





Scoping Review

Identifying Conservative Interventions for Individuals with Subacromial Pain Syndrome Prior to Undergoing a Subacromial Decompression: A Scoping Review

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Background

Subacromial decompression (SAD) surgery remains a common treatment for individuals suffering from subacromial pain syndrome (SAPS), despite numerous studies indicating that SAD provides no benefit over conservative care. Surgical protocols typically recommend surgery only after exhausting conservative measures; however, there is no consensus in the published literature detailing what constitutes conservative care “best practice” before undergoing surgery.

Purpose

To describe conservative interventions received by individuals with SAPS prior to undergoing a SAD.

Study Design

Scoping review.

Methods

An electronic search using MEDLINE, CINAHL, PubMed, and Scopus databases was conducted. Peer-reviewed randomized controlled control trials and cohort studies published between January 2000 and February 2022 that included subjects diagnosed with SAPS who progressed to receive a SAD were eligible. Subjects who received previous or concurrent rotator cuff repair with SAPS were excluded. Conservative interventions and treatment details that subjects received prior to undergoing a SAD were extracted.

Results

Forty-seven studies were included after screening 1,426 studies. Thirty-six studies (76.6%) provided physical therapy (PT) services, and six studies (12.8%) included only a home exercise program. Twelve studies (25.5%) specifically detailed the delivered PT services, and 20 studies (42.6%) stated who provided the PT interventions. Subacromial injections (SI) (55.3%, n=26) and non-steroidal anti-inflammatories (NSAIDs) (31.9%, n=15) were the next most frequently delivered interventions. Thirteen studies (27.7%) included combined PT and SI. The duration of conservative care varied from 1.5 months to 16 months.

Conclusion

Conservative care that individuals with SAPS receive to prevent advancement to SAD appears inadequate based on the literature. Interventions, such as PT, SI, and NSAIDs,

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are either underreported or not offered to individuals with SAP prior to advancing to surgery. Many questions regarding optimal conservative management for SAPS persists.

Level of Evidence

n/a

INTRODUCTION

Shoulder pain affects approximately one-third of individuals in a lifetime, and 36-70% of those who experience shoulder pain are diagnosed with either subacromial impingement syndrome or subacromial pain syndrome (SAPS).¹⁻³ Subacromial decompression (SAD) surgery is one of the most common orthopedic procedures utilized to address SAPS with rates increasing 117-254% between 1990 to the early 2000s in the United States.^{4,5} In the United Kingdom, 21,000 SAD procedures were performed in 2010 costing nearly £50 million.⁶ Individuals with shoulder pain who receive a SAD exhibit similar clinical outcomes in pain, function, and quality of life when compared to those who receive conservative management, yet the procedure is frequently performed when individuals fail conservative management.^{3,6-9}

There is no accepted definition for “adequate nonoperative treatment.” This requires judgment by the medical team and patient to determine if conservative treatment was sufficient before progressing to surgery.¹⁰ Completing conservative care is a common inclusion criterion to receive a SAD in the literature; however, studies seldom describe the provided interventions. This omission does not assist clinicians or patients in determining if adequate care was exhausted, a common clinical challenge, prior to recommending SAD. Standard care for SAPS is outlined in a recent clinical practice guideline (CPG) suggesting the exhaustion of conservative interventions prior to performing a SAD, and recommending that individuals only receive a SAD if functional loss persists following completion of conservative care.^{3,6} The CPG recommendations include physical therapy (PT), a guided home exercise program (HEP), non-steroidal anti-inflammatory drugs (NSAIDs), education, and subacromial injections (SI).⁶

PT intervention has high-level supportive evidence to treat individuals suffering from SAPS.¹¹ Several randomized control trials exist highlighting equivalent outcomes and cost savings when individuals receive supervised exercise compared to receiving a SAD.^{12,13} Additional authors have found enhanced benefits from combined manual therapy (MT) and exercise over exercise alone.¹⁴⁻¹⁷ However, to date, PT is not always delivered to individuals with SAPS prior to undergoing a SAD.^{11,18} Therefore, identifying the PT interventions offered to people with SAPS prior to undergoing a SAD is needed in the attempt to understand why individuals continue on to surgery.¹⁹

Based on the current evidence, it is unclear if adequate conservative management is provided to individuals with SAPS prior to considering a SAD. Therefore, the purpose of this review was to describe the conservative interventions received by individuals with SAPS prior to undergoing a SAD in the published research. This information will al-

low for future critical appraisals (e.g. systematic reviews) in attempt to define adequate management to prevent SAD as well as assist clinicians and patients to determine if adequate care was exhausted before advancing to surgery. A scoping review allows for data extraction without the need for a critical analysis, and it can provide an overview of the available evidence without producing an answer to a discrete research question.²⁰

METHODS

The Preferred Reporting Items for Systematic Reviews and Meta-Analyses - Extension for Scoping Reviews (PRISMA-ScR) Checklist guided the design for this scoping review.²¹ The question was registered with the Open Science Framework and OSF Registries (Identification: <https://doi.org/10.17605/OSF.IO/EUP9C>).

