

FUNCTIONAL RESULTS OF HIGH TIBIAL OSTEOTOMY IN KL GRADE 4 OSTEOARTHRITIS OF KNEE

Atanu Ganguly¹, Debojyoti Mukherjee², Sunit Hazra³, Sandip Ghosh³

¹Junior Resident, Department of Orthopaedics, R G Kar Medical College, Kolkata, West Bengal, India

²Associate Professor, Department of Orthopaedics, RG Kar Medical College, Kolkata, West Bengal, India.

³Associate Professor, Department of Orthopaedics, RG Kar Medical College, Kolkata, West Bengal, India.

⁴Professor, Department of Orthopaedics, RG Kar Medical College, Kolkata, West Bengal, India

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Corresponding Author:
Dr. Debojyoti Mukherjee,
Email: debojyoti64@gmail.com

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Abstract

Background: The most prevalent joint condition, osteoarthritis (OA) of the knee affects 10% of males and 13% of women over 60. An estimated 45% of people will develop knee OA in their lifetime.² Varus malalignment is the most prevalent deformity associated with osteoarthritis (OA) of the knee. It increases the stresses passing through the medial compartment, leading to cartilage deterioration and clinical arthritis. There is no concrete proof that any of the many conservative treatment methods for deloading the medial compartment—including braces, insoles, and physical therapy to strengthen the periarticular muscles—will be beneficial in the long run.³ High Tibial Osteotomy (HTO), which was first described in 1958, has grown in acceptance and changed throughout time. Available literature focuses on replacement surgeries for grade 4 OA of knee but there have been no current studies investigating the result of MOWHTO in the KL grade 4 OA knee. The UK Knee Osteotomy Consensus Group has recently declared that bone-on-bone osteoarthritis (OA) should not be seen as an absolute reason to avoid high tibial osteotomy (HTO), among other factors^{7–9}. **Materials and Methods:** Individuals that visited our hospital's orthopaedic outpatient department from August 2022 to September 2024. Weight bearing radiographs and a clinical examination were used to assess the patients. Patients who met the eligibility requirements and were diagnosed with Gr 4 (KL. Gr.) osteoarthritis with knee pain not improved by conservative treatment were chosen for HTO. **Result:** We compared the outcomes across different groups and used descriptive statistics to analyse the data. Summaries of the quantitative data were expressed as mean \pm SD, while the categorical data were expressed as proportions and percentages (%). **Conclusion:** The resurgence of osteotomy surgery has facilitated the use of novel methods and approaches to extend the life of the original knee by leveraging well-established concepts. Achieving the best possible surgical results depends on selecting the proper patients, and criteria for selecting patients are always being updated to encompass a greater range of individuals. Thanks to developments in preoperative planning, surgical techniques, and a team approach with improved rehabilitation, surgeons can now safely and dependably handle challenging clinical situations. HTO is crucial for preserving the original knee in individuals who are suitably chosen.

INTRODUCTION

While arthroplasty is often used to treat end-stage knee osteoarthritis (OA), its results are less than ideal for younger patients. According to recent arthroplasty registries and pertinent articles, individuals under the age of 55 who undergo knee

replacement surgery have a lifetime chance of needing a revision surgery that falls between 20 and 35%. Additionally, these patients also experience a significant level of discontent.^[1-3]

High tibial osteotomy (HTO), traditionally performed as a closed wedge procedure, is a well-established surgical technique used to treat

osteoarthritis in the medial compartment of the knee. However, its popularity has declined due to the success of arthroplasty. HTO functions by deliberately adjusting the mechanical axis of the lower leg to alleviate pressure on the inner compartment and distribute it to the healthy outer compartment⁴. Medial opening-wedge high tibial osteotomy (MOWHTO) has become increasingly popular due to its avoidance of fibular osteotomy, common peroneal nerve dissection, disruption of the proximal tibiofibular joint, and bone stock loss, which are associated with closing wedge HTO. MOWHTO has several benefits, including the ability to correct multiple planes and facilitate future total knee replacement procedures.^[4,5]

While this surgical method has been commonly employed to treat active, young, and middle-aged persons with isolated medial compartment knee osteoarthritis (OA), the existing research primarily focuses on findings from the Western population^{5,6}. Moreover to the best of authors knowledge there have been no current studies investigating the result of MOWHTO in the KL grade 4 OA knee. So, there is earnest necessity to find out the functional outcome of high tibial osteotomy in these patients.^[6] Patients should show significant improvements in clinical, functional, and survival outcomes, as well as alignment preservation, which can delay the need for an arthroplasty. The research that is now available concentrates on knee replacement procedures for grade 4 OA, but no studies have looked into the effects of MOWHTO in KL grade 4 OA knees. Among other considerations, the UK Knee Osteotomy Consensus Group has stated that bone-on-bone osteoarthritis (OA) should not be viewed as a definitive cause to forego high tibial osteotomy (HTO).^[7-9]

We expect that patients would demonstrate preservation of alignment, along with significant clinical, functional and survival outcomes that can postpone arthroplasty.

