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Rotator Cuff Injuries in Physically Active Individuals: Diagnosis, Conservative Management, and Return to Sport - A Narrative Review

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Abstract (Structured)

Background. Rotator cuff disorders commonly cause pain, weakness, and reduced performance in active individuals. Assessment is challenging because structural abnormalities may be asymptomatic and demands differ between recreational and competitive athletes.

Aim. To summarize evidence on diagnosis, conservative management, and return-to-sport criteria in individuals with rotator cuff tendinopathy or tears.

Material and methods. A targeted narrative review included 25 open-access PubMed articles published in 2007–2024. The evidence comprised reviews, meta-analyses, consensus statements, cohorts, and clinical articles on diagnosis, imaging, rehabilitation, prognosis, and return to sport.

Results. Diagnosis requires combined interpretation of history, physical examination, and imaging, as no single test can confirm or exclude a rotator cuff tear. Ultrasonography and magnetic resonance imaging are highly accurate for full-thickness tears, whereas partial-thickness lesions are harder to characterize. Exercise-based rehabilitation is the mainstay of conservative treatment and may improve pain and function in tendinopathy, partial-thickness tears, and many atraumatic full-thickness tears. Rehabilitation should restore mobility, rotator cuff and scapular strength, kinetic-chain function, and tolerance to sport-specific loads. Return-to-sport decisions should not rely on time alone, because return to participation is more common than return to preinjury performance, particularly in competitive overhead athletes.

Conclusions. An individualized, criteria-based pathway is preferable to decisions based only on imaging or elapsed time. Conservative rehabilitation should be the initial strategy for non-traumatic and partial-thickness disorders. Prompt specialist assessment is indicated after acute traumatic loss of function, marked weakness, or failure of adequate rehabilitation.

Key words: rotator cuff injury, shoulder, athletes, ultrasonography, exercise therapy, return to sport.

Content

1. Introduction

The rotator cuff is formed by the tendons of the supraspinatus, infraspinatus, subscapularis, and teres minor muscles. Together with the deltoid, scapular stabilizers, capsule, and the remainder of the kinetic chain, these structures contribute to humeral head centering, force transmission, and efficient elevation and rotation of the arm. Rotator cuff-related disorders include tendinopathy, bursal or articular-sided partial-thickness tears, full-thickness tears, and more extensive lesions associated with muscle atrophy or fatty infiltration. In active populations, this spectrum is clinically important because a relatively small structural lesion can substantially impair high-velocity or repetitive overhead performance, whereas larger structural abnormalities may be present with limited symptoms in other individuals. [1,6,19-21]

Rotator cuff symptoms can arise after an acute traumatic event, but many cases develop through cumulative load exposure. Repeated overhead activity subjects the cuff to tensile, compressive, and shear forces during acceleration and deceleration. In tennis, throwing, swimming, volleyball, strength training, and occupational overhead work, symptoms may be influenced by training volume, abrupt workload changes, glenohumeral mobility, scapular mechanics, trunk and lower-limb contribution, and recovery capacity. The athlete therefore requires assessment of the entire movement system rather than an isolated evaluation of the tendon. [6,19-21,24]

Structural findings do not map perfectly onto symptoms or performance. The probability of degenerative abnormalities increases with age, and imaging may identify tears in people who remain functional. Conversely, a symptomatic athlete can have marked pain and loss of capacity without a full-thickness defect. Imaging should therefore answer a clinically meaningful question and should be interpreted in the context of mechanism, symptoms, physical examination, sport demands, and treatment goals rather than being treated as an independent diagnosis. [1-4,7]

Management is similarly complex. Exercise-based rehabilitation is widely recommended as first-line treatment for rotator cuff tendinopathy and for many atraumatic or partial-thickness tears. However, protocols vary in exercise selection, loading intensity, duration, and criteria for progression. Return to sport presents an additional challenge because the available literature often defines readiness by time alone, while the demands of sport require recovery of strength, endurance, coordination, confidence, and tolerance to repeated high-load tasks. [8-10,12-18,22-25]

Research objective. The objective of this narrative review was to synthesize evidence relevant to the diagnosis, conservative management, and return to sport of physically active individuals with rotator cuff disorders.

Research questions. The review addressed four questions: (1) Which components of history and physical examination are most useful? (2) How should ultrasonography, magnetic resonance imaging, and other imaging methods be positioned in the diagnostic pathway? (3) Which principles are supported for conservative rehabilitation? (4) Which clinical and functional criteria should guide return to sport?

