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Original Article

Physical Medicine and Rehabilitation Section

Effect of the Shoulder Symptom Modification Procedure on Pain and Kinesiophobia in Patients with Shoulder Pain: A Quasi-experimental Study

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ABSTRACT

Introduction: Shoulder pain, ranking third among musculoskeletal issues, hampers diagnostics due to test limitations. The present study explores the potential of the Shoulder Symptom Modification Procedure (SSMP) as an intervention. Influential factors in physiotherapy outcomes, including kinesiophobia, are linked to shoulder pain. A knowledge gap remains on the impact of SSMP on pain and kinesiophobia in individuals with shoulder pain, contributing insights to musculoskeletal interventions.

Aim: To investigate the effect of SSMP on pain and kinesiophobia in patients with shoulder pain.

Materials and Methods: A single-blinded quasi-experimental study was conducted in the Department of Musculoskeletal Physiotherapy on 35 participants aged 40-60 years experiencing shoulder pain, recruited from R.V. College of Physiotherapy, Bengaluru, Karnataka, India, over a six month period from February 2022 to July 2022. Pain was measured using the Numerical Pain Rating Scale (NPRS), and kinesiophobia was measured with the Tampa Scale for Kinesiophobia (TSK). The researcher, blinded to pre- and post-test results of TSK-11 and NPRS, conducted a shoulder symptom modification assessment. The procedure's response-guided treatment was administered twice a week for three weeks, with each session lasting 30 minutes. Pre-assessment of TSK-11 and NPRS was performed by an assessor, with the same assessor re-evaluating outcomes after three weeks. Data underwent statistical analysis using a paired t-test in R Software version 4.1.0, with significance attributed to results having a p-value <0.05.

Results: The mean age of the study participants was 52±7.74 years. There was a significant reduction in NPRS from 7.54±1.146 to 3.74±1.70 post-intervention and TSK-11 scores from 27.20±5.12 to 23.17±4.83 in subjects with shoulder pain after three weeks of intervention. The study showed a significant improvement in pain ($p<0.001$*) and kinesiophobia ($p<0.001$*) in patients with shoulder pain.

Conclusion: The SSMP was found to be effective in reducing pain and kinesiophobia in patients with shoulder pain. Further research should be conducted in the future, taking large samples and varied techniques into account for the identification of optimal strategies in improving health-related outcomes.

Keywords: Biomechanics, Healthcare, Mobility, Musculoskeletal conditions, Physiotherapy

INTRODUCTION

Shoulder pain, a complex challenge in musculoskeletal health, is marked by its unpredictable nature, presenting a multifaceted puzzle for diagnosis and management. This discomfort is linked to structural damage, referred pain, and altered central pain modulation, adding layers of complexity to clinical decisions [1]. The shoulder, being highly mobile and susceptible to various pathologies, stands as the third most common musculoskeletal issue, posing a significant challenge in the general population [2]. A systematic review underscores the prevalence of shoulder pain, revealing monthly rates of 18.0-31.0%, annual rates of 4.7-46.7%, and a lifetime prevalence of 66.7%. This impactful condition affects mobility, daily activities, sleep, work, and healthcare utilisation [3]. Persistent issues are common, with 50% experiencing problems after six months, and 40% reporting incomplete recovery within a year [4]. Shoulder disorders often share similar clinical characteristics, and the absence of agreement on diagnostic criteria and consistency in clinical evaluations adds complexity to deciding on appropriate treatments [3,5].

Recent systematic reviews consistently find no recommended single shoulder physical examination method for establishing a pathological diagnosis, citing deficiencies in accuracy and likelihood ratios across existing approaches [6-8]. As an alternative to traditional methods such as Manual Therapy, electrotherapeutic modalities, and Codman pendular exercises, Dr Jeremy Lewis introduced the SSMP in the year 2009. It employs standardised tests to reposition structures, facilitate movement, and neuromodulate symptoms associated with the shoulder [9]. In the pursuit of pain relief, addressing factors like diminished self-efficacy and fear of movement is crucial. Miller's concept of kinesiophobia, dating back to 1990, involves an exaggerated fear of movement, disrupting the Fear-avoidance Model and impeding post-trauma recovery [10]. Recent research links psychological factors to shoulder pain intensity, emphasising the crucial role of addressing pain-related fear [11,12]. Understanding the psychological factors affecting physiotherapy outcomes for shoulder pain is crucial, with kinesiophobia emerging as a key factor. While kinesiophobia is extensively researched in low back pain, neck pain, and knee injury, its impact on shoulder pain is poorly understood [13-15]. Moreover, there is limited research on how assessment methods like the SSMP affect pain and kinesiophobia in shoulder pain patients [16-18]. Further research is crucial to improve understanding and optimise therapeutic approaches for shoulder pain, where kinesiophobia impact is understudied.

