Received: 17 April 2025/ Revised: 08 June 2025/ Accepted: 26 August 2025

ORIGINAL ARTICLE

Journal of Hacettepe University
Physical Therapy and Rehabilitation

Immediate Effects of Scapular Mobilization on Shoulder Range of Motion and Pain Level in Patients with Proximal Humerus Fractures

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ABSTRACT

Purpose: Pain and muscle spasms around the scapula are common following proximal humerus fractures and can adversely effect shoulder function. This study aimed to examine the immediate effects of scapular mobilization on shoulder range of motion and pain level in patients with proximal humerus fractures.

Method: Twenty-eight patients (mean age: 54.20±4.36 years) with conservatively treated proximal humerus fractures were included in the study. Pain level was assessed using the Visual Analog Scale, while shoulder flexion and abduction angles were measured with a goniometer. Scapular mobilization was performed for approximately 10 minutes, consisting of 10 repetitions in medio-lateral, supero-inferior, and circumduction movements. Evaluations were conducted on the day the arm sling was removed, both before and after the scapular mobilization intervention.

Results: Immediately after scapular mobilization, significant improvements were observed in shoulder flexion ($p<0.001$) and abduction ($p<0.001$), with increases of 14.46° and 15.52°, respectively. Resting pain levels also significantly decreased ($p<0.001$), with a reduction of 2.41 cm.

Discussion: Scapular mobilization significantly improves shoulder range of motion and reduces pain in patients with proximal humerus fractures, suggesting its potential as an effective physiotherapy approach in the acute rehabilitation phase.

Key Words: Bone Fracture, Manual Therapies, Pain, Range of Motion, Scapula

INTRODUCTION

Proximal humerus fractures (PHFs) are common, particularly among older adults, typically resulting from falls (1). Careful management is crucial to ensure proper healing and optimize functional recovery. Since the majority of these fractures occur as minimally displaced or non-displaced fractures, they are typically treated conservatively (1, 2). The conservative treatment of PHFs includes the use of analgesics, shoulder slings, and physiotherapy management (3). Regardless of whether the fracture is treated conservatively or surgically, a significant number of patients experience shoulder stiffness and a decrease in joint range of motion (3). It has been reported that early physiotherapy management initiated within the first two weeks after the fracture is more effective in improving shoulder and upper extremity function compared to immobilization (4).

Full shoulder elevation in the scapular plane is achieved through the coordination between the scapulothoracic and glenohumeral joints. Establishing proper scapulohumeral rhythm plays a crucial role in the rehabilitation process, especially in maintaining shoulder function. Altered scapulohumeral rhythm is a common consequence of PHFs and adversely affects functional outcomes (5).

Several factors following a PHF can affect the biomechanics of the shoulder joint, including alterations in bony alignment, rotator cuff tension, soft tissue injury resulting from the initial injury or surgical approach, and the effects of immobilization (6). After a proximal humerus fracture, a decrease in shoulder joint range of motion, pain, and spasms are among the frequently encountered problems in patients (3). Early mobilization protocols have been shown to improve shoulder function and reduce pain without compromising fracture healing (4, 7). Scapula mobilization applications are considered a useful manual therapy technique that can be

applied to individuals with painful shoulder movement restrictions (8-10). Effective scapula mobilization is crucial for restoring proper scapulohumeral rhythm and shoulder function in patients with PHFs (5). A randomized controlled study reported that scapula mobilization acutely improved shoulder range of motion and reduced pain compared to no or sham mobilization in patients with shoulder pain (9).

In the literature, there are studies investigating the effectiveness of scapula mobilization applied to patients with shoulder pathologies (8, 10). However, no study has been found that examines its effectiveness on patients with proximal humerus fractures. This study aims to investigate the immediate effects of scapula mobilization on shoulder movements and pain in patients with proximal humerus fractures.