2. Research materials and methods

2.1. Review design and information sources

A targeted narrative review was performed to provide a clinically oriented synthesis rather than a quantitative estimate of treatment effect. PubMed was used as the bibliographic source, and eligibility was restricted to publications with freely accessible full text in PubMed Central. The final evidence set comprised the 25 articles identified for this manuscript, published from 2007 through 2024. The search and source verification were completed on 24 July 2026.

Search concepts combined terms related to the rotator cuff (rotator cuff, tear, tendinopathy, partial-thickness tear, full-thickness tear), active populations (athlete, overhead athlete, tennis, sport, physically active), diagnosis (clinical examination, special test, ultrasonography, MRI, MR arthrography), treatment (exercise, physical therapy, conservative treatment, non-operative management, rehabilitation), and return to activity (return to sport, return to play, sport-specific rehabilitation). Reference lists of the included open-access reviews were used to contextualize the findings, but the formal source set presented in Table 1 remained limited to the 25 predefined articles.

2.2. Eligibility and synthesis

Articles were included when they directly informed at least one of the following domains: clinical diagnosis, diagnostic imaging, conservative treatment, rehabilitation, athlete-specific management, or return to sport after rotator cuff injury or repair. Eligible designs included systematic reviews, meta-analyses, consensus statements, prospective or retrospective cohorts, and narrative clinical reviews. Publications were excluded when they were not available as a complete open-access article, were not written in English, focused primarily on an unrelated shoulder condition, or described a surgical technique without clinically relevant rehabilitation or return-to-sport information.

For each article, information was extracted on study design, population or clinical scope, diagnostic or therapeutic focus, and the contribution to the present review. Owing to heterogeneity in diagnoses, age, sporting level, tear characteristics, interventions, outcome measures, and follow-up, no meta-analysis was attempted. Findings were synthesized thematically. Greater interpretive weight was assigned to systematic reviews, meta-analyses, consensus guidance, and prospective multicenter data, while sport-specific narrative reviews were used to translate general evidence into athletic practice.

2.3. Use of artificial intelligence

OpenAI ChatGPT was used as an assistive tool for improving language and readability, text formatting, and verification of bibliographic style. No artificial intelligence tool was used to generate, modify, or statistically analyze study data, select the included sources, or determine the substantive interpretation of the evidence. All references, statements, and numerical results were verified by the authors, who reviewed and edited the manuscript and accept full responsibility for its content.

3. Results of the literature review

3.1. Characteristics of the included evidence

The 25 articles represented complementary levels of evidence. Seven publications primarily addressed diagnosis or imaging, eleven focused on non-operative treatment or rehabilitation, and seven examined athletic management or return to sport. The evidence base included diagnostic meta-analyses, a Cochrane review, an imaging consensus statement, systematic reviews of exercise therapy and return-to-play criteria, prospective cohort studies, and clinically focused reviews of overhead and elite athletes. Much of the rehabilitation literature included middle-aged or older adults rather than competitive athletes, while most direct return-to-sport evidence concerned surgically treated cohorts. This imbalance is important when applying the findings to non-operatively managed active individuals. [1-25]

Table 1. Characteristics and contribution of the 25 open-access articles included in the narrative review.

