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Physiotherapy Management After ORIF in Proximal Humerus Fracture: A Case Report

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Abstract

Background: Proximal humerus fractures are common upper-extremity injuries that often require surgical intervention such as open reduction and internal fixation (ORIF). Postoperative complications frequently include pain, limited range of motion (ROM), decreased muscle strength, and impaired functional ability, which necessitate structured rehabilitation.
Objective: To describe the clinical outcomes of a physiotherapy program in a patient with proximal humerus fracture following ORIF.
Methods: This case report followed CARE guidelines and involved a 65-year-old female with a right proximal humerus fracture (Neer 2-part) post-ORIF. The physiotherapy intervention consisted of Transcutaneous Electrical Nerve Stimulation (TENS), active and active-assisted range of motion exercises, and progressive resisted exercises targeting the shoulder muscles. The program was conducted over three sessions within three weeks. Outcomes were assessed using Numerical Pain Rating Scale (NPRS), goniometric ROM, Manual Muscle Testing (MMT), and Disabilities of the Arm, Shoulder, and Hand (DASH) questionnaire.
Results: Active shoulder ROM improved from 50–0–110° at baseline to 50–0–115° at the final session, while passive ROM increased from 50–0–150° to 50–0–155°. Muscle strength improved from grade 3− to grade 5. Functional ability showed substantial improvement, with DASH scores decreasing from 47 to 15.
Conclusion: A short-term physiotherapy program combining pain modulation and progressive exercise improved joint mobility, muscle strength, and functional outcomes in a patient following ORIF for proximal humerus fracture.

Keywords
proximal humerus fractures; internal fixation devices; physical therapy modalities; rehabilitation; range of motion; activities of daily living

Introduction

Proximal humerus fractures are among the most common upper-extremity fractures, accounting for approximately 5–6% of all fractures and representing the third most frequent fracture in older adults.[1] These injuries predominantly occur in elderly populations due to low-energy falls associated with osteoporosis, although they may also affect younger individuals following high-energy trauma.[2,3] The incidence of proximal humerus fractures continues to increase globally, contributing to a substantial burden on healthcare systems and significantly impacting patients' functional independence and quality of life.[3,4]

The Neer classification system remains widely used to guide clinical decision-making by categorizing fractures based on displacement and the number of fragments.[5] Among these, Neer 2-part fractures involve displacement of a single fragment and may lead to impaired shoulder stability and functional limitation if not managed appropriately.[1] Surgical intervention, particularly open reduction and internal fixation (ORIF), is commonly indicated in displaced fractures to restore anatomical alignment and provide mechanical stability.[6] However, despite advances in surgical techniques, postoperative outcomes remain variable, with many patients experiencing persistent pain, restricted range of motion (ROM), reduced muscle strength, and diminished upper-extremity function.[7]

Postoperative rehabilitation plays a crucial role in optimizing recovery following ORIF. Current evidence emphasizes the importance of early mobilization and structured physiotherapy to restore joint mobility and prevent complications such as stiffness and muscle atrophy.[7,8] Early active rehabilitation has been associated with improved functional outcomes without increasing complication rates, highlighting the importance of timely and appropriate intervention.[9] Nevertheless, there is still considerable heterogeneity in rehabilitation protocols, and no consensus exists regarding the optimal combination, intensity, and progression of physiotherapy interventions.[7]

Physiotherapy interventions typically include therapeutic exercise, electrotherapy, and manual therapy aimed at reducing pain, improving ROM, enhancing muscle strength, and restoring functional performance. Exercise-based rehabilitation is considered the cornerstone of recovery, while modalities such as Transcutaneous Electrical Nerve Stimulation (TENS) may support pain modulation and facilitate participation in active rehabilitation.[10] However, the specific contribution of combined interventions, particularly in post-ORIF cases, remains insufficiently explored in clinical literature.

In addition, most existing studies focus on randomized controlled trials or comparative designs, with limited detailed reporting of individual clinical trajectories following physiotherapy interventions. Case-based evidence is essential to provide in-depth insight into patient-specific responses, clinical decision-making, and real-world rehabilitation strategies, especially in complex postoperative conditions.[11,12]

Therefore, this case report aims to describe the clinical outcomes of a structured physiotherapy program in a patient with a proximal humerus fracture following ORIF. This report highlights the potential role of combined physiotherapy interventions in improving joint mobility, muscle strength, and functional outcomes, while contributing to the limited case-based evidence in postoperative rehabilitation.

