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## Assessment of functional outcome of distal intra-articular fracture of femur treated with distal femoral LCP by Neer's score

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### Abstract

**Background:** Intra-articular fracture of the femur is a composite and complex injury that poses various challenges for orthopaedic surgeon. Fracture of the distal femur are one of the most prevalent fracture encountered in high velocity trauma which are associated with high morbidity and mortality if not managed well. This necessitates early stabilization of fracture.

**Materials and Methods:** We conducted a prospective interventional study on 25 consecutive patients with intra-articular fracture of distal femur treated by ORIF with LCP from January 2018 to December 2018 at R.N.T. Medical College Udaipur All patients were regularly followed up with x-ray and clinical examination. Post-operatively all patients were followed up for a minimum period of 1 year. The functional and radiological outcome was evaluated by Neer's score criteria at the end of 1 year.

**Results:** All patients were evaluated to assess their functional and radiological results using Neer's scoring system and compared with available literature. The results were analysed using different parameters. The results were excellent in 16(64%), good in 4(16%), fair in 3(12%) and poor in 2(8%). Results were found to be excellent in majority of the patients with mean knee flexion being 95°.

**Conclusion:** Surgery in the form of open reduction and internal fixation is recommended for intra-articular fracture of femur for good outcome and early mobilization with minimum preventable complication.

**Keywords:** Intra-articular fracture of distal femur, ORIF (Open reduction internal fixation), LCP (Locking compression plate), Neer's scoring system, early stabilization, early mobilization

### 1. Introduction

The incidence of distal femur fractures is approximately 7% of all femoral fractures and 30% of fractures of femur excluding hip fractures<sup>[1]</sup>. These are associated with high energy trauma (in the youngsters) and osteoporotic bones (in the elderly) and are frequently comminuted and intra-articular<sup>[2]</sup>. The management of intra-articular distal femur fractures is challenging with wide range of potential complications. In elderly patients, extreme osteoporosis represents a particular problem for anchoring the implant<sup>[3]</sup>. Current generation of distal femoral LCP is precontoured based on the average bony anatomy of the adult population and they form a fixed angled construct. The pull-out strength of locking screws is higher than the conventional screws and is particularly useful in osteoporotic bones. These plate are designed to apply in minimally invasive fashion to preserve local biology and problems with fracture healing and infection<sup>[4,5]</sup>.

### Aims and Objectives

1. To evaluate functional outcome of distal intra-articular fractures femur (AO type B and C) treated by distal femoral LCP using Neer's score. The patients are above the age of 18 years.
2. To evaluate the effectiveness and complications of distal end femur fractures treated with LCP.
3. To compare the results with other such related studies.
4. To study means for early regaining of functions and minimising the duration of hospital stay

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### Material and Methods

The data for this study collected from the patients who admitted with distal intra-articular femoral fractures to R.N.T. medical college & hospitals Udaipur, during the period January 2018 to December 2018 and treated with distal femoral LCP satisfying inclusion and exclusion criteria and all patients were followed according to postoperative follow up protocol. A total of 25 cases were studied.

The study which was a clinical, prospective and observational conducted at R.N.T. Medical College Udaipur. After obtaining a detailed history, complete general physical and systemic examination, the patient are subjected to relevant investigation. Post-operatively all cases are followed up for a minimum period of 1 year. With each follow up clinical and radiological evaluation done by using Neer's scoring system.

All the fractures in this series were post-traumatic. No pathological fracture was included in the study. Also supracondylar fractures in children were not considered.

### Inclusion Criteria

1. Adult of age 18-75 years.
2. Patients with distal third intra-articular femoral fractures AO type B and type C (type B-partial articular and type C-intra-articular).
3. Closed and compound fractures of distal third femur including Gustillo and Anderson types I, II.
4. Patients willing for treatment and given informed written consent.