Therefore, the aim of the present study was to find out the effect of the SSMP on pain and kinesiophobia in shoulder pain conditions.

MATERIALS AND METHODS

A single-blinded, quasi-experimental study was conducted in the Department of Musculoskeletal Physiotherapy, RV College of Physiotherapy, Bengaluru, Karnataka, India, over a period of six months from February 2022 to June 2022 after approval by the Institutional Ethics Committee (Ref: RVCP/RESEARCH/0420 dated 24-08-2021).

Inclusion criteria: Individuals aged 40-60 years who willingly enrolled and provided written informed consent were considered. Eligible participants were those with shoulder pain persisting for over three months. Inclusion criteria required the presence of atleast one positive sign among Neer's Impingement test (sensitivity 78%; specificity: 58%), Hawkin's Kennedy (sensitivity: 58%; specificity: 67%), painful arc (sensitivity 53%; specificity 78%), and drop arm (sensitivity 73%; specificity 77%) [19]. Additionally, individuals in the initial (painful) stage of frozen shoulder were included in the study.

Exclusion criteria: Participants with a history of significant shoulder trauma, recurrent shoulder dislocation, or recent shoulder surgery within the past year were not included. Additionally, individuals experiencing shoulder pain originating from the cervical spine or related to specific disorders such as arthritis {(e.g., Rheumatoid Arthitis (RA)} or neurologic conditions (e.g., stroke) were not included in the study.

Sample size calculation: The sample size (n) was calculated using the formula $n=\{((Z\alpha/2)^2 * p*q)\div d^2\}$. With specified values (α=0.05, Z 0.025=1.96, p=22.9%=0.229, q=1-p=0.771, and d=15%=0.15), the calculation resulted in n=35. This sample size was determined, accounting for a 15% non response error. The study justified this sample size based on a similar prior study's estimated prevalence [20].

Study Procedure

A total of 35 subjects were screened and recruited for the study based on inclusion and exclusion criteria.

Pretest: Subjects screened for the study were asked to fill out the TSK-11 [21], following which subjects were asked to rate their level of pain using the NPRS [22,23]. Outcome measures (TSK-11 and NPRS) were pre-assessed by an experienced physiotherapy graduate.

The SSMP (assessment) [16] was conducted by the researcher, and the response of the procedure was utilised for treatment for a total of three weeks, i.e., six sessions. The researcher was blinded to the results of the pre and post-test values of the outcome measures, i.e., (TSK-11 and NPRS) done by the assessor.

Post-test: At the end of three weeks, the same assessor re-evaluated the outcome measures (NPRS and TSK-11).

Outcome Measures:

- **Numerical Pain Rating Scale (NPRS):** The NPRS is an 11-point measure of pain in which patients rate their pain ranging from 0 (no pain) to 10 (worst imaginable pain). It has already shown good responsiveness in shoulder pain [22].
- **Tampa Scale of Kinesiophobia-11 (TSK-11):** The original TSK comprises 17 items, each rated on a scale from 1 to 4 or 0 to 3, providing a total score ranging from 17 to 68 or 0 to 51. Shortened versions like TSK-13 and TSK-11, known for their reliability and validity, are widely employed for kinesiophobia assessment. TSK demonstrates high test-retest reliability and internal consistency, solidifying its role as a psychometrically sound and clinically valuable tool [21].
- **Subscales of TSK:** TSK-harm, measuring fear of physical harm or injury during movement, and TSK-avoidance, assessing avoidance of activities due to fear, regardless of actual harm. Scores for each item range from 1 to 4, with higher scores indicating greater kinesiophobia. TSK-harm gauges concern about potential harm, while TSK-avoidance focuses on the fear of pain during movement. Total scores for both subscales are obtained by summing item responses. Elevated scores on either subscale suggest heightened kinesiophobia, influencing individuals to avoid activities and potentially impeding rehabilitation efforts [21].

STATISTICAL ANALYSIS

The data collected for present study were entered into MS Excel and analysed using R software version 4.1.0.

The data was statistically analysed as follows:

- **Descriptive statistics:** The categorical variables were expressed as frequency and percentage. The quantitative variables were described as mean and Standard Deviation (SD).
- **Inferential statistics:** The difference in the mean scores from pretest to post-test between the outcome measures scales (NPRS and TSK-11) was assessed using a paired t-test, subject to verification of the normality assumption. Results were considered significant whenever $p<0.05$.