No.	Article	Design	Primary contribution
1	Sambandam et al., 2015	Evidence-based clinical review	Broad overview of pathology, diagnosis, imaging, natural history, and treatment selection.
2	Roy et al., 2015	Systematic review and meta-analysis	Compared ultrasonography, MRI, and MR arthrography; high accuracy for full-thickness tears.
3	Lenza et al., 2013	Cochrane diagnostic review	Assessed MRI, MR arthrography, and ultrasonography in patients considered for surgery.
4	Nazarian et al., 2013	Multidisciplinary consensus statement	Proposed a practical imaging algorithm for suspected rotator cuff disease.
5	Jain et al., 2017	Prospective diagnostic cohort	Quantified diagnostic performance of 15 commonly used shoulder examination tests.
6	Cotter et al., 2018	Clinical review	Described comprehensive examination of the athlete’s shoulder and kinetic-chain context.
7	Farooqi et al., 2021	Systematic review and meta-analysis	Evaluated ultrasonography accuracy and comparison with MRI for supraspinatus tears.
8	Edwards et al., 2016	Narrative review	Synthesized principles and components of exercise rehabilitation for non-operative tears.
9	Jeanfavre et al., 2018	Systematic review	Examined exercise therapy for non-operative full-thickness tears.
10	Kuhn et al., 2013	Multicenter prospective cohort	Evaluated a standardized physical-therapy program for atraumatic full-thickness tears.
11	Merolla et al., 2011	Clinical review	Discussed conservative treatment and prognostic factors relevant to patient selection.
12	Ainsworth and Lewis, 2007	Systematic review	Reviewed exercise therapy for conservatively managed full-thickness tears.
13	Desmeules et al., 2016	Systematic review	Evaluated exercise therapy in workers with rotator cuff tendinopathy.
14	de-Queiroz et al., 2023	Clinical review	Compared exercise approaches used in rotator cuff tendinopathy.
15	Dominguez-Romero et al., 2021	Systematic review	Assessed muscle-development programs and functional recovery in tendinopathy.
16	Bush et al., 2021	Prospective registry cohort	Identified clinical and tear-related predictors after non-operative full-thickness tears.
17	Boland et al., 2021	Current-concepts review	Integrated rehabilitation principles for rotator cuff-related disorders.
18	Sciarretta et al., 2023	Current-concepts review	Summarized contemporary conservative and postoperative rehabilitation trends.

No.	Article	Design	Primary contribution
19	Weiss et al., 2018	Elite-athlete clinical review	Addressed diagnosis, treatment selection, and sport-specific management in elite athletes.
20	Liu et al., 2018	Overhead-athlete clinical review	Focused on partial-thickness tears and the priority of non-operative treatment.
21	Alrabaa et al., 2020	Sport-specific clinical review	Reviewed mechanisms, management, and outcomes in tennis players.
22	Bravi et al., 2022	Systematic review	Identified and quantified criteria used for return to play after rotator cuff surgery.
23	Migliorini et al., 2023	Systematic review	Synthesized outcomes and return to play after arthroscopic repair in overhead athletes.
24	Oak et al., 2022	Clinical rehabilitation review	Presented staged rehabilitation and return-to-play principles after upper-extremity injury.
25	Li et al., 2024	Systematic review and meta-analysis	Estimated return-to-sport rates after surgical treatment in young athletes.

Source: authors' synthesis of references 1-25.

3.2. Clinical presentation and mechanisms in active individuals

The history should first distinguish acute trauma from gradually developing overload. A fall, collision, dislocation, sudden traction event, or forceful eccentric contraction followed by immediate weakness raises concern for a traumatic tear and may justify expedited imaging and specialist review. Overuse presentations more commonly involve pain during repeated elevation, serving, throwing, swimming, pressing, or deceleration. Symptoms may include pain over the anterolateral shoulder or deltoid region, night pain, painful arc, perceived weakness, reduced throwing velocity, loss of accuracy, or inability to tolerate previous training volume. Duration, irritability, prior episodes, dominant side, competition schedule, recent load spikes, and the athlete's expectations should be documented. [1,6,19-21]

Overhead performance depends on a coordinated sequence from the lower limbs and trunk through the scapula and glenohumeral joint. Limited thoracic rotation, reduced hip contribution, fatigue of scapular stabilizers, altered humeral rotation, or inadequate eccentric cuff capacity can increase local shoulder demand. In overhead athletes, adaptive changes such as increased external rotation may coexist with loss of internal rotation and changes in total rotational motion. These findings are not automatically pathological; their relevance depends on symptoms, side-to-side comparison, sport, position, and movement quality. [6,19-21,24]

The examination should also screen for competing or coexisting sources of symptoms, including cervical radiculopathy, glenohumeral instability, acromioclavicular disease, long-head biceps pathology, adhesive capsulitis, and labral injury. This is particularly relevant in the athlete because internal impingement, labral lesions, biceps pathology, and partial articular-sided cuff tears may occur together. A diagnostic label based solely on the location of pain or one positive maneuver can therefore be misleading. [1,6,19-21]