METHODS

Study Design

A retrospective, single-blind, pre- and post-assessment design was adopted for the present study. All measurements were performed at Hacettepe University Faculty of Physical Therapy and Rehabilitation, Department of Musculoskeletal Physiotherapy and Rehabilitation. Ethical approval was obtained from the Institutional Ethics Review Board (FTREK24/122). The data were retrospectively collected from the records of patients with PHFs who were conservatively treated and referred to the physiotherapy department between 2017 and 2022.

All patients attended a treatment session following the removal of the shoulder sling and received scapular mobilization intervention from a senior physiotherapist (EUY) specialized in orthopedic rehabilitation. Assessments were performed before and immediately after the intervention by a blinded physiotherapist (NBC).

Participants

A total of 28 patients (mean age 54.20±4.36 years, mean body mass index=27.76±3.12 kg/m^2, and gender=17f, 11m) with PHFs who were referred to the Orthopedic Rehabilitation unit, following the removal of the shoulder sling, were included in the study. The demographic characteristics of patients are presented in Table 1.

Table 1. Demographic characteristics of patients.

	Participants N = 28
Characteristics	**Mean ± SD**
Age (year)	54.20 ± 4.36
Gender (f/m)	17/11
Body weight (kg)	79.60 ± 10.20
Height (cm)	167.32 ± 5.98
Body mass index (kg/m^2)	27.76 ± 3.12

SD: Standard deviation, f: female, m: male.

Based on a post hoc power analysis (G*Power software, version 3.1, Universität Düsseldorf, Germany) using the observed effect size (d = 1.54) obtained from the shoulder flexion ROM variable, with an alpha level of 0.05, a sample size of n = 7 was sufficient to achieve 95% statistical power. The inclusion criteria are as follows: being between 35 and 65 years old, having been conservatively treated after a PHF, being referred to physiotherapy within a maximum of 4 weeks after the fracture, and having more than 25% limitation in shoulder flexion and abduction range of motion. Exclusion criteria: having neurological or vascular complications related to the fracture, and having a previous surgery or injury involving the upper extremity.

Procedure

Scapula mobilization was performed on patients in the side-lying position, with their arms in 90° flexion. The physiotherapist performed medio-lateral, supero-inferior, and circumduction movements on the scapula by stabilizing its medial border, with each movement repeated 10 times. A 30-second interval was given between each application (8).

Assessments

Pain level: The resting pain level of the patients was assessed using the Visual Analog Scale (VAS) before and after scapula mobilization. The patient was asked to mark the level of pain they felt on a 10 cm long line where 0 represents "no pain" and 10 represents "the most severe" pain. Then, the marked distance was measured in centimeters and recorded (11).

Shoulder joint range of motion: Active shoulder flexion and abduction were evaluated in the supine position with the scapula stabilized laterally using a goniometer (8).

Statistical Analysis

Statistical Package for the Social Sciences (SPSS) (IBM Corp., Armonk, New York, USA) 23.0 program was used for statistical analysis of the data. Data were analysed with histograms, Q-Q plots, and Shapiro-Wilk tests for normality of the distribution. The variables are presented as mean and standard deviation (SD). Before and after treatment, pain level and range of motion results were analysed with a Paired Sample T test. The significance level was set at 0.05.

RESULTS

Immediately after the scapular mobilization intervention, significant improvements were observed in both shoulder flexion ($p<0.001$) and abduction ($p<0.001$) angles. After the intervention, shoulder flexion improved by 14.46° and abduction increased by 15.52°. Additionally, a significant reduction was observed in resting pain levels ($p <0.001$). Pain levels decreased by 2.41 cm after intervention (Table 2).

DISCUSSION

This study demonstrated that a single session of scapular mobilization significantly improved shoulder flexion and abduction angles, as well as a notable reduction in resting pain immediately after the intervention in patients with proximal humerus fractures. These findings suggest that scapular mobilization may be an effective manual therapy technique for acutely enhancing shoulder mobility and reducing pain in patients with PHFs.

