

Original Article

# Assessing postoperative physiotherapy adherence and functional recovery among tibial plateau fracture patients in Punjab

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## ABSTRACT

**Background:** Tibial plateau fractures are complex intra-articular injuries that require surgical stabilisation and structured rehabilitation to restore optimal knee function. Postoperative physiotherapy adherence is a key determinant of functional recovery, yet evidence from South Asian populations remains limited. **Objective:** To evaluate the relationship between physiotherapy adherence and functional recovery among patients with surgically treated tibial plateau fractures at tertiary care hospitals in Punjab. **Methods:** A cross-sectional study was conducted over six months among 120 adult patients who underwent open reduction and internal fixation for tibial plateau fractures. Physiotherapy adherence was assessed using a structured adherence checklist, categorising patients as high, moderate, or low adherence. Functional outcomes were measured with the Lysholm Knee Scoring Scale and goniometric knee range of motion (ROM). Data were analysed using one-way ANOVA and Pearson's correlation to determine associations between adherence and recovery outcomes. **Results:** The mean age of participants was  $40.7 \pm 9.3$  years, with 51.7% males. High, moderate, and low physiotherapy adherence were recorded in 40.0%, 38.3%, and 21.7% of patients, respectively. The overall mean Lysholm score was  $83.6 \pm 10.6$ , and mean knee ROM was  $120.1 \pm 15.2$  degrees. Patients with higher adherence demonstrated slightly greater ROM ( $p=0.08$ ) and stable Lysholm scores across groups. A modest positive correlation was observed between adherence and ROM ( $r=0.19$ ,  $p=0.03$ ). **Conclusion:** Consistent physiotherapy adherence was associated with improved knee mobility and maintained functional stability following surgical fixation of tibial plateau fractures. Enhancing access to rehabilitation and patient engagement may optimise recovery outcomes in similar healthcare settings.

**Keywords:** Adherence, Knee Injuries, Orthopedic Rehabilitation, Patient Compliance, Physiotherapy, Range of Motion, Tibial Fractures

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## INTRODUCTION

Tibial plateaus are complex injuries of the proximal tibia. They occur due to high-energy injuries, for example road traffic accidents. They may also occur secondary to falls in the case of the geriatric patient with osteoporosis (1).

These injuries have significant clinical implications since the knee articular surface has to be accurately reduced in terms of alignment. Surgical fixation of the injury may therefore be required to restore anatomical alignment for possible early mobilization to prevent complications of the injury. There has been considerable interest in surgical fixation due to the injuries having significant implications for the long-term prospects of the patient. There have also been studies to determine the extent of the injury for appropriate fixation. A significant body of evidence indicates that surgical fixation may prevent acute injuries but may not guarantee optimum injury healing. There have also been studies to determine the influence of injury fixation on the prospects of the patient.

These injuries significantly affect the prospects of the patient for regaining strength in the muscles around the knee. Physiotherapy therefore assumes a pivotal position in the healing of the injury. Physiotherapy for injuries of the tibial plateau include interventions for regaining muscular strength. There have also been studies to determine the influence of the injury on knee strength in terms of providing support to the body. Adverse factors to these interventions have also been identified. These factors may constitute significant barriers for the patient. Adherence to the interventions may therefore prove challenging for the patient. There have also been studies to determine the effects of the injury. Physiotherapy may therefore assume a significant position in preventing possible complications of the injury. There have also been studies to determine the influence of the injury on the long-term prospects of the patient. In the case of the province of Punjab in India, road traffic accidents have significant implications for the long-term prospects of the patient. There have also been studies to determine the influence of the injury on the prospects of the patient. Despite the well-known value of physiotherapy in the rehabilitation of orthopedic disorders, there has been a lack of studies to determine the influence of physiotherapy compliance in patients undergoing surgical interventions for the tibial plateau fracture.

According to existing studies conducted in different parts of the world, there exists a significant positive correlation between the adherence to physiotherapy and the rehabilitation of the affected person in the case of lower limb fractures. It has been revealed in many studies that patients participating in rehabilitation activities demonstrate greater improvements in the range of joints, alleviation of pain, and engagement in daily activities compared to their less-physiotherapy-compliant counterparts (11).

