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Combined Effect of Manual Therapy, Electrotherapy, and Therapeutic Exercises in the Rehabilitation of Subacromial Impingement Syndrome: A Case Study

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ABSTRACT

Background: *Subacromial impingement syndrome is a leading cause of shoulder pain and functional limitation, commonly managed through conservative rehabilitation strategies. Multimodal physiotherapy approaches that integrate manual therapy, electrotherapy, and therapeutic exercises are increasingly used in clinical practice; however, detailed evidence describing short-term outcome trajectories following structured, protocol-driven multimodal interventions remains limited, particularly at the individual patient level.* ***Objective****: To evaluate the effects of a four-week multimodal physiotherapy program on pain intensity, shoulder range of motion, and functional disability in a patient with subacromial impingement syndrome.* ***Methods****: This prospective case study was conducted in an outpatient rehabilitation setting and included a 42-year-old female diagnosed with subacromial impingement syndrome based on clinical examination. The intervention comprised a staged, four-week program integrating electrotherapy, manual therapy, and progressive therapeutic exercises. Pain intensity was assessed using the Visual Analogue Scale, functional disability using the Shoulder Pain and Disability Index, and shoulder range of motion using goniometric measurements. Outcomes were recorded at baseline and monitored weekly throughout the intervention period.* ***Results****: Pain intensity decreased progressively from 8/10 at baseline to 1/10 at week four, representing a clinically meaningful reduction. Shoulder flexion improved from 90° to 180°, abduction from 80° to 170°, external rotation from 40° to 85°, and internal rotation from 50° to 85°. Functional disability improved substantially, with the Shoulder Pain and Disability Index score decreasing from 62% at baseline to 10% at the end of the intervention.* ***Conclusion****: A structured multimodal physiotherapy program combining manual therapy, electrotherapy, and therapeutic exercises was associated with marked improvements in pain, shoulder mobility, and functional capacity in a patient with subacromial impingement syndrome, supporting the clinical value of integrated rehabilitation approaches.*

Keywords
Subacromial Impingement Syndrome; Shoulder Pain; Manual Therapy; Electrotherapy; Therapeutic Exercise; Rehabilitation

INTRODUCTION

Subacromial impingement syndrome (SIS), often described within the broader spectrum of subacromial shoulder pain, is a leading cause of atraumatic shoulder pain in clinical practice and accounts for a substantial proportion of presentations in rehabilitation and musculoskeletal services (1). Clinically, SIS is characterized by pain exacerbated during arm elevation—commonly within the painful arc—night pain, and functional limitation during overhead or behind-the-back activities, reflecting mechanical compression and irritability of the rotator cuff tendons and subacromial tissues (2). Because the shoulder complex requires coordinated glenohumeral and scapulothoracic motion for efficient elevation, even modest impairments in tissue tolerance, joint mobility, or neuromuscular control can translate into disproportionately large restrictions in daily activities and participation.

Contemporary models describe SIS as a multifactorial condition arising from both structural and functional contributors that narrow the subacromial space and disrupt normal shoulder biomechanics (2). Structural contributors include anatomical variations of the acromion, degenerative changes, and soft-tissue adaptations that increase mechanical encroachment on subacromial tissues, potentially perpetuating inflammation and tendon pathology when movement demands remain unchanged (3). Functional contributors—such as rotator cuff weakness, altered scapular kinematics, and postural adaptations—may further increase superior humeral head translation and impair dynamic clearance during elevation, thereby sustaining pain and limiting active range of motion (2,4). This multifactorial perspective has shifted management away from

isolated symptom control toward multimodal rehabilitation strategies that target pain modulation, joint and soft-tissue mobility, and progressive restoration of strength and motor control.