MATERIALS AND METHODS

Individuals that visited our hospital's orthopaedic outpatient department from August 2022 to September 2024. Weight bearing radiographs and a clinical examination were used to assess the patients. Patients who met the eligibility requirements and were diagnosed with Gr 4 (KL Gr.) osteoarthritis with knee pain not improved by conservative treatment were chosen for HTO. The patients with Normal ligament balance, Isolated medial sided knee pain, Age 40 to 60 years, BMI <30, range of motion (ROM) of the knee larger than 90° were included and

Obese patients (BMI \geq 30), patients with Bicompartamental and tricompartmental osteoarthritis, Fixed flexion contracture, Previous knee surgery, Inflammatory arthropathy, Active knee infection were excluded.

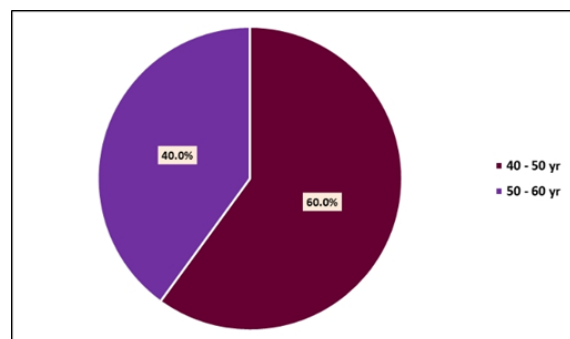
Method

An MRI scan is performed as part of a routine assessment for a patient undergoing a high tibial osteotomy (HTO). The MRI makes it possible to evaluate a number of factors to assess a patient's appropriateness for an osteotomy. An MRI can also be used to determine whether further therapy, such ligament restoration or cartilage repair, is required. When confirming the extent of a disease affecting the lateral and patellofemoral compartments, an MRI is especially helpful. However, traditional X-ray imaging procedures such anteroposterior (AP), lateral, Rosenberg, Skyline views, and long leg films may also yield sufficient information, as may a thorough evaluation by a medical practitioner.

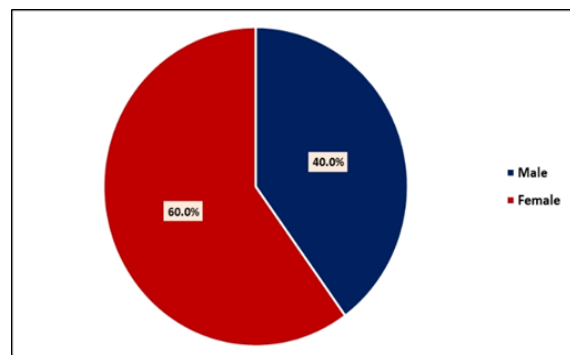
RESULTS

We compared the outcomes across different groups and used descriptive statistics to analyse the data. Summaries of the quantitative data were expressed as mean \pm SD, while the categorical data were expressed as proportions and percentages (%).

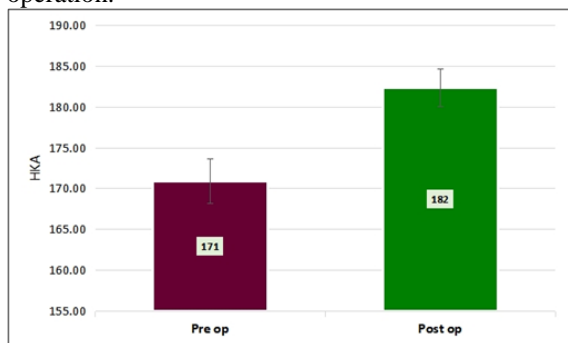
The study sample consisted of individuals divided into two age groups. The first group, aged 40 to 50 years, comprised 15 participants, accounting for 60.0% of the total sample. The second group, aged 50 to 60 years, included 10 participants, making up 40.0% of the sample. The overall mean age of the participants was 47.92 years with a standard deviation of 4.09 years.



The study sample was composed of 25 participants, with 10 males making up 40.0% of the group and 15 females constituting the remaining 60.0%.



The study measured the hip-knee-ankle (HKA) angle at two different time points: preoperative and postoperative. Preoperatively, the mean HKA angle was 170.92 degrees with a standard deviation (SD) of 2.72. Postoperatively, the mean HKA angle increased to 182.32 degrees with an SD of 2.29. This represents a mean change of 11.40 degrees with an SD of 2.84. The paired t-test for this change yielded a t-value of 20.08, with a p-value of less than 0.001, indicating a statistically significant improvement in the HKA angle following the operation.