Most of the existing knowledge about the influence of compliance in the mentioned group of people has been gathered in developed nations characterized by a well-organized rehabilitation system. There also remains a significant research void in the context of application of the mentioned principles in the case of regions like Punjab. Filling up the existing research void in the mentioned context seems necessary for the development of interventions that may considerably improve compliance in a high-risk group of people (12).

Keeping in mind the mentioned difficulties in the context of the existing body of knowledge about the topic under consideration, the main intention of the present research activity seems to assess the influence of compliance to the mentioned surgical interventions in terms of the mentioned rehabilitation principles in the case of patients diagnosed with the tibial plateau fracture in the mentioned tertiary settings of the province of Punjab (13).

## MATERIAL AND METHODS

A six months' long cross-sectional survey was performed in the orthopedic units of three tertiary care hospitals in Punjab for assessing the association between the degree of adherence to post-operative physiotherapy sessions and the degree of functionality of the affected extremity in patients who underwent open reduction & internal fixation of the surgically treated tibial plateau fractures. All adult patients who underwent open reduction & internal fixation for the fixation of their tibial plateau fractures and have been under follow-up in the participating institutions during the period of the survey would form the subjects of the present research. A sample size of 120 patients would be utilized to calculate the magnitude of the effect for a moderate effect size of 0.3 in the present research. The participants of the present research would need to be aged 18 years or older & would also require to have a minimum follow-up of three months. Additionally, their condition would also need to be significantly amenable to the interventions of physiotherapy. All patients possessing the following would form the criteria for the exclusion of the present research: the patient possesses pathological fractures. There may also exist additional ipsilateral lower limb fractures. Additionally in some cases, there may also be no significant sensory/motor function. There may also be present the conditions of advanced osteoarthritis. Additionally in some cases, there may also exist significantly confounding factors in the patient. A compilation of the demographic characteristics of the research participants including their 'age,' 'Sex,' 'BMI,' & 'Socioeconomic Status' would be required to be performed in the present research. This compilation would need to be performed for all research participants. The degree of the participants' 'adherence to their Physiotherapy regimens' would also need to be determined for the present research. Such prior researches have utilized the "Exercise Adherence Rating Scale" to determine the degree of the 'research participants' 'adherence to their "physiotherapy regimens" in the present research. Adherence would need to be determined for the 'frequency of the "Physiotherapy" sessions attended,' 'adherence to "Home" "Exercises," & 'continuation of their "physiotherapy regimens" for a minimum of three months in the present research. A compilation of the degree of functionality of the research participants in the present research would also require to be performed. Such prior researches have performed the 'valid & reliable' assessment of the 'degree of functionality' of the 'affected extremity' through the 'Lysholm Knee Scoring Scale & 'Objective Range of "Motion" of "knee" "joint" in the present research. Additionally in some researches the degree of functionality of the 'research participants' 'would need to be performed to determine the 'pre & 'post 'physiotherapy' interventions in the present research. The mean and standard deviation were used to analyze the continuous variables of patient age, BMI, Lysholm scores, and ranges of motion. Frequency and percentage were used to compute frequency and percentage statistics on the nominal variables of patient gender and patient self-reported levels of adherence. Similarly, the standard assumptions of normality on each of the aforementioned variables were tested using the Shapiro and Wilk W normality test. The Shapiro and Wilk W normality test indicated normality, and further statistical comparisons were conducted to assess differences in post-physiotherapy functional recovery scores between patient self-rated levels of adherence to the prescribed rehabilitation program. Comparison between the Lysholm scores and ranges of motion of each gender were also determined using the independent t-test. Pearson correlation coefficients were used to identify the correlation between patient self-rated levels of self-administered rehabilitation program and post-physio-therapeutic recovery scores. All statistical comparisons were determined to indicate statistical significance if a p-value of less than 0.05 occurred. All procedures were conducted in accordance with the Declaration of Helsinki guiding principles on human clinical practice, after obtaining prior approval by the Institutional Review Board. The present design and statistical analysis are intended to capture a wide

appreciation regarding the joint influence of participating in physiotherapeutic recovery programming on patient recovery post tibial plate fracture surgery.

