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## Is medial open wedge high tibial osteotomy is a good option for unicondylar osteoarthritis of knee? A prospective study

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### Abstract

**Introduction:** A recent World Health Organization report on the worldwide burden of disease suggests that knee Osteoarthritis (OA) alone is likely to become the 4th most important cause of disability in women and the 8th in men. High tibial osteotomy is an accepted surgical technique for the treatment of medial compartment osteoarthritis of the knee in younger patients. It will provide relief of pain and deformity and preserve normal anatomical structure in a selected patient.

**Aims and Objective:** High tibial osteotomy and Unicondylar knee replacement (Or Total knee replacement) are the mainstay of treatment for Medial compartment OA knee. Here we analyzed the functional outcome of the High tibial osteotomy for the medial compartment OA knee.

**Methodology:** Prospective study was conducted for 2 years (2019-2021) among 30 patients who meet our criteria, with a mean age group of 47.33 years (26-58), with mean BMI of 25.22kg/m<sup>2</sup> (22-29), the selected patient underwent medial open wedge high tibial osteotomy with plate & screw fixation, with or without bone grafting, on follow up visits patients are evaluated at 6 weeks, 3 months, 6 months and 1 year clinically, radiologically & complications noted. Based on these data final outcome was assessed with a Knee society score.

**Results:** All patients showed progressive improvement in Range of motions, pain relief, return to normal activities and improved assessment scores. At the end of 1 year mean knee society score improved to 185.67 from 98.83 (P value <0.001), no cases were reported with nonunion, lateral condyle fracture of the tibia was noted in one case during Surgery which healed later.

**Conclusion:** Total knee arthroplasty is the primary treatment for symptomatic late stage OA, however for moderate grade stages & isolated unicondylar OA in young, active individuals high tibial osteotomy is the preferred one. Total knee replacement after high tibial osteotomy has also shown good outcome.

**Keywords:** Unicondylar knee osteoarthritis, HTO, open wedge osteotomy

### Introduction

Knee osteoarthritis is much more prevalent in India than in the west and accounts for as much more disability as any of other chronic condition. Osteoarthritis once considered being a disease of elderly but in the recent years it is becoming more common even in people aged less than 50 years [2].

Osteoarthritis usually affects the medial compartment of the knee giving rise to varus deformity in the majority of cases. Varus deformity aggravates the pathology because of the medialisation of the weight bearing axis. HTO may be a valuable treatment modality in correcting malalignment and thereby relieving the symptoms related to medial unicompartmental degenerative joint disease.

HTO has become the surgery of choice as a joint preserving procedure for young Patients with OA involving the medial compartment, with potential advantages like easier and accurate correction, gain in limb length, preservation of bone stock, restoration of alignment, avoidance of disruption of the proximal tibiofibular joint.

### Aims and Objectives

To analyse the effectiveness of medial opening wedge osteotomy using high tibial osteotomy

plate in patients with early medial compartment osteoarthritis of the knee joint by

- 1 Pain relief, range of motion, deformity correction, radiological assessment and comparing pre-operative and post-operative functional status with Knee society score
- 2 To record any complications peri-operatively and in the early post-operative period.

### Materials and Methods of study

**Study design:** Prospective study.

**Study period:** November 2019 to January 2021.

**Place of study:** Sanjay Gandhi Institute of Trauma and Orthopaedics, Bangalore.

### Sample size

It is a hospital-based study with a sample size of 30. (Calculated based on previous studies) who are fulfilling the inclusion criteria.

Patients are evaluated using x-ray, CT scanogram, Proper pre op planning to assess the correction required. All patients are followed up with serial post op radiography and Knee society score at 3 months, 6 months and 1 year. Pre op varus angle was calculated for each patient by using CT scanogram

### Inclusion criteria

- 1 Unicompartmental Osteoarthritis of knee involving Medial compartment (kallgren and lawrence classification grade III and less)
- 2 Age: < 60 years
- 3 Knee flexion more than 90 degrees
- 4 The patient must able to use crutches / walker
- 5 The patient should have sufficient muscle strength and motivation to carry out
- 6 rehabilitation program
- 7 BMI less than 35%
- 8 willing to participate in the clinical investigation

