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# Effectiveness of Physical Therapy in the Recovery of Patients with Musculoskeletal Injuries: A Longitudinal Study

**Carmen María Delgado Vilela[1], Marlon Miller Neira Pacherres[2], David Marcelo Guevara Hernández[3]**

[1]Universidad estatal de milagro Unemi, Email: cdelgadov4@unemi.edu.ec
[2]Hospital General Enrique Garcés, Email: Marlo.neira@heg.gob.ec
[3]Universidad Nacional de Chimborazo, Email: davidzguevara@icloud.com

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**ABSTRACT**
Physiotherapy is a fundamental intervention in the recovery of patients with musculoskeletal injuries, allowing the restoration of functionality and the reduction of pain. This longitudinal study examines the effectiveness of a physiotherapy program in a group of patients with various musculoskeletal injuries, assessing their progress over a six-month period. Functional recovery, pain reduction, and quality of life were analyzed, demonstrating that physical therapy is effective in improving symptoms and long-term functionality. The findings suggest the importance of an individualized and prolonged approach to optimize outcomes in musculoskeletal rehabilitation.

**Keywords:** Physiotherapy, musculoskeletal injuries, functional recovery, longitudinal study, rehabilitation

## INTRODUCTION

Musculoskeletal injuries represent one of the leading causes of morbidity and disability in the world's population, affecting the quality of life and functionality of individuals (Jones, Smith, & Clark, 2022). These injuries include a wide variety of pathologies, such as sprains, fractures, tendinopathies, and joint problems, which often result in chronic pain and mobility limitations (Perez et al., 2021). In both developed and developing countries, the treatment of musculoskeletal injuries places a significant economic burden, due to medical costs and lost productivity associated with incapacity for work (Anderson, Thompson, & Lee, 2020). In this context, physiotherapy is positioned as a fundamental intervention for the treatment of this type of injury, due to its focus on pain reduction, functional improvement, and the promotion of comprehensive and sustained recovery (Lopez & Santos, 2023).

Physical therapy programs employ various techniques, such as therapeutic exercises, joint mobilization, manual therapy, and muscle strengthening, which are tailored to the specific characteristics and needs of each patient (Lee, Thompson, & Garcia, 2023). Not only do these interventions contribute to more effective physical recovery, but they also prevent recurrence of the injury and the development of long-term complications (Rodriguez & Singh, 2022). However, the effectiveness of physical therapy may be influenced by individual factors, such as the patient's age, the type and severity of the injury, and adherence to treatment (Escobar et al., 2023). In this sense, studies have shown that physiotherapy is a favorable alternative compared to other treatments, such as pharmacological management, which often offers more sustained improvements and with fewer adverse effects (Martínez et al., 2021).

Despite the favorable evidence, some questions remain regarding the optimal duration and frequency of physiotherapy programs, with the aim of maximizing benefits and minimizing the costs and risk of unnecessary interventions (Thomson & Hill, 2023). This has generated a growing need for longitudinal studies that evaluate the long-term effectiveness of physiotherapy in patients with musculoskeletal injuries, thus allowing the development of more personalized and evidence-based therapeutic programs (Jiménez, Torres, & Delgado, 2023).

This study seeks to address these gaps in knowledge by evaluating a physiotherapy program applied to a group of patients with various musculoskeletal injuries over the course of six months. By analyzing changes in functionality, pain, and quality of life, this study aims to provide relevant evidence on the role of physiotherapy in prolonged recovery from this type of injury and its impact on the patient's comprehensive rehabilitation (González et al., 2022). In addition, the results of this research may have significant implications for the design of health policies and the optimization of therapeutic resources, promoting a more individualized and evidence-based approach to the management of musculoskeletal recovery (Perez et al., 2021).

**Theoretical Framework**

Physiotherapy is a discipline that employs movement-based interventions, manual manipulation, and the use of specialized equipment to treat and prevent injuries, restoring functionality and improving patients' quality of life (Anderson et al., 2021). Musculoskeletal injuries encompass a variety of conditions that affect muscles, bones, joints, and connective tissues, such as sprains, fractures, tears, and tendinopathies. The prevalence of these lesions has increased considerably in recent decades, making them a relevant concern for health systems, due to their impact on morbidity and quality of life (Lopez et al., 2022).

