ORIGINAL RESEARCH PAPER
Volume - 14 | Issue - 06 | June - 2025 | PRINT ISSN No. 2277 - 8179 | DOI : 10.36106/ijsr
INTERNATIONAL JOURNAL OF SCIENTIFIC RESEARCH

FUNCTIONAL AND RADIOLOGICAL OUTCOME OF TBW USING FIBER WIRE IN THE TREATMENT OF PATELLAR FRACTURE - A PROSPECTIVE STUDY.

Orthopaedics

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ABSTRACT

Background: The patella is a critical component of the knee's extensor mechanism, essential for joint stability and knee function. Patellar fractures disrupt this mechanism and often require surgical intervention to restore anatomy and function. This study evaluates the clinical outcomes and postoperative complications in patients undergoing open reduction and internal fixation (ORIF) of transverse patellar fractures using a tension-band wiring technique with Fiber Wire sutures. **Methods:** A longitudinal hospital-based study was conducted at the Regional Institute of Medical Sciences, Imphal. Sixty-nine patients aged 18–70 years with displaced Grade 1 transverse patellar fractures underwent ORIF with Fiber Wire tension-band wiring. Patients were followed for an average of 15.3 months. Functional outcomes were assessed using the Bostman score, and radiological healing was evaluated with Schmitz criteria. Range of motion (ROM) and complication rates were also recorded. **Results:** The mean age was 52.49 ± 13.36 years, with a female predominance (59.4%). The mean operative time was 71.16 ± 12.95 minutes. All patients received spinal anesthesia without intraoperative or neurovascular complications. Bone healing was achieved at a mean of 12.78 ± 2.26 weeks. Functional outcomes improved significantly over time, with mean Bostman scores rising from 20.41 at 3 months to 27.70 at 12 months ($p<0.001$). ROM of the operated knee improved from 113.12° at 3 months to 135.72° at 12 months, approaching the contralateral normal knee (142.39°). At 12 months, 58% of patients had excellent and 42% good outcomes. Postoperative complications were minimal. **Conclusion:** Tension-band wiring with Fiber Wire sutures is an effective technique for ORIF of transverse patellar fractures, providing satisfactory functional recovery and low complication rates.

KEYWORDS

Patellar Fracture, Open Reduction and Internal Fixation, Tension-band Wiring, Fiber Wire Sutures, Functional Outcome, Bostman Score, Knee Range of Motion, Transverse Patellar Fracture, Surgical Fixation, Postoperative Complications

INTRODUCTION

The patella serves as the primary attachment site for the patellar ligament and quadriceps tendon, residing within the tendon of the quadriceps muscle. It plays a crucial role in the knee's extensor mechanism by protecting deeper structures of the knee joint, shielding the quadriceps tendon from friction, directing forces to the patellar ligament, increasing compressive forces on the extensor mechanism, and providing joint stability. Consequently, the patella is an essential component of the lower limb musculoskeletal system and is vulnerable to injury.[1]

As a key element of the knee's extensor mechanism, the patella controls the biomechanical range of motion during knee movement.[2] A fracture of the patella can disrupt this mechanism, particularly if the congruity of the posterior articular surface is compromised. Such disruption may lead to long-term complications, including femoropatellar osteoarthritis characterized by chronic pain.[3]

Patellar fractures typically result either from a direct impact or an indirect mechanism such as a forceful eccentric contraction of the quadriceps muscle. Direct trauma, such as from dashboard injuries or falls, often causes stellate or comminuted fracture patterns. In contrast, forced rapid knee flexion against a contracted quadriceps generally leads to transverse fractures with displacement but without direct impact. Accurate diagnosis requires a detailed history and physical examination. Patients usually present with a swollen, painful knee and difficulty walking. An acute hemarthrosis is common, and a palpable defect may be detected between proximal and distal fracture fragments. Absence of joint effusion might indicate more extensive soft tissue injury, possibly including retinaculum tears. Evaluation of the extensor mechanism function is critical; patients should attempt a straight leg raise or active knee extension against gravity to assess integrity. Approximately 6–9% of patella fractures are open, making inspection for skin lacerations or abrasions vital.[4-5]

Gross Anatomy

The patella lies deep to the fascia lata and the tendinous fibers of the rectus femoris muscle. Its anteroinferior border is flat and roughly spherical, tapering to a rounded apex. The proximal portion is called the base. The base provides roughened surfaces for the attachment of the rectus femoris and vastus intermedius tendons. The medial and lateral borders are rounded and also exhibit roughened surfaces for ligamentous attachments.[6]

Surgical Anatomy

Anterior Surface: The anterior surface of the patella is defined by rough vertical ridges formed by the quadriceps tendon insertion, which occupies the superior third at the base. The superficial part of the quadriceps tendon continues over this surface, contributing to the deep fascia that attaches firmly to the bone. The middle portion shows vertical striations and vascular foramina. The inferior apex is sharp and serves as the insertion point for the patellar ligament.[7]

