Functional and Clinical Outcome of Fiber Tape Fixation in Transverse Patella Fractures: A Prospective Observational Study

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ABSTRACT:

Background:
Patellar fractures account for approximately 1% of all skeletal injuries and commonly affect the working-age population. Traditional fixation using tension band wiring (TBW) is associated with complications such as hardware irritation and reoperation. FiberTape fixation offers a non-metallic alternative with superior biomechanical properties.

Objective:
To evaluate the functional and clinical outcomes of FiberTape fixation in transverse patella fractures.

Methods:
A prospective observational study was conducted on 30 patients with transverse patella fractures treated using FiberTape fixation. Functional outcomes were assessed using the Tegner activity score and knee range of motion (ROM) over a follow-up period of 6 months. Statistical analysis included Chi-square test, independent t-test, and ANOVA.

Results:
The mean age was 42.9 years. Mean ROM achieved was 131.1°, and the mean Tegner score was 88.9. Excellent outcomes were seen in 73.3% of patients. ROM ($p=0.02$), Tegner score ($p=0.01$), and mode of injury ($p=0.03$) showed statistically significant correlation with outcomes. Complication rate was low (13.3%).

Conclusion:
FiberTape fixation provides excellent functional recovery with minimal complications and represents a reliable alternative to metallic fixation techniques.

Keywords: Patella fracture, FiberTape, Tegner score, Knee ROM, ture fixation

1. Introduction

The patella plays a critical role in the knee extensor mechanism by increasing the mechanical advantage of the quadriceps muscle. Fractures of the patella disrupt this mechanism, leading to significant functional impairment.[1] Transverse fractures are the most common pattern,

accounting for nearly 50–70% of patellar fractures.[2]

Traditional fixation using tension band wiring (TBW) converts tensile forces into compressive forces at the fracture site, facilitating union.[3] However, TBW is associated with several complications, including implant prominence, soft-tissue irritation, and reoperation rates reported to be as high as 40%.[4]

Recent advancements in orthopaedic biomaterials have led to the development of high-strength suture-based constructs such as FiberWire and FiberTape. These materials demonstrate superior tensile strength, resistance to cyclic loading, and improved load distribution compared to metallic wires.[5] FiberTape, with its flat and broad configuration, reduces the risk of tissue cut-through and provides stable fixation while minimizing hardware-related complications.[6]

Materials and Methods

Study Design

Prospective observational study conducted in accordance with the Declaration of Helsinki.[7]

Study Setting

Department of Orthopaedics, Sree Balaji Medical College and Hospital, Chennai.

Study Duration

December 2024 to December 2025, with a minimum follow-up period of 6 months.

Sample Size

Thirty patients were included based on feasibility and case availability.

Inclusion Criteria

- Patients aged >18 years
- Closed transverse patella fractures
- Both genders

Exclusion Criteria

- Comminuted fractures
- Open fractures (Gustilo-Anderson Grade II and III)
- Polytrauma patients
- Pathological fractures

Surgical Technique

All patients underwent open reduction and internal fixation using FiberTape in a figure-of-eight configuration through transosseous tunnels, reproducing the tension band principle.

Outcome Measures

- Knee Range of Motion (ROM)
- Tegner Activity Score
- Complications
- Final functional outcome

Statistical Analysis

- Chi-square test
- Independent t-test
- One-way ANOVA
- Significance: $p < 0.05$

Results

Demographic Profile

The mean age was 42.9 years, with the majority in the 51–60 age group (43.3%). Males constituted 53.3% of the study population. Age ($p=0.42$) and gender ($p=0.61$) showed no significant association with outcomes.

Injury Characteristics

Right-sided fractures were more common (63.3%). The most frequent mode of injury was fall from height (33.3%), followed by self-fall and road traffic accidents (26.7% each). Mode of injury significantly influenced outcomes ($p=0.03$), with high-energy trauma associated with delayed recovery.

