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# HIGH TIBIAL OSTEOTOMY AS AN ALTERNATIVE TO REPLACEMENT ARTHROPLASTY IN LOW SOCIOECONOMIC GROUP WITH UNICOMPARTMENTAL OSTEOARTHRITIS

Orthopaedics

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## ABSTRACT

**Background:** Osteoarthritis is a slowly progressive degenerative disease which can induce pain and functional impairment thereby disabling an individual. It needs prolonged treatment which is associated with high cost for individual and family

**Purpose:** To determine usefulness of high tibial osteotomy in low socioeconomic group with predominant unicompartmental osteoarthritis of knee.

**Method:** This is a prospective study of patients who attended the orthopaedic out patient department in Alluri Sitaramaraju Institute of Medical Sciences between September 2013 to November 2015. 20 patients belonging to poor socioeconomic status with predominant unicompatrmental osteoarthritisof knee were selected based on clinical examination and weight bearing xrays. These patients were followed up and functional outcomes were analysed and discussed.

**Results:** In the present study excellent results were seen in 12 cases(60%), good results in 3 cases (15%) , fair results in 5 cases(25%) and no poor results .The results in the present study were disappointing with older age groups.

**Conclusion:** In a developing country like India, high tibial osteotomy is a valuable surgical option where high demand activities are common particularly in the poor. This is even more appropriate for people with a rural life style. The financial burden also hinders the individual from undergoing an arthroplasty.In contrast, osteotomy provides an alternative that preserves the knee joint and, when appropriately performed, should not compromise later arthroplasty if it becomes necessary.

## KEYWORDS:

HTO, High tibial osteotomy, Unicompartmental osteoarthritis of knee.

**Introduction:**

Osteoarthritis is a slowly progressive degenerative disease which can induce pain and functional impairment, thereby disabling an individual. It is the fourth leading cause world wide of 'years lived with disability' (YLDs), accounting for 3.0% of total global YLDs.[1] The incidence of OA (osteoarthritis) is increasing at present due to aging population and longevity of life. It needs prolonged treatment which is associated with high cost for the individual and his family. At present, medications or surgical interventions are yet to prove to alter the development of OA.

India has a higher prevalence of knee osteoarthritis in the rural population (13.7%) compared with the urban (6.0%) community.[2]. It typically has its onset as unicompartmental osteoarthritis and gradually progresses to end stage tricompartmental arthritis.

Present day therapy for OA combines pharmacologic and non-pharmacologic methods which mainly aim at symptomatic relief. There are multiple treatment modalities available for unicompartmental OA, including nonsurgical conservative care, arthroscopic debridement, varying types of cartilage transplants, osteotomy, and unicompartmental replacement. Surgical intervention is considered when conservative treatment fails to relieve the pain. High tibial osteotomy is considered as a valuable option in the surgical management of unicompartmental OA. Various techniques of high tibial osteotomy have been developed which include lateral closing wedge osteotomy, medial opening wedge osteotomy and dome osteotomy.

The goal of high tibial osteotomy is to relieve medial compartment knee pain and slow down the arthritic progression. This is achieved by a partial unloading of the compartment with a slight overcorrection of the mechanical axis. Pain relief is often dramatic and is ascribed to[3]:

1) vascular decompression of the subchondral bone
2) Redistribution of loading forces towards less damaged parts of the joint.
3) After load redistribution, fibrocartilage may grow to cover exposed subchondral bone.

This also postpones the need for total knee arthroplasty.[4]

**BIOMECHANICS:**

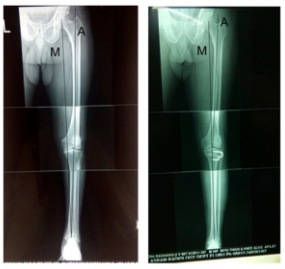
The mechanical axis of lower limb extends from the center of femoral head to the center of ankle joint and passes near or through the knee joint. It is in 3 degrees of valgus from the vertical axis of body. Anatomical axis of femur is about 6 degrees of valgus from mechanical axis of lower limb and 9 degrees of valgus from true vertical axis of body. Anatomical axis of tibia lies in 2 to 3 degrees varus from vertical axis of the body.

In the standing position and chiefly during walking, the body weight tends to adduct the femur on the tibia, increasing thus the load on the medial compartment. The lateral muscular forces tend to adjust a dynamic equilibrium in the knees. The lateral force and the body weight result in an overload distribution of about 60% in the medial compartment and 40% in the lateral compartment [5].