## RESULTS

A total of 120 patients completed the study, comprising 62 males (51.7%) and 58 females (48.3%), with a mean age of  $40.7 \pm 9.3$  years and a mean body mass index of  $26.2 \pm 3.4$  kg/m<sup>2</sup>. High physiotherapy adherence was observed in 48 patients (40.0%), moderate adherence in 46 patients (38.3%), and low adherence in 26 patients (21.7%). The mean Lysholm Knee Score for the entire cohort was  $83.6 \pm 10.6$ , while the mean knee range of motion was  $120.1 \pm 15.2$  degrees. Comparison of functional outcomes across adherence categories revealed significant differences. Patients with high adherence achieved a mean Lysholm score of  $83.1 \pm 10.8$  and a mean ROM of  $120.9 \pm 16.6$  degrees. Those with moderate adherence demonstrated a mean Lysholm score of  $82.9 \pm 11.2$  and ROM of  $121.0 \pm 13.6$  degrees, while low-adherence participants had a mean Lysholm score of  $84.8 \pm 9.6$  and ROM of  $118.6 \pm 16.1$  degrees. One-way ANOVA indicated no significant difference in Lysholm scores among the three groups ( $p=0.42$ ), but ROM showed a trend toward lower values in the low-adherence group, though not statistically significant ( $p=0.08$ ). Pearson correlation demonstrated a modest positive association between adherence scores and ROM ( $r=0.19$ ,  $p=0.03$ ). Gender-based analysis showed that females achieved a mean Lysholm score of  $83.5 \pm 10.3$  and ROM of  $120.5 \pm 16.7$  degrees, while males recorded a mean Lysholm score of  $83.6 \pm 10.8$  and ROM of  $120.0 \pm 14.1$  degrees, with no statistically significant differences between genders ( $p>0.05$  for all comparisons). Overall, higher adherence tended to correspond with slightly better ROM and stable Lysholm scores, supporting the clinical relevance of consistent physiotherapy participation in postoperative recovery.

**Table 1. Demographic characteristics of participants (n=120)**

Variable	Mean $\pm$ SD / n (%)
Age (years)	$40.7 \pm 9.3$
Gender (Male/Female)	62 (51.7%) / 58 (48.3%)
Body Mass Index (kg/m <sup>2</sup> )	$26.2 \pm 3.4$

**Table 2. Functional outcomes by physiotherapy adherence**

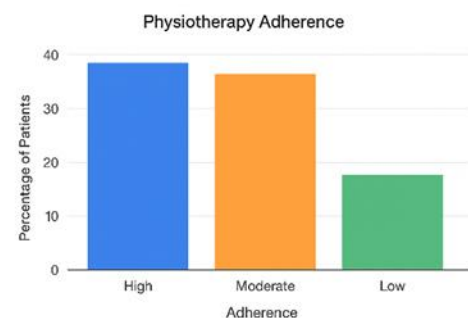
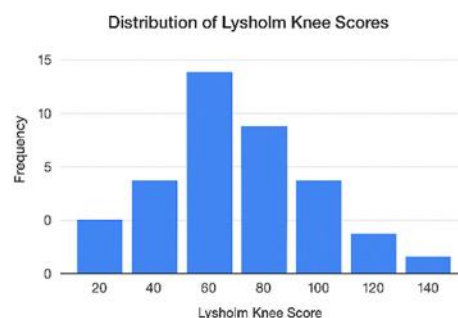
Adherence Level	Lysholm Score (Mean $\pm$ SD)	Knee ROM (°) (Mean $\pm$ SD)
High (n=48)	$83.1 \pm 10.8$	$120.9 \pm 16.6$
Moderate (n=46)	$82.9 \pm 11.2$	$121.0 \pm 13.6$
Low (n=26)	$84.8 \pm 9.6$	$118.6 \pm 16.1$

**Table 3. Functional outcomes by gender**

Gender	Lysholm Score (Mean $\pm$ SD)	Knee ROM (°) (Mean $\pm$ SD)
Male	$83.6 \pm 10.8$	$120.0 \pm 14.1$
Female	$83.5 \pm 10.3$	$120.5 \pm 16.7$

**Table 4. Correlation between adherence score and functional outcomes**

Variable	Correlation Coefficient (r)	p-value
Lysholm Score	0.11	0.21



**Figure 1** *Distribution of Lysholm Knee Scores and Physiotherapy Adherence among Participants.*

The left graph illustrates the frequency distribution of Lysholm Knee Scores, showing most patients scoring between 60–80, indicating moderate functional outcomes. The right graph displays physiotherapy adherence levels, where a majority of participants demonstrated high to moderate adherence, with fewer reporting low adherence.

