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Rotator Cuff Tendinopathy Diagnosis, Nonsurgical Medical Care, and Rehabilitation: A Clinical Practice Guideline

Rotator cuff (RC) disorders account for more than half of shoulder conditions and are commonly treated by physiotherapists, as well as other health practitioners including physicians.[92,110,184,192] The RC comprises the supraspinatus, infraspinatus, subscapularis, and teres minor. These muscles have different origins on the scapula and their tendons converge on the greater and lesser tuberosities of the humerus bone. The main function of the RC is to stabilize the shoulder joint.[33]This group of disorders includes most commonly RC tendinopathies with or without calcifications and partial-thickness RC tears.[92,100,138] Terms such as subacromial pain syndrome, subacromial impingement syndrome, subacromial bursopathy, and long head of biceps tendinopathy are also considered to fall within an RC tendinopathy diagnosis.[17,71,100,103] The term RC calcific tendinopathy is used when a calcific deposit within the RC is confirmed by imaging.

SYNOPSIS: This evidence-based clinical practice guideline (CPG) aims to guide clinicians with recommendations covering the assessment, treatment, and prognosis of adults with shoulder pain with suspected rotator cuff (RC) tendinopathy, the nonsurgical medical care and rehabilitation of adults with RC tendinopathy, as well as the return to function and sport for elite and recreational athletes. This CPG includes recommendations for managing RC tendinopathy with or without calcifications and partial-thickness RC tears. *J Orthop Sports Phys Ther 2025;55(4):235-274. Epub 30 January 2025. doi:10.2519/jospt.2025.13182*

KEY WORDS: *expert clinical practice, rotator cuff, shoulder, tendinopathy*

Initial diagnosis and treatment of RC disorders often do not follow evidence-based recommendations.[9,22] Diagnoses of shoulder disorders commonly rely on the unnecessary use of diagnostic imaging tests such as magnetic resonance imaging (MRI),[106] driving additional costs, treatment delays, and potential overmedicalization.[114,170,183] This evidence-based clinical practice guideline (CPG) provides clinical recommendations covering the assessment and prognosis of adults with shoulder pain with suspected RC tendinopathy, the nonsurgical medical care and rehabilitation of adults with RC tendinopathy, and the return to function and play for elite and recreational athletes. This CPG includes recommendations for managing RC tendinopathy with or without calcifications, and partial-thickness RC tears. This CPG excludes other RC-related diagnoses such as full-thickness tears. The CPG is a resource for patients, policymakers, payers, and other

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knowledge users, offering a comprehensive reference on best practice in musculoskeletal (MSK) care for RC tendinopathy.

SUMMARY OF RECOMMENDATIONS

Note: The letter grades of recommendations (A to F) reflect the overall strength of the evidence supporting the recommendations according to guidelines described by Guyatt et al,[69] as modified by MacDermid et al.[121] For more information, see **TABLE 4**.

Section 1: Clinical Assessment of the Painful Shoulder and Suspected Rotator Cuff Tendinopathy

1. F When assessing an adult with shoulder pain, clinicians must include a subjective assessment, as well as a detailed history of the injury. Early in the management, clinicians must cover the following aspects of the subjective assessment: reason for consultation, age, gender, hand dominance, work and related requirements, sports and leisure, list of medications, comorbidities, medical history, presence of psychosocial and contextual factors, history and mechanism of injury, previous investigation, previous treatments, symptoms including shoulder pain, loss of range of motion (ROM) and strength, cervical pain and dysfunction, and the presence of paresthesia or other neurological symptoms, functional limitations, and patient goals.
2. F In the physical assessment and differential diagnosis for the adult with shoulder pain, clinicians must include the observation of the shoulder complex (deformity, muscle atrophy, and swelling), as well as measurements of active and passive ROM and muscle strength. Clinicians may include palpation of the shoulder structures, clinical orthopedic special tests selected according to the patient's condition and the diagnostic reasoning of the professional, and a screening examination of the cervical spine.
3. F Clinicians must identify any signs or symptoms of serious pathology (red flags) or of systemic involvement. Signs or symptoms of serious pathology include but are not limited to suspicious deformity, fever and/or chills, signs or symptoms suggesting cardiovascular or visceral impairment, and history or suspicion of cancer.
4. B Clinicians should identify personal, clinical, psychosocial, or work-related factors that may influence the prognosis of an adult with rotator cuff tendinopathy.
5. B Clinicians may use the following tests to confirm or to rule out a diagnosis of rotator cuff tendinopathy. To confirm the diagnosis: Painful arc test. To rule out the diagnosis: Hawkins-Kennedy test.
6. A Clinicians should use an inclinometer, goniometer, or a smartphone inclinometer/goniometer application to objectively measure shoulder active and passive ROM instead of visual estimation. Scapular ROM measures are unreliable and have limited validity and, thus, should not be used by clinicians to objectively measure dynamic scapular ROM.
7. A Clinicians should use a handheld dynamometer to objectively measure the isometric muscle strength of the shoulder complex.
8. A Clinicians must use valid, reliable, and responsive patient-reported questionnaires and/or mixed tools to objectively assess pain and disability in patients with shoulder pain including rotator cuff tendinopathy.
9. F Clinicians should not prescribe or recommend a diagnostic imaging test to confirm rotator cuff tendinopathy in the initial management of an adult with shoulder pain.
10. F Clinicians may recommend or prescribe diagnostic imaging test(s) for adults with a rotator cuff tendinopathy if symptoms do not resolve or improve within a maximum of 12 weeks of appropriate nonsurgical management.
11. F Clinicians must consider the following factors when choosing a diagnostic imaging test: suspected pathologies, diagnostic properties, accessibility, and costs of the diagnostic test.
12. F Clinicians must prioritize diagnostic ultrasound because of its lower cost and its diagnostic properties being similar to magnetic resonance imaging for confirming a rotator cuff disorder.
13. F Clinicians must inform the adult with shoulder pain of the diagnostic value and limitations of the various imaging tests and should also discuss diagnostic imaging test results with patients.
14. F Clinicians should refer adults with a rotator cuff tendinopathy who have severe and persistent pain and/or disability despite a maximum of 12 weeks of appropriate nonsurgical care to a musculoskeletal physician specialist such as a primary care sports physician, a physiatrist, or an orthopedic surgeon for further assessment and treatment.

Section 2: Pharmacological Treatment for Rotator Cuff Tendinopathy

15. C Clinicians may recommend acetaminophen to reduce pain in the short term for adults with rotator cuff tendinopathy.
16. B Clinicians may recommend oral nonsteroidal anti-inflammatory drugs

(NSAIDs) to reduce pain in the short term for adults with rotator cuff tendinopathy.

17. Regarding opioids:
a) F Clinicians may recommend using opioids in the short term for pain reduction in adults with rotator cuff tendinopathy who have severe pain and disability and are refractory or have contraindication to other analgesic modalities.
b) C Clinicians should not recommend opioids as a first-line pharmacological treatment to reduce pain and disability in adults with rotator cuff tendinopathy.
18. F Prescribing clinicians must regularly reassess the risks of dependence and the need for taking opioids.
19. Regarding corticosteroid injections:
a) B Clinicians may recommend or administer corticosteroid injections to reduce pain and short-term disability in adults with rotator cuff tendinopathy.
b) C Clinicians should not recommend or administer corticosteroid injections as first-line treatment to reduce pain and disability in adults with rotator cuff tendinopathy.
20. B If available, clinicians should use or recommend using ultrasound guidance for subacromial corticosteroid injection to reduce pain in the short term.
21. B Clinicians should use or recommend using calcific lavage to reduce pain and disability in adults with calcific rotator cuff tendinopathy refractory to initial treatment.
22. Regarding platelet-rich plasma (PRP) injections:
a) D Clinicians may use or recommend PRP injections to reduce pain and disability in adults with rotator cuff tendinopathy.
b) F Clinicians should not use or recommend PRP injections as a first-line treatment to reduce pain and disability in adults with rotator cuff tendinopathy.
23. Regarding hyaluronic acid injections:
a) D Clinicians may use or recommend hyaluronic acid injections to reduce pain and disability in the short and medium terms in adults with rotator cuff tendinopathy.
b) F Clinicians should not use or recommend hyaluronic acid injections as a first-line treatment to reduce pain and disability in adults with rotator cuff tendinopathy.

Section 3: Rehabilitation Treatments for Rotator Cuff Tendinopathy

24. C Clinicians should provide patients with patient-centered and individualized education on their condition, pain management options, activity modification, and self-management. Clinicians should consider the individual's level of health literacy, personal beliefs and goals, and relevant psychosocial factors.
25. A Clinicians should prescribe or recommend an active rehabilitation exercise program, which may include motor control and/or resistance training exercises with various loads, as an initial treatment to reduce pain and disability in adults with rotator cuff tendinopathy.
26. B Clinicians may perform spinal and/or upper limb manual therapy alone or in combination with other interventions such as exercise, to help reduce pain in adults with rotator cuff tendinopathy in the short term. Manual therapy can include soft tissue techniques and/or joint mobilizations or manipulations.
27. D Clinicians may use taping in addition to an active rehabilitation program to reduce pain in adults with rotator cuff tendinopathy in the short term.
28. C Clinicians may use or recommend acupuncture in addition to an active rehabilitation program to reduce pain and disability in adults with rotator cuff tendinopathy.
29. C Clinicians should not use or recommend extracorporeal shock wave therapy to reduce pain and disability in adults with rotator cuff tendinopathy without calcification.
30. C Clinicians may use or recommend extracorporeal shock wave therapy to reduce pain and disability in adults with rotator cuff calcific tendinopathy.
31. C Clinicians may use laser therapy alone or in addition to an active rehabilitation program to reduce pain and disability in adults with rotator cuff calcific tendinopathy.
32. C Clinicians should not use or recommend therapeutic ultrasound alone or in addition to an active rehabilitation program to reduce pain and disability in adults with rotator cuff calcific tendinopathy.
33. B Clinicians should not use or recommend therapeutic ultrasound alone or in addition to an active rehabilitation program to reduce pain and disability in adults with rotator cuff noncalcific tendinopathy.
34. C Clinicians may perform or recommend ergonomic adaptations to reduce occupational shoulder pain in adults.

Section 4: Return to Sport for Rotator Cuff Tendinopathy

35. F Clinicians may consider an athlete's capacity and load tolerance for the rotator cuff muscles and tendons along with associated shoulder muscles and joints to develop a return-to-sport program.
36. F Clinicians may use reliable, valid, and responsive patient-rated outcome tools

for pain, disability, and readiness to return to sport, along with functional performance measures to guide the return-to-sport continuum and determine timelines for return to sport.

METHODS

Scope of the CPG

The aim of this CPG is to (1) provide a concise summary of the evidence related to managing RC tendinopathy with or without calcification, and partial-thickness RC tears, and (2) develop recommendations to guide clinicians. This guideline is not intended to formally set a standard of care. Standards of care are determined by considering clinical data and may change as scientific evidence and care practices evolve. The final decision regarding a clinical procedure or treatment plan should be based on the clinician's experience and expertise, considering the patient's clinical presentation, trustworthy evidence, multiple treatment options, and the patient's values and preferences. The recommendations provided in this CPG may not be within the regulated scope of practice of a practitioner depending on their title and location. Clinicians using this CPG are responsible for practicing within the professional standards, licensing requirements, and regulated scope of their profession when applying recommendations.

An international steering committee including expert researchers, clinicians (12 physiotherapists, a physical medicine physician, and an orthopaedic surgeon), and patient partners developed this CPG. The steering committee included members who developed a previous CPG on RC disorders for adults and workers (F.D., J.S.R., S.L., M.C., M.L., T.V.), and a group of international researchers and clinicians (L.M., E.S., J.G., K.M., M.O.D., H.M.K.). The CPG development team maintained editorial independence from the involved funding agencies, and all authors declared relationships and submitted a conflict-of-interest form. Articles authored by members of the CPG team and reviewed for the current guidelines were assigned to independent reviewers. The project received approval from the Ethics Committee of the Maisonneuve-Rosemont Hospital Research Center in Montreal, QC, Canada (# FWA00001935 and IRB00002087). This CPG was supported by the Quebec Rehabilitation Network (REPAR) and the Quebec Pain Research Network (QPRN) and by additional funds from the Academy of Orthopaedic Physical Therapy (AOPT) of the American Physical Therapy Association (APTA), and from the American Physical Therapy Association (APTA).

ICD Classification

The primary International Classification of Diseases and Related Health Problems, 10th version (ICD-10) codes associated with RC tendinopathy are presented in **TABLE 1** for function and for activities and participation.

CPG Development

In 2015, the senior authors of this CPG (J.S.R. and F.D.) published an evidence synthesis on RC disorders that aimed to systematically review all relevant literature on assessing shoulder pain, the nonsurgical and surgical management for RC disorders (including full-thickness tears), and return to work with shoulder pain.[155] In 2017, based on this evidence synthesis, a CPG was developed on diagnosing, managing (nonsurgical medical, rehabilitation, and surgical treatments), and supporting return to work of adults with RC disorders (RC tendinopathies with or without calcifications, partial- and full-thickness RC tears).[44] The guide, published in French, included additional systematic searches and a 3-round modified Delphi consultation involving 51 panelists to create 74 recommendations. The guide was later updated in 2022 (later referred to as the 2022 CPG), and an English version was published.[53,92]

The development of the current CPG is based on these previous projects and publications, and the methodology is adapted from these works to update relevant recommendations covering the assessment of adults with shoulder pain and suspected RC tendinopathy, the

Table 1 ICD Classification Codes Associated With RC Tendinopathy

S46.0	Injury of Muscle(s) and Tendon(s) of the RC of Shoulder
M75	Shoulder lesions
s7202	Muscles of shoulder region
s7209	Structure of shoulder region, unspecified
Function	
b730-b74	Muscle functions
b7300	Power of isolated muscle and muscle groups
b740	Muscle endurance functions
b7400	Endurance of isolated muscles
b7401	Endurance of muscle groups
b28014	Pain in upper limb
Activities and Participation	
d430	Lifting
d4451	Pushing
d4452	Reaching
d4454	Throwing
d9201	Sports
d840-859	Work and employment

Abbreviation: RC, rotator cuff.

nonsurgical medical care and rehabilitation of adults with RC tendinopathy, and the return to function and play for elite and recreational athletes.

Evidence Eligibility Criteria

Eligible publications for this CPG were identified via bibliographic searches conducted in Medline, Embase, Cochrane Central, and CINAHL. Only new systematic reviews with or without meta-analysis published since the 2022 CPG were included.[92] A professional librarian reviewed all search strategies. Searches to update the literature were conducted between July 2022 and October 2023 (see Appendices A and B for full search strategies, eligibility criteria, and dates). For each bibliographic search, 2 reviewers independently performed each step of the selection process. They screened titles and abstracts to assess eligibility. Full texts of potential eligible review articles were retrieved and assessed. In case of disagreement between reviewers, a third reviewer was available at each stage to facilitate a consensus and a final decision. Data extraction of included reviews was performed using a predefined standardized form by 1 evaluator and revised by a second evaluator. For data extraction, the follow-up periods were operationally defined as follows for results reported:

- immediate: data within 1 day;
- short-term: data including closest follow-up time point to 1 month (but less than 2 months);
- medium-term: data including closest follow-up time point to 3 months (between 2 and 6 months);
- long-term: data including closest follow-up time point to 12 months (between 6 and 18 months); or
- very long-term: any data with follow-up time points beyond 18 months after the initiation of care.

Eligibility criteria for evidence included in the present CPG are presented in **TABLE 2** for the diagnosis and treatments. Exact eligibility criteria per search strategies are

Table 2 Eligibility Criteria

	Clinical Assessment Evidence Content for the Painful Shoulder	RC Tendinopathies Treatment Evidence (Pharmacological and Rehabilitation Treatments)	Return to Sport and Rotator Cuff Tendinopathies
Population	Adults with shoulder pain or suspected RC tendinopathy	Adults with a RC tendinopathy, including partial tear and/or calcific tendinopathy	Elite or recreational athletes with a RC tendinopathy
Interventions	Clinical tests, imaging tests, measurement tools (range of motion and strength) and self-reported questionnaires or mixed tools	Pharmacological treatments (acetaminophen, oral and topical NSAIDs, opioids, corticosteroid injections, PRP injections, hyaluronic acid injections, opioids, suprascapular nerve block, prolotherapy, and stem cell), rehabilitation treatments (education, exercise, manual therapy, taping, ergonomic interventions, TENS, therapeutic ultrasound, laser, shockwave, acupuncture/dry needling, interferential currents, and iontophoresis)	Prognostic factor studies: none Intervention studies: any intervention as part of a rehabilitation program aimed at return to sport in athletes
Comparators	Gold standards (imaging tests, surgery, etc)	Any other intervention, no intervention or placebo	Prognostic factor studies: none Intervention studies: any intervention as part of a rehabilitation program aimed at facilitating return to sport in athletes
Outcomes	Diagnostic accuracy (sensitivity, specificity, positive/negative LR) or metrological quality (validity, reliability, sensitivity to change)	Measures related to pain, function, health-related quality of life, or a global rating of change	Prognostic studies: proportion of athletes who returned to sport (%) at a specific time, time to return to sport (days), reinjury rate (%), and determinants associated with the above prognostic factors or clinical outcomes (pain, disability, quality of life, or performance) Intervention studies: self-reported pain, disability/function, health-related quality of life or any performance measures
Study design	Systematic review with or without meta-analysis	Systematic review with or without meta-analysis Randomized controlled trial if no review ever published or systematic review with or without meta-analysis if available	Randomized controlled trials, nonrandomized controlled trials, analytic observational studies, or descriptive observational studies published in a peer-reviewed scientific journal
Language	Published in English or French in a scientific peer-reviewed journal		

Abbreviations: LR, likelihood ratio; NSAIDs, nonsteroidal anti-inflammatory drugs; PRP, platelet-rich plasma; RC, rotator cuff; TENS, transcutaneous electrical nerve stimulation.

available in the Appendix B. Moreover, we included the recommendations and evidence from the 2022 CPG to guide the formulation of the current recommendations, as it covered several aspects of this CPG. In the 2022 CPG, some recommendations for the initial assessment and referral to specialized care were only based on a consensus because of the absence of published evidence as no original studies or reviews were identified to inform these questions specific to shoulder pain or shoulder tendinopathy (recommendations 1, 2, 4, and 14). No literature search was made to update these recommendations for this CPG. For the return to play section, a literature search was performed from databases inception, and new recommendations were created by the team. Inclusion and exclusion criteria are presented in **TABLE 2**.

Methodological Quality Assessment of Evidence

Articles were rated according to criteria adapted from the Centre for Evidence-Based Medicine, Oxford, UK (http://www.cebm.net).[77] In pairs, evaluators independently performed a critical appraisal using the AMSTAR II (A Measurement Tool to Assess Systematic Reviews, version 2) for systematic reviews,[171,172] the Effective Public Healthcare Panacea Project (EPHPP) Quality Assessment Tool for Quantitative Studies tool for randomized controlled trials (RCTs),[8,186] or the Scoping Review Checklist for scoping reviews,[38] and assigned a level of evidence to each article. If the 2 evaluators did not agree on the critical appraisal or on the level of evidence for a particular article, a third evaluator was consulted to resolve disagreement. (See **TABLE 3** for the levels of evidence table and details on procedures used for assigning levels of evidence, available at www.jospt.org and www.handpt.org.) The evidence was organized and presented from the highest to the lowest level of evidence. An abbreviated version of the grading system is provided in **TABLE 3**.

