International Journal of Medical and Pharmaceutical Research

Online ISSN-2958-3683 | Print ISSN-2958-3675
Frequency: Bi-Monthly
Available online on: https://ijmpr.in/

Original Article

A STUDY OF THE OUTCOME OF HIGH TIBIAL OSTEOTOMY (HTO) IN MEDIAL COMPARTMENT OSTEOARTHRITIS(OA) OF KNEE

Dr. Nivas S Gowda[1], Dr. Manjunatha A[2], Dr. Prashantha[3]

[1] Senior Resident, Department of Orthopaedics, Kodagu institute of Medical Sciences Madikeri, Kodagu, Karnataka, India.
[2] Associate Professor , Department of Orthopaedics, Kodagu institute of Medical Sciences Madikeri, Kodagu, Karnataka, India.
[3] Assistant Professor , Department of Orthopaedics, Kodagu institute of Medical Sciences Madikeri, Kodagu, Karnataka, India.

Corresponding Author:

Dr.Nivas S Gowda
Senior Resident, Department of Orthopaedics, Kodagu institute of Medical Sciences Madikeri, Kodagu, Karnataka, India.

Received: 06-12-2025
Accepted: 03-01-2026
Available online: 13-01-2026

ABSTRACT

Introduction: Medial compartment osteoarthritis of the knee is a common degenerative condition that leads to pain, deformity, and functional limitation. High tibial osteotomy (HTO) is a joint-preserving surgical procedure aimed at correcting varus malalignment and redistributing load from the diseased medial compartment to the relatively preserved lateral compartment, thereby relieving symptoms and improving knee function.
Aims: To evaluate the clinical and functional outcomes of high tibial osteotomy in patients with medial compartment osteoarthritis of the knee.
Materials and Methods: This prospective study included patients with symptomatic medial compartment knee osteoarthritis treated with high tibial medial opening wedge osteotomy. A total of 25 knees were evaluated. Patients were assessed clinically and functionally using standardized scoring systems preoperatively and during follow-up. Radiological assessment was performed to evaluate alignment correction and disease progression. Outcomes were analyzed over a follow-up period of up to one year.
Result: The study demonstrated significant improvement in pain relief and functional outcomes following high tibial osteotomy. Most patients showed maximal improvement within one year of surgery. The procedure effectively corrected varus deformity and slowed the progression of osteoarthritis. Male patients were more commonly affected, and right-sided involvement was slightly higher. No major complications were observed, and bone grafting was not required in all cases.

Keywords: *High tibial osteotomy; Medial compartment osteoarthritis; Knee; Varus deformity and Functional outcome.*

INTRODUCTION

A chronic, crippling condition that significantly impairs function, osteoarthritis of the knee is increasingly affecting younger people. According to global data, osteoarthritis causes significant health and welfare expenses and accounts for 3% of all "years lived with disability" worldwide. It affects day-to-day activities.

The medial compartment of the knee is frequently affected by osteoarthritis, which frequently causes varus deformity. By medializing the weight-bearing axis, this distortion exacerbates the disease. A successful treatment for medial unicompartmental osteoarthritis is high tibial osteotomy (HTO), which corrects misalignment and reduces pain. The foundational principles of osseous deformity correction were established by Friedrich Pauwels in 1964 and Paul Maquet in 1976.[1]A closed wedge osteotomy procedure developed by Mark Coventry in 1965 was the gold standard for many years. Although his method of placing the osteotomy close to the tuberosity allowed for quicker healing, it also had drawbacks, including injury to the peroneal nerve, the need for a fibular osteotomy, compartment syndrome, limb shortening, and challenges with arthroplasty because of the lateral offset of the proximal tibia.

