https://doi.org/10.29309/TPMJ/2025.32.03.8839

The Professional Medical Journal
www.theprofesional.com
2025, Volume, 32 Issue, 03

ORIGINAL ARTICLE

Comparison of radiological outcome between dynamic condylar screw (DCS) and distal femoral locking compression plate (LCP) technique in distal femoral fracture.

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Article Citation: Khan AH, Samo A, Safdar M, Zaib B, Mustafa MA, Amin A. Comparison of radiological outcome between dynamic condylar screw (DCS) and distal femoral locking compression plate (LCP) technique in distal femoral fracture. Professional Med J 2025; 32(03):266-271. https://doi.org/10.29309/TPMJ/2025.32.03.8839

ABSTRACT… Objective: To compare the radiological results of distal femoral fractures treated by DCS surgery versus the Distal Femoral Locking Compression Plate technique, with a special emphasis on union time and associated demographic and clinical variables. **Study Design:** Randomized Controlled Trial. **Setting:** The Department of Orthopaedic Surgery, Ghurki Trust Teaching Hospital, Lahore. **Period:** July 05, 2024, to Nov 05, 2024. **Methods:** A total of 78 patients with distal femoral fractures were randomized into two groups: Group A (DCS) and Group B (LCP). Data on demographic and clinical characteristics, mode of injury, and union time were collected and analyzed using SPSS version 26. Union time was compared across subgroups, and statistical significance was determined using t-tests. Results: The study revealed significant differences in union time between the two groups. The mean union time for Group A (DCS) was 14.01 ± 0.61 weeks, compared to 13.29 ± 0.68 weeks for Group B (LCP) ($p < 0.001$). Subgroup analysis showed statistically significant faster union times in Group B across gender, age, side of fracture, and mode of injury. Male patients treated with LCP had a mean union time of 13.33 ± 0.70 weeks compared to 13.90 ± 0.44 weeks in the DCS group ($p < 0.001$). Similarly, patients aged 19–50 years in the LCP group demonstrated faster union (13.31 ± 0.72 weeks) compared to the DCS group (14.03 ± 0.70 weeks; $p = 0.001$). **Conclusion:** The LCP technique exhibited superior results in terms of radiological union time compared to DCS. It is, therefore, a better alternative for treating distal femoral fractures. Orthopedic surgeons can use these findings to make appropriate choices between surgical techniques based on the characteristics of the patient and the pattern of the fracture.

Key words: Distal Femur Fracture, Dynamic Condylar Screw (DCS), Locking Compression Plate (LCP), Radiological Outcome.

INTRODUCTION

Around 3 to 6% of femoral fractures and less than 1% of all fractures occur in the distal part of the femur. These injuries have a bimodal distribution, with the older osteoporotic group exhibiting the second peak and the young individuals suffering from high-energy trauma displaying the first peak.[1]

Male adolescents between the ages of 15 and 24 and females over the age of 75 had the highest prevalence of distal femur fractures. The surgical repair of these fractures is essential for the patient's mobilization and resilience because the distal femur is essential for both the longitudinal axis stability of the leg and the biomechanical functioning of the knee joint. Shortening, flexion, and external rotation of the proximal fragments, as well as the extension of the distal pieces, are common abnormalities in distal femur fractures. The powerful muscles that insert on the distal femur and apply unilateral stresses, including the adductor and gastrocnemius, are the cause of these problems.[2]

Managing these distal fractures presents a major challenge to the attending orthopaedic surgeon due to extensive soft tissue damage, intra-articular extension, severe comminution, and impairment to the quadriceps mechanism. The supracondylar fracture of the femur is extremely difficult to cure due to its thin cortical, large canal,

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Article received on: 10/12/2024
Accepted for publication: 15/02/2025

and poor bone stock.[3]

