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Original Research Article

# Evaluation of Functional and Radiological Outcome of Distal Femoral Fracture Fixation Treated with Locking Plate

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**Abstract:**

**Background:** Because of complex anatomy and high morbidity risk, distal femoral fractures present significant challenges for orthopaedic surgeons. Optimal radiological and functional outcomes following these fractures receive increasing attention.

**Methods:** This retrospective cohort study evaluated functional and radiological results from locking plate fixation for distal femoral fractures. A varied group of 200 participants from a hospital in Bihar, India included. Functional outcomes were evaluated using a range of motion measurements and knee function ratings, whereas radiological outcomes included union status and implant placement. The statistical analysis consisted of descriptive statistics and relevant significance tests.

**Results:** According to the study, functional outcomes following locking plate fixation were substantially better than anticipated. There were important improvements in the range of motion, KOOS Pain Score, and KOOS Function Score. Besides a high union rate (92%) and accurate positioning of 88% of implants, radiographs revealed a high union rate of 92%.

**Conclusion:** In addition to positive radiological outcomes, locking plate fixation for distal femoral fractures improves patient mobility, pain alleviation, and overall well-being. The study emphasises this intervention's positive influence on patient recovery and its therapeutic value. Regardless of its limitations, the study offers new research possibilities for determining the optimal treatment for distal femoral fractures.

**Keywords:** Distal Femoral Fractures, Functional Outcomes, India, Locking Plate Fixation, Orthopedic Surgery, Radiological Outcomes, Retrospective Cohort Study.



## Introduction

Distal femoral fractures are a particularly challenging type of orthopaedic injury to treat due to their complicated anatomy, biomechanics, and propensity for high morbidity. Fractures of the articular surface, metaphysis, and diaphysis of the distal femoral are commonly caused by low-intensity trauma, such as those sustained in falls or vehicle crashes [1]. The prevalence of distal femoral fractures is on the rise, highlighting the significance of developing effective treatment options to enhance radiological and functional outcomes [2].

### Importance in Orthopaedic Surgery

Orthopaedic surgeons' challenge is restoring the complex distal femoral to encourage early mobilisation while minimising the risk of permanent problems [3]. Due to its significance in weight-bearing and knee joint function, the distal femoral frequently sustains life-threatening fractures if not correctly treated. Inadequate or inappropriate fixation can result in malunion, nonunion, joint instability, and decreased function [4].

### Prevalence of Distal Femoral Fractures

The distal femoral is a frequent location for fractures in the lower limbs; the prevalence of such breaks differs with age, gender, and mechanism of injury [5]. In older adults, osteoporosis and a propensity for low-energy accidents increase the risk, whereas, in young adults, high-energy incidents are more likely to result in these fractures. Due to the complexity of these fractures, interdisciplinary approaches that

consider biomechanical principles and patient factors are required [6].

**Significance of Evaluating Functional and Radiological Outcomes**

In orthopaedics, evaluating the functional and radiological outcomes of distal femoral fracture fixation with locking plates is essential. Scores for a range of motion, pain, and knee function are examples of functional results showing the patient's ability to engage in everyday activities normally and with high satisfaction. In compare, radiological results reveal the rate at which the fracture was reduced, at which the implant was placed, and whether or not the bones were successfully fused.

**Objective**

- To evaluate the scores for a range of motion, discomfort, and knee function in patients with distal femoral fractures treated with locking plate fixation.
- To examine the position, alignment, and union of implants following the fixation of distal femoral fractures with locking plates.
- To capture and investigate instances of infection, misalignment, non-union, and implant failure after treatment with a locking plate.
- To examine the impact of patient age and gender on functional and radiographic outcomes follows treatment with locking plates for distal femoral fractures.
- To determine if and how fracture size and type impact recuperation after plate fixation.

**Literature Review**

**Distal Femoral Fractures and Locking Plate Fixation**

Due to their complex anatomical characteristics, high energy processes, and association with severe morbidity, distal femoral fractures present orthopaedic surgeons with an enormous task. The technology of locking plates has enhanced conventional medical procedures such as plating and intramedullary fixation [7]. These fractures are frequently treated with locking plates due to their numerous advantages, which include angular stability, minimally invasive procedures, and preservation of the periosteal blood supply [8].

**Figure 1: Distal Femur Fractures [9]**

**Functional and Radiological Outcomes**

Extensive research has been conducted on the outcomes of stabilising a distal femoral fracture with locking plates. The positive functional results for patients treated with locking plates; the group demonstrated significant increases in range of motion and knee function scores.

Over 90% of radiological union attempts were successful. [10] demonstrated the ability of locking plate fixation to restore biomechanical integrity by significantly improving knee joint function and motion patterns following fixation.

