

E-ISSN: 2395-1958
P-ISSN: 2706-6630
IJOS 2022; 8(1): 509-514
© 2022 IJOS
www.orthopaper.com
Received: 10-10-2021
Accepted: 31-12-2021

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International Journal of Orthopaedics Sciences

Medial opening wedge high tibial osteotomy with tibial plate fixation in medial compartment osteoarthritis of knee

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DOI: <https://doi.org/10.22271/ortho.2022.v8.i1g.3066>

Abstract

Aim: Prospective evaluation of medial opening wedge high tibial osteotomy with tibial plate fixation for the treatment of medial compartment osteoarthritis of knee.

Method: The study included 31 cases of medial compartment osteoarthritis of knee joint of which 18 were males and 13 were females in the age group of 40-60 years. All the osteotomies were fixed with either wedged plate (n=11) or non wedged plate(n=20). For the clinical evaluation of the patients Hospital of Special Surgery (HSS) score, Knee Society score(KSS) and visual analogue score were taken into consideration for clinical evaluation of the patients.

Results: The mean preoperative HSS score was 58.4 and objective and functional knee society score was 57.4 and 57.2 respectively. In the last assessments of our cases, mean improvements detected in HSS scores, Objective and functional scores of Knee Society score were 85.8, 87.3, and 87.1, respectively at 6 months follow up post operatively. Visual analogue score was improved from 8 preoperatively to 1.2 post operatively. Complications such as tendinitis (9.6%), hardware irritation (9.6%), delayed union (6.4%), lateral cortex fracture (3.2%) and superficial infection (3.2%).

Conclusion: According to our information, there was significant improvement in the functional outcome and was concluded that medial opening wedge high tibial osteotomy with plate fixation is a reliable and effective procedure for medial compartment osteoarthritis of knee joint.

Keywords: Osteoarthritis knee, medial open-wedge osteotomy

Introduction

Osteoarthritis is a progressive arthropathy with heterogeneous clinical presentation that can occur in any joints [1]. It involves all the tissues concurrently –cartilage, synovium and bone. It commonly affects knees, hips, spine, hands and feet [2]. Osteoarthritis occurs due to excessive mechanical stress applied to susceptible joints predisposed on chondrocyte dysfunction that may be genetic or environmental [1]. In neutrally aligned knees, the medial compartment bears 60-70% of the force across the knee in weight bearing activities. Therefore, medial compartment is more commonly involved [4]. Genu varus leads to malalignment causing overload and successive medial unicompartmental osteoarthritis of knee.

Medial opening wedge high tibial osteotomy is indicated in patients with genu varus malalignment with less than 12 degree angular deformity and isolated medial compartment osteoarthritis of the knee in young patients (less than 60 years). As the disease progress to end stage osteoarthritis, the surgical treatments available are high tibial osteotomy, medial compartmental arthroplasty and total knee arthroplasty [4].

Selection of the appropriate patients, extensive pre-operative planning and accurate surgical technique are essential for successful outcome. Medial opening wedge osteotomy with tibial plate fixation stands ahead of closed wedge osteotomy because more precise correction is achieved. The peroneal nerve is not in jeopardy and also there is no disruption of proximal tibiofibular joint and lateral collateral ligaments. The biomechanical principle of high tibial osteotomy is to redistribute the weight bearing forces from the worn medial compartment across to the lateral compartment thereby relieves pain and slows the disease progression [4].

We have hereby conducted the study to evaluate the functional outcome of medial opening wedge high tibial osteotomy with tibial plate fixation in medial compartment osteoarthritis of knee based on clinical and radiological findings.

We conducted this study to evaluate the functional outcome after medial opening wedge high tibial osteotomy with tibial plate fixation in medial compartment osteoarthritis of knee based on clinical and radiological findings.

Materials and Method

Our prospective study included 31 cases of medial compartment osteoarthritis of knee and was carried out from September 2019- May 2021 in BLDE Shri B.M. Patil medical college and hospital. All the cases were treated with medial opening wedge high tibial osteotomy with plating. The study involved patients between 40-60 years of age. The average age was 48.9 years and the largest group of patients being from 46 to 50 years. There were 18 males and 13 females in the study. Body mass index was calculated for all patients with 19 patients ranging from 18.50-22.99 and 12 patients >25. The left knee was operated in 19 patients and the right knee was operated in 12 patients. Grade of radiographic osteoarthritis was calculated using the Kellgren Lawrence scale and majority of the patients (n=23) were Grade I Osteoarthritis. Angle to be corrected was found to be 8 degrees in 18 patients, 10 degrees in 10 patients and 12 degrees in 3 patients. MPTA (medial proximal tibial angle) was 82-83 deg in 12 patients and 80-81 deg in 6 patients.

