TO STUDY THE OUTCOME OF HIGH TIBIAL OSTEOTOMY FOR MEDIAL COMPARTMENT OSTEOARTHRITIS KNEE

Introduction

Osteoarthritis (OA) is the most prevalent form of arthritis, affecting millions globally and serving as a leading cause of disability, particularly among the middle-aged and elderly. Among the various types, knee osteoarthritis (KOA) is especially common due to the knee's crucial role in movement and load-bearing. KOA often leads to chronic pain, joint stiffness, functional impairment, and diminished quality of life. The disease is characterized by progressive degeneration of articular cartilage, narrowing of joint space, osteophyte formation, and subchondral bone changes. It can affect different compartments of the knee—medial, lateral, or patellofemoral—with medial compartment osteoarthritis (MCOA) being the most frequently encountered due to the natural varus alignment of the knee, which places greater mechanical stress on the medial side.

In early stages, conservative treatments such as physiotherapy, weight management, analgesics, and intra-articular injections may provide symptom relief. However, these measures often fail to halt disease progression in more advanced cases. In such scenarios, surgical options are considered. High tibial osteotomy (HTO) has emerged as an effective joint-preserving surgical intervention for patients with isolated MCOA and varus deformity, particularly in younger and more active individuals. Unlike total knee arthroplasty (TKA), which involves replacing the joint with a prosthesis, HTO realigns the mechanical axis of the lower limb to shift the load away from the diseased medial compartment toward the relatively

healthier lateral compartment. This redistribution of weight-bearing stress can relieve pain, improve knee function, and potentially delay or avoid the need for joint replacement surgery.

HTO is particularly suited for physically active patients under 60 years of age who wish to maintain a higher level of knee function. One of its major advantages is the preservation of native knee anatomy and proprioception, which are often compromised following TKA. Among the two main techniques of HTO—medial opening wedge (OWHTO) and lateral closing wedge (CWHTO)—the OWHTO has gained popularity due to better control over the degree of correction, reduced risk of fibular nerve injury, and preservation of bone stock. In OWHTO, a medial bone cut is made in the proximal tibia, and the gap is gradually opened to achieve the desired realignment. This space is stabilized using a plate and often a bone graft. Conversely, CWHTO involves removing a lateral bone wedge and shifting the tibia medially, which can offer faster union but is technically more demanding and poses higher risks.

Despite the proven benefits of HTO, long-term outcomes remain variable, and patient satisfaction depends on multiple factors, including surgical technique, degree of correction, rehabilitation, and patient adherence to postoperative care. Given the increasing prevalence of knee OA and the growing demand for joint-preserving procedures, further research is needed to evaluate the clinical, radiological, and functional outcomes of HTO in different patient populations.

This study aims to assess the effectiveness of HTO in patients with MCOA, focusing on pain relief, functional improvement, radiological alignment, and complications.

Materials and methods

This prospective observational study was conducted in the Department of Orthopaedics at Silchar Medical College and Hospital, Silchar, from July 2023 to June 2024. The research involved 30 patients diagnosed with medial compartment osteoarthritis of the knee who were treated with medial opening wedge high tibial osteotomy (OWHTO). Ethical clearance for the study was obtained from the Institutional Ethical Committee of Silchar Medical College and Hospital. Informed consent was secured from all participants after thorough explanation of the surgical procedure, potential risks, benefits, and follow-up requirements. The inclusion criteria consisted of patients aged between 40 to 60 years with radiographically confirmed isolated medial compartment osteoarthritis, varus deformity, and a body mass index (BMI) less than 30. Patients were excluded if they had tricompartmental osteoarthritis, inflammatory arthritis, prior knee surgeries, joint infections, or significant comorbidities contraindicating surgery.