Posterior Surface: The posterior surface features a large, smooth oval facet covered with hyaline cartilage for articulation with the femoral trochlea. This surface is divided by a vertical midline ridge corresponding to the trochlear groove of the distal femur. The inferior 25% of the posterior surface is nonarticular. The apex contains vascular foramina that connect to vessels passing through the infrapatellar fat pad.[8]

The patellofemoral joint displays a cartilage configuration that does not exactly match the shape of the underlying subchondral bone. The articulating surface is oval and divided by a vertical median ridge into lateral and medial facets of nearly equal prominence. Wiberg classified patella types based on the relative size and shape of these facets: Type I (10%) has concave, similarly sized facets; Type II (65%) has a smaller, flat or slightly convex medial facet; and Type III (25%) features a smaller but convex medial facet.[9-10]

Medial Facet: The medial facet is subdivided into the main medial facet and a smaller "odd facet" located at the medial border. This "secondary ridge" develops postnatally due to stress and is separated by a vertical ridge. Its prominence varies and influences the cartilage thickness and subchondral bone structure.[7,11]

Lateral Facet: The lateral facet is concave in both vertical and transverse planes and can be divided into three transverse segments by ridges in adults.[12,13]

Base and Apex: The base is triangular and tilted distally, serving as an insertion point for the quadriceps tendon. The apex serves as the attachment for the patellar ligament.

Paramedian Borders: The medial border is thinner than the lateral and serves as the attachment site for the medial patellofemoral ligament (MPFL), which is essential for patellar stability. The lateral border receives a two-layered fibrous retinaculum important for lateral stabilization.[7]

Femoral Trochlea: The trochlea, located anterior to the distal femur, articulates with the patella and has medial and lateral facets with an average depth of 5.2 mm. The lateral trochlear facet is generally larger, more proximal, and more anterior than the medial. Cartilage thickness is 2 to 3 mm, thicker medially than laterally.[7]

Classification Systems
Patellar fractures are classified mainly based on fracture morphology, articular involvement, and displacement. Common patterns include transverse, vertical, stellate, superior pole, and inferior pole fractures. Displacement is typically categorized as either nondisplaced or displaced.[11] The AO/ASIF classification, adapted from Müller et al.'s system for long bone fractures, is widely used for patellar fractures.[12]

Treatment Modalities
Transverse patellar fractures are commonly treated using three main surgical techniques: anterior tension band wiring, longitudinal wiring, and cerclage wiring. Cerclage wiring provides circumferential compression of fracture fragments but may lose stability during knee flexion. Longitudinal wiring maintains alignment and prevents step-off but may be ineffective in comminuted fractures. Anterior tension band wiring offers superior resistance against flexion displacement but may lose reduction in comminuted cases.[13]

Therefore the aim of the study is to evaluate clinical outcome and rate of postoperative complications of patients who underwent an open reduction and internal fixation (ORIF) using a tension-band wiring technique with a Fiber Wire suture.

MATERIALS AND METHODS
Study Design:
This was a longitudinal hospital-based study conducted in the Department of Orthopaedics, Regional Institute of Medical Sciences (RIMS), Imphal.

Study Population:
Patients aged 18 to 70 years presenting with patellar fractures at the Orthopaedics OPD and emergency department at RIMS, who subsequently underwent open reduction and internal fixation (ORIF) using tension-band wiring with Fiber Wire sutures during the study period, were included.

Inclusion Criteria:
- Patients with compound Grade 1 transverse patellar fractures
- Fractures displaced by more than 3 mm
- Articular incongruity of ≥ 2 mm and loss of extensor mechanism
- Medically fit for surgery

Exclusion Criteria:
- Pathological fractures
- Metabolic bone diseases or bony metastasis
- Associated neurovascular injuries or conditions interfering with post-operative rehabilitation
- Patients who refused to give consent

Study Duration
Protocol preparation and approval occurred between April and May 2023. Data collection was performed from July 2023 to October 2024. Literature review was completed by December 2024, and thesis writing finalized by February 2025, with submission in March 2025.

Sample Size and Sampling:
The sample size was calculated using the formula N=1.962×P×QL2N = \frac{1.96^2 \times P \times Q}{L^2}N=L21.962×P×Q, with a proportion of excellent outcomes (P) of 11.76% (Camarda et al.14), precision (L) of 6%, and alpha of 1.96, yielding a sample size of 63. Accounting for 10% loss to follow-up, 69 patients were targeted. Convenience sampling was used to enroll eligible patients during the investigator's duty days.

Data Sources
Primary data were collected using a structured proforma capturing clinical history, investigations, operative details, and follow-up findings.

Study Variables:
Independent variables included demographic data (age, sex), injury mechanism, fracture type and side, operative duration, and timing of surgery. Outcome variables comprised time to union, range of motion (ROM), residual deformity, further treatment, radiological and functional outcomes assessed by Bostman score22 and Schmitz radiological evaluation23, and post-operative complications such as infection, stiffness, deformity, and pain.