Before the significance of restoring varus alignment in treating ligamentous injuries and knee imbalance rekindled interest, these operations were out of favor (Noyes et al., 1993). [2]. High Tibial Osteotomy (HTO) was introduced by Jackson et al. in 1961 and popularized by Coventry in 1985.[3]It gained acceptance as a treatment for unicondylar osteoarthritic knee abnormalities and pain relief. Hernigou et al. first described the medial opening wedge HTO, [4]is currently a tried-and-true method for treating unicompartmental knee OA. For young patients with medial compartments, HTO is the preferred surgical procedure. OA because of its advantages, which include simpler and more precise correction, bone stock preservation, limb length gain, alignment restoration, and prevention of damage to the anterior compartment muscles, peroneal nerve, and proximal tibiofibular joint. Additionally, when switching to total knee arthroplasty (TKA), it produces superior outcomes (Hooper et al., 2005). [5]. However, intraoperative correction angle choice and postoperative correction loss were main challenges.

HTO is on the rise thanks to developments in implants and methods for axis correction around the knee. It has become popular recently to combine HTO with cartilage repair methods such as subchondral drilling, abrasion arthroplasty, and microfracture.

Compared to lateral closure wedge HTO or UKA, OWHTO has less problems and a high degree of precision in correcting deformities. In order to relieve pressure on the afflicted knee compartment, high tibial osteotomy (HTO) is a commonly used treatment for medial osteoarthritis of the knee.

High tibial osteotomy is used as a stopgap measure till knee replacement when life expectancy rises. It offers patients substantial advantages if it relieves pain for more than ten years.

MATERIALS AND METHODS

Study design: Prospective study

Study population: Patients who attended the OPD with pain in knee and deformity

Sample population: 25 patients

Study duration: 18 months (1st August 2023 to 31st January 2025)

Patients who attended the orthopaedic OPD in our hospital between August 2023 to January 2025 . The patients were evaluated by clinical examination and weight bearing radiographs. The patients who were found to have unicompartmental osteoarthritis with knee pain not relieved by conservative management and who satisfy the inclusion criteria were selected for HTO.

Study Variables:
Age in years
Gender
Side of injury
VAS scores
JOA scores
KSS score

INCLUSION CRITERIA:
1. Medial compartment OA of knee joint with varus deformity
2. Age less than 60 years
3. Medically fit patient with medial compartment OA of knee willing for surgery

EXCLUSION CRITERIA:
1. Narrowing of lateral compartment joint space
2. Valgus knee
3. Rheumatoid arthritis
4. Flexion contracture of more than 15 degrees
5. Knee flexion less than 90 degrees
6. More than 15 degrees of varus deformity in the affected knee

The patients were explained about osteotomy and its advantages and disadvantages were discussed. Alternative options of TKR and unicondylar knee replacement discussed. Those patients who were willing for the procedure were selected and their consent obtained. pre- operative evaluation done by Visual Analogue pain scale, Knee society Scoring System and Japanese Orthopaedic Association Knee rating scale.

Statistical Analysis:

Data were entered and analyzed using SPSS version 25.0. Continuous variables were expressed as mean ± standard deviation, and categorical variables as frequencies and percentages. The prevalence of refractive errors was calculated, and associations with screen time and other risk factors were assessed using chi-square tests for categorical variables and independent t-tests or ANOVA for continuous variables. Correlation between screen time and severity of refractive errors was evaluated using Pearson's correlation coefficient. A p-value <0.05 was considered statistically significant.

