

Science, Movement and Health, Vol. XXVI, ISSUE 1, 2026
January 2026, 26 (1): 22-27
Original article: <https://www.doi.org/10.61801/OUA.2026.1.05>

INDIVIDUALIZED PHYSICAL THERAPY PROGRAM ENHANCES FUNCTIONAL RECOVERY AFTER PROXIMAL HUMERUS FRACTURE – A CASE STUDY

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Abstract

Proximal humerus fracture is one of the most common injuries to the shoulder skeleton, especially in the elderly, resulting from trauma from falls or other direct impact mechanisms on the upper limb. This condition affects the bone and periarticular structures, leading to pain, limited range of motion, and difficulty performing daily activities. Functional recovery of the shoulder after a proximal humerus fracture is a complex process, which depends on the type of treatment (conservative or surgical), the degree of stability of the fracture and the individual patient's response to therapy.

Aim. The purpose of this study is to highlight the effectiveness of implementing a complex and individualized recovery program, consisting of staged physical therapy and physiotherapy interventions, in the complete functional restoration of patients with proximal humerus fracture, regardless of the type of initial treatment applied (conservative or surgical). This study also aims to evaluate the impact of combining progressive physical therapy exercises with modern physiotherapeutic procedures, such as Tecar therapy, TENS currents and neuromuscular electrostimulation (COMPEX), on regaining joint mobility, reducing pain and discomfort, preventing muscle atrophy and facilitating functional reintegration of the upper limb in daily activities, within a period of 8–10 weeks.

Methods. The study was conducted on a group of 5 patients with proximal humerus fracture, in the recovery period and aimed to evaluate the effectiveness of a complex program of physiotherapy and kinesitherapy. The program, structured in three stages, aimed to reduce pain and inflammation, regain joint mobility and improve quality of life. The evaluation of patients was multidimensional, using validated scales for pain, mobility and functionality (pain scale, goniometry, Appley test and D.A.S.H. questionnaire).

Results. The analysis of the clinical evolution of patients highlighted the effectiveness of an integrated therapeutic approach, based on the association of physical therapy with physiotherapy, in the functional recovery of the shoulder after proximal humerus fracture. The results showed a significant reduction in pain and a notable improvement in joint mobility, confirmed by objective assessments and functional tests. Also, the scores of the Appley test and the D.A.S.H. questionnaire indicated a progressive recovery of shoulder function and a significant decrease in disability in daily activities.

Conclusions. The aim of the study was achieved, demonstrating that the implementation of a complex and individualized recovery program, which effectively integrates physiotherapy and kinesitherapy, contributes significantly to the improvement of painful symptoms, the restoration of joint mobility. This therapeutic approach facilitates the functional reintegration of the upper limb and improves the quality of life of patients with proximal humerus fracture.

Keywords: proximal humerus fracture, physiotherapy, shoulder mobility.

Introduction

Proximal humerus fracture is one of the most common injuries of the shoulder skeleton, especially in the elderly, resulting from trauma caused by falls or other direct impact mechanisms on the upper limb. Anatomically, the proximal humerus includes the humeral head, the anatomical neck, the surgical neck, and the greater and lesser tuberosities. The most commonly used classification is the Neer classification, which divides fractures according to the number of displaced fragments (one to four parts), considering significant displacement when it exceeds 1 cm or 45° of angulation (Neer, 1970). Clinically, patients present with intense shoulder pain, swelling, bruising, and severe limitation of joint mobility. On inspection, an intensely swollen shoulder with a shortened acromio-epicondylar distance is observed, with total functional impotence. A few days after the accident, Hennequin ecchymosis appears, being a pathognomonic sign of a cervical fracture that occurs through the fusion of the post-fracture hematoma into the muscle in the sheath of the pectoralis major and latissimus dorsi muscles (Tomoaia, 2008).

Diagnosis is established by clinical examination and imaging studies, with shoulder radiography being the primary method, sometimes supplemented by computed tomography for the evaluation of complex fractures (Rockwood & Green, 2015).

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Treatment can be conservative or surgical, depending on the type of fracture, the degree of displacement, the patient's age, and the patient's functional level. Nondisplaced or minimally displaced fractures are usually treated orthopedically, with immobilization and progressive functional recovery, while displaced or unstable fractures may require osteosynthesis or shoulder prosthesis (Court-Brown et al., 2012).