The study evaluated the weight-bearing line (WBL) point, also known as the Miculiz line, at two time points: before and after surgery. Preoperatively, the mean WBL point was 2.36 with a standard deviation (SD) of 7.81. Postoperatively, the mean WBL point significantly increased to 50.52 with an SD of 3.03. This represents a mean change of 48.16 with an SD of 8.18. The paired t-test for this change resulted in a t-value of 20.08, with a p-value of less than 0.001, indicating a statistically significant improvement in the WBL point following the surgery.

The study assessed the Western Ontario and McMaster Universities Arthritis Index (WOMAC) score at multiple postoperative time points to evaluate the improvement in patient outcomes. Preoperatively, the mean WOMAC score was 83.92 with a standard deviation (SD) of 3.80. At three months post-surgery, the mean WOMAC score significantly decreased to 69.48 with an SD of 4.98, representing a mean change of -14.44 with an SD of 5.34. The paired t-test for this change resulted in a t-value of 13.52 and a p-value of less than 0.001, indicating a statistically significant improvement.

At six months post-surgery, the mean WOMAC score further decreased to 40.24 with an SD of 6.81. This represented a mean change of -43.68 with an SD of 8.61. The paired t-test for this interval showed a t-value of 25.38 with a p-value of less than 0.001, demonstrating a highly significant improvement.

One year post-surgery, the mean WOMAC score dropped to 17.08 with an SD of 4.79, showing a mean change of -66.84 with an SD of 7.14. The paired t-test for this change yielded a t-value of 46.81 and a p-value of less than 0.001, confirming a

substantial and statistically significant improvement in the WOMAC scores from preoperative levels.

The study assessed the Western Ontario and McMaster Universities Arthritis Index (WOMAC) score across two age groups, 40-50 years and 50-60 years, at different postoperative time points to evaluate improvements in patient outcomes.

For the 40-50 years age group, the mean preoperative WOMAC score was 84.33 with a standard deviation (SD) of 4.42. At three months post-surgery, the mean WOMAC score decreased to 69.87 with an SD of 5.36, representing a mean change of 14.47 with an SD of 5.84. The paired t-test for this change showed a t-value of 9.59 and a p-value of less than 0.001, indicating a statistically significant improvement. At six months post-surgery, the mean WOMAC score further decreased to 40.53 with an SD of 6.51, corresponding to a mean change of 43.80 with an SD of 9.24. The paired t-test for this period yielded a t-value of 18.35 with a p-value of less than 0.001. One year post-surgery, the mean WOMAC score dropped to 17.07 with an SD of 4.95, reflecting a mean change of 67.27 with an SD of 8.06. The paired t-test for this change showed a t-value of 32.33 and a p-value of less than 0.001, indicating substantial improvement.

In the 50-60 years age group, the mean preoperative WOMAC score was 83.30 with an SD of 2.71. At three months post-surgery, the mean WOMAC score decreased to 68.90 with an SD of 4.56, representing a mean change of 14.40 with an SD of 4.79. The paired t-test for this change showed a t-value of 9.51 and a p-value of less than 0.001. At six months post-surgery, the mean WOMAC score decreased further to 39.80 with an SD of 7.57, corresponding to a mean change of 43.50 with an SD of 8.03. The paired t-test for this period resulted in a t-value of 17.13 with a p-value of less than 0.001. One year post-surgery, the mean WOMAC score was 17.10 with an SD of 4.79, reflecting a mean change of 66.20 with an SD of 5.85. The paired t-test for this change showed a t-value of 35.81 and a p-value of less than 0.001, demonstrating significant improvement in the WOMAC scores from the preoperative levels.

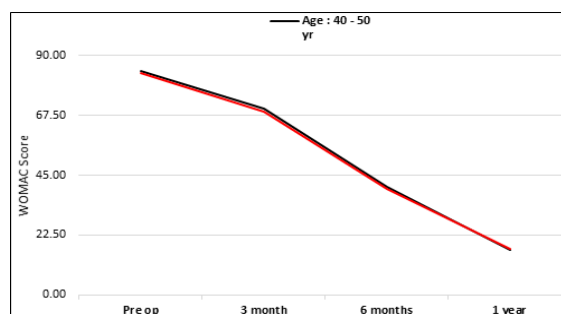


Table 1: Distribution of Cases according to Age.

