e-ISSN: 0976-822X, p-ISSN:2961-6042

Available online on http://www.ijcpr.com/

International Journal of Current Pharmaceutical Review and Research 2026; 18(2); 1033-1037

Original Research Article

A Study of Clinical Outcome of Lateral Closing Wedge High Tibial Osteotomy in Adults in Medial Compartment of Osteoarthritis Knee

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Received: 01-11-2025 / Revised: 15-12-2025 / Accepted: 21-01-2026

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Conflict of interest: Nil

Abstract

Background: Medial compartment osteoarthritis of the knee associated with varus deformity results in pain, functional limitation, and progressive joint degeneration. Lateral closing wedge high tibial osteotomy aims to redistribute mechanical load and preserve native joint function.

Objective: To analyse the effectiveness of lateral closing wedge high tibial osteotomy in improving clinical and functional outcomes in patients with medial compartment osteoarthritis using Oxford Knee Score.

Methods: A prospective interventional study including 28 patients was conducted, with preoperative evaluation and postoperative assessment at 1, 6, and 12 months using validated scoring systems and radiological analysis.

Results: The majority of patients demonstrated moderate varus deformity preoperatively, and postoperative outcomes showed progressive improvement in Oxford Knee Scores, with 57.14% achieving mild symptom status at 12 months and minimal complications reported.

Conclusion: Lateral closing wedge high tibial osteotomy is a reliable joint-preserving procedure that significantly improves function and reduces pain in appropriately selected patients with medial compartment osteoarthritis.

Keywords: High tibial osteotomy; medial compartment osteoarthritis; Oxford Knee Score; lateral closing wedge.

DOI: 10.25258/ijcpr.18.2.170

Introduction

Osteoarthritis of the knee is one of the most common degenerative joint disorders, frequently affecting the medial compartment due to varus alignment and abnormal joint loading patterns [1]. In patients with symptomatic medial compartment osteoarthritis, high tibial osteotomy (HTO) has been widely used as a joint-preserving surgical option, particularly in younger and active individuals seeking to delay or avoid total knee arthroplasty [2]. The principle of HTO is to realign the mechanical axis of the lower limb, unloading the diseased medial compartment and transferring load to the relatively preserved lateral compartment, thus reducing pain and improving function [3].

Among HTO techniques, lateral closing wedge high tibial osteotomy (LCW-HTO) has historically been favoured for its ability to provide stable fixation and early bone union [4]. In LCW-HTO, a wedge of bone is removed laterally, and the two bone ends are closed and fixed with hardware to achieve the desired correction [5]. Several studies have demonstrated that LCW-HTO yields satisfactory long-term clinical and functional outcomes, with survivorship extending beyond ten years in selected populations [6,7]. Moreover, recent long-term follow-up studies have reported survival rates of greater than 85% at 10–15 years, with low rates of conversion to total knee arthroplasty when appropriate patient selection and surgical technique are employed [8].

Comparative studies between lateral closing wedge and medial opening wedge HTO have shown that both techniques achieve comparable improvements in patient-reported outcomes and mechanical axis correction; however, LCW-HTO may be associated

with specific peri-operative considerations including nerve injury and differences in posterior tibial slope [9]. Furthermore, radiological analyses support the durability of correction achieved with LCW-HTO, correlating with improvements in functional scores and delayed progression of osteoarthritis [10].

Despite the demonstrated benefits, careful pre-operative planning, precise surgical execution, and appropriate post-operative rehabilitation are essential to minimize complications and optimize outcomes in patients undergoing LCW-HTO for medial compartment osteoarthritis of the knee.

Material and Methods

The present prospective interventional study was conducted at C. U. Shah Medical College and Hospital, Surendranagar, including a total of 28 patients diagnosed with medial compartment osteoarthritis of the knee who fulfilled the predefined inclusion and exclusion criteria. Both male and female patients were enrolled up to May 2025 and were managed surgically with lateral closing wedge high tibial osteotomy. All patients were followed according to a standardized postoperative follow-up protocol. The mean age of the study population was 59.33 years, with an age range of 42 to 71 years. All 28 knees demonstrated varus deformity, and one patient had an associated flexion deformity, which was corrected intraoperatively by modifying the posterior tibial slope.

