



CURRENT EVIDENCE AND FUTURE DIRECTIONS IN EXERCISE –BASED MANAGEMENT OF SUBACROMIAL IMPINGEMENT SYNDROME: A NARRATIVE REVIEW

Physiotherapy

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ABSTRACT

Background: Subacromial Impingement Syndrome (SAIS) is a leading cause of shoulder pain and functional limitation, primarily managed through conservative, exercise-based interventions. Over the past few years a growing research proved the role of various exercise interventions in modulating symptoms and restoring function. However, inconsistencies in clinical approaches and variability in outcomes warrant a critical evaluation of the current evidence and identification of future directions. **Objective:** This narrative review aims to summarize and appraise the existing literature on exercise-based management of SAIS, including the effectiveness of specific exercise types such as motor control, neuromuscular training, and strength-based protocols. **Methods:** A narrative review approach was used to synthesize findings from peer-reviewed articles, clinical guidelines, and systematic reviews published in literature. Sources were identified through searches in PubMed, Scopus, and Google Scholar, focusing on exercise-based interventions for SAIS. **Results:** Current evidence supports exercise therapy as the mainstay of SAIS management, mainly the protocols that focus on scapular stabilization, rotator cuff strengthening, and proprioceptive training. Although there is evidence to suggest exercise interventions can reduce shoulder impingement symptoms, there is minimal evidence of these interventions changing movement patterns of the shoulder complex. There are many varieties of exercises with different rationale and techniques. Many of the exercise programs do not provide adequate information of what and why interventions are used. **Conclusion:** Future research should prioritize high-quality trials with standardized protocols, long-term follow-up, and structured exercise programs tailored to treat patient-specific structural impairments leading to functional impairments to improve functional performance.

KEYWORDS

Sub acromial impingement syndrome, exercise therapy, motor control, shoulder pain, strength training.

INTRODUCTION

Shoulder pain is the second most common problem among the general population reporting musculoskeletal pain. The pain is often of long duration and only 50% of patients report recovery after 18 months. Subacromial impingement syndrome (SAIS) is responsible for 44% to 60% of medical consultations related to shoulder pain with an approximate prevalence of 70-200 per 1000 adults, which implies a remarkable use of health care resources.¹

SAIS refers to the pain that arises when structures in the sub acromial space primarily the rotator cuff tendons and the sub acromial bursa are impinged between the humeral head and the acromion mainly during arm activity above the horizontal plane.² This syndrome is a multifactorial condition where intrinsic and extrinsic mechanisms of rotator cuff pathology are the two main factors.

The Pathomechanics of SAIS result from a combination of tissue inflammation, muscle dysfunction, postural abnormalities, and faulty movement patterns during daily and recreational activities.³ These factors collectively disrupt normal shoulder biomechanics, contributing to pain, dysfunction, and compromised movement quality.⁴ Understanding these mechanisms is essential for designing effective exercise programs targeting the underlying causes of SAIS. Correction of scapular alignment with respect to scapulothoracic and glenohumeral mechanism with diagnosing the cause and identifying the source or affected structure is of utmost importance.^{5,6}

Conclusions from various systematic reviews suggest that physiotherapy interventions, combining different methods or techniques like manual therapy, and electrotherapy seem to be of additional benefit. Numerous systematic reviews have been undertaken in relation to the various plausible interventions including exercise and multimodal physiotherapy, but many are emphasizing on strengthening exercise program.⁵

All the meta-analysis conclude that strengthening and endurance exercises are recommended but the type of exercises are not mentioned and not much emphasis on regaining scapular and thoracic spine motor control. Many of the exercise programs do not provide adequate information of what and why interventions are used. There are many varieties of exercises with different rationale and techniques.⁷

This demands continued research on well-designed structured exercise programs in detail considering content, dosage and progression to

guide treatment for patients with sub acromial pain.

This narrative review aims to provide a comprehensive synthesis of the current understanding of SAIS and evidence-based rehabilitation strategies. Special emphasis is placed on regaining motor control, neuromuscular efficiency, and progressive strengthening as main pillars of conservative management.