Study Instruments
- Departmental medical records
- Pretested structured proforma covering demographic data, clinical examination, laboratory investigations, and imaging
- Surgical instruments including Fiber Wire (No. 2 and No. 5), 2.0 mm drill bit, drills, depth gauge, tourniquet, retractors, periosteal elevators, reduction clamps, and bone levers
- Follow-up clinical and radiographic assessments
- Outcome scores: Bostman score and Schmitz radiological evaluation

Data Collection Procedure
Eligible patients with Grade 1 transverse patellar fractures undergoing ORIF with tension-band wiring using Fiber Wire were enrolled after informed consent. Detailed explanation of the surgical procedure and potential risks/benefits were provided. Clinical examination, history, hematological tests, and radiographs were documented systematically in the proforma.

Surgical Procedure
Patients were assessed preoperatively and given prophylactic antibiotics (cefazolin 1g pre-op, repeated if surgery exceeded 4 hours, followed by 7 days post-op antibiotics guided by intraoperative cultures). Anaesthesia was spinal or epidural unless contraindicated. A midline longitudinal incision (~12.5 cm) exposed the patella. Fracture surfaces were cleared and anatomically reduced. Using a 2 mm drill bit, holes were drilled in distal and proximal fragments for Fiber Wire Krackow sutures. A double-stranded No. 2 Fiber Wire tension band in a figure-of-eight configuration was applied anteriorly and tightened. Post-reduction knee movement was assessed intraoperatively.

Post-operative Care
A hinged knee brace was applied, permitting 30–40° knee flexion initially, progressing to 90° by six weeks and full flexion by three months. Inferior pole and comminuted fractures had modified protocols with restricted early flexion.

Follow-up and Assessment
Patients were monitored for 12 months at intervals of 3 weeks, 6 weeks, 3 months, 6 months, and 12 months. Clinical assessment included standardized examination, Bostman functional scoring22, and radiological evaluation using Schmitz criteria23 on AP, lateral, and specialized patellar views.

Operational Definitions
- Bostman Functional Score: Total scores classified as excellent (28–30), good (20–27), and unsatisfactory (<20).
- Schmitz Radiological Evaluation: Four healing phases: Resting (0–3 weeks), Stability (3–6 weeks), Weight bearing (6–12 weeks), and Healing (12–24 weeks) characterized by callus formation and fracture line obliteration.

Statistical Analysis
Data were analyzed using IBM SPSS version 21. Descriptive statistics (mean, SD, percentages) summarized demographic and clinical variables. Paired t-tests assessed changes in Bostman scores and ROM over time. One-sample t-tests compared 12-month ROM with the unaffected knee. A p-value <0.05 was considered statistically significant.

Ethical Considerations

Ethical approval was obtained from the RIMS Research Ethics Board. Written informed consent was obtained from all participants. Confidentiality was maintained by assigning unique codes, with data used solely for research purposes.

RESULTS

A total of 69 patients under went an open reduction and internal fixation (ORIF) using a tension-band wiring technique with a Fiber Wire suture for transverse patellar fracture during the study period.

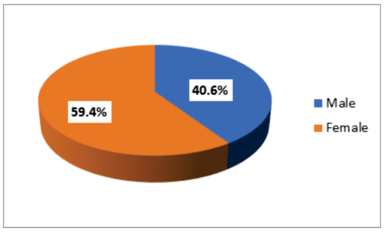

Fig.1. Distribution of the Patients by Gender (N=69)

Maximum of the patients were female (41, 59.4%) and remaining 28 patients (40.6%) were males.

Table 1. Age Distribution of Patients (N=69)

Sl.no.	Age group in years	No. of patients	Percentages (%)
1.	18-30	6	8.7
2.	31-40	6	8.7
3.	41-50	18	26.1
4.	51-60	13	18.8
5.	61-70	22	31.9
6.	Above 70	4	5.8
7.	Mean age in years	52.49 ± 13.36 years (range 22-73 years)	

Most of the patients belong to the age group of 61-70 years (31.9%) followed by 41-50 years (26.1%). The age group 51-60 years has 18.8% of the patients. The mean age of the patients was 52.49 ± 13.36 years.

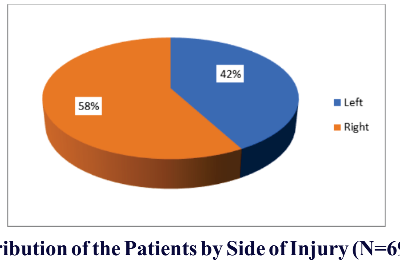

Fig.2. Distribution of the Patients by Side of Injury (N=69)

More than half of the patients had their right patella (58.0%) fractured and the remaining 42% (29) of the patients had their left patella fractured.

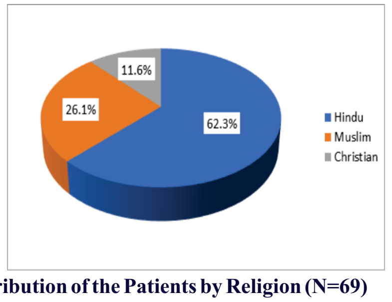

Fig.3. Distribution of the Patients by Religion (N=69)

Most of the patients were Hindu (43, 62.3%) followed by Christian (18, 26.1%). Only 11.6% (8) of the patients were Muslim.