In medial osteoarthritis, the resulting lateral force is displaced medially. Limb alignment is altered and more load is then distributed medially with subsequent degenerative lesions. This progressive joint destruction causes knee deformity, which, in a vicious circle, aggravates arthritis in the medial compartment.

Treatment by HTO therefore aims at correcting the excessive load stresses caused by an abnormal tibio-femoral angle. This is done by transferring the excessive load from medial to lateral, with respect to the lateral compartment. The goals of osteotomy are to relieve pain, to redistribute weight bearing forces, to improve function and thereby potentially increase the longevity of the native knee joint.

**Figure 1: preoperative and postoperative anatomical and mechanical axis**




**Mechanical axis passing through centre of knee joint after surgery**

## MATERIALS AND METHODS:

This is a prospective study of patients who attended the orthopaedic out patient department in Alluri Sitaramaraju Institute of Medical Sciences between September 2013 to November 2015.Ethical committee approval for the study has been obtained from the ethical committee of our institute. The patients were evaluated by clinical examination and weight bearing radiographs. 20 patients of unicompartmental osteoarthritis with knee pain not relieved by conservative management and who satisfy the inclusion criteria were selected. Consents from the patients for participating in the study were obtained. Among the selected 20 patients 12 were males and 8 were females. 11 patients were operated for osteoarthritis of the right knee and 9 patients were operated on the left side. During the study period we did not lose any patient to follow up and results of all the 20 patients were assessed and analyzed.

## INCLUSION CRITERIA :

Pain and disability resulting from osteoarthritis that interfere with high-demand employment or recreation. Evidence on weight bearing radiographs of degenerative arthritis that is predominantly affecting one compartment with a corresponding varus deformity.The ability of the patient to use crutches after the operation and the possession of sufficient muscle strength and motivation to carry out a suitable rehabilitation program. Good vascular status without serious arterial insufficiency or large varicosities.

## EXCLUSION CRITERIA :

Patients with narrowing of lateral compartment cartilage space, lateral tibial subluxation of more than 1 cm, medial compartment tibial bone loss of more than 2 or 3 mm, flexion contracture of more than 15 degrees, Knee flexion of less than 90 degrees, if more than 20 degrees of correction needed and any inflammatory disease of the knee joint are excluded from this study.

## SURGERY AND POST OP PROTOCOL

Surgery was performed after obtaining anaesthetic clearance All cases were operated with Lateral closing wedge high tibial osteotomy and staple fixation.

Post-operative regimen for the patients is Immobilisation in an above knee slab till end of 10$^{th}$ post operative day to facilitate drain removal and regular dressings. Conversion to above knee cast after suture removal on day 10 and advising the patient not to bear weight for 6 weeks on the operated limb. Quadriceps strengthening exercises are also taught and the patient is adivised to practice the quadriceps drill inside the POP cast. Knee brace is applied and the patient is encouraged to do partial weight bearing using crutches or walker after 6 to 8 weeks when radiological union has occured. After gait training, the patient is then allowed to weight bear completely. The patients are evaluated on 2$^{nd}$ post operative day, at 6 weeks and 12 weeks by radiographs,VAS scores[Visual Analog Scale] and WOMAC scores.

**Figure 2: Intraoperative staple fixation after osteotomy**

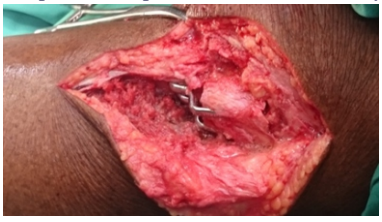
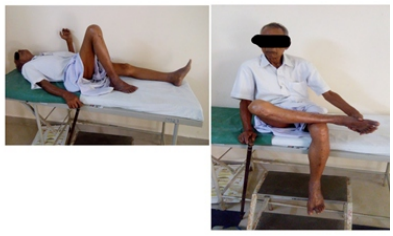


**Figure 3: Functional outcome of patient**



**Good flexion and range of motion after surgery in addition to pain relief**

## RESULTS:

Based on the inclusion and exclusion criteria and patient requirements, 20 patients were selected for the procedure after pharmacotherapy failed to relieve the pain.Our study was conducted in these 20 patients. The patients in the age group of 56-65 were considerably higher when compared. The mean age of the patients taken up by us for surgery is 61.1 years. Female patients were of a higher percentage (55%) when compared with males(45%) and Left sided involvement was slightly higher among the patients we considered for our study. The time interval between duration of the disease and operative intervention among our patients was between 3 years and 8 years with majority of patients falling within 3-4 and 5-6 years class intervals. The average time interval during our study between the disease onset and surgical procedure was calculated as 5.3 years.