Conservative care remains first-line for most individuals with SIS, and exercise-based rehabilitation is consistently positioned as the cornerstone of non-surgical management because it addresses modifiable biomechanical drivers and supports durable functional improvement (5). Systematic syntheses indicate that exercise improves pain and function compared with minimal care, while adjunctive manual therapy may enhance short-term pain relief and facilitate movement restoration when integrated with an active program, although the magnitude and consistency of manual-therapy-specific effects vary across study designs and clinical subgroups (6,7). Electrotherapy modalities are frequently used clinically as adjuncts to reduce pain and improve tolerance to exercise; however, evidence for electrotherapy in isolation is mixed, and its value is best justified when it enables timely progression of active rehabilitation rather than serving as a stand-alone intervention (6). Despite this growing evidence base, there remains a practical knowledge gap in clinically detailed, protocol-driven reports that transparently document session structure, progression logic, and week-by-week outcome trajectories using validated measures—information that is highly actionable for physiotherapists managing patients with marked baseline pain, restricted range of motion, and activity limitations in routine practice.

Accordingly, this case study was designed to document the short-term clinical course of a structured, multimodal physiotherapy program combining manual therapy, electrotherapy, and progressive therapeutic exercise for a middle-aged female patient with SIS, with outcomes tracked longitudinally using pain intensity, shoulder range of motion, and region-specific functional disability measures (VAS, goniometry, and SPADI) (6). The objective was to evaluate whether a four-week, staged rehabilitation plan integrating pain-modulating adjuncts with manual techniques and progressive strengthening could reduce pain and disability while restoring clinically meaningful shoulder mobility in a symptomatic patient with functional limitation.

MATERIAL AND METHODS

This investigation was conducted as a prospective single-patient clinical case study designed to document short-term outcomes following a structured multimodal physiotherapy intervention for subacromial impingement syndrome. The study was carried out in a private rehabilitation facility in Sargodha, Pakistan, over a four-week period from June to July 2025, reflecting a real-world outpatient clinical setting. A case study design was selected to allow detailed, protocol-driven documentation of intervention components, progression logic, and outcome trajectories in a patient presenting with clinically significant pain and functional limitation, consistent with recommendations for hypothesis-generating clinical research in rehabilitation sciences (7).

The participant was a 42-year-old female who presented with a two-month history of insidious-onset left shoulder pain associated with restricted movement and difficulty performing activities of daily living, particularly overhead tasks and household activities. Inclusion criteria were unilateral shoulder pain consistent with subacromial impingement syndrome, positive clinical impingement tests, pain provoked during mid-range elevation, and functional limitation as reflected by self-report. Exclusion criteria included a history of shoulder trauma or surgery, systemic inflammatory disease, neurological disorders affecting the upper limb, cervical radiculopathy, or uncontrolled medical comorbidities that could confound shoulder symptoms. The patient was recruited consecutively during routine clinical consultation. Written informed consent was obtained prior to enrollment for participation and publication of anonymized clinical data in accordance with ethical principles for human research (8).

Diagnosis was established through a standardized clinical examination conducted by an experienced physiotherapist, incorporating inspection, palpation, assessment of active and passive shoulder range of motion, resisted isometric testing, and special orthopedic tests. Positive Hawkins–Kennedy, Neer, Empty Can, and painful arc tests supported the diagnosis of subacromial impingement syndrome, while cervical spine screening tests were negative, reducing the likelihood of referred cervical pathology. Baseline assessment was completed prior to intervention initiation and repeated weekly to allow monitoring of response to treatment.

Pain intensity was quantified using the Visual Analogue Scale (VAS), a 10-cm horizontal scale anchored by “no pain” and “worst imaginable pain,” which has demonstrated reliability and responsiveness in shoulder disorders (9). Shoulder-specific functional disability was measured using the Shoulder Pain and Disability Index (SPADI), a validated 13-item questionnaire comprising pain and disability subscales, scored as a percentage from 0% (no disability) to 100% (maximum disability) (10). Glenohumeral joint range of motion—flexion, abduction, internal rotation, and external rotation—was measured in degrees using a universal goniometer, following standardized positioning and measurement procedures to enhance intra-rater consistency (11). All assessments were performed by the same clinician at each time point to minimize measurement variability.