### Exclusion Criteria

1. Children with distal intra-articular femoral fractures in whom, growth plate is still open (patient below 18 years of age).
2. Patients with any fractures other than the distal intra-articular femur in the ipsilateral or contralateral limb were excluded from the study.
3. Patients lost in follow – up.
4. Patients managed conservatively for other medical reasons.
5. Distal femoral fractures with neurovascular compromise.
6. Patients with pathological fractures of distal third femur other than osteoporosis.
7. Patients not willing for treatment and not given written consent for surgery.

### Surgical Procedure

Patient is placed supine on a radiolucent table with a pillow below the knee, the entire injured extremity and ipsilateral iliac crest are prepared and draped. Tourniquet applied. Lateral incision is made parallel to the shaft of the femur, beginning at the Gerdy tubercle and extending proximally far

enough to permit application. Longitudinal incision is made through the fascia lata, and extended distally into the iliotibial band. The distal part of the incision is extended through the lateral joint capsule and synovium, avoiding injury to the meniscus.

More proximally, the fascia overlying the vastus lateralis muscle is incised and the muscle reflected anteriorly off the intermuscular septum and perforating vessels are identified and ligated or coagulated. Minimal Stripping of soft tissue necessary for application of the plate and reduction of the articular surface is done. To preserve their vascularity, attempt is not made to expose and anatomically reduce comminuted anterior and metaphyseal fragments. We first anatomically reduce articular fragments and provisionally stabilize them with k wires. Then the proper sized plate is selected and the fracture is fixed. Then we insert minimum 5 screws including lag screws and locking head screws in distal expanded part and minimum 4 screws (8cortises) in proximal femoral diaphysis [6-8]

After plate fixation wound thoroughly irrigated with normal saline, Romovac suction drain placed & secured suction tube. We closed joint capsule arthrotomy with absorbable suture, Fascia of vastus lateralis and iliotibial band and subcutaneous tissue closed with absorbable suture. Skin closed with non-absorbable suture. Cleaning & dressing done. Compression bandage applied. Tourniquet released. Above knee slab applied. Patient shifted to ward.

Post operatively suction drain was removed after 48 hours and first wound inspection was done on 3<sup>rd</sup> post –operative day. Intra-venous antibiotic were continued for 5 days in closed fractures and 7-10 days in case of open fractures. Post-operative physiotherapy regime was tailored according to fracture pattern and fixation achieved. Knee bending was started on post operative day 3. On post-operative day 3, active and assisted knee range of motion exercise were initiated. Patients were mobilized based on the degree of bone quality, severity of injuries and pattern of fractures. At post-operative day 7 to 8, the patients were mobilized with crutches/walker earlier non weight bearing followed by partial weight bearing until 6 weeks. After 6 weeks Full weight bearing ambulation with aids until 3 months. Full weight bearing ambulation without any aids was started at approximately 3 months in majority of the cases with radiographic evidence of fracture union. Patients were discharged at post-operative day 12 with stitch removal being done at time of discharge, making it convenient for the patients to take bath and maintain good body hygiene. The first follow up was at 6 weeks and subsequent follow up were done at 3 months, 6 months and at 1 years. Functional and radiological evaluation was done according to the Neer's scoring system.

