative findings: The qualitative findings largely supported and explained the quantitative findings. For example, qualitative findings explain the factors that can influence adherence, including barriers, facilitators, beliefs, previous experiences and the 'therapeutic alliance'. They provide explanation for supervised exercise being adhered to more than unsupervised, due to levels of confidence. They also help to explain the range of tolerability reported: beliefs about the pain–exercise relationship, the individualised response to pain, and the impact of symptomatic response all moderate an individual's tolerability of therapeutic exercise. Environmental factors including group-based exercise and remote supervision via telehealth had been explored in the qualitative but not quantitative studies.

Strengths and limitations

Strengths: All tendinopathies and all forms of exercise were included in this evidence synthesis, allowing a large amount of data to be included. The modelling approaches featured in both the efficacy and mixed-methods reviews attempted to synthesise these data, identifying general results and where possible exploring heterogeneity to generate novel and clinically relevant findings. In addition, the inclusive approach with regard to tendinopathies, participants, therapies and outcomes enabled the review to synthesise diverse sets of information from both the providers' and patients' perspectives to provide the most comprehensive summary of the field to date. We excluded few studies based on language of publication, as we used both automated and personal translation where possible.

Limitations: Restricting inclusion to studies conducted in countries with very high human development, by applying the Human Development Index, may have excluded some potentially relevant studies but does make the findings more relevant to the UK context. Several limitations in the available body of evidence were identified through conducting this project and include low-quality evidence, lack of agreed definitions (e.g. adherence), lack of standardised measurements (e.g. feasibility, acceptability), lack of consensus on outcome domains and measurement tools, poor reporting of exercise interventions and patient factors, and a lack of qualitative research.

Conclusions and recommendations

In conclusion, this comprehensive, robust, inclusive mixed-methods evidence synthesis has provided an extensive map of the contemporary research on exercise for tendinopathy, evaluated the efficacy and comparative efficacy of exercise across the common tendinopathies and identified what is known about the feasibility and acceptability of exercise therapy for the management of tendinopathy from patients' and providers' perspectives. The following recommendations can be made.

Practice recommendations: Outcome domains are important to consider when evaluating the outcome of specific exercise interventions, with subjective measures likely to result in larger relative improvements compared to objective outcomes. Gathering information on patient satisfaction, including reasons for (dis)satisfaction, would be useful to inform practice. Resistance training should be prescribed at an appropriate intensity and frequency to increase muscle strength and subsequent positive adaptations to tendons. Use of flexibility and proprioceptive exercise should be considered for RCRSP rather than using resistance exercise in isolation; flexibility regimes may also be considered for Achilles tendinopathy. A focus on eccentric resistance exercise above all other treatments does not appear warranted. Given the loading protocols commonly used, it is likely that standard resistance exercise practices that combine concentric and eccentric exercise will be superior to eccentric-only and easier to implement in practice. Exercise could be combined with other non-exercise adjuncts earlier in the rehabilitative process. An individualised, person-centred approach should be taken when delivering exercise therapy to people with tendinopathy.

Research recommendations: There is still a need for high-quality adequately powered research in the following areas: dose parameters and their interactions with patient characteristics; cost-effectiveness, which may also investigate models that include multiple modalities earlier in the therapeutic process; true effectiveness studies such as pragmatic trials to better quantify the effectiveness of current and developing therapeutic models. There is a need for exercise interventions to be carefully developed and tested, including their feasibility and acceptability, prior to moving to studies of efficacy and effectiveness. There is also a need for further high-quality qualitative research on patients' and healthcare professionals' perceptions and experiences of exercise for tendinopathy to generate a greater depth of understanding of the factors that influence efficacy of exercise therapy and implementation in the real-world clinical setting. Standard reporting of exercise for tendinopathy requires considerable improvement, including the development of, or consensus agreement on, definitions (e.g. of exercise types, intervention components, adherence, feasibility), the use of core outcome sets, and full and transparent reporting in compliance with reporting checklists. Development of a taxonomy for guidance on reporting exercise therapy for tendinopathy, which is introduced in this project, would benefit from further research involving all key stakeholders (e.g. people with experience of exercise for tendinopathy, clinicians, academics, researchers).

Policy recommendations: Research funders and service providers need to fund and facilitate research within different care settings to enable cost-effectiveness, acceptability and adherence comparisons between different modes of delivery of exercise interventions for tendinopathy to be conducted. Service provision may need to be adapted and funded to enable a person-centred approach to care and access to additional non-exercise treatment modalities when appropriate. This may include the need for extended periods of intervention to be enabled in order that the timescales of physiological tendon

change are reflected in interventions. The use of technologies that facilitate better patient engagement with exercise therapy and more consistent self-reporting of adherence, outcomes and side effects should be explored.

Study registration

This project is registered as:

DOI: 10.11124/JBIES-20-00175 (scoping review)

PROSPERO CRD42020168187 (efficacy reviews overarching methodology)

https://osf.io/preprints/sportrxiv/y7sk6/ (efficacy review 1)

https://osf.io/preprints/sportrxiv/eyxgk/ (efficacy review 2)

https://osf.io/preprints/sportrxiv/mx5pv/ (efficacy review 3)

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This report

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