The prognosis depends on the severity of the fracture, the quality of the bone and the correctness of the treatment applied, possible complications including joint stiffness, vascular necrosis of the humeral head and pseudarthrosis (Rockwood & Green, 2015).

The specialized literature emphasizes that recovery is not only a complementary stage to surgical or orthopedic treatment, but a central element of the healing process. Early initiation and correct dosage of the physical therapy and physiotherapy program determines the reduction of pain, the prevention of stiffness, the acceleration of the bone consolidation process and the rapid reintegration of the patient into daily activities.

A major current issue is the lack of international consensus on recovery protocols: the optimal duration of immobilization, the timing of initiating active mobilization, and the progression of exercises are still debated in the literature. Therefore, recent research focuses on comparing the effectiveness of different methods and on the introduction of modern technologies (electrostimulation, Tecar therapy, TENS currents) to accelerate functional recovery.

Scientific studies show that the success of treatment of proximal humerus fractures depends largely on the quality and individualization of the recovery program. Shoulder rehabilitation after this injury includes both physical therapy and physiotherapy interventions, aimed at reducing pain, preventing joint stiffness, and restoring normal range of motion and muscle strength. Physical therapy focuses on progressive exercises — from passive and active-assisted movements to strength exercises and neuromuscular control — depending on the phase of fracture healing and the patient's tolerance to exercise. Physiotherapy methods, such as manual therapy, electrotherapy is also integrated to help reduce inflammation and improve symptoms.

Clinical studies and recovery protocols highlight that significant functional progress is usually observed between 3- and 8-weeks post-trauma, with full recovery of shoulder function within 5–7 months after the injury, depending on the interventions used and the patient's motivation. The therapeutic approach should be individualized and supervised by specialists, adapting the exercises to the clinical stage and response to treatment.

Proximal humerus fractures are based on the damage to the portions between the scapulohumeral joint line and the lower edge of the pectoralis major insertion. Proximal humerus fractures represent approximately 5% of all fractures, they are more common in patients over 60 years of age where the preponderance is dominated by women with a ratio of 3: 1. A percentage of 85% shows us that these fractures are treated non-surgically (Lynn & Robert, 2015).

The choice of the appropriate treatment for humerus fractures is divided into two categories, namely orthopedic (non-surgical) treatment and surgical treatment. The older treatment plan algorithm was based on the Neer classification. The treatment plan formulation method that has emerged and is currently practiced is to focus on the characteristics of each patient, thus considering the age, lifestyle and expectations of each individual patient.

Objectives

The purpose of this study is to highlight the effectiveness of implementing a complex and individualized recovery program, consisting of staged physical therapy and physiotherapy interventions, in the complete functional restoration of patients with proximal humerus fracture, regardless of the type of initial treatment applied (conservative or surgical). This study also aims to evaluate the impact of combining progressive physiotherapy exercises with modern physiotherapeutic procedures, such as Tecar therapy, TENS currents and neuromuscular electrostimulation (COMPEX), on regaining joint mobility, reducing pain and discomfort, preventing muscle atrophy and facilitating functional reintegration of the upper limb in daily activities, within a period of 8–10 weeks.

Material and methods

The study was conducted on a group of 5 female patients, aged between 34 and 77 years, diagnosed with proximal humerus fracture, respectively or in the post-fracture recovery period. All participants were informed in advance about the objectives of the study and gave their consent to participate.

Within the recovery program, the following priority objectives were defined:

1. Combating pain and the inflammatory process;
2. Prevention and combating vascular disorders;
3. Prevention and combating vicious positions, joint realignment;
4. Regaining range of motion;
5. Improving quality of life.

The recovery plan included physical therapy and physiotherapy (tecar therapy, tens currents and neuromuscular electrostimulation). Physical therapy is the most important because it is based on movement, including passive exercises, active passives, neuroproprioceptive facilitation, stretching and active exercises with resistance, etc. The recovery program was divided into 3 parts: initial (first 4 weeks), intermediate (next 3 weeks) and final (last 3 weeks). Physiotherapy, based on the aim of significantly reducing pain, inflammation and joint discomfort caused by trauma, we

will use these devices and in order to increase the degree of mobility of the joint. The patient evaluation process represented a fundamental stage in starting the recovery program, as it allowed the establishment of an initial clinical picture and the objective monitoring of the progress achieved. Since proximal humerus fracture has multiple consequences – from pain and functional limitation to impaired quality of life – a multidimensional assessment was chosen, using both clinically and scientifically validated tools.