3.3. Diagnostic assessment

3.3.1. Physical examination

A structured examination begins with posture, muscle bulk, scapular position, active elevation, and the quality of scapulohumeral rhythm. Active and passive range of motion should be compared bilaterally, including forward elevation, abduction, external rotation at the side and at 90 degrees of abduction, and internal rotation. A discrepancy between restricted active movement and relatively preserved passive movement may indicate weakness, pain inhibition, or a larger tear, while restriction of both active and passive motion suggests a substantial capsular component. Strength testing should evaluate internal rotation, external rotation, abduction in the scapular plane, and endurance under repeated or sustained loading. [1,5,6]

Special tests refine rather than replace the overall assessment. In the ROW cohort, tests such as the Jobe and full-can maneuvers were clinically useful for supraspinatus involvement, while external-rotation lag signs, the Hornblower sign, and the drop-arm test tended to be more specific but less sensitive for more substantial dysfunction. Subscapularis assessment may include lift-off, belly-press, and related internal-rotation tests. A highly specific positive test can increase suspicion, but a negative result from a low-sensitivity maneuver does not exclude a tear. Combining mechanism, age, weakness pattern, several examination findings, and imaging when indicated is more defensible than relying on a single test. [5,6]

Athlete assessment should extend beyond isolated manual strength. Repeated external rotation, closed-chain control, scapular endurance, trunk rotation, and sport-specific movements can reveal deficits that are not apparent during a brief clinic examination. Pain behavior and response to modified loading are also informative. The objective is to identify the athlete’s limiting impairment and load intolerance, not merely to reproduce pain. [6,19-21,24]

3.3.2. Imaging

Imaging is indicated when its result is likely to change management, when trauma and true weakness suggest a clinically important tear, when symptoms persist despite appropriate initial care, or when associated pathology or surgery is being considered. The Society of Radiologists in Ultrasound consensus algorithm supports initial radiographs in many adults, particularly after trauma or in patients aged 40 years or older, to identify fracture, arthritis, calcification, superior migration, or other osseous abnormalities. For suspected isolated rotator cuff disease, high-quality ultrasonography is a practical first-line soft-tissue examination where experienced operators are available. [4]

Systematic reviews show that ultrasonography, MRI, and MR arthrography have high diagnostic performance for full-thickness tears. Roy et al. reported pooled sensitivity and specificity above 0.90 for full-thickness lesions across these modalities. Farooqi et al. found no statistically significant difference between ultrasonography and MRI for the diagnosis of any-thickness, full-thickness, or partial-thickness supraspinatus tears in the studies suitable for direct comparison. Ultrasonography offers dynamic assessment, side-to-side comparison, accessibility, and lower cost, but performance is more operator-dependent and accuracy is generally lower for partial-thickness than full-thickness tears. [2,3,7]

MRI provides a broader assessment of tear size and retraction, muscle atrophy and fatty infiltration, marrow, cartilage, labrum, biceps anchor, and other intra-articular structures. MR arthrography can improve characterization of selected articular-sided partial tears and associated labral pathology but is invasive and is not required routinely. When ultrasonography does not explain the clinical presentation, or when complex intra-articular disease or operative planning is relevant, MRI or MR arthrography can be used as the next examination. [2-4,7]

Imaging findings should be communicated in functional context. Tear thickness, dimensions, tendon involvement, retraction, muscle quality, and associated abnormalities are more informative than a binary statement that a tear is present. In an active patient, the treatment decision should integrate these features with age, traumatic onset, objective weakness, symptom duration, sport demand, and response to rehabilitation. [1,4,16,19,20]

Table 2. Practical diagnostic pathway for suspected rotator cuff injury in a physically active individual.

Stage	Core assessment	Interpretation	Suggested action
1. Triage and history	Mechanism, immediate loss of function, deformity, neurologic symptoms, dominant side, workload change, sport demands.	Acute trauma with marked weakness or inability to elevate increases concern for a clinically important tear or other urgent injury.	Prompt radiographs and specialist assessment; early US or MRI when indicated.
2. Clinical examination	Active/passive ROM, scapular mechanics, cuff strength, cervical screen, biceps/labral/instability assessment, selected special tests.	Use patterns and clusters; no single test independently confirms or excludes a tear.	Initiate appropriate load modification and rehabilitation, or proceed to imaging if findings will alter care.
3. Initial imaging	Radiographs when trauma, age-related change, calcification, arthritis, or bony pathology is relevant; high-quality US for suspected isolated cuff disease.	US is highly accurate for full-thickness tears and useful dynamically, but partial tears and operator dependence require caution.	Correlate structure with symptoms and function.
4. Advanced imaging	MRI for complex presentations, muscle quality, associated pathology, or surgical planning; MRA selectively for articular-sided/labral questions.	Advanced imaging adds anatomic detail but should not replace clinical reasoning.	Use findings to refine prognosis, rehabilitation, and referral decisions.