Following inclusion criteria were used patient aged 40-60 years, unicompartment medial osteoarthritis of knee and patients willing for treatment and giving informed and written consent. Exclusion criteria were patients aged > 60 years, with previously operated knee, secondary osteoarthritis, Associated neurovascular injury, patients medically unfit for surgery, immunocompromised status non-union or mal-union cases. For the clinical evaluation of the patients Hospital of Special Surgery (HSS) score, Knee Society score (KSS) and visual analogue score, and for the radiological assessment medial proximal tibial angle (MPTA) and angle of correction were basically taken into consideration.

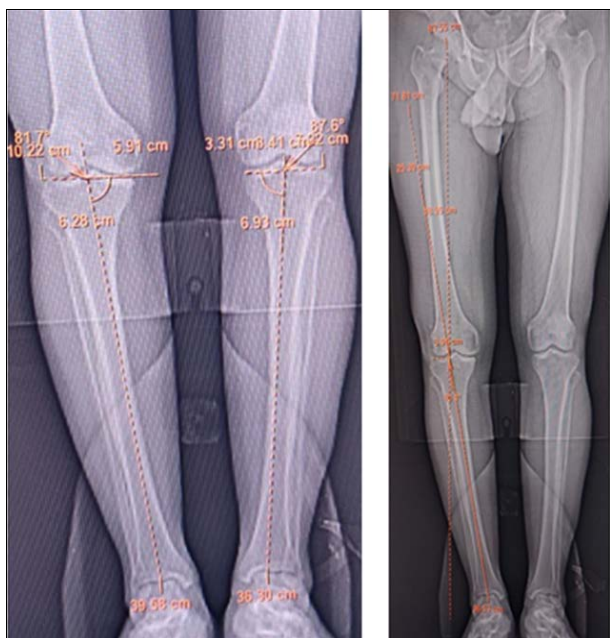


Fig 1: Calculation of MPTA and angle of correction

Table 1: Distribution of Cases according to Implants

Implants	Patients	Percent
Wedge plate	11	35.5
Non wedge plate	20	64.5
Total	31	100

Surgical procedure

After preoperative evaluation spinal Anaesthesia was given in all of the patients and was placed supine on the operating table. An angle frame was attached below the knee to facilitate flexion. Above knee pneumatic tourniquet was used with an air compressor. The limb was prepared by scrubbing and whole patient was draped with sterile drapes All members of the operative team after thorough scrubbing wore double gloves and then proceeded to do sterile draping. A 6 to 8 cm long proximal anteromedial incision was made halfway between the tibial tubercle and the posteromedial edge of the tibia. The superficial medial collateral ligaments and the distal part of the patellar tendon were identified and preserved. A retractor was introduced after a sub periosteal dissection was done anteriorly under the infrapatellar bursa and patellar tendon. After incising the superficial medial collateral ligament and the popliteus muscle, a sub periosteal dissection was conducted and a retractor was used to preserve the neurovascular bundle. Two guide pins were inserted roughly parallel to the joint line, just distal to the tibial metaphyseal flare and laterally these guide pins were just superior to the head of the fibula. Lateral hinge was kept intact. The guide pins matched the appropriate tibial slope in the sagittal plane. Using an oscillating saw tibial cut was made underneath these guide pins. Osteotomes were used to progress the osteotomy (initially, anteromedially, then middle, and finally posteromedial cortex). Fluoroscopic imaging was done to check the location and ensure that a lateral bone hinge of roughly 1 cm was maintained to prevent injuring the lateral cortex. A spreader device was used to slowly distract the medial cortex. The tibial slope was then assessed using fluoroscopic imaging. The spreader is maintained in place for few minutes after the necessary correction has been achieved to allow for stress relaxation of the lateral cortex. After accommodation of the lateral cortex, the spreader was removed and wedged plate or non wedged locking plate was fixed over the medial cortex, distally with two 4.5-mm cortical screws and four 5 mm fully threaded cancellous screws proximally. Finally, the wound was irrigated with normal saline, closed in layers with or without a drain, and placed into an immobilizer brace.

Post-operative rehabilitation

Postoperatively, the patient was kept non-weight bearing for 6 weeks and a knee immobilizer brace was worn during this period [4]. Starting on postoperative day 1, a supervised physical therapy program was initiated. Particular emphasis was placed on quadriceps activation. Quadriceps strengthening exercises were performed 3 to 5 times daily. Passive range of motion were limited from 0° to 120° of knee flexion during the first 2 weeks. After 6 weeks, weight bearing is started based on clinical and radiographic evidence of bone healing [8].

