

Research Journal of Pharmaceutical, Biological and Chemical Sciences

Management of Medial Compartment Knee Osteoarthritis with Medial Opening Wedge Tibial Osteotomy.

Ahmad Ezz Al-Ghandour*.

7 Abu-Thar Al-Ghifari st., Zagazig City, Ash-Sharkia Governorate, Egypt.

ABSTRACT

Management of medial compartment osteoarthritis (MCOA) of the knee is controversial. There are different surgical techniques used for treatment of this problem; as high tibial osteotomy, unicondylar knee replacement and total knee arthroplasty. Recently medial opening wedge high tibial osteotomy (MOWHTO) has gained popularity due to many advantages, almost technical. This study aimed at proving that MOWHTO procedure is a suitable management option for Management of medial compartment osteoarthritis (MCOA). A prospective randomized study was carried on zagazig university hospitals. Patients with isolated MCOA, resulting from genu varum were included to study after obtaining approval from research ethical committee and consent from patients. Clinical data were taken and evaluated by investigators to determine surgical technique. Patients were followed up for 12 months and then evaluated the MOWHTO in management of MCOA. Eight patients have successively healed with no bony defects within mean of 12 weeks. Four considered delayed union, healed completely within 22 weeks. One osteotomy did not heal after 26 weeks, planned for secondary surgical intervention for bone grafting and refixation. The deformity was well corrected in eleven cases. The mean period of pain relief was 8 months. Patellar height changes was assessed by Insall Slavati Ratio (ISR), it was pre-operative $0,93 \pm 0,17$ and postoperative $0,86 \pm 0,09$. All patients have resumed everyday life and mild strenuous activity after 6 months. No instability issues has detected. MOWHTO is a good option for treatment of isolated MCOA. In such cases, MOWHTO allows reasonably pain free knees, restoring axes and improving motion in most of them.

Keywords: MCOA-MCOHTO-genu varum-zagazig University

**Corresponding author*

INTRODUCTION

There are different ways of managing of medial compartment osteoarthritis (MCOA) of the knee; as high tibial osteotomy, unicompartmental knee replacement and total knee arthroplasty. However, tibial osteotomy for medial compartment degeneration is still preferred for younger age and active group[1].

Malalignment can be a leading cause of mono-compartment knee arthritis or a sequel of this condition. Correction of malalignment around the knee joint permits redistribution of forces applied upon the knee joint, relieving pressure on the diseased compartment, and applying more loads on the healthy compartment. Thus, allowing restoration of damaged articular cartilage, and -if present- healing of eroded articular bone.

Tibial osteotomy has become a widely used procedure for management of medial compartment OA of the knee depending on current and previous reports of its high success rates. Many techniques have been used for tibial osteotomy -including lateral closed wedge (LCW), medial opening wedge, dome and chevron osteotomies. Each technique has its advantages and drawbacks[2]. Recently medial opening wedge high tibial osteotomy (MOWHTO) has gained popularity due to many advantages, almost technical[3], [4].

MOWHTO is a promising technique in management of MCOA in selected cases, so we promise to demonstrate the clinical value of MOWHTO in practice.

Aim of the study: this study aimed at proving that MOWHTO procedure is a suitable management option for Management of medial compartment osteoarthritis (MCOA).

Patients and Methods

Study design:

A prospective randomized study was adopted to fulfill the purpose of the research.

Setting:

The study took place in Zagazig University Hospitals, General Administration of Medical Affairs and Students Hospital. The total period of the study was one year.

Patients:

Patients with isolated MCOA resulting from genu varum, who were admitted to orthopedic department.

Inclusion criteria:

Patients of adult age group, with isolated MCOA and secondary to genu varum deformity.

Both genders are included.

Exclusion criteria:

- Patients with tricompartmental OA.
- Patients older than 55 y.
- Patients with severe Varus deformity (greater than 20°).
- Patients with patellofemoral OA.

Sampling:

We carried on this study on a comprehensive sample of 12 cases, all of which came to orthopaedic surgery department with pain as the primary complaint, secondary to apparent genu varum.

Thirteen medial opening wedge tibial osteotomies were performed on the twelve patient (one of them had bilateral genu varum expressed by MCOA).