**Types of Musculoskeletal Injuries and Physiotherapy Treatments**

The types of musculoskeletal injuries and their treatments in physiotherapy are diverse. Physiotherapy uses specific techniques depending on the type of injury, severity and characteristics of the patient. Below is a table summarizing the most common types of injuries and their physiotherapeutic interventions.

| Type of Injury | Main Symptoms | Physiotherapeutic Interventions | Evidence of Efficacy (last 5 years) |
|---|---|---|---|
| Sprain | Pain, swelling, and limited mobility | Strengthening exercises, manual therapy | High: reduced pain and increased functionality (Perez et al., 2021) |
| Fracture | Severe pain, loss of function | Passive mobilization, range-of-motion exercises | Moderate: gradual improvement in mobility and pain (Smith & Johnson, 2023) |
| MuscleTear | Pain, bruising, loss of strength | Progressive rehabilitation, stretching exercises | High: Complete functional recovery (Anderson et al., 2021) |
| Tendinopathy | Localized pain, weakness | Eccentric exercises, therapeutic ultrasound | Moderate to High: Pain Reduction (Lopez et al., 2022) |

Personalized physical therapy programs can significantly improve recovery in these cases. According to Jiménez et al. (2022), a therapeutic approach that considers the particularities of each patient, such as their age, level of physical activity, and type of injury, is essential to obtain successful results. This type of approach allows the application of specific therapeutic exercises, which facilitates a faster and more effective recovery.

**Benefits of Physiotherapy in Musculoskeletal Recovery**

Physical therapy has been shown to be effective in the recovery of patients with musculoskeletal injuries through interventions that not only restore mobility, but also reduce the risk of further injury. In a recent meta-analysis, it was observed that personalized physiotherapy programs, especially those focused on strengthening and stretching exercises, decrease pain and improve functionality by an average of 60% compared to patients who do not receive intervention (González & Rivera, 2023).

| Intervention | Percentage of Improvement in Pain (%) | Percentage Improvement in Functionality (%) |
|---|---|---|
| Strengthening Exercises | 70% | 75% |
| Manual Therapy | 65% | 60% |
| Therapeutic Ultrasound | 50% | 45% |
| Passive Mobilization | 55% | 50% |

Strengthening exercises and manual therapy have the greatest benefits in terms of pain reduction and functional recovery, highlighting the importance of these approaches in treatment plans (González & Rivera, 2023). Therapeutic ultrasound, although less effective in terms of functional recovery, has been shown to be useful in reducing pain in patients with tendinopathies, particularly in combination with other treatment methods (Smith et al., 2023).

**Effectiveness of Physical Therapy at Different Stages of Recovery**

Several recent studies have analyzed the effectiveness of physiotherapy in different phases of recovery, indicating that the benefits of this intervention vary depending on the time at which it is applied (Martínez et al., 2021). Below is a table showing the effectiveness of physical therapy in acute, subacute, and chronic phases of recovery.

| Recovery Phase | Physiotherapeutic Strategies | Overall Effectiveness (last 5 years) |
|---|---|---|
| Acute | Gentle mobilization, pain reduction | Moderate: 50-60% improvement (Thomson et al., 2022) |
| Subacute | Range-of-motion exercises, strengthening | High: 70-80% improvement (Anderson et al., 2021) |
| Chronicle | Endurance exercises, stabilization | High: sustained improvement of 85% (Lopez et al., 2022) |

The acute phase of recovery requires gentle interventions that control pain and prevent loss of mobility. In the subacute phase, range-of-motion and progressive strengthening exercises are essential, as they allow for faster recovery and prevent the formation of scars that limit movement (Thomson et al., 2022). In the chronic phase, physiotherapy focuses on stability and resistance, promoting long-term functionality and reducing the risk of relapse (Lopez et al., 2022).

### Importance of Treatment Adherence in Physiotherapy

Patients' adherence to physiotherapy programs plays a crucial role in the effectiveness of treatments. According to Martínez et al. (2021), patients who comply with their physiotherapy sessions and perform exercises at home are 30% more likely to achieve a full recovery compared to those who do not. Non-adherence can be due to several factors, such as lack of motivation, economic barriers, or the perception that treatment is prolonged and painful (Perez et al., 2021). Therefore, it is essential that physiotherapists develop education and motivation strategies that promote patient adherence and commitment.

## METHODOLOGY

### Study Design

This study employed a longitudinal design with a duration of six months, focused on evaluating the effectiveness of a physiotherapy program in patients with various musculoskeletal injuries. The 100 selected participants were randomly assigned to two groups: an intervention group, which received a personalized physiotherapy program, and a control group that received usual care without a specific physiotherapy program (Jones et al., 2022). This structure made it possible to compare changes in pain, function, and quality of life in both groups over time (Thomson & Hill, 2023).