SEARCH STRATEGY

A librarian assisted with the creation of a database specific search strategy for MEDLINE, CINAHL, PubMed, and Scopus. Keywords, boolean operators, MeSH terms, and MeSH subheadings were used. The search was conducted on February 11, 2022. The search strategy for PubMed is as follows and was adjusted to support each database search criteria:

((((((((((shoulder[MeSH Terms]) OR (“shoulder impingement syndrome”[MeSH Terms]) OR (“shoulder pain”[MeSH Terms]) OR (shoulder*[Title/Abstract])) OR (“shoulder impingement syndrome”[Title/Abstract])) OR (shoulder impingement syndrome) OR (subacromial pain syndrome) OR (“subacromial pain syndrome”[Title/Abstract])) AND (((subacromial decompression) OR (“SAD”)) OR (“subacromial decompression”))) AND (((orthopedics[MeSH Terms]) OR (surgery[MeSH Subheading])) OR (surgery[Title/Abstract]))

ELIGIBILITY CRITERIA

Peer-reviewed randomized control and cohort studies with subjects diagnosed with SAPS, subacromial impingement syndrome, or subacromial shoulder pain were included since these terms are interchangeable.^{15,22-24} Both open or arthroscopic SAD procedures were included.

Studies published between January 2000 and February 2022 were considered since literature from the early to late 2000’s began to highlight non-superior results associated with SAD outcomes.^{9,15,25} Other inclusion criteria consisted of studies: (1) evaluating conservative interventions for SAPS, subacromial impingement syndrome, or subacromial shoulder pain when compared to SAD, (2) including subjects listed as having completed conservative care but ultimately received a SAD, and (3) subjects who did not receive any conservative care prior to undergoing

a SAD. There was no language restriction in order to maximize study inclusion. An attempt to identify a translated study was made if not published in English.

If one or more of the following conditions were present, the study was excluded: (1) subjects had a concurrent acromioclavicular or glenohumeral joint separation or dislocation, rotator cuff muscle tear(s), humeral head avascular necrosis, humerus or clavicle fracture, glenohumeral labral tear or insufficiency, calcified tendinopathy, or glenohumeral joint osteoarthritis, (2) subjects had a history of undergoing a prior SAD or rotator cuff repair, a surgical procedure other than a SAD for shoulder pain, a procedure to address either a complete or partial rotator cuff repair concurrently with a SAD, or a total or reverse shoulder replacement, (3) cadaver studies, (4) subjects with SAPS receiving conservative management but unclear if advancement to surgery occurred, (5) follow-up studies performed on the same study population as the initial publication, (6) pharmacological studies focusing on pain management for consecutively scheduled SAD procedure, or (7) the study design was a systematic review, protocol, conference abstract, case study, narrative review, treatment clinical practice guidelines, or was published in a non-peer reviewed journal.

DATA EXTRACTION AND ANALYSIS

Title/abstract and full-text screening was performed independently by two reviewers (JS and GT). Disagreements regarding inclusion were resolved by discussion, and a third reviewer (JY) resolved the discrepancy if no consensus occurred. A quality assessment was not conducted given the purpose of this scoping review.

The same reviewers independently extracted the data meeting the inclusion criteria and collaborated to organize and validate the findings. The data extracted from each included study were: (1) the types and number of conservative interventions (if provided) completed by subjects prior to undergoing a SAD, and (2) duration of care (months) and/or treatment sessions completed, if available. Details for each extracted intervention were collected, such as the number of SI and/or injected medications, NSAIDs dosage and frequency, interventions and exercises used during PT, and exercises prescribed in the HEP as the details were available.

PT specificity was captured since it is a common conservative intervention received by individuals with SAPS.^{12,13,18} PT was defined as an intervention or a group of interventions provided by a physical therapist or physiotherapist. Additionally, only a licensed physical therapist can offer PT services, and the PT provider was identified to ensure a licensed professional rendered PT services. An intervention including no specific provider was categorized as an independent intervention. For example, if PT and ultrasound were separately listed but the provider delivering these interventions remained absent, these were identified as two separate interventions. If there was or was not a specific description of the treatment provided during PT services, it was categorized into specific-PT or non-specific PT, respectively.

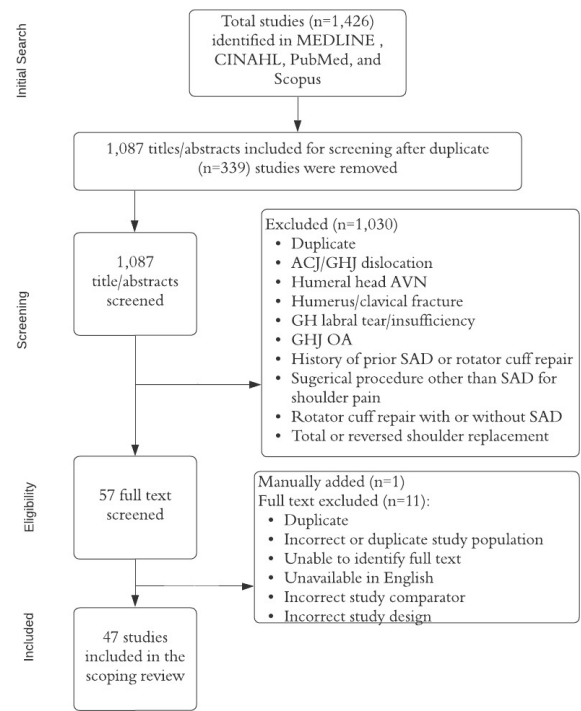


Figure 1. Flow diagram for study inclusion

ACJ = acromioclavicular joint; GHJ = glenohumeral joint; AVN = avascular necrosis; OA = osteoarthritis; SAD = subacromial decompression

For the purposes of this review, a HEP was defined as an unsupervised exercise regimen prescribed by any health-care provider. The HEP compliance rate, if available, was collected since intervention adherence is associated with improved outcomes.²⁶ If a physical therapist delivered the HEP, it would be categorized as a part of PT. For example, if a study mentioned PT and a HEP separately but did not clearly state the HEP was provided during PT services, then these were classified as two separate interventions. If PT included a HEP, then it was combined with PT and considered one intervention.