Methods

This study was conducted as a single-case report following the CARE (Case Report) guidelines to ensure comprehensive and transparent reporting of clinical findings, interventions, and outcomes. As this study involved a retrospective description of routine clinical care, formal ethical approval was not required according to institutional policy. However, written informed consent was obtained from the patient for participation and publication of clinical data.

The subject of this study was a 65-year-old female diagnosed with a right proximal humerus fracture (Neer 2-part) who underwent open reduction and internal fixation (ORIF) on July 12, 2025. The surgical procedure involved fixation using a PHILOS plate and screws via a deltopectoral approach. Postoperative radiographic evaluation confirmed appropriate anatomical alignment and stable fixation without evidence of complications such as implant failure or malposition.

The patient had a medical history of anemia, which was clinically stable and did not interfere with the rehabilitation process. No additional comorbidities or neurological impairments were identified. Prior to injury, the patient was independent in performing activities of daily living. Differential diagnoses such as rotator cuff tear and adhesive capsulitis were considered but ruled out based on clinical findings and postoperative radiographic confirmation of fracture fixation without soft tissue complications. Radiographic evaluation demonstrated a fracture at the surgical neck of the humerus with stable internal fixation using a PHILOS plate, without evidence of displacement or implant failure.

At approximately 2.5 months postoperatively, the patient presented with persistent limitations in shoulder mobility, decreased muscle strength, and functional difficulties in daily activities, including dressing, grooming, and bathing. The patient also reported intermittent pain localized around the surgical site, particularly during shoulder elevation movements such as flexion and abduction.

Baseline clinical examination included inspection, palpation, range of motion assessment, muscle strength testing, and functional evaluation. Inspection revealed a well-healed surgical incision over the anterior deltoid region without signs of inflammation. Palpation did not reveal local tenderness or increased temperature. Active shoulder movement was limited, particularly in flexion and abduction, while passive movement showed relatively greater range but remained restricted. Muscle strength testing demonstrated weakness in the anterior and middle deltoid muscles, graded as 3− on the Manual Muscle Testing (MMT) scale.

Outcome measures included the Numerical Pain Rating Scale (NPRS) to assess pain intensity, a universal goniometer to measure shoulder range of motion (ROM), MMT to evaluate muscle strength, and the Disabilities of the Arm, Shoulder, and Hand (DASH) questionnaire to assess functional ability. These instruments are widely used in musculoskeletal rehabilitation and demonstrate high validity and reliability, with reported intraclass correlation coefficients exceeding 0.85–0.99.

The physiotherapy intervention program consisted of a combination of electrotherapy and therapeutic exercise. Transcutaneous Electrical Nerve Stimulation (TENS) was applied for 15 minutes using a conventional mode for pain modulation. TENS was applied using a conventional mode with a frequency of 80–100 Hz and a pulse width of 100–200 µs. The intensity was adjusted to produce a strong but comfortable sensory stimulation without muscle contraction. Electrodes were placed around the shoulder region near the surgical site, and the intervention was administered for 15 minutes per session. The exercise program included active and active-assisted range of motion exercises, followed by progressive resisted exercises targeting the shoulder musculature, particularly the anterior and middle deltoid. Each exercise was performed in two sets of eight repetitions, with intensity adjusted according to patient tolerance and clinical progression. In addition, manual therapy techniques were applied, including Grade I–II glenohumeral joint mobilization (Maitland concept) for pain reduction and Grade III mobilization for improving joint mobility. Scapulothoracic mobilization was also performed to enhance scapular movement and coordination. Each mobilization was applied for 2–3 sets of 30–60 seconds based on patient tolerance.

In addition to supervised therapy, the patient was prescribed a structured home exercise program consisting of active and active-assisted shoulder movements to be performed daily. Education regarding proper movement techniques and activity modification was also provided to support recovery and prevent reinjury.

The intervention was conducted over three sessions within a three-week period. Outcome measures were recorded at baseline (T0) and at each subsequent session (T1–T3) to monitor clinical progression.

For clarity of the clinical course, the patient timeline is presented as follows: injury occurred on July 12, 2025, followed by immediate ORIF surgery on the same day; postoperative recovery continued for approximately 2.5 months prior to initiation of physiotherapy; physiotherapy intervention was then administered over three weeks with serial evaluations at each session. Data analysis was performed descriptively by comparing changes in ROM, muscle strength, and DASH scores across time points. Absolute changes were calculated to demonstrate clinical improvement. Due to the single-case design, no inferential statistical analysis was performed.