All patients underwent thorough preoperative evaluation, including clinical examination, radiographic assessment (weight-bearing anteroposterior, lateral, and skyline views), and mechanical axis analysis using full-length standing scanograms. Preoperative planning focused on determining the correction angle required to shift the weight-bearing axis to the Fujisawa point, which lies approximately 62.5% lateral from the medial edge of the tibial plateau. Surgical planning also included templating the osteotomy and selecting appropriate fixation devices.

The surgical procedure was performed under spinal or epidural anesthesia with the patient in the supine position. A pneumatic tourniquet was applied to the upper thigh. A medial longitudinal incision was made starting below the joint line. The pes anserinus was reflected, and the superficial medial collateral ligament was released. A biplanar osteotomy was

performed at the proximal tibia using an oscillating saw under fluoroscopic guidance, maintaining an intact lateral cortex to serve as a hinge. The medial wedge was gradually opened using laminar spreaders until the planned correction angle was achieved. The osteotomy site was then stabilized using a locking plate system (usually a TomoFix or equivalent plate). Bone grafting, either using autograft or bone substitute, was performed to fill the osteotomy gap depending on the size and need.

Postoperatively, patients were kept under observation for immediate complications and were started on a standardized rehabilitation protocol. This included quadriceps strengthening and knee range of motion exercises starting from the first postoperative day. Partial weight bearing was allowed after six weeks, progressing to full weight bearing based on radiological evidence of osteotomy healing. Patients were followed up at regular intervals—6 weeks, 3 months, 6 months, and 12 months postoperatively. Clinical outcomes were evaluated using the Visual Analog Scale (VAS) for pain, the Japanese Orthopaedic Association (JOA) score, and the Knee Society Score (KSS), both for knee function and clinical status. Radiographic parameters such as mechanical axis alignment and osteotomy healing were also assessed during follow-up. Statistical analysis of the data was performed using SPSS software, with p-values less than 0.05 considered statistically significant.

Tables and figures

Table 1. Socio-clinical characteristics of the patients (n=20)

Parameters	**Frequency/ Mean**	**Percentage/ SD**
Sex		
Male	8	40
Female	12	60
Occupation		
Homemaker	9	45
Laborer	4	20
Farmer	2	10
Teacher	2	10
Businessperson	2	10
Maid	1	5
Mean age (years)	49.2	5.8
Mean BMI (kg/m^2)	24.4	2.1

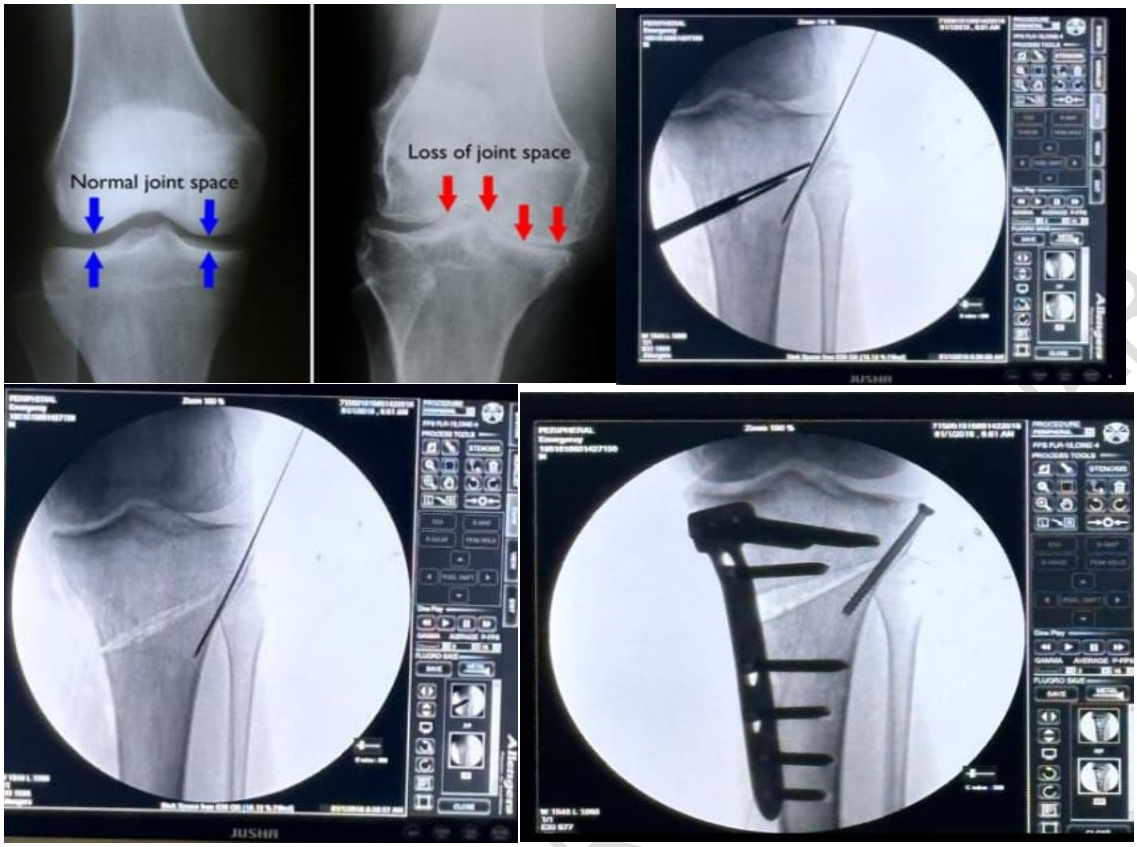
Table 2. Surgery related characteristics of the patients (n=20)