The data were subsequently reviewed to identify intervention clusters. Intervention clusters were defined *post hoc* as the most common combinations of interventions (e.g. both PT and SI is one intervention cluster).

RESULTS

The electronic database searches identified 1,426 studies. The scoping review included 47 studies^{7,14,18,27-70} after duplicate removal, title/abstract screen, and full-text review (Figure 1). A hand search produced one additional study.³⁸ Two protocol studies^{71,72} were excluded; the two primary results studies^{7,60} based on the initial protocol publications were included. Lastly, Haahr and Anderson⁷³ was excluded as this was a follow-up study on the same subject population from Haahr et al.⁴² The reviewer interrater agreement for the title/abstract screen was strong ($\kappa=.76$) and moderate for the full-text review ($\kappa=.66$). The two reviewers discussed and resolved all discrepancies. See Table 1 for a summary of results.

Table 1. Extracted interventions and details per study for scoping review.

Study	Conservative interventions and dosing, if provided ⁺	Number of conservative interventions provided	Physical therapy description and provider*	Amount and duration of conservative treatment
Aydin et al. 2014 ²⁷	<ul style="list-style-type: none"> • Physiotherapy: <ul style="list-style-type: none"> ◦ ROM ◦ Isometric strengthening exercises • NSAIDs 	2	Specific, performed by physiotherapist	6 months
Back et al. 2021 ²⁸	<ul style="list-style-type: none"> • Conservative treatment 	1	None Listed	3 months
Baltaci et al. 2007 ⁷⁰	<ul style="list-style-type: none"> • Physiotherapy <ul style="list-style-type: none"> ◦ Stretching ◦ Strengthening • Activity modification • NSAIDs • Steroidal anti-inflammatory medication 	4	Non-specific, performed by unknown provider	6 months
Basharat et al. 2021 ²⁹	<ul style="list-style-type: none"> • Moist heat • NSAIDs • HEP including isometric contractions for 6-10 seconds, 10-20 repetitions per day for 5-6 days per week up to 12; then for 12-24 weeks progressive resistance exercise 5 times per week 	3	None Listed	6 months
Beard et al. 2018 ⁷	<ul style="list-style-type: none"> • Physiotherapy: <ul style="list-style-type: none"> ◦ Remedial exercise regimen • At least one steroid injection 	2	Non-specific, performed by unknown provider	3 months
Bengtsson et al. 2006 ³⁰	<ul style="list-style-type: none"> • At least one steroid injection • Physiotherapy 	2	Non-specific, performed by physiotherapist	6 months
Bhattacharyya et al. 2014 ³¹	<ul style="list-style-type: none"> • Physiotherapy • At least one subacromial steroid injection • Local anesthetic injection 	3	Non-specific, performed by physiotherapist	6 months
Biberthaler et al. 2013 ³²	<ul style="list-style-type: none"> • Physiotherapy: <ul style="list-style-type: none"> ◦ Heat/cold pack ◦ Soft tissue treatment ◦ Active training of the periscapular muscles and strengthening of the stabilizing muscles of the shoulder joint ◦ HEP (2-3 times per week) 	1	Specific, performed by unknown provider	16 sessions for 60 minutes for 3 months
Bjornsson Hallgren et al. 2017 ³³	<ul style="list-style-type: none"> • Physiotherapy: <ul style="list-style-type: none"> ◦ Eccentric exercise for the rotator cuff ◦ Eccentric and concentric exercise for scapula-stabilizing musculature 	1	Specific, performed by physiotherapist in Physical Therapy Department	3 months
Butt et al. 2015 ³⁴	<ul style="list-style-type: none"> • One or more steroid injections • Physiotherapy 	2	Non-specific, performed by unknown provider	6 months
Cederqvist et al. 2020 ³⁵	<ul style="list-style-type: none"> • Physical Therapy: <ul style="list-style-type: none"> ◦ Cold pack 10-15 minutes prior to exercise ◦ Specific exercises following a protocol ◦ Joint mobilization with muscle energy techniques ◦ Cross friction massage 	1	Specific, performed by physical therapists	15 sessions within 3 months
Christiansen et al. 2016 ¹⁸	<ul style="list-style-type: none"> • Physiotherapy: <ul style="list-style-type: none"> ◦ Advice/instruction ◦ Exercise therapy 	1	Specific, performed by physiotherapist	Greater than 5 sessions