Patients presenting with knee pain not relieved by conservative management and showing clinical and radiological evidence of medial compartment osteoarthritis were selected for the procedure. Preoperative evaluation included detailed clinical examination, weight-bearing radiographs of the knee, and full-length lower limb weight-bearing scanograms to assess alignment and deformity correction planning. Patients with rheumatoid arthritis or other seronegative arthropathies and those with a history of previous lateral meniscectomy were excluded from the study. All participants were counseled regarding the osteotomy procedure, including its benefits, risks, and alternative surgical options such as total knee replacement and unicondylar knee replacement. Written informed consent was obtained prior to surgery.

Clinical outcomes were assessed using the Oxford Knee Score (OKS) both preoperatively and postoperatively at one month, six months, and twelve months. The Oxford Knee Score is a validated patient-reported outcome measure consisting of 12 questions evaluating knee pain and functional limitations over the previous four weeks. Each item is scored from 0 to 4, where a score of 4 represents no pain or difficulty and a score of 0 indicates severe symptoms. The total score ranges from 0 to 48, with higher scores indicating better knee function. Scores between 40 and 48 were interpreted as excellent function, 30 to 39 as good function, 20 to 29 as moderate impairment, and scores below 20 as poor function with significant disability.

Preoperative planning included routine laboratory and systemic evaluation. Investigations included random blood sugar level, haemoglobin level, bleeding time, clotting time, blood grouping and Rh typing, serological screening for HIV, hepatitis B surface antigen, and hepatitis C virus, as well as serum urea, creatinine, and electrolyte levels. Radiological and cardiopulmonary assessments included chest radiography and electrocardiography, while cardiology consultation and echocardiography were obtained in indicated cases. Medical fitness was obtained from the physician for patients with associated comorbid conditions.

All osteotomies were stabilized using a high tibial osteotomy locking plate system. Fixation included the use of 6.5 mm cortical cancellous screws, K-wires, stainless steel wire loop tension band wiring, and washers. In all 28 patients, fixation was achieved using a medial locking plate with tension band wiring between one screw and washer in the proximal fragment and one screw with washer in the distal fragment placed along the lateral surface. Postoperative monitoring included clinical and functional evaluation at scheduled intervals. One patient experienced pain while bending the knee postoperatively, and implant removal was performed after seven months in that case.

Results

The demographic characteristics of the study population are presented in Table 1. Among the total 28 patients included in the study, the largest proportion belonged to the 51–60 years age group comprising 18 patients (64.28%), followed by 5 patients (17.85%) each in the 41–50 years and 60–65 years age categories. This indicates that nearly two-thirds of the study population fell within a single decade of life, reflecting the higher prevalence of symptomatic medial compartment osteoarthritis requiring surgical intervention during late middle age. The mean age of 59.33 years further supports that lateral closing wedge high tibial osteotomy was performed primarily in relatively active individuals who may benefit from joint preservation procedures rather than early arthroplasty.

The severity of deformity distribution shown in Table 2 demonstrates that none of the patients had mild varus deformity (0%), while the majority, 23

out of 28 patients (92.00%), presented with moderate deformity ranging between 6–10 degrees. Only 5 patients (08%) exhibited severe deformity greater than 10 degrees, highlighting that most surgical candidates were treated before progression to extreme malalignment. The absence of mild deformity cases suggests that operative intervention was reserved for clinically significant biomechanical imbalance. Statistical comparison showed non-significant variation within deformity categories ($p>0.05$), indicating a relatively uniform deformity profile among the participants.

Body mass index analysis presented in Table 3 revealed that none of the patients were in the normal BMI category (<25 kg/m²), whereas 20 patients (71.42%) were classified within the overweight category (25–30 kg/m²) and 8 patients (28.57%) were in the obese category (30–35 kg/m²). The predominance of elevated BMI values indicates a strong association between increased body weight and medial compartment loading, which likely contributed to the development and progression of osteoarthritis in this cohort. The difference between overweight and obese groups was not statistically significant ($p>0.05$), reflecting a relatively consistent distribution of increased body mass among participants.

Functional outcomes assessed using the Oxford Knee Score at 6 months postoperatively, as illustrated in Table 4, demonstrated marked improvement compared to baseline. A total of 22 patients (78.57%) achieved mild to moderate functional status with OKS values between 30–39, indicating substantial relief in pain and improvement in daily activities. Additionally, 5 patients (17.85%) achieved mild symptom status with scores between 40–48, suggesting near-normal knee function. Only 1 patient (3.5%) remained in the moderate to severe category (20–29), and none were classified as severe (<20), indicating that the majority experienced clinically meaningful recovery. Statistical evaluation showed significant improvement compared to preoperative status ($p<0.05$).