Table 2. Intraoperative Characteristics and Complications (N=69)

Sl.no.	Characteristics	No. of patients	Percentages (%)
1.	Spinal Anaesthesia	69	100
2.	Blood transfusion	0	0
3.	Intraoperative complication	0	0
4.	Distal neurovascular complication	0	0

All the patients underwent operation through spinal anaesthesia. No blood transfusion was given postoperatively. No intraoperative complications were encountered. No distal neurovascular complications were encountered postoperatively.

Table 3. Mean Duration of the Operation of the Patients (N=69)

Sl.no.	Parameters	Mean	Standard Deviation	Range
1.	Operation duration in minutes	71.16	12.95	50 – 110

The mean duration of operation was 71.16 ± 12.95 minutes.

Table 4. Number of Days of Injectable Analgesics Given to Patient (N=69)

Sl.no.	Number of days	No. of patients	Percentages (%)
1.	One day	64	92.8
2.	Two day	5	7.2

Maximum of the patients were given injectable analgesics till day 1 (92.8%) and remaining patients were given injectable analgesics till day 2 (7.2%).

Table 5. Number of Days of Injectable Antibiotics Given to Patient (N=69)

Sl.no.	Number of days	No. of patients	Percentages (%)
1.	Ten days	69	100.0

All the patients received 10 days full course of injectable antibiotics.

Table 6. Follow up time of the Patients (N=69)

Sl.no.	Parameters	Mean	Standard deviation	Range
1.	Follow up time in months	15.30	3.24	8-23

The mean duration of follow up period of the patients was 15.30 ± 3.24 months.

Table 7. Mean Time of Bone Healing of the Patients (N=69)

Sl.no.	Characteristic	Mean	Standard deviation	Range
1.	Bone healing in weeks	12.78	2.26	9-19

The mean time of bone healing was observed at 12.78 ± 2.26 weeks with the range of 9 to 19 weeks. All the patients had bone healing during follow-up.

Table 7. Mean Bostman Score at 3 months, 6 months and 12 months (N=69)

Sl.no.	Bostman score	Mean	Standard deviation	Range
1.	At 3 months	20.41	2.29	16 – 26
2.	At 6 months	24.64	2.07	20 – 28
3.	At 12 months	27.70	1.85	23 – 30

In this study the mean Bostman score at 3 months, 6 months and 12 months follow-up period was 20.41 ± 2.29, 24.64 ± 2.07 and 27.70 ± 1.85, respectively.

Table 8. Functional Outcome at 3, 6 and 12 Months Follow up (N=69)

Sl. no.	Functional outcome by Bostman score	No. of patients, n(%)		
		At 3 months	At 6 months	At 12 months
1.	Excellent	0	4 (5.8)	40 (58.0)
2.	Good	44 (63.8)	65 (94.2)	29 (42.0)
3.	Unsatisfactory	25 (36.2)	0	0

Functional outcome at 3 months showed maximum patients with Good result (63.8%) and remaining 36.2% (25) of the patients were having unsatisfactory result, but at 6 and 12 months follow up zero unsatisfactory results were seen. Maximum of the patients had excellent result (58.0%) at 12 months follow up.

Table 9. Mean Range of Motion at 3, 6 and 12 Months of Follow up (N=69)

Sl.no.	Range of motion (degree)	Mean	Standard deviation
1.	Normal knee (other limb)	142.39	5.18
2.	At 3 months (operated limb)	113.12	10.71
3.	At 6 months (operated limb)	124.57	8.98
4.	At 12 months (operated limb)	135.72	8.58

At 3 months of follow up the mean range of motion was 113.12 ± 10.71 degrees and at 6 month follow up the mean range of motion was 124.57 ± 8.98. The mean range of motion at 12 months of follow up was

 PRINT ISSN No. 2277 - 8179 | DOI : 10.36106/ijsr

135.72 ± 8.58 in comparison to the normal limb knee range of motion was 142.39 ± 5.18.

Table 10. Association Between Mean Bostman Score at Different Time of Follow up (N=69)

Sl. no.	Follow up period	Bostman score		P value
		Mean ± SD	Mean difference	
1.	At 3 months	20.41 ± 2.29		Reference
2.	At 6 months	24.64 ± 2.07	4.23 ± 1.05	< 0.001*
3.	At 12 months	27.70 ± 1.85	7.29 ± 1.23	< 0.001*

* paired-t test

The mean Bostman score was more when measured at 6 months in comparison to 3 months and the difference was found to be statistically significant. Similarly, the mean Botsman score was more when measured at 12 months in comparison to 3 months measurement and the difference is found to be significant.