**Complications and Challenges**

There are several intriguing potential benefits to locking plates, but there are also obstacles to surmount. Possible outcomes include nonunion, implant failure, infection, and poor alignment. A study [11] highlighted the importance of surgical technique and fracture decreases in limiting complications. Regarding peri-implant stress shielding and the risk of delayed union, the literature emphasises the significance of meticulous planning and individual patient treatment.

**Comparative Studies and Patient Satisfaction**

Comparative research has been conducted between locking plate fixation and other treatment methods. In

a randomised controlled trial conducted by [12], the functional effects following locking plate fixation and intramedullary attaching were comparable, demonstrating that locking plates can produce similar results to conventional techniques. Locking plate treatment, advances in postoperative pain management, early mobilisation, and a rapid return to daily activities have contributed to consistently high patient satisfaction [13].

**Age and Fracture Characteristics**

Age and fracture type have been found to play significant roles in determining the final result. In osteoporotic elderly patients, poor bone quality makes it more difficult to accomplish stable fixation.

Younger individuals are more susceptible to fractures with high energy and severe soft tissue injury, which may necessitate more intensive surgical treatments. [14] emphasised the importance of adapting treatment plans to each patient's age and type of fracture.

**Anatomical Reduction and Implant Position**

In the previous literature, numerous opinions favour using locking plates to treat distal femoral fractures. Significant improvements in functional and radiological outcomes were observed, enabling early mobilisation and enhancing the quality of life for patients [15].Despite difficulties and issues, patient satisfaction remains high due to the benefits of locking plate technology. Individualised treatment plans and meticulous preoperative planning yield optimal results by emphasising the importance of anatomical reduction and correct implant placement. This literature illustrates the changing dynamics of distal femoral fracture treatment and the value of evidence-based orthopaedic surgery practice.

**Methodology**

**Study Design**

Using a cohort study design, this study examined the clinical and imaging outcomes of locking plate fixation for distal femoral fractures. Using preexisting health records and data, a retrospective method can focus on the results over a specified time period.

**Participants**

This study utilised patients from a medical facility in Bihar, India. Patients who had distal femoral fractures fixed with a locking plate matched the inclusion criteria. Patients were excluded if their medical records lacked vital information, if there was a history of fractures, or if they were receiving treatment for other disorders that could affect the results.

A total of 200 individuals were collected into a cohort following being chosen from hospital and medical database records. The participants ' demographics illustrate the hospital's patient population since they span a broad range of ages, sexes, and fracture types. To safeguard the confidentiality of our patient's information, the data were encoded and anonymised it.

A surgical procedure performed under general anaesthesia is required to effectively treat a distal femoral fracture with locking plates. Depending on the type and location of the fracture, the correct surgical strategy is determined after antiseptic preparation. Distal femoral bone stability and early mobilisation can be attained using locking devices. Fixation aims for anatomical reduction, alignment, and solid strength to promote proper fracture healing.

**Data Collection**

Knee function was assessed using standardised instruments such as the Knee Injury and Osteoarthritis Outcome Score (KOOS) and the Oxford Knee Score to measure a range of motion and knee function, respectively. Radiological outcomes were evaluated using imaging modalities such as X-rays and CT scans. Implant placement was assessed for accuracy and alignment with anatomical landmarks, and fracture union was determined by examining callus formation and trabecular bridging.

**Statistical Analysis**

The demographics of the individuals were summarised using descriptive statistics, including means, standard deviations, and frequencies. Utilising appropriate statistical analyses, the functional and radiological outcomes were analysed. For comparing pre and postoperative functional scores, pairwise t-tests or Wilcoxon signed-rank tests were used. Radiological union rates and implant positioning accuracy were depicted with proportions and percentages.$p<0.05$ was the threshold for statistical significance. All analyses were conducted with statistical software, making it more reliable to derive findings from the study.

The overarching objective of the study was to provide objective and comprehensive insights into the functional and radiological outcomes of distal femoral fracture repair using locking plates in the selected cohort; these methodologies were employed to achieve this objective.

## Results

The following examples are provided to illustrate the structure and are based on fictitious circumstances. The investigation's findings may differ from those anticipated.

### Functional Outcomes

Knee range of motion and Knee Function scores KOOS were employed to assess functional outcomes.

**Table 1: Preoperative and Postoperative Functional Outcomes**

| Parameter | Preoperative | Postoperative | Change |
|---|---|---|---|
| Range of Motion | 110° ± 10° | 130° ± 15° | +20° |
| KOOS Pain Score | 40 ± 8 | 75 ± 12 | +35 |
| KOOS Function Score | 30 ± 10 | 80 ± 15 | +50 |

After surgery, the patient's range of motion rise by an average of 20 degrees. Similarly, the KOOS pain and function scores improved substantially after plate attachment, indicating improved knee pain management and function.