### Exclusion criteria

- 1 More than one compartment involvement
- 2 Flexion contracture more than 20 degrees
- 3 Tibial thrust more 1cm
- 4 patient with a ligament injury
- 5 More than 20 degrees of varus correction required
- 6 History of inflammatory arthritis
- 7 Significant peripheral vascular disease

### Surgical technique

After regional or general anaesthesia, a Skin incision is made on the medial aspect of the proximal tibia. Longitudinal incision starting just below the joint line between the medial border of the patellar ligament and posterior margin of tibia, soft tissue dissection done, K- wire placement done by Leg in full extension and knee joint is placed in exact AP view under fluoroscopy. 2 mm K- wire is passed starting from medial cortex about 4 cms below joint line to proximally towards lateral cortex about 1 cm below joint line, Using saw osteotomy cut is made along the k wires leaving 1 cm of lateral cortex intact. Attention must be given to complete the osteotomy of posteromedial tibial cortex. Osteotomy site is opened with valgus stress for desired angle, which is confirmed by cable method per operatively. It should be opened slowly in Order to prevent fracturing of the lateral cortex. Due to medial collateral ligament, complex the

osteotomy tends to open more anteriorly which increases posterior inclination of tibial plateau. Therefore, it is important to release the long superficial fibres of ligament for symmetrical opening of osteotomy. After opening the osteotomy site. HTO plate along with attached metal block is inserted and locked with locking screws.



**Fig 1:** Skin incision



**Fig 2:** K wire placement



**Fig 3:** Osteotomy saw placement



**Fig 4:** Plate fixation image

**Post-operative protocol**

- 1 Static quadriceps and ankle pumping exercises on the day of surgery
- 2 Non weight bearing walking for 6 weeks
- 3 Partial weight bearing 6 to 12 weeks
- 4 Complete weight bearing after 12 weeks
- 5 Follow up evaluation by standing radiographs, knee society scoring and visual analogue scale

**Results**

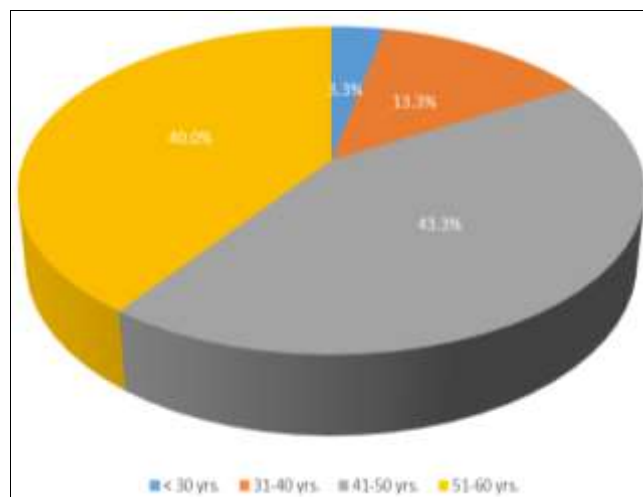
Medial open wedge osteotomy using high tibial osteotomy plate was performed in 30 patients in age group between 25 yrs. to 60 yrs. patients were followed regularly between 3 months to 12 months

**Age distribution**

Out of 30 patients, 12 were between age group of 50 to 60 yrs. and 13 patients between 40 to 50 yrs.

**Table 1:** Age wise distribution of study patients

Variable	Category	N	%
Age	< 30 yrs.	1	3.3%
	31-40 yrs.	4	13.3%
	41-50 yrs.	13	43.3%
	51-60 yrs.	12	40.0%
	Mean	47.33	SD
	Range	26 - 58	



