

Does Exercise Type Matter in Rotator Cuff Tendinopathy? A Focused Comparative Review of Randomized Controlled Trials

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ABSTRACT:

Background: Rotator cuff tendinopathy is a common cause of shoulder pain and functional limitation. Exercise therapy is widely recommended as a conservative intervention; however, uncertainty remains regarding whether specific exercise approaches provide superior clinical outcomes.

Objective: This focused comparative review examined two randomized controlled trials by Heron et al. (2016) and DeJaco et al. (2017), with emphasis on participant characteristics, exercise interventions, outcome measures, methodological considerations, and clinical outcomes.

Methods: Two randomized controlled trials involving a combined sample of 156 participants were selected for focused comparison because they evaluated contrasting exercise-based rehabilitation strategies for rotator cuff tendinopathy. Data on participant characteristics, exercise protocols, intervention duration, outcome measures, and reported treatment effects were extracted from the published articles and synthesized narratively. The review was designed as a focused comparative synthesis rather than an exhaustive systematic review.

Results: Heron et al. (2016) compared minimally loaded range-of-motion, open-chain loading, and closed-chain loading exercises, whereas DeJaco et al. (2017) compared eccentric exercise with conventional exercise therapy. Both trials reported improvements in shoulder-related pain and/or function following exercise-based rehabilitation. However, neither trial demonstrated statistically significant between-group differences sufficient to establish the superiority of a particular exercise approach.

Conclusion: The two trials support exercise-based rehabilitation as a reasonable conservative approach for rotator cuff tendinopathy, but they do not establish the superiority of one specific exercise strategy. Exercise selection may therefore consider individual symptoms, functional goals, tolerance, and appropriate progression of loading. Further adequately powered randomized controlled trials with comparable outcome measures and longer follow-up periods are needed to determine whether particular exercise strategies provide clinically meaningful advantages.

KEYWORDS: rotator cuff tendinopathy, rotator cuff-related shoulder pain, exercise therapy, rehabilitation, progressive loading, randomized controlled trial, focused comparative review.

INTRODUCTION

Shoulder pain is a common musculoskeletal complaint encountered in clinical and rehabilitation settings and may substantially affect daily activities, occupational performance, and participation in sport. Epidemiological evidence suggests that point prevalence ranges from approximately 7% to 26%, while lifetime prevalence may be considerably higher (Luime et al., 2004). Because the shoulder complex contributes to a wide range of upper-extremity activities, persistent shoulder symptoms can produce meaningful functional limitations.

The shoulder joint is made up of four joints, including the glenohumeral, acromioclavicular, sternoclavicular, and scapulothoracic joints, that work together to provide mobility and stability. The rotator cuff is one of the structures that ensure the normal function of the shoulder joint. This includes four muscles and tendons, which are known as the supraspinatus, infraspinatus, teres minor, and subscapularis, and help in stabilizing the humeral head in the glenoid cavity and, at the same time, in moving the shoulder joint (Lewis, 2009).

Tendinopathy of the rotator cuff is one of the most common causes of chronic shoulder pain. According to current literature, tendinopathy is more than just an inflammatory condition; rather, it is considered a continuum of tendon injury

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involving collagen disorganization, failure of tendon healing, new blood vessel formation, and degeneration caused by repetitive mechanical stress (Cook & Purdam, 2009). Patients with rotator cuff tendinopathy experience shoulder movement-related pain, loss of muscle strength, stiffness, limited joint movement, weakness, and night-time pain (Lewis, 2016).

A variety of factors cause rotator cuff tendinopathy. Internal factors include aging, tendon degeneration, muscle weakness, scapular biomechanical changes, and reduced vascular supply, which increase susceptibility to tendon injuries. Other external factors like overhead movements, occupation, bad posture, participation in sporting activities, trauma, and mechanical loads further enhance the likelihood of developing the disorder (Lewis, 2016). Individuals who engage in overhead sports such as swimming, baseball, volleyball, and tennis are likely to develop rotator cuff problems due to repetitive strain on their shoulders.

Management of rotator cuff tendinopathy commonly begins with conservative care aimed at reducing pain, restoring shoulder function, improving movement capacity, and supporting return to daily and recreational activities. Conservative management may include patient education, activity modification, exercise therapy, manual therapy, medication, injections, and other rehabilitation strategies, with surgery generally reserved for selected cases or persistent symptoms (Pieters et al., 2019).