RESULT

Table 1: Age and gender wise distribution of osteoarthritis of knee patients

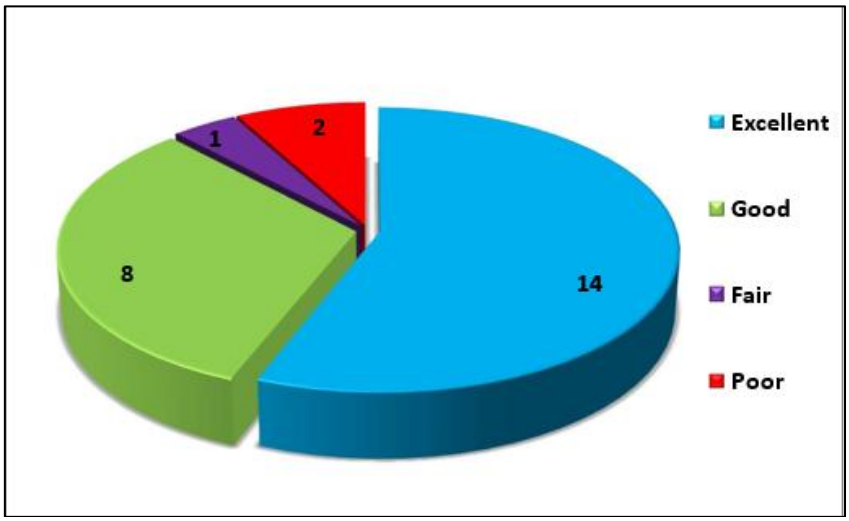
Age in years	Males		Females		Total	
	No.	%	No.	%	No.	%
31—40	7	50	3	27.3	10	40
41—50	5	35.7	5	45.4	10	40
51—60	2	14.3	3	27.3	5	20
Total	**14**	**100**	**11**	**100**	**25**	**100**
Mean ± SD	**42.14 ± 7.51**		**45.45 ± 6.26**		**43.60 ± 6.91**	
t-test & P-value	**t = 1.174 P = 0.252 NS**					

Table: 2 Distribution of Gender and Side of injury

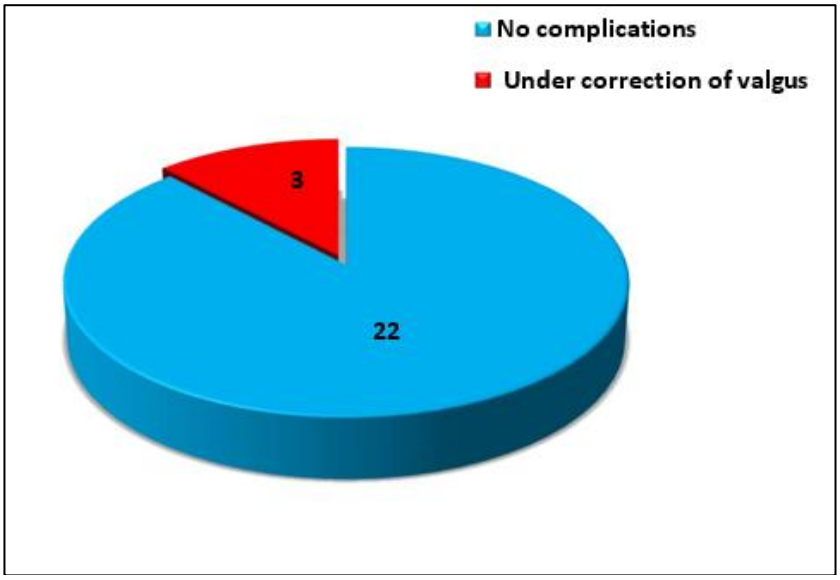
		Number of patients	Percentage
Gender	**Males**	14	56
	Females	11	44
	Total	**25**	**100**
Side of injury	**Right**	13	52
	Left	12	48
	Total	**25**	**100**

Table 3:Distribution of mean with VAS scores, JOA scores and KSS score

	Time interval	No. of patients	Mean ± SD	Paired t-test,
VAS scores	**Pre-Op**	25	7.04 ± 1.17	**P-value & significance t = 28.652 P = 0.000, HS**
	Post-OP	25	2.28 ± 0.97	
	Correlation coefficient	25	r = 0.716, P = 0.000, HS	
JOA scores	**Pre-Op**	25	49.76 ± 4.54	**P-value & significance t = 28.476 P = 0.000, HS**
	Post-OP	25	71.92 ± 7.86	
	Correlation coefficient	25	r = 0.941, P = 0.000, HS	
KSS score Pre-OP and Post-OP VAS scores	**Pre-Op**	25	104.76 ± 8.81	**P-value & significance. t = 31.254.P = 0.000, HS**
	Post-OP	25	177.80 ± 14.86	
	Correlation coefficient	25	r = 0.619, P = 0.001, HS	