(The mean age of patients is 35.5 y, with the youngest 21 years old. SD=10.)

Method:

Approval was obtained from Zagazig University Institutional Review Board (IRB).the study was approved by The Research Ethical Committee, Faculty of Medicine, Zagazig University

Details of procedure & aim of work were explained to all patients before any intervention. All possible outcomes, complications were also explained. Patients were enrolled in this study after obtaining written consent.

Operational design:

The clinical data of the patients were evaluated as follows:

Interview/Clinical data obtaining full history.

Clinical examination:

- Physical examination before surgery for the varus knee deformity, degree of pain, affected range of motion, any apparent joint injury signs was performed .
- Valgus and varus stress tests were done assessing the medial and lateral collateral ligaments, McMurray's test for assessment of both menisci.

Radiographic evaluation:

- An anteroposterior (AP) view of both knees in upright standing position , lateral (30° flexion) & skyline patellar projection
- Computed tomography (CT) scanogram .

Both for deformity assessment and planning.

- Magnetic resonance imaging (MRI) -only for selected cases- for assessment of surrounding soft tissue/ligamentous lesion or laxity, as well as meniscal injuries.

Laboratory investigations:

The patients had the following pre-operative routine lab investigations:

- Complete blood count.
- Fasting and random blood glucose levels.
- Bleeding profile.
- Liver function tests.
- Kidney function tests.

Manipulation /management plan:

We use spacer Puddle plate for fixation of deformity and to shift excess weight from medial to lateral compartment of the knee. And then redistribute the weight on joint.

Calculation of the opening wedge

The opening wedge is calculated using both the methods demonstrated by Dugdale, with the objective of transferring the axis of weight-bearing to 62% of the surface of the tibia laterally, in cases of primary varus. This correction enables a final angle of 3 to 6 degrees of valgus from the mechanical axis to be obtained[5], and the method detailed by Chahla et. al. (2016)[6]. This calculation is done using panoramic radiography with full weight-bearing[7]. The angle of correction is obtained from the intersection between a line drawn from the center of the femoral head to the point previously found on the surface of the knee for transfer of the axis of weight-bearing (62%) and another line from this point to the center of the ankle .

Surgical technique

Patient was supine under spinal anesthesia; we performed knee arthroscopy before osteotomy to manage joint lesions and remove of loose bodies. With the aid radioscopy, we did opening wedge osteotomy. First we made a longitudinal incision in proximal and medial third of tibia, followed by dissection of gooses foot and sup.med.collateral ligament .then we pass two parallel krishner wires over ant.tuberosity of tibia to head of fibula, and after making sure that wire in correct position ,bone was cut out with lat.cortex intact. Then we calculated the opening wedge in pre-operative assessment, after that the alignment calculated checked during surgery through radioscopy by diathermy to confirm the mechanical axis of weight bearing of knee. The puddi plate was used to fix the osteotomy and bone graft was used in wedges larger than 12 mm (in four patients) to give added stability and consolidation potential. After the procedure, the patients were not fully immobilized, and were encouraged to become mobile earlier. Partial weight bearing was allowed at six weeks with full weight bearing at 10 weeks, on average, accompanied by radiographic consolidation.

Statistical analysis

By using the statistical package for social sciences program (SPSS) data was analyzed and results were presented as frequencies and percentages for qualitative data .Chi-square or fisher exact tests were used to compare between frequencies while differences between means were compared by t-test. Evaluation of correlations between studied variables was assessed by pearson correlation coefficient test .ANOVA test was used for dependent variables followed by logistic regression. We consider p value <0.05 is statistically significant.

RESULTS

In our regular follow up for the study subjects, the following criteria were implemented to interpret the results:

Duration of healing: From the thirteen osteotomies performed, eight have successfully healed with no bony defects within a mean of 12 weeks (**figure 1**). Four osteotomies were considered delayed union, healed completely within 22 weeks. One osteotomy did not heal after 26 weeks and was considered nonunion, planned for surgical intervention for bone grafting and refixation of osteotomy. 16 weeks later, at subsequent follow up after the second surgery, the osteotomy site had completely healed and filled up radiologically. (**Figure 2**)

Degree of deformity correction: The deformity was successfully corrected in eleven knees. However, two knees were found to be under corrected -one of which had a delayed union- owing to technical faults, with subsequent lasting mild varus and complaints, but to a lesser extent than preoperative.