Developing Preliminary Recommendations

We followed the National Institute for Health and Care Excellence (NICE) collaboration's standards.[134] Recommendations were formulated based on the International Classification of Functioning, Disability and Health (ICF) and the Population, Intervention, Comparison, Outcome (PICO) frameworks.[79,196,197] Each recommendation was based on a synthesis of the evidence addressing a clinical question within the scope of the CPG. Preliminary recommendations were developed considering several predetermined elements of appraisal, including the quality of the evidence, the trade-off between benefits and harms, the cost effectiveness, and the acceptability and feasibility of the proposed recommendations.[161,196,197]

A working group first drafted a document proposing these clinical recommendations. A list of preliminary clinical recommendations approved by all members of the working committee was developed. Each preliminary recommendation included a statement of the recommendation with explanatory details and a summary of the supporting evidence. The full team then reviewed these recommendations, and modifications were made until consensus was achieved.

Grades of Recommendations

The overall certainty of the evidence was graded according to guidelines described by Guyatt et al,[69] as modified by MacDermid et al.[121] The typical A, B, C, and D grades of evidence have been modified to include the role of consensus expert opinion (**TABLE 4**). In developing the recommendations, we considered the strengths and limitations of the body of evidence and the health benefits, potential side effects, and risks of tests or interventions. When indicated, the certainty of evidence based on meta-analysis was downgraded due to risk of

Table 3 Levels of Evidence

Level	Intervention	Diagnosis/Diagnostic Accuracy	Summary
I	Systematic review of high-quality RCTs	Systematic review of high-quality diagnostic studies	Evidence obtained from high-quality diagnostic studies, prospective studies, systematic reviews, or randomized controlled trials
II	Systematic review of high-quality cohort studies or lower-quality RCTs	Systematic review of exploratory diagnostic studies or consecutive cohort studies (lower-quality diagnostic studies)	Evidence obtained from lesser-quality diagnostic studies, systematic reviews, prospective studies, or randomized controlled trials[a]
III	Systematic reviews of case-control studies	Systematic reviews of nonconsecutive study or without consistently applied reference standards[b]	Case-control studies or retrospective studies
IV	Case series (NA)	Case-control study (NA)	Case series (NA)
V	Expert opinion	Expert opinion	Expert opinion

Abbreviations: NA, not applicable to this clinical practice guideline; RCT, randomized controlled trial.
[a]*Eg, weaker diagnostic criteria and reference standards, improper randomization, no blinding, less than 80% follow-up.*
[b]*From the work of Phillips et al.*[77]

Table 4 Grades of Recommendations

Grades of Recommendations[a]		Strength of Evidence	Level of Obligation (Based on Treatment Effects)
A	Strong evidence	A preponderance of level I and/or level II studies support the recommendation Must include at least 1 level I study	**Must**: benefits substantially outweigh harms **Should**: benefits moderately outweigh harms **May**: benefits minimally outweigh harms or benefit/harm ratio is value dependent **Should not**: harms minimally or moderately outweigh benefits or evidence of no effect **Must not**: harms largely outweigh benefits
B	Moderate evidence	A single high-quality randomized controlled trial or a preponderance of level II studies support the recommendation	**Should**: benefits substantially outweigh harms **May**: benefits moderately or minimally outweigh harms or benefit/harm ratio is value dependent **Should not**: evidence that harms outweigh benefits or evidence of no effect
C	Weak evidence	A single level II study or a preponderance of level III and IV studies, including statements of consensus by content experts, support the recommendation	**Should**: benefits substantially outweigh harms **May**: benefits moderately or minimally outweigh harms or benefit/harm ratio is value dependent **Should not**: harms minimally or moderately outweigh benefits
D	Conflicting evidence	Higher-quality studies conducted on this topic disagree with respect to their conclusions The recommendation is based on these conflicting study results	**May**: conflicting evidence, the benefit/harm ratio is value dependent.
E	Theoretical / foundational evidence	A preponderance of evidence from animal or cadaver studies, from conceptual models/principles, or from basic sciences/bench research support this conclusion	**May**: in the absence of evidence from clinical studies, theoretical and or foundational evidence supports benefit. **Should not**: in the absence of evidence from clinical studies, theoretical and or foundational evidence suggests risk of harms.
F	Expert opinion	Best practice based on the clinical experience of the guideline development team supports this conclusion	**Must**: strongly supported by consensus-based best practice/standard of care **Should**: moderately supported by best practice/standard of care **May**: supported by expert opinion in the absence of consensus **Should not**: best practice/standard of care indicates potential harms **Must not**: potential harms are strongly supported by consensus-based best practice/standard of care

[a]*Grades of recommendations based on meta-analysis could be downgraded due to risk of bias, imprecision, heterogeneity, or other factors as described by Grading of Recommendations, Assessment, Development, and Evaluation (GRADE) (https://bestpractice.bmj.com/info/toolkit/learn-ebm/what-is-grade/).*

bias, imprecision, heterogeneity, or other factors as prescribed by the Grading of Recommendations, Assessment, Development, and Evaluation (GRADE) system.[68]

Patient Involvement

The final recommendations were presented to patients who sought care for shoulder tendinopathy in the province of Quebec, Canada (n = 3), County Limerick, Ireland (n = 3), and California, USA (n = 2), to obtain various views and opinions as these countries have different types of health care systems, and patients' experiences may differ. Using a purposive sample, patients were recruited from previous projects conducted by research team members in these countries. Participants were asked to review the recommendations and complete 2 patient feedback questionnaires in which patients had to indicate their level of agreement with the recommendations. We also developed a semistructured interview guide and completed focus groups and individual interviews with the participants so they could provide input on the recommendations.

Participants mentioned that, based on their level of understanding, all recommendations from the current CPG were comprehensive and presented clearly and that they agreed with them. Some participants suggested minor changes to the wording of only a few recommendations. These changes were incorporated in the final revisions of the recommendation.

Organization of the Guideline

A brief section introduces pathoanatomical features of RC tendinopathy; then, 4 sections present evidence and recommendations for the assessment, medical, and rehabilitation treatments and return to sport. For each section, summaries of included literature based on systematic reviews of the literature with the corresponding evidence levels are followed by gaps in knowledge, evidence synthesis, and rationale and by the clinical recommendation(s) including the grade of recommendation.

Presented recommendations use actionable terms such as *must*, *should*, *may*, *should not*, or *must not*, according to the level of obligation presented in **TABLE 4**, but also the terms *use*, *perform*, *prescribe*, *or recommend*, so that it is inclusive of various regulated scopes of practice of different providers from different legislations. Practitioners have the responsibility to practice according to the professional standards of their profession, licensing body, and regulated scope of practice when using recommendations.

For Section 1 and for Sections 2 and 3 combined, 2 decision trees including the relevant recommendations are also presented.

PATHOANATOMICAL FEATURES OF RC TENDINOPATHY

The shoulder is the most mobile joint of the human body.[50,133] While this is convenient to allow for the performance of daily life activities, it may increase the risk of RC tendinopathy especially when repetitive movements are involved.[10,189] For optimal function, all components of the shoulder must operate in a synergy to ensure an adequate balance between mobility and stability.[190] Those components include passive (scapula, humerus, clavicle, ligaments, labrum, and capsule) and active (glenohumeral and scapulothoracic muscles) structures relying on a dynamic interaction supported by the sensorimotor system.[150,151] Together those structures form the acromioclavicular, sternoclavicular, and glenohumeral joints, as well as the scapulothoracic joint, a pseudo joint.[99] Most (2/3) of the movement occurs at the glenohumeral joint while the scapulothoracic joint allows for the remaining movement.[164]

RC tendinopathy is mostly associated with pain, usually during arm elevation and external rotation, but pain can also occur during sleep or rest in more irritable presentations.[87,129,140] In turn, this pain can lead to reduced muscle performance (strength and endurance),[34,120]as well as kinematic alterations of the upper limb.[115,116] Although there is no consensus, the most consistently reported shoulder alterations are reduced upward rotation and posterior tilt of the scapula, as well as an increased elevation of the shoulder girdle. When pain persists over time, it can even lead to the development of maladaptive pain behaviors such as kinesiophobia, catastrophization, and reduced self-efficacy.[119,125,126]

Various intrinsic, extrinsic, and environmental factors alone or in combination have been suggested to explain why RC tendinopathy occurs.[108,165] Age may lead to morphological changes in the tendons influencing its ability to sustain the loads applied.[66,195,199] In addition, bony changes and altered kinematics may increase the compressive and shear loads applied on the tendons.[55,63,141,142] Repetitive movements leading to fatigue may also predispose individuals to experience RC tendinopathy.[20,127] Occupational hazards, smoking, nutritional deficiencies, genetics, or variations in blood supply to the RC are also all factors considered to contribute to the development of RC tendinopathy.[102,165] Finally, psychosocial factors have also strongly been advocated for as an explanation for why some individuals experience persistent symptoms.[16,90,175] Some occupations or sports activities may put workers or athletes at higher risk of developing RC tendinopathy since higher demands and several risk factors may be present and put the person at higher risk.[102]

SECTION 1: CLINICAL ASSESSMENT OF THE PAINFUL SHOULDER AND SUSPECTED RC TENDINOPATHY

1.1 History and Physical Exam

A pathoanatomical diagnosis model for the shoulder remains of great value as it guides the clinician in the evaluation of the prognosis, establishing a patient-centered care plan and selecting therapeutic interventions. To formulate an adequate diagnosis, the clinical assessment of a patient involves a detailed history of injury, subjective and physical assessments that may include standardized questionnaires, identification of any red flags, screening for yellow flags, use of special clinical tests, and suggesting or prescribing imaging tests if relevant.

Overview

Based on a systematic review of CPGs[48] and on recommendations from a 2021 CPG for RC disorders[44] that was based on a consensus from a modified Delphi study, it is recommended that the evaluation of adults presenting with shoulder pain should include a thorough subjective evaluation including a detailed history, a comprehensive objective evaluation, as well as the prompt identification of yellow and red flags early on during the initial consultation or during the following reassessment.[44,48]

Gaps in Knowledge While it is accepted that a complete history and physical exam is crucial to ensure safe and efficient patient care, there is a lack of evidence on the diagnostic value of

these aspects when evaluating a patient with a suspected RC tendinopathy. More evidence is needed to conclude on the exact diagnostic accuracy of a subjective evaluation of a patient with a suspected RC tendinopathy.

Recommendations

Recommendation No. 1

F When assessing an adult with shoulder pain, clinicians must include a subjective assessment as well as a detailed history of the injury. Early in the management, clinicians must cover the following aspects of the subjective assessment: reason for consultation, age, gender, hand dominance, work and related requirements, sports and leisure, list of medications, comorbidities, medical history, presence of psychosocial and contextual factors, history and mechanism of injury, previous investigation, previous treatments, symptoms including shoulder pain, loss of range of motion (ROM) and strength, cervical pain, and the presence of paresthesia or other neurological symptoms, functional limitations, and patient goals.

Recommendation No. 2

F In the physical assessment and differential diagnosis for the adult with shoulder pain, clinicians must include the observation of the shoulder complex (deformity, muscle atrophy, and swelling), as well as measurements of active and passive ROM and muscle/joint strength. Clinicians may include palpation of the shoulder structures, clinical orthopedic tests selected according to the patient's condition and the diagnostic reasoning of the professional, and a screening examination of the cervical spine.

Recommendation No. 3

F Clinicians must identify any signs or symptoms of serious pathology (red flags) or of systemic involvement. Signs or symptoms of serious pathology include but are not limited to suspicious deformity, fever and/or chills, signs or symptoms suggesting cardiovascular or visceral impairment, and history or suspicion of cancer.

1.2 Risk Factors and Prognostic Factors

Risk and prognostic factors can be useful to identify patients at risk of poor outcomes such as persistent and/or high levels of pain and disability. Identifying these factors may be helpful for the management of adults with RC tendinopathy. Yellow flags are psychological prognostic factors for the development of disability following the onset of MSK pain.[61,139] Personal, clinical, psychosocial, or environmental factors may affect the prognosis and therefore influence therapeutic choices.

V Based on a systematic review of CPGs[48] and on recommendations from a 2021 CPG[44] based on a consensus from a modified Delphi study, it is recommended to identify personal, psychosocial, or environmental factors that may negatively influence the progression or the return-to-work process when assessing a worker with shoulder pain. These include, but are not limited to, advanced age (50 years and over for return to work); a history of shoulder injury; prolonged duration of symptoms; high pain intensity; delayed medical care after the injury; delayed compensation claims in relation to the date of the injury; a history of absenteeism at work; presence of psychosocial factors such as psychological distress, anxiety, catastrophizing, or kinesiophobia; worker's feelings of injustice; lack of social support; having 1 or more dependent(s); loss of employment ties; worker's perception of work-related high demands, and litigation with their employer or insurer. These factors are not specific for RC tendinopathy as this evidence applies to general shoulder pain.

II A systematic review on the risk factors for pain chronicity[179] included 2 RCTs of patients with RC tendinopathy. Authors reported moderate evidence that being over 55 years old (odds ratio [OR] = 3.8), and the perception of high job demand (OR = 4.1) were associated with higher risk of persistent pain. Undergoing rehabilitation, medical nonsurgical or surgical care (OR = 5.4), and not taking pain medication regularly (OR = 5.3) were protective factors against chronicity. Dominant or nondominant side involvement, education level, comorbidities, higher pressure point thresholds, job-associated repetitive movements, perceived job control, job requiring the use of higher shoulder forces, and psychosocial factors such as emotional distress, internal locus of control, and intrinsically motivated personality were not associated with the risk of persistent pain for adults with RC tendinopathy.

II A systematic review[21] including 5 low-quality prognostic studies on adults with RC tendinopathy (n = 387) receiving physiotherapy care (exercises, manual therapy, electrotherapy, and education) and other treatments such as acupuncture or corticosteroid injections reported a lack of any valid and useful prognostic models to help predict outcomes in adults with pain due to RC tendinopathy. Authors highlighted the need for further research on prognostic models and validated tools for predicting outcomes in adults with RC tendinopathy.

II A systematic review on the association of psychological factors and tendinopathies[123] included 2 studies on RC tendinopathy. One high-quality cross-sectional study (n = 200) with moderate quality showed no significant associations between the presence of emotional distress and pain levels and disability related to RC tendinopathy. A second high-quality longitudinal study (n = 90) with moderate evidence suggested that initial higher levels of kinesiophobia and catastrophizing are only weakly associated with higher initial disability levels and are not predictive of future disability levels at 3 months. Authors concluded that individualized management for tendinopathy disorders is essential, and that clinicians should consider using validated screening tools (not defined) to assess psychological factors associated with suboptimal outcomes for patients suffering from tendinopathy.

II A systematic review on the association between psychological factors and tendinopathy[180] included 4 studies of moderate quality on

adults with RC tendinopathy and reported low-certainty evidence (GRADE) from 3 cross-sectional studies supporting a weak association between higher depression, anxiety, and emotional distress levels and higher pain and disability levels.

III A systematic review,[194] reported on 1 low-quality cross-sectional study on the association of psychological factors with pain for adults with RC tendinopathy. They reported that patients with higher fear of pain demonstrated a lower pain tolerance and painful threshold compared to patients with lower fear of pain. A correlation was found between pain catastrophizing and higher shoulder pain intensity.

Gaps in Knowledge While it is accepted that a complete history and physical exam including psychosocial and contextual factors is necessary to ensure optimal patient-specific care, there remains limited evidence on their prognostic value when evaluating a patient with a suspected RC tendinopathy. The limited evidence is partially due to the lack of longitudinal cohort studies as several studies referenced above used a cross-sectional study design. Additional longitudinal research using well-defined risk (exposure) factors is needed to develop or validate prognostic tools that efficiently identify prognostic or psychosocial risk factors (yellow flags) in patients with RC tendinopathy.[187] Despite the lack of prognostic tools available for RC tendinopathy, clinicians could consider the use of other prognostic assessment tools for general MSK disorders, such as the Orthopaedic Shoulder Pain and Disability Index – Youth Form (OSPRO-YF) tool[98] or the Start Back Screening Tool for MSK Disorders (STarT MSK) tool.[52]

Evidence Synthesis and Rationale Several personal, clinical, psychosocial, or environmental risk factors are reported to be associated with poor outcomes or high pain levels and disability in patients with RC tendinopathy.

These include but are not limited to the following:

- Personal factors
  - Advanced age
- Clinical factors
  - Prolonged duration of symptoms
  - Previous history of shoulder injury
  - Delayed care after the initial injury
  - High shoulder pain intensity
- Psychosocial factors
  - Psychological distress
  - Anxiety
  - Catastrophizing
  - Kinesiophobia
  - Poor social support
- Work-related factors
  - Delayed workers compensation claims in relation to the date of the injury
  - Loss of employment ties
  - A history of absenteeism at work
  - Work-related feelings of injustice
  - For workers, having 1 or more dependent(s) at home
  - Worker's perception of work-related high demands and litigation with their employer or insurer
  - Work physical requirements including more frequent or higher arm elevation, shoulder loads, hand-arm force exertion, hand-arm vibration, repetitive movements, or awkward postures

However, the observed relationships are often weak and based on low-level quality studies, and the clinical utility remains to be fully evaluated. In a recent systematic review of prognostic tools,[136] the authors were unable to identify any clinically valuable externally validated prognostic models for the upper limb.

Recommendation No. 4:

B Clinicians should identify personal, clinical, psychosocial, or work-related factors that may influence the prognosis of an adult with RC tendinopathy.

1.3 Diagnostic Value of Clinical Tests

Diagnosing RC tendinopathy involves typically using a variety of clinical tests to make a valid diagnosis and excluding other shoulder or upper-limb disorders. These tests, integral to the diagnostic process, assess specific movements and responses to potentially identify structures that may be linked or explain shoulder pain or other symptoms. Their results can help establish a diagnosis and assist in formulating an effective treatment plan. Combined with a full clinical evaluation, they are fundamental in guiding health care providers toward efficient, evidence-based care of this population.

Overview

V Based on a systematic review of CPGs[48] and on recommendations from a 2021 CPG[44] that was based on a consensus from a modified Delphi study, clinicians should not rely solely on clinical test results to diagnose RC tendinopathy.

I Three systematic reviews with and without meta-analysis assessed the diagnostic value of different clinical tests for RC tendinopathy.[64,104,154] Roy et al reported that the Hawkins-Kennedy test is the test with the lowest negative likelihood ratio (LR–) (Sn = 0.83; 95% confidence interval [CI]: 0.59, 0.99; Sp = 0.69; 95% CI: 0.37, 0.77; LR+ = 2.68; LR– = 0.25; n = 962) while the painful arc test is the test with the highest positive likelihood ratio (LR+) (Sn = 0.62; 95% CI: 0.31, 0.91; Sp = 0.82; 95% CI: 0.62, 1; LR+ = 3.44; LR– = 0.46; n = 964) based on 5 studies comparing the diagnostic value of the Hawkins-Kennedy, painful arc, and Neer tests to diagnose RC tendinopathy.[154] Gismervik et al found that the clinical performance of the Hawkins-Kennedy (LR+ = 1.76; LR– = 0.63; 2 studies) or Neer (LR+ = 1.48; LR– = 0.68; 2 studies) tests for RC tendinopathy is limited to exclude or to confirm a diagnosis of RC tendinopathy.[64] A recent systematic review by Liaghat et al included 1 study of high quality and reported that the combination of 3 out of 5 positive tests (Hawkins-Kennedy, Neer, painful arc, empty can (Jobe), and external rotation against resistance) have an LR+ of 2.93 and an LR– of 0.34.[104]

Gaps in Knowledge Evidence on the diagnostic value of clinical tests for RC tendinopathy is limited. Included studies suggest that the diagnostic value of these tests is modest at best. Methodologically sound diagnostic studies of patients with

various shoulder pain disorders evaluating the combination of common clinical tests with elements of the patient's history and subjective evaluation are needed to better inform clinicians on the diagnostic value of a clinical evaluation for a suspected RC tendinopathy.