Although scapular mobilization in the context of PHFs has not been directly addressed in the existing literature, the principle of early mobilization has been widely supported (4, 7, 12). In PHFs, early restoration of scapular motion may help prevent secondary complications such as joint stiffness, restriction of shoulder range of motion, and delayed return to function following shoulder immobilization (7, 13). Moreover, by improving joint mobility and reducing pain, scapular mobilization may potentially accelerate overall functional recovery.

In the current study, a single session of scapular mobilization significantly improved shoulder flexion and abduction range of motion, as well as resting shoulder pain, in patients with PHFs. While there is limited literature examining scapular mobilization in patients with PHFs, several studies have explored its effectiveness in other shoulder pathologies. Our findings are consistent with previous studies reporting positive outcomes of scapular mobilization in individuals with various shoulder pathologies. For instance, many researchers have reported positive effects of scapular mobilization in improving glenohumeral mobility and reducing pain in patients with frozen shoulder (8, 14, 15). Similarly, Fani et al.(16) found it effective in altering scapular resting posture in individuals with rounded shoulder posture. In contrast, studies by Gutiérrez-Espinoza et al. (17) and Aytar et al. (18) found no significant clinical advantage of scapular mobilization in patients with subacromial impingement syndrome.

These conflicting findings may stem from differences in patient populations, chronicity of symptoms, or outcome measures. Nevertheless, the immediate improvements observed in our study suggest that scapular mobilization may be a beneficial adjunct in the acute rehabilitation phase of PHF. These effects may be attributed to the restoration of optimal scapulohumeral kinematics and the reduction of neuromuscular inhibition associated with pain and joint dysfunction.

Table 2. Comparison of shoulder range of motion and pain level before and after intervention.

	Before intervention Mean ± SD	After intervention Mean ± SD	p	Cohen's d
Active shoulder ROM (°)				
Flexion	58.72 ± 10.43	73.18 ± 8.20	<0.001	-1.54
Abduction	53.85 ± 8.91	69.37 ± 7.82	<0.001	-1.85
Pain Level				
VAS (cm)	4.66 ± 1.13	2.25 ± 1.12	<0.001	2.14

ROM: Range of motion, VAS: Visual analog scale, SD: Standard deviation.

However, unlike previous research primarily focusing on non-traumatic conditions, the present study is the first to demonstrate similar benefits in post-traumatic shoulder disorders. Further research with larger sample sizes and extended follow-up periods is needed to confirm these preliminary findings.

Manual therapy techniques, including scapular mobilization, are thought to contribute to pain relief and functional improvement through both biomechanical and neurophysiological mechanisms. These techniques help restore normal joint and soft tissue mobility, while also activating central inhibitory mechanisms that reduce central sensitization and produce analgesic effects (19). Specifically, joint mobilization has been shown to stimulate descending inhibitory pathways in the spinal cord via serotonin, noradrenaline, adenosine, and cannabinoid receptors, thereby reducing pain perception (20, 21). In addition to improving joint range of motion, such neuromodulatory effects support the use of manual therapy as an effective intervention in managing musculoskeletal pain. The significant reductions in resting shoulder pain observed in our study following scapular mobilization may be explained by these underlying mechanisms.

A recent systematic review emphasized the advantages of early mobilization initiated within the first week leads to better functional recovery and pain reduction in PHFs, particularly within the first three months of rehabilitation (7). The results of the present study highlight the positive effects of early scapular mobilization in patients with PHFs. Given the limited range of motion and pain are common barriers to the rehabilitation process following PHFs, the use of scapular mobilization as a manual therapy technique could facilitate earlier engagement in active movement and functional tasks. In this context, the application of scapular mobilization during the early period may not only enhance patient comfort but also contribute to improved rehabilitation outcomes by preventing stiffness and promoting more efficient neuromuscular reactivation without compromising fracture healing.