Duration of pain relief: The mean period of pain relief among study subjects was eight months. Seven patients started feeling gradual pain regression after six months, then complete pain relief within eight months postoperative. Three patients (four osteotomies) took up to ten months for pain to subside -two of which had delayed union-. Two patients suffered persistent pain until now -one had nonunion.

Patellar height changes: The Insall-Salvati ratio (ISR) was used to determine the patellar height pre and postoperatively. The mean preoperative ISR= 0.93 (\pm 0.17), postoperative= 0.86 (\pm 0.09).

Posterior tibial slope changes: The mean posterior TS preoperatively was $7.19^\circ (\pm 2.23^\circ)$, increased to $7.94^\circ (\pm 3.08^\circ)$ postoperatively.

Return to previous life style: Generally, all patients -whose osteotomies healed in time (three months)- managed to resume everyday life, careers, and mildly strenuous activities after six months postoperative. Patients who experienced delayed union could not resume the mentioned lifestyle except after eight months postoperative. The nonunion patient could resume his non-demanding previous lifestyle only three months after the second surgery.



Fig 1: Six weeks after osteotomy x-rays

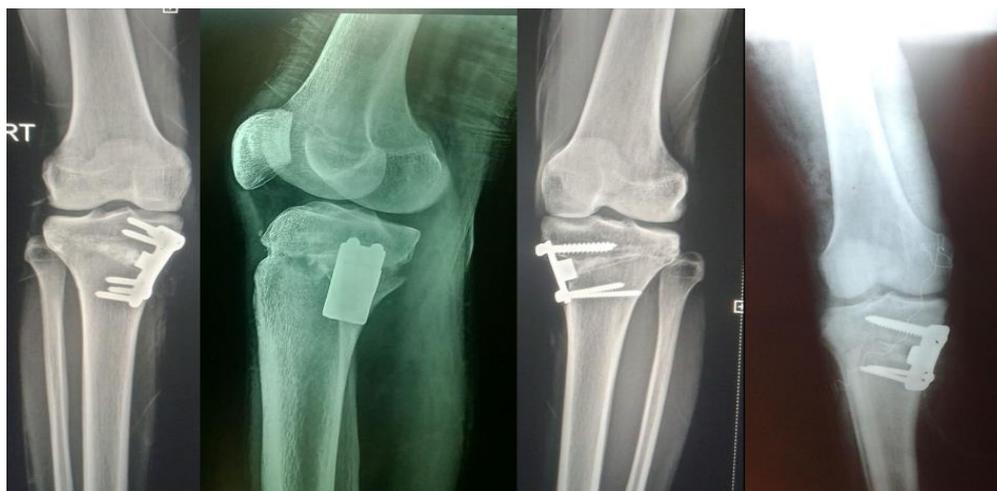


Fig 2: Ten weeks after osteotomy x-rays

Degree of knee stability: no one of the patients suffered any stability issues.

Range of motion: Two patients developed limited ROM due to pain after surgery, with range lying between full extension and about 110° degrees of flexion. Both patients had complete healing, but did not restore full active ROM until four months after surgery, with adequate physiotherapy.

Knee scoring implementation: Functional evaluation was made using the Knee Society Scoring System (KSS)[8][9], pre and postoperatively, (figure3) for qualitative documentation and assessment of progress. All subjects -but one- accomplished an advancement in overall knee score mean (mean of full score= 63.5) with the least postoperative= 40.5, the greatest= 59.8 (SD= 6.6). The least increase (in total mean) = 0.2, the greatest= 25.7 (SD= 8). Four subjects scored a difference above 14 (Excellent), four above 7 (very good), four above 0 (good) and one below 0 (bad). (Table 1).

