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# A Prospective Study of Functional Outcome of Locking Compression Plate Fixation Over Dynamic Condylar Screw Fixation in the Treatment of Distal Femur Fractures

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**Abstract:** ***Aim: To analyse and compare the functional outcome of distal femur fractures treated with Locking Compression Plate fixation and Dynamic Condylar Screw fixation Materials and Methods: Our study is a prospective study conducted in Department of orthopedics, Government Dharmapuri Medical College and Hospital, Dharmapuri, Tamil Nadu from July 2015 to January 2021. Patients admitted with distal femur fractures are selected on the basis of inclusion and exclusion criteria. We have followed Muller Classification for distal femur fractures, based on which treatment modalities determined. Our study sample size is 25 patients, of which 10 patients were treated with dynamic condylar screw and 15 patients with distal femur locking compression plate. We have used Extensile Lateral approach to fix the fracture with patient supine with sand bag underneath knee. Fractures treated with either LCP and DCS followed in standard protocol and evaluated in serial follow up. Functional outcome analyzed using standard scoring system called Hospital for Special Surgery. Result: In our study Males are more affected with 80% and age group 40 - 50 years more commonly involved with 28%. Mode of injury Road traffic accidents in 76% patients and 24% in accidental fall.11 patients got associated injuries. Muller sub type C2, C3 accounts for 40% of patients. Open injuries of type I and II accounts for 20% of all fractures. Distal femur fractures treated with DCS shows 60% excellent and good outcome and 40% shows fair and poor outcome, whereas those treated with LCP shows 66.6% excellent and good results and 33.3% fair and poor results. Overall in our study 64% excellent and good outcome and 36% poor outcome. Muller subtype - A fractures with both LCP and DCS showed similar results whereas for Muller subtype C, LCP showed very good results when compared to DCS.5 Patients shown complications like superficial wound infection, deep infection. Conclusion: Fractures of distal femur are more common in high velocity injuries and occur in middle aged men and old age women. Most fractures were comminuted. Locking compression plate [LCP] appears to be technically an ideal implant for comminuted distal femoral fractures with proper physiotherapy produced excellent results, whereas extra articular distal femoral fracture with Type A fractures LCP and DCS shown similar results. However large study group and long follow up needed for accurate functional outcome.***

**Keywords:** Locking Compression Plate, Dynamic Condylar Screw, Distal Femur Fracture

## 1. Introduction

Fractures affecting the distal femur are very complex injuries that pose a challenge to every orthopaedic surgeon. It involves about 7% of all femur fractures. It commonly occurs during high velocity trauma in younger group of patients and frequently are associated with other skeletal injuries and concomitant other system injuries. In contrast to this, elderly patients with severe osteopenia might sustain isolated distal femur fractures from trivial trauma such as a simple slip and fall. Treating the elderly individuals with relatively weak bone quality is night mare to surgeons. Though well advanced Technologies and modern diagnostic imaging modalities versatile implants available in market, makes this fractures more amenable to treat satisfactorily. Despite all these modalities, treatment of distal femur fractures are not without of complications, since most of this fractures located very proximity to traversing neurovascular structures, hence they are more prone for injury to popliteal vessels and badly comminuted fragments and bone loss, displacement of fragments all these components make this fractures difficult to fixation. Since fractures involving juxtaarticular location in relation to knee joint, the movement of this joint affected very early and recovery of the lost knee movement is delayed unless followed good physiotherapy and gradual mobilization exercises. It is recognized that operative fixation with the ability to maintain anatomical reduction of the joint surface, restoring axial alignment and early range of motion presents clear advantages over closed means of treatment. Numerous devices have been proposed for the treatment of these fractures. The principles of internal fixation must be met regardless of the choice of fixation. These include anatomical reduction of the distal femoral articular surface, stable internal fixation, minimal soft tissue stripping and early active mobilization.

## 2. Aim and Objectives

The aim of this study is comparing the functional outcome of the Patients who sustained the Distal femoral fractures treated with Locking Compression Plate fixation against Dynamic Condylar Screw fixation.

Study Place: Government Dharmapuri Medical College and Hospital, Dharmapuri. Study Design: Both Prospective and Retrospective

**Study**

**Study Period:** July 2015 to July 2021

**Study Sample Size:** 25

## 3. Materials and Methods

This study pattern is prospective & retrospective study with study sample of 25 patients with supracondylar and distal femur fractures treated with either Locking Compression Plate fixation or Dynamic Condylar Screw at **Government Dharmapuri medical college and hospital, Dharmapuri, Tamil Nadu** from **July 2016 to December 2021.** Patients were selected from among the admissions to the Orthopaedic ward in the Department of Orthopaedics, Government Dharmapuri medical college and hospital, Dharmapuri and recruited into the study prospectively based on the following criteria.