Table 11. Association Between Mean (Range of Motion) ROM at Different Time of Follow up at Operated Knee (N=69)

Sl.no.	Follow up period	ROM		P value
		Mean ± SD	Mean difference	
1.	At 3 months (operated limb)	113.12 ± 10.71	Reference	-
2.	At 6 months (operated limb)	124.57 ± 8.98	11.44 ± 4.93	< 0.001*
3.	At 12 months (operated limb)	135.72 ± 8.58	22.60 ± 6.50	< 0.001*

* paired-t test

The mean Range of Motion (ROM) of the operated limb was more when measured at 6 months in comparison to 3 months and the difference was found to be significant. Similarly, the mean Range of Motion (ROM) was more when measured at 12 months in comparison to 3 months measurement and the different was found to be statistically significant.

Table 11. Association Between Mean Range of Motion (ROM) at Different Time of Follow up Between Operated Knee and Normal Limb (N=69)

Sl.no.	Follow up period	ROM		P value
		Mean ± SD	Mean difference	
1.	Normal knee (other limb)	138.84 ± 5.82		Reference
4.	At 12 months (operated limb)	134.57 ± 7.46	3.11 ± 4.29	< 0.001

In this study the mean Range of Motion (ROM) of the operated limb was less when measured at 12 months in comparison to the normal knee joint range of motion and the difference was found to be statistically significant.

DISCUSSION

During the study period, a total of 69 patients underwent open reduction and internal fixation (ORIF) using a tension-band wiring technique with FiberWire sutures for transverse patellar fractures. Of this study population, 59.4% were female and 40.6% were male. Camarda L et al. [14] reported that among 17 patients treated with FiberWire sutures for patellar fractures, 12 were male and 5 were female. Similarly, Shea GK et al. [24] observed that in their cohort of 87 patients, 36.7% were men and 63.3% were women, consistent with the findings of this study. In contrast, Wongthongsalee P et al. [25] reported a predominance of males (68.75%) over females (31.25%) among 16 patellar fracture patients. Munawar S et al. [27] also noted a male to female ratio of 6:3 in their study of 29 patients. Jirangkul P et al. [31] found that 62.5% of their patellar fracture patients were female, a finding supported by Lee KW et al. [32]. Giuseppe R et al. [34] similarly reported 59.4% female and 40.6% male patients in their study of 64 individuals. Taken together, most studies report a higher incidence of patellar fractures in females, consistent with this study's findings. This trend may be attributed to a greater propensity for falls in women, particularly with advancing age, linked to hormonal changes during menopause, reduced bone density, and balance impairments. Additionally, factors such as inappropriate footwear, like high heels, may contribute to instability and falls [41].

In the current study, the majority of patients (31.9%) were aged 61 to 70 years, followed by 26.1% aged 41 to 50, and 18.8% aged 51 to 60. The mean patient age was 52.49 years (SD ±13.36). Camarda L et al. [14] reported a slightly lower mean age of 46.6 years (range 20–75), whereas Lee BJ [17] found a mean age of 59.6 years (range 39–76), which closely aligns with this study. Shea GK et al. [24] reported an average age of 60 years (SD ±15.4). Wongthongsalee P et al. [25] found a mean age of 46.19 years (range 19–88), while Chang SM et al. [26] noted a mean age of 59.8 years (range 50–76). Munawar S et al. [27] reported a mean age of 53.2 years, and Yotsumoto T et al. [30] documented 58.2 years (range 31–85). Jirangkul P et al. [31] reported a mean age of 45.18 ± 19.14 years, and Lee KW et al. [32] reported 54.2 ± 10.6 years (range 33–73). Collectively, these studies suggest that patellar fractures most commonly occur in the fifth and sixth decades of life, consistent with the present study. This may be due to age-related factors such as osteoporosis, decreased bone strength, loss of muscle mass and agility, and morphological changes resulting in reduced muscle fibers from the fourth decade onward [42,43].

Regarding laterality, 58.0% of patients in this study had fractures of the right patella, while 42.0% had left-sided fractures. Munawar S et al. [27] also reported a similar distribution with a 15:14 ratio for right versus left patella involvement. Most patients were Hindu (62.3%), followed by Christian (26.1%) and Muslim (11.6%), reflecting the demographic profile of the hospital's catchment area. All surgeries were performed under spinal anesthesia without intraoperative complications or need for blood transfusion. Postoperative neurovascular function was preserved in all patients.

The mean follow-up duration was 15.14 months (SD ±3.21). Camarda L et al. [14] reported a longer follow-up averaging 33 months (range 8–68), while Shea GK et al. [24] had a follow-up of 13.5 ± 5.8 months, similar to this study. Wongthongsalee P et al. [25] reported 17.5 months (range 9–32), Chang SM et al. [26] followed for 12 months, and Munawar S et al. [27] reported 29 months (range 1–84). Yotsumoto T et al. [30] documented 18 months (range 12–22), and Jirangkul et al. [31] followed patients for 14.6 months (range 12–18). Most studies thus report follow-ups of approximately 14 to 16 months, consistent with our findings.