The period for union of the osteotomy site ranged from 6 weeks to 12 weeks with an average union time of 8.2 weeks. 11 of our patients had no comorbidities. Diabetis and hypertension was present in 4 patients, Diabetis only in 3 and hypertension only in 2 patients. Superficial infection of the wound was present in 1 patient (5%). It healed well with antibiotic usage and dressings. All the osteotomies united well. The functional results were assessed taking into criteria the Visual Analogue Scale for pain(VAS) and WOMAC scores for knee function. The mean pre operative VAS score was 6.95.The mean post operative VAS score was 1.4.The mean pre operative WOMAC score was 51.2.The mean post operative WOMAC score was 79.1. Excellent results were seen in 12 cases(60%), Good results in 3 cases (15%), Fair results in 5 cases(25%) and no poor results according to WOMAC and VAS scores.

## DISCUSSION

Knee joint osteoarthritis has become a frequently seen problem in the community as the life expectancy of the population has increased. India has a higher prevalence of knee osteoarthritis in the rural population (13.7%) compared with the urban (6.0%) community[2]. At our institute 1827 patients were diagnosed as OA of knee in which 1168 (63.93%) were females and 659 (36.07%) were males. The sex distribution is similar to that reported by **Daniel Prieto-Alhambra, Andrew Judge et al(2014)**[6]in which males were 35.59% in their study conducted at Catolonia in a population of approximately 15 lakhs. The sex incidence in our country is also on similar lines according to study conducted by **IOACON Agra**[7] team (2013). The present detailed study was done on 20 patients who were operated with high tibial osteotomy.It was performed to evaluate the relief of pain and to correct the varus deformity of knee in unicompartmental osteoarthritis of knee. Age of the patients taken up for surgery varied from 47 years to 70 years. The mean age of the patients was 61.1 years when taken up for surgery. This is similar to that of **Insall et al**[8] **(1984)** who reported mean age of 60 years with patients ranging from 30 to 83 years. **Tuli.S and Kapoor (2008)**[9] undertook High Tibial Osteotomy in an age group which ranged from 56-73 years. The study by **Bonasia, Davide Edoardo et al**[10] **(2014)** had a mean age of 54.5 years. Out of the 20 patients treated by us, 11 were females and 9 were males. **Insall et al**[8] **(1984)**conducted their study on 59 females and 24 males while **Tuli.S and Kapoor (2008)**[9]undertook their study on 46 females and 19 males. The significantly higher number of females taken up for surgery reflects the higher incidence of knee osteoarthritis in females. We performed our surgery on 11 Right sided knees and 9 left sided knees.**Insall et al**[8] **(1984)** operated 46 right sided and 49 left sided knees.

A lateral closing wedge high tibial osteotomy was performed all 20 cases. **Insall et al**[8]**(1984)** operated on 83 knees and stabilized 80 knees

with cast alone. Staples were used in 1 case and compression clamps with external fixator was used in 2 cases by them.

The time taken for union at the osteotomy site ranged from 6 weeks to 12 weeks in our study with the average duration being 8.2 weeks. **Insall et al**[8] observed a range 5- 12 weeks and had an average duration of around 9 weeks which is comparable to that in our study.

Only one case (5%) had a superficial wound infection in the present study.This was the only complication encountered. According to **James A. W. Tunggal & Gordon A. Higgins et.al (2010)**[11] infection rates in High Tibial Osteotomy range from 0.8 to 10.4% among which most are superficial infections.They also reported deep vein thrombosis in 2-5%. Compartment syndrome, fractures, delayed and non union were reported by them as uncommon complications.In our study we did not encounter any DVT.

The Visual Analogue Scale for pain scoring [VAS] has been used to quantify the pain relief obtained after the surgery.The pre operative scores ranged from 6-8 whereas the post operative scores ranged from 0-3. The mean VAS score pre-operatively was 6.95. This was significantly reduced on postoperative followup to 1.4**. Philippe Hernigou, Steffen Queinnec & Laure Picardet.al (2013)**[12] reported VAS scores in their study decreased from a mean of 6.5 to 2.1 at one month post operatively. These results are comparable to the present study. **T. Duivenvoorden, R.W. Brouwer et.al(2014)**[13] reported mean pre operative VAS score of 6.3 and one year post operative score 3.6 and 6 years post operative VAS score with a mean of 4.0 in closing wedge osteotomy. In opening wedge osteotomy,the pre op mean was 6.0; one year and 6 years post operative scores were reported by them as 3.6 and 3.4. The Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC) has been used to assess the functional outcome of the knee.The pre operative mean WOMAC score in our study was 51.2 while the post operative mean score was 79.1.**Bonasia, Davide Edoardo, Dettoni, Federico et.al (2014)**[14]also reported significant improvement in the WOMAC scores after High tibial osteotomy. They conducted their study with level 4 evidence standards and obtained a score transition from 50.7 pre operatively to 76.1 post operatively after high tibial osteotomy. The results in our study reflect positively on this study. **DeMeo, Patrick J; Johnson, Eric M et. Al (2010)**[15] obtained a post operative WOMAC score of 84 at their final follow up of 8 years.