Parameters	**Preoperative**		**Postoperative**		**p-value**
	Mean/ n	**SD/ %**	**Mean/ n**	**SD/ %**	
VAS	6.8	0.8	2.1	0.3	<0.001*
KSS score	98.2	12.1	183.2	8.0	<0.001*
JOA score	50.2	4.9	72.2	5.5	<0.001*
Varus/ valgus (degrees)	9.1	2.2	1.2	0.4	<0.001*

*Statistically significant, VAS – Visual analogue scale, KSS – Knee society score, JOA – Japanese orthopedic association score

Table 3. Complication distribution (n=20)

Complication	Frequency	Percent
Implant prominent	2	40
Superficial infection	3	60
Total	5	100



Results

The study involved 30 patients who underwent medial opening wedge high tibial osteotomy (OWHTO) for medial compartment osteoarthritis of the knee. The patient cohort consisted predominantly of males (63.33%) compared to females (36.67%). The majority of participants (40%) were in the 51–55 year age group, followed by 30% in the 56–60 year range, and 23.33% between 46–50 years. Only a small portion (6.67%) were between 40–45 years of age. Most patients presented with normal BMI (66.67%), while the remainder were overweight (33.33%). No patients had a BMI over 30, adhering to the inclusion criteria.

The dominant side of knee involvement was the right in 53.33% of cases, with the left side affected in 46.67%. Preoperatively, the mean Visual Analog Scale (VAS) score for pain was 7.90, which significantly decreased to 3.17 at six months and further to 2.13 at 12 months postoperatively, indicating notable pain relief over time. The improvement was statistically significant ($p < 0.0001$). Similarly, the Japanese Orthopaedic Association (JOA) score showed marked functional recovery: the mean preoperative score was 54.83, which improved to 82.67 at six months and 91.33 at the one-year mark.

Radiologically, the mechanical axis deviation (MAD) improved considerably. The preoperative mean MAD was measured at 1.20 mm medially, which corrected to a mean of 2.63 mm laterally at 12 months post-surgery, showing successful mechanical axis realignment. The change was statistically significant ($p < 0.0001$), confirming the effectiveness of OWHTO in achieving desired biomechanical correction. Additionally, the mechanical tibiofemoral angle (mTFA) shifted from a mean preoperative varus alignment of -7.53° to a postoperative valgus of +3.77° at 12 months, representing a significant angular correction.