Source: authors' synthesis based on references 1-7 and 19-21.

3.4. Conservative management

3.4.1. Role and expected outcomes of exercise-based care

Exercise-based rehabilitation is the central component of conservative management. It is appropriate as initial treatment for most rotator cuff tendinopathy, many partial-thickness tears, and many atraumatic full-thickness tears, provided that urgent traumatic indications and other important diagnoses have been excluded. The purpose is not necessarily to reverse an anatomic tear. Rather, treatment aims to reduce symptom irritability, restore motion, improve cuff and scapular capacity, optimize movement strategy, and rebuild tolerance to the loads required by daily activity and sport. [8-18,19-21]

The strongest prospective evidence in the included literature comes from the MOON Shoulder Group cohort. A standardized physical-therapy program was effective in approximately 75% of patients with atraumatic full-thickness tears at two years when failure was defined by the patient electing surgery. This population was not equivalent to young competitive athletes, but the study demonstrates that the presence of a full-thickness tear does not automatically require operative treatment. Bush et al. similarly found clinically meaningful improvements in patient-reported outcomes that were maintained through two years in a non-operative cohort. [10,16]

Systematic reviews consistently support exercise for pain and function, although the underlying studies are heterogeneous and do not identify one universally superior exercise mode. Conventional strengthening, eccentric loading, progressive resistance, scapular exercise, and combined programs can all be effective. Consequently, the clinically important features appear to be appropriate starting load, progressive exposure, adherence, sufficient duration, and alignment with the individual's impairments and goals rather than allegiance to a single contraction type or protocol. [9,12-15,17]

3.4.2. Rehabilitation framework

Early management should include education and modification of aggravating loads rather than indiscriminate rest. The athlete may temporarily reduce serving, throwing, repeated overhead lifting, or heavy pressing while maintaining pain-tolerable conditioning and lower-body training. Pain-monitoring rules can be used to titrate exercise, but rigid universal thresholds are not supported by the included literature. Sleep, recovery, training density, and rapid changes in workload should be addressed because the same exercise program may fail if the total load remains excessive. [8,14,17,19-21]

Mobility work should target clinically relevant restrictions. This may include assisted elevation, external rotation, posterior shoulder mobility, or thoracic motion, while avoiding aggressive stretching that repeatedly provokes symptoms. Restoration of motion is followed or accompanied by low-irritability activation and endurance work for the external rotators, internal rotators, abductors, and scapular stabilizers. Exercise may progress from isometric and short-lever tasks to isotonic work through larger ranges, then to heavier resistance, sustained holds, and repeated contractions. [8,17,18,24]

A later phase should develop force, rate of force development, endurance, and control in positions relevant to sport. Examples include side-lying or standing external rotation, rowing patterns, scapular-plane elevation, pressing and pulling progressions, closed-chain stabilization, perturbation training, and integrated trunk and lower-limb tasks. Exercise selection should be based on the target adaptation and symptom response. Strengthening only the cuff in isolation is insufficient for an athlete whose deficit emerges during whole-body high-velocity movement. [6,8,17-21,24]

The final rehabilitation stage should reproduce sport demands progressively. For overhead athletes, this can include plyometric catches and throws, deceleration drills, interval throwing or serving programs, and gradual exposure to velocity, volume, fatigue, and competition-specific sequences. For strength athletes, return may progress from restricted range and controlled tempo to full range, higher loads, ballistic tasks, and sport-specific intensity. The preceding stages are not strictly time-bound; progression depends on symptom stability, motion, strength, movement quality, and recovery after loading. [19-21,24]

Table 3. Criteria-based framework for conservative rehabilitation.