The intervention consisted of a predefined four-week multimodal physiotherapy program integrating electrotherapy, manual therapy, and progressive therapeutic exercises. Treatment frequency was five sessions per week during the first two weeks, followed by three sessions per week during weeks three and four, with each session lasting approximately 30–40 minutes. Electrotherapy modalities included therapeutic ultrasound, transcutaneous electrical nerve stimulation, infrared therapy, and cryotherapy, applied with parameters commonly used for pain modulation and tissue preparation in shoulder rehabilitation (12). Manual therapy techniques targeted the glenohumeral joint and periarticular soft tissues through graded joint distraction, accessory glides, and myofascial release to address pain, capsular restriction, and soft-tissue tightness. Therapeutic exercises progressed systematically from pain-free pendular and assisted range-of-motion exercises to active mobility, isometric activation, and resisted strengthening of the rotator cuff and scapular stabilizers, culminating in functional and task-specific activities aligned with the patient’s daily demands (5).

To reduce potential bias, standardized outcome measures were used, assessments were conducted at consistent time points, and treatment progression followed predefined clinical criteria based on pain tolerance and movement quality rather than subjective preference. As this was a single-case investigation, no formal sample size calculation was undertaken, and the analysis was descriptive in nature. Continuous variables were summarized using absolute values and week-by-week changes to illustrate clinical trajectories over time, consistent with methodological guidance for case-based rehabilitation research (7). Data were recorded contemporaneously in structured clinical forms to ensure accuracy and data integrity.

The study was conducted in accordance with the principles of the Declaration of Helsinki. Patient confidentiality was maintained by de-identification of all data prior to analysis and reporting. All procedures, assessment tools, and intervention parameters are described in sufficient detail to enable reproducibility by other clinicians or researchers managing similar patient presentations in comparable settings.

RESULTS

Over the four-week multimodal physiotherapy intervention, the patient demonstrated substantial and progressive improvements in pain intensity, shoulder range of motion, and functional capacity. All outcomes were assessed at baseline and monitored weekly to document the trajectory of clinical change across the rehabilitation period.

Pain intensity, as measured by the Visual Analogue Scale, showed a marked and clinically meaningful reduction over time. At baseline, the patient reported severe pain (VAS 8/10), which decreased to moderate levels by the end of week two (VAS 6/10), further improved to mild pain during activity only by week three (VAS 3/10), and reached minimal pain by week four (VAS 1/10). This progressive decline reflects an absolute reduction of 7 points on the VAS over four weeks, exceeding commonly accepted thresholds for clinically important change in shoulder pain conditions.

Table 1. Weekly Changes in Pain Intensity (VAS)

Assessment Time Point	VAS Score (0–10)	Absolute Change from Baseline	p-value
Baseline (Week 1)	8	Reference	NA
Week 2	6	−2	NA
Week 3	3	−5	NA
Week 4	1	−7	NA

Progressive restoration of shoulder mobility was observed across all measured planes of motion. Shoulder flexion improved from 90° at baseline to 180° by week four, representing full restoration of the normal range. Abduction increased from 80° to 170°, approaching normative values, while external rotation improved from 40° to 85° and internal rotation from 50° to 85°. The largest gains in range of motion were observed between weeks two and four, coinciding with the strengthening and functional training phases of rehabilitation.

Table 2. Weekly Changes in Shoulder Range of Motion (Degrees)

Movement	Baseline	Week 2	Week 3	Week 4	Total Gain	Normal Range	p-value
Flexion	90°	110°	145°	180°	+90°	180°	NA
Abduction	80°	100°	120°	170°	+90°	180°	NA
External Rotation	40°	55°	70°	85°	+45°	90°	NA
Internal Rotation	50°	60°	75°	85°	+35°	90°	NA

Functional disability, assessed using the Shoulder Pain and Disability Index, showed a pronounced improvement over the intervention period. The baseline SPADI score of 62% indicated severe functional limitation affecting daily and overhead activities. By week four, the SPADI score decreased to 10%, reflecting minimal residual disability and near-complete functional recovery. This 52-percentage-point reduction highlights a substantial improvement in patient-reported functional capacity and symptom burden.