**Inclusion Criteria**

All patients above 18 years with closed fractures of supracondylar & distal femur fractures extending up to 15 cm from distal articular surface.

**Fractures Include**

1) Closed distal femoral fractures & nonunion
2) Muller type A1 A2 & A3 fractures.
3) Muller type C1 C2 &C3 fractures.
4) Presence of distal 3rd femoral fractures which needs to be internally fixed in displaced Muller's type A and Type C fractures
5) Grade I and Grade II compound injuries
6) Patients who give consent to be included in the study.
7) Patient who is preoperatively mobile.

**Exclusion Criteria**

1) AO type B1 B2 & B3 fractures.
2) Grade III open fractures
3) Pathological fractures
4) Fractures in children with Skeletal immaturity with open physics.
5) Undisplaced fracture patterns needing only conservative management.

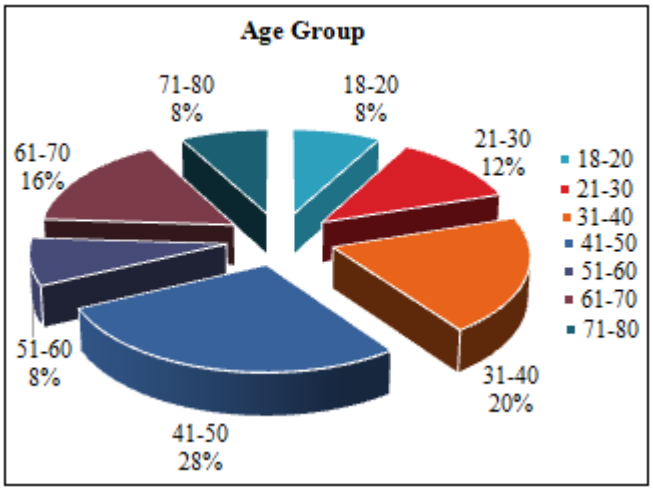
## 4. Results and Statistics

In our study, 25 cases of distal femur fracture were operated with Open Reduction with internal fixation with Dynamic Condylar screw and Locking compression plate.10 patients of distal femur fractures operated with DCS and 15 patients were operated with locking compression plate. Patients were followed up every 3 weeks till fracture united and thereafter at 3 months, 5 months and 1 year. The minimum follow up period in our study was 3 months and maximum follow up period was 16 months.

Clinically, tenderness at fracture site, knee pain, limb length discrepancy, range of movements, any varus or valgus deformity were assessed at each follow up. The results were analyzed with standard anteroposterior and lateral radiographs. Clinical and radiological signs of union were analyzed at each follow up. The fracture was said to be radiologically united if callus was seen in at least 3 cortices in anteroposterior and lateral views. The functional outcomes were analyzed using scoring system of HOSPITAL FOR SPECIAL SURGERY.

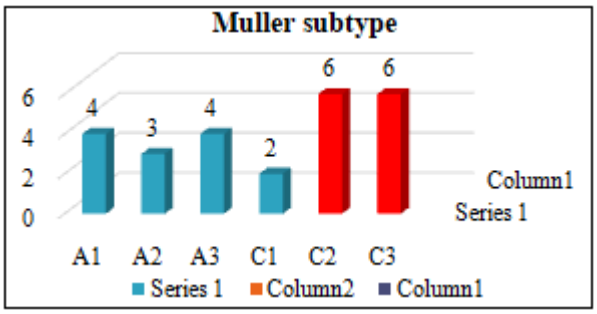
Majority of injured patients were males (80%) and Highest number of patients were in their 4th decade (28%), Road traffic accident was the most common mode of injury (76%) 2 patients had associated distal radius fracture, one patient had ipsilateral clavicle and one patient had ipsilateral pubic rami fracture, one patient had ipsilateral tibial condyle and 2 patients had ipsilateral tibial shaft fracture making a total of 11 patients (43%) with associated fractures Most of the patients, reported within 1st week of injury to the hospital.20 out of 25 patients had closed injury. Type C2 and C3 muller fracture was the most common fracture type 12 out of 25 patients (48%). The shortest follow up period was 3 months and the longest follow up period was 16 months. The average range of knee flexion achieved was about 0 to 98°. Maximum gain in knee flexion was 120° and minimum gain about 60°. The average knee score 76.55% was rated using HSS functional score.

Early complications were encountered in 4 patients and these were superficial wound infection, wound gaping, pin site infection and mild transfusion reaction. Late complications were observed like mal - union with varus in 3 patients, knee stiffness in 9 patients. The average stay in hospital was about 28days.