Results

This section presents the clinical outcomes of the physiotherapy intervention, focusing on changes in shoulder range of motion (ROM), muscle strength, and functional ability across four assessment points (baseline/T0 to final session/T3). The data are presented to illustrate the patient's progression during the rehabilitation period. To provide a clear overview of joint mobility changes, Table 1 summarizes the progression of active and passive shoulder ROM throughout the intervention period.

Table 1. Changes in Shoulder Range of Motion (ROM)

Time Point	Active ROM (Flexion–Neutral–Extension)	Passive ROM (Flexion–Neutral–Extension)
T0	50–0–110°	50–0–150°
T1	50–0–113°	50–0–150°
T2	50–0–113°	50–0–155°
T3	50–0–115°	50–0–155°

As shown in Table 1, both active and passive ROM demonstrated gradual improvement over time. Active ROM increased by 5° in flexion from baseline to the final session, while passive ROM improved by 5° overall. These findings indicate a modest but consistent gain in shoulder mobility during the intervention period. The improvement in passive ROM appeared earlier and was slightly greater than that observed in active ROM, suggesting reduced joint stiffness and enhanced soft tissue extensibility following the intervention. In contrast, active ROM gains may reflect progressive improvement in muscle activation and movement control during shoulder motion. Overall, the changes observed across sessions indicate a positive response to the rehabilitation program, particularly in maintaining and improving functional shoulder mobility. Muscle strength outcomes are presented in Table 2 to illustrate changes in key upper-extremity muscle groups following the intervention.

Table 2. Changes in Muscle Strength (Manual Muscle Testing)

Muscle Group	Baseline (T0)	Final (T3)
Shoulder Flexors	3−	5
Shoulder Extensors	5	5
Shoulder Abductors	3−	5
Shoulder Adductors	5	5
Elbow Flexors	5	5
Elbow Extensors	5	5

The results demonstrate a clinically meaningful improvement in shoulder muscle strength, particularly in the flexor and abductor groups, which increased from grade 3− (movement against gravity with minimal resistance) to grade 5 (normal strength). Muscle strength in other groups remained stable at normal levels throughout the intervention period. Functional outcomes were assessed using the DASH questionnaire, with results presented in Table 3 to demonstrate changes in upper-extremity function.

Table 3. Changes in DASH Scores

Time Point	DASH Score
T0	47
T1	34
T2	23
T3	15

As presented in Table 3, the DASH score decreased progressively from 47 at baseline to 15 at the final session, representing an absolute improvement of 32 points. This reduction exceeds the commonly reported minimal clinically important difference (MCID) for DASH (10–15 points), indicating a clinically significant improvement in functional ability. The DASH score improvement of 32 points represents a large clinical effect, exceeding the minimal clinically important difference (MCID), indicating substantial functional recovery. To provide a clearer chronological representation of the patient's clinical course, the timeline of injury, surgical intervention, and physiotherapy management is presented in Table 4.

Table 4. Clinical Timeline of the Patient

Phase	Description
Injury	Fall resulting in right shoulder trauma (July 12, 2025)
Surgical Intervention	ORIF performed on the same day using PHILOS plate
Postoperative Recovery	Approximately 2.5 months prior to physiotherapy initiation
Baseline Assessment (T0)	Initial evaluation of pain, ROM, muscle strength, and DASH score
Physiotherapy Session 1 (T1)	First intervention session and reassessment
Physiotherapy Session 2 (T2)	Second intervention session and reassessment
Physiotherapy Session 3 (T3)	Final intervention session and outcome evaluation

Overall, the results demonstrate consistent improvements in joint mobility, muscle strength, and functional outcomes following the physiotherapy intervention, with the most notable change observed in functional recovery as measured by the DASH score. The patient reported that the physiotherapy program helped reduce discomfort and gradually improved her ability to perform daily activities. She noted increased confidence in moving her arm and expressed satisfaction with the progress achieved during the intervention period.

Discussion

This case report demonstrates that a short-term physiotherapy program resulted in measurable improvements in shoulder range of motion (ROM), muscle strength, and functional ability in a patient following ORIF for a proximal humerus fracture. These findings are consistent with current evidence suggesting that structured rehabilitation plays a critical role in optimizing postoperative recovery and restoring upper-extremity function.[5,7,8]

The observed improvement in ROM, although modest in absolute terms, reflects a clinically meaningful progression in joint mobility during the early rehabilitation phase. Active mobilization is known to facilitate capsular elasticity, reduce periarticular stiffness, and promote synovial fluid distribution, thereby enhancing joint nutrition and movement efficiency.[7,8] In postoperative shoulder conditions, restricted ROM is often associated with capsular tightness and altered scapulohumeral rhythm; therefore, early and progressive mobilization is essential to prevent long-term functional impairment.[2,7] The gradual increase in both active and passive ROM in this case suggests that the intervention was effective in addressing these biomechanical limitations.