Graph1: Pie chart represents study results wise distribution of patients



Graph2:Piechartpresentscomplicationswisedistributionofpatients

Study observes that, each 10 (40.0%) of patients were belongs to the age group of 31—40 years and 41—50 years respectively, followed by 5 (20.0%) patients were belongs to the age group of 51—60 years. The minimum age of the patient was 32 years and maximum age of patient was 55 years. The mean age of male patients was 43.69 years. But there was statistically no significant difference of mean age with gender (P>0.05)

In the present study, a total of 25 patients were included. The gender distribution showed a male predominance, with 14 males (56%) and 11 females (44%).

In terms of the side of injury, 12 patients (48%) had left-sided injuries, whereas 13 patients (52%) had right-sided injuries. With a slight predominance of right-sided participation, the overall distribution of injured sides was almost equal. According to the study, pain was evaluated both before and after surgery using the visual analogue score (VAS). Prior to surgery, the average visual analogue score (VAS) was 7.04. Following surgery, the average visual analogue score (VAS) was 2.28. A statistically significant variation in mean pain was observed. Pre-operative and post-operative pain VAS scores showed a statistically significant positive connection (P<0.001), and the VAS score reduced from pre-operative to post-operative (P<0.001).

Study reveals that; assessment of physical function and pain was analysed by usingJapanese Orthopedic Association (JOA) both pre-operatively and Post-operatively. The mean Japanese Orthopedic Association (JOA) score in pre-operative was 49.76 The mean Japanese Orthopedic Association (JOA) score in post-operative was 71.92

A statistically significant positive association was also found, and the mean JOA score increased from pre-operative to post-operative (P<0.001). JOA scores before and after surgery (P<0.001)

According to the study, pre-operative and post-operative Knee Society Score (KSS) tracking and reporting results following total and partial knee arthroplasty were examined.

Before surgery, the average Knee Society Score (KSS) was 104.76. Following surgery, the average Knee Society Score (KSS) was 177.80.

The mean KSS score increases from pre-operative to post-operative were statistically significantly different (P<0.001), and there was a statistically significant positive association between the pre-operative and post-operative KSS scores (P<0.001).Study reveals that out of 25 osteoarthritis of knee patients; 14 (56.0%) patients result shows excellent, 8 (32.0%) osteoarthritis of knee patients outcome result was good, only 1 patient was fair and 2 (8.0%) of patients study result was poor.

Study reveals that out of 25 osteoarthritis of knee patients; 3 (12.0%) patients were seen the complication of under correction of valgus

DISCUSSION

Increased cartilage degradation and varus deformity result from weight bearing shifting to the medial side in medial compartment knee osteoarthritis. For younger patients who lead active lives, total knee replacement and unicondylar knee replacement are not the best options. The best course of action to prevent degeneration and maintain joint function is high tibial osteotomy. [6]

Opening wedge osteotomies are linked to less problems, according to Song et al.'s assessment of 90 medial opening wedge and 104 lateral closing wedge osteotomies. This was corroborated by Luites et al., who noted that the medial opening wedge technique produced more accurate correction. [7]

The main reasons for choosing surgery in our study were significant pain and difficulties in everyday activities. In accordance with Dugdale et al.'s guidelines, a slight overcorrection in high tibial osteotomy (HTO) was advised, usually resulting in 3–5 degrees of valgus angulation. [8]

Esenkaya et al. demonstrated that plates with wedges provided enhanced stabilization and early mobilization, while Koshino et al. highlighted positive outcomes using hydroxyapatite wedges [9]

A five-point average postoperative decrease in pain was found using the visual analogue scale, which closely correlated with precise correction. Even ten years after surgery, Coventry's long-term assessment of 213 knees showed notable pain reduction and functional improvement.In a similar vein, Mukherjee K's visual analogue scale ratings significantly improved after surgery. [10]

Preoperative visual analogue scale scores rated pain at 8(16%) , 7 (16%) followed by 48 (%), while postoperatively, a majority scored 2 (48%) followed by 1 (20%).