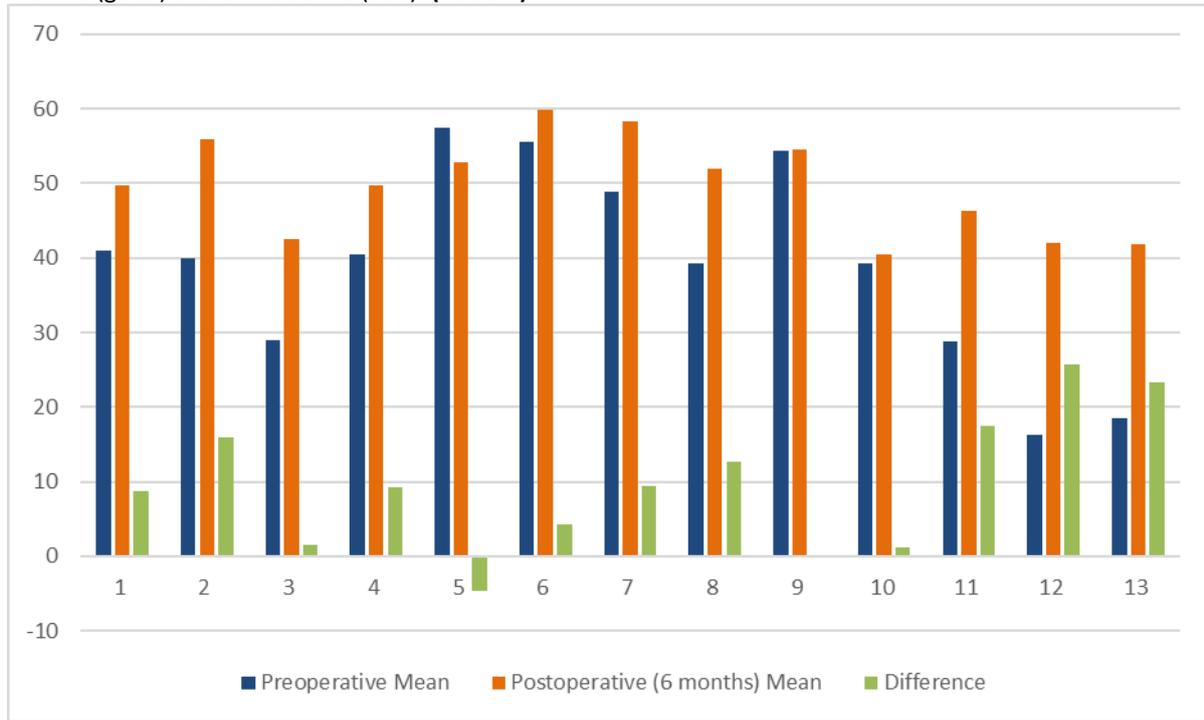


Fig 3: Clustered column representing differences between KSS pre and post-operatively

Table 1: Knee Society Score documentation of study subjects

N	Preoperative				Mean
	Objective Knee Score (100)	Satisfaction Score (40)	Expectation Score (15)	Functional Activity Score (100)	
1	70	22	12	60	41
2	70	24	11	55	40
3	62	14	5	35	29
4	72	32	13	45	40.5
5	85	36	12	97	57.5
6	85	34	7	96	55.5
7	78	28	12	77	48.8
8	63	12	6	76	39.3
9	84	32	10	91	54.3
10	56	30	9	62	39.3
11	58	8	8	41	28.8

12	45	0	5	15	16.3
13	40	2	7	25	18.5

Postoperative (6 months)					
Objective Knee Score (100)	Satisfaction Score (40)	Expectation Score (15)	Functional Activity Score (100)	Mean	Difference
86	20	9	84	49.7	8.7
88	32	12	92	56	16
67	30	14	59	42.5	1.5
70	40	15	74	49.8	9.3
92	16	6	97	52.8	-4.7
87	40	14	98	59.8	4.3
85	36	15	97	58.3	9.5
69	30	15	94	52	12.7
89	34	8	87	54.5	0.2
63	32	7	60	40.5	1.2
69	24	13	79	46.3	17.5
67	28	12	61	42	25.7
65	30	15	57	41.8	23.3

DISCUSSION

MCOA secondary to genu varum is a common problem[10]. multiple interventional trials were occurred for its management, using various surgical techniques, as arthroscopic debridement, high tibial osteotomy (HTO), Un Compartmental Knee Arthroplasty(UKA) and Total Knee Arthroplasty(TKA). Each procedure has its own drawbacks.