a) *Pain assessment.* Pain was investigated using the Gaston-Johansson, Albert M., Fagan E. (1990) scale, an instrument that allows the quantification of intensity on a numerical scale (0–10). The choice of this scale was justified by its simple but at the same time sensitive character, allowing the comparison of pain levels at different times of the day and after physical therapy sessions. In the context of fractures, where pain can limit early mobilization, its monitoring had the role of adjusting the therapeutic program and ensuring the patient's tolerance to exercises.

b) *Assessment of joint mobility.* Goniometry, a standardized and precise method, was used to measure the amplitude of movements. The choice of this technique was necessary because proximal humerus fracture frequently causes joint stiffness, and the recovery of mobility is a central goal of treatment. Recording values for flexion, extension, abduction, and internal and external rotations provided an objective basis for evaluating the effectiveness of the interventions and for progressively adapting the exercises.

c) *Appley test.* For a more global functional assessment, the Appley test was used, which measures the flexibility and coordination of complex movements of the shoulder and shoulder girdle. It was chosen because it provides a practical picture of the patient's ability to perform everyday gestures (e.g. dressing, hair styling), going beyond the limits of strictly biomechanical tests.

d) *D.A.S.H. Questionnaire.* This validated international instrument quantifies the degree of dysfunction perceived by the patient in common activities such as grasping, lifting or manipulating objects. Thus, the assessment integrated the subjective dimension of functional disability, which could not have been captured by clinical measurements alone. The DASH questionnaire employs a 1–5 scale, where 1 indicates no difficulty, 2 mild difficulty, 3 moderate difficulty, 4 severe difficulty, and 5 an inability to perform the activity."

Results

Regarding pain, which was measured using the visual analogue scale and the response to 4 questions, we had the following results presented in table no. 1.

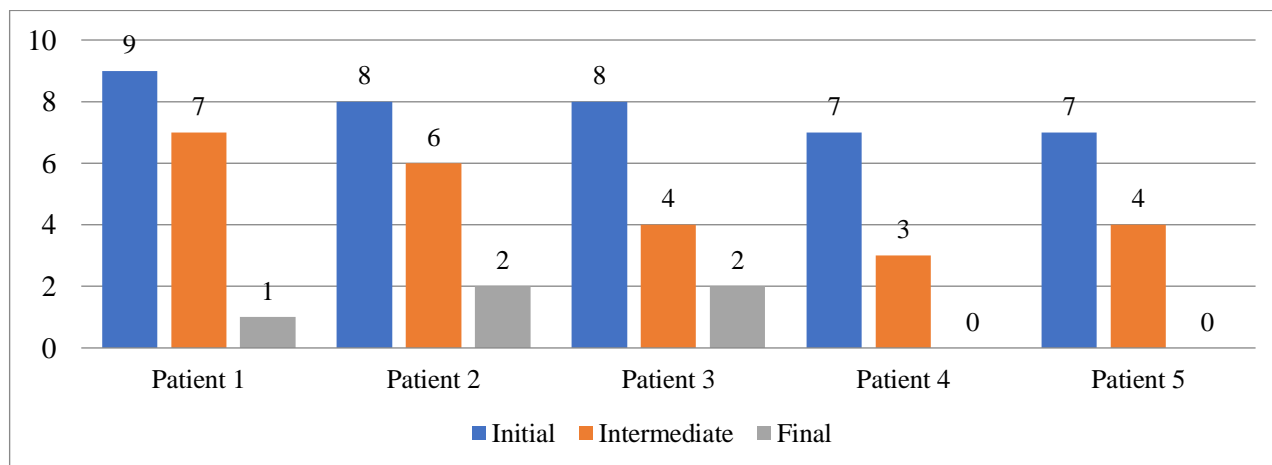


Figure 1. Results obtained on the pain scale

Shoulder mobility performed on the movements of flexion, extension, abduction, internal rotation and external rotation recorded progress for all movements considered.