Evidence Synthesis and Rationale The Hawkins-Kennedy and the painful arc tests have the highest diagnostic values to exclude an RC tendinopathy diagnosis. The painful arc test is the test with the highest diagnostic value to confirm an RC tendinopathy.[155] The positive and negative LRs are considered small for both the painful arc and the Hawkins-Kennedy tests. Clinicians should not solely rely on clinical test results to confirm any RC disorder diagnoses, but also include information from the patient's history and subjective assessment.[48] Use of combinations of tests may yield better diagnostic accuracy than single tests, but evidence is limited.

Recommendations

Recommendation No. 5

B Clinicians may use the following tests to confirm or to rule out a diagnosis of tendinopathy of the RC.

To confirm the diagnosis: Painful arc test

To rule out the diagnosis: Hawkins-Kennedy test

1.4 Psychometric Value of Outcome Measure Instruments: ROM

Clinicians have access to different tools such as the inclinometer and the goniometer to objectively measure shoulder ROM either for diagnostic purposes or to assess change over time. New technologies have also emerged, introducing electronic tools like smartphone applications using the principles of gyroscopes or photo capture to quantify joint ROM.

Overview

Shoulder ROM

I Based on a systematic review with meta-analysis[155] and on a 2021 CPG[44] including 8 metrological studies, the goniometer and the inclinometer are recommended tools for measuring shoulder ROM as their reliability is generally good to excellent for shoulder flexion, abduction, external rotation, and internal rotation.

I One systematic review[86] including 6 metrological studies specific to the shoulder joint concluded that smartphone goniometer applications are valid and reliable to measure various shoulder ROM (flexion, abduction, internal/external rotation, and horizontal adduction) and supported their use by clinicians.

II Based on a systematic review[155] and on a 2021 CPG,[44] the minimum detectable change (MDC) values are similar between the inclinometer or the goniometer. They vary between 8° and 23° for active ROM and between 3° and 21° for passive ROM for flexion, abduction, internal rotation, and external rotation.[155] More data on the MDC are needed to confirm these results since they mostly come from small sample sizes.

Scapular ROM

I Three systematic reviews[46,47,144] assessed the validity and reliability of measurement tools for assessing scapular dynamic ROM. They concluded that there is insufficient evidence to recommend any instrument or test to measure scapular ROM as they are not reliable and may often lead to misinterpretation of scapular motion. However, D'hondt et al reported that there is high-quality evidence supporting the use of inclinometer to measure the scapular upward rotation angle at a static position of rest.[46]

Gaps in Knowledge Shoulder ROM using a goniometer or an inclinometer has a wide range of reported MDCs. Shoulder ROM MDCs using smartphone goniometer applications were not reported in any systematic reviews. Acceptable levels of reliability and validity are not established using any instrument to measure scapular dynamic ROM.

Evidence Synthesis and Rationale Based on high-quality evidence, goniometer, inclinometer, and smartphone goniometer applications are valid and reliable tools to measure shoulder ROM. Based on high quality-evidence, the measurement of scapular motion using inclinometers or goniometers is not recommended due to limited reliability and validity.

Recommendations

Recommendation No. 6

A Clinicians should use an inclinometer, goniometer, or a smartphone goniometer application to objectively measure shoulder ROM over visual estimation. Scapular ROM measures are unreliable and have limited validity and, thus, should not be used by clinicians to objectively measure dynamic scapular ROM.

1.5 Psychometric Value of Outcome Measure Instruments: Muscle Strength

Clinicians frequently evaluate shoulder strength as part of the diagnostic and treatment process for shoulder pain-related conditions. They may utilize tools like the handheld dynamometer to objectively measure shoulder strength. Dynamometers offer a quantification of muscle strength for various shoulder muscle groups or movements, enabling clinicians to make informed decisions for diagnosis and for objectively monitoring strength deficits or gains during patient care.

Overview

I Based on a 2021 CPG[44] including 7 metrological studies and 2 systematic reviews with meta-analysis,[30,177] there is high-quality evidence that handheld dynamometry is reliable to assess shoulder strength in adults with or without shoulder pain. Based on moderate- to high-quality evidence, the MDC for handheld dynamometry is probably between 15% and 20%.[177] Sørensen et al included 10 studies using peak force (newton or kilograms), 1 study used relative peak force (kilogram/body weight), and 1 study used newton meters. Most studies included 2 or 3 repetitions. Isokinetic testing was used as the reference criteria in these validation studies.

II Based on a systematic review,[155] the validity of manual muscle testing is questionable as only 20% of maximal strength is necessary to obtain a 4/5 score. Therefore, the use of manual muscle testing is not recommended, and authors recommend using handheld dynamometry as an alternative.[155]

Evidence Synthesis and Rationale There is strong evidence supporting the use of a handheld dynamometer to measure shoulder muscle strength, as it is valid and reliable contrary to manual muscle testing.

Recommendations

Recommendation No. 7

A Clinicians should use a handheld dynamometer to objectively measure the isometric muscle strength of the shoulder.

1.6 Patient-Reported Questionnaires and Mixed Outcome Tools

Numerous self-reported questionnaires have been developed to quantify pain, symptoms, and disability for patients with shoulder pain, including RC tendinopathy. They are valuable assessment tools, offering clinicians a structured method for assessing the impact of RC tendinopathy on patient's subjective experiences, symptoms, and functional limitations. By tracking changes over time, clinicians can adjust treatment plans accordingly and optimize patient-centered care.

Overview

I Based on a 2021 CPG,[44] including 16 studies on their psychometric properties, there is strong evidence supporting the use of self-reported questionnaires and/or mixed tools to assess pain, disability, health-related quality of life and other symptoms in adults with shoulder disorders. Validated and reliable questionnaires for patients with RC tendinopathy and other shoulder disorders include the following:

1. American Shoulder and Elbow Surgeons Shoulder Score (ASES),
2. Constant-Murley Score (CMS),
3. Disabilities of the Arm, Shoulder and Hand (DASH) and associated short version (QuickDASH),
4. Oxford Shoulder Score (OSS),
5. Rotator Cuff Quality of Life Index (RC-QOL),
6. Shoulder Pain and Disability Index (SPADI),
7. Simple Shoulder Test (STT),
8. Upper Extremity Functional Index (UEFI),
9. Western Ontario Rotator Cuff (WORC) Index, and
10. Pennsylvania Shoulder Score (Penn).

I A systematic review by Hao et al[72] synthesizing level I studies looked at the responsiveness of self-reported questionnaires and/or mixed tools and reported median minimal clinically important difference (MCID) values for various shoulder disorders including RC tendinopathy. Another systematic review from Jones et al,[84] including 4 studies specific to the WORC Index, reported a range of MCID values for this questionnaire. MCID values reported on these 2 reviews are presented in **TABLE 5**.

II Four systematic reviews[39,72,84,188] reported MCID values for self-reported questionnaires as presented in **TABLE 6**.

Gaps in Knowledge It remains unclear if any of the questionnaires should be preferred over another for clinical use to measure pain, symptoms, and disability in adults with RC tendinopathy. MCID values, the minimal change considered of value to the patient, have been reported in the literature to vary for several self-reported questionnaires. These values are based on studies that included heterogeneous populations with various shoulder disorders and not only RC tendinopathy. There are a variety of methods to derive an MCID, which in part results in a range of MCID values.[59] The use of a single MCID value could also be inaccurate as baseline values influence

TABLE 5 MCID Values of Self-reported Questionnaires (Level I Evidence)

Questionnaires	Score Range	Scale Direction (Higher Score Signs a Better or Worse Condition)	Construct(s) Measured	MCID
Level I Evidence				
DASH	0-100	Worse	Pain, disability, and other symptoms	Median: 10.2 (range, 4.4-25.4; 6 studies)
OSS	0-48	Better	Pain, disability, and other symptoms	Median: 5.3 (range, 4/48-14.7; 8 studies)
SST	0-12	Better	Pain, disability, and other symptoms	Median: 1.8 (range, 1.5/12-2.1; 2 studies)
CMS	0-100	Better	Pain, disability other symptoms, disability, ROM, and strength	Median: 8.3 (range, 3-16.6; 10 studies)
WORC	0-2100	Worse	Pain, disability, other symptoms, emotions	Mean: 275.7 (range, 245.3-300; 4 studies)
Pain VAS - overall	0-10	Worse	Pain	Median: 1.5 (range, 1.4-1.6; 2 studies)

Abbreviations: ASES, American Shoulder and Elbow Surgeons Shoulder Score; CMS, Constant-Murley Score; DASH, Disabilities of the Arm, Shoulder and Hand; MCID, minimal clinically important difference; OSS, Oxford Shoulder Score; PNRS, pain numeric-rating scale; ROM, range of motion; SST, Simple Shoulder Test; VAS, Visual Analogue Scale; WORC, Western Ontario Rotator Cuff Index.

TABLE 6 MCID Values of Self-reported Questionnaires (Level II Evidence)

Questionnaires	Score Range	Scale Direction (Higher Score Signs a Better or Worse Condition)	Construct(s) Measured	MCID
Quick DASH	0-100	Worse	Pain, disability, and other symptoms	Median: 13.4/100 (1 study)
PNRS	0-10	Worse	Pain	Median: 3.5/10 (range, 1.1-6.3; 5 studies)
ASES	0-100	Better	Pain, disability, and other symptoms	6.4[39] Mean: 15.5 (range, 6.4-21.9)[84]
Penn	0-100	Better	Symptoms, satisfaction, and disability	1.4[39]
SPADI	0-100	Worse	Pain, disability, and other symptoms	8[39]

Abbreviations: ASES, American Shoulder and Elbow Surgeons Shoulder Score; DASH, Disabilities of the Arm, Shoulder and Hand; MCID, minimal clinically important difference; PNRS, pain numeric-rating scale; Penn, Pennsylvania Shoulder Score; SPADI, Shoulder Pain and Disability Index.

the magnitude of the MCID.[19,97] Because baseline scores impact the magnitude of MCID, a single MCID value is likely not to be accurate to assess treatment outcomes across all patients.[19,97] The smallest worthwhile effect is defined as the smallest beneficial effect of an intervention that justifies its costs and harms. This estimate using the benefit-harm trade-off method has been suggested as an indicator to compare 2 different interventions.[57,58] The estimated smallest worthwhile effects for various interventions for RC disorders are unknown, which is an area that should be examined in future research.

Evidence Synthesis and Rationale There is strong evidence supporting the use of self-reported questionnaires and/or mixed tools to assess and monitor pain and disability in adults with shoulder pain during the course of care. There are numerous valid, reliable, and responsive self-reported questionnaires. Clinicians should refer to established MCIDs of these questionnaires when objectively measuring change in a patient's shoulder condition to determine if change is meaningful. However, MCIDs are likely valid only for a specific range of baseline scores. Use of MCIDs obtained from baseline score measurements, when available, are preferred.

Recommendations

Recommendation No. 8

A Clinicians must use valid, reliable, and responsive patient-reported questionnaires and/or mixed tools to objectively assess pain and disability with shoulder pain including RC tendinopathy.

1.7 Diagnostic Value of Diagnostic Imaging Tests

Clinicians should primarily rely on a comprehensive clinical examination (patient's history, subjective assessment, and physical exam) to diagnose an adult with a suspected RC tendinopathy. However, diagnostic imaging tests, including radiography, diagnostic ultrasound, MRI, and MRI with intra-articular contrast (MRA) may be required to exclude other shoulder disorders in particular clinical presentations.

Overview

II Based on 2 systematic reviews with meta-analyses, MRA and MRI have similar diagnostic values for partial-thickness RC tear. Huang et al[78] reported LR for MRA (LR+ = 43.1; 95% CI: 14.5, 128.2; LR− = 0.23; 95% CI: 0.16, 0.34; 8 studies) and MRI (LR+ = 10.17; 95% CI: 3.00, 34.49; LR− = 0.31; 95% CI: 0.18, 0.54; 6 studies). Liu et al[111] reported sensitivity and specificity values for MRA (Sn = 0.45; 95% CI: 0.07, 0.89; Sp = 0.76; 95% CI: 0.05, 1.00) and MRI (Sn = 0.70; 95% CI: 0.50, 0.85; Sp = 0.95; 95% CI: 0.90, 0.98).

II Three systematic reviews[112,155,182] concluded that because of its lower cost and comparable diagnostic accuracy, diagnostic ultrasound should be prioritized over the use of MRA or MRI for partial-thickness RC tear.

III Based on a systematic review with a network meta-analysis, the diagnostic value of MRA (Sn = 0.81; 95% CI: 0.74, 0.86; Sn = 0.90; 95% CI: 0.86, 0.93; 28 studies) is superior than MRI (Sn = 0.67; 95% CI: 0.60, 0.73; Sp = 0.86; 95% CI: 0.81, 0.89; 41 studies) or diagnostic ultrasound (Sn = 0.62; 95% CI: 0.53, 0.71; Sp = 0.85; 95% CI: 0.80, 0.89; 39 studies) for partial-thickness RC tear.[112]

V A 2021 CPG[44] stated that clinicians should inform adults with shoulder pain of the diagnostic value, possible pitfalls, and limitations of the various prescribed imaging tests, and should also discuss diagnostic imaging test results with patients.

Gaps in Knowledge Even if initial imaging for a suspected RC tendinopathy should not be performed, more research on potentially relevant imaging findings related to RC tendinopathy in patients with persistent pain and disability could help identify imaging findings or measures that may have a clinically useful prognostic value. It is important to note that in patients with persistent pain, disability, and other factors, such as psychosocial factors, may play a determining role in the persistence of and the level of symptoms experienced by the patient.

Evidence Synthesis and Rationale Diagnostic imaging tests should be used in the presence of a trauma, if there is a clinical suspicion of a significant structural lesion such as a full-thickness RC tear,

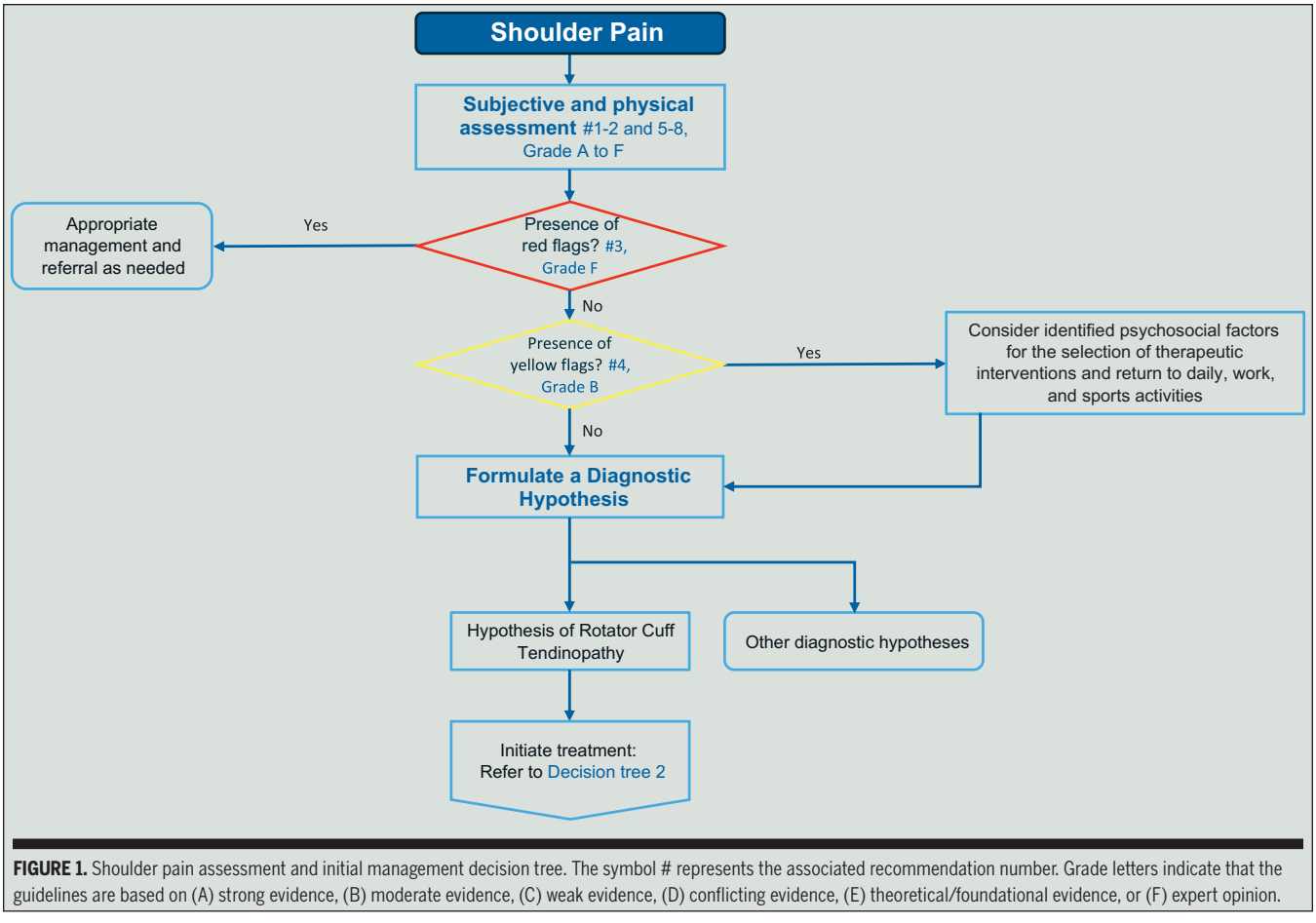

FIGURE 1. Shoulder pain assessment and initial management decision tree. The symbol # represents the associated recommendation number. Grade letters indicate that the guidelines are based on (A) strong evidence, (B) moderate evidence, (C) weak evidence, (D) conflicting evidence, (E) theoretical/foundational evidence, or (F) expert opinion.

or after failure of adequate nonsurgical management.

Recommendations

Recommendation No. 9

F Clinicians should not prescribe or recommend diagnostic imaging tests to confirm an RC tendinopathy in the initial management of an adult with shoulder pain.

Recommendation No. 10

F Clinicians may recommend or prescribe diagnostic imaging test(s) for adults with an RC tendinopathy if symptoms do not resolve or improve within a maximum of 12 weeks of appropriate nonsurgical management.

Recommendation No. 11

F Clinicians must consider the following factors when choosing a diagnostic imaging test: suspected pathologies, diagnostic properties, accessibility, and costs of the diagnostic test.

Recommendation No. 12

F Clinicians should prioritize diagnostic ultrasound because of its lower cost and its diagnostic properties being similar to MRI to confirm an RC disorder.

Recommendation No. 13

F Clinicians should inform the adult with shoulder pain of the diagnostic value and limitations of the various imaging tests, and should also discuss diagnostic imaging test results with the patient.

1.8 Indications for Referral to a MSK Medical Specialist

When a patient presents with persistent pain related to RC tendinopathy and shows limited improvement following initial nonsurgical interventions, health care providers may decide to refer the patient to a MSK medical specialist for specialized nonsurgical care. This could be a sports medicine physician, a physiatrist, or an orthopedic surgeon. This decision should be discussed with the patient.

Overview

V Based on recommendations from a 2022 CPG,[92] which was based on a consensus from a modified Delphi study, following the failure of initial nonsurgical care, a consultation with a MSK specialist such as a sports physician, a physiatrist, or an orthopedic surgeon is recommended.

Gaps in Knowledge There is limited evidence on the indications for MSK physician specialists' referral as the available evidence is based on expert consensus.