In the past, bone traction and plaster casts were the standard treatments for these fractures, and they came with a number of drawbacks, including delayed mobilization, malalignment, and joint incongruity. Numerous of these issues have been resolved with the introduction of more modern methods, such as distal femoral locking compression plate procedure (LCP) and dynamic condylar screw surgery (DCS). For proximal or distal femur fractures, DCS is a modular, fixed-angle implant. Though very straightforward, the technique demands a high level of accuracy. Once the fracture has been reduced, the condylar screw is positioned over the guide wire and fastened to the lateral aspect of the femur shaft using a 95-degree barrel and plate. The primary benefit of this method is that there is room for very little table modification. On the other hand, rigid fixation may be compromised if the fracture spreads into the intercondylar zone.[4]

Nonetheless, more bone must sometimes be lost owing to the screw's location, and more screws may occasionally need to be positioned farther out for increased stability. For the purpose of inserting a DCS with a derotation screw, DCS must be at least one centimeter away from the knee joint. Another innovative method that offers robust and effective internal fixation is the distal femoral locking compression plate approach. Using a cannulated cancellous screw, which can support the plate, it is simple to fracture repair the intercondylar fracture with intercondylar extension in this instance. Osteoporotic and periarticular bones may be readily used with these plates because of the increased pullout resistance of the locking screws. Furthermore, compared to a DCS, these locking plates are simpler to install and move percutaneously.[5]

Reddy et al.[6] conducted the same study based on the radiological outcome, and the findings indicate that the average time of union observed in the DCS group was 14.4 weeks and of LCP was 13.1 weeks.

Bandaru et al.[7] conducted a similar study, and the findings reveal that the average time of union observed in distal femoral fractures treated with LCP was 15±1.06 weeks. Lemsanni et al.[8] study findings reveal that the average time of union observed in distal femoral fracture treated with DCS was 12.6±3.0 weeks,

By conducting this study, we aim to address several critical questions. Firstly, we intend to clarify whether one surgical manner is proven to be superior in terms of radiological meantime or not, particularly in terms of the duration of union. Knowing the transient matters of union is very important as it can lead to increased patient morbidity, healthcare costs, and the possibility of non-union or implant failure if prolonged healing times are not accounted for. On the other hand, the comparison analysis will also help orthopedic surgeons to distinguish any pros or cons inherent in each method and choose the best tactic according to the fracture with which they work, the patient's condition, and the desired outcome. So the purpose of this study is to compare the radiological outcome between dynamic condylar screw surgery and distal locking compression plate in distal femoral fracture.

METHODS

This randomized controlled trial (RCT) was conducted in the Department of Orthopaedic Surgery at Ghurki Trust Teaching Hospital, Lahore, (July 05, 2024, to Nov 05, 2024) post-synopsis approval (CPSP) after obtaining approval from hospital ethical committee (Ref. No: 2024/03/R-11). Seventy-eight patients admitted with distal femur fractures were recruited. Informed consent was obtained, and demographic data (registration number, age, gender, residence) were recorded. A sample size of 64 patients (32 per group) was calculated with a 99% confidence level and 90% test power based on anticipated union times of 15 ± 1.06 weeks for the LCP group[7] and 12.6 ± 3.0 weeks for the DCS group. Participants were selected via non-probability, consecutive sampling and must meet inclusion criteria: diagnosed distal femur fracture, age over 18 years, and any gender. Exclusion criteria included pathological fractures, prior knee injury, other ipsilateral limb fractures, and loss of follow-

up.

Each patient underwent a thorough clinical and general assessment, including X-rays for fracture classification. Immediate first aid (POP, skeletal traction, analgesics, wound care, tetanus, and antibiotics) was provided as needed. Patients were randomly assigned to two groups: Group A underwent Dynamic Condylar Screw Surgery (DCS), and Group B underwent Distal Femoral Locking Compression Plate (LCP) techniques.

In DCS surgery, a K-wire was placed in the lateral femur condyle at the intersection of the anterior 1/3 and posterior 2/3 of the longest AP dimension, guided by the patellar groove and joint K-wire. A lag screw of appropriate length was inserted, followed by an eight-hole side plate, cortical screws, and cancellous screws. In the LCP method, a lateral parapatellar approach was used with 6.5 cm cannulated cancellous screws, temporary K-wire fixation, and locking screws to secure the articular block. Diaphyseal screws were secured with stab incisions at screw sites. Postoperatively, antibiotics were administered for five days, with initial immobilization using a POP back slab for three to four days. Active range-of-motion and quadriceps strengthening exercises began as early as feasible. Weight-bearing with assistance (walker or crutches) was allowed once muscle strength improved. Follow-up X-rays monitor fracture union, and monitoring continues until the full union is achieved. A predefined proforma collected data on age, gender, side affected, injury type, and union time.