RESULTS

In the present study involving 35 individuals with shoulder pain, the age distribution showed that 12 (34.3%) were between 40 and 50 years old, and 23 (65.7%) fell within the 51-60 age group, resulting in a mean age of 52.00±7.74 years [Table/Fig-1]. Gender distribution indicated that 19 (54.3%) were males, and 16 (45.7%) were females. The majority exhibited right-hand dominance 33 (94.3%), while 2 (5.7%) had left-hand dominance. Pain predominantly occurred on the right-side 19 (54.3%), and 16 (45.7%) experienced pain for less than five months, 40% for 6-11 months, and 14.3% for over 12 months [Table/Fig-1].

Parameters		n (%)
Age (in years) (Mean±SD)		52.00±7.74
Gender	Male	19 (54.3)
	Female	16 (45.7)
Hand dominance	Left	2 (5.7)
	Right	33 (94.3)
Painful side	Left	16 (45.7)
	Right	19 (54.3)
Duration of pain (months)	≤5	16 (45.7)
	6-11	14 (40)
	≥12	5 (14.3)

[Table/Fig-1]: Demographic and clinical characteristics of subjects who participated in the study.
SD: Standard deviation

Most painful movement	Frequency	Percentage
AB	9	25.7
AB, ER	1	2.9
AB, IR	9	25.7
ER	1	2.9
F, ER	1	2.9
F, AB	2	5.7
F, AB, IR	2	5.7
F, AB, IR, ER	2	5.7
Horizontal adduction	2	5.7
IR	4	11.4
IR, AB	1	2.9
IR, ER	1	2.9
Total	35	100.0

[Table/Fig-2]: Distribution of most painful movement in subjects with shoulder pain.
F: Flexion; AB: Abduction; IR: Internal rotation; ER: External rotation

As shown in [Table/Fig-2], abduction and abduction with internal rotation were identified as the most painful movements in 9 (25.7%) of subjects.

Regarding the SSMP, 7 (20%) had complete symptom reduction, and 28 (80%) had partial reduction [Table/Fig-3] [16].

The analysis showed that NPRS scores significantly decreased from pre-intervention (7.74±1.146) to post-intervention (3.74±1.70), p<0.001**, demonstrating a 51.68% reduction (PR=7.74-3.74÷7.74×100. PR=51.68%) [Table/Fig-4] [22].

SSMP results	Frequency	Percentage
Complete	7	20.0
Partial	28	80.0
Total	35	100.0

[Table/Fig-3]: Distribution of SSMP results in subjects with shoulder pain [16].

Outcome measure	Pre-test		Post-test		t-value	p-value
	Mean	SD	Mean	SD		
Numerical pain rating scale	7.54	1.146	3.74	1.70	14.881	<0.001**

[Table/Fig-4]: Comparison of NPRS values pre- and post-intervention after three weeks [22].
For NPRS– Paired t-test

In present study, the TSK-11 scores for subjects with shoulder pain significantly decreased from a pre-intervention mean±SD of 27.20±5.12 to a post-intervention mean±SD of 23.17±4.83 (t-value=4.720, p<0.001**). This indicates a substantial 14.82% reduction in TSK-11 scores from pre-intervention to post-intervention. TSK-avoidance scores decreased by 11.53%, and TSK-harm scores decreased by 17.91% from pre-intervention to post-intervention [Table/Fig-5] [21].

Parameters	Pretest		Post-test		t-value	p-value
	Mean	SD	Mean	SD		
Tampa scale for kinesiophobia	27.20	5.12	23.17	4.83	4.720	<0.001**
TSK- Harm	10.89	2.56	8.94	2.31	4.050	<0.001**
TSK-avoidance	16.31	3.26	14.43	3.38	4.582	<0.001**

[Table/Fig-5]: Comparison of TSK-11 values pre- and post-intervention after three weeks [21].
Subcategories of TSK-11 are TSK-harm and TSK-avoidance
For TSK-11: Paired t-test

DISCUSSION

The present study demonstrated the significant effectiveness of the SSMP in reducing pain and kinesiophobia scores in individuals with shoulder pain conditions over a three week period. The study included participants aged 40-60 years, with 34.3% in the 40-50 years age range and 65.7% in the 51-60 years range. The duration of shoulder pain varied, with 45.7% experiencing it for 6-11 months, 40% for less than five months, and 14.3% for over 12 months. Among the 35 subjects, 33 were right-dominant, and two were left-dominant. Notably, right-dominant individuals (19) predominantly had pain in the right shoulder, while left-dominant ones (16) reported pain mainly in the left shoulder.