Evidence Synthesis and Rationale Adults with an RC tendinopathy who experience significant and/or persistent pain and/or disability after adequate nonsurgical management could benefit from

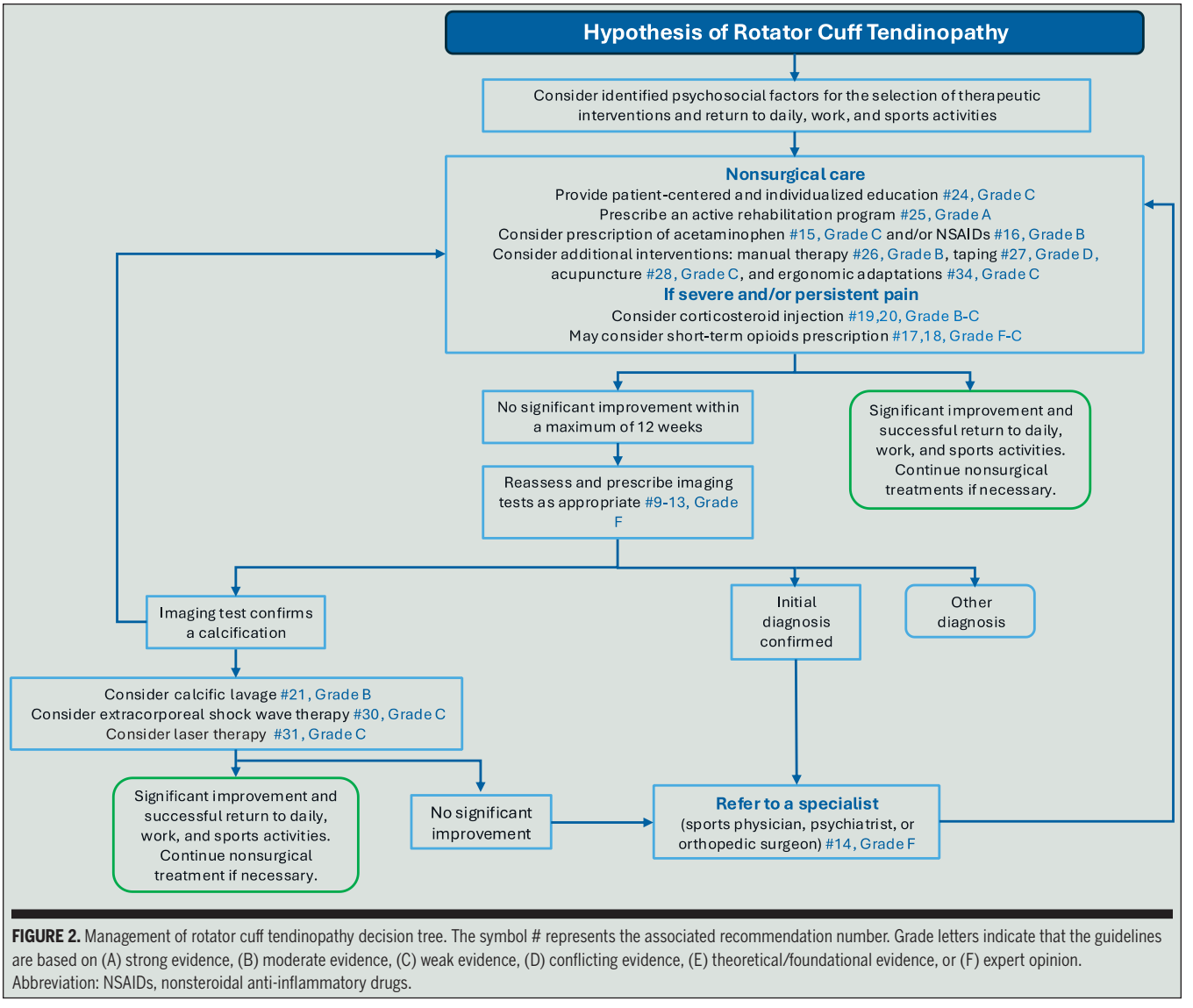

FIGURE 2. Management of rotator cuff tendinopathy decision tree. The symbol # represents the associated recommendation number. Grade letters indicate that the guidelines are based on (A) strong evidence, (B) moderate evidence, (C) weak evidence, (D) conflicting evidence, (E) theoretical/foundational evidence, or (F) expert opinion. Abbreviation: NSAIDs, nonsteroidal anti-inflammatory drugs.

a consultation with a medical specialist such as a sports physician, a physiatrist, or an orthopedic surgeon for further assessment and treatment. The scope of the current CPG only covers nonsurgical interventions, but it is important to note that our group had previously published a recommendation in the 2022 CPG that subacromial decompression surgery is not recommended to treat RC tendinopathy (level A recommendation – Strength of Recommendation Taxonomy [SORT] scale) as it does not provide any clinically important benefits when compared to a placebo surgery.[92] This recommendation is based on a systematic review with meta-analysis[85] that high-certainty evidence shows that subacromial decompression with an acromioplasty surgery does not provide clinically important benefits when compared to a placebo surgery in terms of pain and disability reductions in adults with RC tendinopathy who failed initial nonsurgical management and are referred to a medical specialist such as an orthopedic surgeon.

Recommendations

Recommendation No. 14

F Clinicians should refer adults with an RC tendinopathy who have severe and persistent pain and/or disability despite a maximum of 12 weeks of adequate nonsurgical care to a MSK physician specialist such as a sports physician, a physiatrist, or an orthopedic surgeon for further assessment and treatment.

SECTION 2: PHARMACOLOGICAL TREATMENTS

Physiotherapists are essential health care providers. While they primarily focus on education, exercises, and other physical modalities, they can recommend or refer for medical interventions or prescriptions within

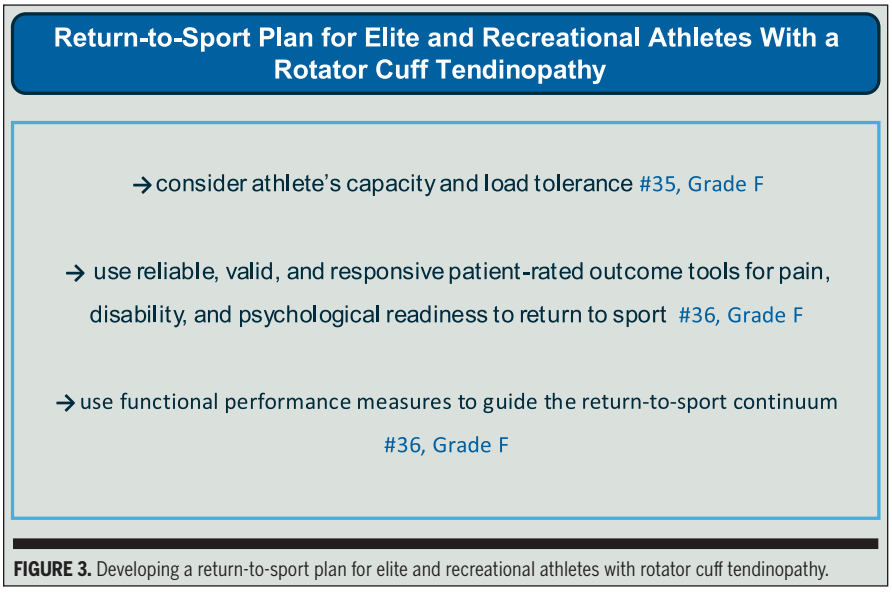

FIGURE 3. Developing a return-to-sport plan for elite and recreational athletes with rotator cuff tendinopathy.

their regulated scope of practice. Physiotherapists play a crucial role in health care systems worldwide, though the extent of their scope of practice varies internationally and is continuously expanding to meet evolving health care needs. When necessary, they collaborate with other health care providers to ensure patients receive comprehensive care. Therefore, this section includes medical intervention recommendations to be used by physiotherapists and other health care providers. These recommendations may not always be within their scope of practice, and it is important for clinicians to respect their regulated scope of practice.

Note: An international steering committee including expert researchers, clinicians (12 physiotherapists, a physical medicine physician, and an orthopaedic surgeon) and patient partners participated in the development of this CPG and section. Previous versions of this CPG were also reviewed by various clinicians including MSK physicians and surgeons.

2.1 Acetaminophen

Shoulder pain is a common reason for consultation in the general population.[118] Therefore, it is justified to consider pain relief as one of the goals to be achieved in the treatment of shoulder pain. Pain management is often necessary to ensure optimal outcomes and prevent persistent pain and disability for various MSK disorders and in adults with RC tendinopathy. Acetaminophen has been widely recommended in several CPGs as an initial pharmacological treatment to reduce MSK-related pain and is recommended to treat shoulder pain in general.[114,149]

Overview

V Based on a systematic review of CPGs[48] and on recommendations from a 2021 CPG for RC disorders[44] that was based on a consensus from a modified Delphi study, acetaminophen is recommended as a first-line pharmacological treatment to relieve mild to moderate MSK pain.

Gaps in Knowledge There is limited available evidence on the efficacy of acetaminophen for pain management of RC tendinopathy. However, several studies report benefits of acetaminophen for the management of acute MSK pain as reported in a systematic review and network meta-analysis of randomized trials on acute MSK pain excluding spinal pain.[25]

Evidence Synthesis and Rationale Expert consensus suggests that acetaminophen can be used as a first-line treatment to reduce mild to moderate MSK pain including RC tendinopathy.

Recommendation

Recommendation No. 15

C Clinicians may recommend acetaminophen to reduce pain in the short term for adults with RC tendinopathy.

2.2 Oral Nonsteroidal Anti-inflammatory Drugs

Nonsteroidal anti-inflammatory drugs (NSAIDs) encompass 2 classes of medications, namely, selective cyclooxygenase (COX-2) inhibitors and nonselective inhibitors.[17] NSAIDs are prescribed for their analgesic and anti-inflammatory effects[143] and are commonly used to treat MSK disorders including tendinopathies.

Overview

Oral NSAIDs

II Based on a 2021 CPG,[44] there is low- to moderate-quality evidence that oral NSAIDs may significantly reduce pain in the short term in adults with RC tendinopathy.

II A systematic review[28] reported that, based on low-certainty evidence (GRADE), oral NSAIDs significantly reduce night pain in the short term (MD, −0.80/10; 95% CI: −1.37, −0.23; 1 RCT; n = 365) when compared to placebo in adults with RC tendinopathy. The evidence suggests that this effect for night pain may or may not be clinically important.

II A systematic review[178] reported that, based on low- to very low–certainty evidence (GRADE), oral NSAIDs significantly reduce pain (SMD, −0.29; 95% CI: −0.53, −0.05; 1 RCT; n = 306) when compared to placebo in adults with RC tendinopathy at an unspecified follow-up time. Based on very uncertain evidence, these effects for oral NSAIDs may be trivial to moderate for pain.

II A pairwise comparison from a network meta-analysis[11] reported that NSAIDs significantly reduce pain in the short term (SMD, −0.56; 95% CI: −1.01, −0.1) when compared to

placebo or no intervention in adults with RC tendinopathy. The evidence suggests that these effects for NSAIDs may be trivial to large.

Oral vs Topical NSAIDs

II Based on a 2021 CPG,[44] topical NSAIDs could lead to a similar disability reduction when compared to oral NSAIDs while being associated with fewer adverse events. However, this is not specific for RC tendinopathy as this evidence applies to general MSK pain.

COX-2 vs Nonselective NSAIDs

II Based on a 2021 CPG,[44] both types of NSAIDs lead to similar pain reduction. There also does not seem to be significant differences in terms of gastro-intestinal adverse events between both types when taken over a short period of time.

Gaps in Knowledge There is currently very limited evidence on the efficacy of oral NSAIDs to reduce disability. In addition, there are no long-term follow-up studies on the benefits and the associated long-term risks on the MSK system of a prolonged oral NSAIDs use. There is also no evidence specific to RC tendinopathy on the efficacy of topical NSAIDs. The fact that the RC tendons underlie the deltoid muscle could also lead to a lesser effect given possible poorer penetration from such a topical product.

Evidence Synthesis and Rationale When compared to a placebo, oral NSAIDs may lead to a significant pain reduction. However, they can cause adverse effects, notably on the gastrointestinal[4,17,74,155] and the cardiovascular systems,[4,17,74,153] and animal studies show they might affect tendon health as well.[51] Potential benefits and harms should be discussed with patients.

Recommendations

Recommendation No. 16

B Clinicians may recommend oral NSAIDs to reduce pain in the short term for adults with RC tendinopathy.

2.3 Opioids for Shoulder Pain

Opioid prescriptions and use continue to be a topic of intense scrutiny, and the prescribing of opioids for the treatment of pain in patients with RC disorders remains high across multiple settings and specialties in several health care systems, more often to control postoperative pain but often to treat more severe nonsurgical shoulder pain.[65] The current opioid crisis is a significant public health issue; in response to it, it is important to assess the risks of opioid dependence and to ensure that each opioid prescription is justified.[45,89]

Overview

II Based on 2021 CPG,[44] including 1 systematic review on the efficacy of oral opioids for chronic MSK pain, oral opioids significantly reduce pain (MD, −0.69/10; 95% CI: −0.82, −0.56; 42 RCTs; n = 16 617) and disability on the 36-Item Short Form Physical Component Score (MD, −2.04/100; 95% CI: −2.68, −1.41; 51 RCTs; n = 15 754) when compared to a placebo but do not significantly reduce pain (MD, −0.60/10; 95% CI: −1.54, 0.34; 9 RCTs; n = 1431) and disability on the 36-Item Short Form Physical Component Score (MD, 0.9/100; 95% CI: −0.89, 2.69; 7 RCTs; n = 1311) when compared to oral NSAIDs in adults with chronic MSK pain. Opioid use is also significantly associated with an increased risk of adverse events, such as vomiting, nausea, constipation, dizziness, drowsiness, pruritus, dry mouth, and increased risks of dependency, overdose, or death.

V Based on a systematic review of CPGs[48] and on recommendations from a 2021 CPG for RC disorders[44] that was based on a consensus from a modified Delphi study, opioids are not recommended as a first-line pharmacological treatment to reduce pain and disability in adults with RC tendinopathy. If used, opioids should be prescribed in the short term for adults with persistent and severe pain that are refractory to other analgesic modalities. The risks of dependence and the relevance of the prescription of opioids should be reassessed regularly.

Gaps in Knowledge There is no evidence on the efficacy of opioids compared to oral NSAIDs or other interventions for RC tendinopathy. However, indirect evidence supports small to moderate effects for pain reduction, but evidence does not appropriately consider potential side effects and other risks related to dependency. Moreover, debilitating pain because of an RC tendinopathy is uncommon.

Evidence Synthesis and Rationale There is no specific evidence that opioids may reduce pain in the short term in individuals with severe and/or persistent RC tendinopathy. In individuals with chronic MSK pain, opioid use results only in a small reduction in pain when compared to a placebo and is comparable to oral NSAIDs.[26] Opioids are associated with more adverse events, such as vomiting, nausea, constipation, dizziness, drowsiness, pruritus, or dry mouth, and have an increased risk of dependency, overdose, or death.[26] When considering opioids as an adjunct to treatment, clinicians should establish that their use is necessary and ensure that the opioid dependency risk profile has been evaluated beforehand.[45,89]

Recommendations

Recommendations #17

Regarding opioids:

a) F Clinicians may use or recommend using opioids in the short term for pain reduction in adults with RC tendinopathy who have severe pain and disability and are refractory or have contraindications to other analgesic modalities.

b) C Clinicians should not use or recommend opioids as a first-line pharmacological treatment to reduce pain and disability in adults with RC tendinopathy.

Recommendations #18

F Prescribing clinicians must regularly reassess the risks of dependence and the relevance of taking opioids.

2.4 Corticosteroid Injections

Corticosteroid injection is a commonly used modality to relieve pain caused by various MSK injuries, including RC tendinopathy.[155] Injections are usually performed in the subacromial space either with or without ultrasound guidance.

Overview

I A 2021 CPG[44] reported that, based on high-quality evidence, corticosteroid injections lead to small but significant pain and disability reductions in the short-term only (effect up to 8 weeks) when compared to a placebo. However, they also reported that, based on low- to high-quality evidence, corticosteroid injections do not significantly reduce pain and disability when compared to other interventions (sodium bicarbonate injection, manual therapy, platelet-rich plasma (PRP) injections, topical analgesics, or kinesiotaping).

V A 2021 CPG[44] reported that based on expert opinion, it is recommended that if pain and disability have not improved after 2 injections, a third one is not indicated.

I A systematic review[36] reported that, based on high-quality evidence from 8 trials, corticosteroid injections significantly reduce pain and disability when compared to anaesthetic-only injections in adults with RC tendinopathy in the short term. Authors also reported that based on moderate-quality evidence from 7 trials, corticosteroid injections do not significantly reduce pain and disability when compared to anaesthetic-only injections in adults with RC tendinopathy in the medium term. Authors also reported that corticosteroid injections do not significantly reduce pain and disability when compared to anaesthetic-only injections in adults with RC tendinopathy in the long term at 6 months (based on high-quality evidence from 2 trials) and ≥1 year (based on high-quality evidence from 1 low risk of bias trial).

II A pairwise comparison from a network meta-analysis[107] reported that corticosteroid injections significantly reduce pain when compared to a placebo in adults with RC tendinopathy in the short term (SMD, −0.51; 95% CI: −1.01, −0.01; 7 RCTs; n = 398) but these differences do not remain in the medium (SMD, −0.20; 95% CI: −0.83, 0.43; 5 RCTs; n = 308) and long term (SMD, 0.20; 95% CI: −0.07, 0.48; 3 RCTs; n = 222). They also reported that corticosteroid injections significantly reduce disability when compared to a placebo in adults with RC tendinopathy in the short term (SMD, −0.33; 95% CI: −0.67, 0.00; 7 RCTs; n = 398), but these differences do not remain in the medium term (SMD, −0.21; 95% CI: −0.84, 0.43; 5 RCTs; n = 308) and the long term (SMD, 0.26; 95% CI: −0.01, 0.53; 3 RCTs; n = 222). Based on 2 high-quality RCTs, 4 moderate-quality RCTs, and 1 low-quality RCT, these effects for corticosteroids may be trivial to large for pain and trivial to moderate for disability in the short term.

II A systematic review with meta-analysis[178] reported that, based on low- to very low–certainty evidence (GRADE), corticosteroid injections significantly reduce pain (SMD, −0.65; 95% CI: −1.04, −0.26; 6 RCTs; n = 372) and disability (SMD, −0.56; 95% CI: −1.06, −0.05; 5 RCTs; n = 362) when compared to a control (sham or placebo control) in adults with RC tendinopathy at an unspecified follow-up time. Based on very uncertain evidence, these effects for corticosteroid injections may be small to large for pain and trivial to large for disability.

II A systematic review with meta-analysis[191] reported that corticosteroid injections significantly reduce pain (MD, −1.59; 95% CI: −2.89, −0.30; 3 RCTs; n = 180) and disability (SMD, −0.80; 95% CI: −1.42, −0.18; 5 RCTs; n = 260) when compared to PRP injections in adults with RC tendinopathy in the short term. These differences for pain (MD, 0.17; 95% CI: −0.63, 0.97; 3 RCTs; n = 150) and disability (SMD, 0.35; 95% CI: −0.35, 1.04; 5 RCTs; n = 217) did not remain significant in the medium term. Based on 3 moderate-quality RCTs and 2 low-quality RCTs, these short-term effects for corticosteroid injections may or may not be clinically important for pain and trivial to large for disability.

II A pairwise comparison from a network meta-analysis[11] reported that subacromial corticosteroid injections significantly reduce pain when compared to oral NSAIDs (SMD, −1.13; 95% CI: −1.63, −0.62) in adults with RC tendinopathy in the short term. The evidence suggests that these effects for subacromial corticosteroid injections may be moderate to large for pain. They also reported that exercises significantly reduced pain when compared to subacromial corticosteroid injections (SMD, −0.25; 95% CI: −0.48, −0.03) in adults with RC tendinopathy in the medium term. The evidence suggests that these effects for exercises compared to subacromial corticosteroid injections may be trivial to small for pain.