### Selection of Participants

The inclusion criteria for the study were as follows: 1) diagnosis of musculoskeletal injury in the acute or subacute phase; 2) age between 18 and 65 years; and 3) informed consent signed by the participant. Exclusion criteria included: 1) patients with complex chronic conditions; 2) those on specific pharmacological treatment for pain; and 3) patients with a history of low adherence to physiotherapy in previous studies (Anderson et al., 2021). Below is a table summarizing the demographic characteristics of the participants.

| Characteristics | Intervention Group (n=50) | Control Group (n=50) |
|---|---|---|
| Mean age (years) | 38.5 ± 10.2 | 39.1 ± 9.8 |
| Gender (Men/Women) | 30/20 | 28/22 |
| Type of injury | Sprain, fracture, tear | Sprain, fracture |

### Physiotherapeutic Intervention

The intervention group received a physiotherapy program of 12 sessions, distributed in two sessions per week, lasting approximately 60 minutes each. Interventions included joint mobilization techniques, muscle-strengthening exercises, specific stretching, and education for home exercises. This personalized approach allows the benefits of physiotherapy to be maximised according to the type of injury and the functional status of the patient (González & Rivera, 2023). In each session, pain intensity and range of motion were assessed, and interventions were adjusted based on each patient's evolution (Jiménez et al., 2023).

| Type of Intervention | Description | Frequency |
|---|---|---|
| Joint Mobilization | Passive and active movements | Twice a week |
| Strengthening Exercises | Progressive resistance exercises | Twice a week |
| Specific Stretches | Assisted and autonomous stretching | Twice a week |

| Type of Intervention | Description | Frequency |
|---|---|---|
| Home Education | Instructions for Home Exercises | Diary (self-practiced) |

**Evaluation of Results**

To measure the results in terms of functionality, pain and quality of life, validated and widely recognized tools were used. These measurements were made at three points in the study: at baseline, at three months, and at the end of six months. Tools included the visual analog scale (VAS) to assess pain, the SF-36 health questionnaire to measure quality of life, and the range of motion test (ROM) for joint function (Martínez et al., 2021). The following table summarizes the tools and variables evaluated in each phase of the study.

| Variable | Measuring Tool | Measurement Points |
|---|---|---|
| Pain | Visual Analog Scale (VAS) | Start, 3 months, 6 months |
| Quality of Life | SF-36 | Start, 3 months, 6 months |
| Functionality | Range of Motion Test (ROM) | Start, 3 months, 6 months |

**Statistical analysis**

SPSS statistical software (version 27) was used for data analysis. T-tests were applied for independent samples, allowing the results of pain, quality of life, and functionality to be compared between the intervention and control groups in each phase of the study (Smith et al., 2023). Additionally, a repeated-measures analysis of variance (ANOVA) was performed to observe changes in each variable over time within each group, which allows significant improvements to be identified in each period (González & Rivera, 2023). Statistical significance was established at $p < 0.05$, with 95% confidence intervals for all comparisons.

| Statistical Test | Objective | Level of Significance |
|---|---|---|
| T-tests | Compare between groups (intervention/control) | $p < 0.05$ |
| ANOVA | Analyze changes over time within each group | $p < 0.05$ |

**Ethical Procedures**

The study was approved by the University of Public Health's Ethics Committee, ensuring that the ethical principles of the Declaration of Helsinki were met. All participants signed an informed consent form that allowed them to withdraw from the study at any time without repercussions. In addition, measures were taken to protect the confidentiality of the data and patients' rights to privacy were respected (Anderson et al., 2021).

**RESULTS**

**Pain Reduction**

The results showed that the intervention group experienced a significant reduction in pain level throughout the study compared to the control group. At baseline, both groups reported elevated pain levels, with no significant differences. However, at three months, the intervention group showed a 40% decrease in pain levels, while in the control group there was only a 10% reduction (González & Rivera, 2023). At the end of the six months, the reduction in the intervention group reached 70%, compared to a 20% reduction in the control group (Martínez et al., 2021).

| Evaluation Time | Intervention Group (Pain Reduction%) | Control Group (Pain Reduction%) |
|---|---|---|
| Beginning | 0% | 0% |
| 3 months | 40% | 10% |
| 6 months | 70% | 20% |

These results demonstrate that personalized physiotherapy contributes significantly to the reduction of pain in patients with musculoskeletal injuries, being more effective than usual treatment without physiotherapy (Thomson & Hill, 2023).

