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## Functional outcome of tension band wiring in transverse patella fracture

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### Abstract

**Background:** Patellar fractures constitute about 1% of all skeletal injuries resulting from either direct or indirect trauma. The subcutaneous nature of the patella makes it vulnerable to direct trauma, whereas violent contraction of the quadriceps results in indirect fractures of the patella. Patella is the largest sesamoid bone in the body and forms an integral part of the extensor mechanism of the knee joint. The functional outcome of patella fractures depends on age, the severity of the injury, treatment modality, anatomical reduction and restoration of articular congruity, post-operative rehabilitation. The study aims to assess the functional outcome of tension band wiring in transverse patella fracture.

**Materials and Method:** This study was carried out at the Department of Orthopaedics, Navodaya Medical College, Raichur over a period of 2 years. In this study, 30 patients (23 male, 7 females) with transverse patella fracture were admitted and were treated by tension band wiring. Functional outcome was assessed as per knee pain score, good fellow grading for a range of motion.

**Results:** A total of thirty patients were evaluated in our study, of which there were 23 males and 7 females. Out of which 24 patients had excellent results, 4 had good results and 2 had fair results. At the end of the 6<sup>th</sup> month, the majority of patients show excellent results according to good fellow grading range of motion.

**Conclusion:** The tension band wiring is safe and effective in the management of transverse patella fracture because of the good stability of the implant and easier postoperative rehabilitation.

**Keywords:** Transverse patella fracture, tension band wiring, functional outcome

### Introduction

The patella is the largest sesamoid bone; it is embedded in the quadriceps tendon, provides the mechanical advantage and leverage that increases the force of knee extension. Tensile forces are transmitted from the quadriceps to the tibia via the patella, the patella is also subjected to compressive forces at the articulation with the femur. The magnitudes of these forces vary with the degree of flexion and, with maximal tensile force occurring at 45 to 60 degrees of flexion, the joint contact forces of 3.3 times bodyweight occur during stair climbing, with up to 7.6 times bodyweight occurring during squatting <sup>[1]</sup>.

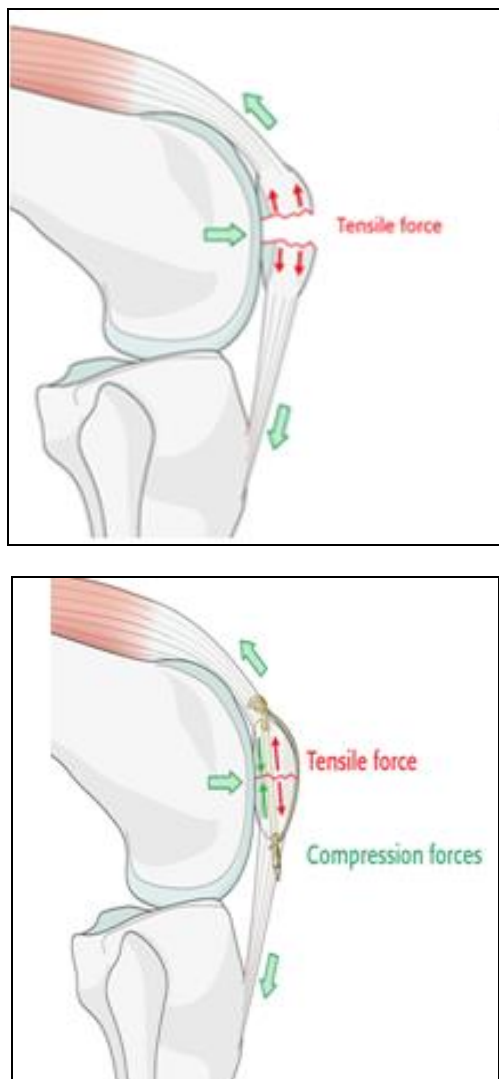
Fractures of the patella make up approximately 1% of all fractures. These fractures are seen in active individuals between the ages of 20 and 50. Commonly patella fracture is transverse. The most common mechanism is direct or indirect trauma. Direct trauma due to a direct blow during a fall onto the knee or because of hitting a hard object. The indirect fracture can be due to sudden jumping, or rapid knee flexion against fully contracted quadriceps. A major sequelae when the treatment is not entirely successful are post-traumatic arthritis of the patello-femoral joint and a decrease in the range of motion of the knee joint.

Different opinions are there for the treatment of fractures of the patella. Non-operative treatment has been limited to fracture that shows intact quadriceps component, separation less than two-millimeter and no significant displacement of the articular surface. Tension band wiring is a commonly used treatment for displaced transverse fractures of the patella. The principle of Tension band wiring is distractive forces at the fracture site are converted to compressive forces. The implant absorbs the tension and bone compression.

Fixation of patellar fractures is crucial as it allows early mobilisation of the knee without detrimental displacement at the fracture site <sup>[2]</sup>.

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This study analyses the functional outcome of tension band wiring in transverse patella fracture.



**Fig 1:** Principles of TBW

Fixation of patellar fractures is very crucial as it allows early mobilisation of the knee without detrimental displacement at the fracture site [2].

This study analyses the functional outcome of tension band wiring in transverse patella fracture.

### Materials and Method

This study of 30 patients with Transverse Patellar fractures

was conducted during the period between December 2019 to October 2021 in the Department of Orthopaedics, Navodaya Medical College Hospital and Research Centre, Raichur and were treated with Tension Band Wiring. Inclusion criteria include transverse fracture of the patella, transverse fracture of patella between the age of 20-45 years, including both sex groups, associated with condylar and supracondylar fracture of the femur, open fracture gustilo-anderson type 1 & 2, patient willing to give consent. Patients with comminuted fracture, medically unfit for surgery, patients not willing for surgery were excluded from the study. A detailed history was taken and a systematic examination of the patient was conducted according to Proforma. Radiographs of the knee were taken to confirm the fracture. Then splinting of the fracture was done with a rigid knee brace. All patients were taken for elective surgery as soon as possible after necessary investigations.