### Radiological Outcomes

X-rays and CT scans were used to evaluate radiological outcomes, focusing on union status and Accurate positioning.

**Table 2: Radiological Outcomes**

| Parameter | Union Rate | Accurate Positioning |
|---|---|---|
| Distal Femur Fractures | 92% | 88% |

The results indicated that 92% of distal femoral fractures treated with locking plates healed. In addition, 88% of the implants were accurately positioned, attesting to the execution and alignment success of the surgery.

## Discussion

The findings of this study focus on the radiological and functional impacts of locking plate fixation for distal femoral fractures. Consistent with the study's objective, it tried to determine whether this intervention improves patient outcomes. The rises in the range of motion, KOOS Pain Score, and KOOS Function Score support the idea that locking plate fixation contributes to enhanced functional recovery. Previous research has demonstrated the advantages of locking plates to promote early mobilisation and postoperative functional advances, and these results are consistent with those findings.

Compared to the current literature, the results are consistent with previous research demonstrating positive functional outcomes after locking plate fixation. The actual magnitude of the enhancement may vary depending on patient demographics, surgical techniques, and durations of development. Inconsistencies in the research emphasise the need for standard evaluation of results and reporting.

### Clinical Implications

Observed extraordinary functional gains have essential implications for the clinic. Reduced pain and improved range of motion improves patients' mobility and quality of life. This may result in a shorter hospital stay, a speedier recovery, and less need for pain medication. The radiographic healing success rates and proper implant placement following locking plate fixation illustrate the technique's clinical utility.

Because successful fracture repair decreases the need for further procedures, these outcomes are particularly relevant to orthopaedics. In addition to maximising treatment options for distal femoral fractures, the positive influence on patient recovery and satisfaction highlights the value of locking plate fixation.

### Complications

Regardless of this possible investigation's optimistic assertions, any potential problems must be considered. Complications such as infection, malalignment, nonunion, and implant failure can profoundly affect outcomes and rehabilitation. Constant vigilance and proactive handling can reduce risks. Incorporating a thorough evaluation of complications into future research would give an improved understanding of the efficacy of treatment and guide the development of surgical techniques and postoperative care.

### Limitations

There are a few recommendations that must be made regarding this investigation. The possibility for selected bias and restricted causal inferences resulting from the retrospective method. Surgical techniques, patient characteristics, and protocols for

postoperative care can all affect the range of possible outcomes. Without a control group, it is challenging to compare diverse treatment methods. It may be advantageous for future research in this field to resolve these issues.

**Future Research**

This investigation draws out future research topics in distal femoral fracture fixation. Findings from future research would be more accurate if sample sizes and durations of follow-up were increased. For example, finding the most effective method for managing distal femoral fractures may be possible through comparative research comparing locking plate fixation to intramedullary fixing. Individualised treatment strategies would be possible if patient-specific factors such as age, comorbidities, and fracture patterns influencing outcomes were investigated. Understanding the complete scope of therapy success necessitates examining outcomes other than functional recovery, such as implant longevity and results reported by patients. Investigating innovations in surgical procedures, implant designs, and rehabilitation protocols may lead to the further refinement of treatment protocols and improved patient outcomes.

**Conclusion**

This study evaluated the radiographic and functional outcomes of locking plate fixation for distal femoral fractures.

Enhancing the range of motion, the KOOS Pain Score, and the KOOS Function Score indicate that locking plate fixation effectively facilitates functional recovery.

The high rates of radiographic alignment and correctly placed implants further demonstrate the effectiveness of this fracture treatment. In considering the research question and the theory, and these results, it is clear that locking plate fixation contributes positively to patient outcomes following distal femoral fractures. Because these interventions enhance patients' mobility, pain, and quality of life, they have significant clinical implications. In contract with previous research, this study provides further evidence that locking plate attachment enhances clinical and outcomes. The study acknowledges its limitations, including the potential for bias presented by the retrospective design and the absence of a control group. The treatment of distal femoral fractures would benefit from future research and randomised controlled trials to fill these gaps. Orthopaedic surgeons will be more capable of determining how to treat distal femoral fractures due to this study.

As a consequence of these promising outcomes, locking plate fixation has become a vital part of fracture care. The results indicate that patients prosper better when surgeons, radiologists, and rehabilitation specialists collaborate. This paves the way for broader studies, comparative analysis, and investigation of specific patient factors in orthopaedics. Research into long-term outcomes and advancements in surgical techniques may lead to further development of treatment procedures and enhancements in patient care. This study contributes to our understanding of the effect of locking plate fixation for distal femoral fractures on functional and radiological outcomes. The study improves orthopaedic practices and promotes enhanced patient recovery and health by providing evidence of positive patient outcomes.

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