

## Research paper

# “Is articular cartilage reconstruction feasible in OTA-C2, C3 comminuted patellar fractures?” A prospective study of methodical reduction and fixation



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## ABSTRACT

**Background:** Comminuted patellar fracture reduction and articular reconstruction is surgically demanding situation to deal with, as patellar articular surface is complex with two diverging facets separated by a median ridge.

**Purpose:** The objective of this study is to evaluate functional outcome of OTA-34 C2, C3 comminuted patellar fractures treated surgically by methodical reduction and fixation.

**Methods:** We prospectively analyzed 12 patients of OTA-34 C2, C3 patellar fracture operated by our technique in 2 female and 10 male patients. We obtained three dimensional patellar articular facet reconstruction, by direct observation and reduction of articular surface and fixation with mini fragment screws and cerclage wire. The knee outcome survey – Activity of Daily Living Scale (ADLS) was used to assess functional outcome and follow-up X-rays were taken to assess radiological outcome of the fracture fixation.

**Results:** In all cases fracture union was achieved at an average of 10.83 weeks (2.49 months). The mean age was 43.58 years, average follow-up was 27.83 months and mean knee outcome survey ADLS – 90.08%. Functional knee range of motion was achieved by the end of 12 weeks (mean ROM – 119.08°). None of the patients had any infection, avascular necrosis of patellar fragments; implant cut out or patellofemoral arthritis. Three patients with associated ipsilateral long bone fracture showed delayed return to work.

**Conclusion:** Three dimensional patellar articular reconstruction and restoration of extensor apparatus is possible in comminuted patellar fracture with good clinical outcome by accurate and meticulous surgical reduction and fixation.

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## 1. Introduction

Patellar fractures constitute about 1% of all skeletal injuries.<sup>1</sup> Comminuted patellar fractures are usually due to high velocity injuries following direct impact. Currently, many methods of treatment are advocated for comminuted patellar fractures like

patellectomy (partial/complete), tension band wiring, cerclage wiring, and screw fixation.<sup>2</sup> Like any other Intra articular fractures, patellar fracture warrants anatomical reduction of articular fragments to restore articular congruity. The goal of surgical procedure is to obtain anatomic reduction of the articular fragments, stable fixation, and with restoration of the knee-extensor apparatus, so early mobilization of knee could be started.<sup>3</sup> Articular reconstruction of the comminuted fracture is surgically demanding, as the patellar articular surface is three dimensionally complex with diverging medial facet, lateral facet and median ridge separating the two facets. In regular techniques, patella articular surface reduction and restoration is checked blindly by

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retropatellar palpation and with the help of intraoperative fluoroscopy. Also, articular reconstruction is difficult in cases of articular comminution and many small fragments may not be adequately reduced by current techniques leading to non-congruent reduction and early patellofemoral arthritis. The aim of our technique is directly observed reduction of comminuted fragments by everting them and fixation using minifragments screws, cerclage wire and tension band wire. We evaluated our results where this technique was followed to reconstruct the three dimensional patellar articular surface to restore the extensor apparatus and allow early mobilization of knee joint.

## 2. Patients and methods

We prospectively analyzed 12 patients with 34-C2, C3 type comminuted patellar fractures (AO/Orthopaedic Trauma Association Classification) who sustained it following road traffic accident/direct fall on the knee during February 2011–July 2014. The mean age was 43.58 years (range 29–53 years) and included 2 females and 10 males (Table 1). We excluded simple transverse fractures, OTA A type, B type and C1 fractures for this study. Nine patients had injury in right knee and 3 patients had fracture in left knee. All patients underwent preoperative radiological workup with X-rays