In this study, the average time to bone healing was 12.78 ± 2.26 weeks (range 9–19 weeks), with all patients achieving union during follow-up. Camarda L et al. [14] reported a shorter mean healing time of 9.2 ± 2 weeks, while Wongthongsalee P et al. [25] reported union in 8.87 ± 1.54 weeks (range 7–12) with no fixation failures. Chang SM et al. [26] noted union at an average of 12 weeks (range 8–16). Noothan PT et al. [28] reported 12.85 ± 1.573 weeks (range 12–17) for union with FiberWire fixation, consistent with this study. Yotsumoto T et al. [30] observed bone union approximately three months postoperatively with FiberWire, without failures or redislocation. Jirangkul et al. [31] reported a mean healing time of 11.68 weeks (range 8–15), and Lee KW et al. [32] reported 10.8 ± 1.5 weeks. Overall, studies of ORIF with FiberWire indicate bone union times ranging from 9 to 12 weeks, in agreement with our results.

Functional outcomes were evaluated using the Bostman score. The mean Bostman scores at 3, 6, and 12 months postoperatively were 20.41 ± 2.29, 24.64 ± 2.07, and 27.70 ± 1.85, respectively. At 3 months, 63.8% of patients had good functional results, with 36.2% unsatisfactory. At 6 and 12 months, no poor outcomes were observed, with 58.0% achieving excellent outcomes at 12 months. Wongthongsalee P et al. [25] reported a mean Bostman score of 27.13 ± 2.5 at final follow-up, similar to our findings. Another study reported Bostman scores of 19.57, 21.85, and 24 at 6, 12, and 20 weeks for FiberWire TBW, comparable to stainless steel wire outcomes [28]. Jirangkul et al. [31] recorded mean scores of 20.56 ± 3.58, 25.0 ± 3.29, and 26.44 ± 3.01 at 3, 6, and 12 months, respectively, also comparable. Our study similarly demonstrated a significant increase in Bostman scores over time, indicating progressive improvement in function.

Range of motion (ROM) of the operated knee was assessed against the contralateral normal knee. Mean ROM was 113.12 ± 10.71 degrees at 3 months, 124.57 ± 8.98 degrees at 6 months, and 135.72 ± 8.58 degrees at 12 months, compared to 142.39 ± 5.18 degrees in the normal knee. ROM significantly improved at 6 and 12 months compared to 3 months but remained statistically lower than the normal knee at 12 months. Camarda L et al. [14] reported an average ROM of 131.1 degrees, similar to the normal contralateral knee. Wongthongsalee P et al. [25] reported flexion of 126.25 degrees (range 120–130) and extension deficit of 0.63 degrees (range 0–10), with no significant difference compared to the uninjured side. Chang SM et al. [26] found 122.5 degrees ROM at 12 months following ORIF with tension band wiring through cannulated screws, less than in this study. Munawar S et al. [27] reported average flexion of 98.1° in the braided polyester suture group and 98.8° in the metal tension band group. Noothan PT et al. [28] documented progressive ROM increases after FiberWire fixation, reaching 118.57° ± 18.64° at 20 weeks, with no significant differences versus stainless steel wire. Yotsumoto T et al. [30] reported a 12-month ROM of 134.68 degrees with FiberWire, consistent with our findings. Jirangkul et al. [31] observed similar results. Lee KW et al. [32] reported ROM at 3, 6, and 12 months of 110.5 ± 7.7, 124.4 ± 9.8, and 133.6 ± 10.9 degrees, respectively, for the operated knee, closely matching this study. Collectively, these studies confirm excellent functional ROM outcomes, with flexion exceeding 130 degrees and near-normal contralateral knee values.

In conclusion, FiberWire tension band fixation yields good functional and radiological outcomes comparable to conventional methods employing metal wires or screws [26–28]. Although stainless steel wire offers strong fixation, its use is often associated with symptomatic hardware and related complications, leading to high rates of reoperation or hardware removal [44]. FiberWire, despite lower tensile strength than stainless steel wire, can withstand higher maximum tensile forces and is associated with reduced rates of symptomatic hardware removal [31]. One study reported only 8% of patients required hardware removal after patella fixation with cannulated screws and FiberWire [46]. FiberWire fixation allows secure stabilization without metal implants, adapts better to soft tissues and bone, resists fatigue, and is linked to higher patient satisfaction and fewer revision surgeries. When maintaining tension bands under deforming forces, FiberWire performs as effectively as stainless steel wire. Due to its lower complication rate and improved patient comfort, FiberWire is a suitable option for treating transverse patellar fractures [28].

CONCLUSION

Patellar fractures are a frequent injury among middle-aged women. The patients were monitored for a little over a year, and all of them achieved bone union within three months of their surgery. The study shows that ORIF with FiberWire sutures produced good outcomes both clinically and radiologically. As a result, FiberWire sutures might be seen as a possible option for treating patellar fractures, which would lower the frequency and occurrence of problems and reoperations.