Ultrasound Guided vs Landmark Guided

II A CPG[44] reported that ultrasound-guided corticosteroid injections significantly reduce pain and disability when compared to landmark-guided injections in the short term (6 weeks), although these differences are probably not clinically meaningful.

I A Cochrane review[201] reported that, based on moderate-certainty evidence (GRADE), ultrasound-guided corticosteroid injections significantly reduce pain (MD, −0.58/10; 95% CI: −1.05, −0.11; 12 RCTs; n = 777) but not disability (MD, −5.06/10; 95% CI: −13.35, 3.23; 11 RCTs; n = 687) when compared to landmark or intramuscular corticosteroid injections in adults with RC tendinopathy in the short term. Based on low-certainty evidence (GRADE), there are no significant differences between the 2 interventions regarding quality of life and number of adverse events. It is likely that these effects for ultrasound-guided corticosteroid may not be clinically important for pain. The nonsignificant CIs are large, and the true effects remain unclear for disability reductions.

II A systematic review with meta-analysis[42] reported that, based on moderate-certainty evidence (GRADE), ultrasound-guided injections significantly reduce pain (MD, −0.58; 95% CI: −1.05, −0.10; 10 RCTs; n = 795) when compared to landmark-guided injections in adults with RC tendinopathy in the short term. These effects for ultrasound-guided injections may or may not be clinically important for pain. They also reported that based on very low–certainty evidence (GRADE), ultrasound-guided injections significantly reduce disability (SMD, −0.84; 95% CI: −1.41, −0.27; 11 RCTs; n = 851) when compared to landmark-guided injections in adults with RC tendinopathy in the short term. Based on very uncertain evidence, these effects for ultrasound-guided injections may be small to large for disability.

II A systematic review with meta-analysis[54] reported that, ultrasound-guided injections significantly reduce pain (SMD, −0.48; 95% CI: −0.79, −0.17; 15 RCTs; n = 850) and disability (SMD, −0.35; 95% CI: −0.65, −0.05; 9 RCTs; n = 482) when compared to landmark-guided injections in adults with shoulder disorders including RC tendinopathy in the short term. Based on 10 moderate-quality RCTs and 5 low-quality RCTs, these effects for ultrasound-guided injections may be trivial to moderate for pain and trivial to moderate for disability. There were no significant differences between the compared groups in terms of side effects (Risk Ratio, 0.45; 95% CI: 0.15, 1.34; 8 RCTs; n = 412).

II A systematic review with meta-analysis[178] reported that, based on low- to very low–certainty evidence (GRADE), ultrasound-guided corticosteroid injections significantly reduce pain (SMD, −0.51; 95% CI: −0.89, −0.13; 5 RCTs; n = 298) and disability (SMD, −0.43; 95% CI: −0.71, −0.15; 4 RCTs; n = 298) when compared to landmark-guided corticosteroid injections in adults with RC tendinopathy at an unspecified follow-up time. Based on very uncertain evidence, these effects for corticosteroids injections may be trivial to large for pain and trivial to moderate for disability.

Gaps in Knowledge There is limited evidence on the medium and long-term effects of repeated corticosteroid injections on the MSK system.

Evidence Synthesis and Rationale Corticosteroid injections may significantly reduce pain and disability in the short term (up to 8 weeks) when compared to a placebo or oral NSAIDs, but the evidence when compared to other interventions in the medium term support the use of other less invasive interventions such as exercise, manual therapy, or kinesiotaping. Corticosteroid injections could be associated with additional but rare side effects (ie, tendon rupture and infections). Patients have to be informed by the clinicians (referring and/or provider) regarding the potential risks and benefits of corticosteroid injections, when an injection is considered. Overall, ultrasound-guided corticosteroid injections appear to offer greater reduction in pain and disability and may be preferred, if available.

Recommendations

Recommendations #19

Regarding corticosteroids injections:

a) B Clinicians may recommend or perform corticosteroid injections to reduce pain and short-term disability in adults with RC tendinopathy.

b) C Clinicians should not recommend or perform corticosteroid injections as a first-line treatment to reduce pain and disability in adults with RC tendinopathy.

Recommendation No. 20

B If available, clinicians should use or recommend using ultrasound guidance for subacromial corticosteroid injection to reduce pain in the short term.

2.5 Calcific Lavage

RC calcific tendinopathy is characterized by the deposition of hydroxyapatite crystals in one of the RC tendons.[23,60] Calcific lavage, using ultrasound guidance as a second-line treatment, has gained popularity in the last decades and is a minimally invasive intervention consisting in the introduction of a needle into the calcific deposit. A saline and/or an anaesthetic solution is then injected into the calcification with several short injections, each followed by release of pressure on the plunger to allow the solution and calcific material to evacuate back into the syringe. Guided lavage is often followed by a subacromial corticosteroid injection.[23]

Overview

II A systematic review with meta-analysis[93] reported that ultrasound-guided lavage significantly reduces pain in the short to medium term (MD, −1.98; 95% CI: −2.52, −1.45; 2 RCTs; n = 226), in the long term (MD, −1.84 /10; 95% CI: −2.63, −1.04; 2 RCTs; n = 220) and disability on the Constant-Murley Score (MD, 11.7/100; 95% CI: 0.01, 23.29; 1 RCT; n = 25) in the short term when compared with shockwave therapy in adults with calcific RC tendinopathy. These authors also report that the addition of ultrasound-guided lavage to a corticosteroid injection significantly reduces disability on the Constant-Murley Score (MD, 17.9/100; 95% CI: 2.0, 33.7; 1 RCT; n = 48) when compared to a corticosteroid injection alone in the long term in adults with chronic calcific RC tendinopathy.

II A systematic review with meta-analysis[202] reported that ultrasound-guided lavage/needling with or without extracorporeal shockwave therapy or corticosteroid injection significantly reduce pain (MD, −1.96/10; 95% CI: −2.20, −1.72; 4 RCTs; n = 378) and disability on the Constant-Murley Score (MD, 10.49/100; 95% CI: 6.99, 13.98; 5 RCTs; n = 281) when compared to extracorporeal shockwave therapy or corticosteroid injection alone in individuals with RC calcific tendinopathy in the long term. They also reported that, based on evidence from 1 moderate-quality RCT, there were no significant differences between ultrasound-guided lavage and ultrasound-guided needling to reduce pain at the medium term. Based on 5 moderate-quality RCTs,

these effects for ultrasound-guided lavage/needling are clinically important for pain and may or may not be clinically important for disability.

Gaps in Knowledge There is some evidence on the efficacy of calcific lavage for individuals with calcific RC tendinopathy. However, the evidence is related specifically to persistent painful cases. The efficacy of calcific lavage for acute cases and as an initial treatment is not demonstrated.

Evidence Synthesis and Rationale For individuals with calcific RC tendinopathy, calcific lavage/needling with or without corticosteroid injection may significantly reduce pain and disability compared to extracorporeal shockwave therapy or corticosteroid injection alone. Clinicians can consider this treatment option if the calcific RC tendinopathy has been refractory to other modalities, such as oral NSAIDS and a corticosteroid injection. Patients have to be informed by the clinicians (referring and/or provider) regarding the potential risks and benefits of calcific lavage/needling with or without corticosteroid injection.

Recommendations

Recommendation No. 21

B Clinicians should recommend or use using calcific lavage to reduce pain and disability in adults with calcific RC tendinopathy refractory to initial treatment.

2.6 PRP Injections

PRP is an autologous concentration of platelets, growth factors, and cellular signaling factors that are derived from whole blood through the centrifugation process.[117,152] Injecting PRP is said to foster the natural tissue repair response to injury through the action of blood platelets, which undergo degranulation and release bioactive proteins or growth factors that encourage the healing process once they are activated by mediators at the site of injury.[76] Using PRP injections as a modality for the treatment of MSK injuries has been gaining in popularity in recent years.[44]

Overview

Effect of PRP Injection Compared to a Placebo, Saline Alone, or in Conjunction With Other Modalities

II Based on a 2021 CPG,[44] there is very low–quality evidence that PRP injections may significantly reduce pain and disability when compared to placebo in adults with RC tendinopathy in whom other nonsurgical treatment has failed.

I A systematic review with meta-analysis[13] reported that PRP injections do not significantly reduce pain when compared to a placebo (saline or other injections) in the medium term (MD, −0.28/10; 95% CI: −0.61, 0.05; 3 RCTs; n = 192). They also reported that PRP injections significantly reduce pain in the long term at 6 to 7 months (MD, −1.64/10; 95% CI: −2.87, −0.40; 5 RCTS; n = 281), but not at a long- to very long–term follow-up at ≥1 year (MD, −1.92/10; 95% CI: −5.13, 1.29; 3 RCTs; n = 212) in adults with shoulder disorders including RC tendinopathy. These authors also report that PRP injections do not significantly reduce disability when compared to placebo (saline or other injections) in the medium term (SMD, −0.79; 95% CI: −2.53, 0.95; 3 RCTs; n = 192), in the long term at 6 to 7 months (SMD, −1.36; 95% CI: −2.92, 0.21; 5 RCTs; n = 281), and in the long- to very long–term at ≥1 year (SMD, −2.52; 95% CI: −5.76, 0.72; 3 RCTs; n = 212). Based on 4 high-quality RCTs and 1 low-quality RCT, the effect of PRP injections may or may not be clinically important for pain reduction in the long term.

II A systematic review with meta-analysis[70] included 8 RCTs, seven of which were already included in another reviewed systematic review,[13] and reported similar results and conclusions.

II Two systematic reviews[81,152] carried out narrative syntheses that compared PRP injections to placebo (saline injections) in adults with shoulder disorders including RC tendinopathy. These authors found a total of 3 RCTs that are also included in a more recent meta-analysis mentioned above[13] and reported similar results.

II A pairwise comparison from a network meta-analysis[107] compared PRP injections with a placebo (saline or excipient) in adults with RC tendinopathy and included 2 RCTs. These RCTs included were also included in more recent meta-analyses of Barman et al[13] and in a 2021 CPG by Desmeules et al[46] presented above.

PRP vs Exercise

II A systematic review[13] reported that PRP injections do not significantly reduce pain in the medium term (MD, −0.20/10; 95% CI: −1.09, 0.69; 1 RCT; n = 44) and long term (MD, 0.80/10; 95% CI: −0.09, 1.69; 1 RCT; n = 44) and disability in the long term (SMD, −0.22; 95% CI: −0.83, 0.39; 1 RCT; n = 42) when compared to exercise therapy in adults with shoulder disorders including RC tendinopathy. Based on 1 low-quality RCT, PRP is not more effective than exercise to reduce pain and disability. The CIs are below any clinically important differences for pain and below a moderate effect size for disability.

II A systematic review[81] reported a narrative synthesis of 2 RCTs that compared PRP injections to exercise therapy for the treatment of RC tendinopathy. Based on 1 low-quality RCT (Nejati et al,[137] n = 22 treated with PRP, n = 20 treated with exercise therapy), there was a significant difference for pain in favor of exercise therapy when compared to PRP in the short to medium term and no significant difference between groups for pain in the medium term. Exercise therapy significantly reduces disability on the WORC but not on the DASH when compared to PRP in the medium term. Based on another low-quality RCT (Ilhanli et al,[83] n = 30 treated with 3 PRP injections, n = 32 treated with exercise therapy) exercise therapy significantly reduces pain (at rest and with activity) when compared with PRP injections in the long term, while PRP injections significantly reduce disability

on the DASH when compared to exercise therapy in the long term.

II A systematic review with meta-analysis[117] reported that, based on 1 high-quality RCT (n = 70) and 1 moderate-quality RCT (n = 62), PRP injections do not significantly reduce pain compared to physiotherapy in the long term (no additional information on intervention) for adults with RC disorders, including RC tendinopathy.

PRP vs Corticosteroids

II A systematic review with meta-analysis[13] reported that PRP injections significantly reduce pain in adults with RC tendinopathy (MD, −0.81/10; 95% CI: −1.51, −0.10; 2 RCTs; n = 110) when compared to corticosteroid injections in the long term, but do not significantly decrease pain in the medium term (MD, 0.41/10; 95% CI: −0.20, 1.01; 5 RCTs; n = 95). Based on 1 high-quality RCT and 1 moderate-quality RCT, the effect of PRP injections may or may not be clinically important for pain reduction in the medium and long terms.

II Two systematic reviews[81,152] reported a narrative synthesis of 3 RCTs that compared PRP injections to corticosteroid injections for the treatment of shoulder pain, including RC tendinopathy. Based on 1 low-quality RCT (Damjanov et al,[40] n = 32, n = 16 treated with PRP), PRP injections significantly reduce pain and disability compared to corticosteroid injections in the medium term, but based on 2 other low-quality RCTs (Shams et al,[166] n = 40, n = 20 treated with PRP; Ibrahim et al,[82] n = 30, n = 14 treated with PRP), PRP injections do not significantly reduce pain and disability in the short and long terms.

PRP vs Dry Needling

II A systematic review[81] reported a narrative synthesis of 1 RCT that compared PRP injections with dry needling for the treatment of RC tendinopathy. Based on 1 low-quality RCT (Rha et al,[148] n = 16 treated with PRP, n = 14 treated with dry needling), PRP injections do not significantly reduce pain and disability when compared to dry needling in the medium term.

Gaps in Knowledge There is conflicting evidence on the effectiveness of PRP injections compared to other treatments for RC disorders, and high-quality studies are missing. Available evidence mostly included mixed populations, comprising various RC disorders (ie, RC tears), and evidence related to the treatment efficacy for RC tendinopathy alone is missing. Two systematic reviews[13,152] mention that some trials[163] reported adverse effects such as pain for more than 48 hours and cases of frozen shoulder. These authors note that these adverse effects occurred in both the PRP group and the placebo saline group but appear higher in the PRP group. While some evidence reported that PRP injections are relatively safe and carry a low risk of complications,[13,152] more studies are needed to investigate potential adverse events related to the use of PRP injections for RC tendinopathy. In addition, the complexity and variability in preparation techniques has been reported to be an issue in a recent review,[7] there is still uncertainty regarding the risks and benefits of their use and the cost-effectiveness of such interventions as they may be costly for patients.

Evidence Synthesis and Rationale Efficacy of PRP injections when compared to a placebo, exercise therapy, or corticosteroid injections is unclear, and evidence is conflicting and tends to show that PRP injections are not superior to other treatments to decrease pain and disability. Patients refractory to other modalities presenting with chronic pain and disability have to be informed by the clinicians (referring and/or provider) regarding the costs, potential risks, and benefits of PRP injections, when an injection is considered.

Recommendations

Recommendation No. 22

Regarding PRP injections:

a) D Clinicians may use or recommend PRP injections to reduce pain and disability in adults with RC tendinopathy.

b) F Clinicians should not use or recommend PRP injections as a first-line treatment to reduce pain and disability in adults with RC tendinopathy.

2.7 Hyaluronic Acid Injections

Hyaluronic acid is naturally produced in the extracellular matrix of soft tissue and synovial fluid and is gaining interest as a potential option for the management of soft tissue injuries.[88] Secreted by the tendon sheath, hyaluronic acid reduces sliding friction and optimizes tendon nutrition.[1] Intra-articular hyaluronic acid injections are intended as an alternative treatment modality to corticosteroid injections, and increasing evidence is showing the use of hyaluronic acid to treat osteoarthritis of the knee or shoulder.[31]

Overview

Hyaluronic Acid Injections Compared to Placebo

II A 2021 CPG[44] reported that, based on very low evidence, hyaluronic acid injections do not significantly reduce pain and disability in adults with RC tendinopathy.

II A systematic review with meta-analysis[88] reported that hyaluronic acid injections significantly reduce pain in the short term (MD, −1.16/10; 95% CI: −1.44, −0.88; 10 RCTs; n = 593), the medium term (MD, −1.44/10; 95% CI: −1.73, −1.15; 8 RCTs; n = 536) and the long term (MD, −1.78/10; 95% CI: −2.20, −1.36; 3 RCTs; n = 209) and disability on the Constant-Murley Score in the short term (MD, 5.86/100; 95% CI: 4.38, 7.33; 3 RCTs; n = 244) and the medium term (MD, 9.4/100; 95% CI: 8.83, 9.97; 4 RCTs; n = 290) when compared to other interventions, including placebo, corticosteroid injections, or PRP injections, for adults with shoulder pain, including RC tendinopathy. Based on 1 high-quality RCT, 4 moderate-quality RCTs and 6 low-quality RCTs, these effects for hyaluronic injections may or may not be clinically important when compared to these several heterogenous comparators for pain and disability.

II A pairwise comparison from a network meta-analysis[107] reported that, based on 3 high-quality RCTs, hyaluronic acid injections do not significantly reduce pain when compared to placebo in the short (3-6 weeks) (SMD, −0.49; 95% CI: −1.65, 0.66; 3 RCTs; n = 197), medium (12 weeks) (SMD, −0.18; 95% CI: −1.75, 1.39; 2 RCTs; n = 157), and long terms (≥24 weeks) (SMD, 0.23; 95% CI: −0.18, 0.64; 1 RCT; n = 106) in adults with RC tendinopathy. They also reported that hyaluronic acid injections do not significantly reduce disability when compared to placebo in the short (3-6 weeks) (SMD, 0.01; 95% CI: −0.33, 0.35; 2 RCTs; n = 157), medium (12 weeks) (SMD, −0.64; 95% CI: −2.14, 0.87; 3 RCTs; n = 197), and long terms (≥24 weeks) (SMD, 0.29; 95% CI: −0.13, 0.70; 1 RCT; n = 106) in adults with RC tendinopathy. The nonsignificant CIs are large, and the true effects remain unclear for pain and disability.

Gaps in Knowledge There are still very few good-quality RCTs that evaluate the efficacy of hyaluronic acid injections for the treatment of RC disorders. These injections may be effective to reduce pain and disability when compared to other injections, but most of the existing literature is not specific to patients with RC tendinopathy, which limits the applicability of the results to this population. Based on 1 systematic review with meta-analysis,[107] no adverse events were related to the use of hyaluronic acid injections (based on 3 good-quality RCTs). However, there is still a need for more high-quality studies evaluating the effectiveness and safety of hyaluronic acid injections in the long term in patients with RC tendinopathy.

Evidence Synthesis and Rationale Hyaluronic acid injections may significantly reduce pain and disability when compared to other interventions such as corticosteroid and PRP injections in the short and medium terms. However, evidence is conflicting when comparing hyaluronic acid injections to placebo and the true effects remain unclear in RC tendinopathy. With the current state of the evidence, hyaluronic acid injection should not be a first line of treatment and may be considered for refractory cases.

Recommendations

Recommendation No. 23

Regarding hyaluronic acid injections:

a) D Clinicians may use or recommend hyaluronic acid injections to reduce pain and disability in the short and medium terms in adults with RC tendinopathy.

b) F Clinicians should not use or recommend hyaluronic acid injections as a first-line treatment to reduce pain and disability in adults with RC tendinopathy.

2.8 Prolotherapy

Prolotherapy is an intra-articular and/or extra-articular injection on ligament and tendon insertions. In clinical practice, the most frequently injected agent is a hypertonic dextrose solution, with concentration levels varying most commonly from 12.5% to 25%.[7] Prolotherapy aims to repair connective tissue and reduce pain, but its mechanism is not completely understood. The supposed principle of action is the injection of a proliferant. Dextrose, for example, will initiate inflammatory reaction locally, which will then attract inflammatory cells and eventually lead to the proliferation of connective tissues.[152] There is literature on the use of prolotherapy for treating various pathologies in the upper and lower limbs such as knee osteoarthritis, Achilles tendinopathy, plantar fasciitis, Osgood-Schlatter disease, hand osteoarthritis, and lateral epicondylitis showing positive results as a treatment option.[7]

Overview

II A systematic review with meta-analysis[7] reported that prolotherapy (hypertonic dextrose injections) does not significantly reduce pain in the short (SMD, −0.05; 95% CI: −0.71, 0.62; 4 RCTs; n = 307) and medium terms (SMD, −0.01; 95% CI: −0.45, 0.43; 4 RCTs; n = 349) when compared to placebo injections (saline), other injections (corticosteroid, anesthetics, PRP) or exercise programs in adults with RC tendinopathy. Based on 1 high-quality RCT and 3 moderate-quality RCTs, the effects of hypertonic dextrose injection are not more effective than comparators, the nonsignificant CIs are large, and the true effect remains unclear for short- to medium-term pain reduction.

