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Original Article

Evaluation of Medial Open-Wedge High Tibial Osteotomy Results

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ABSTRACT

Objective: There are several studies on medial open-wedge tibial osteotomy, but there is still some debate about the acceptable amount of preoperative flexion contracture degree. Also, clinical effects of alteration of the tibial slope after the procedure are not clear. This study aimed to investigate the mid-term the clinical and radiological findings and complications of medial open-wedge tibial osteotomy.

Methods: A total of 44 knees of 42 patients were retrospectively investigated between January 2001 and February 2012. Tibial sagittal slope, mechanical tibiofemoral angle (mTFA), mechanical lateral distal femoral angle (mLDFA), and medial proximal tibia angle (MPTA) were measured both preoperatively and postoperatively. The mean follow-up period was 92±7 (range 70–113) months. In four (10%) patients, 10 degrees of flexion contracture was present preoperatively. The clinical outcome was evaluated with the Hospital for Special Surgery (HSS) Knee Score, Oxford Knee Score (OKS), and Knee Outcome Survey-Activities of Daily Living Scale (KOS-ADLS).

Results: The mean age of the participants was 45.7±18.3 (range 17–84) years. There were 34 (81%) females and 8 (19%) males. The mean knee range of motion increased from 120±11 to 130±9 degrees, postoperatively. The HSS scores improved to excellent in 29 (69%), good in 9 (21%), and moderate in 4 (10%). The ADLS and Oxford scores improved two-fold.

Conclusion: In conclusion, further studies are needed to understand the relationship between flexion contracture and tibial sagittal slope. Therefore, in selected patients, flexion contracture may not be a restraint for osteotomy, especially if the slope increase is prevented.

INTRODUCTION

In the elderly, medial gonarthrosis causes knee pain and restricts daily activities.[1] In young patients with early osteoarthritis, high tibial osteotomy is a better procedure than arthroplasty.[2] Lower extremity mechanical axis can be improved and total knee replacement in the future can be avoided by high tibial osteotomy.[3] Various tibial osteotomy types (e.g., closing wedge, opening wedge, dome osteotomy) were defined in this purpose. Osteotomy can also be added to osteochondroplasty, menisectomy, or instability procedures aiming to facilitate cartilage preservation, subchondral healing, and to increase stability.[4] To our knowledge, several studies investigate medial open-wedge tibial osteotomy, but there is still some debate about the acceptable amount of preoperative flexion contracture degree. Also, the clinical effects of alteration of tibial slope after the procedure are not clear. This study aimed to evaluate the clinical effects of preoperative flexion contracture degree and alteration of the tibial slope. Also, we investigated the mid-term clinical and radiological results and complications of medial open-wedge tibial osteotomy.

MATERIAL AND METHODS

Institutional review board approval was taken and informed consent was obtained from the patients. In this study, both the Belmont report on ethical principles and the National Institute of Health guidelines were considered. Between January 2001 and February 2012, 54 knees of 52 patients with high tibial osteotomy were retrospectively investigated. Inclusion criteria were medial knee pain, isolated medial compartment osteoarthritis or osteonecrosis of the medial compartment, misalignment with 5–15 degrees varus between the tibial and femoral mechanical axis, medial open-wedge osteotomy, and fixation with a wedge plate. Anterior cruciate ligament insufficiency, symptomatic osteoarthrosis of the lateral or patellofemoral compartment, osteotomy added to osteochondroplasty, menisectomy, instability surgery, and revision cases were excluded. Five patients died, and five

