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Review

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Review

Current and future advances in practice: tendinopathies of the shoulder

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Abstract

Tendinopathies of the shoulder are a burdensome problem. Current treatments include exercise, physical therapies, corticosteroid injections and surgery. However, the clinical outcomes from randomized controlled trials evaluating the effectiveness of these interventions are largely unremarkable. Given the apparent lack of progress in improving clinical outcomes for patients, it is appropriate to consider other avenues. Research has identified a link between lifestyle-related modifiable risk factors, including smoking, overweight and physical inactivity, and the onset and persistence of tendinopathies of the shoulder. Further research is required to understand whether addressing these factors results in better clinical outcomes for patients. Teachable moments and shared decision-making are concepts that could enable clinicians to integrate the assessment and management of these lifestyle factors. Given that these lifestyle factors also increase the risk of developing other common morbidities, including cardiovascular disease, an evolution of routine clinical care in this way could represent an important step forwards.

Lay Summary

What does this mean for patients?

Disorders of the muscles and tendons of the shoulder are common and can be very painful. Treatments include exercise, injections and surgery. But many people with this condition do not respond well to those treatments and complain of ongoing shoulder pain and disability. More recent research has identified links between lifestyle, including smoking, being overweight and not moving enough, and painful disorders of the muscles and tendons of the shoulder. When people complain of painful disorders of the muscles and tendons, it might be helpful to consider these lifestyle factors rather than focusing on the muscles and tendons themselves.

Keywords: tendinopathy, shoulder, rotator cuff, exercise, rehabilitation, corticosteroid, surgery, risk factors, lifestyle, review.

Key messages

- Shoulder tendinopathies are refractory to current treatments or the passage of time for many.
- Modifiable lifestyle-related risk factors, including smoking, overweight and physical inactivity, warrant further consideration.
- Teachable moments and shared decision-making can help clinicians integrate consideration of these lifestyle factors.

Introduction

Annually, ~1% of adults >45 years of age consult with a new episode of shoulder pain [1]. Tendinopathies of the shoulder account for ~70% of cases, causing substantial pain and adversely affecting quality of life [1]. Half of patients report ongoing symptoms 2 years after onset, suggesting that, for many, this clinical presentation is refractory to current treatments and the passage of time [2].

Tendinopathies of the shoulder have been on somewhat of a journey over the last 30 years, albeit a circular one [3], from the label supraspinatus tendinitis in the 1990s, implying an inflammatory cause, to supraspinatus tendinosis in the 2000s, implying a soft tissue degeneration cause, tendinopathy more recently, implying unknown cause, and then the re-emergence of the inflammatory pathoaetiological model [4]. Interspersed with the various non-specific pain syndrome labels, including subacromial pain syndrome, the changing nomenclature reflects the lack of progress with understanding.

As the nomenclature narrative has journeyed along, it is apparent that the pathoaetiology of tendinopathies of the shoulder remains poorly understood [4]. In this context of inconsistent and uncertain labelling and pathoaetiology, a range of treatments have been proposed and tested, including various medications, injections, exercise, physical therapies and surgeries [5]. This range of treatments with potentially different mechanisms of action have largely resulted in

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unremarkable clinical outcomes for patients [6–9]. It is perhaps unsurprising that we are observing these unremarkable clinical outcomes with such uncertain pathoaetiology and mechanisms of actions of many of the treatments, particularly the most prescribed treatment, exercise [4, 10].

Given this, and the number of already published reviews on shoulder and rotator cuff tendinopathies, how might another review be helpful? Well, despite this circular journey and considerable uncertainty, it is apparent that the tendinopathy world, clinicians and researchers, have largely remained focused on shoulder tendinopathy as an isolated clinical diagnosis. The resultant treatments, particularly injections, exercise and surgery, remain focused on specific tissues. Given our astounding lack of progress in improving clinical outcomes for patients, we now need to be open to exploring other mechanisms of onset, persistence of symptoms, and treatment options. Hence, the purpose of this review is twofold. First, we provide a review of the literature to set the scene by highlighting the unremarkable clinical outcomes for patients from current treatments; we have to recognize this as a stimulus for evolving our thinking. Second, we provide a prompt to broaden perspectives through exploration of the role of lifestyle and potentially modifiable risk factors as key issues to consider in the assessment, diagnosis, management and future research for people with shoulder tendinopathy. Along with this, we will introduce the concepts of teachable moments and shared decision-making to aid clinicians in this venture.