Results

All the patients were followed up at 6 weeks, 3 months and 6 months. Osteotomy sites were united by 4 months in 18 patients (58.1%), 4.5 months in 7 patients (22.6%) and 6 months in 2 patients (6.5%). The type of plates we used for our patients are presented in Table 1. Most common complications were hardware irritation (9.6%) (n= 3); tendinitis (9.6%) (n=3). Both of these complications were treated with NSAIDS and did not alter the final functional or clinical outcome. Only one patient sustained undisplaced lateral cortex fracture (3.2%) and was fixed with kirshner wire

and one patient had superficial surgical site infection (3.2%) and appropriate antibiotics were administered. Two patients (6.4%) had a complication of delayed union; osteotomy site was united by 6 months. There was no difference in outcomes at 6 months due to these complications. On the other hand, we did not observe any plate failure at the end of third month even though we allowed patients to bear full weight. The clinical evaluation of our patients and X-ray results are shown in Table 2 and 3 respectively.

The mean preoperative HSS score was 58.4 and objective and functional knee society score was 57.4 and 57.2 respectively. In the last assessments of our cases, mean improvements detected in HSS scores, Objective and functional scores of Knee Society score were 85.8, 87.3, and 87.1, respectively at 6 months follow up post operatively. Outcome of HSS score showed 20 patients (64.5%) outcome was excellent, 11 patients (33.5%) outcome was good and no patients had fair or poor outcome.

Table 2: Pre op and post op assessment results

	Functional score (KSS)	Objective Score (KSS)	Patient expectation score	Patient satisfaction score	HSS score	Visual analogue score
Preop	57.2±6.1	57.4±4.6	13±0.9	6.3±4.6	58.4	8
post op	87.1±2.9	87.3±2.4	14.3±0.9	38.7±1.4	85.8	1.2



Fig 2: Case 1- Radiographs and clinical pictures

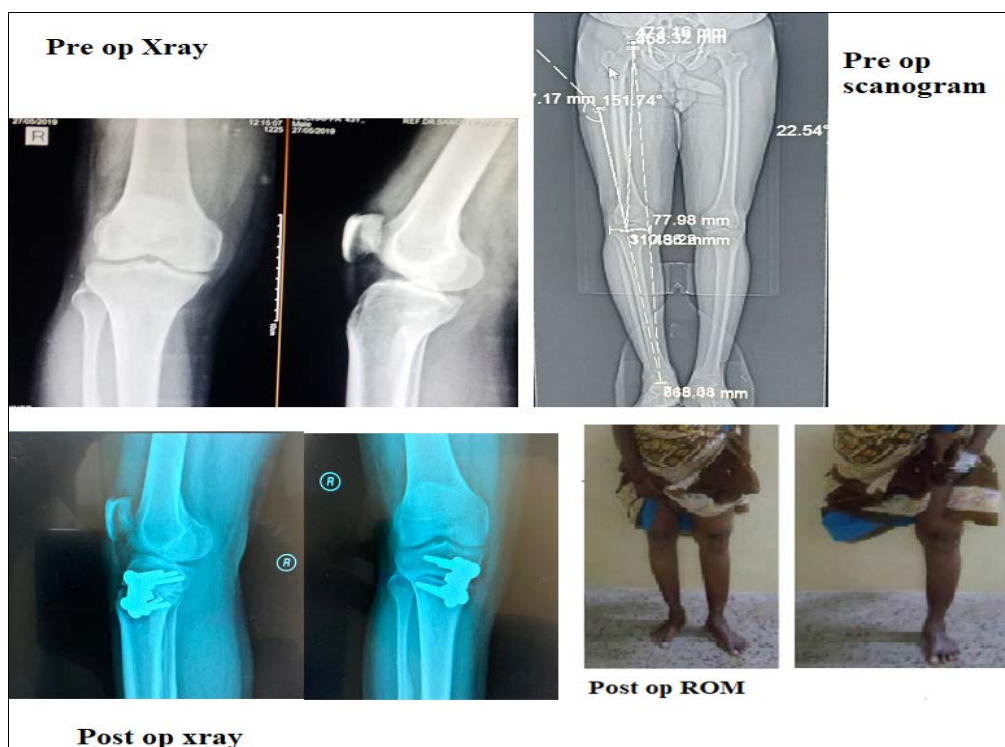


Fig 3: Case 2 -radiographs and clinical pictures

Discussion

The redistribution of weight bearing to the medial side of the knee in medial compartment osteoarthritis leads to increased cartilage breakdown and, as a result, varus deformity [1, 25]. Therefore, a unicompartmental knee replacement will not correct the alignment. To slow down the degenerative process and avoid the progression to osteoarthritis, a corrective osteotomy to change the weight-bearing axis is ideal. Many factors influence the treatment and prognosis of medial compartment osteoarthritis in the knee like age, patients general health, body mass index, grade of osteoarthritis, range of motion, angle of correction, concurrent medical illness. The goals of the high tibial osteotomy include less weight bearing impact on subchondral bone, reduction of intraosseous venous hypertension and microfractures involving subchondral bone, alleviation of clinical complaints such as pain, and improvement in functional status of patients. In the our study 31 patients of medial compartment osteoarthritis knee were evaluated. Osteoarthritis was graded according to Kellgren and Lawrence classification system. In our study 74.2% patients belonged to osteoarthritis grade I and 25.2% patients belonged to grade II. All the patients were evaluated for medial proximal tibial angle (MPTA) and was 80-81 deg in 6 patients and 82-83 deg in 12 patients and 84-85 in 13 patients. Angle to be corrected was found to be 8 degrees in 18 patients, 10 degrees in 10 patients and 12 degrees in 3 patients.