patients were lost to follow-up. Following the eligibility criteria, 44 knees of 42 patients were finally included in the study. Knee range of motion (ROM), instability, contracture, and muscle strength was assessed by physical evaluation. For all patients, anteroposterior, lateral, tangential X-rays, and leg length orthoroentgenogram while standing was obtained for both of the lower extremity. The Ahlback classification was used to evaluate the osteoarthritis for operation.[1] Two different surgeons performed the operations. A longitudinal incision is extending to 7 cm distal of the joint, between the tibial tuberosity and medial collateral ligament (MCL) was made. The anterior fibers of the superficial MCL were cut, and a retractor was placed to the posteromedial corner. A medial open-wedge osteotomy was performed and fixed with a wedge plate to establish the needed correction angle. One gram of cephalosporin was administered prior to skin incision. On the first postoperative day, low-molecule weight heparin was applied subcutaneously for 1 month. Patients were allowed to sit and perform isometric quadriceps exercises. On the second day, drains were taken, and patients were allowed to walk with no load. Weight-bearing was allowed at postoperative sixth week. All patients were followed up at 6, 12, 18, and 24 weeks and after that six months until the last review. The mean follow-up time was 92±7 (range 70–113) months. All patients were assessed with anterior-posterior and lateral X-rays while standing. Mechanical axis and femorotibial angle were measured and compared with the preoperative values. Tibial slope angle was measured by using a tibial anatomic axis. Knee ROM, Hospital for Special Surgery (HSS) Knee Score, Knee Outcome Survey-Activities of Daily Living Scale (KOS-ADLS), and Oxford Knee Score (OKS) were used to evaluate the clinical results.

Accepting less than 5% probability of type I error and a power of 80%, the required sample size was 34. SSPS version 11 (SPSS, Inc., Chicago, IL, USA) was used for statistical analysis, and the data were presented as the mean and standard deviations. Postoperative functional results and osteoarthrosis radiological classification data were compared using Fischer's exact test. Preoperative and postoperative data of the scoring systems used in the study were compared with Student's t-test. A value of $p<0.05$ was considered statistically significant.

RESULTS

The mean age of the participants was 45.7±18.3 (range 17–84) years. The mean body mass index was 32±2 kg/m^2. According to the Ahlback criteria,[5] 23 (55%) and 19 (44%) patients had stage I and stage 2 arthrosis, respectively. The mean mechanical axis was 7.8±3.04 degrees varus preoperatively and 0.8±3.32 degrees valgus postoperatively. The mean anatomic axis was 5.7±2.22 degrees varus preoperatively and 2.7±3.46 degrees valgus postoperatively. Also, the mean knee ROM increased 10±10 degrees postoperatively. Flexion contracture was present in four patients (up to 10 degrees) and improved to 0 degrees in all, postoperatively. The measured HSS scores were excellent to good in 38 (90%) patients (Fig. 1). The ADLS and Oxford scores improved from 35.83±2.8 and 42.58±4.5 to 71.24±5.2 and 21.62±4.4, respectively (Table 1). The mean tibial slope angle was increased to 2.34±1.18 degrees after surgery. Among the participants, 22 (52%) were very satisfied, 13 (31%) were satisfied, 6 (14%) were moderately satisfied, and 1 (3%) was mildly satisfied with the results of the surgery. A tibia non-displaced lateral plateau fracture was encountered in one patient, and it was treated with long leg brace. There was a superficial wound problem in one patient, and it was successfully treated with oral antibiotics. Both of them did not require secondary intervention. No implant insufficiency, deep venous thrombosis, or pulmonary embolism was encountered.

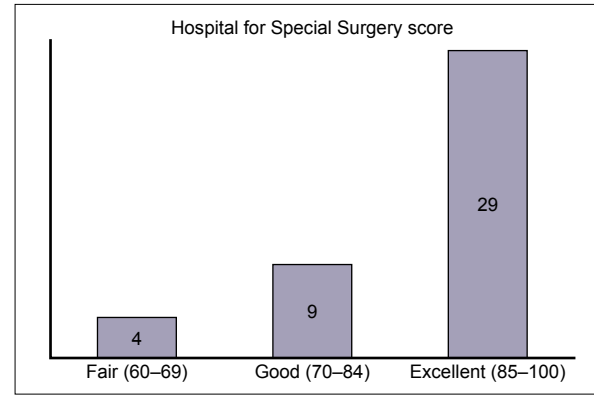

Figure 1. The postoperative Hospital for Special Surgery scores of the patients.