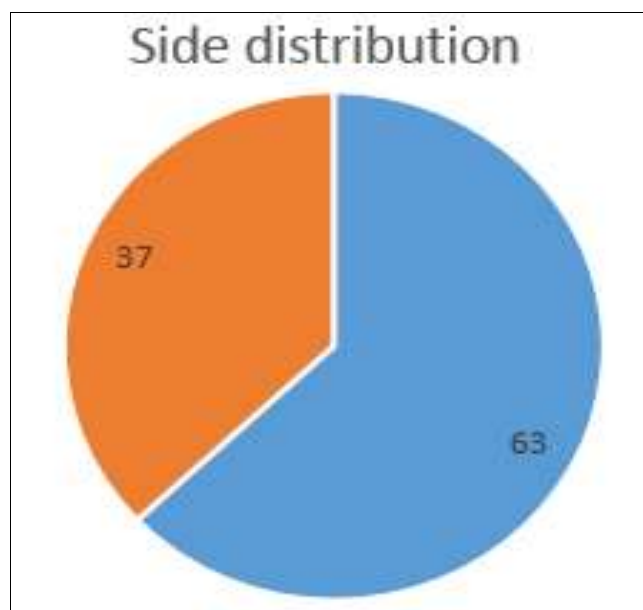
**Fig 5:** Age wise distribution of study patients

**Side of knee involvement**

The left knee is involved in 19 the patients and right knee 11 in patients.

**Table 2:** Side of knee involvement

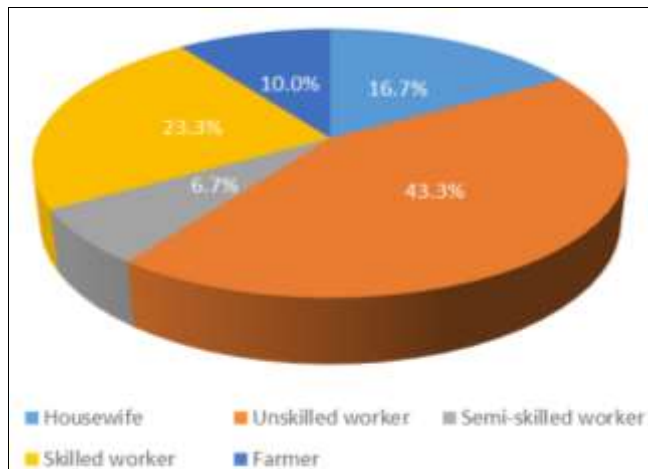
Sex	Frequency	Percentage
Left	19	63%
Right	11	37%
Total	30	100%



**Fig 6:** Sex distribution

**Table 3:** Distribution of study patients based on their Occupation

Variable	Category	N	%
Occupation	Housewife	5	16.7%
	Unskilled worker	13	43.3%
	Semi-skilled worker	2	6.7%
	Skilled worker	7	23.3%
	Farmer	3	10.0%



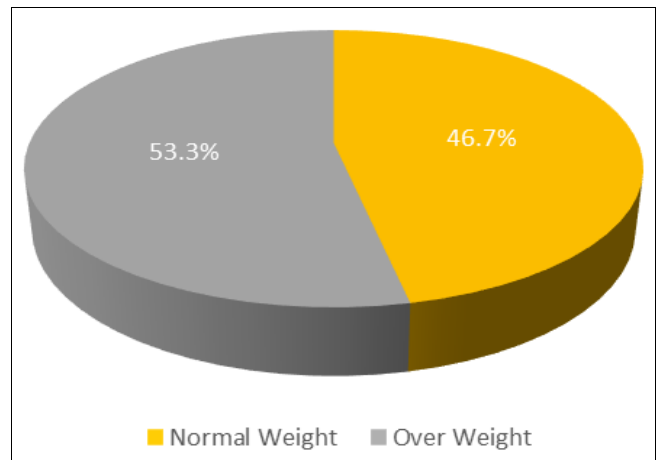
**Fig 7:** Distribution of study patients based on their Occupation

**BMI**

All 30 patients who underwent study within BMI of 35, Out of 30 patients 16 were overweight, 14 were normal weight

**Table 4:** Distribution of study patients based on their BMI Status

Variable	Category	N	%
BMI Status	Normal Weight	14	46.7%
	Over Weight	16	53.3%
	Mean	Mean	SD
	Range	25.22	2.10
		22 - 29	