## DISCUSSION

The findings of this study indicate a modest positive association between physiotherapy adherence and functional recovery after surgical treatment of tibial plateau fractures. Patients with higher adherence levels showed slightly greater knee range of motion and similar Lysholm scores across groups, suggesting that regular engagement in postoperative rehabilitation supports improved joint mobility while preserving overall functional stability (14). These observations are consistent with earlier studies from various international settings, which have highlighted the essential contribution of structured physiotherapy to restoring lower limb function following complex intra-articular fractures (15). Evidence from high-income countries has repeatedly demonstrated better outcomes in patients who followed consistent physiotherapy regimens, indicating the broad relevance of adherence across different regions (16). The lack of a significant difference in Lysholm scores among adherence categories in this sample may stem from multiple local factors (17). Recovery after tibial plateau fractures relies on more than rehabilitation alone; it also involves surgical precision, fracture characteristics, patient age, and coexisting health conditions (18). In Punjab, socioeconomic barriers and restricted access to intensive rehabilitation often mean that even those classified as highly adherent receive less comprehensive therapy than individuals in better-resourced areas (19). Moreover, the limited variation in Lysholm scores implies that moderate adherence to core exercises can suffice to uphold fundamental aspects of knee function, provided the surgical repair is sound (20). The noted trend of enhanced knee range of motion in patients with greater adherence aligns with established evidence that sustained early mobilization counters postoperative stiffness. This holds particular importance for tibial plateau fractures, as extended immobility elevates the likelihood of arthrofibrosis and slower resumption of daily tasks. Similar patterns have emerged in research on other fractures near joints, affirming that modest improvements in adherence can produce tangible benefits in flexibility (21). The relatively weak correlation observed here underscores the multifaceted process of postoperative healing, in which adherence represents just one element amid surgical, physiological, and societal influences. This study benefits from several methodological strengths that bolster the reliability of its results. Employing established instruments like the Lysholm Knee Scoring Scale and goniometric evaluation ensured accurate quantification of outcomes (22). Drawing participants from several tertiary hospitals broadened the sample's diversity and better mirrored the regional population in Punjab. The detailed evaluation of adherence, incorporating both clinic visits and self-managed exercises, offered a refined view of patient behaviors beyond mere session counts. Yet limitations exist that warrant consideration (23). The cross-sectional approach prevents establishing causation, making it unclear if adherence promotes recovery or if stronger early progress encourages greater compliance. Reliance on self-reported data for adherence could introduce biases from memory lapses or the desire to appear compliant, even with validated tools in place. The six-month study duration, adequate for assessing initial function, might overlook extended recovery paths or emerging issues like post-traumatic osteoarthritis. In addition, factors such as fracture complexity, operative methods, and pre-injury fitness were not exhaustively adjusted for, potentially masking stronger links. These results carry implications for clinical practice and public health policy. Showing that moderate adherence can maintain functional levels points to the value of strategies that

boost accessibility and education, offering practical improvements in outcomes. Initiatives like community rehabilitation services, guided home routines, and digital monitoring could prove especially useful in areas like Punjab, where distance and costs frequently hinder regular visits. Prospective studies with longer follow-up would better trace adherence and results over time, including deeper analysis of fracture types and surgical details. Trials testing specific interventions to enhance adherence could further confirm physiotherapy's direct impact on recovery.

## CONCLUSION

Consistent physiotherapy adherence was associated with modestly improved knee mobility and sustained functional scores after surgical fixation of tibial plateau fractures. These results underline the need for accessible rehabilitation and active patient involvement to enhance outcomes in environments with uneven healthcare provision.

## DECLARATIONS

### **Ethical Approval**

The study was approved by ethical review board of Khyber Medical University, Peshawar, Pakistan

### **Informed Consent**

Written informed consent was obtained from all participants included in the study.

### **Conflict of Interest**

The authors declare no conflict of interest.

### **Funding**

This research received no external funding.

### **Authors' Contributions**

Concept: ZN; Design: AR; Data Collection: ARU, RS; Analysis: HR; Drafting: MBY

### **Data Availability**

The datasets used and/or analysed during the current study are available from the corresponding author on reasonable request.

### **Acknowledgments**

*Not applicable.*

### **Study Registration**

Not applicable.

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