Limitations

There are some limitations in our study. First, the study assessed only the immediate effects of a single intervention, and the long-term benefits of scapular mobilization remain unknown. Second, since no control group was included in the study, it remains unclear whether the observed improvements following scapular mobilization can be directly attributed to the intervention itself. Third, although a goniometer was used for measuring shoulder range of motion—a widely accepted and practical tool in clinical settings—it may be subject to both inter- and intra-rater variability. Moreover, the goniometer may lack the sensitivity to detect small yet clinically important changes in joint angle. To minimize potential bias, all measurements were performed by a single experienced physiotherapist using a consistent positioning and measurement protocol.

CONCLUSION

This study highlights the immediate benefits of scapular mobilization in improving shoulder range of motion and reducing pain in patients with proximal humerus fractures. The findings suggest that scapular mobilization may serve as a valuable physiotherapy approach in the acute rehabilitation phase, particularly during the early stages following fracture, for maintaining shoulder functionality. Further research with larger sample sizes and longer follow-up periods is needed to confirm the long-term effects of these results.

Acknowledgments

The authors would like to express their deepest thanks to Prof. Dr. Hande Guney-Deniz for her invaluable contributions and continuous support throughout this study.

Author Contributions:

EÜY: Conceptualization, methodology, formal analysis and investigation, writing – original draft preparation, writing – review and editing, funding acquisition, resources, supervision. NBC: Methodology, writing – original draft preparation, resources

Financial Support: The authors declare that no funds, grants, or other support were received during the preparation of this manuscript.

Conflict of Interest: The author(s) state that there are no potential conflicts of interest concerning the research, writing, and/or publication of this article.

Ethical approval: The study was approved by the Hacettepe University Faculty of Physical Therapy and Rehabilitation Unit Research Ethics Committee (FTREK24/122).

How to cite this article: Unuvar-Yuksel E, Cigercioglu N. Immediate Effects of Scapular Mobilization on Shoulder Range of Motion and Pain Level in Patients with Proximal Humerus Fractures. Journal of Hacettepe University Physical Therapy and Rehabilitation. 2026;4(1),1-5.