Exercise therapy is a central component of conservative rehabilitation for rotator cuff tendinopathy. Programs may target shoulder strength, mobility, neuromuscular control, scapular function, and tolerance to mechanical loading. Investigated approaches include range-of-motion exercise, eccentric and concentric strengthening, open-chain and closed-chain exercise, and progressive loading. Although exercise is widely supported, uncertainty remains about whether any particular exercise mode consistently yields superior clinical outcomes.

Heron et al. (2016) compared minimally loaded range-of-motion exercises, open-chain loading exercises, and closed-chain loading exercises. Dejaco et al. (2017), in contrast, compared eccentric exercise with conventional exercise therapy. These trials represent different approaches to exercise selection and loading, making them useful for a focused comparison of whether the specific exercise mode influences clinical outcomes.

A focused comparative review can be useful when the purpose is to examine a small number of deliberately selected studies in depth rather than to estimate a pooled treatment effect. In the present paper, the two trials are treated as contrasting clinical examples. Accordingly, the review uses narrative comparison and does not claim to represent an exhaustive systematic review of all exercise trials for rotator cuff tendinopathy.

The purpose of this focused comparative review was therefore to examine Heron et al. (2016) and Dejaco et al. (2017) with respect to participant characteristics, exercise interventions, treatment duration, outcome measures, methodological considerations, and reported clinical outcomes. Particular attention was given to whether either trial provided evidence that one exercise approach was superior and to the implications of the findings for individualized exercise prescription.

METHODS

Study Design

This study used a focused comparative review design to examine two randomized controlled trials that evaluated contrasting exercise-based rehabilitation approaches for rotator cuff tendinopathy.

Heron et al. (2016) and Dejaco et al. (2017) were selected as the primary comparison because both were randomized trials involving exercise-based management of rotator cuff tendinopathy but differed meaningfully in exercise strategies, treatment durations, and outcome assessments. The purpose was not to identify every eligible randomized trial or to generate a pooled effect estimate, but to compare these two trials in depth as clinically relevant examples of different exercise approaches. Because the trials differed in intervention structure, comparison groups, treatment duration, and outcome measures, quantitative pooling was not appropriate for the purpose of this focused review. Findings were therefore organized through narrative synthesis, emphasizing similarities and differences in intervention characteristics and reported outcomes.

Literature Identification and Study Selection

A targeted literature search was conducted in PubMed, Google Scholar, and ScienceDirect during May-June 2025 to identify peer-reviewed literature relevant to exercise rehabilitation for rotator cuff tendinopathy. Search terms included combinations of rotator cuff tendinopathy, shoulder pain, exercise therapy, eccentric exercise, physiotherapy, rehabilitation, and randomized controlled trial. Titles, abstracts, and available full texts were examined to identify trials relevant to the comparative purpose of the paper. Because this was a focused comparative review, the search was used to identify and contextualize the two selected trials rather than to support a claim of exhaustive systematic study identification.

Heron et al. (2016) and Dejaco et al. (2017) were retained for focused comparison because they examined distinct exercise strategies in adults with rotator cuff tendinopathy and reported clinically relevant outcomes related to pain and shoulder function.

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Other randomized trials exist in the literature, including Littlewood et al. (2014); therefore, the two studies included here should be understood as deliberately selected comparator trials rather than the only randomized controlled trials available.

Comparison Criteria

The two selected trials were compared using the following criteria:

1. Randomized controlled trial design.
2. Adult participants diagnosed with rotator cuff tendinopathy or a closely related clinical classification used by the original investigators.
3. Exercise therapy as a principal rehabilitation intervention.
4. Reporting of clinically relevant outcomes related to pain and/or shoulder function.
5. Sufficient intervention detail to permit comparison of exercise approach and treatment duration.
6. Publication in English.
7. Availability of the published report for data extraction.

Together, the two selected trials included 156 participants.

Scope Boundaries

1. This review did not attempt to include all exercise trials for rotator cuff-related shoulder pain.
2. Pharmacological or surgical interventions were outside the primary comparative focus.
3. Studies centered on full-thickness rotator cuff tears, fracture, postoperative rehabilitation, or shoulder instability were outside the intended clinical comparison.
4. Because the review was focused rather than systematic, study exclusion counts and a PRISMA-style study-flow estimate were not used to imply exhaustive coverage.

Data Extraction

Data were extracted from the published reports of the two selected trials. Extracted variables included sample size, participant characteristics, symptom duration, exercise intervention, treatment duration, outcome measures, and reported treatment effects. Information from the text, tables, figures, and reported results of the original articles was organized to facilitate direct comparison. Microsoft Excel 2021 was used as an organizational aid.

