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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 patella makes it vulnerable to direct trauma, whereas violent contraction of quadriceps result in indirect fractures of patella. Patella is the largest sesamoid bone in the body and forms integral part of extensor mechanism of the knee joint. Functional outcome of patella fractures depends on age, severity of injury, treatment modality, anatomical reduction and restoration of articular congruity, post-operative rehabilitation. Aim of the study is 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 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 6<sup>th</sup> month 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 good stability of 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 body weight occur during stair climbing, with up to 7.6 times body weight occurring during squatting <sup>[1]</sup>.

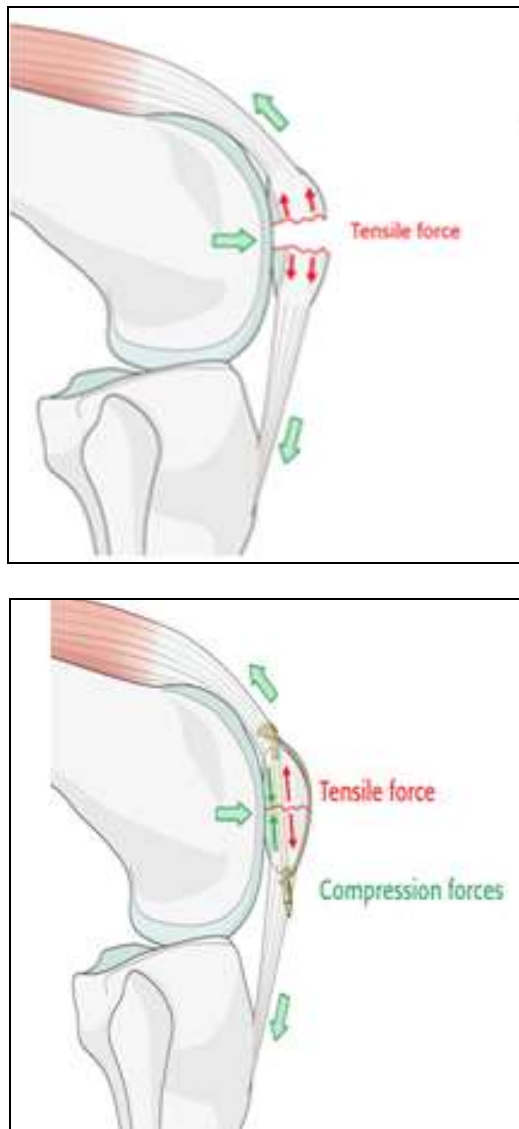
Fracture of patella make up approximately 1% of all fractures. These fractures are seen in active individuals between the ages of 20 and 50. Commonly patella fracture is transverse. The most common mechanism is direct or indirect trauma. Direct trauma due to direct blow during fall onto knee or because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

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

Fixation of patellar fractures is very 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 includes transverse fracture of patella, transverse fracture of patella between the age of 20-45 years, includes both sex groups, associated with condylar and supracondylar fracture of femur, open fracture gustillo- anderson type 1 & 2, patient willing to give consent. Patients with comminuted fracture, medically unfit for surgery, patients not willing for surgery was excluded from the study. A detailed history taken and systematic examination of the patient was conducted according to Proforma. Radiographs of knee were taken to confirm the fracture. Then splinting of fracture was done with rigid knee brace. All patients were taken for elective surgery as soon as possible after necessary investigations.

Patient was kept in supine position in an operating table after spinal anaesthesia. Midline longitudinal incision put over the mid portion of patella. Skin and subcutaneous tissue were reflected in order to expose fracture surface of patella and retinacular tears. Thorough irrigation of the joint and fracture with saline to remove blood clots and small bone pieces.

Fracture fragments 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 anterior surface of patella. The wires were kept as 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 reduced patella in figure of 8 fashions. Insert wire transversely through patellar tendon at inferior fragment and deep to protruding k-wires then back over the anterior patellar surface. Wire was tightened at the upper end. Upper ends of k-wires were acutely bent anteriorly. After they were cut, k-wires were rotated 180° and embedded into superior margin of patella posterior to wire loop. Protruding ends of k-wires inferiorly were cut short. Retinacular tears were repaired bilaterally. Wound was cleaned thoroughly with saline and was closed in layers. The limb was immobilized in a long knee brace. Patients were evaluated at 2nd week, 4th week, 3rd month and 6th months. In each follow up knee pain score was recorded. Range of motion, extension lag and good fellow's grading of motion were recorded. Check x- ray of operated knee was taken to assess fracture union.



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



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

**Results**

Age of patients ranged from 20-45 years with mean age of 32.5 years. Out of 30 patients, 23 (76.66%) patients were male and 7 (23.33%) patients were female. Right knee was involved in 20 (66.66%) cases, while the left knee involved in 10 (33.33%) cases. 18 (60%) cases attained fracture due to indirect trauma, 12 (40%) cases attained fracture due to direct trauma. Majority of cases attained fracture due to self fall. Mean operation time was 90 minutes. Extension lag was noted in 12(40%) cases out of 30 cases in first follow up. At 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 remaining patients had no pain. Radiological union of fracture was seen in all patients by 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 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 articular congruity, preservation of patellar bone stock, and repair of extensor mechanism. Tension band wiring is 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 main stay of treatment of patella fractures and lead to reliable results with simple transverse fracture patterns. Curtis MJ *et al.* [7] 1990 compared modified AO tension band technique with the combination of cerclage wiring, and tension band. The combination of cerclage and tension band

wiring proved to be significantly stronger and is recommended. Berg EE *et al.* [8] shows that radiological union of transverse fracture of patella was seen at a mean age of 13 week. In our study all patients had radiological union at 12th 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 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 techniques and effective means of fixing fracture based on biomechanical principle with minimum complications.

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