Clinical outcome assessments using the Knee Society Score (KSS) demonstrated substantial functional improvements. The mean clinical KSS score increased from 51.30 preoperatively to 84.97 at six months and 91.17 at 12 months. The functional component of the KSS improved from a mean of 48.67 preoperatively to 82.00 at six months and 88.50 at one year. These changes were all statistically significant and consistent across age, sex, and BMI subgroups, indicating that the procedure was broadly effective.

No major intraoperative complications such as neurovascular injury or hinge fractures were reported. Minor complications included superficial wound infections in 6.67% of patients, all

of which resolved with antibiotic therapy. There were no cases of non-union or loss of correction during the follow-up period.

Discussion

The present study evaluated the clinical and radiological outcomes of medial opening wedge high tibial osteotomy (OWHTO) in patients suffering from medial compartment osteoarthritis (MCOA) of the knee. The findings support the efficacy of OWHTO as a joint-preserving surgical option for younger and more active individuals with varus-aligned knees and isolated medial compartment degeneration. Notable improvements were observed in both functional scores and radiological alignment, aligning with the results reported by previous studies in the orthopedic literature.

A significant reduction in pain was demonstrated postoperatively, as evidenced by the marked decrease in Visual Analog Scale (VAS) scores. The average preoperative VAS score of 7.9 decreased to 2.13 at one year, indicating substantial pain relief. This is consistent with the study by Kohn et al., who also observed improved pain outcomes following OWHTO. Functional scores, including the Japanese Orthopaedic Association (JOA) score and Knee Society Score (KSS), showed substantial improvements over time. The mean JOA score increased from 54.83 to 91.33, and both clinical and functional components of the KSS improved significantly. These findings are in agreement with the results of Brouwer et al. and Billings et al., who reported similar positive outcomes in function and quality of life after OWHTO.

Radiological parameters such as mechanical axis deviation (MAD) and mechanical tibiofemoral angle (mTFA) demonstrated effective realignment of the lower limb axis. The shift from a preoperative varus alignment of -7.53° to a postoperative valgus of +3.77°

indicates that the targeted correction toward the Fujisawa point was successfully achieved. This biomechanical correction redistributes the load-bearing stress away from the medial compartment, facilitating cartilage unloading and functional recovery. These findings are comparable to those reported by Akizuki et al., who emphasized the importance of precise correction to optimize clinical outcomes and reduce the risk of overcorrection or undercorrection.

In terms of complications, the procedure proved to be safe, with minimal adverse events. Only 6.67% of patients developed superficial wound infections, all of which resolved with conservative management. There were no major complications such as deep infection, neurovascular injury, delayed union, or hardware failure during the follow-up period. This reflects the high safety profile of OWHTO when performed with proper technique and postoperative care. Our study further validates the notion that OWHTO offers a lower complication rate than total knee arthroplasty (TKA) in selected younger patients, as emphasized by Spahn et al.

Patient selection played a crucial role in the success of the procedure. All patients had a BMI under 30, were under the age of 60, and had no evidence of lateral compartment or patellofemoral joint degeneration. These inclusion criteria are consistent with international guidelines and supported by studies such as those by Coventry and Duivenvoorden, who emphasized the need for strict selection to ensure durable outcomes. Rehabilitation also played a pivotal role, with early mobilization and a structured weight-bearing protocol contributing to positive recovery trajectories.

Conclusions

Medial opening wedge high tibial osteotomy (OWHTO) is a safe and effective joint-preserving surgical option for patients with medial compartment osteoarthritis of the knee, particularly in younger, active individuals with varus alignment. This study demonstrated significant improvements in pain relief, knee function, and mechanical axis correction, with minimal complications. By realigning the weight-bearing axis away from the diseased compartment, OWHTO delays the progression of osteoarthritis and the need for total knee arthroplasty.

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