REFERENCES

1. Fox AJ, Wanivenhaus F, Rodeo SA. The basic science of the patella: structure, composition, and function. J Knee Surg. 2012;25(02):127-42.
2. Loudon JK. Biomechanics and pathomechanics of the patellofemoral joint. Int J Sports Phys Ther. 2016;11(6):820–30.
3. Vedel JO, Vistrup S, Larsen P, Elsoe R. Altered long-term health-related quality of life in patients following patella fractures: a long-term follow-up study of 49 patients. Eur J Trauma Emerg Surg. 2018;44(5):707–16.
4. Robert BW, Heckman JD, Brown CMC, Rockwood CA, Green DP, editors. Rockwood and Green's Fractures in Adults. 6th ed. Philadelphia: Lippincott Williams & Wilkins; 2006. 2710p.
5. Anand S, Hahnel JC, Giannoudis PV. Open patellar fractures: high energy injuries with a poor outcome?. Injury. 2008;39(4):480-4.
6. Fox AJ, Wanivenhaus F, Rodeo SA. The basic science of the patella: structure, composition, and function. J Knee Surg. 2012;25(02):127-42.
7. Fulkerson JP, Buuck DA. Disorders of the Patellofemoral Joint. 4th ed. Baltimore: Lippincott Williams & Wilkins; 2004. 374p.
8. Matthews BF. Composition of articular cartilage in osteoarthritis; changes in collagen/chondroitin-sulphate ratio. BMJ. 1953;2(4837):660–1.
9. Stäubli HU, Dürrenmatt U, Porcellini B, Rauschning W. Anatomy and surface geometry of the patellofemoral joint in the axial plane. J Bone Joint Surg Br. 1999;81(3):452–8.
10. Wiberg G. Roentgenographic and anatomic studies on the femoro-patellar joint. Acta Orthop Scand. 1941;(12):319–410.
11. Posner AD, Zimmerman JP. Surgical Management of Patella Fractures: A Review. Arch Orthop. 2022;3(1):17-21.
12. Müller ME, Allgöwer M, Schneider R, Willenegger H. Manual of internal fixation: techniques recommended by the AO-ASIF group. Berlin: Springer; 1991. 292p.
13. Lotke PA, Ecker ML. Transverse fractures of the patella. Clin Orthop Related Res. 1981;158:180-4.
14. Camarda L, La Gattuta A, Butera M, Siragusa F, D'Arienzo M. Fiber Wire tension band for patellar fractures. J Orthop Traumatol. 2016;17(1):75-80.
15. Chatakondu SC, Abhaykumar S, Elliott DS. The use of non-absorbable suture in the fixation of patellar fractures: a preliminary report. Injury. 1998;29(1):23-7.
16. Chen CH, Huang HY, Wu T, Lin J. Transosseous suturing of patellar fractures with braided polyester–A prospective cohort with a matched historical control study. Injury. 2013;44(10):1309-13.
17. Lee BJ, Chon J, Yoon JY, Jung D. Modified tension band wiring using Fiber Wire for patellar fractures. Clin Orthop Surg. 2019;11(2):244-8.
18. George JC, George K, Chittaranjan S, John S, Thomas AA, Thamarassery F. Vertical and figure of eight fiber wiring for patella fractures. International Journal of Orthopaedics. 2017;3(3):860-4.
19. Hughes SC, Stott PM, Hearnden AJ, Ripley LG. A new and effective tension-band braided polyester suture technique for transverse patellar fracture fixation. Injury. 2007;38(2):212-22.
20. Gosal HS, Singh P, Field RE. Clinical experience of patellar fracture fixation using metal wire or non-absorbable polyester—a study of 37 cases. Injury. 2001;32(2):129-35.
21. Juutilainen T, Patiälä H, Rokkanen P, Törmälä P. Biodegradable wire fixation in olecranon and patella fractures combined with biodegradable screws or plugs and compared with metallic fixation. Arch Orthop Trauma Surg. 1995;114:319-23.
22. Egol K, Howard D, Monroy A, Crespo A, Tejwani N, Davidovitch R. Patella fracture fixation with suture and wire: you reap what you sew. Iowa Orthop J. 2014;34:63-7.
23. Bryant TL, Anderson CL, Stevens CG, Conrad BP, Vincent HK, Sadasivan KK. Comparison of cannulated screws with FiberWire or stainless steel wire for patella fracture fixation: a pilot study. Journal of orthopaedics. 2015;12(2):92-6.
24. Shea GK, Hoi-Ting So K, Tam KW, Yee DK, Fang C, Leung F. Comparing 3 different techniques of patella fracture fixation and their complications. Geriatric Orthopaedic Surgery & Rehabilitation. 2019;10:1-8.
25. Wongthongsalee P, Chobpenthai T. Transosseous suture with an all-FiberWire technique in patellar fracture fixation. Techniques in Orthopaedics. 2022;37(4):224-31.
26. Chang SM, Ji XL. Open reduction and internal fixation of displaced patella inferior pole fractures with anterior tension band wiring through cannulated screws. J Orthop Trauma. 2011;25(6):366-70.