II Two systematic reviews[29,152] that included 5 RCTs already included in the meta-analysis by Aris-Vazquez et al[7] presented a narrative synthesis of the results. Based on 1 good-quality RCT and 1 low-quality RCT (n = 67), prolotherapy does not significantly reduce pain and disability when compared to placebo (saline injection,) and corticosteroid injection in adults with RC tendinopathy. Based on 1 good-quality RCT (n = 120), prolotherapy significantly reduces pain and disability ($P<.05$) when compared to a 12-week physiotherapy intervention in the long term at 12 months. Based on a low-quality RCT,[15] prolotherapy significantly reduces pain when compared to placebo (saline injection) in the long term at 9 months.

II A pairwise comparison from a network meta-analysis[107] reported that prolotherapy significantly reduces pain (SMD, −2.63; 95% CI: −3.38, −1.88; 1 RCT; n = 54) when compared to placebo (saline injection) in the long term in adults with RC tendinopathy (24 weeks). The effect on pain reduction may be large.

Gaps in Knowledge The exact effect of prolotherapy remains unclear as some evidence shows reduction in pain in the long term, but not in the short or medium terms. The reasons for this delayed reduction are unclear. Types of preparation and dosage evaluated across studies are also very heterogeneous.

Evidence Synthesis and Rationale Prolotherapy may significantly reduce pain and disability in the long term when compared to other interventions, such as placebo and exercise therapy. However, its effects in the short and medium terms remain unclear as evidence

showed no significant difference for pain and disability reduction when compared to other interventions, including placebo. Only minor and rare adverse events have been reported in 3 RCTs.

Recommendations There are no recommendations due to conflicting evidence.

2.9 Suprascapular Nerve Block

Suprascapular nerve blocks can be landmark or ultrasound guided.[156] Aiming for pain relief, the suprascapular nerve block technique consists in injecting a long-lasting anesthetic, such as mepivacaine or bupivacaine 2%, at 1 of 2 possible sites of passage of the suprascapular nerve, either the coracoid notch or the spinoglenoid notch.[130] As the suprascapular nerve plays an important role with the shoulder girdle sensory innervation,[167] there are studies proposing this modality for many painful chronic shoulder pathologies such as rheumatoid arthritis, osteoarthritis, and shoulder pain after a stroke of due to motor neuron disease.[168]

Overview

II A low-quality RCT[14] included 96 patients with RC tendinopathy lasting more than 3 months and reported that a single suprascapular nerve block injection (solution of prilocaine and triamcinolone acetate, n = 51) significantly reduces pain and disability on the Constant-Murley Shoulder score, in the short and medium terms when compared to placebo (saline injection, n = 45).

Gaps in Knowledge There is very limited available evidence on the effectiveness of suprascapular nerve block to reduce pain and disability in adults with RC tendinopathy in the short and medium terms. There is no evidence on the risks versus benefits of suprascapular nerve block in the long term.

Evidence Synthesis and Rationale There is very limited evidence that a suprascapular nerve block could reduce pain and disability in the short and medium terms for patients with RC tendinopathy lasting more than 3 months.

Recommendations There is insufficient evidence to formulate a recommendation.

2.10 Stem Cell Injections

In the past decade, research has been emerging to assess the potential of stem cell injection therapy for MSK disorders. Studies injecting adult stem cells isolated from adipose tissue into animal models with pathologic RC tissues state they have had effects such as decreasing the amount of inflammatory cells, improving tendon regeneration by reducing scar tissue, improving the arrangement of collagen fibers, allowing increased load-to-failure, and increasing levels of tensile strength of the treated animal tendons.[80] The literature about the use of stem cell for RC tendinopathy reports using adipose-derived stem cells, which are a type of mesenchymal stem cell (MSC) that are said to be easier to harvest.[174] MSCs are sometimes also used and described as adult stem cells that were originating from the bone marrow.[174]

Overview

II A moderate-quality RCT[32] included 24 patients with chronic RC tendinopathy with partial tears (>3 months), and reported that MSCs injections (allogenic adipose tissue-derived adult MSC with fibrin glue) do not significantly reduce pain during activity and disability on the American Shoulder and Elbow Score (ASES) in the short, medium, and long to very long terms when compared to placebo (saline). For the primary pain outcome, the change between baseline and 3 months was MD: −1.37/10 ± 2.85 in the stem cell injections group and −3.0/10 ± 2.56 in the placebo group ($P = .35$).

II A low-quality pilot RCT[80] included 20 patients with RC tendinopathy who had not responded to physical therapy treatments for at least 6 weeks and reported that stem cell injections (unmodified autologous adipose-derived regenerative cells) (n = 12) significantly reduce disability on the ASES in the medium and long term when compared to corticosteroid injection (n = 8). Stem cell injections do not significantly reduce pain compared to corticosteroid injection in the medium and long terms.

Gaps in Knowledge There is very limited evidence available on the efficacy of stem cell injection to reduce pain and disability in adults with RC tendinopathy in the short and medium terms. There is also limited evidence on the risks versus benefits of this intervention.

Evidence Synthesis and Rationale Stem cell injections have been proposed for the treatment of RC tendinopathy based on the principle that increasing the number of stem cells in the local cell population would increase the regenerative potential of the tendon. To date, there are still very few studies that evaluate its effectiveness to reduce pain and disability in patients with RC tendinopathy to recommend its use. The 2 RCTs found for RC tendinopathy both used adipose-derived regenerative cells.

Recommendations Insufficient evidence to formulate a recommendation.

2.11 Botulinum Toxin Injections

Botulinum toxin is used to inhibit overactive or spastic muscles and may be used to alleviate pain with overactive muscle spasms or contractions. There has been research on botulinum toxin showing it reduces pain in peripheral joints, in the low back, and for the buttocks (piriformis syndrome) with alleged minimal side effects.[96] Botulinum toxin is being investigated for its potential to give an alternative to corticosteroids as a pain control modality as it may have longer-lasting clinical benefits.[96]

Overview

II A high-quality RCT[96] included 61 adults (n = 31 botulinum toxin injection and n = 30 corticosteroid injection) with subacromial bursitis and subacromial impingement syndrome who had not responded to physiotherapy or analgesic treatments, and reported that botulinum toxin injections significantly reduce pain on the

numeric rating scale and disability, as measured with the DASH, when compared to corticosteroid injections in the medium term.

Gaps in Knowledge There is very limited available evidence on the efficacy of botulinum toxin injection for pain management of RC tendinopathy. There is no evidence on the risks vs benefits of botulinum toxin injections in the long term.

Evidence Synthesis and Rationale There is very limited evidence that botulinum toxin injections could reduce pain and disability in the medium term for patients with RC tendinopathy who had not responded to physiotherapy or analgesic treatments.

Recommendations Insufficient evidence to formulate a recommendation.

SECTION 3: REHABILITATION TREATMENTS FOR RC TENDINOPATHY

3.1 Education

A patient-centered approach in rehabilitation appears to lead to better outcomes.[200] Patients' education about their pathology, pain education, and strategies to cope with their condition is an inherent part of this approach. A better understanding of the experienced symptoms may reinforce patients' involvement in their rehabilitation for patient with MSK disorders including RC tendinopathy.

Overview

II Based on a 2021 CPG,[44] there is limited evidence to conclude that a multimodal intervention, which may include, but is not limited to, pain education, self-efficacy advice, psychosocial and workplace interventions, and/or exercises, leads to additional benefits compared to usual care for adults with RC tendinopathy.

V A scoping review,[128] including 82 studies of various designs, reported that physiotherapy advice for RC tendinopathy covered 7 key themes: exercise intensity and pain response, activity modification, posture, pain self-management, pathoanatomical and diagnosis information, behavioral approaches, and pain biology. The authors suggested that clinicians may need to consider integrating education about pain mechanisms and psychological factors into their management of patients with RC tendinopathy, tailoring these to patient-specific health literacy, goals, beliefs, and support systems.

V A scoping review,[18] including 93 randomized and quasi-randomized controlled trials about therapeutic shoulder exercise intervention, documented the behavior change techniques and education used in the management of RC related shoulder pain and compared them to the recommendations in 3 CPGs. The authors reported that 53% of trials they analyzed included some form of education, the most common one being exercise education. They also noted that education was underutilized in these trials when comparing to the recommendations of CPGs regarding elements such as activity modifications. The authors reported that over two thirds of included trials had some type of behavior change technique included with exercise interventions for RC tendinopathy, but they mostly consisted of exercise supervision. The authors recommend that future trials consider using behavior change techniques aimed at improving exercise adherence and outcomes.

Gaps in Knowledge There is a need for future research looking at the content of advice and education for the management of RC tendinopathy, as well as their mode of delivery.[128] In addition, there are few, if any, studies comparing the effect of education to other interventions or the effect of different modes of education. Future research should explore the mediation effect that education may have on other interventions, such as exercise therapy.[18]

Evidence Synthesis and Rationale The inclusion of education is recommended in the management of RC tendinopathy. It should include advice pertaining to exercise supervision, goal setting, activity modification, and information about the condition and pain management options. The information provided should be patient-centered, individualized, and consider the individual's level of health literacy, goals, concerns, beliefs, and social support.

Recommendation

Recommendation No. 24

C Clinicians should provide patients with patient-centered and individualized education on their condition, pain management options, activity modification, and self-management. Clinicians should consider the individual's level of health literacy, personal beliefs and goals, and relevant psychosocial factors.

3.2 Exercise

Overview Exercise is a core component of nonoperative management of RC tendinopathy.[178] The components of exercise therapy reported in clinical trials include exercises for the neck and thoracic muscles, scapula-focused exercises, motor control exercises, concentric or eccentric strengthening, and variable levels of high- or low-intensity resistance training, as well as whole-body exercises and aerobic conditioning.[24,109] These exercise programs are proposed to decrease pain and disability, increase muscle strength and endurance, improve neuromuscular control, and increase ROM and load tolerance.[101]

Efficacy of Exercise Programs Compared to No Intervention

I Based on a 2021 CPG,[44] including 2 systematic reviews and 5 RCTs, it is recommended to prescribe an active rehabilitation program as an initial treatment modality to reduce pain and disability in adults with RC tendinopathy.

I Based on an umbrella review,[145] there is moderate to high levels of evidence from 7 systematic reviews supporting the use of exercise therapy to reduce symptoms and improve disability in patients with RC tendinopathy in the short to long term.

I A systematic review[113] reported that, based on very low–certainty evidence (GRADE), home-based

exercise significantly reduces pain (MD, −1.47/10; 95% CI: −2.33, −0.61; 1 RCT; n = 67) and disability (SMD, −0.81; 95% CI: −1.31, −0.31; 1 RCT; n = 67) in the short term, when compared to no treatment in adults with RC tendinopathy. Based on very uncertain evidence, these effects for home-based exercise may or may not be clinically important for pain and may be small to large for disability.

I A systematic review with meta-analysis[135] including 4 studies reported that, based on low-quality evidence (GRADE), progressive and resisted exercises significantly reduce pain (MD, −1.07/10; 95% CI: −1.57, −0.56; 3 RCTs; n = 197) and disability on the Constant-Murley Score (MD, −14.96/100; 95% CI: −21.37, −8.55; 4 RCTs; n = 271) when compared to basic advice, placebo detuned laser or no treatment in adults with RC tendinopathy in the short to medium term. The evidence suggests that these effects for progressive and resisted exercise may or may not be clinically important for pain and disability.

Based on low-quality evidence (GRADE), nonprogressive resisted exercises and nonresisted exercises do not significantly reduce pain (MD, −0.33/10; 95% CI: −0.81, 0.15; 3 RCTs; n = 198) and disability (MD, −3.62/100; 95% CI: −9.43, 2.18; 3 RCTs; n = 198) when compared to various comparators of a shoulder brace, ultrasound, or sham ultrasound in adults with RC tendinopathy in the short to medium term. Moreover, the nonsignificant CIs are large. Based on these 3 studies, nonprogressive resistance exercise and nonresisted exercise do not appear to provide benefits in pain and disability over a passive intervention or a sham.

II A systematic review with meta-analysis,[105] reported that, based on low-certainty evidence (GRADE), supervised exercise significantly reduces pain at rest (MD, −1.68/10; 95% CI: −3.06, −0.31; 4 RCTs; n = 286), during movement (MD, −1.84/10; 95% CI: −2.76, −0.91; 5 RCTs; n = 353), and disability (SMD, −0.30; 95% CI: −0.52, −0.07; 5 RCTs; n = 396) when compared to no exercise in the short term in adults with RC tendinopathy. The evidence suggests that the effects for supervised exercise may or may not be clinically important for pain at rest and during movement and may be trivial to moderate for disability.

II A systematic review with meta-analysis[178] reported that, based on low- to very low–certainty evidence (GRADE), exercise significantly reduces pain (SMD, −0.94; 95% CI: −1.69, −0.19; 5 RCTs; n = 189) and disability (SMD, −0.57; 95% CI: −0.85, −0.29; 4 RCTs; n = 202) when compared to no treatment in adults with RC tendinopathy at an unspecified follow-up time. Based on very uncertain evidence, the effects for exercise may be trivial to large for pain and moderate to large for disability.

II A pairwise comparison from a network meta-analysis[11] reported that exercise significantly reduces pain when compared to no intervention (SMD, −0.42; 95% CI: −0.68, −0.15) or corticosteroid injections (SMD, −0.25; 95% CI: −0.48, −0.03) in adults with RC tendinopathy in the medium term. They reported that exercise significantly reduces disability when compared to no intervention in the short to medium term (SMD, −0.69; 95% CI: −0.99, −0.39) and in the medium term (SMD, −0.32; 95% CI: −0.58, −0.06). They also reported that shoulder taping significantly reduces disability (SMD, −0.48; 95% CI: −0.82, −0.15) when compared to exercise in the long term. However, the number of RCTs per meta-analyses and the quality of these RCTs are not reported. Based on unknown certainty of the evidence, these effects for exercise ranged from trivial to large when compared to the various comparators mentioned above.

Efficacy of Supervised Exercise Programs Compared to Unsupervised Exercise Programs

I A systematic review with meta-analysis[113] reported that, based on low-certainty evidence (GRADE), clinic-based exercise does not significantly reduce pain (MD, −0.31/10; 95% CI: −0.66, 0.03; 3 RCTs; n = 478) or disability (SMD, −0.12; 95% CI: −0.71, 0.47; 1 RCT; n = 44) in the short to medium term when compared to home-based exercise in adults with RC tendinopathy. The evidence suggests that supervised exercise is not more effective than unsupervised (home-based) exercise to reduce pain. The CIs are below any clinically important differences for pain. For disability reductions, the nonsignificant CIs are large, and the true effects remain unclear.

I A systematic review with meta-analysis[67] reported that supervised physiotherapy does not significantly reduce pain (MD, 0.21/10; 95% CI: −1.36, 1.78; 4 RCTs; n = 216) and disability (SMD, −0.14; 95% CI: −1.04, 0.76; 4 RCTs; n = 216) when compared to home-based exercises in adults with RC tendinopathy at an unspecified follow-up time. Based on 2 moderate-quality RCTs and 2 low-quality RCTs, the nonsignificant CIs are large, and the true effects remain unclear for reductions in pain and disability.

I A systematic review with a narrative synthesis[73] reported that, based on 1 high-quality trial, supervised exercise combined with home-based exercise does not in the short or long term, significantly reduce pain or disability (1 RCT, n = 46) when compared to home exercise only in adults with RC tendinopathy. Both groups presented significant reductions in pain and disability. Neither the magnitude of the effect nor the CIs were reported.

II A systematic review[105] included a single RCT, which was already included in 2 other reviewed systematic reviews,[67,113] and reported similar results and conclusions.

Efficacy of Different Types of Exercises Programs

I A systematic review with meta-analysis performed by Lafrance et al[91] reported that, based on low-to moderate-certainty evidence (GRADE), motor control exercise programs do not significantly reduce

pain in the short term (SMD, −0.19; 95% CI: −0.41, 0.03; 7 RCTs; n = 323, moderate) but do significantly reduce pain in the medium (SMD, −0.38; 95% CI: −0.71, −0.05; 5 RCTs; n = 286, low) and in the long term (SMD, −0.57; 95% CI: −0.98, −0.16; 2 RCTs; n = 96, low), as well as disability in the short (SMD, −0.29; 95% CI: −0.51, −0.07; 7 RCTs; n = 323, moderate), medium (SMD, −0.33; 95% CI: −0.57, −0.09; 5 RCTs; n = 286, moderate), and long term (SMD, −0.48; 95% CI: −0.88, −0.07; 2 RCTs; n = 96, low) when compared to standard exercise programs (more generic shoulder resistance or strengthening exercise programs without emphasis on muscle control, scapular muscles/stability, or eccentric exercises) in adults with RC tendinopathy. The evidence suggests that these effects for motor control exercise programs may be trivial to large for pain and disability. It remains unclear if these effects could be due to the types of exercise (motor control exercises compared to standard exercises) or to other program characteristics such as the frequency, intensity, specificity, or level of tailoring.

I A systematic review with meta-analysis[94] including 1 study of moderate quality and 4 studies of low quality reported that motor control exercises programs (ie, exercises targeting the activation of specific musculature, neuromuscular control exercises, dynamic muscular stabilization exercises, proprioceptive exercises, specific movements, or movement control exercises) significantly reduce pain (MD, −0.79/10; 95% CI: −1.47, −0.12; 2 RCTs on RC tendinopathy and 2 RCTs on instability; n = 157) and disability (SMD, −0.42; 95% CI: −0.69, −0.15; 3 RCTs on RC tendinopathy and 2 RCTs on shoulder instability, n = 217) when compared to strengthening exercise programs in the short to medium term. Certainty of the evidence was evaluated only for their primary analysis including various disorders for upper and lower extremity and was considered moderate (GRADE).

I A systematic review with meta-analysis[95] reported that, based on low-quality evidence (GRADE), eccentric exercises do not significantly reduce pain when compared to other types of exercises (resistance and mobility exercises) in the short term (MD, −13.5; 95% CI: − 28.5, 1.4; 6 RCTs; n = 281) and in the long term (MD, −4.9; 95% CI: − 15.4, 5.6; 3 RCTs; n = 167) but it did in the medium term (MD, −11.9; 95% CI: − 18.2, − 5.5; 3 RCTs; n = 194). The evidence suggests that these effects for eccentric exercises may or may not be clinically important for pain in the medium term, but in the short and long term, the nonsignificant CIs are large and the true effects remain unclear for pain reductions.

In addition, based on very low–quality evidence (GRADE), eccentric exercises do not significantly reduce disability in the short and medium terms (SMD, −0.10; 95% CI: − 0.79, 0.58; 6 RCTs; n = 281) and in the long term (SMD, 0.28; 95% CI: − 0.67, 1.24; 3 RCTs; n = 167) when compared to other type of exercises (resistance and mobility exercises). The nonsignificant CIs are large, and the true effects on disability reduction remain unclear.

