Fast Track to Play: Standardization of Accelerated Postoperative Rehabilitation Following Pediatric Tibial Tubercle Fracture Fixation

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INTRODUCTION

- Postoperative rehabilitation following pediatric tibial tubercle fracture fixation varies substantially among providers with limited evidence to guide optimal recovery protocols.
  - ➢ Although standardized clinical pathways have improved consistency and outcomes in other areas of pediatric orthopaedics, data regarding their use following tibial tubercle fracture fixation remain limited.

The purpose of this study was to describe the development and implementation of an accelerated standardized postoperative rehabilitation pathway and evaluate early clinical outcomes following surgical fixation of pediatric tibial tubercle fractures.

METHODS

- Following consensus among 7 fellowship-trained pediatric orthopaedic surgeons, a standardized postoperative rehabilitation pathway was implemented.
- A retrospective comparison of prospectively collected data on all patients undergoing surgical fixation of a tibial tubercle fracture between October 2021 and March 2026 at a single, large tertiary-care pediatric referral center was performed.
- Outcomes were compared with a historical cohort managed under heterogenous, provider-specific rehabilitation protocols.
- Protocol failure was defined as deviation from the standardized rehabilitation pathway due to complications, delayed recovery, or inability to progress through established milestones.

Tibial Tubercle Accelerated Rehabilitation Protocol

	WEIGHT BEARING	BRACE	RANGE OF MOTION
PHASE 1 0-2 WEEKS	WBAT (100%)	Worn at all times locked in extension (may remove for hygiene)	No passive ROM Avoid active extension out of the brace
PHASE 2A 2-4 WEEKS	WBAT (100%)	Worn at all times Locked in extension while ambulating	0-90° active and passive ROM as tolerated (Brace may be unlocked while sedentary)
PHASE 2B 4-6 WEEKS	WBAT (100%)	Worn at all times (May remove under PT supervision)	Unrestricted passive ROM as tolerated 0-90° while ambulating
PHASE 3 6-12 WEEKS	WBAT (100%)	Wean from brace	Unrestricted full ROM

Table 1. Standardized accelerated rehabilitation protocol.

RESULTS

- 83 fractures from 82 patients:
  - ➢ Age: 14.0 ± 1.4 years
  - ➢ Male: 76 (92%)
  - ➢ 47 (57%) left-sided
  - ➢ 53 (64%) jumping/landing mechanism of injury
  - ➢ Median time to brace discontinuation: 45 days (IQR 42–51)
  - ➢ **Median time to return to sport: 91 days (IQR 84–101)**
  - ➢ ***Protocol "failure": 3 (3.6%)***

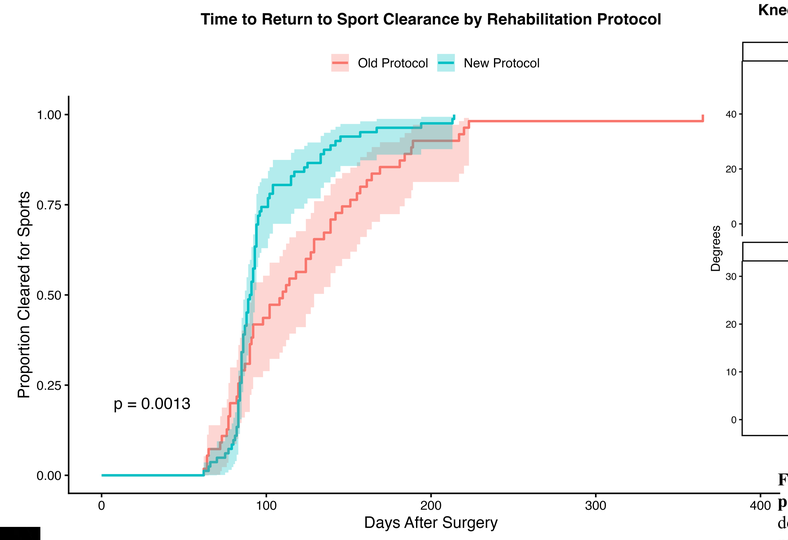


Figure 1. Time to return to sport clearance by rehabilitation protocol. Kaplan–Meier curves demonstrating significantly earlier return to sport clearance with the standardized accelerated rehabilitation protocol compared with historical protocols (log-rank p = 0.0015). Shaded areas represent 95% confidence intervals.

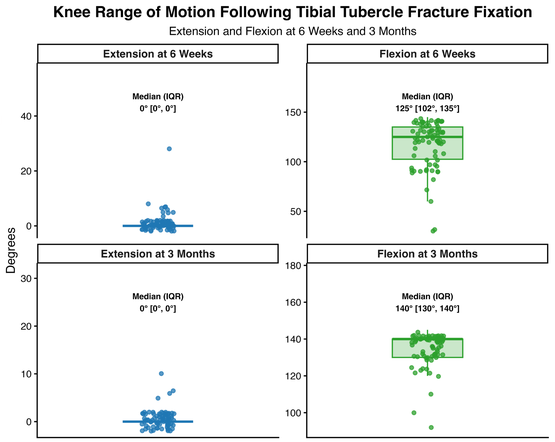


Figure 2. Knee range of motion following surgical fixation of pediatric tibial tubercle fractures. Box-and-whisker plots demonstrating knee extension and flexion at 6 weeks and 3 months postoperatively among patients managed with the standardized accelerated rehabilitation protocol. Median and interquartile range (IQR) values are displayed for each time point.



Characteristic	Old Protocol n = 55*	Accelerated Protocol n = 82*	p-value†
Ogden Type			**0.10**
1	8 (15%)	7 (8.5%)	
2	14 (26%)	12 (15%)	
3	22 (41%)	35 (43%)	
4	10 (19%)	28 (34%)	
Hardware Removal			**<0.001**
Yes	17 (31%)	3 (4%)	
Days until Clearance	110 (83, 151)	91 (84, 101)	**0.0013**

*n (%); Median (Q1, Q3)

† Fisher's exact test; Log-rank test

Table 2. Comparison of historical and accelerated rehabilitation protocols.

DISCUSSION

- **Patients achieved timely return to unrestricted activities, satisfactory restoration of knee range of motion, and low rates of postoperative complications.**
- Protocol failures were uncommon, occurring in only three patients (3.6%).
  - ➢ *2 later identified as Ogden Type V reflecting disruption of the extensor mechanism rather than failure of osseous healing or fixation integrity.*
  - ➢ 1 failure occurred in a patient who did not adhere to prescribed postoperative brace and activity restrictions.
- Our median time to clearance (91 days) approached the lower end of previously reported recovery timelines (3-6 months) suggesting that **accelerated rehabilitation may safely facilitate earlier return to athletic participation**.
  - ➢ Comparison with the historical cohort demonstrated that patients managed with the standardized accelerated pathway returned to sports significantly earlier than those treated under prior provider-specific protocols *without evidence of increased complications or adverse outcomes.*
- The lower rate of subsequent hardware removal in the accelerated cohort may reflect differences in fixation technique, including increased use of headless screws, rather than the rehabilitation protocol itself.

Overall, these findings support standardized accelerated rehabilitation as a safe and reproducible approach following pediatric tibial tubercle fracture fixation and provide objective recovery benchmarks to inform future postoperative guidelines.

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