Effectiveness of current treatments

Defining the clinical presentation

For the purpose of clear communication throughout this review, when referring to tendinopathies of the shoulder, we are describing people who typically complain of shoulder pain around the anterior and/or lateral deltoid region. According to our definition, people with tendinopathies of the shoulder will have a largely maintained range of shoulder movement but will report that their pain is reproduced through active and/or resisted movements, for example shoulder flexion or abduction, more than passive movement. Lifting with the shoulder or lying on the affected side will usually aggravate the familiar shoulder pain. Imaging is not required to confirm this clinical diagnosis. Others might choose to include further clinical tests as part of their examination, including Speed's test, Hawkins–Kennedy impingement tests, for example, and might use diagnostic terms including bicipital tendinitis, subacromial impingement syndrome, rotator cuff tendinopathy, subacromial pain syndrome etc. However, for the purpose of this review, we are regarding additional tests as unnecessary and suggest that the wide range of different terms do not add value or facilitate understanding or communication, hence they will be grouped under the term tendinopathies of the shoulder.

Treatment guidelines for tendinopathies of the shoulder [10], based on weak evidence and clinical opinion, previously recommended physiotherapy and/or corticosteroid (CS) injection as first-line treatment, which is where this review will begin.

Effectiveness of exercise and physical therapies

To evaluate these treatment guidelines, the GRASP randomized controlled trial [6] recruited 708 adults from the UK NHS with rotator cuff disorders and compared: (i) one session of best practice physiotherapy [face-to-face (60 min); shoulder examination, advice booklet and exercise programme] without a CS injection; (ii) one session of best practice physiotherapy with a CS injection; (iii) up to six sessions of progressive exercise supported by physiotherapist without a CS injection; and (iv) up to six sessions of progressive exercise supported by physiotherapist with a CS injection. Participants in all groups improved over time, but six sessions with a physiotherapist did not confer additional benefit over one session, and CS injection provided no benefit over 12 months. However, we must be cognisant that, in the absence of a no-treatment control group, the improvements over time could be explained by natural history and other non-specific effects rather than being attributable to any specific effects of the treatment [11].

Further weight is added to this suggestion via a Cochrane systematic review that examined the effectiveness of manual therapy combined with exercise *vs* placebo, no intervention or any other control intervention for people with rotator cuff disorders/tendinopathies of the shoulder [12]. Only one randomized controlled trial ($n = 120$) comparing manual therapy combined with exercise *vs* placebo (inactive US therapy) was identified and included in the systematic review [8]. No clinically important differences in shoulder pain and disability were reported up to the final follow-up point at 6 months [8, 12].

This lack of comparative treatment effectiveness reported in the GRASP trial and Cochrane systematic review is apparent in other common musculoskeletal conditions and provides further justification to look beyond isolated tissues or tendons. Miller *et al.* [13] undertook a systematic review evaluating the effects of exercise-based treatments *vs* true control (no treatment or wait-and-see) or usual care (general practitioner care but not physical therapies etc.) for people with chronic musculoskeletal pain conditions. Their systematic review concluded that exercise-based treatments were more effective than true control or usual care; however, the clinical importance of this difference is unclear. The quality of evidence was considered very low, there was risk of publication bias, and cost–effectiveness analyses were absent. It is also apparent that there is a dearth of high-quality, adequately powered randomized controlled trials with mid- to long-term follow-up.

Effectiveness of CS injections

CS injections can be offered in isolation or in combination with exercise or other physical therapies, as described above. Mohamadi *et al.* [9] undertook a systematic review and meta-analysis that included data from 726 patients with rotator cuff tendinopathy. They concluded that CS injections offer transient pain relief in a small number of patients but do not positively change the natural history of tendinopathies of the shoulder. Mohamadi *et al.* [9] suggest that, given limited clinical effect and the potential to accelerate tendon degeneration, CS injections have limited appeal.