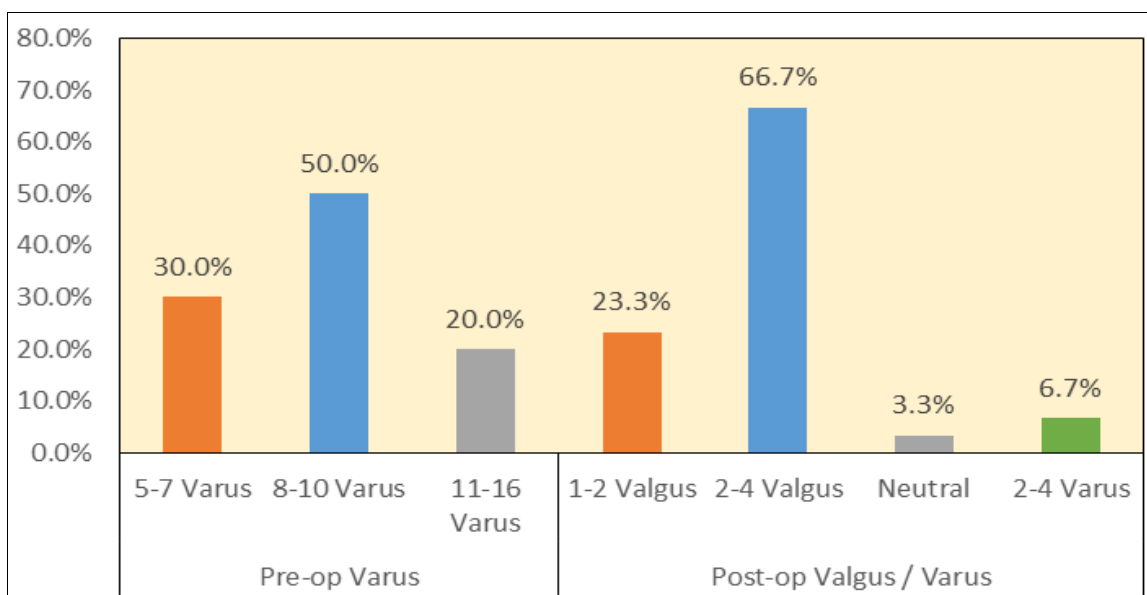
**Fig 8:** Distribution of study patients based on their BMI Status

**Preoperative and postoperative degree of deformity**

The varus deformity in these patients were graded as mild (5-7 degrees), moderate (8-10 degrees), and severe (> 10 degrees). Out of 30 patients 15 patients had moderate varus deformity, 6 had severe and 6 had mild varus deformity

**Table 5:** Distribution of study patients based on the deformity condition

Variable	Category	N	%
Pre-op Varus	5-7 Varus	9	30.0%
	8-10 Varus	15	50.0%
	11-16 Varus	6	20.0%
Post-op Valgus / Varus	1-2 Valgus	7	23.3%
	2-4 Valgus	20	66.7%
	Neutral	1	3.3%
	2-4 Varus	2	6.7%