Functional.....(70 units)	Anatomical .....(30 units)
<p><b>Pain (20 units)</b></p> <p>5. No pain..... 20</p> <p>4. Intermittent..... 16</p> <p>3. With fatigue..... 12</p> <p>2. Restrict function..... 8</p> <p>1-0. Constant or at night.....4-0</p>	<p><b>Gross anatomy (15 units)</b></p> <p>5. Thickening only..... 15</p> <p>4. 5 degrees angulation or 0.5 cm short..... 12</p> <p>3. 10 degrees angulation or rotation, 2.0 cm short-0.....9</p> <p>2. 15 degrees angulation or rotation, 3.0 cm short..... 6</p> <p>1. Union but with greater deformity..... 3</p> <p>0. Non-union or chronic infection.....0</p>
<p><b>Function (20 units)</b></p> <p>5. As before injury..... 20</p> <p>4. Mild restriction..... 16</p> <p>3. Restricted, stairs sideways..... 12</p> <p>2. Cane or severe restriction..... 8</p> <p>1-0. Crutches or brace.....4 -0</p>	<p><b>Roentgenogram (15 units)</b></p> <p>5. Near normal..... 15</p> <p>4. 5 degrees angulation or 0.5 cm displacement..... 12</p> <p>3. 10 degrees angulation or 1.0 cm displacement.....9</p> <p>2. 15 degrees angulation or 2.0 cm displacement..... 6</p> <p>1. Union but with greater deformity; Spreading of condyles; osteoarthritis.....3</p> <p>0. Non-union or chronic infection.....0</p>
<p><b>Motion (20 units) knee flexion</b></p> <p>5. Normal or 135 degrees.....20</p> <p>4. 100 degrees.....16</p> <p>3. 80 degrees..... 12</p> <p>2. 60 degrees..... 8</p> <p>1. 40 degrees..... 4</p> <p>0. 20 degrees or less..... 0</p>	<p><b>Outcome assessment</b></p> <p>Excellent &gt; 85 units,</p> <p>Satisfactory 70-85 units,</p> <p>Unsatisfactory 55-69 units,</p> <p>Failure &lt; 55 units</p>
<p><b>Work (10 units)</b></p> <p>5. As before injury..... 10</p> <p>4. Regular but with handicap.....8</p> <p>3. Alter work..... 6</p> <p>2. Light work.....4</p> <p>1-0. No work.....2-0</p>	

**Observations & Results**

In our study which was clinical, prospective and observational consisted of 25 intra-articular distal femur fractures treated with open reduction and internal fixation with locking compression plate. Post-operatively all patients were followed-up for a minimum period of one year. With each follow-up clinical and radiological evaluation done by using Neer's scoring system.

**Epidemiology**

23(92%) patients were males and 2 (8%) were females. The patients' ages ranged from 18 to 75 years with a mean age of 40 years.18 years old was the youngest patients and 75 years was the oldest patients.

**Mechanism of Injury**

The causes of fractures were motor vehicle accident in 23(92%) patients and accidental fall in remaining 2 (8%). All of them had acute fresh fractures. 17 (68%) patients had right and 8 (32%) patients had left lower extremity involvement.

**Classification**

According to AO classification of distal femur 1 (4%) were AO type B1; 2 (8%) AO type B2; 2 (8%) AO type B3; and 4 (16%) AO type C1; 8 (32%) AO type C2; 8 (32%) AO Type C3.

21 (86%) of them had closed fracture and 4 (16%) open type fracture.

**Perioperative**

11 (44%) patients were operated within 7 days of injury. 14

(56%) patients surgery was delayed more than 7 days.

The operative time ranged from 60 to 120 min with an average of 90 min.

Average blood loss was 150 ml.

**Union**

Of 25 patients, 24 patients (96%) showed radiological union within 20 weeks. Average time for union was 18 weeks.

**Range of Motion**

Average flexion in this study was 95 degree with more than 60% patients having knee range of motion more than 100 degree.

**Complications: Non-union:** One (4%) had delayed union at 5<sup>th</sup> months who were management with freshening of edge and secondary bone grafting. One out of twenty five patients (4%) had non-union. Who were managed with freshening of edges and secondary bone grafting at 9<sup>th</sup> months with sign of union at 12 months.

**Superficial Infection:** No patients had superficial infections.

**Deep Infection:** One patients (4%) developed deep infection on 5<sup>th</sup> post operative day which was resolved surgical wound debridement and antibiotics.

**Shortening**

Out of 25 patients three patients (12%) had shortening.2 cm-two (8%) patients. 3cm shortening was seen in one (4%) patient.