METHOD:

A narrative review approach was used to synthesize findings from peer-reviewed articles, clinical guidelines, and systematic reviews published in English. Sources were identified through searches in PubMed, Scopus, and Google Scholar, Science Direct focusing on exercise-based interventions for SAIS.

The related keywords included sub acromial impingement syndrome, shoulder impingement, structured exercise protocols, rehabilitation, scapular dyskinesia, neuromuscular training and motor control exercises. The selection process of the articles was: full-text articles from peer reviewed journal, cross-sectional, meta- analysis and systematic review studies and the articles whose title being related to the topic i.e., exercise protocols in subacromial impingement syndrome. The Studies focusing exclusively on surgical interventions, case reports or single-patient case studies, non-English language articles, studies on impingement secondary to systemic or traumatic causes were excluded from the study. Relevant data was extracted independently and summarized narratively.

Key Aspects Analyzed Included: Type and structure of exercise intervention, Duration and frequency of treatment, Primary outcomes mainly pain, range of motion, functional tests, clinical effectiveness and limitations. Evidence was synthesized thematically under the domains of pathophysiological rationale for exercise in SAIS, types of exercise interventions, prescription of exercises clinical and research gaps and future directions with innovations.

Table 1: Studies Related To Exercise-based Interventions For SAIS.

Referen ce	Study Type	Title	Results	Conclusion
Louise Pieters et al	Systema tic Review	An update of systematic reviews	As multimodal physical therapy can cover a wide	Ongoing research is necessary to

(2020)		examining the effectiveness of conservative physical therapy interventions for subacromial shoulder pain	range of different treatment modalities, a clear and well-considered selection should be made to determine which treatment modalities should be used in addition to exercise therapy.	identify whether there is an optimal dose and type of exercise
Abdulla et al. (2015)	Systematic Review	Is exercise effective for the management of subacromial impingement syndrome and other soft tissue injuries of the shoulder?	Supervised progressive shoulder exercises (strengthening/stretching) improved pain and function in short- and long-term follow-up.	Exercise is a highly recommended first-line treatment for SAIS.
Bury et al. (2016)	Systematic Review	Effectiveness of scapula-focused approaches in patients with rotator cuff-related shoulder pain	Scapula-focused exercises outperformed generalized approaches in pain and function at 4–6 weeks.	Scapular-focused exercise programs are recommended for short-term improvement.
Desjardins-Charbonneau et al. (2015)	Systematic Review	The efficacy of manual therapy for rotator cuff tendinopathy	Manual therapy combined with exercise reduced short-term pain but had unclear effects on function.	Manual therapy is a beneficial adjunct to exercise for pain relief.
Goldgrub et al. (2016)	Systematic Review	The effectiveness of multimodal care for soft tissue shoulder injuries	Multimodal therapy (e.g., exercise + manual therapy + modalities) had minor, non-clinically significant benefits.	Multimodal therapy is not superior to isolated evidence-based interventions (e.g., exercise).
Saito et al. (2018)	Systematic Review	Scapular-focused interventions to improve shoulder pain and function in adults with subacromial pain	Scapular-focused exercises improved pain and function at 4 weeks.	Scapular rehabilitation is effective in the short term and should be included in exercise programs.
Bennell et al. (2010)	RCT	Efficacy of standardised manual therapy and home exercise programme for chronic rotator cuff disease	Manual therapy + exercise reduced pain and improved function vs. placebo at 22 weeks. No difference in strength.	Combined manual therapy and exercise is beneficial, but exercise alone may suffice.
Bayattork et al. (2021)	RCT	Scapular Proprioceptive Training Added to Conventional Therapy	Significant improvements in pain, function, and scapular control at 8 weeks vs. conventional therapy alone.	Proprioceptive training enhances outcomes by improving neuromuscular control.
Barrett, E. et al. (2016)	systematic review	Is thoracic spine posture associated with shoulder pain,	There is a strong level of evidence that maximum shoulder ROM is	Higher quality research is warranted to

		range of motion and function?	greater in erect postures compared to slouched postures ($p < 0.001$), in people with and without shoulder pain.	fully explore the role of thoracic posture in shoulder pain.
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DISCUSSION:

The current literature confirms that exercise therapy is the principal component of conservative management for Subacromial Impingement Syndrome (SAIS). Most of the included studies reported the interventions which focus on scapular stabilization, rotator cuff strengthening, and neuromuscular re-education.^{4, 9} Scapular-focused exercises demonstrated short-term improvements in pain and shoulder function compared to conventional protocols. Similarly, incorporating the proprioceptive and motor control training improved neuromuscular coordination and symptom modulation.^{10,11}

Current evidence for the physiotherapeutic treatment of SIS, summarized in systematic reviews through the last years, supports the specific and structured exercise program. Furthermore, these studies used either different types of exercises in their groups as a basic treatment, or applied a set of manual techniques to all patients without considering the individual situation of the patient. Reasons for the selection or the combination of the exercises or the manual techniques used varied considerably between studies, were not explained and thus remained unclear.^{12,13,14}

The multimodal approaches like combining manual therapy, modalities, and exercise were common, they did not consistently yield superior outcomes when compared to exercise therapy alone. High-quality randomized controlled trials with clearly defined protocols are very limited.

Postural dysfunctions of the cervical and thoracic spine significantly influence scapulothoracic and glenohumeral kinematics. These changes alter the mechanics of the shoulder complex, predisposing the subacromial space to narrowing and impingement.

The limited emphasis on the thoracic spine and its influence on scapulothoracic and glenohumeral coordination—factors that may contribute to persistent dysfunction if left unaddressed.¹⁴

Recent systematic review and meta-analysis concluded that continued research is needed to more fully understand the uncertainty around the optimal type, dose, and duration of exercise for sub-acromial shoulder pain. Thus, nearly all systematic reviews emphasize the need for more high-quality trials of physiotherapy interventions to optimize the dosimetry of exercise program.^{15, 16} Also, there was limited evidence supporting long-term changes in shoulder biomechanics or altered movement patterns with thoracic spine dysfunction and lumbo-pelvic muscles integrations.

Through this review we conclude that role of exercise therapy in the management of SAIS should emphasize on correction of altered scapular mechanics, regaining motor control of glenohumeral joint and to improve neuromuscular efficiency of glenohumeral and scapulothoracic muscles. The integration of kinetic chain, motor control strategies and correction of trunk mechanism has very important role in addressing dysfunctional movement patterns commonly observed in SAIS.¹⁷

The review also highlights the insufficient long-term follow-up in many trials. Although short-term pain reduction and functional improvements are well documented, the sustainability of these outcomes and their correlation with kinematic restoration remain unclear, hence difficult to replicate in the clinical practice. Individualized exercise programs that address patient-specific impairments and provide a progressive framework are necessary for optimal results.

There is a need for well-designed structured exercise program in detail considering content, dosage and progression to guide treatment for patients with sub acromial pain. This demands developing a specific guidance on how exercise interventions should be reported in clinical trials depending on what structure is affected in intrinsic and extrinsic

mechanisms of subacromial impingement syndrome.

Rehabilitation, 13, 84. <https://doi.org/10.1186/s13102-021-00305-6>.

CONCLUSION

Exercise therapy remains the mainstay of conservative treatment for subacromial Impingement syndrome. Evidence supports the use of protocols that emphasize scapular and rotator cuff muscles strengthening and endurance training. However, the current literature shows significant heterogeneity and a lack of standardized, individualized exercise protocols.

To bridge this gap, future studies must prioritize the development and validation of structured exercise programs tailored to specific biomechanical impairments.

The structured exercise program should be designed based on the assessment of structural impairments and contextual factors contributing to functional impairments in individuals with subacromial impingement syndrome (SAIS). It must incorporate the identification of the specific phase of tissue healing to optimize the exercise program. Furthermore, it should aim to enhance neuromuscular efficiency in associated structures affected by dysfunction, including scapulothoracic mechanics, as well as trunk and thoracic mechanism. A more precise, exercise prescription will prevent the need for surgery and it will help the patients to regain the shoulder functions and improve the physical activities as well as quality of life.

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