In the present study of 20 patients which was studied from September 2013 to November 2015, Excellent results were seen in 12 cases(60%), Good results in 3 cases (15%) , Fair results in 5 cases(25%) and no poor results according to WOMAC and VAS scores. The results in the present study showed unsatisfactory results with older age groups.

Present study in the age group pattern shows Excellent results in 80% among 45-55 year age group, Excellent results in 77 % among 56-65 year age group and Excellent result only in 16% among the 66-75 year age group. Similar unsatisfactory outcome with progressive age had been noted in the studies conducted by **Mathews et.al(1988)**[16] and **Naudie et.al(1999)**[17].

Unicompartmental Knee replacement is another procedure of choice in case of unicompartmental knee joint arthritis. **Dettoni et al**[18]**.** compared 56 consecutive UKA and 54 opening wedge HTO. They found that clinical and radiological midterm results were comparable in the two groups. This is the first study comparing the opening wedge HTO with UKA. **Stukenborg-Colsman et al**[19]. prospectively compared the outcome of 32 HTO and 28 UKA, at seven to ten years follow-up and concluded that UKA offers better long-term success and less intraoperative complications.Although this data seem to support the use of UKA rather than HTO, **Brouwer et al**[20]. in their meta-analysis stated that there is no significant difference in pain, function and gait analysis between HTO and UKA.

All data published fail to demonstrate statistically significant differences between the patients treated with a primary TKR or with a TKR following an HTO[54] . **Amendola et al**[21]. in their retrospective study compared primary TKR with TKR following HTO. They concluded that previous osteotomy does not affect the outcome of TKR. **Karabatsos et al**[22]. in their retrospective cohort study stated that TKR after HTO was technically more challenging than primary TKR and that there were no significant differences between the two groups at the five-year followup. Similar results were described by **Van Rajii et al**[23]. and **Kazakos et al**[24].

## CONCLUSION

With development of modern medicine and technology, we are rapidly progressing towards replacement of the damaged parts with artificially made components in almost all fields of medicine. Total knee replacement is one such entity in the huge array. Though rewarding it may be, it is also associated with its own limitations and very high costs.

In a developing country like India, high tibial osteotomy is a valuable surgical option where high demand activities are common particularly in the poor. The financial burden also hinders the individual from undergoing an arthroplasty. High tibial osteotomy surgery costs around 10 times less than a total knee arthroplasty in India.

For people with a rural life style, this is even more appropriate. The person can perform squatting and cross legged sitting after HTO which might not be possible after normal total knee replacement. Though hiflex knee replacement models have come up, they are associated with even higher costs. Squatting and cross legged are essential in rural lifestyle during their activities.

Osteotomy provides an alternative that preserves the knee joint, and when appropriately performed, it will not compromise later arthroplasty, even if it becomes necessary. Thus, in a developing country like India, High tibial osteotomy is a viable option particularly in the poor people of rural background.