**Malalignment**

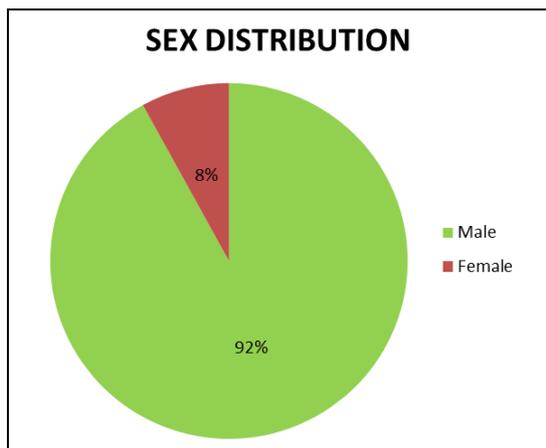
Two (8%) patient had 10° of valgus malalignment.  
One (4%) patient had 15° of valgus malalignment.

**Functional Outcome**

Functional outcome was assessed at the end of one year using Neer’s scoring system. Excellent in 16 (64%), Good in 4 (16%), Fair in 3 (12%), Poor in 2 (8%).

**Table 1: Sex Distribution**

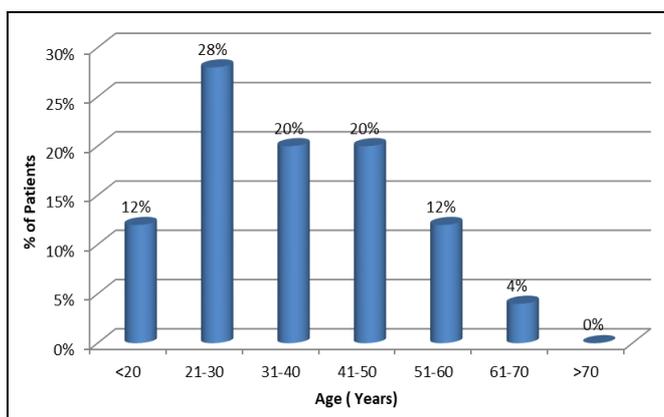
Sex	Lower end femur	%
Male	23	92
Female	02	08
Total	25	100



**Fig 1: Sex Distribution**

**Table 2: Age Distribution**

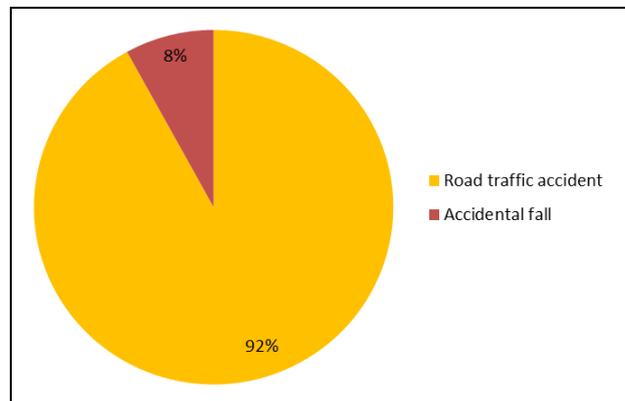
Age (years)	Lower end femur	%
<20	03	12
21-30	07	28
31-40	06	24
41-50	05	20
51-60	03	12
61-70	01	04
>70	0	0
Total	25	100



**Fig 2: Age Distribution**

**Table 3: Mechanism of Injury**

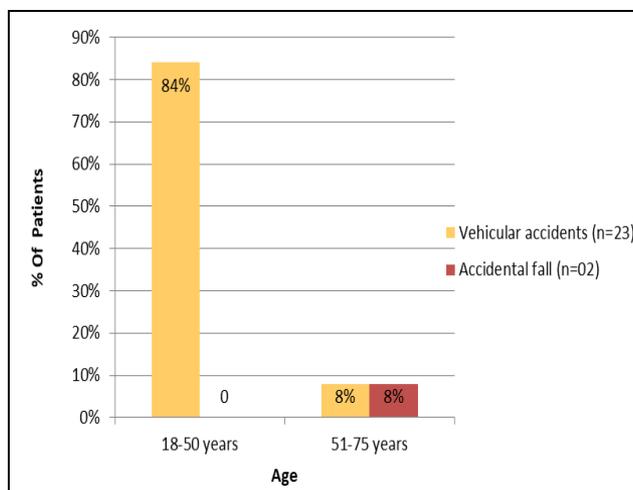
Mechanism	Lower end femur	%
Road traffic accident	23	92
Accidental fall	02	08
Total	25	100