Functional Outcomes

Range of Motion

The mean ROM achieved was 131.1°, with most patients achieving flexion greater than 125°. ROM showed a statistically significant correlation with final outcome ($p=0.02$).

Tegner Activity Score

The mean Tegner score was 88.9, with 63.3% of patients scoring between 91–95. Higher Tegner scores were significantly associated with better outcomes (p=0.01).

Complications

Complications were minimal:

- Infection: 10%
- Malunion: 3.3%

The association between complications and outcome was borderline significant (p=0.06).

Final Functional Outcome

- Excellent: 73.3%
- Good: 13.3%
- Fair: 6.7%
- Poor: 6.7%

This distribution was statistically significant (p=0.04), indicating favorable outcomes with FiberTape fixation.

Discussion

The present study demonstrates that FiberTape fixation provides excellent functional outcomes in transverse patella fractures. The high mean range of motion (131°) and Tegner score (88.9) observed in this study indicate effective restoration of knee function and facilitate early mobilization.[8,9]

From a biomechanical perspective, FiberTape constructs have been shown to provide superior load-to-failure strength and greater resistance to cyclic displacement when compared with conventional stainless steel wire constructs.[8] This enhanced stability permits early rehabilitation, which plays a crucial role in preventing joint stiffness and optimizing functional recovery.[9]

The predominance of excellent outcomes (73.3%) in the present study is in concordance with previous studies by Monaco et al. and Camarda et al., who reported high rates of fracture union and improved functional outcomes with suture-based fixation techniques.[9,10] Furthermore, these findings are comparable with the study by Wright et al., who demonstrated that suture-based fixation combined with tension band principles provides stable fixation with satisfactory clinical outcomes and early return of function.[11]

In the study by Wright et al., the use of suture and hybrid constructs showed reduced hardware-related complications while maintaining adequate fracture stability.[11] Similarly, in the present study, FiberTape fixation achieved excellent functional outcomes without compromising stability, reinforcing the reliability of non-metallic fixation methods in patellar fractures.

In contrast to traditional tension band wiring, FiberTape fixation eliminates complications related to hardware prominence, irritation, and migration, thereby significantly reducing the need for secondary implant removal procedures.[4,12] Wright et al. also reported decreased rates of symptomatic hardware and reoperation with suture-based constructs.[11] Notably, in the present study, no cases required implant removal, further supporting its clinical advantage.

The statistically significant association between range of motion and functional outcome underscores the importance of early mobilization in achieving optimal results. Similarly, higher Tegner scores reflect a better return to pre-injury activity levels, highlighting the effectiveness of this technique in restoring functional capacity.[13]

Although FiberTape fixation is associated with a higher initial cost, both the present study and previous reports suggest that the reduction in complications and avoidance of secondary surgeries may make it a cost-effective option in the long term.[11,14]

Conclusion

FiberTape fixation is a safe, reliable, and effective treatment modality for transverse patella fractures, providing stable fixation, high union rates, and excellent functional outcomes. The technique facilitates early mobilization and rehabilitation, resulting in satisfactory restoration of knee range of motion and extensor mechanism function. In addition, the low-profile,

non-metallic construct minimizes implant-related complications such as hardware prominence, soft-tissue irritation, and the need for secondary

implant removal procedures.[8,9,12]

The favorable clinical and functional outcomes observed in the present study support the use of FiberTape fixation as a viable alternative to conventional metallic fixation techniques for transverse patella fractures. Further multicenter studies with larger sample sizes and longer follow-up periods are warranted to validate its long-term effectiveness and broader clinical applicability.[9,10,14]

Key Findings

- Excellent functional outcomes (73.3%)
- High ROM and activity scores
- Low complication rates
- No implant-related morbidity

Limitations

- Small sample size
- Single-center study
- Short follow-up
- Lack of control group

Future Recommendation

Multicentric randomized controlled trials with long-term follow-up are required to validate these findings.

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