	<ul style="list-style-type: none"> ◦ Manual therapy ◦ Physical modalities 			
DeWachter et al. 2005 ³⁶	<ul style="list-style-type: none"> • Physiotherapy • NSAIDs • Subacromial steroid injections 	3	Non-specific, performed by physiotherapist	6 months
Diab et al. 2009 ³⁷	<ul style="list-style-type: none"> • NSAIDs • Physiotherapy • At least one subacromial steroid injection 	3	Non-specific, performed by physiotherapist	3-6 months
Dickens et al. 2005 ³⁸	<ul style="list-style-type: none"> • Three subacromial steroid injections at six week intervals 	1	n/a	4.5 months
Dorum et al. 2017 ³⁹	<ul style="list-style-type: none"> • Physical Therapy: <ul style="list-style-type: none"> ◦ Strengthening and stretching exercises ◦ Manual therapy • Oral analgesics • NSAIDs • Injections of corticosteroid • Radial extracorporeal shockwave therapy 	5	Non-specific, performed by physical therapist	3 months
Farfaras et al. 2016 ⁴⁰	<ul style="list-style-type: none"> • Physical Therapy: <ul style="list-style-type: none"> ◦ Pain-free exercises with gravity forces removed ◦ Strengthening of rotator cuff and scapula-stabilizing muscles ◦ Exercises with corresponding leisure activities 	1	Specific, performed by physiotherapist	3-6 months
Farfaras et al. 2018 ⁴¹	<ul style="list-style-type: none"> • Physical Therapy • NSAIDs • Local steroid injection 	3	Non-specific, performed by physiotherapist	3-6 months
Haahr et al. 2005 ⁴²	<ul style="list-style-type: none"> • Physical Therapy: <ul style="list-style-type: none"> ◦ Heat/cold pack ◦ Soft tissue treatments ◦ Exercise: <ul style="list-style-type: none"> ◦ Active training of the periscapular muscles ◦ Strengthening of the stabilizing muscles of the shoulder ◦ Daily HEP 	1	Specific, performed by physical therapist	3 months including 19 sessions for 60 minutes
Hawkins et al. 2001 ⁴³	<ul style="list-style-type: none"> • No prior interventions listed 	0	n/a	Not Listed
Holmgren et al. 2012 ¹⁴	<ul style="list-style-type: none"> • Corticosteroid injection • Physical Therapy: <ul style="list-style-type: none"> ◦ Eccentric strengthening of rotator cuff (3 sets, 15 reps, 2 times per day) ◦ Concentric/Eccentric exercises for scapular stabilizers (3 sets, 15 reps, 2 times per day) ◦ Posterior shoulder stretch (hold 30-60 sec, 3 reps, 2 times per day) ◦ Shoulder abduction, shoulder retraction, shoulder elevation, neck retraction, stretch of upper trapezius, stretch of pectoralis major ◦ Manual intervention of posterior GH capsule and pectoralis minor stretching ◦ Education on posture (thoracic spine extension and scapular retraction) 	2	Specific, performed by physiotherapist	3 months (then HEP for 2 more months)
Holmgren et al. 2012 ⁴⁴	<ul style="list-style-type: none"> • Local anesthetic injection • Physiotherapy 	2	Non-specific, performed by Physical Therapist	3 months

Hultenheim Klintberg et al. 2011 ⁴⁵	<ul style="list-style-type: none"> No prior interventions listed 	0	n/a	Not Listed
Husby et al. 2003 ⁴⁶	<ul style="list-style-type: none"> NSAIDs Local steroid injections Physical Therapy: <ul style="list-style-type: none"> Ultrasound 	3	Non-specific, performed by physical therapist	6 months
Jacobsen et al. 2017 ⁴⁷	<ul style="list-style-type: none"> Physical Therapy: <ul style="list-style-type: none"> Daily HEP Supervised training of rotator cuff muscles and scapular stabilizers Glucocorticoid injections 	2	Specific, performed by physiotherapist	3 months
Jarvela et al. 2010 ⁴⁸	<ul style="list-style-type: none"> Conservative treatment 	1	None Listed	6 months
Jenkins et al. 2020 ⁴⁹	<ul style="list-style-type: none"> No prior interventions listed 	0	n/a	Not Listed
Kappe et al. 2015 ⁵⁰	<ul style="list-style-type: none"> Oral analgesics Physical Therapy 	2	Non-specific, performed by unknown	Not Listed
Ketola et al. 2009 ⁵¹	<ul style="list-style-type: none"> Rest NSAIDs Subacromial glucocorticosteroid injections Physical Therapy: <ul style="list-style-type: none"> Exercise programs: <ul style="list-style-type: none"> increase dynamic stability of the glenohumeral joint and scapula (performed 4 times per week, 9 different exercises, 30-40 reps with 3 sets) Massage Heat TENS HEP 	4	Specific, performed by physiotherapist	Not Listed
Khare et al. 2015 ⁵²	<ul style="list-style-type: none"> Conservative treatment 	1	None Listed	3 months
Klintberg et al. 2010 ⁵³	<ul style="list-style-type: none"> No prior interventions listed 	0	n/a	Not Listed
Kohler et al. 2020 ⁵⁴	<ul style="list-style-type: none"> Physical Therapy: 3 times per week for 2 weeks then 2 times per week for 4 weeks <ul style="list-style-type: none"> Exercises <ul style="list-style-type: none"> Shoulder stabilization Lifting against gravity Exercises that focus on extending the spine Exercise therapy using equipment Manual Therapy <ul style="list-style-type: none"> Mobilization of the scapula, cervical, and thoracic spine Friction massage Caudal gliding Traction Additional Therapies <ul style="list-style-type: none"> Ultrasound Kinesiotaping Electrotherapy Subacromial injections <ul style="list-style-type: none"> Bupivacaine with dexamethazone (maximum of 3 with minimum intervals of 2 weeks) 	2	Specific, performed by physiotherapist or physician	1.5 months
Konradsen et	<ul style="list-style-type: none"> Physical Therapy 	2	Non-specific,	6 months