27. Munawar S, Iqbal J, Sufyan M. A comparison of braided polyester suture fixation vs. Metal tension band wiring in patellar fractures. J Pakistan Orthop Assoc. 2017;29(03):112-8.
28. Noothan PT, Somashekara SA, Sunkappa SR, Karthik B, Rameshkrishnan K. A Randomized Comparative Study of Functional and Radiological Outcome of Tension Band Wiring for Patella Fractures Using SS Wire Versus Fiberwire. Indian J Orthop. 2023;57(6):876-83.
29. Kadam R, Pandey S, Challani A, Jain V, Shah A, Agarwal A. Comparison of the outcomes of pull through suturing vs. tension band wiring fixation techniques in the management of patellar fractures. Int J Res Orthop. 2018;4:502-6.
30. Yotsumoto T, Nishikawa U, Ryoke K, Nozaki K, Uchio Y. Tension band fixation for treatment of patellar fracture: novel technique using a braided polyblend sutures and ring pins. Injury. 2009;40(7):713-7.
31. Jirangkul P, Kosiyatrakul A. Abstaining from symptomatic implants of modified tension band wiring by nonabsorbable suture fixation for transverse patella fractures. J Orthop Surg Res [Internet]. 2021 [cited 2025 Jan 23];16(1):[about 7p.]. Available at: https://link.springer.com/content/pdf/10.1186/s13018-021-02494-3.pdf.
32. Lee KW, Ma SB, Yang DS, Oh SH, Park SH. Open reduction and internal fixation using multiple nonabsorbable suture materials in acute patella fracture: comparison of clinical and radiological outcome with tension band wiring. Knee Surg Relat Res [Internet]. 2021 [cited 2025 Jan 23];33(1):[about p 8.]. Available at: https://pmc.ncbi.nlm.nih.gov/articles/PMC8477530/pdf/43019_2021_Article_116.pdf
33. Itro A, De Cicco A, Conza G, Schiavo L, Garofalo N, Braile A, et al. Modified Tension Band Wiring Using Only Non-Absorbable Braided Polyblend Sutures for the Treatment of Patellar Fractures. Surg Tech Develop. 2024;13(2):227-36.
34. Giuseppe R, Michele R, Luca F, Michele G, Giuseppe G, Valentina M, et al. Nonmetallic tension band fixation is a viable and low-complication surgical technique in patellar fractures: a five-year retrospective study. Eur J Orthop Surg Traumatol. 2024; 34(4):2065-71.
35. Saini A, Mathur AK, Jangir R, Saini R, Thakan S. A prospective study to estimate the outcome of patellar fracture fixation with suture material of high resistance properties. Int J Res Orthop. 2023;9(4):710-15.
36. Heusinkveld MH, den Hamer A, Traa WA, Oomen PJ, Maffulli N. Treatment of transverse patellar fractures: a comparison between metallic and non-metallic implants. British Med Bulletin. 2013;107(1):71-85.
37. Lee MY, Ahn TH, Son SI, Kim HY. Biomechanical evaluation of three fixation methods in a feline transverse patella fracture model. J Feline Med Surg [Internet]. 2023 [cited 2025 January 23];25(5):[about p 7.]. Available at: https://journals.sagepub.com/doi/pdf/10.1177/1098612X231172630
38. Böstman O, Kiviluoto O, Nirhamo J. Comminuted displaced fractures of the patella. Injury. 1981;13(3):196-202.
39. Schmidt's, Schmidt KP. Evaluation of fracture healing and its disturbances. In: Maatz R, Lents W, Arens W, Beck H, editors. Plate Osteosynthesis. 15th Ed. Philadelphia: WB Saunders; 1986: p.51-61.
40. Hargett DI, Sanderson BR, Little MT. Patella fractures: approach to treatment. J American Acad Orthop Surg. 2021;29(6):244-53.
41. Gale CR, Cooper C, Aihie Sayer A. Prevalence and risk factors for falls in older men and women: The English Longitudinal Study of Ageing. Age Ageing. 2016;45(6):789-94.
42. Burr DB. Muscle strength, bone mass, and age-related bone loss. Journal of bone and mineral research. 1997;12(10):1547-51.
43. O'Flaherty EJ. Modeling normal aging bone loss, with consideration of bone loss in osteoporosis. Toxicological Sciences. 2000;55(1):171-88.
44. Smith ST, Cramer KE, Karges DE, Watson JT, Moed BR. Early complications in the operative treatment of patella fractures. J Orthop Trauma. 1997;11(3):183–7.
45. Wright PB, Kosmopoulos V, Coté RE, Tayag TJ, Nana AD. FiberWire is superior in strength to stainless steel wire for tension band fixation of transverse patellar fractures. Injury. 2009;40(11):1200–3.
46. Busel G, Barrick B, Auston D, Achor K, Watson D, Maxson B, et al. Patella fractures treated with cannulated lag screws and fiberwire® have a high union rate and low rate of implant removal. Injury. 2020;51(2):473–7.