In our study 13 MOWHTO were performed for twelve patients, who had a common complaint and pathology, knee pain due to MCOA secondary to genu varum deformity .they all had full or reasonable range of motion, impaired everyday life activities and early to moderate OA changes as revealed by preoperative radiography. All cases were followed up postoperatively for 12 months.

In addition to being a relatively simple procedure, it has an ultimate biomechanical benefit; corrected the varus deformity ,shifted the excess weight load and decreased the stress form upon medial compartment of the knee to relatively unstressed lateral compartment and thus redistributed the uneven load ,widened the joint space and delayed the joint wear out.

The shift of the weight bearing axis from medial to lateral compartment is a common outcome for both the two basic HTO techniques that are commonly performed ,LCW and MOWHTO[11], [12].however, although LCWHTOs were more common in past ,the MOWHTO has gradually taken the place of LCW[13] .MOWHTOs have several advantages over LCWHTOs ,including being a simpler technique ,easier control of the degree of correction ,correcting the deformity closer to its source ,less extensive soft tissue dissection,sparing the proximal tibiofibular joint, protecting the bone stock as no need for fibular osteotomy, avoidance of serious complications such as peroneal palsy, enabling exercise applications to open knee movements in early post-operative periods and a longer survival rate[14] .

Unlike LCWHTOs, there is no need for fibular osteotomy in MOWHTOs [15], [16].fibula and the tibiofibular joint are not damaged,Hernigou et al .reported a case of temporary peroneal nerve paralysis, which disappeared later among 93 MOWHTOs[15].Nakamura et al.performed fibulectomy in OWHTO cases where there were hemicallosis and a need for correction more than 15[17].

There has been a controversy about MOWHTO in the necessity of grafting. While the classic literature about MOWHTO recommends implementing an autograft into the osteotomy gap in order to prevent loss of correction or delayed/malunion[15].some recent studies suggest that there no difference in the duration of healing between grafted and non-grafted osteotomies .**Assal et al (2010)** supported this suggestion by stating that between 2004 and 2008 they performed 58 OWHTO for patients. All osteotomies healed completely without any grafting[18].

Another important factor in the superiority of MOWHTO as an option for management of genu varum resulted MCOA is that representing a valid further correctible solution in cases of failure or deterioration over years, as well as it offers both correction of malalignment and offloading the excessively side.

Two complications occurred among this study subjects; delayed union and nonunion. Delayed union took place in an obese smoker patient, and a middle-aged female with a sedentary lifestyle. They both healed spontaneously within a five months period without further intervention. Nonunion happened in a heavy smoker, mildly obese patient, in which no bone graft was introduced primarily. We managed the defect by a second surgery, an autogenous corticocancellous structural iliac crest graft was inserted in the osteotomy gap, and fixation was then achieved by a proximal tibial locked plate. Two months later the defect healed completely with no further complications.

CONCLUSION

MOWHTO is a good option for treatment of isolated MCOA. In such cases, MOWHTO allows reasonably pain free knees, restoring axes and improving motion in most of them.

ACKNOWLEDGMENT

This study was carried out at both the Department of Orthopedic Surgery, and the General Administration of Medical Affairs, Zagazig University .I wish to express my sincere gratitude to my supervisors, for their guidance and collaboration. Their open-minded and supportive attitude has been essential for this work.