The limited effectiveness of CS injections for tendinopathies of the shoulder has been attributed to suboptimal modes of delivery. Most injections are offered using surface landmarks to guide needle placement, otherwise known as blind injections, in comparison to what has been referred to as gold-standard, image-guided injections [14]. Roddy *et al.* [14], in their factorial randomized controlled trial evaluating physiotherapist-led exercise *vs* an exercise leaflet, and US-

guided subacromial CS injection *vs* unguided injection, concluded that US guidance confers no additional benefit over unguided CS injection. The results from this trial somewhat challenged the notion of superior outcomes from image-guided CS injections and validated the conclusions of Mohamadi *et al.* [9]. Although Roddy *et al.* [14] reported superior clinical outcomes in favour of physiotherapist-led exercise *vs* an exercise leaflet, this was at only one outcome time point (6 months) and was of marginal clinical significance. This is an important consideration given the time and cost associated with training of physiotherapists and attendance at appointments by patients.

Effectiveness of surgery

Typically, following exercise, CS injections and other physical therapies, if pain and disability associated with tendinopathies of the shoulder remain unacceptable to the patient, then surgery might be considered [7, 10]. Beard *et al.* [7] undertook a randomized controlled trial ($n = 313$) comparing arthroscopic subacromial decompression, investigational arthroscopy only, without bone or soft tissue removal, and no treatment. They concluded that arthroscopic subacromial decompression and investigational arthroscopy only resulted in better clinical outcomes for patients compared with no treatment, but this difference was not clinically important. Given the extra time, cost and burden of surgery, this lack of clinical importance is an important finding. Additionally, arthroscopic subacromial decompression did not confer any extra benefit over investigational arthroscopy alone, which led Beard *et al.* [7] to conclude that the difference between the surgical groups and no treatment might be attributable to placebo, and any change in pain and/or function over time might be attributable to natural history.

Thus, it can be seen that the comparative effects of current treatments, including exercise, physical therapies, CS injections and surgery, are largely unremarkable, with no consistent difference in clinical outcomes between active treatments. Furthermore, when tested against placebo or natural history, a similar picture emerges, with a lack of clinically significant outcomes, even with the most invasive and expensive interventions. As a result, tendinopathies of the shoulder continue to present a significant burden to individuals suffering, health services and society more broadly.

It is this research evidence that we believe should be a stimulus to think differently about tendinopathies of the shoulder. Evidence to date suggests that this clinical condition is largely refractory to current treatment approaches, including exercise, physical therapies, injections and surgery. It is apparent that any changes we observe in clinical status for people with tendinopathies of the shoulder might be attributed to the placebo effect and/or the passage of time rather than specific treatment effects.

Modifiable risk factors and the relevance of lifestyle in shoulder tendinopathies

A risk factor is something that increases the chance of developing a condition such as tendinopathy of the shoulder. Risk factors can be modifiable or non-modifiable, and knowledge of such factors might guide treatment prescription. Non-modifiable risk factors including increasing age, sex and, to an extent, working practice, i.e. repeated working above shoulder height, have been reported, but such knowledge might be regarded as being of limited interest if the factor cannot be changed or targeted with treatment [15].

Although most contemporary treatments focus on local issues, tissues and tendon, there is a developing body of research evidence highlighting the role of lifestyle factors in relationship to the onset and persistence of tendinopathies of the shoulder.