According to our study statistically significant improvement was seen in preoperatively and post-operatively comparable in HSS, KSS and visual analogue scoring systems. Similar results were evaluated in a study done by M Asik *et al.* and concluded that the postoperative pain usually disappears, and the patient's knee functions improve significantly post-surgery. The association between BMI and medial open wedge high tibial osteotomy results is a topic of debate in the literature. Flecher *et al.* studied 313 individuals and observed that those with a BMI of less than 30 had better results. In a study of 95 high tibial osteotomy patients, Howells *et al.* found a similar result [31]. After high tibial osteotomy, Giagounidis *et al.* assessed 112 knees (94 patients) and concluded that patients with a BMI larger than 10% above normal values had a pain-free duration of 5 years, compared to 7.8 years for those with a BMI less than 10% above normal values [29]. According to our study body mass index was not found to be statistically significant in the function out of these patients. Comparing with the results of Kolb *et al.* the consolidation of the wedge occurred without bone grafting in all 31 of our patients in about 3 to 6 months [44]. According to our study age, range of motion, body mass index, and osteoarthritis grade were not observed to be significant factors in the clinical and functional results of medial opening wedge high tibial osteotomy. The angle of deformity correction and MPTA were observed to be significant factors in the outcome of medial opening wedge high tibial osteotomy.

Seo S, Kim Gul *et al.* (2016) studied 167 patients with medial opening wedge high tibial osteotomy [45]. They observed complications in 49 people in all. Lateral cortex fracture (15.6%), neuropathy (3.6%), correction loss (2.4%), hematoma (2.4%), delayed union (2.4%), delayed wound healing (2.4%), postoperative stiffness (1.2%), hardware irritation (1.2%), tendinitis (1.2%), and hardware failure without related symptoms were among the minor complications. They concluded that medial opening wedge high tibial osteotomy is a safe and effective procedure. Most of their complications were minor and recovered without any

significant problems. We found similar results to literature in short term outcome. Most common complications were hardware irritation (9.6%) (n= 3); tendinitis (9.6%) (n=3). Both of these complications were treated with NSAIDS and did not alter the final functional or clinical outcome. Only one patient sustained lateral cortex fracture (3.2%) and one patient had superficial surgical site infection (3.2%). No cases of peroneal nerve palsy were noted. Two patients (6.4) had a complication of delayed union; osteotomy site was united by 6 months. There was no difference in outcomes at 6 months due to these complications.

The mean preoperative HSS score was 58.4 and objective and functional knee society score was 57.4 and 57.2 respectively. In the last assessments of our cases, mean improvements detected in HSS scores, Objective and functional scores of Knee Society score were 85.8, 87.3, and 87.1, respectively at 6 months follow up post operatively. Visual analogue score was improved from 8 preoperatively to 1.2 post operatively. Hernigou *et al.* followed 93 cases with arthrosis of the medial compartment that had undergone open-wedge osteotomies for a median of 11.5 years, and reported that the results obtained were satisfactory up to 7 years postoperatively. The success of medial open-wedge osteotomy is primarily determined on how well the technique is applied. The precise identification of the osteotomy site under good fluoroscopic supervision, careful not to fracture the lateral cortex during osteotomy site opening, and periodic examination of the osteotomy site, frequent evaluation of the correction angle at every step of the procedure, selection of appropriate size of non wedged locking plate or wedged plate, avoidance of overcorrection are all important details that increase the success rate of this procedure.

As stated by Sen *et al.*, long term studies are lacking in high tibial osteotomies and are necessary for more clear idea about the outcome. The pros of this procedure were more correction was possible compared to closing wedge osteotomy, progression to osteoarthritis was avoided and probably the delay for total knee replacement. The cons associated were tedious preoperative planning, arduous technique and short term study. According to our study after using both Non wedged and wedged plate for osteotomy fixation we can say that in medial compartmental osteoarthritis, medial open wedge osteotomy is an effective treatment option that reduces discomfort and improves patients' functional outcomes and hence is a safe procedure without major complications. However, attention needs to be paid to avoid these complications.

Thus we can conclude that Medial opening wedge high tibial osteotomy with plate fixation is a reliable and effective procedure for medial compartment osteoarthritis of knee joint.

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