## References:


1. Syed A. Haq and Fereydoun Davatchi (2011),Osteoarthritis of the knees in the COPCORD world, International Journal of Rheumatic Diseases; 14: 122–129.
2. Joshi VL, Chopra A (2009) Is there an urban-rural divide? Population surveys of rheumatic musculoskeletal disorders in the pune region of india using the COPCORD Bhigwan Model. J Rheumatol 36, 614–22.
3. Louis Solomon (2010). Osteoarthritis. Apley's system of Orthopaedics and Fractures 9th edition; 5: 85-96.
4. Amendola A, Bonasia DE (2010). Results of high tibial osteotomy: review of the literature. Int Orthop. 2010;34(2):155–60.
5. Akizuki S, Shibakawa A, Takizawa T, Yamazaki I, Horiuchi H (2008) The long-term outcome of high tibial osteotomy: a 10- to 20-year follow-up. J Bone Joint Surg Br 90(5):592–596
6. Prieto-Alhambra D, Judge A, Javaid MK, Cooper C, Diez-Perez A, Arden NK (2014). Incidence and risk factors for clinically diagnosed knee, hip and hand osteoarthritis: influences of age, gender and osteoarthritis affecting other joints. Ann Rheum Dis; 73:1659–64.
7. Dr. Chandra Prakash Pal, Dr. Sanjay Chaturvedi, Study to find the prevalence of knee osteoarthritis in Indian population and the factors associated with it. June to Nov (2013).Study by Prognosis Management and Research Consultants Ltd in collaboration with IOACON Agra.
8. John N. Insall, M.D., Douglas M. Joseph, M.D, and Charles Msika, M.D(1984) ,High Tibial Osteotomy for Varus Gonarthrosis - A long-term follow-up study, New York, N.Y. –JBJS 1984.
9. Tuli SM, Kapoor V (2008), High tibial closing wedge osteotomy for medial compartment osteoarthrosis of knee. Indian J Orthop. 2008, 42: 73-77
10. Bonasia DE, Dettoni F, Sito G, Blonna D, Marmotti A, Bruzzone M, et al(2014). Medial opening wedge high tibial osteotomy for medial compartment overload/arthritis in the varus knee: prognostic factors. Am J Sports Med.; 42:690–8.
11. James A. W. Tunggal & Gordon A. Higgins & James P. Waddell (2010). Complications of closing wedge high tibial osteotomy, nternational Orthopaedics (SICOT)34:255–261
12. Philippe Hernigou , Steffen Queinnec, Laure Picard, Isaac Guissou, Tarek Naanaa, Pascal Duffiet, Didier Julian & Valerie Archer (2013); Safety of a novel high tibial osteotomy locked plate fixation for immediate full weight-bearing: a case-control study; International Orthopaedics (SICOT) 37:2377–2384
13. Duivenvoorden T, Brouwer RW, Baan A, Bos PK, Reijman M, Bierma-Zeinstra SM, Verhaar JA (2014). Comparison of closing-wedge and opening-wedge high tibial osteotomy for medial compartment osteoarthritis of the knee: a randomized controlled trial with a six-year follow-up. J Bone Joint Surg Am;96:1425–1432.
14. Davide Edoardo, Bonasia , Giorgio Governale, Simone Spolaore , Roberto Rossi & Annunziato Amendola (2014); High tibial osteotomy; Modern Techniques In Lower Limb Realignment; Curr Rev Musculoskelet M ed 7:292–301;
15. DeMeo PJ, Johnson EM, Chiang PP, Flamm AM, Miller MC (2010). Midterm follow-up of opening-wedge high tibial osteotomy. Am J Sports Med.;38(10):2077-2084.
16. Matthews LS, Goldstein SA, Malvitz TA, Katz BP, Kaufer H(1988) Proximal tibial osteotomy. Factors that influence the duration of satisfactory function. Clin Orthop Relat Res 229:193–200
17. Naudie D, Bourne RB, Rorabeck CH, Bourne TJ (1999) The Install Award. Survivorship of the high tibial valgus osteotomy. A 10- to 22-year followup study. Clin Orthop Relat Res 367:18–27
18. Dettoni F, Bonasia DE, Castoldi F, Bruzzone M, Blonna D, Rossi R (2010). High tibial osteotomy versus unicompartmental knee arthroplasty for medial compartment arthrosis of the knee: a review of the literature. Iowa Orthop J;30:131–40
19. Stukenborg-Colsman C, Wirth CJ, Lazovic D, Wefer A (2001) High tibial osteotomy versus unicompartmental joint replacement in unicompartmental knee joint osteoarthritis: 7–10-year followup prospective randomised study. Knee 8(3):187–194
20. Brouwer RW, van TM Raaij, Bierma-Zeinstra SM, Verhagen AP, Jakma TS, Verhaar JA (2007) Osteotomy for treating knee osteoarthritis. Cochrane Database Syst Rev 18(3):CD004019
21. Amendola A, Rorabeck CH, Bourne RB, Apyan PM (1989) Total knee arthroplasty following high tibial osteotomy for osteoarthritis.J Arthroplasty 4(Suppl):S11–S17
22. Karabatsos B, Mahomed NN, Maistrelli GL (2002) Functional outcome of total knee arthroplasty after high tibial osteotomy. Can J Surg 45(2):116–119.

23. Van Raaij TM, Bakker W, Reijman M, Verhaar JAN (2007) The effect of high tibial osteotomy on the results of total knee arthroplasty: a matched case control study. BMC Musculoskelet Disord 8:74–79
24. Kazakos KJ, Chatzipapas C, Verettas D, Galanis V, Xarchas KC,Psillakis I (2008) Mid-term results of total knee arthroplasty after high tibial osteotomy. Arch Orthop Trauma Surg 128:167–173