Phase	Primary goals	Typical interventions	Progression indicators	Common errors
1. Symptom and load control	Reduce irritability; preserve general fitness; clarify diagnosis.	Education, relative load reduction, pain-tolerable ROM, isometrics, lower-body and cardiovascular training.	Symptoms stable or improving; tolerates daily activity and initial exercise without prolonged flare.	Complete rest, repeated painful testing, or continuing unchanged high-volume overhead load.
2. Mobility and foundational capacity	Restore relevant ROM; improve cuff and scapular endurance.	Assisted and active ROM, posterior shoulder/thoracic mobility when indicated, low-to-moderate resistance cuff and scapular exercise.	Near-full functional ROM; improved control; progressive resistance tolerated.	Aggressive stretching without a demonstrated restriction; treating every asymmetry as pathological.
3. Strength and kinetic-chain integration	Increase force, endurance, and whole-body control.	Progressive resistance, pressing/pulling variations, closed-chain stabilization, perturbations, trunk and lower-limb integration.	Strength and endurance approaching the uninvolved or preinjury level; no major next-day response.	Underloading for too long or focusing only on isolated shoulder exercises.
4. Sport-specific reconditioning	Restore velocity, repeated-load tolerance, confidence, and performance.	Plyometrics, deceleration, interval throwing/serving, graded overhead volume, sport-specific lifting and fatigue exposure.	Completion of graded sessions with acceptable symptoms, recovery, and objective performance.	Returning directly from basic exercises to unrestricted competition.

Source: authors' synthesis based on references 8-21 and 24.

3.4.3. Prognosis and indications for referral

Outcome is influenced by more than tear size. In the cohort reported by Bush et al., female sex, smoking, and substantial subscapularis fatty infiltration were associated with less favorable outcomes at selected follow-up points, while symptoms lasting longer than one year were associated with less improvement at one year. These findings should be interpreted as prognostic tendencies rather than deterministic rules because the sample was modest and the population heterogeneous. Baseline function, expectations, adherence, occupational or sport demands, traumatic onset, tendon involvement, and muscle quality all contribute to decision-making. [11,16]

Referral should be considered when an acute traumatic event produces marked objective weakness, pseudoparalysis, or loss of previously normal function; when imaging suggests a repairable traumatic full-thickness tear in a young high-demand patient; when there is progressive weakness or substantial muscle compromise; or when a well-delivered rehabilitation program fails to restore acceptable function. Elite and overhead athletes may require earlier specialist involvement because timing within a competitive season and the limited probability of returning to the same performance level after some repairs materially affect the decision. Specialist consultation does not imply that surgery is inevitable; it supports shared decision-making. [1,19-21]

3.5. Return to sport

3.5.1. Return as a continuum

Return to sport should be viewed as a continuum from return to participation, through return to the previous sport, to return to preinjury performance. An athlete may be medically capable of participating in modified training but not yet able to tolerate unrestricted competition or reproduce previous speed, accuracy, volume, or strength. This distinction is essential when interpreting published return rates, which often combine different levels of return. [22-25]

Direct evidence defining return after conservative management is limited. Most publications describe rehabilitation principles or report postoperative outcomes. Therefore, criteria for non-operative return must be extrapolated from general shoulder rehabilitation, athlete assessment, and surgical return-to-play literature. This limitation should be stated explicitly rather than implying that a single validated test battery exists. [17,19-24]

3.5.2. Limitations of time-based clearance

Bravi et al. identified nine categories of return-to-play criteria after rotator cuff surgery. Time from surgery was reported most frequently and was the only criterion in more than half of the included studies, whereas strength and range of motion were reported much less often. The review estimated an average return time after arthroscopic repair of approximately 6.8 months, but the authors emphasized heterogeneity and inadequate standardization. Time is necessary for biological healing after repair, yet it does not demonstrate that an individual has regained motion, capacity, confidence, or sport-specific tolerance. [22]

Outcomes also depend on the level and type of sport. In the systematic review of overhead athletes by Migliorini et al., approximately 75.4% returned to play at some level after arthroscopic repair, but approximately 62.5% returned to their preinjury level. The mean reported time to return was approximately 6.4 months, with substantial variability. Li et al. estimated an overall return-to-sport rate of 84% among young athletes after surgical treatment, while 63% returned to their preinjury level; return to the preinjury level was lower in competitive than recreational athletes. These data show that structural treatment and return to participation do not guarantee full restoration of performance. [23,25]

3.5.3. Proposed criteria-based decision

A return decision should integrate symptoms, impairment measures, functional tests, sport exposure, and the athlete's response over time. Pain should be absent or minimal at rest and during required sport tasks, without a clinically important delayed flare after training. Functional range of motion should be restored for the athlete's sport rather than judged against a universal value. Strength and endurance should be compared with preinjury data when available and otherwise with the contralateral side, while accounting for normal dominance-related adaptations in overhead athletes. [6,22,24]