II A systematic review with meta-analysis performed by Lafrance et al[91] reported that, based on very low to low evidence (GRADE), scapula-focused programs do not significantly reduce pain (SMD, −0.1; 95% CI: −0.54, 0.35; 4 RCTs; n = 150, very low) or disability (SMD, −0.42; 95% CI: −0.99, 0.16; 4 RCTs; n = 150, very low) in the short term, while they significantly reduce pain (SMD, −0.45; 95% CI: −0.74, −0.26; 3 RCTs; n = 187, low) and disability (SMD, −0.51; 95% CI: −1.01, −0.02; 3 RCTs; n = 187, very low) in the medium term when compared to standard exercise programs (more generic shoulder resistance or strengthening exercise programs without emphasis on muscle control, scapular muscles/stability, or eccentric exercises) in adults with RC tendinopathy. Based on uncertain evidence, these effects may be large in favor of scapula-focused exercise programs to small in favor of standard exercise programs.

II A systematic review with meta-analysis performed by Lafrance et al[91] reported, based on low evidence (GRADE), that in adults with RC tendinopathy eccentric exercise programs do not significantly reduce pain in the short term (SMD, −0.32; 95% CI: −0.75, 0.12; 2 RCTs; n = 82), but significantly reduce pain in the medium term (SMD, −0.62; 95% CI: −1.11, −0.13; 2 RCTs; n = 70). Based on very low–certainty evidence (GRADE) eccentric exercise programs do not significantly reduce disability in the short (SMD, 0.1; 95% CI: −0.65, 0.86; 4 RCTs; n = 177) or medium terms (SMD, −0.16; 95% CI: −0.81, 0.49; 4 RCTs; n = 165) when compared to standard exercise programs. Based on uncertain evidence, these effects may be large in favor of eccentric exercise programs to small in favor of standard exercise programs.

II A systematic review with meta-analysis[173] reported that an exercise program involving specific exercises (ie, exercise targeting the activation and coordination of scapulothoracic musculature and/or the dynamic humeral head stabilizers that encompass the shoulder joint) does not significantly reduce pain (SMD, −0.19; 95% CI: −0.61, 0.22; 4 RCTs; n = 132) and disability (SMD, 0.30; 95% CI: −0.16, 0.76; 5 RCTs; n = 193) when compared to general resistance exercises in adults with RC tendinopathy in the short term. Based on 4 moderate-quality RCTs and 1 low-quality RCTs, the nonsignificant CIs are large, and the true effects remain unclear for pain and disability reductions.

II A systematic review[35] concluded that, based on limited evidence (2 RCTs, n = 63), isometric exercises are not superior to cryotherapy to reduce pain and disability in adults with an acute RC tendinopathy (≤12 weeks) in the short term.

II A systematic review with meta-analysis[178] reported that, based on low- to very low–certainty

evidence (GRADE), specific exercises significantly reduce pain (SMD, −0.65; 95% CI: −0.99, −0.32; 2 RCTs; n = 145) and disability (SMD, −0.68; 95% CI: −1.26, −0.10; 2 RCTs; n = 145) when compared to nonspecific exercises in adults with RC tendinopathy at an unspecified follow-up time. Based on very uncertain evidence, these effects for specific exercises may be moderate to large for pain and trivial to large for disability.

II A systematic review[49] including 6 studies of low quality reported that there were no statistically significant differences between the different exercise approaches (concentric vs eccentric exercises [2 RCTs, n = 154], exercises with vs without co-activation of RC [1 RCT, n = 42], exercises with vs without pain [1 RCT, n = 22], eccentric vs strengthening and/or stretching exercises [3 RCTs, n = 135] to reduce pain and disability in adults with RC tendinopathy at various follow-up times in the short to long term.

II A systematic review with narrative synthesis[132] looked at the effect of various types of interventions such as scapular muscle strengthening, scapular stabilization exercise, and stretching in adults with scapular dyskinesis that may include RC tendinopathy at an unspecified follow-up time. All RCTs of interest included in this systematic review are included in the systematic review by Lafrance et al.[94]

II A systematic review with a narrative synthesis[147] concluded that scapular stabilization exercises are effective without specifying specific outcomes. The authors' conclusion was based on 7 RCTs (2 high-quality and 5 medium-quality, n = 228) using a variety of comparators with follow-ups in the short to medium term.

II A systematic review with meta-analysis[157] reported that scapular-focused interventions, which include scapular mobilization and muscle retraining, as well as taping and stretching, significantly reduce pain with activities (MD, −0.88/10; 95% CI: −1.19, −0.58; 6 RCTs; n = 250) and disability (MD, −11.31/100; 95% CI: −17.20, −5.41; 5 RCTs; n = 182) when compared to usual care in adults with RC tendinopathy immediately postintervention. Based on 4 moderate-quality RCTs and 2 low-quality RCTs, these effects for scapular-focused interventions may or may not be clinically important for pain and may be moderate to large for disability. However, scapular-focused interventions do not significantly reduce pain with activities (MD, −0.87/10; 95% CI: −1.80, 0.07; 2 RCTs; n = 57) and disability (MD, −3.12/100; 95% CI: −12.49, 6.25; 2 RCTs; n = 57) when compared to usual care in adults with RC tendinopathy in the short term. The nonsignificant CIs are large, and the true effects remain unclear for pain and disability reductions.

Dosage

I A systematic review with meta-analysis[91] reported that, based on very low evidence (GRADE), high-load exercise programs do not significantly reduce pain in the short (SMD, −0.15; 95% CI: −0.93, 0.62; n = 221; 2 RCTs) and medium terms (SMD, −0.19; 95% CI: −0.49, 0.11; n = 453; 4 RCTs), nor disability in the short (SMD, −0.21; 95% CI: −0.72, 0.29; n = 301; 3 RCTs) or medium terms (SMD, −0.49; 95% CI: −1.02, 0.05; n = 453; 4 RCTs) when compared to low-load exercise programs in adults with RC tendinopathy. Based on very uncertain evidence and no significant effects, high load cannot be recommended over low-load resistance exercise programs. These effects may be large in favor of high-load exercise programs to moderate in favor of standard exercise programs.

I A systematic review[122] reported that, based on low-certainty evidence (GRADE), higher dose (load and volume) exercises significantly reduce pain with activity (MD, −1.6/10; 95% CI: −2.7, −0.5; 1 RCT; n = 102) and disability on the Constant-Murley Score (MD, −20/100; 95% CI: −28.5, −11.6; 1 RCT; n = 102) when compared to lower dose of exercises in adults with RC tendinopathy in the medium term. The evidence suggests that these effects for higher load and volume exercises may or may not be clinically important for pain and may be trivial to small for disability.

Based on very low–certainty evidence (GRADE), the efficacy of higher versus lower doses (load only) of exercises does not significantly differ in the short term (MD, −5.00; 95% CI: −15.85, 5.85; 1 RCT; n = 61) in terms of function. The nonsignificant CIs are large, and the true effects of higher versus lower load doses of resistance exercise remain unclear.

Based on very low–certainty evidence (GRADE), higher dose (volume only) as compared to lower dose of exercises significantly reduces disability on the Shoulder Rating Questionnaire (MD, −12.9/100; 95% CI: −18.1, −7.6; 1 RCT; n = 56) of exercises in adults with RC tendinopathy in the medium term. The evidence suggests that these effects for higher-volume exercises may be trivial to moderate for disability.

Gaps in Knowledge While resistance exercise is supported in systematic reviews to improve pain and disability for RC tendinopathy, there are questions remaining as to the optimal parameters. Stronger evidence is needed about supervised versus unsupervised exercise programs, and more research is needed about optimal dosage parameters. Regarding the efficacy of different types of exercises programs, current evidence is quite divided even though a fair number of systematic reviews were published on the subject. It remains unclear if specific exercise programs are more effective than general exercise programs. The FITT principle has been proposed to indicate that the components of frequency, intensity, type and time are needed to replicate exercises.[3] More research is needed about which parameters for frequency, intensity, type, and time show the best results for the efficacy of exercise programs to treat pain and disability related to RC tendinopathies.

Evidence Synthesis and Rationale Evidence generally shows that using an exercise program is more effective to reduce

pain and disability in adults with RC tendinopathies than no treatment or other intervention. Current evidence seems to indicate that supervised exercise programs are not superior to home-based unsupervised exercise programs for pain and disability reductions. Motor control exercise programs could be better than standard exercise programs for pain and disability reductions. It remains unclear if specific exercise programs are more effective than general exercise programs and if higher-load exercise programs show better efficacy than lower-load exercise programs.

Recommendations

Recommendation No. 25

A Clinicians should prescribe or recommend an active rehabilitation exercise program, which may include motor control and/or resistance training exercises of various load, as an initial treatment modality to reduce pain and disability in adults with RC tendinopathy.

3.3 Manual Therapy

Physiotherapists often use manual therapy interventions to address impairments potentially associated with RC tendinopathy. Manual therapy interventions have been defined as skilled hand movements performed by a therapist on a patient. Manual therapy can include soft tissue techniques, massage, muscle release techniques, passive stretching, and joint mobilizations or manipulation of the spine.[43] For RC tendinopathy, manual therapy can be applied to the glenohumeral joint, the shoulder girdle, or the thoracic and cervical spine.

Overview

II Based on a 2021 CPG,[44] including 1 systematic review with meta-analysis and 6 RCTs, there is low- to moderate-quality evidence that manual therapy performed alone or in combination with other treatments such as exercise, may significantly reduce pain and disability among adults with an RC tendinopathy, but only in the short term.

I Based on an umbrella review,[145] there is low to high levels of evidence from 6 systematic reviews supporting the use of manual therapy in combination with exercises to reduce pain and disability, especially in the short term.

I A systematic review,[73] concluded that mobilization with movement significantly reduces pain when compared to sham mobilization in adults with RC tendinopathy in the short term. Neither the magnitude of the effect nor the CIs were reported in this review. The authors' conclusion was based on 1 high-quality RCT (n = 42). The authors also reported that there is strong evidence that a single thoracic manipulation is no better than a sham thoracic manipulation to reduce pain and disability in adults with RC tendinopathy as reported in 3 high-quality RCTs (n = 147). Neither the magnitude of the effect nor the CIs were reported.

I A systematic review with meta-analysis[159] reported that, based on very low–certainty evidence (GRADE), mobilization with movement alone or the addition of mobilization with movement to physiotherapy care (exercise and/or physical modalities) significantly reduces pain (SMD, −1.07; 95% CI: −1.87, −0.26; 7 studies; n = 228) but does not significantly reduce disability (SMD, −0.88; 95% CI: −2.18, 0.43; 5 studies; n = 155) when compared to sham mobilization with movement or physiotherapy care (exercises or physical modalities) at an unspecified follow-up time. Based on very uncertain evidence, these effects for mobilization with movement alone or combined with electrotherapeutic modalities are small to large for pain. For disability, the nonsignificant CIs are large, and the true effects remain unclear. Eligible trials in this review included adults with shoulder pain and dysfunction related to movement, not limited to those with an RC tendinopathy diagnosis.

I A systematic review with meta-analysis[169] reported that the addition of manual therapy to exercise significantly reduces pain (SMD, −1.07; 95% CI: −1.85, −0.28; 5 RCTs; n = 230) but not disability (SMD, −0.10; 95% CI: −0.33, 0.14; 4 RCTs; n = 315) when compared to exercises alone in adults with RC tendinopathy at an unspecified follow-up time. Based on these high-quality RCTs, the effect of adding manual therapy to exercise may be small to large for pain. However, the addition of manual therapy to exercise is not effective to reduce disability as the CIs are below a moderate effect size for disability.

II A systematic review[131] reported that, based on 3 moderate-quality RCTs, there is no difference between thoracic manipulation and a sham thoracic manipulation to decrease immediate pain and disability in adults with RC tendinopathy. The authors concluded that there is limited evidence on the efficacy of thoracic spine thrust manipulation to reduce pain or disability in adults with RC tendinopathy.

II A pairwise comparison from a network meta-analysis[11] reported that manual therapy significantly reduces pain (SMD, −1.61; 95% CI: −2.33, −0.9) and disability (SMD, −1.03; 95% CI: −1.71, −0.35) in the short term when compared to shoulder taping. Manual therapy combined with exercises also significantly reduces disability (SMD, −0.52; 95% CI: −1.03, −0.02) in the short to medium term when compared to no intervention. However, the number of RCTs per meta-analyses and the quality of these RCTs are not reported. Based on unknown certainty of the evidence, these effects for manual therapy ranged from trivial to large when compared to taping or no intervention.

II A systematic review with meta-analysis[178] reported that, based on low- to very low–certainty evidence (GRADE), that manual therapy significantly reduces pain when compared to placebo immediately after the intervention (SMD, −0.62; 95% CI: −0.97, −0.28; 3 RCTs; n = 134) in adults with RC tendinopathy. It is also

noted that manual therapy significantly reduces pain (SMD, −0.35; 95% CI: −0.69, −0.01; 4 RCTs; n = 137) but not disability (SMD, 0.17; 95% CI: −0.41, 0.75; 2 RCTs; n = 47) at an unspecified follow-up time in adults with RC tendinopathy. Based on very uncertain evidence, these effects for manual therapy may be trivial to large for pain, but the true effects remain unclear for disability reductions as the nonsignificant CIs is large.

Also based on low- to very low–quality evidence, these authors reported that manual therapy combined with exercise significantly reduces pain (SMD, −0.32, 95% CI: −0.62, −0.01; 9 RCTs; n = 363) and disability (SMD, −0.41; 95% CI: −0.71, −0.11; 7 RCTs; n = 301) when compared to exercise alone in adults with RC tendinopathy at an unspecified but probably short follow-up time. Based on very uncertain evidence, these effects for manual therapy may be trivial to moderate for pain and disability.

Gaps in Knowledge While manual therapy may be integrated as an adjunct intervention to reduce pain in adults with RC tendinopathy, there are questions remaining as to what the optimal parameters are. The optimal type of spinal or upper limb manual therapy (manipulation, mobilization, mobilization with movement, massage) and the parameters (duration and frequency) are unknown. Furthermore, it is difficult to conclude whether some manual therapy treatments to the soft tissue and/or joint are better than others, since they are frequently combined in trials. In addition, more research is needed to highlight the individuals who are most likely to benefit from the addition of manual therapy to a rehabilitation treatment plan including education and exercise.

Evidence Synthesis and Rationale Spinal and upper limb manual therapy, manipulation, mobilization, mobilization with movement, and massage can be used as an addition to exercise for the treatment of RC tendinopathy. Alone or combined with other modalities, manual therapy can provide mostly short-term pain and disability reductions in adults with RC tendinopathy.

Recommendations

Recommendation No. 26

B Clinicians may perform spinal and/or upper limb manual therapy alone or in combination with other modalities, such as exercise, to help reduce pain in adults with RC tendinopathy in the short term. Manual therapy can include soft tissue techniques and/or joint mobilizations or manipulations.

3.4 Taping

For RC tendinopathy, when applied to the scapulothoracic and glenohumeral joints and their surrounding muscles, taping is believed to improve posture and shoulder kinematics as well as to decrease pain. There are 2 broad categories of taping: nonelastic taping and elastic kinesiology taping.

Overview

II Based on a 2021 CPG,[44] including 2 low-quality RCTs, the current evidence is insufficient to formulate recommendations on the use of proprioceptive taping.

I A systematic review[158] reported weak and conflicting results on the effectiveness in the short term of the addition of rigid or elastic taping to physiotherapy care including exercise, manual therapy, and/or other physical modalities for adults with RC tendinopathy (3 RCTs and 1 controlled trial, n = 135). The authors concluded that taping might be a therapeutic option in the early phase of rehabilitation of adults with RC tendinopathy but that high-quality RCTs are needed to draw firm conclusions on the efficacy of taping.

II A Cochrane review[62] reported that, based on very low–certainty evidence (GRADE), kinesiotaping significantly reduces pain with movement (MD, −1.48; 95% CI: −2.25, −0.71; 4 RCTs; n = 153), but not overall pain (MD, 0.07/10; 95% CI: −0.77, 0.9; 3 RCTs; n = 106) or disability (SMD, −0.49; 95% CI: −1.28, 0.30; 6 RCTs; n = 214) when compared to sham taping in adults with various RC disorders such as RC tendinopathy in the short term. Based on very uncertain evidence, the effect of kinesiotaping may or may not be clinically important to reduce pain with movement but is not effective to reduce overall pain as the CI is below any clinically important differences. Regarding disability, the nonsignificant CIs are large, and the true effects remain unclear.

II A Cochrane review on kinesiotaping for adults with RC disorders such as RC tendinopathy[62] reported that, based on very low–certainty evidence (GRADE), kinesiotaping, in the short term, does not significantly reduce pain with movement (MD, −0.06/10; 95% CI: −0.80, 0.68; 6 RCTs; n = 225) or overall pain (MD, −0.44/10; 95% CI: −1.33, 0.46; 5 RCTs; n = 266) but significantly reduces disability (SMD, −0.66; 95% CI: −1.22, −0.1; 12 RCTs; n = 499) when compared to other treatments such as conventional taping, exercise, medications, corticosteroid injections, or other interventions. The efficacy of kinesiotaping to reduce pain and disability compared to other interventions is very unclear as the certainty of evidence is very low and because the comparison includes heterogenous interventions.

II A systematic review with meta-analysis[5] compared several interventions, including kinesiotaping in a single meta-analysis. Comparisons were made for (1) kinesiotaping compared to sham taping, (2) exercise and kinesiotaping compared to exercise with corticosteroid injections, (3) exercise and kinesiotaping compared to exercise and manual therapy with thermotherapy and/or electrotherapy. However, based on the authors' methods that compared simultaneously multiple interventions, it is not possible to isolate the effect of kinesiotaping alone nor the effect of the addition of kinesiotaping to other interventions. No conclusion on the efficacy of kinesiotaping can be drawn from this review.

Gaps in Knowledge Description of interventions, sample sizes, and statistical

analyses in current trials are not optimal, leading to uncertainty on the effectiveness of rigid taping or kinesiotaping on pain and disability in people with RC tendinopathy. Future research should investigate the effect of taping with rigorous methodology, including adequately powered studies and registered published protocols. Trials should also improve a description of the taping interventions, such as description of the intervention provider(s), targeted muscle(s), and modalities of applications (ie, indications when to apply and duration) to better assess the potential benefits of such interventions. Trials should focus on standardizing outcomes, measuring potential adverse events, relevant data collection timepoints, and follow-up period.

Evidence Synthesis and Rationale There is a lack of high-level quality evidence to conclude on the efficacy of taping. There is uncertain evidence regarding the effect of taping alone or in combination to reduce pain and disability in adults with RC tendinopathy when compared to a sham or other conservative interventions.

Recommendation

Recommendation No. 27

D Clinicians may use taping in addition to an active rehabilitation program to reduce pain in adults with RC tendinopathy in the short term.

3.5 Physical Modalities

Various physical modalities are commonly used in the rehabilitation of adults with RC tendinopathy. These may include therapeutic ultrasound, acupuncture, extracorporeal shockwave therapy, laser, or transcutaneous electrical nerve stimulation (TENS). Depending on the type of tendinopathy, calcific or noncalcific, some interventions may be preferred. Most commonly, the use of these physical modalities is part of a multimodal program to treat adults with RC tendinopathy.

Overview

II Based on a 2021 CPG:[44]

• Therapeutic ultrasound does not reduce pain and/or disability in adults with RC noncalcific tendinopathy but may reduce pain and/or disability in adults with RC calcific tendinopathy.

• Acupuncture may reduce pain and/or disability, especially when combined with exercises, in adults with RC tendinopathy.

• Extracorporeal shockwave therapy does not reduce pain and/or disability in adults with RC noncalcific tendinopathy, but it may reduce pain, disability, and the size of the calcification in RC calcific tendinopathy. High-energy extracorporeal shockwave therapy appears to be superior to low-energy extracorporeal shockwave therapy to reduce pain and/or disability.

• The use of laser in combination with other modalities does not reduce pain and/or disability.