Bishop *et al.* [16], in their systematic review, retrieved 13 studies including 16 172 patients and reported that smoking is positively correlated with shoulder pain, disability and the presence of rotator cuff tears. These findings were corroborated by Rechardt *et al.* [17] in their population-based cross-sectional study including 6237 people. They reported that smoking, waist circumference and waist-to-hip ratio were related to an increased prevalence of shoulder pain in both sexes. Viikari-Juntura *et al.* [18], in their systematic review, aimed to assess whether there was any association between risk factors relating to atherosclerosis and shoulder pain/disorders. Aligned with the findings of Rechardt *et al.* [17], they reported consistent association between diabetes and shoulder disorders, some associations for weight-related factors, in addition to a possible preventive effect of physical exercise. In the context of these findings, Viikari-Juntura *et al.* [18] suggested a metabolic pathophysiological process underlying shoulder disorders, possibly linked with systemic inflammation as an underlying mechanism. Likewise, Wendleboe *et al.* [19], in their case–control study with 311 participants, reported an association between obesity and shoulder repair surgery in men and women and concluded that increasing BMI is a risk factor for tendinopathies of the shoulder.

In their cross-sectional study with 1226 participants, Applegate *et al.* [20] aimed to evaluate possible associations between risk factors for cardiovascular disease and rotator cuff tendinopathy. They reported that individual risk factors, including hypertension, were associated with rotator cuff tendinopathy. However, combined cardiovascular risk factors, including cholesterol levels, hypertension and diabetes, demonstrated a strong correlation with rotator cuff tendinopathy. These findings support those of the previously cited work and led Applegate *et al.* to conclude that their results suggest a potentially modifiable disease mechanism.

Despite this emerging evidence, it is apparent that assessing and then managing relevant lifestyle factors alongside musculoskeletal pain conditions, including tendinopathies of the shoulder, is a departure from routine for many clinicians. In the context of uncertainty and time pressures, the concepts of teachable moments and shared decision-making, for individuals and populations, might be helpful and are thus introduced and discussed in the next section.

Teachable moments and shared decision-making

If lifestyle factors can indeed impact the development of tendinopathies of the shoulder, then promoting relevant lifestyle modification might be useful for secondary prevention at the individual level. Incorporating relevant behaviour change messaging into routine clinical consultations might, therefore, represent one approach to preventing and managing tendinopathies of the shoulder without increasing current care costs. The term teachable moments has been applied to health behaviour change messaging that leverages relevant features of a patient's circumstances to create persuasive advice. In other

words, a patient's current health concern (for which they are seeking treatment) can be linked to an undesirable health behaviour, such as smoking or physical inactivity, and used to promote a change to this behaviour. Cohen *et al.* [21] have identified three key communication features of a teachable moment: (i) talk that links a patient's current health concern to the health risk factor or undesirable behaviour; (ii) talk that is designed to motivate the patient to change the undesirable behaviour; and (iii) a patient response that indicates engagement and a commitment to changing the undesirable behaviour.

Teachable moments are created through the interaction between patients and clinicians [22] and seek to contextualize behaviour-change conversations in ways that are meaningful to patients. Adopting this approach when patients present with shoulder pain might, therefore, offer an alternative to current treatments and allow a more holistic approach to management of tendinopathies of the shoulder.

As we have discussed, tendinopathies of the shoulder appear to be largely refractory to treatment, yet interventions such as exercise, physical therapies, CS injections and surgery are still commonly offered, arguably without adequate explanation of the uncertainty about their effectiveness. Supporting patients to understand this uncertainty and select the most appropriate treatment option for them is, therefore, a key responsibility of the treating clinician. Shared decision-making in health care is a collaborative process between the patient and clinician that allows patients to reach a decision about their treatment. A robust shared decision-making process brings together the expertise of the clinician in relationship to the treatment options available (including evidence of the effectiveness, risks and benefits of each option) along with the preferences, personal circumstances, values and beliefs of the patient [23]. Best practice in shared decision-making involves communicating any existing uncertainty about the effectiveness of available treatments and, importantly, explaining what would happen if the condition were left untreated [23, 24]. Given this, discussions about the limited effectiveness of common treatments for tendinopathies of the shoulder and the potential benefit of lifestyle modification would align with best practice in this context.