Table 3. Change in Shoulder Pain and Disability Index (SPADI)

Time Point	SPADI Score (%)	Interpretation	Absolute Change	p-value
Baseline	62	Severe disability	Reference	NA
Week 4	10	Minimal disability	−52	NA

Collectively, the results demonstrate a consistent and clinically meaningful improvement across pain, mobility, and functional outcomes over a four-week multimodal rehabilitation program. The temporal alignment of pain reduction with subsequent gains in range of motion and functional capacity suggests a favorable response to the staged integration of electrotherapy, manual therapy, and progressive therapeutic exercise.

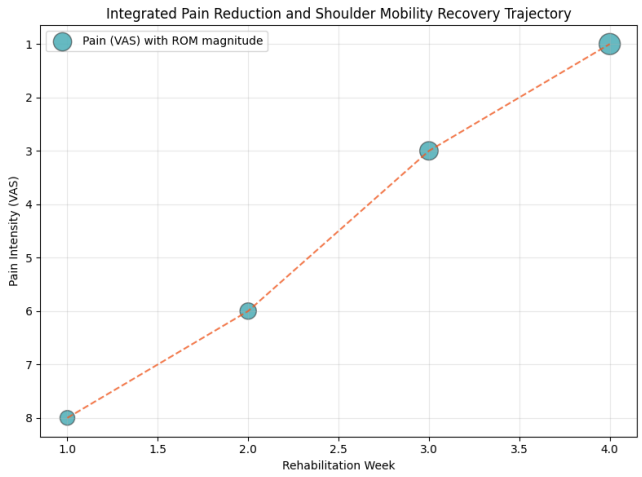

Figure 1 Integrated Pain Reduction and Shoulder Mobility Recovery Trajectory

Figure 1 illustrates the concurrent trajectory of pain reduction and improvement in shoulder mobility over the four-week multimodal rehabilitation program. The inverted vertical axis demonstrates a progressive decline in pain intensity, with Visual Analogue Scale scores decreasing from 8 at baseline to 1 by week four, indicating a 7-point absolute reduction. Bubble size represents the aggregated magnitude of shoulder mobility, derived from the mean of flexion and abduction ranges at each time point, and shows a clear expansion over time, reflecting substantial gains in joint excursion. Notably, the most pronounced increase in mobility coincided with the steepest reduction in pain between weeks two and four, suggesting a nonlinear interaction in which early pain modulation facilitated accelerated functional recovery. Clinically, this pattern supports the concept that

effective early symptom control may enable greater participation in progressive strengthening and mobility exercises, thereby amplifying overall rehabilitation gains in patients with subacromial impingement syndrome.

DISCUSSION

The present case study demonstrates that a structured, staged multimodal physiotherapy program integrating manual therapy, electrotherapy, and progressive therapeutic exercise was associated with substantial reductions in pain, marked improvements in shoulder range of motion, and clinically meaningful recovery of functional capacity in a patient with subacromial impingement syndrome. The magnitude and temporal pattern of improvement observed over the four-week intervention underscore the potential value of combining symptom-modulating modalities with targeted mechanical and neuromuscular rehabilitation strategies, particularly in patients presenting with high baseline pain and functional limitation.

The observed reduction in pain intensity, reflected by a 7-point decrease on the Visual Analogue Scale, exceeds commonly reported minimal clinically important differences for shoulder pain and aligns with prior evidence emphasizing the role of early pain control in facilitating active rehabilitation (5,9). Manual therapy techniques, including graded glenohumeral mobilizations and myofascial release, likely contributed to short-term analgesia by reducing capsular stiffness, improving joint mechanics, and modulating nociceptive input, thereby enabling greater tolerance to movement and exercise (6,14). The adjunctive use of electrotherapy modalities, such as therapeutic ultrasound and transcutaneous electrical nerve stimulation, may have further supported pain modulation through thermal, mechanical, and neurophysiological mechanisms, consistent with findings that these modalities are most effective when used to prepare patients for active interventions rather than as isolated treatments (7,8,12).