al. 2015 ⁵⁵	<ul style="list-style-type: none"> • Steroid injections 		performed by unknown provider	
Lim et al. 2007 ⁵⁶	<ul style="list-style-type: none"> • Rest • Physiotherapy • NSAIDs • Steroid injections in subacromial space 	4	Non-specific, performed by unknown provider	2-16 months (mean: 4.6 months)
Lunsjo et al. 2011 ⁵⁷	<ul style="list-style-type: none"> • Subacromial glucocorticoid steroid injection • Physical Therapy 	2	Non-specific, performed by unknown provider	6 months
Magaji et al. 2012 ⁵⁸	<ul style="list-style-type: none"> • At least 1 subacromial injection of steroid • Local anesthetic injection • Physiotherapy: <ul style="list-style-type: none"> ◦ Global strengthening exercises ◦ Lifestyle and ADL changes to change posture and strengthen appropriate ◦ Taping for biofeedback 	3	Non-specific, performed by a physiotherapist	Not Listed
Odenbring et al. 2008 ⁵⁹	<ul style="list-style-type: none"> • Physical Therapy • NSAIDs • Subacromial steroid injection 	3	Non-specific, performed by unknown provider	6 months
Paavola et al. 2018 ⁶⁰	<ul style="list-style-type: none"> • Physical Therapy: <ul style="list-style-type: none"> ◦ Individually designed progressive HEP 	1	Specific, performed by physiotherapist	15 visits
Paavola et al. 2021 ⁶¹	<ul style="list-style-type: none"> • Physiotherapy • NSAIDs • Corticosteroid injection • Rest 	4	Non-specific, performed by physiotherapist	3 months
Rehman et al. 2009 ⁷⁴	<ul style="list-style-type: none"> • Conservative treatment 	1	Non-specific, performed by unknown provider	6 months
Rombach et al. 2019 ⁶²	<ul style="list-style-type: none"> • Conservative treatment • At least 1 steroid injection 	2	None listed	Not listed
Rudbeck et al. 2013 ⁶³	<ul style="list-style-type: none"> • Rest • Exercises • NSAIDs 	3	Non-specific, performed by unknown provider	Not listed
Singh et al. 2014 ⁶⁴	<ul style="list-style-type: none"> • Physiotherapy • Subacromial steroid injection • Local anesthetic injection 	3	Non-specific, performed by physiotherapist	3 months
Nizam Siron et al. 2021 ⁶⁵	<ul style="list-style-type: none"> • Physiotherapy • Analgesics 	2	Non-specific, performed by unknown provider	1.5 months to 3 months
Taverna et al. 2007 ⁶⁶	<ul style="list-style-type: none"> • Physical Therapy: <ul style="list-style-type: none"> ◦ ROM Strengthening ◦ Ice • Subacromial corticosteroid injection(s) • NSAIDs • Activity modification • Rest 	5	Non-specific, performed by unknown provider	6 months
Wright et al. 2000 ⁶⁷	<ul style="list-style-type: none"> • Physical Therapy: <ul style="list-style-type: none"> ◦ Moist Heat ◦ Ice • NSAIDs • Steroid injections 	3	Non-specific, performed by unknown provider	4-6 months

Yeoman et al. 2012 ⁶⁸	<ul style="list-style-type: none"> • Physiotherapy • Two steroid injections 	2	Non-specific, performed by unknown provider	6 months
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* Identified conservative care interventions noted within each study. Dosage, frequency, and other details were listed when available.

* Physical therapy was defined as specific or non-specific. "Specific" included a description of the physical therapy interventions (e.g. manual therapy, home exercise program). "Non-specific" provided no description. The provider for physical therapy services was identified (e.g. physical therapist, physiotherapy, physician, etc.), or labeled as unknown if no provider was stated.

(ADL = activities of daily living. NSAIDs = non-steroidal anti-inflammatory drug. HEP = home exercise program. ROM = range of motion).

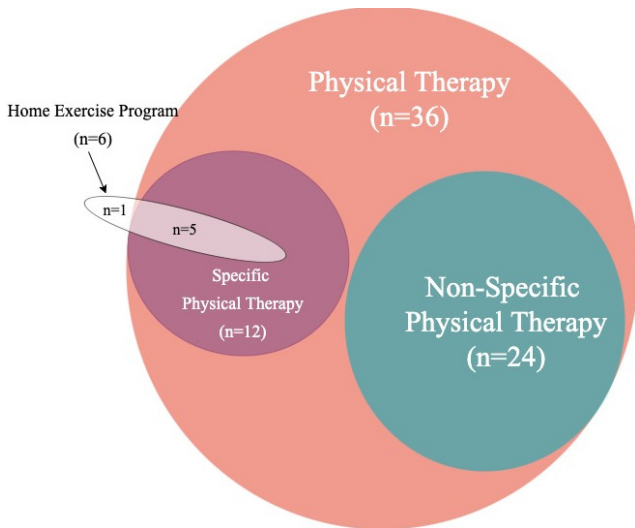


Figure 2. Physical therapy and home exercise use in the included studies.