Methodological Considerations

The methodological features of each trial were considered when interpreting the findings, including randomization, blinding, outcome measurement, sample size, intervention duration, and follow-up. Because contemporary Cochrane RoB 2 assessment is outcome-specific and requires structured signaling questions and supporting judgments, this focused review does not present a new formal RoB 2 rating for each trial.

Particular caution is warranted when interpreting blinding in exercise trials because participants and treating personnel may be aware of the assigned exercise intervention. A description of a study as single-blinded does not, by itself, establish that participants and treating personnel were blinded.

Accordingly, methodological limitations are discussed narratively rather than summarized as definitive low- or high-risk judgments that cannot be fully supported within the present focused review.

Data Synthesis

Given differences in exercise protocols, comparison groups, outcome measures, and treatment duration, findings were synthesized narratively. The analysis emphasized the direction of within-group change, evidence for between-group differences, and the extent to which the trials supported or failed to support superiority of a particular exercise approach.

Microsoft Excel 2021 was used to organize extracted study characteristics and outcomes. No meta-analysis was performed because quantitative pooling was outside the purpose of this focused two-study comparison.

RESULTS

Selection of Comparator Trials

The targeted literature search identified a broader body of exercise-rehabilitation literature for rotator cuff tendinopathy. For the present focused comparison, Heron et al. (2016) and Dejaco et al. (2017) were selected because they represent distinct exercise strategies and provide directly interpretable randomized comparisons.

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The inclusion of these two trials should not be interpreted as evidence that they are the only randomized trials in this field. Rather, they serve as two contrasting clinical examples for examining whether specific exercise modes demonstrated superiority.

Study and Participant Characteristics

The total number of participants was 156 across the two randomized controlled trials. The participants' demographics, such as age, sex ratio, and the length of shoulder pain, are presented in Table 1 below.

Table 1. Characteristics of Participants Included in the Comparative Review

Characteristics	Heron et al. (2016)	Dejaco et al. (2017)
Sample size	120 participants	36 participants
Mean age (years)	49.9	49.49
Sex distribution	Male = 71 (59%)Female = 49 (41%)	Male = 19 (53%)Female = 17 (47%)
Pain duration	3–12 months: 78 (65%)>12 months: 42 (35%)	Mean duration: 19.66 months

Table 1 summarizes participant characteristics. Mean age was approximately 50 years in both trials (49.9 years in Heron et al., 2016; 49.49 years in Dejaco et al., 2017). Both samples included slightly more men than women. Symptom duration differed in reporting: Heron et al. categorized participants by duration, whereas Dejaco et al. reported a mean duration of 19.66 months. These differences in symptom-duration reporting should be considered when comparing the samples because chronicity may influence baseline presentation and response to rehabilitation.

Methodological Considerations

Both trials used randomized designs, but their methodological features should be interpreted in the context of nonpharmacological exercise research. Blinding of participants and treating personnel can be difficult or impossible when exercise programs are visibly different. In addition, the trials differed substantially in sample size, treatment duration, follow-up, and outcome measures.

For this reason, the present review avoids assigning definitive study-level risk-of-bias labels. Instead, these methodological differences are treated as factors that may affect comparability and the strength of conclusions drawn across the two trials.

Table 2. Methodological comparison of the included trials

Methodological feature	Heron et al. (2016)	Dejaco et al. (2017)
Design	Randomized controlled trial	Randomized, single-blinded clinical trial
Sample size	120 participants	36 participants
Exercise comparison	Three exercise-loading approaches	Eccentric versus conventional exercise
Treatment duration	6 weeks	12 weeks
Follow-up	Primary comparison at 6 weeks	Outcomes reported through 26 weeks
Blinding consideration	Participant/personnel blinding limited by visible exercise assignment	Single-blinded design; the blinded party should be interpreted from the original report
Interpretive caution	No between-group superiority demonstrated	No superiority of eccentric exercise demonstrated

DISCUSSION

Table 3 summarizes the major similarities and differences between the two randomized controlled trials included in this focused comparative review.