Further improvement was observed at the 12-month follow-up as presented in Table 5. Sixteen patients (57.14%) achieved mild symptom status with OKS between 40–48, while 12 patients (42.85%) remained within the mild to moderate range (30–39). No patient fell into the moderate to severe or severe categories, demonstrating sustained functional gains over time.

The progressive shift of patients toward higher OKS categories from 6 to 12 months highlights continued recovery and adaptation following osteotomy, supporting the effectiveness of lateral closing wedge high tibial osteotomy in improving clinical and functional outcomes.

Table 1. Age distribution

Age (in years)	Frequency	Percentage
41–50	05	17.85
51–60	18	64.28 %
60–65	05	17.85
Total	28	100 %

Table 2. Preoperative Degree of Deformity

Degree of varus	Frequency	Percentage
Mild (0–5 degree)	0	0%
Moderate (6–10 degree)	23	92.00%
Severe (>10 degree)	05	08%
Total	28	100 %

Table 3. Body mass index

BMI	Frequency	Percentage
<25	0	0%
25–30	20	71.42%
30–35	08	28.57%
Total	28	100%

Table 4. Postoperative OKS 6 months

Oxford Knee Score	Frequency	Percentage
Normal (>48)	0	0 %
Mild (40–48)	5	17.85%
Mild to moderate (30–39)	22	78.57%
Moderate to severe (20–29)	1	3.5%
Severe (<20)	0	0 %

Total	28	100 %

Table 5. Postoperative OKS 12 months

Oxford Knee Score	Frequency	Percentage
Normal (>48)	0	0%
Mild (40–48)	16	57.14%
Mild to moderate (30–39)	12	42.85%
Moderate to severe (20–29)	0	0%
Severe (<20)	0	0 %
Total	28	100 %

Discussion

The present study evaluated the clinical and functional outcomes of lateral closing wedge high tibial osteotomy (LCW-HTO) in patients with medial compartment osteoarthritis using Oxford Knee Score as the primary outcome parameter. The demographic profile demonstrated that the majority of patients were between 51–60 years of age with a mean age of 59.33 years, reflecting that osteotomy continues to be considered even in relatively older but active individuals. Similar findings have been reported by Niemeyer et al., who demonstrated that patient-reported functional outcomes continue to improve over time following high tibial osteotomy, particularly between 12 and 36 months, suggesting sustained biomechanical correction and adaptation after surgery [11]. In the present study, most patients presented with moderate varus deformity (92%), emphasizing the importance of correcting malalignment before severe degenerative changes occur. Schröter et al. reported comparable findings, noting that correction of mechanical axis significantly improves functional scores and activity levels, which aligns with the progressive improvement in Oxford Knee Scores observed in this cohort at 6 and 12 months [12].

Body mass index analysis revealed that the majority of patients were overweight, a factor known to influence medial compartment loading and osteoarthritis progression. Bode et al. demonstrated that improvements in IKDC and Lysholm scores were significant in patients undergoing osteotomy, particularly when preoperative functional status was adequately assessed, supporting the use of validated scoring systems such as OKS in the current study [13]. Functional outcome assessment showed a clear shift from lower score categories preoperatively to higher score ranges postoperatively, with 57.14% of patients achieving mild symptom status (OKS 40–48) at 12 months. Haviv et al. similarly reported significant improvement in Oxford Knee Scores after HTO, highlighting that patient-reported outcome measures are sensitive indicators of clinical success [14]. Complication rates in the present study were minimal, with only isolated cases of pain and implant prominence, reflecting the safety of the lateral closing wedge technique when proper surgical planning and fixation methods are applied. Long-term registry data analysed by Howells et al. have shown favourable survivorship and functional outcomes following LCW-HTO, supporting its role as a joint-preserving procedure in selected patients [15]. Overall, the findings of this study demonstrate that LCW-HTO provides meaningful clinical and functional improvement, particularly in patients with moderate deformity and preserved knee function, thereby delaying the need for total knee arthroplasty while maintaining activity levels.

Conclusion

Lateral closing wedge high tibial osteotomy is an effective joint-preserving surgical option for patients with medial compartment osteoarthritis of the knee. The procedure demonstrated significant improvement in Oxford Knee Scores over a 12-month follow-up period with minimal complications, indicating favourable clinical and functional outcomes. Proper patient selection, accurate deformity correction, and structured postoperative rehabilitation contribute to successful results and improved quality of life.

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