**Fig 3: Mechanism of Injury**

**Table 4: Relationship between Age and Mechanism of Injury**

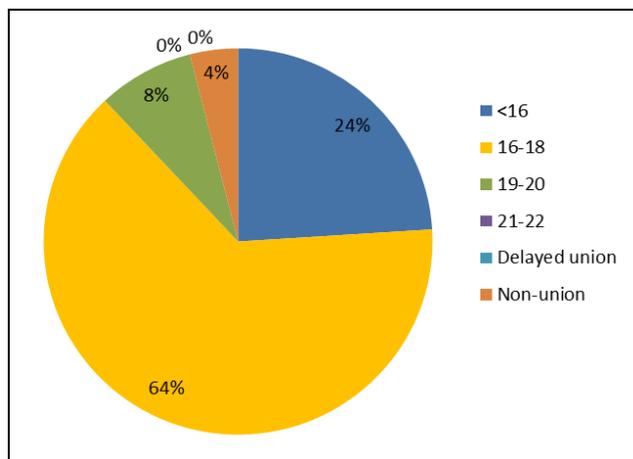
Age (years)	Vehicular accidents (n=23)		Accidental fall (n=02)	
	No.	%	No.	%
18-50 years	21	84	00	00
51-75 years	02	08	02	08
Total	23	92	02	100



**Fig 4: Relationship between Age and Mechanism of Injury**

**Table 5: Radiological Union**

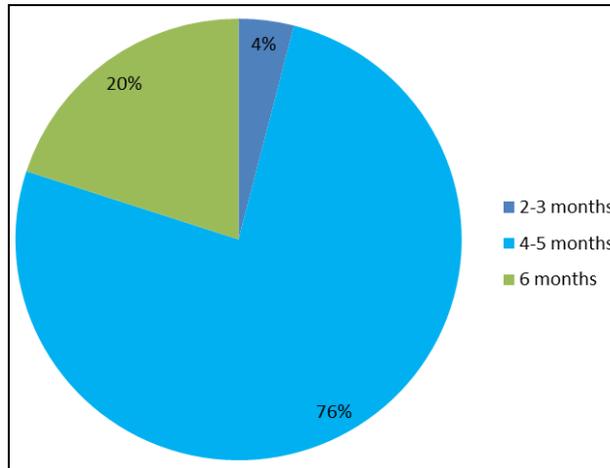
Union (weeks)	No. of cases	%
<16	06	24
16-18	16	64
19-20	02	08
21-22	0	0
Delayed union	0	0
Non-union	01	04



**Fig 5: Radiological Union**

**Table 6:** Time at Which Weight Bearing Achieved

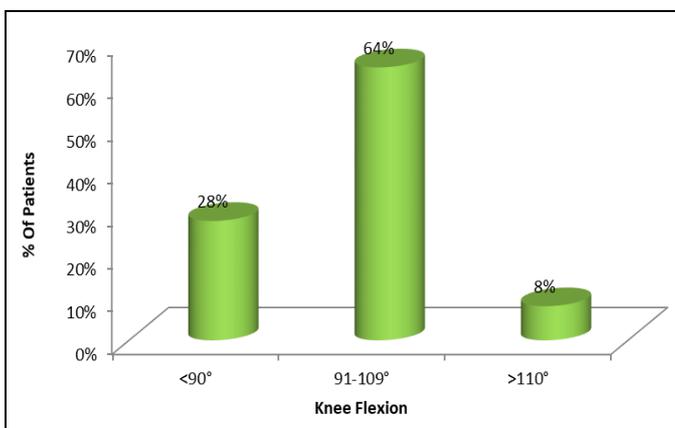
Achieved time	No. of cases	%
2-3 months	01	04
4-5 months	19	76
6 months	05	20
Total	25	100