After HTO, total knee replacement had a variety of outcomes. Amendola et al. found that prior osteotomy had no discernible impact on results when comparing main TKR with TKR post-HTO. [11]. Haslam et al. noted the benefits of opening wedge osteotomies in maintaining bone stock for subsequent arthroplasty but reported worse results in TKR after HTO, similar to revision arthroplasty. [12]

In line with results from Kolb et al. and Sen et al., our study's JOA scores revealed 12% excellent and 64% good results, respectively, whereas knee scores showed 12% excellent and 64% good outcomes.. [9]

Within three to six months, all 25 of the patients in our research had their osteotomies consolidated. Given the soft tissue constraints of the medial tibia, complications highlight the significance of careful preoperative planning, proper surgical technique, and infection management.

Short-term follow-up and a limited sample size are two of the study's weaknesses. However, our results indicate that young, active patients with unicompartmental knee osteoarthritis may benefit with HTO.

CONCLUSION

We conclude that based on this prospective study of 25 knees, high tibial medial opening wedge osteotomy was found to be an effective treatment for unicompartmental knee osteoarthritis, providing significant pain relief and improvement in functional outcomes. The procedure appears to slow the progression of osteoarthritis and may delay or reduce the need for total knee replacement. Successful outcomes depend largely on meticulous preoperative planning and precise surgical execution. Most patients demonstrated maximal clinical improvement within one year following surgery. Importantly,

high tibial osteotomy does not compromise the option of future total knee replacement if required. Additionally, the findings suggest that routine bone grafting may not be necessary in all patients undergoing this procedure.

REFERENCES

1. Louis Solomon, David Warwick, Selvadurai Nayagam. Apley's System of Orthopaedics and Fractures.9th ed. Hodder Arnold, an imprint of Hodder Education, an Hachette UK Company;2010
2. Dugdale TB, Noyes FR, StyerD. Preoperative planning for high tibial osteotomy. The effect of lateral tibiofemoral separation and tibiofemorallength. Clinorthop related Res 1992;(274):248-264
3. DrorPaley.Principles of deformity correction.1st ed:Germany Springer 2005
4. Hernigou P, Ma W. Open wedge tibial osteotomy with acrylic bone cement as bone substitute. Knee. 2001;8(2):103–110
5. Hooper GJ, Rothwell AG, Frampton C, Wyatt MC**.** Does prior high tibial osteotomy compromise the outcome of total knee arthroplasty? *J Bone Joint Surg Br.* 2005;87(4):473–479
6. MaquetPV.valgus osteotomy for osteoarthritis of the knee.clinical orthopedic related research 1976,120:143-148
7. Luites et al.Fixation of opening versus closed wedge high tibial osteotomy. J bone joint surgery 2009;91B:1459-65
8. Dugdale TB, Noyes FR, Styer D. Preoperative planning for high tibial osteotomy. The effect of lateral tibiofemoral separation and tibiofemorallength.Clinorthop related Res 1992;(274):248-264
9. Mc coy GF,Graham HK,Mc Clellan CJ. High tibial osteotomy in degenerative diseases of the knee .Ulster med J 1999;54(1):46-52 16.Coventry MB. Osteotomy of the upper portion of the tibia for Degenerative arthritis of the knee : A
10. Coventry MB. Osteotomy of the upper portion of the tibia for Degenerative arthritis of the knee : A
11. preliminary Report.JBJS 1965;47A:984Amendola A, Rorabeck CH,Bourne RB, Aryan PM.Total knee arthroplasty following high tibial osteotomy for osteoarthritis. J arthroplasty 4(suppl).1989;S11-S17
12. Haslam P et al (2007).total knee arthroplasty after failed high tibial osteotomy :long term follow up of matched groups. J arthroplasty :22(2):245- 250