The collected data were entered and analyzed accordingly using SPSS version 26. Mean ± SD was calculated for age and time to achieve union. Frequency and percentages were calculated for gender, mode of injury, and side effected. Data were stratified for age, gender, mode of injury, and side effects to study effect modifiers. Post-stratification t-test was applied. P-value ≤ 0.05 was considered significant.

RESULTS

Characteristics	Group A (N=39)	Group B (N=39)	P-Value
Gender			
Male	27(69.2)	31(79.5)	.437
Female	12(30.8)	8(20.5)	
Age(years)	43.10±15.90	39.54±14.50	.312
Side			
Left	13(33.3)	21(53.8)	.068
Right	26(66.7)	18(46.2)	
Mode of Injury			
RTA	22(56.4)	30(76.9)	.055
Fall	17(43.6)	9(23.1)	
Union achieved (weeks)	14.01±.61	13.29±.68	<.001

Table-I. Comparison of demographic and clinical characteristics between Groups A (DCS) and B (LCP)

Characteristics	Group A (N=39)	Group B (N=39)	P-Value
Gender			
Male	13.90(.44)	13.33(.70)	<.001
Female	14.07(.90)	13.13(.59)	.018
Age(years)			
19-50	14.03(.70)	13.31(.72)	.001
51-70	13.99(.44)	13.24(.58)	.001
Side			
Left	14.01(.49)	13.26(.51)	<.001
Right	14.02(.67)	13.33(.86)	.005
Mode of Injury			
RTA	14.09(.67)	13.36(.67)	<.001
Fall	12.91(.52)	13.07(.69)	.002

Table-II. Comparison of mean Union Time(weeks) by Subgroups Between Groups A (DCS) and B (LCP)

In Group A (DCS), 69.2% of patients were male, while in Group B (LCP), 79.5% were male. The average age of patients in Group A was 43.10 ± 15.90 years, while in Group B, it was slightly younger at 39.54 ± 14.50 years. Group A had a higher proportion of fractures on the right side (66.7%) compared to Group B (46.2%), with a corresponding higher proportion of left-sided fractures in Group B (53.8%) compared to Group A (33.3%). The majority of patients in both groups were injured in road traffic accidents (RTA): 56.4% in Group A and 76.9% in Group B. Falls were more common in Group A (43.6%) than in Group B (23.1%). The average union time for Group A

(DCS) was 14.01 ± 0.61 weeks, while for Group B (LCP), it was 13.29 ± 0.68 weeks. The difference between the two groups in terms of union time was statistically significant ($p < 0.001$), with Group B (LCP) achieving union slightly faster than Group A (DCS). (Table-I)

In males, Group A had a mean union time of 13.90 ± 0.44 weeks, while Group B had a slightly shorter union time of 13.33 ± 0.70 weeks, with a statistically significant difference ($p < 0.001$). In females, the union time in Group A was 14.07 ± 0.90 weeks, while in Group B, it was 13.13 ± 0.59 weeks, with a statistically significant difference ($p = 0.018$).

For patients aged 19-50 years, Group A had a mean union time of 14.03 ± 0.70 weeks, while Group B had 13.31 ± 0.72 weeks, with a significant difference ($p = 0.001$). For patients aged 51-70 years, Group A had 13.99 ± 0.44 weeks, while Group B had 13.24 ± 0.58 weeks, with a similarly significant difference ($p = 0.001$). This indicates that the LCP method resulted in a shorter union time in both age subgroups.

For left-sided injuries, Group A had a mean union time of 14.01 ± 0.49 weeks, while Group B had 13.26 ± 0.51 weeks, with a significant difference ($p < 0.001$). For right-sided injuries, Group A had 14.02 ± 0.67 weeks, while Group B had 13.33 ± 0.86 weeks, with a significant difference ($p = 0.005$). These results show that the LCP method consistently resulted in a shorter union time, regardless of the side of injury.