REFERENCES

- [1] G. F. McCoy, H. K. Graham, and C. J. McClelland, "High tibial osteotomy in degenerate diseases of the knee," *Ulster Med. J.*, vol. 54, no. 1, pp. 46–52, Apr. 1985.
- [2] A. Amendola and D. E. Bonasia, "Results of high tibial osteotomy: review of the literature," *Int. Orthop.*, vol. 34, no. 2, pp. 155–160, Feb. 2010.
- [3] J. P. Jackson, W. Waugh, J. P. Green, and H. Wood, "High tibial osteotomy for osteoarthritis of the knee," *J. Bone Joint Surg. Br.*, vol. 51–B, no. 1, pp. 88–94, Feb. 1969.
- [4] D. E. Bonasia et al., "Medial Opening Wedge High Tibial Osteotomy for Medial Compartment Overload/Arthritis in the Varus Knee, Medial Opening Wedge High Tibial Osteotomy for Medial Compartment Overload/Arthritis in the Varus Knee: Prognostic Factors, Prognostic Factors," *Am. J. Sports Med.*, vol. 42, no. 3, pp. 690–698, Mar. 2014.
- [5] S. AHLBACK, "Osteoarthrosis of the knee. A radiographic investigation," *Acta Radiol*, vol. 227, pp. 7–72, 1968.
- [6] J. W.-P. Michael, K. U. Schlüter-Brust, and P. Eysel, "The Epidemiology, Etiology, Diagnosis, and Treatment of Osteoarthritis of the Knee," *Dtsch. Arzteblatt Int.*, vol. 107, no. 9, pp. 152–162, Mar. 2010.
- [7] P. Suri, D. C. Morgenroth, and D. J. Hunter, "Epidemiology of Osteoarthritis and Associated Comorbidities," *PM&R*, vol. 4, no. 5, Supplement, pp. S10–S19, May 2012.
- [8] P. C. Noble et al., "Development of a new Knee Society scoring system.," *Clin. Orthop.*, vol. 470, no. 1, pp. 20–32, Jan. 2012.
- [9] G. R. Scuderi, R. B. Bourne, P. C. Noble, J. B. Benjamin, J. H. Lonner, and W. N. Scott, "The New Knee Society Knee Scoring System," *Clin. Orthop.*, vol. 470, no. 1, pp. 3–19, Jan. 2012.
- [10] A. A. Andrianakos et al., "Prevalence of symptomatic knee, hand, and hip osteoarthritis in Greece. The ESORDIG study.," *J. Rheumatol.*, vol. 33, no. 12, pp. 2507–2513, Dec. 2006.

- [11] A. Schallberger, M. Jacobi, P. Wahl, G. Maestretti, and R. P. Jakob, "High tibial valgus osteotomy in unicompartmental medial osteoarthritis of the knee: a retrospective follow-up study over 13–21 years," *Knee Surg. Sports Traumatol. Arthrosc.*, vol. 19, no. 1, pp. 122–127, Jan. 2011.
- [12] H. Sun, L. Zhou, F. Li, and J. Duan, "Comparison between Closing-Wedge and Opening-Wedge High Tibial Osteotomy in Patients with Medial Knee Osteoarthritis: A Systematic Review and Meta-analysis," *J. Knee Surg.*, vol. 30, no. 2, pp. 158–165, Feb. 2017.
- [13] S.-S. Seo, O.-G. Kim, J.-H. Seo, D.-H. Kim, Y.-G. Kim, and I.-S. Lee, "Complications and Short-Term Outcomes of Medial Opening Wedge High Tibial Osteotomy Using a Locking Plate for Medial Osteoarthritis of the Knee," *Knee Surg. Relat. Res.*, vol. 28, no. 4, pp. 289–296, Dec. 2016.
- [14] S. B. Han, D. H. Lee, G. M. Shetty, D. J. Chae, J. G. Song, and K. W. Nha, "A 'safe zone' in medial open-wedge high tibia osteotomy to prevent lateral cortex fracture," *Knee Surg. Sports Traumatol. Arthrosc.*, vol. 21, no. 1, pp. 90–95, Jan. 2013.
- [15] P. Hernigou, D. Medevielle, J. Debeyre, and D. Goutallier, "Proximal tibial osteotomy for osteoarthritis with varus deformity. A ten to thirteen-year follow-up study.," *J. Bone Joint Surg. Am.*, vol. 69, no. 3, pp. 332–354, Mar. 1987.
- [16] I. Esenkaya and N. Elmali, "Proximal tibia medial open-wedge osteotomy using plates with wedges: early results in 58 cases," *Knee Surg. Sports Traumatol. Arthrosc.*, vol. 14, no. 10, pp. 955–961, Oct. 2006.
- [17] S. H. White, P. F. Ludkowski, and J. W. Goodfellow, "Anteromedial osteoarthritis of the knee," *J. Bone Joint Surg. Br.*, vol. 73, no. 4, pp. 582–586, Jul. 1991.
- [18] M. A. El-Assal, Y. E. Khalifa, M. M. Abdel-Hamid, H. G. Said, and H. M. A. Bakr, "Opening-wedge high tibial osteotomy without bone graft," *Knee Surg. Sports Traumatol. Arthrosc.*, vol. 18, no. 7, pp. 961–966, Jul. 2010.