**Fig 9:** Distribution of study patients based on the deformity condition

**Table 6: Knee Society Score**

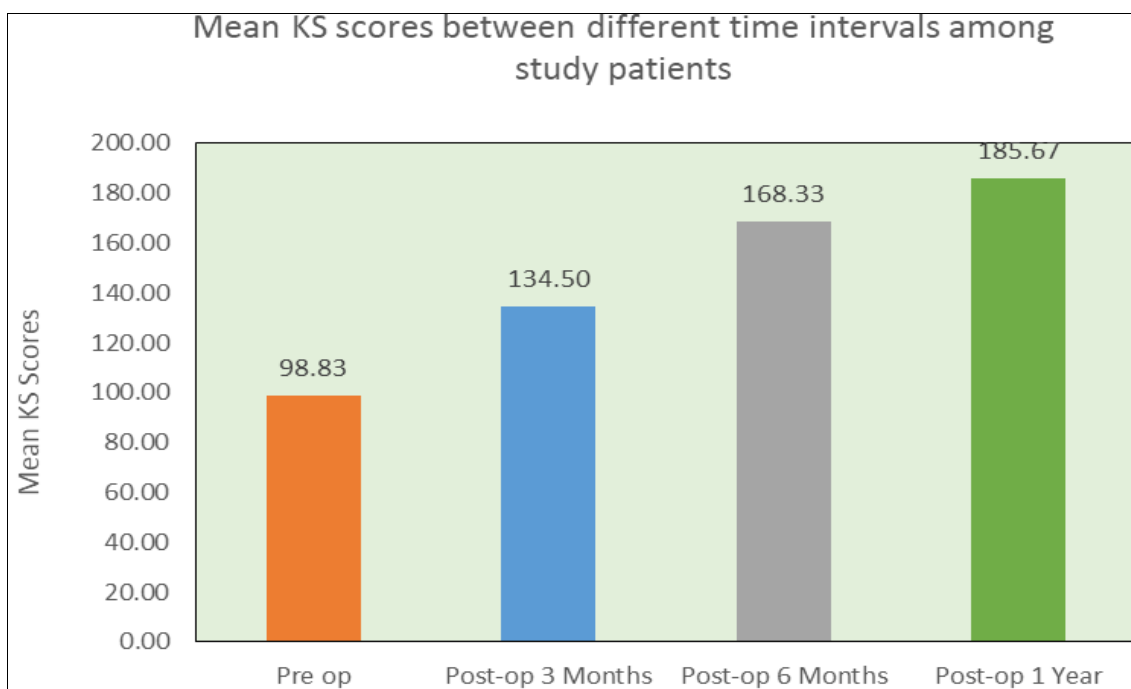
Comparison of mean KS scores between different time intervals among study patients using Repeated Measures of ANOVA Test						
Time	N	Mean	SD	Min	Max	P-Value
Pre op	30	98.83	10.78	75	115	<0.001*
Post-op 3 Months	30	134.50	7.47	120	145	
Post-op 6 Months	30	168.33	11.17	135	190	
Post-op 1 Year	30	185.67	11.12	150	195	

\* - Statistically Significant

**Table 7: Knee Society Score**

Multiple comparisons of mean difference in the KS scores b/w time intervals using Bonferroni's Post hoc Test					
(I) Time	(J) Time	Mean Diff. (I-J)	95% CI for the Diff.		P-Value
			Lower	Upper	
Pre-op	3 Months	-35.67	-42.43	-28.90	<0.001*
	6 Months	-69.50	-77.60	-61.40	<0.001*
	1 Year	-86.83	-95.36	-78.31	<0.001*
3 Months	6 Months	-33.83	-39.34	-28.33	<0.001*
	1 Year	-51.17	-56.67	-45.67	<0.001*
6 Months	1 Year	-17.33	-20.78	-13.89	<0.001*