Postoperative immobilization with knee brace was advised for severely comminuted fractures, for 3 weeks, although gentle physiotherapy. Exercises were started earlier. Autogenousipsilateral iliac graft was harvested based on the intra operative on table bone loss, there were used in 10 out of 25 patients. Patients were followed at regular intervals (i.e., once in a month for the first 3 months and once every 3 months thereafter). The minimum follow up period was 3 months and the maximum follow up was 12 months. The mean follow up period in this study was 8.46 months. In our study Average healing of the fractures was 14.5 weeks. The mal-alignment was found in the cases of intra articular fractures. None had a step>2mm or more. The average knee flexion in our series was 95 degrees ranging from15° - 120 degrees, the knee flexion varied according to the sub type of the fracture. Shortening less than 1cm was recorded in 8 cases and shortening of 2cm and more was recorded in 7 cases. All the patients remained painless in the post

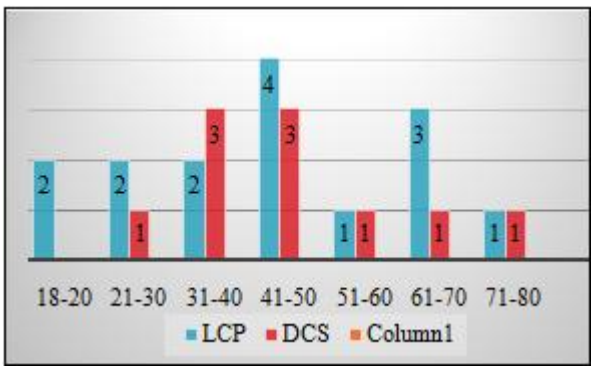
operative period, except for 2 cases which had wound infection. Functionally all the patients discarded walking aid by16 weeks and one patient was using heel and sole rise.




7 patients treated with Dynamic Condylar Screw for type A Muller fractures showing excellent and good results in 5 patients and poor and bad results in 2 patients. Overall 71.4% for positive and 28.6% of poor results given by DCS, in this same category 4 cases treated with Locking compression screw fixation, all 4 cases good and excellent results. As per HSS Scoring system type A Muller fractures LCP shows outstanding results when compare to DCS.

2 cases in Type A Muller show poor results, of which one case had post operative wound infection, considered as superficial wound infection and treated with parentral antibiotics. Patients discharged after wound found to be silent and healthy. He didn't come for follow up for first 3 months. After 4$^{th}$ month of follow up presented with infected wound and sprouting granulation tissue from the operative scar and diagnosed as infected Implant and Wound debridement and implant exit done. Fracture found be in good alignment and sticky he treated with supportive posterior splint and appropriate antibiotics. Another patient had varus deformity of the operated limb and FFD of 30 and knee stiffness.

Out of 25 patients 14 had type C Muller fractures of which 3 patients were treated with DCS and 11 Patients were treated with LCP.6 patients out of 11 shown excellent and good results and 5 patients shown poor results.




3 patients of DCS one patient shown good results and 2 shown poor results

Overall comparative results in concern with type C intra articular fractures treated with LCP and DCS, LCP shown comparatively good functional outcome in 55 % patients and DCS shown 33 % good results and 67% poor results. Of the 5 patients who shown poor and fair outcome mainly of C3 type with highly comminuted intra articular involvement with knee stiffness and knee pain and varus and valgus deformity.

## 5. Discussion

Treatments of the distal femoral fractures have been a controversial subject over the decade [37, 38, 39]. There have been changing philosophies towards surgical treatment of supra condylar fractures of femur. Close management of these fractures was the treatment of choice until 1970. This was due to non - availability of appropriate implants and lack of proper techniques. Apart from the usual problems of confining elderly patient to bed, conservative methods at any age may be complicated by knee stiffness, mal union and nonunion.

Early surgical stabilization can facilitate care of the soft tissue, permit early mobility and reduces the complexity of nursing care. Open reduction and internal fixation has been advocated, using implants, including angled blade plate, fickle devices, Rush rods, Ender nails, Dynamic condylar screw, condylar buttress plate and interlocking nails, locking compression plate.

The use of fixed angle devices such as condylar blade plate along with dynamic condylar screw (DCS) require certain amount of good bone stock should be there to insert Lag screw and also its entry makes significant amount of bone loss from lag screw entry site which itself compromise already fractured condyles hence it limits their use in some fracture type of intra articular fracture. This lead to the development of condylar buttress plates for comminuted fractures. However with standard buttress plating, these fractures often fall into varus deformity.