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Table 3. Comparison of the Two Randomized Controlled Trials Included in the Comparative Review

Feature	Heron et al. (2016)	Dejaco et al. (2017)
Sample	120 participants with rotator cuff tendinopathy	36 participants with rotator cuff tendinopathy
Intervention	Minimally loaded range-of-motion (ROM) exercises, open-chain loading exercises, and closed-chain loading exercises	Eccentric exercise therapy versus conventional exercise therapy
Duration	6-week exercise program	12-week exercise program with outcomes assessed at 26-week follow-up
Outcome Measures	All three exercise groups improved from baseline. No statistically significant between-group differences demonstrated superiority of one approach.	Both eccentric and conventional exercise groups improved. Eccentric exercise did not demonstrate superiority over conventional exercise therapy.
Main Findings	All three exercise groups showed significant improvements in pain and shoulder function. However, no statistically significant differences were found among the three exercise interventions.	Both eccentric and conventional exercise groups demonstrated significant improvements in pain and shoulder function. However, eccentric exercise was not superior to conventional exercise therapy.

Heron et al. (2016)

Heron et al. (2016) investigated three types of exercise interventions used for rotator cuff tendinopathy patients: minimally loaded range-of-motion (ROM) exercises, open-chain loading exercises, and closed-chain loading exercises. All interventions were meant to enhance shoulder mobility, musculoskeletal functions, and progressive loading tolerances. The subjects underwent a 6-week exercise intervention that was either range-of-motion exercise with minimal load, open-chain exercise with load, or closed-chain exercise with load. This was done, and outcomes were assessed six weeks later using the Shoulder Pain and Disability Index (SPADI) scores as well as the Minimally Clinically Important Change MCIC.

ROM exercises refer to those that ensure maintenance or improvement in joint mobility and flexibility, whereas open-chain and closed-chain exercises denote two techniques of kinetic chain training. The open-chain exercises are characterized by distal segment mobility of the limb during the execution of the exercise, and closed-chain exercises refer to exercises in which the distal segment remains stationary, therefore resulting in more joint compression and stabilization loads (Escamilla et al., 2012).

Heron et al. (2016) reported statistically significant pre-to-post improvement within each of the three exercise groups. However, between-group comparisons did not demonstrate statistically significant differences among the minimally loaded range-of-motion, open-chain loading, and closed-chain loading interventions. These findings support improvement across the tested approaches but do not establish that the interventions were equivalent.

Dejaco et al. (2017)

Dejaco et al. (2017) studied the effectiveness of eccentric exercise therapy versus conventional exercise therapy for people suffering from rotator cuff tendinopathy. Effects of a 12-week program of eccentric rotator cuff training were studied, with outcomes measured after 26 weeks. Eccentric exercise consisted of strengthening exercises aimed at improving the muscles responsible for external rotation and empty-can abduction exercises performed in the scapular plane. Both eccentric and traditional forms of exercise showed significant improvement in terms of shoulder function and reduction in pain, but eccentric training was not shown to be more effective than traditional forms of exercise.

The effectiveness was assessed using the Constant-Murley Score (CMS) and the Visual Analog Scale (VAS). The Constant-Murley Score is among the most popular scales used in the assessment of shoulder function. This scale involves the assessment of pain, functional abilities in everyday activities, the range of movement, and strength (Vrotsou et al., 2018). It is worth noting that the Visual Analog Scale is a validated measure that is frequently used in pain evaluation (Myles et al., 2017).

Dejaco et al. (2017) reported improvement in both the eccentric and conventional exercise groups, with no statistically significant between-group difference demonstrating superiority of eccentric exercise. As with Heron et al. (2016), absence of a statistically significant difference should not be interpreted as proof of equivalence unless the trial was specifically designed and powered for an equivalence or non-inferiority question.

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Principles of Tendon Loading and Progressive Loading in Rehabilitation

Both trials incorporated exercise that exposed the shoulder musculotendinous system to movement and mechanical loading, although the specific exercise modes differed. The comparable pattern of improvement across intervention groups is consistent with the possibility that shared rehabilitation features, including repeated exercise and progressive exposure to load, may contribute to clinical improvement.

This interpretation should remain cautious. The two trials were not designed to isolate progressive loading as an independent causal mechanism. Therefore, their findings cannot demonstrate that loading is more important than exercise type. Rather, loading is a plausible common rehabilitation principle that may help explain why different exercise approaches can produce favorable outcomes.

Exercise prescription in tendon rehabilitation commonly considers intensity, volume, progression, symptoms, and individual response (Malliaras et al., 2015). In clinical practice, these factors may be considered alongside the specific exercise selected.