Muscle strength improvement was particularly notable in the shoulder flexor and abductor groups, which increased from grade 3− to grade 5. This finding is clinically significant, as the deltoid and rotator cuff muscles are primary stabilizers of the glenohumeral joint and are essential for functional arm elevation. Progressive resisted exercise has been widely demonstrated to enhance neuromuscular activation, improve motor unit recruitment, and increase muscle القوة in postoperative rehabilitation settings.[10] In this case, the structured progression of exercise intensity, even within a short intervention period, likely contributed to the restoration of muscle performance and joint stability.

Pain modulation also played a critical role in facilitating functional recovery. The use of Transcutaneous Electrical Nerve Stimulation (TENS) may have contributed to pain reduction through mechanisms such as activation of the gate control system and endogenous opioid release.[13,14] By reducing pain perception, TENS enables greater patient participation in active rehabilitation, which is essential for achieving optimal outcomes. Although pain scores were not quantitatively reported in this case, the functional improvements observed suggest that pain was sufficiently controlled to allow progressive exercise engagement.

Importantly, this case highlights the potential benefit of combining multiple physiotherapy interventions, including electrotherapy and therapeutic exercise. While exercise remains the cornerstone of rehabilitation, adjunctive modalities such as TENS may enhance treatment effectiveness by addressing pain-related barriers.[10] The integration of these approaches reflects a multimodal rehabilitation strategy, which has been increasingly recommended in musculoskeletal and postoperative care. However, the relative contribution of each intervention component cannot be isolated in a single-case design, representing an inherent limitation.

When compared with previous studies, the findings of this case align with evidence indicating that early and structured physiotherapy improves functional outcomes following proximal humerus fractures.[6,7] However, most existing studies are based on randomized controlled trials with standardized protocols, whereas this report provides insight into individualized clinical decision-

making and real-world rehabilitation practice. This highlights the value of case-based evidence in complementing higher-level research, particularly in complex postoperative scenarios where patient-specific factors influence treatment outcomes.[11,12]

Despite the positive outcomes, several limitations should be acknowledged. First, the single-case design limits the generalizability of the findings and precludes causal inference. Second, the short duration of follow-up does not allow evaluation of long-term functional outcomes or potential complications. Third, the absence of detailed pain quantification and standardized effect size measures restricts the comprehensiveness of outcome evaluation. Additionally, the lack of a control comparison prevents differentiation between natural recovery and intervention effects. Furthermore, the absence of long-term follow-up limits the ability to evaluate the sustainability of functional improvements and potential late complications.

From a clinical perspective, this case underscores the importance of early, progressive, and individualized physiotherapy in the management of patients following ORIF for proximal humerus fractures. The combination of pain modulation and targeted exercise appears to be effective in improving mobility, strength, and functional performance within a relatively short timeframe. Future research should focus on larger sample sizes, standardized intervention protocols, and longer follow-up periods to establish stronger evidence regarding optimal rehabilitation strategies.

Conclusion

This case report demonstrates that a short-term physiotherapy program combining pain modulation and progressive therapeutic exercise can improve joint mobility, muscle strength, and functional outcomes in a patient following ORIF for a proximal humerus fracture. The observed improvements in ROM, muscle strength, and DASH score indicate meaningful functional recovery within a limited intervention period.

From a clinical perspective, these findings support the use of structured and individualized physiotherapy as an essential component of postoperative management in proximal humerus fractures. However, given the inherent limitations of a single-case design, these results should be interpreted with caution and cannot be generalized to broader populations. Future research is recommended to investigate the effectiveness of multimodal physiotherapy interventions using larger sample sizes, controlled study designs, and longer follow-up periods to establish stronger clinical evidence and optimize rehabilitation protocols.

Author Contribution

Asti Damaningtyas: Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Writing original draft.
Totok Budi Santoso: Conceptualization, Methodology, Supervision, Validation, Writing review and editing.
Prihantoro Larasati: Investigation, Resources, Validation, Writing review and editing.

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Conflict of Interest Statement

The authors declare no conflict of interest.

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Ethics Statement

This study was conducted as a case report based on routine clinical care. Formal ethical approval was not required according to institutional policy. Written informed consent was obtained from the patient for participation and publication of clinical data.

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