Biomechanical studies revealed that gross loosening of standard condylar buttress plate and DCS occurred because of the toggle at the screw - plate interface, which leads early implant loosening results in breakage of implant and varus /valgus collapse of distal fragment. To address these issues, a first generation locking condylar plate was designed

A locking plate decreases the screw - plate toggle and motion at the bone - screw interface and provides more rigid fixation [6, 7, 8, 9]. Rigid fixation is felt to be one key to the successful treatment of these fractures. The conventional plates are associated with their own demerits such as screw pullout, implant failure and unstable fixation needing postoperative immobilization8.

Delay in postoperative mobilization results in stiffness of the knee which is an indicator of poor outcome. Fixation in osteoporotic and comminuted fractures which was difficult previously was addressed with the invention of locking condylar buttress plate. So now with the evolution of locking compression plating for distal femoral fractures especially for the comminuted intra – articular fractures many of the older demerits could be addressed which includes the *increased stability due to locking compression plating principle, multiple screw options in the distal fragment providing option for fixing the multiple fragments*

*restoring the anatomical congruity and providing stable fixation of the distal fragment with the proximal fragment with resulting increased stability allowing for early mobilization.*

Current fracture patterns which we encounter are complex comminuted types due to the prevalence of high speed vehicles mainly due to the high two wheeler population in countries like India. Improved healthcare results in a longer life span and subsequently presents us with more osteoporotic fractures which were previously treated using conservative methods.

The LCP is a single beam construct where the strength of its fixation is equal to the sum of all screw - bone interfaces rather than a single screw's axial stiffness and pullout resistance in unlocked plates30. *Its unique biomechanical function is based on splinting rather than compression resulting in flexible stabilization, avoidance of stress shielding and induction of callus formation. It can also be used as biological fixation without disturbing the fracture site.*

The Distal Femur - LCP is a further development from the LISS, which was introduced in the mid to late 1990' The main difference between the Distal Femur - LCP and the LISS is that the LISS utilizes an outrigger device for shaft holes, functioning essentially as a locking guide jig, which is attached to the distal part of the plate and guides the placement of the proximal locking screws. The shaft holes on the Distal Femur - LCP are oval allowing for the options of a compression screw or a locking screw. This leads to a more precise placement of the plate, as it is able to be compressed more closely to the bone. Although Distal Femur - LCP is designed to fit the anatomy of the distal femur, we were worried about the fit in our local Asian population where shorter and smaller femurs are the norm. During fixation in delayed cases especially if there was severe comminution maintaining the reduction in good alignment and applying the initial screw were difficult. The average time of union was 15.3 weeks which is similar to the other modes of fixation and there is no additional benefit of early healing. However, thus far, our limited numbers demonstrate that this is not an issue.

Comparable studies utilizing the Distal femur LCP demonstrate only short term results. Although the follow - up period of our series was short, studies have shown that early function is comparable to final long term outcome. The outcome seems to correlate with fracture severity, anatomic reduction, etiology, bone quality, length of time elapsed from injury to surgery, concomitant injuries and the exact positioning and fixation of the implant.

Furthermore, the initial severe concomitant cartilage damage may predispose to early osteoarthritis although there is no evidence of that yet.

## 6. Conclusion

- Fractures of distal femur are more common in high velocity injuries and occur in middle aged men and old age women. Most fractures were comminuted. Locking compression plate [LCP] appears to be technically an ideal implant for comminuted distal femoral fractures with proper physiotherapy produced excellent results.

- Dynamic condylar screw [DCS]appears to be relatively easy construct to fix in the distal femur fracture, however bulky implant, mandatory of 2 to 4cm Intact femoral condyle for lag screw insertion and varus collapse of medial fragment in case of comminuted fractures, made this good implant only for Muller type A, and type B.
- In Type C comminuted intra articular distal femur fractures LCP superior to DCS in functional outcome. In Type A, B fractures both LCP and DCS, produced similar functional results.
- Infection, knee stiffness and mal alignment of fractures were the common complication we encountered in our series in both LCP and DCS, of which comparative analysis shows relatively higher incidence complications found in the DCS, which could be tackled by surgical expertise, meticulous soft tissue handling, judicious use of antibiotics.
- Outcome of patient treated with Distal
- Femur LCP at 10 months follow-up

Outcome of patient treated with Distal femur LCP at 10 months follow-up

- In conclusion locking compression plate [LCP] produces better results and appears to be a good method of choice for management of fractures of distal femur.
- However, Large study sample and long term follow up needed for accurate analysis of functional outcome of this fractures.


Outcome of patient treated with DCS at 10 months follow up.

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