Recent clinical research emphasises the integration of the biopsychosocial model in rehabilitation, highlighting the significance of assessing and managing psychological factors in patients with musculoskeletal injuries or pain. Understanding the impact of psychological factors, including self-efficacy, confidence in function, pain catastrophising, kinesiophobia, and fear of re-injury, is crucial for informed decision-making and improved rehabilitation outcomes [24].

A systematic review assessing the impact of manual therapy on fear avoidance, kinesiophobia, and pain catastrophising in chronic musculoskeletal pain patients suggested that manual therapy might not outperform a no-treatment option in reducing kinesiophobia. In contrast, the present study demonstrated noteworthy efficacy in reducing kinesiophobia levels among individuals with shoulder pain [25].

A recent systematic review concluded that exercise therapy yields significant benefits for chronic musculoskeletal pain, often being the preferred treatment choice [26]. While kinesiophobia has been previously assessed in patients with chronic lower back pain and postoperative Accessory Ligament (ACL), present study focuses on measuring kinesiophobia in patients with shoulder pain conditions.

The reasons behind the immediate symptom changes induced by the SSMP remain unknown, aligning with the uncertainty in most musculoskeletal therapies. Nevertheless, present study reveals that a majority of patients experienced significant improvements in pain and kinesiophobia. The present study included 35 subjects with shoulder pain conditions, demonstrating a significant reduction in NPRS from 7.54±1.146 to 3.74±1.70 and TSK-11 scores from 27.20±5.12 to 23.17±4.83 after three weeks of intervention. The findings indicate a substantial improvement in both pain (p<0.001) and kinesiophobia (p<0.001) in subjects with shoulder pain. Thus, the SSMP emerges as an effective approach for assessing and treating symptoms in patients with shoulder pain.

Limitation(s)

The sample size was small, and a long-term effect of the study could not be conducted as it was only for three weeks without further follow-ups. The present was a single-blinded quasi-experimental study, which means there was no control group.

CONCLUSION(S)

The present study provides robust evidence supporting the efficacy of the SSMP in reducing pain and kinesiophobia among individuals with shoulder pain conditions. The statistically significant improvements observed in the NPRS and TSK-11 scores over the three-week intervention period highlight the potential of the SSMP as a promising and valuable strategy for both assessment and intervention in the management of shoulder pain. Studies including larger sample sizes need to be conducted for better positive results. Further research in controlled trials is needed to examine the long-term effects of this intervention and to establish its clinical effectiveness.

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REFERENCES

[1] Sanchis MN, Lluch E, Nijs J, Struyf F, Kangasperko M. The role of central sensitization in shoulder pain: A systematic literature review. Semin Arthritis Rheum. 2015;44(6):710-16. [PubMed]
[2] Khosravi F, Amiri Z, Masouleh NA, Kashfi P, Panjizadeh F, Hajilo Z, et al. Shoulder pain prevalence and risk factors in middle-aged women: A cross-sectional study. J Bodyw Mov Ther. 2019;23(4):752-57.
[3] Luime JJ, Koes BW, Hendriksen IJM, Burdorf A, Verhagen AP, Miedema HS, et al. Prevalence and incidence of shoulder pain in the general population; A systematic review. Scand J Rheumatol. 2004;33(2):73-81.
[4] Ottenheijm RPG, Joore MA, Walenkamp GHIM, Weijers RE, Winkens B, Cals JWL, et al. The Maastricht Ultrasound Shoulder pain trial (MUST): Ultrasound imaging as a diagnostic triage tool to improve management of patients with non-chronic shoulder pain in primary care. BMC Musculoskelet Disord. 2011;12(1):154.
[5] Van der Windt DA, Koes BW, Boeke AJ, Devillé W, De Jong BA, Bouter LM. Shoulder disorders in general practice: Prognostic indicators of outcome. Br J Gen Pract. 1996;46(410):519-23.
[6] May S, Chance-Larsen K, Littlewood C, Lomas D, Saad M. Reliability of physical examination tests used in the assessment of patients with shoulder problems: A systematic review. Physiotherapy [Internet]. 2010;96(3):179-90. [PubMed].