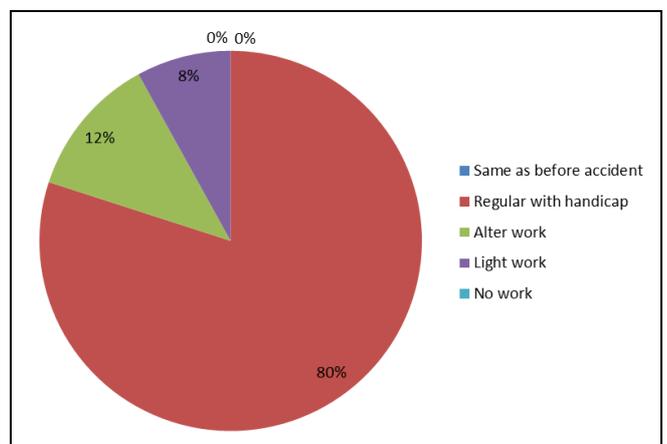
**Fig 6:** Time at Which Weight Bearing Achieved

**Table 7:** Knee Flexion

Knee flexion	No. of cases	%
<90°	07	28
91-109°	16	64
>110°	02	08
Total	25	100



**Fig 7:** Knee Flexion



**Fig 8:** Work Capacity

**Table 8:** Work Capacity

Work capacity	No. of cases	%
Same as before accident	0	0
Regular with handicap	20	80
Alter work	03	12
Light work	02	08
No work	0	0

**Table 9:** Functional Results (Neer's score)

Grade	No. of cases	%
Excellent(>85 point)	16	64
Good(70-85 point)	04	16
Fair(55-69 point)	03	12
Poor(<55 point)	02	08
Total(out of 100 point)	25	100

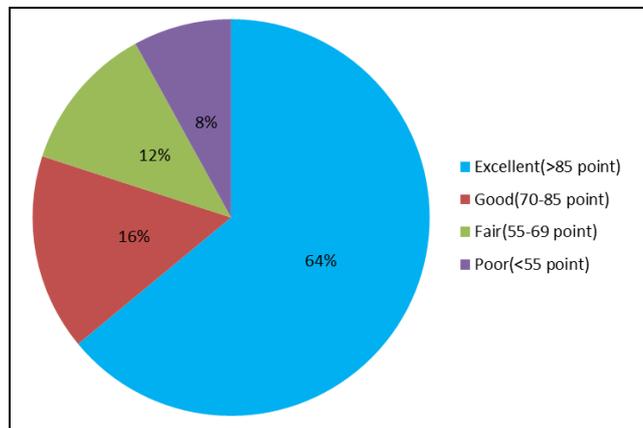


Fig 9: Functional Results (Neer's score)

**Discussion**

Our study comprised of twenty five patients with intra-articular distal femur fractures who were treated by locking compression plate. Overall final outcome was assessed in terms of regaining the lost knee function using Neer's Score.

Various author have studied functional & radiological outcome on distal femur fractures treated by locking compression plate using Neer's score.

In 2011-2012, Shiblee S. *et al.* [10] one prospective study of 50 patients of distal femur fracture with intra-articular extension treated by open reduction and internal fixation. They were evaluated to assess their clinical and functional results using Neer's scoring system and compared with the available literature. The result were excellent in 28(56%) patients, good in 12(24%) patients, fair in 6(12%) and poor in 4(8%) patients.