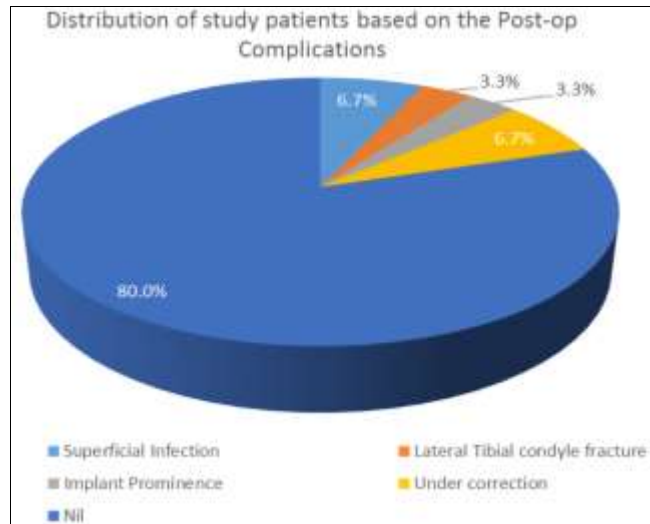
\* - Statistically Significant



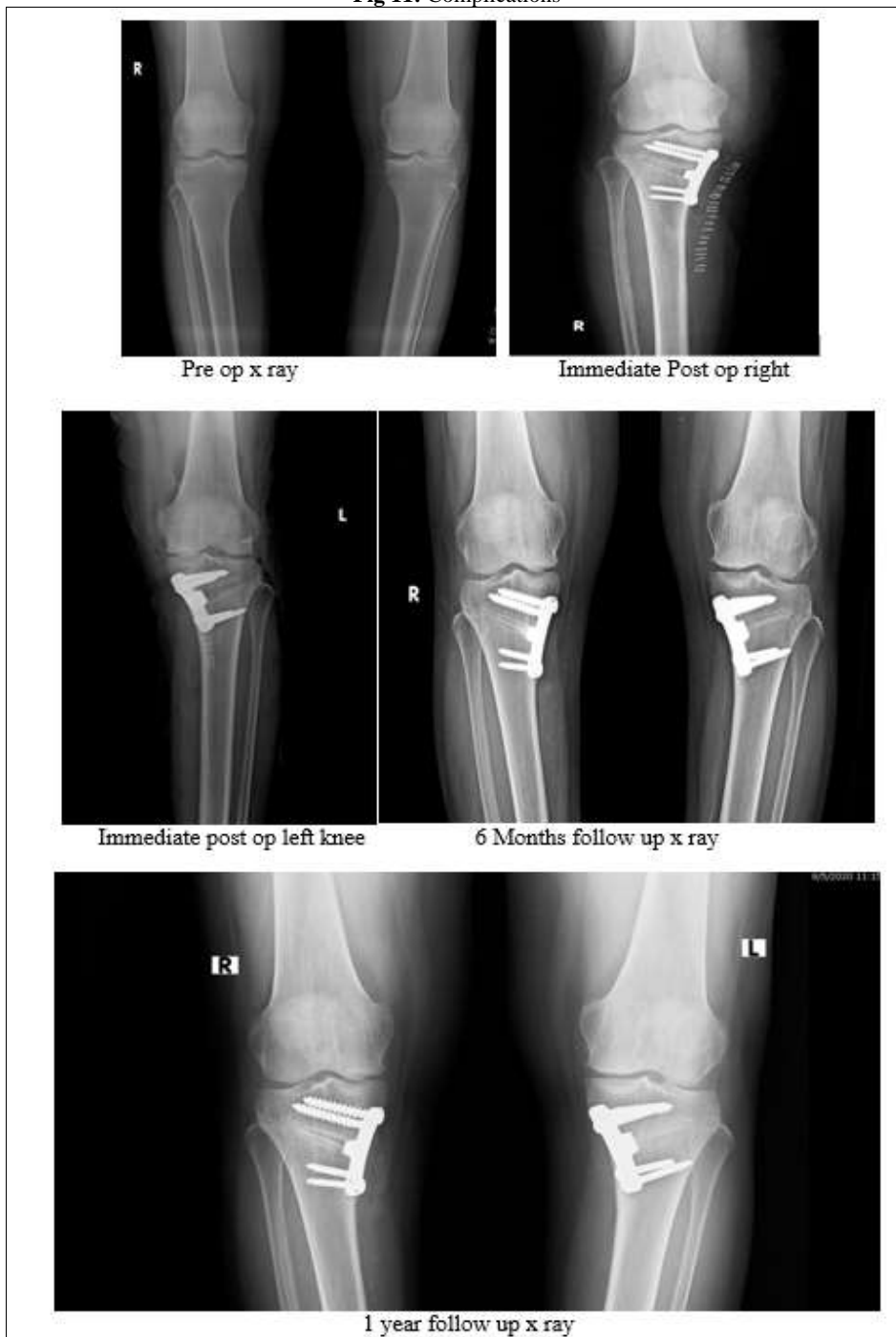
**Fig 10: Knee Society Score**

**Table 8: Complications**

Distribution of study patients based on the Post-op Complications			
Variable	Category	N	%
Post-op Complications	Superficial Infection	2	6.7%
	Lateral Tibial condyle fracture	1	3.3%
	Implant Prominence	1	3.3%
	Under correction	2	6.7%
	Nil	24	80.0%



**Fig 11:** Complications



**Fig 12:** A 45-year-old Patient with bilateral OA knee of medial compartment operated within span of 6 months, images showing follow up x-ray

## Discussion

In medial compartment osteoarthritis of knee due to shifting of weight bearing on medial side, results in more cartilage destruction and varus deformity. Total knee replacement and unicompartmental knee replacement is not good option for young patients with good functional activities. High tibial osteotomy is ideal treatment for these patients to slow down the degenerative process<sup>[11, 12]</sup>.

Song *et al* have analysed the complications of 90 medial opening wedge and 104 lateral closing wedge osteotomies. They stated that opening osteotomy is associated with lesser complications<sup>[13]</sup>. Luites *et al* stated intended correction was achieved more correctly with medial opening wedge technique<sup>[14]</sup>.