• There is insufficient evidence to support the use of TENS, pulsed electromagnetic fields, interferential currents, or iontophoresis for RC tendinopathy.

I Based on an umbrella review,[145] authors report that there is low to high levels of evidence from 6 systematic reviews strongly recommending not to use laser therapy for adults with RC tendinopathy as a single treatment. However, authors report that laser therapy could reduce pain and disability if added to an exercise or multimodal program. In addition, these authors write that there is low to moderate levels of evidence from 5 systematic reviews not to use therapeutic ultrasound for adults with RC tendinopathy. These authors also state that there is low to moderate levels of evidence from 3 systematic reviews not to use extracorporeal shockwave therapy for adults with RC tendinopathy.

II The systematic review by Babatunde et al[11] conducted the following pairwise comparisons:

• Laser therapy significantly reduces pain when compared to ultrasound therapy (SMD, −1.2; 95% CI: −1.61, −0.78), taping (SMD, −1.66; 95% CI: −2.35, −0.97), or a control intervention (SMD, −0.7; 95% CI: −1.22, −0.18) in the short term. In the medium term, laser therapy significantly reduces pain when compared to control intervention (SMD, −0.84; 95% CI: −1.37, −0.31). Regarding disability, laser therapy significantly reduces disability when compared to taping (SMD, −1.21; 95% CI: −1.87, −0.55) or to a control intervention in the short term (SMD, −1.54; 95% CI: −2.12, −0.96) and in the medium term (SMD, −1.73; 95% CI: −2.32, −1.13).

• Acupuncture significantly reduces pain when compared to taping (SMD, −0.58; 95% CI: −0.78, −0.39) in the short term and when compared to TENS (SMD, −0.74; 95% CI: −0.93, −0.54) or to a control intervention (SMD, −0.81; 95% CI: −1.12, −0.51) in the medium term. Regarding disability, acupuncture significantly reduces disability when compared to TENS (SMD, −0.52; 95% CI: −0.72, −0.33) or to a control intervention (SMD, −1.75; 95% CI: −3.26, −0.23) in the short term.

• Extracorporeal shockwave therapy significantly reduces pain when compared to control (SMD, −0.32; 95% CI: −0.55, −0.09) in the medium term. Regarding disability, extracorporeal shockwave therapy significantly reduces disability when compared to control (SMD, −0.48; 95% CI: −0.94, −0.01) in the short term.

It is important to note that in this systematic review, the number of RCTs included and participants per analysis are unknown. Therefore, it is difficult to draw clear conclusions on the true clinical efficacy of these interventions and uncertainty remains.

II A systematic review[56] reported conflicting evidence for reductions in pain and disability when comparing extracorporeal shockwave therapy to other conservative interventions in adults with RC calcific and noncalcific tendinopathy in the medium term to a very long term. Based on 4 high-quality RCTs, 4 moderate-quality RCTs, and 1 moderate-quality pilot study, the true effects remain unclear for pain and disability reductions.

II A systematic review with meta-analysis[178] reported that, based on low- to very low–certainty evidence (GRADE), long-duration ultrasound (8 minutes) significantly reduces pain (SMD, −1.32; 95% CI: −1.76, −0.89; 1 RCT; n = 100) and disability (SMD, −0.42; 95% CI: −0.82, −0.02; 1 RCT; n = 100) when compared to short-duration ultrasound (4 minutes) in adults with RC tendinopathy at an unspecified follow-up time. Based on very uncertain evidence, these effects for long-duration ultrasound may be large for pain and trivial to large for disability.

Also based on low- to very low–certainty evidence (GRADE), these authors reported that extracorporeal shockwave therapy significantly reduces pain (SMD, −0.39; 95% CI: −0.78, −0.01; 3 RCT; n = 117) but not disability (SMD, −0,27; 95% CI: −0.90, 0.35; 3 RCTs; n = 117) when compared to a sham intervention in adults with RC tendinopathy at an unspecified follow-up time. Based on very uncertain evidence, these effects for extracorporeal shockwave therapy may be trivial to moderate for pain. For disability, the nonsignificant CIs are large, and the true effects remain unclear.

Also based on low- to very low–certainty evidence (GRADE), these authors reported that laser therapy significantly reduces pain (SMD, −0.88; 95% CI: −1.48, −0.27; 3 RCTs; n = 128) but not disability (SMD, −0.67; 95% CI: −1.60, 0.25; 2 RCTs; n = 125) when compared to sham laser therapy in adults with RC tendinopathy at an unspecified follow-up time. Also, these authors note that laser therapy plus exercise significantly reduces pain (SMD, −0.65, 95% CI: −0.99, −0.31; 6 RCTs; n = 313) but not disability (SMD, 0.12, 95% CI: −0.24, 0.49; 4 RCTs; n = 190) when compared to sham laser therapy plus exercise in adults with RC tendinopathy at an unspecified follow-up time. Based on very uncertain evidence, these effects for laser therapy may be moderate to large for pain. For disability, the nonsignificant CIs are large, and the true effects remain unclear.

II A systematic review with a narrative synthesis[73] reported that, based on 1 acceptable-quality trial, low-frequency TENS significantly reduces pain just after the therapeutic treatment (1 RCT, n = 20) when compared to sham TENS in adults with RC tendinopathy. Neither the magnitude of the effect nor the CIs were reported.

In addition, these authors report that low-level laser therapy combined with exercise significantly reduces pain when compared to sham laser therapy with exercise (1 RCT, n = 20) in adults with RC tendinopathy at an unspecified follow-up time. It is also mentioned that low-level laser therapy combined with ultrasound, TENS, thermotherapy, and exercise significantly reduces pain when compared to the same intervention with sham laser therapy (1 RCT, n = 50) in adults with RC tendinopathy in the short term. Neither the magnitude of the effect nor the CIs were reported.

Two acceptable quality reviews included report that extracorporeal shockwave therapy is not effective for the treatment of noncalcific RC tendinopathy. Neither the magnitude of the effect nor the CIs were reported.

For RC calcific tendinitis, these authors found 5 acceptable-quality reviews and 1 high-quality review and note that these systematic reviews indicate that extracorporeal shockwave therapy is effective and safe to treat calcific tendinopathy after failed nonsurgical treatment, even though some adverse events were reported (all were resolved after a few days). Neither the magnitude of the effect nor the CIs were reported.

II A systematic review with narrative synthesis[176] reported that, for adults with calcific RC tendinopathy, high-energy extracorporeal shockwave therapy is superior than low-energy extracorporeal shockwave therapy in reducing pain and disability in the medium term (3 RCTs), high-energy extracorporeal shockwave therapy is superior than a sham intervention to reduce disability in the medium term (2 RCTs), and ultrasound-guided lavage or needling is superior than medium/high-energy extracorporeal shockwave therapy in reducing pain and calcification size in the long term (2 RCTs).

II A pairwise comparison from a network meta-analysis[198] reported that high-energy extracorporeal shockwave therapy significantly reduces pain (MD, −2.43/10; 95% CI: −3.48, −1.38; 4 RCTs) and disability on the Constant-Murley Score (MD, 17.43/100; 95% CI: 10.43, 24.42; 5 RCTs) when compared to low-energy extracorporeal shockwave therapy at an unspecified follow-up time in adults with chronic calcific RC tendinopathy.

II A systematic review with meta-analysis[28] reported that, based on very low–quality evidence (GRADE), laser therapy does not significantly reduce night pain (MD, −1.2/10; 95% CI: −4.09, 1.69; 1 RCT; n = 35) when compared to a placebo in adults with RC tendinopathy in the medium term. The nonsignificant CIs are large, and the true effects remain unclear for pain reductions.

Also based on very low–quality evidence (GRADE), extracorporeal shock wave therapy does not significantly reduce pain (MD, 0.17/10; 95% CI: −0.31, −0.03; 2 RCTs; n = 158) in the short to medium term and disability on the SPADI (MD, 5.0/100; 95% CI: −7.4, 17.4; 1 RCT; n = 74) in the medium term when compared to a placebo in adults with RC tendinopathy in the medium term. Based on very uncertain evidence, extracorporeal shock wave therapy is not more effective than placebo in reducing pain and disability. The CIs are below any clinically important differences for pain and below a trivial effect size for disability.

II A systematic review with meta-analysis[181] reported that, based on moderate-quality evidence (GRADE), extracorporeal shockwave therapy significantly reduces pain (MD −0.78/10; 95% CI: −1.4, −0.17; 9 RCTs and 1 quasi-randomized trial; n = 608) and disability (MD, −7.9/100; 95% CI: −14, −1.6; 9 RCTs or QRCT; n = 612) when compared to a sham intervention in

adults with a calcific or noncalcific RC tendinopathy in the medium term (sensitivity analyses suggest that there is no significant difference between adults with or without a calcification). Based on low-quality evidence (GRADE), it is unclear if shockwave therapy increased or reduced the risk of adverse event when compared to a sham intervention. It is likely that these effects for extracorporeal shockwave therapy may or may not be clinically important for pain and may be trivial for disability.

II A systematic review with narrative synthesis[185] notes that extracorporeal shockwave therapy reduced pain (2 RCTs, n = 137) and the calcification size (3 RCTs, n = 450) in patients with calcific RC tendinopathy in the medium to long term. The RCTs mentioned above all used a variety of different comparators for the control group. These authors also noted that it is unclear if extracorporeal shockwave therapy reduces pain or disability in patients with noncalcific RC tendinopathy (8 RCTs, n = 430) in the short to very long term. The RCTs mentioned above all used a variety of different comparators for the control group or no control group and one of these RCTs combined extracorporeal shockwave therapy with physical therapy for the experimental group.

III A systematic review with network meta-analysis[11] assessed the efficacy of several physical modalities for adults with RC tendinopathy. The authors concluded that laser therapy, acupuncture, and TENS are interventions with a high probability of being effective, but with very low certainty for most interventions.

Gaps in Knowledge At the moment, there is insufficient evidence and a lack of reviews and high-quality original studies to reach conclusions for the use of dry needling, TENS, pulsed electromagnetic fields, interferential currents, and iontophoresis.

Evidence Synthesis and Rationale Therapeutic ultrasound and extracorporeal shockwave therapy are not useful to reduce pain and/or disability in adults with RC noncalcific tendinopathy. Acupuncture and laser may be useful to reduce pain and/or disability in adults with RC tendinopathy. Therapeutic ultrasound and extracorporeal shockwave therapy, especially high-energy extracorporeal shockwave therapy, may be useful to reduce pain and/or disability in adults with RC calcific tendinopathy.

Recommendations

Recommendation No. 28

C Clinicians may use or recommend acupuncture in addition to an active rehabilitation program to reduce pain and disability in adults with RC tendinopathy.

Recommendation No. 29

C Clinicians should not use or recommend extracorporeal shock wave therapy to reduce pain and disability in adults with RC tendinopathy without calcification.

Recommendation No. 30

C Clinicians may use or recommend extracorporeal shock wave therapy to reduce pain and disability in adults with RC calcific tendinopathy.

Recommendation No. 31

C Clinicians may use laser therapy alone or in addition to an active rehabilitation program to reduce pain and disability in adults with RC calcific tendinopathy.

Recommendation No. 32

C Clinicians should not use or recommend therapeutic ultrasound alone or in addition to an active rehabilitation program to reduce pain and disability in adults with RC calcific tendinopathy.

Recommendation No. 33

B Clinicians should not use or recommend therapeutic ultrasound alone or in addition to an active rehabilitation program to reduce pain and disability in adults with RC noncalcific tendinopathy.

3.6 Ergonomic Interventions

Ergonomic interventions aim to prevent MSK injuries and disorders associated with various types of exposures such as awkward postures and repetitive motion. These interventions usually consist of the integration of compensatory tools and new equipment or workspace adaptations. The following section reports evidence on ergonomics for adults experiencing *shoulder pain*, and it may include adults with RC tendinopathy.

Overview

II Based on the CPG by Desmeules et al,[44] the use of ergonomic adaptations may be useful to reduce pain and disability in adults with shoulder pain. These results are based on 2 RCTs including participants with shoulder pain (n = 433).

II A Cochrane systematic review with meta-analysis[75] reported that, based on low-certainty evidence (GRADE), the use of an arm support with an alternative mouse significantly reduces pain and discomfort in the neck and shoulder (SMD, −0.41; 95% CI: −0.69, −0.12; 2 RCTs; n = 96) when compared to the use of a conventional mouse in office workers in the long term. However, based on low-certainty evidence (GRADE), the use of an alternative mouse alone does not significantly decrease neck and shoulder discomfort (SMD, 0.04; 95% CI: −0.26, 0.33; 2 RCTs; n = 96) when compared to the use of a conventional mouse in office workers in the long term. The evidence suggests that these effects for the use of an arm support with an alternative mouse may be trivial to moderate. The use of an alternative mouse alone is not more effective than the use of a conventional mouse for decreasing neck and shoulder discomfort. The CI is below any moderate effect size.

II A Cochrane systematic review with meta-analysis[75] reported that, based on low-certainty evidence (GRADE), the use of a sit-stand workstation does not significantly reduce pain and discomfort in the neck and shoulder (MD, −0.30/10; 95% CI: −1.69, 1.09; 1 RCT; n = 25) when compared to usual working conditions in

office workers in the short to medium term (8 weeks). The nonsignificant CI is large, and the true effects remain unclear.

II A Cochrane systematic review with meta-analysis[75] reported that, based on very low–certainty evidence (GRADE), the use of supplementary breaks significantly reduces shoulder or upper arm discomfort (MD, −0.33; 95% CI: −0.46, −0.19; 2 RCTs; n = 186) when compared to usual breaks in office workers in the short term. Based on very uncertain evidence, these effects for the use of supplementary breaks may or may not be clinically important for shoulder or upper arm discomfort.

Gaps in Knowledge Evidence is weak and sometimes contradictory on the effectiveness of ergonomic interventions to reduce pain and disability in people with RC tendinopathy, and more studies of high quality are needed. Most of the evidence identified conducted analyses in workers with neck and shoulder symptoms, which limits the ability to conclude on the specific effect of ergonomic interventions for pain and disability in people experiencing shoulder RC tendinopathy. There are also very few studies that have compared ergonomic interventions to a control intervention, which again limits interpretation of the results. To date, the ergonomic interventions identified in the literature mainly focus on computer workplace stations and include the use of arm support and ergonomic mouse in computer users. There is a lack of studies investigating the potential benefits or ergonomic interventions in other work environments or contexts for people with RC tendinopathy.

Evidence Synthesis and Rationale The use of ergonomic adaptations, including the adjustment of workplace station, ergonomic education, the use of ergonomic mouse and arm support in computer workplace stations, and the use of frequent short breaks, could be useful to reduce pain and disability in people experiencing RC tendinopathy. Evidence is, however, uncertain, and more studies of good quality are needed specific to that population.

Recommendation

Recommendation No. 34

C Clinicians may perform or recommend ergonomic adaptations to reduce occupational shoulder pain in adults.

SECTION 4 – RETURN TO SPORT FOR RC TENDINOPATHY

An important component for return to sport is the assessment of pain, disability, and the athlete's perception as to the readiness to return to sport.[6,37,162] When developing a return-to-sport program, the athlete's capacity and load tolerance for the RC muscles and tendons along with associated shoulder muscles and joints are considered.[162,193] This includes measures of muscle performance, ROM, coordination, and control. The trunk, pelvis, and lower extremities can also be evaluated as it is an important component in the kinetic chain in generating force for upper extremity sports.[193] Psychological readiness to return to sport, as well as the presence of psychosocial and contextual factors are also to be considered.[146,162]

Overview

II Based on 3 reviews,[27,124,160] RC tendinopathy is the first or second most common injury occurring in baseball and water polo. However, these 3 reviews[27,124,160] provided very limited evidence as to the factors to consider when working with an athlete to guide their return-to-sport activity. One review[27] found that in major league baseball players, the reinjury rate for RC tendinopathy was 1.6% to 2.6% but did not describe determinants associated with reinjury proportions.

Gaps in Knowledge None of the 3 reviews provided timelines for return to sport or factors (clinical, psychosocial, or contextual) that may impact return to sport. Moreover, there is no evidence as to the optimal set of patient-reported outcome tools, physical measures, and performance tests, or established criteria that should be used to guide the return to sport. As suggested in the Bern consensus,[162] evidence is needed to define the factors and determinants that are associated with successful return to sport in those with RC tendinopathy. There is a lack of evidence as to the specific shoulder-related factors as well as the kinetic chain factors that have the ability to guide the return to sport in an athlete with RC tendinopathy.

Evidence Synthesis and Rationale It is accepted that a comprehensive assessment of the athlete should include patient-reported outcome measures to assess the athlete's pain, functional limitations, disability, and psychosocial and contextual factors that can impact their perceived readiness to return to sport.[2] To guide clinicians, a group of researchers and experts through a Delphi study (not presented in the overview) recommends for various shoulder disorders, a measure of shoulder function specific to the RC such as the WORC (Western Ontario Rotator Cuff Index) or shoulder-specific such as the Pennsylvania Shoulder Score (Penn), and a measure of pain such as the numeric pain rating scale.[12] This Delphi consensus also recommends that measures of physical performance be used, such as the Closed Kinetic Chain Upper Extremity Stability Test (CKCUEST) that have established reliability and validity, and indicates that physical assessment of the shoulder and entire kinetic chain (ie, trunk, pelvis, and lower extremities) are indicated to determine return-to-sport readiness for shoulder MSK disorders.[12,41] The Bern consensus, a resource supporting the return-to-sport continuum of all level athletes with shoulder injuries, highlights 6 domains to consider: pain; active shoulder ROM; strength, power, and endurance; the entire kinetic chain; psychology; and return to sport–specific activities.[162]

Recommendations

Recommendation No. 35

F Clinicians may evaluate an athlete's capacity and load tolerance for the RC muscles and tendons

along with associated shoulder muscles and joints to develop a return-to-sport program.

Recommendation No. 36

F Clinicians may use reliable, valid, and responsive patient-rated outcome tools for pain, disability, psychosocial factors, or readiness to return to sport, along with functional performance measures to guide the return-to-sport continuum and determine timelines for return to sport. ◉

KEY POINTS

- Clinicians must incorporate a detailed history, physical examination, and identification of psychosocial factors when assessing patients with shoulder pain and suspected rotator cuff tendinopathy. Tools like inclinometer, goniometer, and validated patient-reported outcome measures should be used to ensure accurate diagnosis and monitoring.
- Nonsurgical interventions such as structured exercise programs (including motor control and resistance training) and manual therapy are recommended as initial treatment modalities to reduce pain and disability. Pharmacological treatments like nonsteroidal anti-inflammatory drugs or corticosteroid injections may be considered for short-term relief in specific cases.
- Developing a return-to-sport plan requires evaluating the athlete's capacity, psychosocial readiness, and specific physical performance measures. Patient-rated outcome tools and functional performance metrics are essential to guide timelines and determine readiness for return to sport.

STUDY DETAILS

AUTHOR CONTRIBUTION: F.D., J.S.R., S.L., M.C., and L.A.M. were responsible for the conception and design of the study; M.C. and S.L. were involved with the literature searches; M.C., T.V., M.O.D., F.D.u., and S.L. were involved with data extraction and risk-of-bias analysis; all authors contributed the elaboration of clinical recommendations and decision trees; all the authors were involved in the drafting of the manuscript; F.D. was responsible for obtaining project funding and takes responsibility for the integrity of the work as a whole; all authors have read and agreed to the published version of the manuscript.

DATA SHARING: Data are available from the corresponding author (F.D.) upon reasonable request. Interested individuals may contact him by email: f.desmeules@umontreal.ca.

PATIENT AND PUBLIC INVOLVEMENT: Eight patient partners who sought care for shoulder pain in Quebec, Canada (n = 3); Limerick, Ireland (n = 3); and California, USA (n = 2), participated in the recommendations revision of this clinical practice guideline.

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