The patient was kept in the supine position on an operating table after spinal anesthesia. A midline longitudinal incision was put over the mid-portion of the patella. Skin and subcutaneous tissue were reflected in order to expose the fracture surface of the patella and retinacular tears. Thoroughly irrigate the joint and fracture with saline to remove blood clots and small bone pieces.

Fracture fragments are reduced anatomically by using patellar clamps and towel clips.

Two 2mm Kirschner wires were drilled from superior to inferior borders, about 5 mm deep to the anterior surface of the patella. The wires were kept parallel. Then 18 gauge stainless steel wire was passed transversely through the quadriceps tendon attachments as close to the bone as possible, deep to the protruding kirschner wires. Then turn the wire over the anterior surface of the reduced patella in the figure of 8 fashions. Insert wire transversely through the patellar tendon at the inferior fragment and deep to protruding k-wires, then back over the anterior patellar surface. The wire was tightened at the upper end. The upper ends of k-wires were acutely bent anteriorly. After they were cut, k-wires were rotated 180° and embedded into the superior margin of the patella posterior to the wire loop. Protruding ends of k-wires inferiorly were cut short. Retinacular tears were repaired bilaterally. The wound was cleaned thoroughly with saline and was closed in layers. The limb was immobilized in a long knee brace. Patients were evaluated at the 2nd week, 4th week, 3rd month and 6th month. In each follow-up, knee pain score was recorded. Range of motion, extension lag and good fellow's grading of motion were recorded. A check x-ray of the operated knee was taken to assess fracture union.



**Fig 2:** Shows preoperative and postoperative x-rays



**Fig 3:** Shows Knee Flexion and Extension

**Results**

The age of patients ranged from 20-45 years, with a mean age of 32.5 years.

Out of 30 patients, 23 (76.66%) patients were male and 7 (23.33%) patients were female. The right knee was involved in 20 (66.66%) cases, while the left knee was involved in 10 (33.33%) cases. 18 (60%) cases attained fracture due to indirect trauma, 12 (40%) cases attained fracture due to direct trauma. The majority of cases attained fracture due to self-fall.

The mean operation time was 90 minutes. Extension lag was noted in 12(40%) cases out of 30 cases in the first follow-up.

At the 6th month follow up, extension lag was corrected in all cases. At 1st follow-up, 22(73.33%) patients had ROM <90°. At the end of 6th month 1 (3.33%) patients had ROM <90, 5 (16.66%) patients had 90-120 degree of motion and 23 (76.66%) patients had > 120 degrees motion.

Modified knee pain score was classified into 4 groups: none (50), mild (30-45), moderate (10-20), severe (<10). At 2nd week follow up 22(73.33%) patients had mild pain and 8(26.66%) patients had no pain. At 6th month follow up 2(6.66%) patients had mild (30-45) knee pain score and the remaining patients had no pain. Radiological union of fracture was seen in all patients by the 3rd month.

**Table 1:** Good Fellows grading of range of motion [3]

Grading	Range of Motion
Excellent	Painless full movement and able to squat
Good	Full flexion and extension, but painful squat
Fair	Painless movement with 10-20 degrees limitation of flexion
Satisfactory	Painless movement with a limitation of 20-40 degrees of flexion
Poor	Limitation of >40 degrees flexion

**Table 2:** Shows functional results according to good fellow grading

Good fellow Grading	2 <sup>nd</sup> week		4 <sup>th</sup> week		3 <sup>rd</sup> month		6 <sup>th</sup> month	
Poor	24	80	9	30	0	0	0	0
Satisfactory	5	16.6	11	36.6	0	0	0	0
Fair	1	3.3	7	23.3	7	23.3	2	6.7
Good	0	0	3	10	12	40	4	13.3
Excellent	0	0	0	0	11	36.6	24	80
Total	30	100%	30	100%	30	100%	30	100%

**Discussion**

The aim of surgical treatment in patella fracture is anatomic reduction; restore of articular congruity, preservation of patellar bone stock, and repair of the extensor mechanism.

Tension band wiring is the most widely used technique in Transverse patella fracture fixation [4].

Mehdi *et al.* [5] study shows that excellent and good results in 203 patellar fractures, which are treated by Tension Band Wiring.

Gardner *et al.* [6] concluded that anterior tension band fixation constructs are the mainstay of treatment of patella fractures and lead to reliable results with simple transverse fracture patterns.

Curtis MJ *et al.* [7] 1990 compared the modified AO tension band technique with the combination of cerclage wiring and tension band. The combination of cerclage and tension band

wiring proved significantly stronger and is recommended. Berg EE *et al.* [8] shows that radiological union of transverse fracture of the patella was seen at a mean age of 13 weeks. In our study, all patients had a radiological union at the 12<sup>th</sup> week.

Our study also shows 80% excellent, good results in 13.3% and fair in 6.7% of Transverse patellar fractures treated by tension band wiring.

**Conclusion**

Tension band wiring by principle overcomes the distractive force and achieves compression at the fracture site and maintains the alignment by minimum hardware.

By achieving compression at the fracture site, the fracture heals faster and the patient is back to work earlier. The fixation enables early active movements of joints, which

reduces joint stiffness. TBW method had a high rate of good to excellent results in the treatment of displaced patella fractures.

Hence, it is concluded that tension band wiring is simple, inexpensive technique and effective means of fixing fracture based on biomechanical principles with minimum complications.

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