Patient Compliance and Participation in Exercise Therapy

Adherence is another factor that may influence rehabilitation outcomes. However, because adherence was not analyzed as a principal comparative outcome in the two selected trials, the present review cannot determine whether adherence explains the improvements observed.

Evidence from broader physiotherapy literature suggests that barriers to adherence can influence rehabilitation participation and outcomes (Jack et al., 2010). In the context of the present comparison, adherence should therefore be viewed as a potential contextual or modifying factor rather than as an established explanation for the results of Heron et al. (2016) or DeJaco et al. (2017).

Why No Exercise Intervention Demonstrated Clear Superiority

Across the two trials, no tested exercise strategy demonstrated clear statistical superiority over its comparator. Heron et al. (2016) found improvement across range-of-motion, open-chain, and closed-chain exercise groups without a significant between-group difference. DeJaco et al. (2017) similarly found that eccentric exercise did not outperform conventional exercise therapy.

Several explanations are possible. Rotator cuff tendinopathy is clinically heterogeneous, and response to rehabilitation may be influenced by symptom duration, baseline function, loading tolerance, biomechanics, exercise dose, adherence, and other patient-level factors. The present two-study comparison cannot determine which of these factors explains the observed outcomes, but it supports caution against assuming that a single named exercise mode is universally superior.

Comparison with Previous Literature

The findings of this focused comparison are broadly consistent with the wider literature supporting exercise as an important component of conservative management for rotator cuff-related shoulder pain. Earlier and more recent reviews have generally reported beneficial effects of exercise while also highlighting uncertainty regarding the optimal exercise type, dose, and progression.

Littlewood et al. (2014) is itself a pilot randomized controlled trial, not a systematic review, and provides additional evidence that loaded exercise has been investigated beyond the two comparator trials examined here. More recent systematic reviews and meta-analyses, including LaFrance et al. (2024) and Wu et al. (2025), further demonstrate that the evidence base is broader than these two trials. The contribution of the present paper is therefore not comprehensive evidence synthesis, but an in-depth comparison of two contrasting randomized exercise paradigms.

Clinical Implications

Clinicians should not interpret the absence of between-group superiority as evidence that every exercise program is interchangeable. Rather, the findings support selecting and progressing exercises according to the patient's symptoms, functional goals, clinical presentation, tolerance, and response to loading while monitoring outcomes over time.

SUMMARY OF FINDINGS

Overall, both selected randomized trials reported improvement following exercise-based rehabilitation, despite using different exercise strategies. Neither trial demonstrated clear superiority of one tested exercise approach over its comparator.

The findings should not be described as proving that the exercise methods are equally effective. Instead, they indicate that superiority was not demonstrated in these trials. Differences in sample size, intervention duration, outcome measurement, and follow-up limit direct comparison and prevent stronger conclusions.

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LIMITATIONS

This focused comparative review has several limitations. First, only two deliberately selected randomized controlled trials were examined, and the review should not be interpreted as an exhaustive synthesis of all available trials. Second, the studies differed in intervention protocols, treatment duration, outcome measures, and follow-up, limiting direct comparison. Third, no meta-analysis was performed, and the review cannot estimate pooled treatment effects. Fourth, a formal outcome-specific Cochrane RoB 2 assessment was not undertaken. Finally, because more recent systematic reviews and meta-analyses are available, the principal value of this paper lies in its focused clinical comparison rather than in comprehensive evidence coverage.

CONCLUSION

This focused comparative review examined two randomized controlled trials evaluating different exercise-based rehabilitation approaches for rotator cuff tendinopathy. Heron et al. (2016) evaluated minimally loaded range-of-motion, open-chain loading, and closed-chain loading exercises, whereas DeJaco et al. (2017) compared eccentric with conventional exercise therapy.

Both trials reported improvement in clinically relevant outcomes, but neither demonstrated clear between-group superiority of a particular exercise approach. Importantly, lack of a statistically significant difference should not be interpreted as proof that the interventions are equivalent.

The findings support a clinically flexible approach in which exercise selection is informed by symptoms, functional goals, tolerance, and response to progressive loading rather than by an assumption that one named exercise mode is universally superior. Progressive loading remains a plausible shared rehabilitation principle, but the two trials do not establish it as the independent mechanism responsible for improvement.

Future research should use adequately powered randomized designs, clearly described exercise dose and progression, standardized or comparable outcome measures, adherence reporting, and longer follow-up. Such studies would help determine whether particular exercise strategies provide clinically meaningful advantages for specific subgroups of patients with rotator cuff tendinopathy.

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