For the clinician to contextualize teachable moments and shared decision-making to the setting of managing tendinopathies of the shoulder, it might be appropriate to consider integrating the following questions and discussions into consultations. When a patient presents with shoulder pain, the clinician could ask, 'Did you know that your shoulder pain could be linked with smoking, being overweight, being physically inactive [as/if applicable]? Is this something you would be open to discussing further? If so, could we agree a goal to, for example, increase your levels of physical activity?'. This teachable moment could be aligned with a shared decision-making process whereby clinicians might open with, 'There are a range of treatment options open to you, including exercise, steroid injections, changes to your lifestyle, or waiting to see how your shoulder pain changes over time. The evidence we have suggests that there is no clear best treatment, so it is important that we talk about the benefits, harms and costs of each treatment, including the passage of time, to ensure that you make the best choice for you at this point in time.'. We recognize that by highlighting current clinical uncertainty and the lack of superiority of current treatments over the passage of time, this might be perceived unfavourably by patients and/or clinical colleagues. However, through our patient consultations we consistently find that patients are empowered and request full and honest disclosure about the benefits, or otherwise, of the treatment options available to them.

Research and future avenues for development

Conceptualizing tendinopathies of the shoulder, and other common musculoskeletal disorders and chronic conditions, as isolated clinical entities aligns with current specialization and medical segregation, and appeals owing to the potential simplicity in the context of time and other pressures evident in current clinical practice, yet such an approach risks a disservice to our patients. In this clinical area, as in other areas, much remains unknown, and we are working in a situation of considerable uncertainty, although that is often not well recognized. Key areas for future advancement include developing a clear understanding of any clinically important benefits of current treatments over and above the effects of natural history or the passage of time. In tandem with this knowledge, which must be gleaned through high-quality research, an understanding of the optimal ways to integrate assessment and management of modifiable risk factors, particularly lifestyle-related factors that appear to be important contributors to the onset and persistence of tendinopathies of the shoulder, into clinical practice is needed. Integrating the concepts of teachable moments and true shared decision-making between patients and clinicians appears to be one way of achieving this. Hence, future studies could usefully compare current treatments, such as exercise, with approaches that identify and address relevant lifestyle factors, including overweight/obesity, smoking and physical inactivity, in comparison to current treatments alone and/or natural history.

Conclusion

Tendinopathies of the shoulder remain a burdensome problem and, for many people, the condition is refractory to current treatments or the passage of time. The comparative effects of current treatments, including exercise, physical therapies, CS injections and surgery, which focus largely on isolated management of tendon disorders, are unremarkable. However, there is a growing body of evidence that highlights relevant modifiable risk factors, particularly related to lifestyle, that warrant further consideration. In the context of limited meaningful progress in improving clinical outcomes for patients, this research is a stimulus to challenge current models of thinking and consider the potential impact of lifestyle factors in the assessment and management of people with tendinopathies of the shoulder. In the context of such considerable clinical and research uncertainty, clinicians can use teachable moments and shared decision-making to navigate this challenging area with their patients. Relevant modifiable risk factors for tendinopathies of the shoulder, including smoking, obesity, physical inactivity and hypertension, that are shared with other morbidities, including diabetes, cardiovascular disease and cancer, suggest that there could be important links between major disease areas that we are not recognizing adequately.

Data availability

This is an invited review. No further data are available.