PHYSICAL THERAPY

Thirty-six studies^{7,14,18,27,30-37,39-42,44,46,47,50,51,54,55,57-60,63-68,72,75-77} (76.6%) included PT/physiotherapy or supervised exercise. Twenty-four studies^{7,30,31,34,36,37,39,41,44,46,50,55,57-59,63-68,70,72,77} (51.1%) identified non-specific PT and did not provide details for the provided interventions. Twelve studies^{14,18,27,32,33,35,40,42,47,51,54,60} (25.5%) explicitly described specific-PT interventions. The specific-PT interventions commonly included eccentric or isometric strengthening of the rotator cuff muscles, scapular stabilization activities, modalities, joint mobilizations, pain-free range of motion, or a prescribed HEP. (Figure 2)

Fourteen studies^{7,32,34,50,55,57,59,63,65-68,70,77} (29.8%) did not identify if a physical therapist provided the interventions (Table 1). Twenty studies^{14,18,27,30,31,35-37,39-42,44,46,47,51,58,60,64,72} (42.6%) specifically mentioned that a physical therapist/physiotherapist provided the PT service. One study⁵⁴ (2.1%) provided PT services from either a physical therapist or a physician, and one study³³ (2.1%) rendered services in the Physical Therapy Department. (Figure 3)

Eight studies^{14,18,32,35,39,42,51,54} (17.0%) included MT. MT, soft tissue treatment, or massage were common terms. Only Holmgren et al.¹⁴ gave a specific description of the

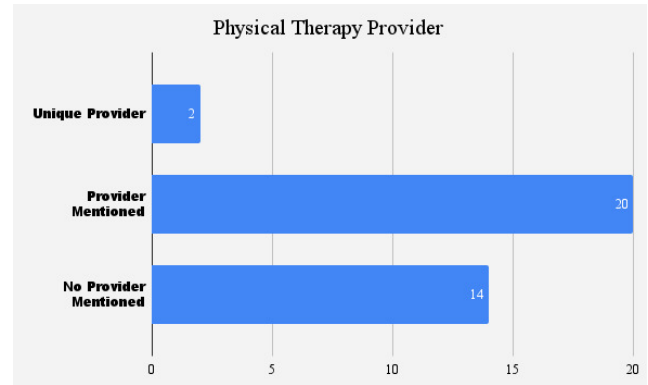


Figure 3. Identified physical therapy provider. Unique providers were used for those studies that stated physical therapy services were provided, but by either a department or physician.

manual therapy method, technique, or targeted body region.

Seven studies^{29,32,35,42,51,66,67} (14.9%) included thermotherapy, and one study³⁹ (2.1%) provided radial extracorporeal shockwave therapy. Several studies included electrotherapy,^{51,54} ultrasound,^{46,54} and taping.^{54,58} One study noted physical modality application within PT.¹⁸

MEDICATION AND INJECTIONS

Fifteen studies^{27,29,36,37,39,41,46,51,56,59,63,66,67,70,72} (31.9%) mentioned NSAIDs, and two studies^{39,50} (4.3%) provided oral analgesic medications. One study⁶⁵ noted "analgesics" while another study⁷⁰ mentioned "steroidal anti-inflammatory medication" without specifying application methods.

Twenty-six studies^{7,14,30,31,34,36-39,41,44,46,47,51,54-59,62,64,66-68,72} (55.3%) provided SI. Ten studies^{7,30,31,34,37,38,54,58,62,68} (21.3%) included subjects receiving at least one SI or more while 16 studies^{14,36,39,41,44,46,47,51,55-57,59,64,66,67,72} (34.0%) mentioned an unspecified amount of shoulder-related injections. Three studies^{47,51,57} (6.4%) mentioned receiving glucocorticosteroid injections, 17 studies^{7,30,31,34,36-38,41,46,55,56,58,59,62,64,67,68} (36.2%) noted steroid, and four studies^{14,39,66,72} (8.5%) described corticosteroid or cortisone injections. Eleven studies^{31,36-38,51,54,56,58,59,64,66} (23.4%) mentioned providing an injection directly into the subacromial space while the remaining studies were non-descript. See Table 1 for a summary of results.

HOME EXERCISE PROGRAM

Six studies^{29,32,42,47,51,60} (12.8%) included a HEP prescribed by an unknown healthcare provider or a physical therapist. Five studies^{32,42,47,51,60} (10.6%) used a prescribed HEP within PT services while one study²⁹ (2.1%) included a HEP without PT. Basharat et al.²⁹ provided a HEP with specific exercise descriptions and dosages; all other studies^{32,42,47,51} provided no HEP detail. Four studies^{29,32,42,47} (8.5%) provided performance frequency associated with the prescribed HEP. Frequency was given as daily,^{42,47} five times per week,²⁹ or a two to three times per week.³² No study mentioned compliance tracking or adherence to the HEP. See [Table 1](#) and [Figure 2](#) for a summary of results.

DURATION OF CONSERVATIVE TREATMENT

Three studies^{37,40,41} (6.4%) provided conservative measures for a range of three to six months. One study⁷⁵ (2.1%) delivered services for 12-16 months and another 15 studies^{27,29-31,34,36,46,48,55,57,59,66-68,70} (31.9%) provided interventions for six months. Ten studies^{7,28,33,39,42,44,47,52,64,72} (21.3%) provided three months of conservative care. One study⁵⁶ (2.1%) ranged from two to sixteen months, one study³⁸ delivered treatment for 4.5 months, and another provided intervention for 1.5 months.⁵⁴ Two studies^{35,60} (4.3%) provided interventions for 15 conservative care sessions, one study³² (2.1%) completed 16 sessions, and one study¹⁸ (2.1%) provided more than five visits before undergoing a procedure. Holmgren et al.¹⁴ provided conservative measures for three months followed by two months of a HEP. See [Table 1](#) for specific details.