Age Group	No.	%
40 - 50 yr	15	60.0%

50 - 60 yr	10	40.0%
Mean±SD	47.92±4.09 year	

Table 2: Distribution of Cases according to Sex

Sex	No.	%
Male	10	40.0%
Female	15	60.0%

Table 3: Pre to Post op Changes in HKA Level

Time	HKA	
	Mean	SD
Pre op	170.92	2.72
Post op	182.32	2.29
Change	11.40	2.84
paired t test	t=20.08, p<0.001	

Table 4: Pre to Post op Changes in WBL Point

Time	WBL Point (Miculiz line)	
	Mean	SD
Pre op	2.36	7.81
Post op	50.52	3.03
Change	48.16	8.18
paired t test	t=20.08, p<0.001	

Table 5: Pre to Post op Changes in WOMAC Score

Time	WOMAC Score		change from pre op		paired t test	
	Mean	SD	Mean	SD	t-value	p-value
Pre op	83.92	3.80	-	-	-	-
3 month	69.48	4.98	-14.44	5.34	13.52	<0.001
6 months	40.24	6.81	-43.68	8.61	25.38	<0.001
1 year	17.08	4.79	-66.84	7.14	46.81	<0.001

Table 6: Pre to Post op Changes in Womac Score among Different Age Categories

Age Group	Time	WOMAC Score		change from pre op		paired t test	
		Mean	SD	Mean	SD	t-value	p-value
Age : 40 - 50 yr	Pre op	84.33	4.42	-	-	-	-
	3 month	69.87	5.36	14.47	5.84	9.59	<0.001
	6 months	40.53	6.51	43.80	9.24	18.35	<0.001
	1 year	17.07	4.95	67.27	8.06	32.33	<0.001
Age : 50 - 60 yr	Pre op	83.30	2.71	-	-	-	-
	3 month	68.90	4.56	14.40	4.79	9.51	<0.001
	6 months	39.80	7.57	43.50	8.03	17.13	<0.001
	1 year	17.10	4.79	66.20	5.85	35.81	<0.001

DISCUSSION

Achieving the required alignment precisely is essential to HTO's success. The long-term effectiveness of HTO depends on precise radiographic alignment of the mechanical axis of the limb. According to Hernigou et al.'s research, knees that had a HKA angle between 183 and 186 degrees had the best outcomes. The Hip-Knee-Ankle (HKA) angle in our research was 170.92 degrees on average with a standard deviation (SD) of 2.72 before the operation, and 182.32 degrees on average with an SD of 2.29 thereafter. One possible explanation for the under-correction might be the electrocautery cord test's confirmation of perioperative correction.^[10-15]

Without a doubt, following precise directions is essential to getting excellent results. The current consensus is that individuals who are not fat and relatively young should be the primary candidates for contemporary high tibial osteotomy (HTO). But

there aren't any strict restrictions based on OA grade8 or body mass index (BMI).^[16-19]

Due to comparable patient demographics, function after high tibial osteotomy (HTO) and unicompartmental knee arthroplasty (UKA) are frequently compared. Cao et al. compared the results of UKA and HTO surgery by a thorough review and meta-analysis. It was discovered that the functional outcomes of the two groups were identical. The HTO group was able to move more freely.^[20-23]

People in this area typically squat for normal sitting as well as for using the loo. After replacement surgery, it is extremely suggested to avoid squatting. Furthermore, the bulk of Asians living in rural areas cannot afford the excessive costs involved. In this group, manual labour is a common source of income, therefore having an arthroplasty requires these patients to change the nature of their jobs. The WOMAC score was 83.92 on average, with a 3.80 standard deviation (SD), prior to the procedure. Three months after the procedure, the average WOMAC score dropped significantly to 69.48, with

a 4.98 standard deviation. The average WOMAC score dropped to 40.24 six months after the procedure, with a 6.81 standard deviation. The average WOMAC score dropped to 17.08 with a standard deviation of 4.79 after a year after the procedure.^[24,25]

CONCLUSION

The revival of osteotomy surgery has made it easier to use new techniques and strategies to prolong the life of the original knee by utilising established ideas. Choosing the right patients is essential to achieving optimal surgical outcomes, and the standards for choosing patients are always changing to include a wider variety of people. Surgeons may now reliably and securely treat difficult clinical circumstances thanks to advancements in preoperative planning, surgical procedures, and a collaborative approach with enhanced rehabilitation. In those who are appropriately selected, HTO is essential in maintaining the original knee. HTO demonstrates efficacy in enhancing pain relief, functional capacity, daily activities, and overall quality of life in those afflicted with medial compartment osteoarthritis of the knee. The Hip Knee Ankle (HKA) angle is a crucial characteristic that must be restored in order to get improved functional outcomes. So in young KL grade 4 OA patients, high tibial osteotomy is an excellent procedure to obtain a favourable functional outcome with preservation of knee.

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