Objective testing may include isometric internal- and external-rotation strength, external-to-internal rotation ratios, repeated external-rotation endurance, closed-chain control, upper-quarter reach or stability tasks, medicine-ball or plyometric performance, and sport-specific velocity or workload. No single threshold has been validated across all rotator cuff injuries and sports. The value of testing lies in identifying residual deficits and documenting that the athlete can tolerate progressively realistic demands rather than in passing an isolated clinic test. [6,22,24]

The final stage requires graded exposure to the actual sport. An interval throwing or serving program should increase distance, effort, velocity, volume, frequency, and complexity in a planned sequence. Strength athletes should demonstrate tolerance to progressive range, load, speed, and repeated sets. Recovery over the following 24 to 48 hours is part of the assessment. Psychological readiness, apprehension, and confidence should be discussed because physical capacity may be present while fear or uncertainty still limits performance. [19-24]

Table 4. Suggested domains for return-to-sport decision-making after rotator cuff injury.

Domain	Suggested criterion	Examples of assessment	Interpretive caution
Symptoms and recovery	No resting pain; absent or acceptable task-related symptoms; no prolonged post-session flare.	Pain rating, night symptoms, response 24-48 hours after loading.	A completely pain-free state may not be necessary in every chronic condition, but symptoms must be stable and compatible with performance.
Mobility	Functional, pain-tolerable ROM sufficient for the sport and position.	Active elevation; internal/external rotation; sport-specific positions.	Compare with preinjury profile and sport adaptations, not only population norms.
Strength and endurance	Near-restoration of relevant cuff, scapular, and kinetic-chain capacity.	Dynamometry, repeated external rotation, pressing/pulling capacity, fatigue testing.	Contralateral comparison may be misleading in bilateral sports or when the uninvolved side is deconditioned.
Movement quality and functional tests	Controlled performance without major compensation or apprehension.	Closed-chain stability, plyometric control, upper-quarter tests, video analysis.	No single test battery is validated for every rotator cuff disorder.
Sport-specific workload	Completion of a graded training progression at realistic intensity, volume, and frequency.	Interval throwing/serving, swimming volume, overhead lifting progression, competition simulation.	One successful session does not demonstrate repeated-load tolerance.
Psychological readiness and shared decision	Athlete understands residual risk and reports adequate confidence.	Interview, confidence ratings, discussion with clinician, coach, and athlete.	Competition pressure should not replace informed, criteria-based judgment.

Source: authors' synthesis based on references 6, 19-25.

4. Discussion

The evidence supports a clinical pathway in which structural diagnosis, functional assessment, and load tolerance are considered together. For most physically active patients with gradual-onset pain, the initial task is not to identify a single painful tendon with certainty, but to determine whether the presentation is compatible with rotator cuff-related disorder, exclude urgent or competing diagnoses, quantify functional deficits, and begin a modifiable loading plan. Imaging becomes most valuable when it answers a specific question: whether a traumatic tear is present, whether the lesion is full or partial thickness, whether muscle quality affects prognosis, whether associated pathology is likely, or whether surgery is being considered. [1-7]

The diagnostic evidence favors ultrasonography as an efficient first-line soft-tissue test for suspected isolated cuff disease when expertise is available. MRI remains valuable when a broader anatomic assessment is required. The similar accuracy of ultrasonography and MRI for many full-thickness tears means that the choice should reflect local expertise, cost, availability, and the clinical question. Neither test eliminates the need for careful examination, and partial-thickness lesions require greater caution because diagnostic performance is lower and their clinical significance varies. [2-4,7]

The conservative-treatment literature is clinically reassuring but should not be oversimplified. Many patients with atraumatic full-thickness tears improve without surgery, and exercise is consistently supported for tendinopathy and tears. However, improvement in a general adult cohort does not establish that a competitive overhead athlete will regain elite performance. The rehabilitation target for an active individual extends beyond symptom reduction to repeated-load capacity, high-speed control, and integration of the trunk and lower extremities. A program that is sufficient for daily activity may be inadequate for serving, throwing, swimming, or heavy overhead lifting. [8-21,24]