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References

1. Mitchell C, Adebajo A, Hay E, Carr A. Shoulder pain: diagnosis and management in primary care. BMJ 2005;331:1124–8.
2. Linsell L, Dawson J, Zondervan K *et al.* Prevalence and incidence of adults consulting for shoulder conditions in UK primary care; patterns of diagnosis and referral. Rheumatology 2006;45:215–21.
3. Littlewood C, Bateman M, Connor C *et al.* Physiotherapists' recommendations for examination and treatment of rotator cuff related shoulder pain: a consensus exercise. Physiother Pract Res 2019;40:87–94.
4. Dean B, Gwilym S, Carr A. Why does my shoulder hurt? A review of the neuroanatomical and biochemical basis of shoulder pain. Br J Sports Med 2013;47:1095–104.
5. Littlewood C, Malliaras P, Chance-Larsen K. Therapeutic exercise for rotator cuff tendinopathy: a systematic review of contextual factors and prescription parameters. Int J Rehabil Res 2015;38: 95–106.
6. Hopewell S, Keene DJ, Marian IR *et al.*; GRASP Trial Group. Progressive exercise compared with best practice advice, with or without corticosteroid injection, for the treatment of patients with rotator cuff disorders (GRASP): a multicentre, pragmatic, 2 × 2 factorial, randomised controlled trial. Lancet 2021;398:416–28.
7. Beard DJ, Rees JL, Cook JA *et al.*; CSAW Study Group. Arthroscopic subacromial decompression for subacromial shoulder pain (CSAW): a multicentre, pragmatic, parallel group, placebo-controlled, three-group, randomised surgical trial. Lancet 2018; 391:329–38.
8. Bennell K, Wee E, Coburn S *et al.* Efficacy of standardised manual therapy and home exercise programme for chronic rotator cuff disease: randomised placebo controlled trial. BMJ (Clin Res Ed) 2010; 340:c2756.
9. Mohamadi A, Chan JJ, Claessen FMAP, Ring D, Chen NC. Corticosteroid injections give small and transient pain relief in rotator cuff tendinosis: a meta-analysis. Clin Orthop Relat Res 2017; 475:232–43.
10. Kulkarni R, Gibson J, Brownson P *et al.* BESS/BOA patient care pathways: subacromial shoulder pain. Shoulder Elbow 2015;7: 135–43.
11. Buchbinder R, Haas R. Optimising treatment for patients with rotator cuff disorders. Lancet 2021;398:369–70.
12. Page MJ, Green S, McBain B *et al.*; Cochrane Musculoskeletal Group. Manual therapy and exercise for rotator cuff disease. Cochrane Database Syst Rev 2016;2016:CD012224.
13. Miller CT, Owen PJ, Than CA *et al.* Attempting to separate placebo effects from exercise in chronic pain: a systematic review and meta-analysis. Sports Med 2022;52:789–816. 27
14. Roddy E, Ogollah RO, Oppong R *et al.* Optimising outcomes of exercise and corticosteroid injection in patients with subacromial pain (impingement) syndrome: a factorial randomised trial. Br J Sports Med 2021;55:262–71.
15. Littlewood C, May S, Walters S. Epidemiology of rotator cuff tendinopathy: a systematic review. Shoulder Elbow 2013;5:256–65.
16. Bishop JY, Santiago-Torres JE, Rimmke N, Flanigan DC. Smoking predisposes to rotator cuff pathology and shoulder dysfunction: a systematic review. Arthroscopy 2015;31:1598–605.
17. Rechardt M, Shiri R, Karppinen J *et al.* Lifestyle and metabolic factors in relation to shoulder pain and rotator cuff tendinitis: a population based study. BMC Musculoskelet Disord 2010;11:165.
18. Viikari-Juntura E, Shiri R, Solovieva S *et al.* Risk factors of atherosclerosis and shoulder pain-is there an association? A systematic review. Eur J Pain 2008;12:412–26.
19. Wendelboe AM, Hegmann KT, Gren LH *et al.* Associations between body-mass index and surgery for rotator cuff tendinitis. J Bone Joint Surg Am 2004;86:743–7.
20. Applegate KA, Thiese MS, Merryweather AS *et al.* Association between cardiovascular disease risk factors and rotator cuff tendinopathy: a cross-sectional study. J Occup Environ Med 2017;59: 154–60.
21. Cohen DJ, Clark EC, Lawson PJ, Casucci BA, Flocke SA. Identifying teachable moments for health behavior counseling in primary care. Patient Educ Couns 2011;85:e8–15.
22. Flocke SA, Clark E, Antognoli E *et al.* Teachable moments for health behavior change and intermediate patient outcomes. Patient Educ Couns 2014;96:43–9. Jul
23. Hoffmann T, Bakhit M, Michaleff Z. Shared decision making and physical therapy: what, when, how, and why? Braz J Phys Ther 2022;26:100382.
24. Elwyn G, Durand MA, Song J *et al.* A three-talk model for shared decision making: multistage consultation process. BMJ 2017;359: j4891.