For patients with injuries from RTAs, Group A had a union time of 14.09 ± 0.67 weeks, while Group B had 13.36 ± 0.67 weeks, with a significant difference ($p < 0.001$). For patients who suffered fractures from falls, Group A had a mean union time of 12.91 ± 0.52 weeks, while Group B had 13.07 ± 0.69 weeks, with a statistically significant difference ($p = 0.002$). This indicates that the LCP method also led to faster union times, regardless of whether the injury was due to an RTA or a fall.

DISCUSSION

This comparative study provides insight into the efficacy and results of DCS and LCP in the treatment of adult distal femoral fractures. Both techniques have advantages and disadvantages.

Many researches published on this topic but this population is particular to study. The comparison of radiological outcomes between dynamic condylar screw (DCS) and distal femoral locking compression plate (LCP) techniques for distal femoral fractures has garnered significant attention in the orthopedic literature. In some literature, the union rate was high in the LCP group as compared to the DCS Group.[8,9]

Our study found that the average time to union was significantly shorter in the LCP group (13.29 weeks) compared to the DCS group (14.01 weeks), aligning with previous findings that suggest LCPs may facilitate faster healing due to their biomechanical advantages and stability in osteoporotic bone.[10-12]

In a study by Nayak et al., the mean time to union for distal femoral fractures treated with LCP was reported as 16.07 weeks, which is not consistent with our findings that indicate a trend towards quicker union times with LCP compared to DCS.[13-14] This is particularly relevant given the challenges associated with distal femoral fractures, such as poor bone quality and the need for stable fixation to promote healing.[15,16]

These findings were in line with a study by Malik et al. that found that the DCS group's union time was 14.25 weeks, while the LCP group's was 13.88 weeks.[17] In one study by Schandelmeir et al., 14.3 weeks were noted among the LCP patients, whereas in another by Markmiller et al., 13.8 weeks were noted.[18,19]

Moreover, the findings of our study are corroborated by Saikia &Tahbildar, who reported better functional outcomes with LCP for intra-articular distal femur fractures, emphasizing the importance of implant choice in achieving optimal recovery.[11] The enhanced stability provided by locking screws in LCP systems is believed to contribute to reduced rates of nonunion and complications, as highlighted by Adams et

al.[12] This is particularly crucial in the geriatric population, where the risk of complications from prolonged immobilization and nonunion is significantly heightened.[14,15]

In terms of demographic factors, our study observed a higher prevalence of male patients and a significant number of injuries resulting from road traffic accidents, which is consistent with the literature indicating that high-energy trauma is a common cause of distal femoral fractures in younger populations. The age distribution in our study, with a mean age of 43.10 years for the DCS group and 39.54 years for the LCP group, reflects the bimodal distribution of these injuries, where younger individuals often sustain fractures from high-energy impacts, while older adults are more prone to low-energy falls.[9,16]

The study has limitations despite its strengths. The follow-up duration is four months, which might not be sufficient to capture the late complications such as nonunion or implant failure. Additionally, randomization was not clearly described; this might result in allocation bias. A future study should consider a higher number of patients and longer follow-ups to validate these findings and assess functional outcomes in relation to radiological union.

CONCLUSION

In conclusion, our findings suggest that the distal femoral locking compression plate technique may offer superior radiological outcomes in terms of union time compared to the dynamic condylar screw technique. This aligns with existing literature that advocates for the use of LCP in managing distal femoral fractures, particularly in patients with compromised bone quality. Future studies should continue to explore these outcomes in larger, multicentric trials to validate these findings further and refine treatment protocols for distal femoral fractures.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

SOURCE OF FUNDING

This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

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2	Asadullah Samo	Study Methodology.	
3	Muhammad Safdar	Data collection.	
4	Bilal Zaib	Data collection.	
5	Muhammad Ahmad Mustafa	Data collection.	
6	Asad Amin	Assisted in discussion.	