The absence of one superior exercise protocol should be interpreted as support for individualized progressive loading, not as evidence that exercise details are irrelevant. Appropriate dosage, progression, adherence, and exposure to the actual sport demand are likely to determine whether physiological gains transfer to performance. Clinicians should avoid both persistent underloading and premature return to high-velocity or high-volume activity. A staged framework also gives the athlete and coach visible milestones and reduces dependence on an arbitrary calendar date. [8,14,15,17,18,24]

Return-to-sport evidence exposes a major gap. Published surgical series often report acceptable rates of return to some sport, but lower rates of return to the previous level, especially in competitive overhead athletes. Moreover, many studies use elapsed time as the principal or sole clearance criterion. A criteria-based approach is logically stronger, but the exact thresholds proposed in practice have not been validated uniformly. The framework in Table 4 should therefore be treated as a structured clinical proposal derived from the available evidence, not as a validated universal rule. [19-25]

Shared decision-making is particularly important when treatment options offer different probabilities of pain relief, structural healing, time away from sport, and return to the same performance level. The athlete's age, tear mechanism, tissue quality, competition level, season, position, career stage, willingness to complete rehabilitation, and tolerance of residual symptoms all matter. A young athlete with an acute traumatic full-thickness tear and objective weakness presents a different problem from an older recreational athlete with an atraumatic tear and preserved function. [1,11,16,19-21]

4.1. Limitations

This review has several limitations. It was a targeted narrative review and did not include duplicate screening, protocol registration, formal risk-of-bias assessment, or quantitative synthesis. Restriction to 25 English-language open-access articles improved transparency and access but may have excluded relevant evidence available only through subscription journals. The source set was heterogeneous with respect to age, diagnosis, tear characteristics, sporting level, interventions, and outcomes. Much of the non-operative evidence came from general adult populations, whereas much of the direct return-to-sport evidence came from postoperative athletes. Consequently, some athlete-specific recommendations represent reasoned extrapolation from adjacent evidence.

The terminology used in the literature also varies. Rotator cuff tendinopathy, rotator cuff-related shoulder pain, impingement, partial-thickness tear, and full-thickness tear are overlapping but non-identical categories. Return to participation, return to sport, and return to performance are not reported consistently. These differences limit direct comparison and reinforce the need for clearer case definitions and standardized outcomes. [17,22-25]

4.2. Directions for future research

Prospective studies should establish return-to-sport criteria specifically for non-operatively managed rotator cuff injuries. Useful research would combine objective strength and endurance testing, patient-reported outcomes, workload exposure, sport-specific performance, psychological readiness, and recurrence or symptom-flare data. Studies should report return to participation, return to sport, and return to preinjury performance separately and should stratify outcomes by sport, competition level, sex, age, traumatic versus degenerative onset, tear depth, and tendon involvement. Comparative trials are also needed to determine how loading magnitude, frequency, velocity, and supervision affect outcomes in athletic populations. [17,19-25]

5. Conclusions

Rotator cuff injuries in physically active individuals require an integrated assessment of mechanism, symptoms, clinical findings, imaging, and sport demands. No single special test or imaging abnormality should determine treatment in isolation. [1-7]

Ultrasonography and MRI are both highly useful for full-thickness tears. Ultrasonography is an efficient first-line option for suspected isolated cuff disease when operator expertise is available, while MRI or MR arthrography is better suited to complex presentations, associated pathology, and surgical planning. [2-4,7]

Conservative exercise-based rehabilitation is the appropriate initial strategy for most tendinopathy, many partial-thickness tears, and many atraumatic full-thickness tears. The program should progress from symptom and load management to mobility, cuff and scapular capacity, kinetic-chain integration, and sport-specific reconditioning. [8-21,24]

Return to sport should not be authorized on elapsed time alone. Readiness should include stable symptoms, functional motion, restored strength and endurance, acceptable movement quality, successful graded sport exposure, adequate recovery, and psychological confidence. Current thresholds remain incompletely validated. [22-25]

Prompt specialist assessment is warranted after acute traumatic loss of function, marked objective weakness, or failure of a sufficiently dosed rehabilitation program. Future research should prioritize standardized, prospective return-to-sport pathways for non-operatively managed athletes. [1,19-25]

Disclosure

Supplementary Materials

No supplementary materials are included with this manuscript. The full-text source set is identified in the References section.

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Conflicts of Interest

The authors declare no conflict of interest.

Declaration of the use of generative AI and AI-assisted technologies in the writing process

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