

A prospective study for initial assessment of functional outcome of high tibial osteotomy in active young adults in early osteoarthritis of knee

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Study performed at Department of Orthopaedics and Trauma Centre in J. A. Group of Hospitals, Gwalior (M. P.)

Abstract

Introduction: Knee osteoarthritis is typically the result of wear and tear and progressive loss of articular cartilage. Common clinical symptoms include knee pain, stiffness and swelling that worsens over time. Osteoarthritis commonly affects the medial compartment of knee giving rise to varus deformity. High tibial osteotomy (HTO) is a valuable treatment modality in correcting malalignment and thereby relieving the symptoms associated with medial unicompartamental osteoarthritis.

Methodology: Twenty-eight young patients with complaints of knee pain were screened and those diagnosed as early knee osteoarthritis (grade I-III on Kellgren-Lawrence grading scale) were operated by high tibial osteotomy. Follow-up evaluation was done at 3, 6 and 9 months by Knee Society Scoring Scale and Visual Analogue Scale (VAS) for pain.

Results: The mean knee score was 53.3 pre-operatively and post-operatively the score improved gradually to the mean of 83.2 at 9 months. The visual analog scale for pain in all patients showed a significant improvement at the final follow-up.

Conclusion: High tibial medial opening wedge osteotomy is a good option in the treatment of unicompartamental osteoarthritis knee. It relieves pain and improves functional outcome. Accurate preoperative planning and good surgical technique gives better results.

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Introduction

Knee osteoarthritis (OA), also known as degenerative joint disease, is typically the result of wear and tear and progressive loss of articular cartilage. It is most common in the elderly. Knee osteoarthritis can be divided into two types, primary and secondary. Primary osteoarthritis is articular degeneration without any apparent underlying reason. Secondary osteoarthritis is the consequence of either an abnormal concentration of force across the joint as with post-traumatic causes or abnormal articular cartilage, such as rheumatoid arthritis (RA).[1]

Osteoarthritis of knee is chronic debilitating disease-causing considerable disability which is increasing in incidence even in younger population. Global statistics reveal that osteoarthritis accounts for 3% of total global 'years lived with disability' and is associated with significant health and welfare costs. On an average 3.62 per hundred yearly prevalence was found, it increased from 3.31 (2011) to 3.91 (2014). Females were 63%, whereas males were 37%. Among overall prevalent cases, 4.23% were undergone total knee arthroplasty surgeries. Compared to males, odd for females was found at high risk (1.393) Common clinical symptoms include knee pain that is gradual in onset and worse with activity,

knee stiffness and swelling, pain after prolonged sitting or resting, and pain that worsens over time. Treatment for knee osteoarthritis begins with conservative methods and progresses to surgical treatment options when conservative treatment fails.[2]

Osteoarthritis commonly affects the medial compartment of knee giving rise to varus deformity in majority of cases. Significant varus deformity further aggravates the pathology due to medialization of the weight bearing axis. High tibial osteotomy (HTO) is a valuable treatment modality in correcting malalignment and thereby relieving the symptoms associated with medial unicompartmental osteoarthritis.

The goals of HTO are twofold: 1) to reduce knee pain by transferring weight-bearing loads to the relatively unaffected lateral compartment in varus knees; and 2) to delay the need for a knee replacement by slowing or stopping destruction of the medial joint compartment. This is achieved by a partial unloading of the medial compartment with a slight overcorrection of the mechanical axis (from 6 to 10° of valgus). Hence this study is done to assess the functional outcome in active young adults with early osteoarthritis knee undergoing High Tibial Osteotomy using knee society score.

Material and Method

It is a prospective interventional single center study conducted in Department of Orthopaedics, Gajra Raja Medical College, Gwalior, during the period between 2022 to June 2023 after permission from Institutional Ethical committee. The young patients between the age group of 40-60 years attending the OPD with complaints of knee pain and disability resulting from osteoarthritis were screened and those classified in grade I to III on the Kellgren-Lawrence grading scale (early knee osteoarthritis) were chosen for the study. Exclusion criteria was patients with secondary osteoarthritis, tumors, metabolic diseases of bone, patient receiving steroid injection within past 6 months, more than 20 degrees of correction needed and hemoglobin less than 10 mg%. Twenty-eight patients were included in the study after prior well-informed written consent and were assessed preoperatively and

postoperatively with Knee Society score. All the data are entered into the protocol proforma and are analyzed by statistical analysis using SPSS version 16. Mean, Standard Deviation, Chi-square test are used to analyze the result and test the significance.



Fig 1. X-ray image of bilateral knees showing early osteoarthritis changes.



Fig 2. Pre-operative scannogram of the patient.