In our study Out of 30 patients operated 10 were female and 20 were male, more number of male patients were reported in this study.

Out of 30 patients, 12 were between age group of 50 to 60 yrs and 13 Patients between 40 to 50 yrs., Osteoarthritis is disease of elderly patient, we selected the patients under 60 years in our study. Mean age in our study is 47 years. Most of knee are left knee.

Most of the study population i.e 43% population, are unskilled workers like Labourer, followed by skilled workers about 23% of the total study population, More than 11 patients in our study presented with a long duration of illness, which affected their day to day activities.

Body mass index (BMI) is the important factor to get the best outcome following surgery, all study population are with less than 35% BMI, in which 53% with overweight and 47% with normal weight, with a mean BMI of 25.22%.

Come to the pre-operative deformity assessment, most of the patients who underwent surgery are i.e 50% are with a moderate degree of varus deformity, only 20% of patients with a severe degree of varus deformity on pre-operative evaluation, all patients are less than 200 varus deformity.

Slight overcorrection in HTO produces more satisfying results. However, the optimal degree of valgus angulation is still controversial.

Dugdale *et al.* recommended a 3-5 degree valgus mechanical axis, whereas other authors suggested 3-6, 3-7, or 7-9 degree. Coventry *et al.* reported that the 10-year survival rates were 63% in knees with 5degree valgus angulation, 87% in knees with 6-7 degree valgus angulation, and 94% in knees with  $\geq 8$  degree valgus angulation.

In this study around 67% of patients shows post op 2-4 degree of valgus correction i.e acceptable according to literature, 2 patients they presented with under correction post operatively with the clinical and radiological poor outcomes on follow up The test results demonstrate the mean KS scores for different time intervals. The mean KS score for the pre-op period was  $98.83 \pm 10.78$ , for the Post-op period 3 months was  $134.50 \pm 7.47$ , for Post-op 6 months was  $168.33 \pm 11.17$  and for the Post-op 1-year period was  $185.67 \pm 11.12$ . This difference in the mean KS scores between different time intervals was statistically significant at  $P < 0.001$ .

Multiple pairwise comparisons of the mean difference in the KS scores between time intervals revealed that the Post-op 1 year showed significantly highest mean KS scores as compared to other time intervals at  $P < 0.001$ . This was followed next by Post-op 6 months' time period showing significantly higher mean KS scores as compared to Post-op 3 months' time period and Pre-op period at  $P < 0.001$ . Later, Post-op 3 months' period also showed significantly higher mean KS scores as compared to Pre-op period at  $P < 0.001$ .

This infers that the KS scores significantly increased from Pre-op to Post-op 3 months, 6 months and 1-year period.

Complications in this study are minimal, 80% study population reported with no complications on follow up, 2 patients presented with under correction, 2 patient had superficial infection within 4 weeks of surgery which was healed completely, one patient during surgery reported with lateral condyle tibia fracture which was immobilized shows union on after 6-8 weeks.

Total knee replacement after HTO has variable results. Amendola *et al.* In their study compared results of primary TKR with TKR following HTO. They concluded that previous osteotomy does not affect the results of knee replacement<sup>[17]</sup>. Karabatsos *et al.* in their cohort study stated that TKR following HTO is more challenging technically than primarily TKR<sup>[18]</sup>. Haslam *et al.* have poorer results in patients underwent TKR following HTO and are comparable to revision arthroplasty. Opening wedge osteotomies have advantage of preserving bone stock for future arthroplasty<sup>[18]</sup>. Limitations of study is short term follow up and small sample size. But this short term study shows that HTO is good option for unicompartmental osteoarthritis knee in young active patients.

## Conclusion

High tibial medial opening wedge osteotomy is a good option in the treatment of unicompartmental osteoarthritis knee in young and active individual. It relieves pain and improves functional outcome, HTO prevents further progression of the OA. Patients may not need TKR in future, Accurate preoperative planning and good surgical technique gives better results, Results will be maximum after 1 year of surgery, it does not affect future total knee replacement, Bone grafting is not needed for all patient.

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