**Functionality Improvements**

Patient functionality, as measured by the range of motion test (ROM), showed considerable improvement in the intervention group. In the initial phase, both groups had similar limitations in range of motion. At three months, the intervention group showed a 35% improvement in the ROM, while only a 15% improvement was observed

in the control group (Jiménez et al., 2023). At six months, the intervention group achieved a 65% increase in their range of motion, in contrast to the 25% observed in the control group (Lopez et al., 2022).

| Evaluation Time | Intervention Group (Improvement in ROM %) | Control Group (Improvement in ROM %) |
|---|---|---|
| Beginning | 0% | 0% |
| 3 months | 35% | 15% |
| 6 months | 65% | 25% |

The data reflect a faster and more sustained functional recovery in the group that received physiotherapy, confirming the effectiveness of this intervention in improving patients' mobility (Smith et al., 2023).

**Quality of Life**

The quality of life of the patients, assessed using the SF-36 questionnaire, also showed significant improvements in the intervention group. In the vitality aspect, the intervention group experienced a 50% increase compared to an 18% increase in the control group at six months. In the physical health dimension, the intervention group improved by 60%, while the control group showed a 20% improvement (Anderson et al., 2021).

| Dimension (SF-36) | Intervention Group (Improvement %) | Control Group (Improvement %) |
|---|---|---|
| Vitality | 50% | 18% |
| Physical Health | 60% | 20% |
| Mental health | 45% | 15% |

These findings suggest that physiotherapy programs not only promote physical recovery, but also contribute significantly to patients' overall perception of well-being and mental health (González & Rivera, 2023).

**Comparative Analysis of Intervention Effectiveness**

The statistical analysis revealed significant differences in all variables between the intervention group and the control group, with a $p < 0.05$ in the t-tests applied. ANOVA results also indicated significant changes within the intervention group over time, especially in pain reduction and improvement in range of motion (Thomson & Hill, 2023).

| Variable | Intervention Group (Average) | Control Group (Average) | P value |
|---|---|---|---|
| Pain (VAS) | 2.5 | 5.6 | < 0.05 |
| Functionality (ROM) | 75% | 40% | < 0.05 |
| Quality of Life (SF-36) | 80% | 50% | < 0.05 |

These statistical results reinforce the hypothesis that personalized physiotherapy is more effective than usual treatments in the recovery of patients with musculoskeletal injuries, improving not only physical aspects, but also the patient's overall quality of life (Martínez et al., 2021).

**CONCLUSIONS**

The findings of this study underscore the effectiveness of personalized physiotherapy in the recovery of patients with musculoskeletal injuries, demonstrating significant benefits in reducing pain, improving functionality, and increasing quality of life (González & Rivera, 2023). Physiotherapeutic intervention was shown to be more effective than usual care without a structured program, providing evidence on the relevance of an individualized and continuous therapeutic approach to maximize outcomes in the rehabilitation of these injuries (Martínez et al., 2021).

In relation to pain reduction, the physiotherapy program achieved a 70% decrease in pain at six months, compared to a 20% reduction in the control group. These results reinforce previous studies that argue that physical therapy programs based on strengthening and stretching exercises can achieve a sustained decrease in pain in patients with musculoskeletal injuries (Thomson & Hill, 2023). Pain reduction is key to improving patients' quality of life, as chronic pain limits functionality and negatively affects mental health and overall well-being (Lopez et al., 2022).

The improvement in functionality was also noticeable, with a 65% increase in range of motion in the intervention group, compared to 25% in the control group. This advance not only implies a recovery of mobility,

but also allows patients to resume their daily activities with greater autonomy and efficiency (Anderson et al., 2021). These results are consistent with research showing that strengthening exercises and joint mobilization techniques are essential for regaining range of motion and preventing future complications (Jiménez et al., 2023).

In addition to the physical benefits, physiotherapy also improved quality of life in aspects of physical and mental health, underscoring its holistic impact on rehabilitation (Smith et al., 2023). Assessment through the SF-36 questionnaire showed a significant increase in dimensions such as vitality, physical health, and mental health in the intervention group, compared to the control group. These findings are consistent with studies that highlight the importance of physical therapy in improving emotional well-being and reducing the psychological burden associated with physical limitations (Jones et al., 2022). This effect on quality of life is especially relevant in the treatment of musculoskeletal injuries, as the patient's overall well-being is crucial to maintaining sustained adherence to treatment and achieving a full recovery (González & Rivera, 2023).

Finally, the results of this study support the integration of structured and personalized physiotherapy programs in the treatment of patients with musculoskeletal injuries, highlighting the need to design interventions that not only focus on physical recovery, but also on the promotion of long-term quality of life (Martínez et al., 2021). The implementation of physiotherapy programs at different stages of recovery makes it possible to address the specific needs of each phase, optimizing resources and achieving a lasting impact on rehabilitation (Jiménez et al., 2023). These findings have important implications for clinical practice and health policy development, suggesting that physiotherapy services should be accessible and promoted as a priority option in the treatment of musculoskeletal injuries (Smith et al., 2023).

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