CONSERVATIVE INTERVENTION CLUSTERS

Interventions were clustered based on the most common combinations of interventions as reported in the reviewed studies ([Figure 4](#)).^{7,14,18,27-60,62-70,72} Four studies^{43,45,49,53} (8.5%) listed no conservative interventions, and four studies^{28,48,52,69} (8.5%) mentioned "conservative treatment" without description; one study mentioned conservative treatment in addition to receiving at least one steroid injection.⁶² Thirteen studies^{7,14,30,31,34,44,47,54,55,57,58,64,68} (27.7%) reported subjects received at least one or more injections combined with PT. Six studies^{36,37,41,46,59,67} (12.8%) included PT, NSAIDs, and injections. Four studies^{51,56,66,72} (8.5%) included PT, NSAIDs, injections, and rest or activity modification. One study³⁸ (2.1%) included only injections, and three studies^{27,50,65} (6.4%) included combined PT and NSAIDs or oral analgesics. One study⁷⁰ (2.1%) included PT, NSAIDs, and activity modification. Three studies^{29,39,63} (6.4%) included conservative care interventions unique to that study. Seven studies^{18,32,33,35,40,42,60} (14.9%) included PT only. ([Figure 4](#))

DISCUSSION

This scoping review highlights the variability in the conservative interventions provided to individuals with SAPS before undergoing a SAD, further emphasizing the need for a standard of what is deemed "adequate conservative management." Few studies provided specific intervention descriptions, such as dosage, type, frequency, medication, or duration of care. Additionally, the interventions received by individuals were provided by physical therapists less than half of the time. The findings from this review call attention to the need for specific criteria that should be met in individuals with SAPS, including maximizing the use of conservative management, before advancing to a SAD.

The majority (76.6%) of subjects in this review received some form of PT service. This finding aligns with research indicating PT, including MT and exercise, can positively impact outcomes for individuals suffering from SAPS¹⁷; however, it questions why individuals continue to undergo surgery. It brings into question whether the PT services rendered are "adequate." The next most commonly delivered interventions included SI (55.3%) and NSAIDs (31.9%). This further brings into question if the standards of care as suggested by Vandvik et al.⁶ is sufficient to limit progression to SAD. This finding should be taken lightly as many conservative measures may be underreported; therefore, not allowing for a full comparison to recommended standards of care. Lastly, only one quarter of the studies offered specific details related to PT intervention, and less than half indicated that a physical therapist rendered PT services. This lack of transparency does not allow for the determination of whether or not adequate PT was provided.

It is concerning that non-invasive interventions are not consistent or exhausted despite being safe, beneficial, and cost effective since SAD procedures produce similar outcomes to conservative care.^{3,6-9} Furthermore, no conservative interventions were reported in 8.2% (n=4) of the included studies.^{43,45,49,53} This finding supports the inadequate attempts to offer effective conservative intervention prior to undergoing a SAD, and aligns with prior research on rotator cuff related pain conducted by Naunton et al.¹² However, caution in making this conclusion is important as operative studies are not typically focused on detailing conservative measures prescribed prior to undergoing a SAD.

Vandvik et al.⁶ recommended that individuals with SAPS receive a guided PT program, including a supervised exercise program and patient education, before undergoing surgery. A majority of the included studies offered PT services to subjects prior to receiving a SAD, which aligns with conservative treatment recommendations^{3,6,12}; however, over half of the studies lacked an exercise description and purpose for the intervention. Only a quarter of the studies included exercise specifications, such as exercise protocols to the rotator cuff musculature or general information about posture improvements. Additionally, few of the PT interventions included MT while only a third of the studies incorporated modalities. Less than a quarter of the studies included a well-designed HEP despite the potential benefits from prescribing a HEP with adequate dosing