Surgical technique: A skin incision made on the medial aspect of proximal tibia, longitudinal incision starting just below the joint line between the medial border of patellar ligament and posterior margin of tibia, subcutaneous tissue dissected and pes anserinus retracted posteriorly. this exposes medial collateral ligament and dissected until posteromedial cortex of proximal tibia is exposed then leg is placed 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 cm below joint line to proximally towards lateral cortex about 1 cm below joint line. Second k-wire is passed parallel and anterior to first one than 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. It should be opened slowly in order to prevent fracturing of the lateral cortex. After opening the osteotomy site, HTO plate along with

attached metal block is inserted and locked with locking screws.



Fig 3. C-arm image of K-wire insertion.



Fig 4. C-arm image of osteotome insertion.



Fig 5. Intra operative of HTO plate fixation

Post operative protocol was static quadriceps and ankle pumping exercises started on the day of surgery. Non weight bearing walking advised for 6 weeks and partial weight bearing for 6 to 12 weeks. Complete weight bearing started after 12 weeks. Follow-up evaluation at 3, 6 and 9 months is done by knee society scoring scale and VAS for pain.

Results

Patient 1



Fig 6. Post operative 6 month follow up scannogram



Fig 7. Post operative 6 month follow up xray Patient 2

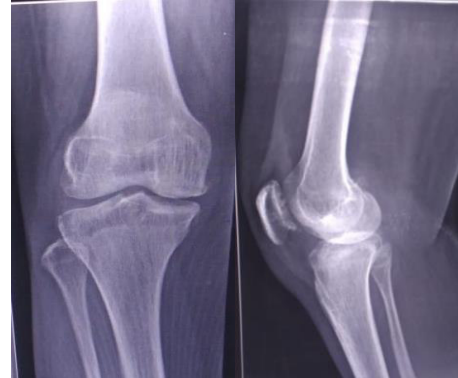


Fig 8. Pre op xray of patient 2



Fig 9. Post of 6 month follow up



Fig 10- post op 9 month follow up of patient

Table 1 shows that the age of the patients had ranged from 40 – 60 years with a mean age of 50.3 years and maximum number of patients were in the age group of 51-55 years (35%). Among the 28 patients 18 were females and 10 were males. For majority of the patient's right side of the knee (58%) was involved and in 5 patients bilateral knee was involved. 53.5% of the patients had grade III type of Osteoarthritis followed by grade II type (35.8%) of Osteoarthritis (Table 3).

The grading of the knee society was done as score below 60 was considered as poor, score 60 – 69 was considered as fair, score 70 – 79 was good and score 80 – 100 is excellent. The mean knee score was 53.3 pre-operatively which was considered as poor. All the patients were followed at the interval of 3, 6 and 9 months and the patients knee score were assessed using the standard orthopedics knee society protocol. Table 4 shows that the patients total knee score gradually improved over the period. The score was initially in the range of fair to good i.e. 62.1 ± 3.5 at 3 months and 74.5 ± 5.3 at 6 months and at the 9th month it was excellent (83.2 ± 6.2) which was proven to be statistically significant ($p < .0001$). On visual analogue scale for pain, the score of 0 was considered as no pain, score 1-3 was mild pain, score 4-6 was moderate pain and 7-10 was severe pain. The pVAS also showed gradual improvement from 5.1 ± 0.9 at 3 months, 3.5 ± 1.2 at 6 months to 2.2 ± 0.9 at 9 months which was proven to be statistically significant ($p < .0001$).

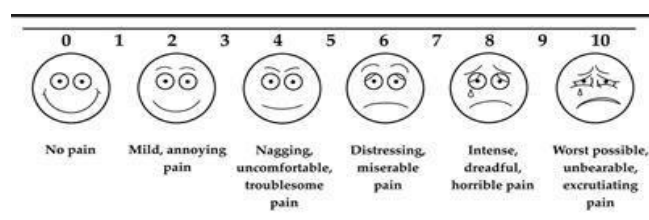


Table 5 shows that the patients who were in the grade of poor based on the total knee score before the high tibial osteotomy had improved to excellent after the surgery. The average pVAS in all patients improved from 7.4 ± 1.5 points preoperatively to 2.2 ± 0.9 points at the final follow-up.

In our study, the medial tibio-femoral joint space was increased and there was radiological benefit as valgus angle was increased.

Out of 28 patients, complications were noted in total 6 patients (table 6). Infection was reported in 2 patients and was the most common complication in our study. There was loss of angle correction radiologically in 2 patients on follow-up, despite the on-table angle correction. Impinging of implant was reported in 1 patient. Deformity at the joint was noted in 1 patient on follow-up.

Table 1: Age wise distribution of the study population.

Age in years	Frequency	Percentage
40-45	4	14
46-50	5	18
51-55	10	35
56-60	9	33
Total	28	100
Mean age (in years)	50.3	

Table 2: Gender wise distribution of the study population.

Gender	Number	Percentage
Male	10	36
Female	18	64
Total	28	100

Table 3: Distribution of the study population based on grading of Osteoarthritis by Kellgren and Lawrence

Grading of Osteoarthritis	Frequency	Percentage
I	3	10.7
II	10	35.8
III	15	53.5
Total	28	100

Table 4: Mean and Standard Deviation of the knee society score among the study population after high tibial osteotomy.