REFERENCES

1. Konrad GG, Mehlhorn A, Kühle J, Strohm PC, Südkamp NP. Proximal humerus fractures - current treatment options. Acta Chir Orthop Traumatol Cech. 2008;75(6):413-21.
2. Bhambra T, Souroullas P, Wright AP, Gandhi M. Evidence-based management of proximal humerus fractures. Orthopaedics and Trauma. 2023;37(5):296-302.
3. Iyengar JJ, Devcic Z, Sproul RC, Feeley BT. Nonoperative treatment of proximal humerus fractures: a systematic review. J Orthop Trauma. 2011;25(10):612-7.
4. Lefevre-Colau MM, Babinet A, Fayad F, Fermanian J, Anract P, Roren A, et al. Immediate mobilization compared with conventional immobilization for the impacted nonoperatively treated proximal humeral fracture. A randomized controlled trial. J Bone Joint Surg Am. 2007;89(12):2582-90.
5. Suphakitchanusan W, Kerdsomnuek P, Jamkrajang P, Fossum BW, Sudjai N, Paugchawee J, et al. Scapular dyskinesis after treatment of proximal humerus fracture, a 3-dimensional motion analysis and clinical outcomes. J Shoulder Elbow Surg. 2023;32(10):e504-e15.
6. Itoi E, Arce G, Bain GI, Diercks RL, Guttmann D, Imhoff AB, et al. Shoulder Stiffness: Current Concepts and Concerns. Arthroscopy. 2016;32(7):1402-14.
7. Ranieri R, Lacouture-Suarez JD, Ferrero M, Longobardi V, Cacace F, Ferrero A, et al. Early rehabilitation vs. conventional immobilization in nonoperative treatment of proximal humeral fracture: a systematic review. Eur Rev Med Pharmacol Sci. 2024;28(11):3771-80.
8. Duzgun I, Turgut E, Eraslan L, Elbasan B, Oskay D, Atay OA. Which method for frozen shoulder mobilization: manual posterior capsule stretching or scapular mobilization? J Musculoskelet Neuronal Interact. 2019;19(3):311-6.
9. Surenkok O, Aytar A, Baltaci G. Acute effects of scapular mobilization in shoulder dysfunction: a double-blind randomized placebo-controlled trial. J Sport Rehabil. 2009;18(4):493-501.
10. Yang JL, Jan MH, Chang CW, Lin JJ. Effectiveness of the end-range mobilization and scapular mobilization approach in a subgroup of subjects with frozen shoulder syndrome: a randomized control trial. Man Ther. 2012;17(1):47-52.
11. Hawker GA, Mian S, Kendzerska T, French M. Measures of adult pain: Visual Analog Scale for Pain (VAS Pain), Numeric Rating Scale for Pain (NRS Pain), McGill Pain Questionnaire (MPQ), Short-Form McGill Pain Questionnaire (SF-MPQ), Chronic Pain Grade Scale (CPGS), Short Form-36 Bodily Pain Scale (SF-36 BPS), and Measure of Intermittent and Constant Osteoarthritis Pain (ICOAP). Arthritis Care Res (Hoboken). 2011;63 Suppl 11:S240-52.
12. Martínez R, Santana F, Pardo A, Torrens C. One Versus 3-Week Immobilization Period for Nonoperatively Treated Proximal Humeral Fractures: A Prospective Randomized Trial. J Bone Joint Surg Am. 2021;103(16):1491-8.
13. Handoll HH, Brorson S. Interventions for treating proximal humeral fractures in adults. Cochrane Database Syst Rev. 2015(11):Cd000434.
14. Sinha U, Sarkar B, Kumar P. Effectiveness of Scapular Mobilization versus Myofascial Release of Subscapularis on Pain, ROM and Function in Subjects with Chronic Frozen Shoulder: A Comparative Study. Int J Health Sci Res. 2019;9:149-56.
15. Boruah L, Dutta A, Deka P, Roy J. To Study the Effect of Scapular Mobilization Versus Mobilization with Movement to Reduce Pain and Improve Gleno-Humeral Range of Motion in Adhesive Capsulitis of Shoulder: A Comparative Study. Int J Physiother.. 2015;2:811-8.
16. Fani M, Ebrahimi S, Ghanbari A. Evaluation of scapular mobilization and comparison to pectoralis minor stretching in individuals with rounded shoulder posture: A randomized controlled trial. J Bodyw Mov Ther. 2020;24(4):367-72.
17. Gutiérrez-Espinoza H, Pinto-Concha S, Sepúlveda-Osses O, Araya-Quintanilla F. Effectiveness of scapular mobilization in people with subacromial impingement syndrome: A randomized controlled trial. Ann Phys Rehabil Med. 2023;66(5):101744.
18. Aytar A, Baltaci G, Uhl TL, Tuzun H, Oztop P, Karatas M. The effects of scapular mobilization in patients with subacromial impingement syndrome: a randomized, double-blind, placebo-controlled clinical trial. J Sport Rehabil. 2015;24(2):116-29.
19. Chimenti RL, Frey-Law LA, Sluka KA. A Mechanism-Based Approach to Physical Therapist Management of Pain. Phys Ther. 2018;98(5):302-14.
20. Fritschy JM, Sarter M. Repeated massage-like stimulation induces long-term effects on nociception: contribution of oxytocinergic mechanisms. Eur J Neurosci. 2009;29(4):868.
21. Agren G, Lundeberg T, Uvnäs-Moberg K, Sato A. The oxytocin antagonist 1-deamino-2-D-Tyr-(Oet)-4-Thr-8-Orn-oxytocin reverses the increase in the withdrawal response latency to thermal, but not mechanical nociceptive stimuli following oxytocin administration or massage-like stroking in rats. Neurosci Lett. 1995;187(1):49-52.