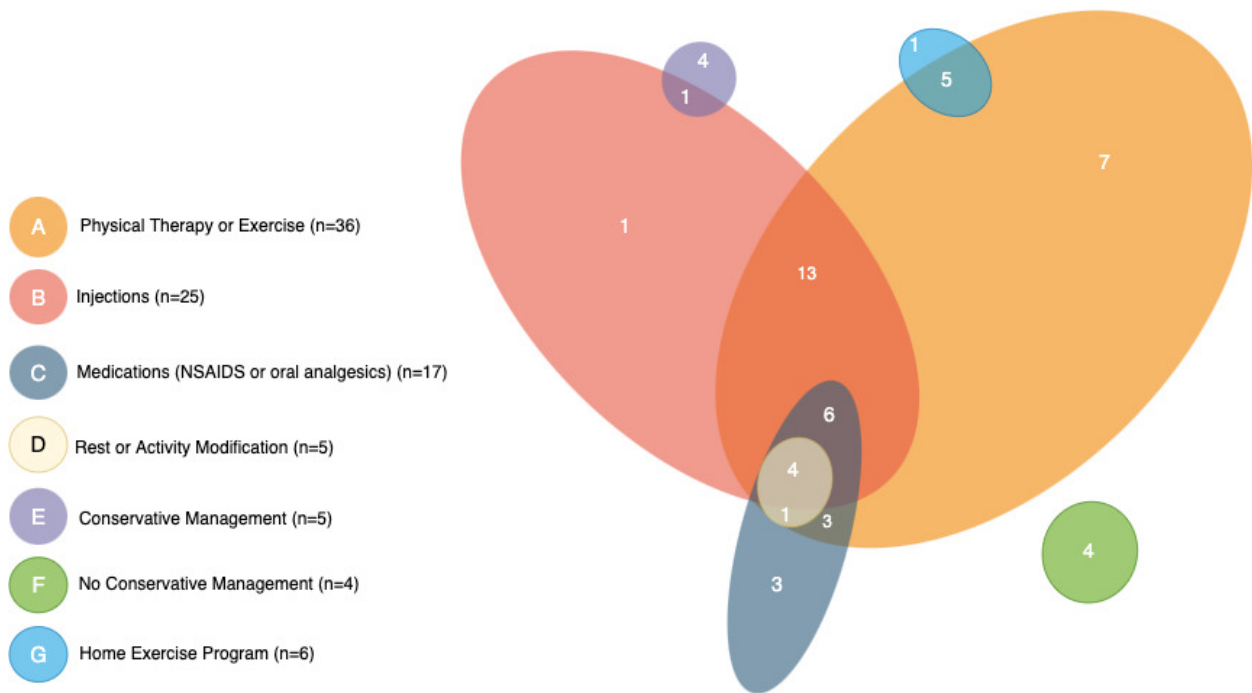


Figure 4. Common conservative intervention clusters.

and frequency.⁷⁸ No studies measured exercise compliance or compliance to attending PT appointments.⁷⁹ These findings highlight the literature is not descriptive enough to define if adequate PT intervention was conducted.

Treatment provided by physical therapists should include specific exercise to the shoulder muscular, thoracic spine, and scapular stabilizers, along with information on psychosocial factors, pain neuroscience education, and behavior change.^{7,14–17,35,80} Future research should provide specific PT intervention details, if rendered PT services prevented SAD, and who provided the PT services since about a third of the studies did not list the provider of PT services. Providing specific intervention details allow for a better understanding of the completed services. Omitting intervention descriptions consequently limits outcome reproducibility in future research or in a clinical environment. Clinicians do not know the specific intervention type or dosage to use to enhance patient outcomes. Therefore, it is recommended to use a set structure to improve the recreation of a study's result. The Template for Intervention Description and Replication (TIDieR) or Consensus on Exercise Reporting Template (CERT) can guide exercise intervention description^{81,82}; the modified CERT could guide MT intervention and dosage.⁸³ Enhanced intervention description, including exercise and MT, will allow for treatment efficacy to be measured and act as a valid comparator to surgery.⁸¹

SI served as the second most provided conservative intervention. Despite the high prevalence for this intervention in the reviewed literature, few studies mentioned the site of the injection, medication, or dosage. Approximately one-third of the included studies in this scoping review did not provide the injected medication or specify the number of injections, which aligns with prior research findings.⁸⁴

Sun et al.⁸⁴ observed irregularities in treatment protocols including the maximum number of injections to administer to a patient with SAPS prior to determining if they failed treatment. If SI are considered for an intervention to address pain associated with SAPS, the anatomical structure to receive the injection is to the subacromial bursa.^{85,86} The outcomes following SI do not appear to be significantly impacted if performed with ultrasound guidance or with anatomic landmarks when conducted by a trained clinician.^{86,87} A 21 gauge needle can be used to inject a methylprednisolone 40 milligrams and one milliliter one percent lidocaine mix directly into the subacromial bursa but recognize individual medical providers may alter the mixture based on experience and the treatment goal.^{85,86,88}

Clinical management for SAPS often includes a multimodal approach. Combined PT and SI accounted for the most common (27.7%) conservative intervention grouping prior to undergoing surgery. These interventions were typically provided over a wide range of time (1.5-16 months). Unfortunately, an effective duration of conservative care prior to considering advancement to surgery remains unclear. Additionally, the timing of when conservative care is delivered remains unknown. For example, it is unknown if receiving PT and SI concurrently leads to an optimal outcome, or if sequential intervention prescription may work best (e.g. PT followed by SI, or vice versa). Several unknowns remain to best define adequate conservative management for SAPS to limit advancement to surgery.

LIMITATIONS

Only studies in the English language were included in the review despite attempts to identify translated studies. Also, no quality assessment was performed, which may limit the

impact of the findings but can guide future systematic reviews. Lastly, there is a lack of high-quality PT CPGs for the treatment of nontraumatic shoulder pain. This makes determining exercise type, dose, duration, timing, and expected outcomes recommendations difficult.^{13,89}

CONCLUSION

Conservative management for SAPS offers an equally advantageous outcome when compared to SAD. Many individuals continue to receive a SAD despite conservative care, bringing into question what is “adequate care” for individuals with shoulder pain. The findings from this scoping review indicate that typical interventions to conservatively manage pain, such as PT, NSAIDs and SI, are underreported or not offered to individuals with SAPS prior to undergoing a SAD. PT intervention shown to positively impact outcomes was underutilized in many studies, further highlighting that adequate care may not be utilized. The inadequate level of conservative care offered does not allow for a valid comparison to surgery. There is a significant need to investigate successful conservative interventions to prevent SAD.

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