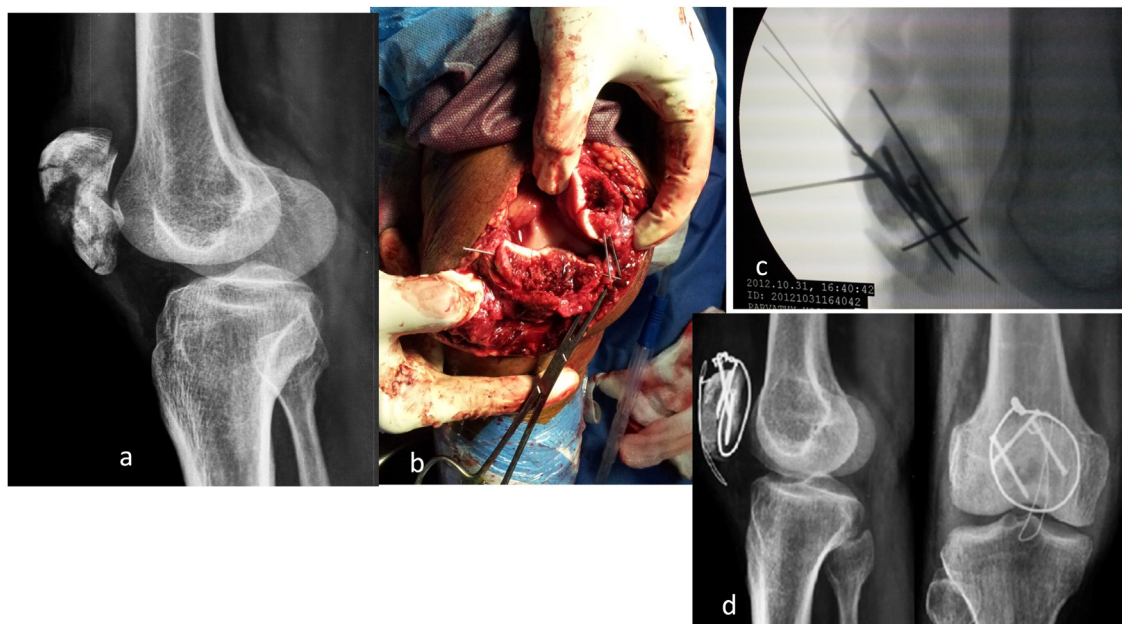
and CT scan to study fracture geometry and plan surgical fixation. Nine fractures were closed fracture and 3 patients with open fracture (2 patients type IIIA and 1 patient type II Gustilo Anderson classification) were treated by wound wash, wound debridement, primary internal fixation of the patella and primary wound closure in all the cases. Two patients had associated fracture of femur and 1 had tibia fracture which was fixed at the index surgery. The objective of our surgical technique is to achieve articular reconstruction and congruity of patellofemoral joint.

## 3. Surgical technique

The patellar fracture was exposed through a midline approach in closed fracture and in case of open fractures extending the laceration. Thorough wound wash was given to clear the blood clots from the knee joint, across fracture surface to define fracture geometry and to delineate major/larger fragments and smaller fragments by atraumatic blunt dissection. For convenience of reduction, patellar fragments was divided into upper and lower pole fragments. Upper pole fragments were everted and articular surface visualized, they were methodically reduced and, held temporarily by 1.2 mm k wire (Figs. 1 and 2) and then fixed with 2.4 mm mini fragment screws. Lower pole fragment reduction was

**Table 1**  
Patients demographic details.

Sl. no.	Age (years)	Side	Sex	MOI	Classification	Associated injuries	Open fracture	Follow-up (months)	ROM	Time to union (weeks)	Knee outcome survey ADLS (%)
1	45	R	M	RTA	34-C2	Nil		49	130	8	96.4
2	51	R	M	RTA	34-C2	Nil	Type IIIA	44	125	14	95.2
3	39	R	F	RTA	34-C2	Nil		40	120	10	94.36
4	29	R	M	RTA	34-C2	Nil		34	124	12	88.78
5	44	L	M	RTA	34-C3	Femur #		31	95	8	77.67
6	49	L	M	RTA	34-C2	Nil	Type II	28	124	11	95.45
7	53	R	M	Fall on knee	34-C2	Nil		26	132	9	97.11
8	35	R	F	RTA	34-C2	Tibial #		25	105	10	84.42
9	39	R	M	RTA	34-C3	Nil		15	120	12	96.47
10	46	R	M	RTA	34-C2	Nil		15	122	9	82.8
11	41	L	M	RTA	34-C3	Femur #		14	108	14	78.98
12	52	R	M	RTA	34-C3	Nil	Type IIIA	13	124	13	93.4



**Fig. 1.** (a) Preoperative X-ray with OTA 34-C3 comminuted fracture. (b) Intraoperative reduction and temporary fixation with 1.2 mm k-wire for upper major fragment and lower major fragment. (c) Intraoperative fluoroscopy to confirm articular reconstruction. (d) 24-months follow X-ray of the same patient.

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