Improvements in shoulder mobility were substantial across all planes of motion, with flexion and abduction demonstrating near-complete restoration by the end of the intervention period. These gains are clinically relevant, as restricted elevation is a defining feature of subacromial impingement syndrome and a key determinant of functional disability (2). The progressive nature of range-of-motion recovery observed in this case, particularly during the later phases of rehabilitation, supports the central role of therapeutic exercise in addressing underlying biomechanical contributors, including rotator cuff weakness, altered scapular control, and impaired glenohumeral rhythm (5). Strengthening of the rotator cuff and scapular stabilizers likely enhanced dynamic humeral head control, reduced superior migration during elevation, and improved subacromial clearance, mechanisms that are widely proposed in contemporary models of shoulder rehabilitation (4,12).

Functional recovery, as measured by the Shoulder Pain and Disability Index, was pronounced, with a 52-percentage-point reduction from baseline to week four. This improvement is comparable to or greater than changes reported in randomized controlled trials examining combined manual therapy and exercise programs for subacromial shoulder pain, despite the shorter intervention duration in the present case (12,16). The temporal alignment of declining pain scores with accelerating gains in range of motion and functional ability suggests an interaction effect whereby early symptom relief facilitated more effective engagement in progressive strengthening and task-specific activities. This observation is consistent with prior reports indicating that multimodal approaches may expedite recovery by addressing both symptomatic and mechanical drivers of dysfunction concurrently (17,18).

From a clinical perspective, the phased structure of the rehabilitation program represents a pragmatic and scalable approach for outpatient settings. Initial emphasis on pain reduction and gentle mobility, followed by gradual progression to strengthening and functional retraining, mirrors best-practice recommendations and may enhance patient adherence while minimizing symptom exacerbation (5,6). Additionally, the tapering of session frequency in later weeks likely supported the transition toward self-management and functional independence, an important consideration in long-term musculoskeletal care.

Several limitations should be acknowledged when interpreting these findings. As a single-case study, the results cannot be generalized to broader populations, and causal inferences regarding the relative contribution of individual intervention components cannot be established. The absence of a comparator condition, objective biomechanical measures, and long-term follow-up limits conclusions regarding durability of effects and mechanistic specificity. Potential measurement bias may also exist, as all assessments were conducted by the treating clinician, although standardized tools and consistent procedures were used to mitigate this risk. Future research employing controlled designs, larger samples, and longer follow-up periods is warranted to confirm these findings and to clarify which patient subgroups derive the greatest benefit from multimodal rehabilitation strategies.

Despite these limitations, this case contributes clinically relevant evidence by providing a transparent, protocol-driven account of multimodal physiotherapy implementation and outcome trajectories in subacromial impingement syndrome. The findings support existing literature advocating integrated rehabilitation approaches and highlight the importance of early pain modulation combined with progressive exercise in achieving meaningful short-term recovery. Further investigation should focus on optimizing intervention sequencing, dosage, and individualization to enhance outcomes and efficiency in the management of subacromial shoulder pain.

CONCLUSION

In conclusion, this case study demonstrates that a structured multimodal physiotherapy program combining manual therapy, electrotherapy, and progressive therapeutic exercises was associated with marked reductions in pain, substantial improvements in shoulder range of motion, and clinically meaningful recovery of functional capacity in a patient with subacromial impingement syndrome. The findings align with the study objective and support the clinical relevance of integrating symptom-modulating modalities with targeted mechanical and neuromuscular rehabilitation to facilitate early pain relief and accelerated functional restoration. Although the results are limited by the single-case design, they underscore the potential value of staged, individualized rehabilitation strategies in routine clinical practice and provide a rationale for future controlled studies to further evaluate the effectiveness and generalizability of multimodal physiotherapy approaches in the management of subacromial shoulder pain.

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