[7] Hegedus EJ, Goode AP, Cook CE, Michener L, Myer CA, Myer DM, et al. Which physical examination tests provide clinicians with the most value when examining the shoulder? Update of a systematic review with meta-analysis of individual tests. Br J Sports Med. 2012;46(14):964-78.[PubMed].
[8] Hughes PC, Taylor NF, Green RA. Most clinical tests cannot accurately diagnose rotator cuff pathology: A systematic review. Aust J Physiother. 2008;54(3):159-70.
[9] Lehman GJ. The role and value of symptom-modification approaches in musculoskeletal practice. J Orthop Sports Phys Ther. 2018;48(6):430-05. [PubMed].
[10] Lewis JS. Rotator cuff tendinopathy/subacromial impingement syndrome: Is it time for a new method of assessment? Br J Sports Med. 2009;43(4):259-64. [Crossref] [PubMed].
[11] Pincus T, Smeets RJEM, Simmonds MJ, Sullivan MJL. The fear-avoidance model disentangled: Improving the clinical utility of the fear-avoidance model. Clin J Pain. 2010;26(9):739-46. [Crossref] [PubMed].
[12] Chester R, Jerosch-Herold C, Lewis J, Shepstone L. Psychological factors are associated with the outcome of physiotherapy for people with shoulder pain: A multicentre longitudinal cohort study. Br J Sports Med. 2018;52(4):269-75. [Crossref] [PubMed].
[13] Luque-Suarez A, Martinez-Calderon J, Navarro-Ledesma S, Morales-Asencio JM, Meeus M, Struyf F. Kinesiophobia is associated with pain intensity and disability in chronic Shoulder Pain: A cross-sectional study. J Manipulative Physiol Ther. 2020;43(8):791-98. [Crossref].
[14] Feleus A, van Dalen T, Bierma-Zeinstra SMA, Bernsen RMD, Verhaar JAN, Koes BW, et al. Kinesiophobia in patients with non-traumatic arm, neck and shoulder complaints: A prospective cohort study in general practice. BMC Musculoskelet Disord. 2007;8(1):117. [PubMed].
[15] Genoese F, Baez S, Hoch JM. The association of fear-avoidance beliefs and self-reported knee function in patients with a knee injury: A critically appraised topic. Int. J. Athl. Ther. Train. 2018;23(5):187-91. [Crossref].
[16] Lewis JS, McCreesh K, Barratt E, Hegedus EJ, Sim J. Inter-rater reliability of the Shoulder Symptom Modification Procedure in people with shoulder pain. BMJ Open Sport Exerc Med. 2016;2(1):e000181. [Crossref] [PubMed].
[17] Meakins A, May S, Littlewood C. Reliability of the Shoulder Symptom Modification Procedure and association of within-session and between-session changes with functional outcomes. BMJ Open Sport Exerc Med. 2018;4(1):e000342. [PubMed].
[18] Bahat HS, Kerner O. The shoulder symptom modification procedure (SSMP): A reliability study. J Nov Physiother. 2016;s3.[Crossref].
[19] Alqunaee M, Galvin R, Fahey T. Diagnostic accuracy of clinical tests for subacromial impingement syndrome: A systematic review and meta-analysis. Arch Phys Med Rehabil. 2012;93(2):229-36. https://www.ncbi.nlm.nih.gov/books/NBK91532/.
[20] Bhawna V, Multani NK, Kundu ZS. Prevalence of shoulder pain among adults in northern India. Asian J. Health Med. Res. 2016:(2):18-22. [Crossref].
[21] Hapidou EG, O'Brien MA, Pierrynowski MR, de Las Heras E, Patel M, Patla T. Fear and avoidance of movement in people with chronic pain: Psychometric properties of the 11-item Tampa Scale for Kinesiophobia (TSK-11). Physiother Can. 2012;64(3):235-41. [PubMed].
[22] Katz J, Melzack R. Measurement of pain. Surg Clin North Am. 1999;79(2):231-52. [PubMed].
[23] Michener LA, Snyder AR, Leggin BG. Responsiveness of the numeric pain rating scale in patients with shoulder pain and the effect of surgical status. J Sport Rehabil. 2011;20(1):115-28. [Crossref].
[24] Pomarensky M, Macedo L, Carlesso LC. Management of chronic musculoskeletal pain through a biopsychosocial lens. J Athl Train. 2022;57(4):312-18.
[25] Kamonseki DH, Christenson P, Rezvanifar SC, Calixtre LB. Effects of manual therapy on fear avoidance, kinesiophobia and pain catastrophizing in individuals with chronic musculoskeletal pain: Systematic review and meta-analysis. Musculoskelet Sci Pract. 2021;51(102311):102311.
[26] Smith BE, Hendrick P, Smith TO, Bateman M, Moffatt F, Rathleff MS, et al. Should exercises be painful in the management of chronic musculoskeletal pain? A systematic review and meta-analysis. Br J Sports Med. 2017;51(23):1679-87.

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