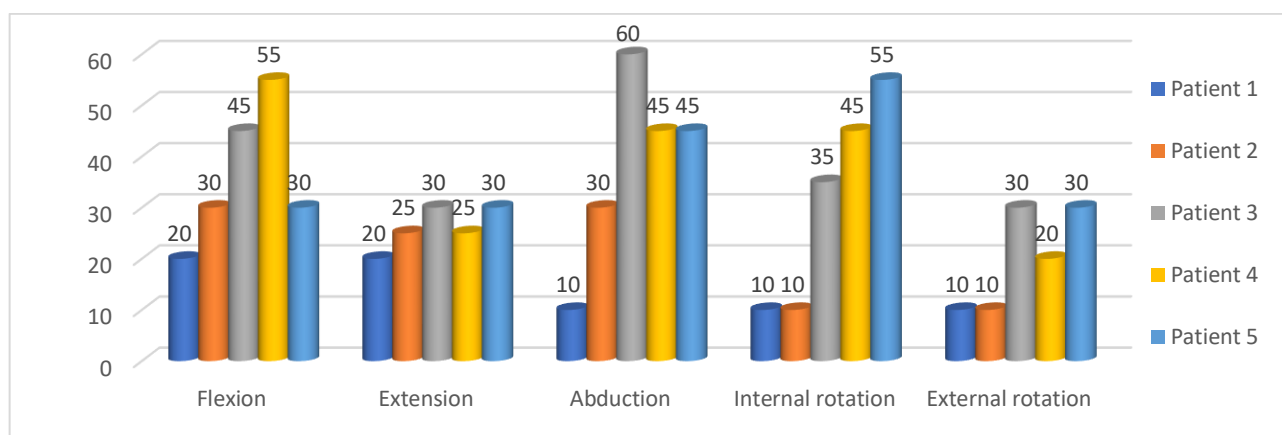


Figure 2. Results obtained during the initial evaluation of shoulder mobility

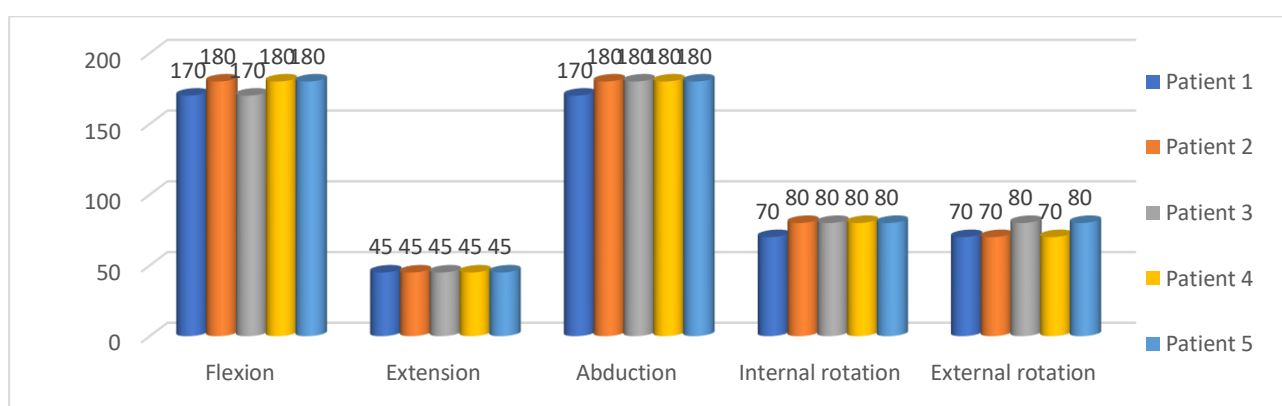


Figure 3. Results obtained during the final evaluation of shoulder mobility

Evaluation with the Appley Test shows that patients at the initial evaluation were unable to perform the test due to lack of mobility and strength, combined with a high rate of pain intensity, resulting in a final evaluation rating of reasonable when the test was performed with the arm up and good when performed with the arm down.

Table 1. Results obtained at the initial and final assessment - Appley Test

Patient	Arm up		Arm down	
	Initial	Final	Initial	Final
1	Unsuccessful	Reasonable	Unsuccessful	Good
2	Unsuccessful	Reasonable	Unsuccessful	Good
3	Reasonable	Good	Reasonable	Good
4	Reasonable	Good	Reasonable	Good
5	Reasonable	Good	Reasonable	Good

Table 2. Results obtained at the initial and final evaluation of the D.A.S.H. questionnaire.