In 2014-2016, Rajnikant Machhi *et al.* [11] done prospective study of 20 patients of intra-articular distal femur fractures AO classification 33C treated with locking compressive plate and studied functional outcome using Neer's score, radiological outcome and complication associated with fracture fixation using locking compression plate. The average duration of weight bearing was 12 weeks. Average time for fracture healing was 20 weeks. Average range of motion of the knee was 110 degrees. Among 20 patients there were 9(45%) excellent result, 5(25%) good result, 3(10%) fair result 3(10%) poor results.

In 2015-2017, Swapna Pran Saikia *et al.* [12] done prospective

study of 30 patients of intra-articular distal femur fracture AO classification 33-C3 who were treated by locking compression plate. The functional and radiological outcomes and complication with fracture fixation using locking compression plate was studied using Neer's score. Among 30 patients, 13 patients have shown excellent result, 7 patients have good result, 5 fair result and 5 poor result.

In 2015-2018, Mriganka Nagen Medhi *et al.* [13] studied 79 patients of distal femur fracture operated with distal femur plate. They have designed their study to analyse clinico-radiological outcome and competency of locked plating for all varieties of distal femur fractures. Patients were regularly followed up with x-ray and clinical examination. At the end of clinico-radiological union, patients were evaluated with Neer's score. In their study, the average period of clinico-radiological union was 16 weeks. 62 (78.48%) patients had excellent to satisfactory outcome, 13 (16.45%) patients had unsatisfactory and 4 (5.06%) patients had poor outcome.

In our study twenty five patients with intra-articular distal femur fractures were treated. 23 (92%) patients were males and 2 (8%) patients were females. 18 years was the age of youngest patients and 75 years old was the oldest patients. Average in our study was 37.04 years. 23(92%) of the fractures were caused by road traffic accidents and 2 (8%) were due to accidental fall. 17 (68%) patients had right and 8 (32%) patients had left lower extremity involvement. Road traffic accident as mechanism of injury was observed more common in younger males and accidental fall more common in elderly population. The average weight bearing duration was 12 weeks. The average time of fracture healing (radiological union) was 18 weeks. Among 25 patients 16 (64%) patients have shown excellent results, 4 (16%) patients have good results, 3(12%) patients have fair results and 2 (8%) patients have poor results.

Secondary bone grafting was done in 1 (4%) patients who had delayed union at 5<sup>th</sup> months, 1 (4%) patients showed nonunion who was treated with secondary bone grafting at 9<sup>th</sup> months with signs of union at 12 months for both of them. 1 (4%) patient developed infection on 5<sup>th</sup> post operative day which was resolved with surgical wound debridement and antibiotics. 2 (8%) patients had 10° valgus malalignment with 2cm shortening and 1 (4%) patient had 15° valgus malalignment with 3cm shortening .

Table 10: Comparison of Functional Outcomes

Study	No. of Studied Patients	Grade				F/U Months	ROM	Union weeks	Complications
		Excellent	Good	Fair	Poor				
Shiblee S. <i>et al.</i> (NEER'S)	50	28	12	06	04	12	94.1 <sup>0</sup>	16.7	1 infection, 6 delayed union, 5 knee stiffness, 5 shortening, 15 knee pain
Rajnikant Machhi <i>et al.</i> (NEER'S)	20	09	05	03	03	12	110 <sup>0</sup>	20	1 infection, 1 nonunion, 1 delayed union, 3knee stiffness
Swapna Pran Saikia <i>et al.</i> (NEER's)	30	13	07	05	05	12	110 <sup>0</sup>	21	2 Infection, 1 non-union, 2 delayed, 4 knee stiffness
Mriganka Ngen Medhi <i>et al.</i> (NEER's)	79	62	-	13	04	12	NA	NA	3superficial infection, 1 nonunion, 1 delayed union, 4 knee stiffness
Present Study	25	16	4	3	2	12	95 <sup>0</sup>	18	1 deep infection





X-ray after 1 year with sound callus formation



Squatting

**Follow UP**



Knee extension



Cross leg sitting



Knee flexion



Active SLR

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