Score	Postoperative period (Mean±SD)			P value
	3 months	6 months	9 months	
Knee Society Score	62.1 ± 3.5	74.5 ± 5.3	83.2 ± 6.2	<.0001
Visual Analogue Scale (VAS) for pain	5.1 ± 0.9	3.5 ± 1.2	2.2 ± 0.9	<.0001

Table 5: Mean and Standard Deviation of the Knee society Score before and after high tibial osteotomy.

Score (Mean±SD)	Before surgery	After surgery (end of 9 months)	P value
Knee Society Score	53.3 ± 2.1	83.2 ± 6.2	<.0001
Visual Analogue Scale (VAS) for pain	7.4 ± 1.5	2.2 ± 0.9	<.0001

P value derived by applying paired T test

Table 6: Post-operative complications in study population.

Complication	Number of patients	Percentage
Infection	2	7.1
Loss of angle correction	2	7.1
Impingement of implant	1	3.5
Deformity	1	3.5

Discussion

The present study had shown a favorable outcome for high tibial osteotomy and the 28 osteoarthritis patients with varus deformity had shown a statistically significant improvement in knee society score at 9 months follow-up following the surgery.

Ivarsson et al. [3] performed 99 lateral closing wedge High Tibial Osteotomy, fixed with staples and immobilized in a cast. They reported 75% of good and acceptable outcomes at 5.7 years and 60% at 11.9 years.

Asik et al. [4] performed 65 open wedge osteotomies fixed with the Puddu plate. They reported significant improvement of pain and knee function at an average follow-up of 34 months.

In our study there was significant improvement in pain with improvement on VAS from 7.4 ± 1.5 to 3.50 ± 1.2 in 6 month follow up to 2.2 ± 0.9 in 9 month follow up

Giuseffi, Steven A. et al (2015) [5] did 100 medial high tibial osteotomies and stated that pain was minimal or mild in 65% of patients, moderate in 16%, and severe in 19% in a mean follow up period of 4 years.

Schuster P et al. (2018) [6] studied that subjective International Knee Documentation Committee [IKDC] score significantly improved from 44 ± 11 preoperatively to 70 ± 13 at one, 66 ± 15 at three, 66 ± 15 at five, and 65 ± 17 at ten years ($P < .001$ at any point of follow-up).

Britt Ollivier et al (2021) [7] in their study found that the 5-year, 10-year, 15-year and 20-year survival rates, respectively, ranged from 86 to 100%, 64-97.6%, 44-93.2% and 46-85.1%. The anatomical and mechanical tibiofemoral axis were, respectively, corrected

to a mean of 7.3° - 13.8° of valgus and 0.6° - 4° of valgus.

In our study the pVAS showed improvement from 7.4 ± 1.5 points preoperatively to 2.2 ± 0.9 points at the final 9 months follow-up. Similar improvement was also noted in the retrospective study done by Kim et al. (2019) [11] where the average pVAS in all 66 patients improved from 7.1 ± 1.7 points preoperatively to 1.0 ± 0.8 points at the 35.9 ± 22.0 months follow-up.

In the study by Britt Ollivier et al (2021) [7], the subjective scoring systems showed an improvement postoperatively that was maintained until mean follow-up of more than 10 years.

In our study there was significant improvement in knee society score from 53.3 ± 2.1 to 83.2 ± 6.2 , there was increase in range of motion with satisfactory motion in 9 month follow up.

A medial compartment osteoarthritis in a young patient with good arc of motion is expected to give satisfactory motion, better function with less pain in 80% of the time after five years. This would, however, deteriorate with time [8].

In our study 18 (64 %) out of 28 patients were female and 10 (36%) out of 28 were male.

According to study by zhang Y et al. among adults 60 years of age or older the prevalence of symptomatic knee OA is approximately 10% in men and 13% in women (2). The number of people affected with symptomatic OA is likely to increase due to the aging of the population and the obesity epidemic.[9]

Arthroplasty, however, despite excellent pain relief and improved function, would not be a life-long remedy for a young person [10]. In addition, it is expensive and also imposes some functional limitations-things which are not always acceptable in developing countries. Open medial wedge osteotomies preserve better bone stock, and cause less patella infra, thus providing an easier future conversion to knee arthroplasty [11].

High Tibial Osteotomy in social settings, where floor sitting (rather than chair sitting) and use

of toilets without seat are common, and also where economy, in terms of health insurance coverage, are important issues, is one of the useful armamentariums in the hand of an orthopedic surgeon.

Conclusion

The main improvements seen in initial assessment in this study were related to pain reduction and an increase in the knee score [12] after high tibial osteotomy and it also delays the need for total knee replacement. Hence it is indisputable that appropriate patient selection, precise surgical planning and various operative techniques provide a favorable outcome of HTO in medial knee arthritis in young or middle-aged active patients.

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