No	Questions	Initial	Final	Progress
1	Can you open a jar?	5	1	4
2	Can you do heavy household chores?	4	1	3
3	Can you carry a shopping bag?	3	1	2

4	Can you wash your back?	4	1	3
5	Can you use a knife to cut food?	3	1	2
6	Can you do recreational activities that require the shoulder?	4	1	3
7	To what extent has your shoulder affected your social activities?	3	1	2
8	You have been limited in your work because of your shoulder?	3	1	2
9	You have shoulder pain?	5	1	4
10	You have tingling in the shoulder?	4	1	3
11	You have sleeping difficulty?	4	1	3

Comparison of initial and final assessments revealed a decrease in the D.A.S.H. score, reflecting improvement in upper limb function for all patients included in this research. The D.A.S.H. score decreased from 5 points at baseline to 1 point at the final assessment, highlighting an improvement in functional disability of the upper limb.

Discussions and recommendations

The results obtained confirm the existing data from the specialized literature and emphasize the value of an integrated and personalized approach in the functional rehabilitation of the patient.

The clinical data and the evolution of each patient clearly show that early and individually adapted intervention is the key to success in the functional reeducation of the shoulder. Recovery after proximal humerus fracture involves not only the restoration of bone integrity, but also neuromuscular rebalancing and restoration of glenohumeral joint function, both of which are possible only through a structured and staged intervention.

Compared to the literature:

1. Clinical studies, such as the one published in Timisoara Physical Education and Rehabilitation Journal (2019), confirm that the integration of TECAR therapy accelerates healing and significantly reduces pain. In the case of the patients analyzed in the present study, the same effects were obtained, with the majority recording the complete disappearance of pain by the 6th week.

2. The use of TENS currents has proven effective since the acute phase, which is also reflected in the evolution of patients who tolerated early passive mobilizations better, without experiencing severe pain.

3. Muscle electrostimulation using the Compex SP 8.0 device played an important role in preventing muscle atrophy and increasing strength in the shoulder, especially in the post-immobilization period. These effects were particularly important in elderly patients, who already had muscle tone deficits at the beginning of the treatment.

An important observation is that surgically treated patients had a faster onset of active therapy and more obvious functional progress in the first 4-5 weeks compared to those who followed conservative treatment. However, at the end of 8 weeks, the differences faded, suggesting that well-structured rehabilitation programs can balance the results regardless of the type of initial treatment.

Regarding functional assessments:

1. The pain assessment scale was a valuable tool in adjusting the progression of therapy. The rapid reduction of pain allowed the transition to active and resistance exercises, with a favorable impact on the total recovery time.

2. Goniometric assessments revealed almost complete recovery of the amplitudes of movement in all planes, with values very close to normal ones, especially in cases treated early and constantly supported in the recovery program.

3. The DASH questionnaire revealed a clear reduction in dysfunctions in daily activities and the Appley test showed significant improvements in flexibility and coordination at the level of the shoulder girdle.

Conclusions

The analysis of the clinical and functional evolution of the five patients included in the study highlights the efficiency of an integrated therapeutic approach, based on the association of physical therapy and physiotherapy methods, in the functional recovery of the shoulder after proximal humerus fracture. The initiation of treatment in a relatively close time interval allowed a comparative monitoring of the individual response to therapeutic interventions, facilitating the staged assessment of progress and the progressive adjustment of the recovery behavior according to the clinical particularities of each patient.

The results obtained demonstrate a significant reduction in pain, correlated with the consistent application of physiotherapy procedures and specific physical therapy exercises, which contributed to increasing patient compliance with the recovery program. A notable improvement in shoulder joint mobility was also found, confirmed by objective assessments using the goniometer, as well as by applying the Appley functional test, the final values fits, in most cases, within functional limits close to normal.



The analysis of the Appley test revealed a favorable functional evolution, with patients initially unable to perform the test due to intense pain, mobility deficit and decreased muscle strength. At the final evaluation, they obtained higher scores, respectively “reasonable” for performing the test with the arm raised and “good” for performing it with the arm lowered, reflecting a progressive recovery of shoulder function.

Regarding the assessment of functional disability, the scores obtained by applying the D.A.S.H. questionnaire indicate a significant decrease in functional limitations of the upper limb, confirming the positive impact of the recovery program on the patients' ability to perform daily activities.

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