Table 1. Postoperative improvements of clinical parameters

	Preoperative	Postoperative	p*
OKS	42.58±4.5	21.62±4.4	=0.000032
KOS-ADLS	35.83±2.8	71.24±5.2	=0.000073
HSS Knee Score	65±3.27	82±3.82	=0.000045
Knee ROM	120±11	130±9	=0.000034
Mechanical axis	7.8±3.04 varus	0.8±3.32 valgus	=0.000053
Anatomical axis	5.7±2.22 varus	2.7±3.46 valgus	=0.000071

*Student's t-test. HSS: Hospital for Special Surgery; OKS: Oxford Knee Score; KOS: Knee Outcome Survey; ADLS: Activities of Daily Living Scale; ROM: Range of motion.

DISCUSSION

Medial opening wedge high tibial osteotomy has become more popular than lateral closing wedge osteotomy. Generally, the tibial slope increases after open-wedge and decreases after closing-wedge high tibial osteotomy.[5] It has been recommended that the osteotomy line in the sagittal plane be parallel to the medial posterior tibial slope.[6] However, the effects on the posterior tibial slope of closing- or opening-wedge osteotomies remain controver-

sial. The distinctive result of this study was that up to 10 degrees of flexion contracture did not restrain the efficacy of tibial open-wedge osteotomy. However, the participants did not exhibit anterior wedge resection or posterior capsule release.

There are some reports that high tibial osteotomy has no effect on the ROM, and over 5 degrees of flexion contracture signifies contraindication for osteotomy.[1,7] Naudie et al.[8] found that a preoperative ROM lower than 120 degrees associated with flexion contracture greater than 5 degrees was related to early failure (p-value 0.042). Flexion contracture as a contraindication is based on relatively poor results of small epidemiological studies. In cases with flexion contracture, the deflexion effect can be achieved by reducing the posterior slope.[9] But this may lead to anterior translation and an increased load on the anterior cruciate ligament. To our knowledge, there is only one study that focuses on preoperative flexion contracture and reported satisfactory results with severe (>20 degrees) flexion contracture.[10]

Ducat et al.[11] suggested loosening soft tissue and performing an osteotomy in the posterior to avoid slope increase. But, osteotomy may result in recurvation with anterior wedge resection or posterior capsulotomy.[12,13] Noyes et al.[14] reported that anterior osteotomy gap should be half as large as the posteromedial gap to obtain a standard posterior tibial slope. Shi et al.[15] found that a 1-degree increase in the posterior tibial slope resulted in a 1.8-degree increase in knee flexion. Similarly in our series, the mean flexion degree increase was 10 degrees, but the mean slope increase was only 2.34 degrees. Despite the slope increase, improve in the flexion contracture may seem like a contradictory. But this improvement may be related to the disappearance of the protective muscle spasm due to the newly formed load distribution.

According to a meta-analysis of sex differences in osteoarthritis, females aged <55 years tended to have more severe OA in the knee. These results demonstrate the presence of sex differences in OA prevalence and incidence. Females also tend to have more severe knee OA, particularly after reaching menopausal age.[16] Van Houten et al.[17] reported a sex ratio of 3:1, BMI of 28±4 kg/m^2 and complication rates of 17% in 192 patients and 224 knees, while Goshima et al. reported a sex ratio of 1:2, BMI of 24±2.6 kg/m^2 and complication rates of 20% in 50 patients and 60 knees.[5]

This study was a retrospective and non-comparative study. Prospective study design may provide further information. Also, patellofemoral arthrosis degree and correction variances (e.g., overcorrection, under correction, loss of correction) could be compared with clinical results.

In conclusion, further studies are needed to understand the relationship between flexion contracture and tibial sagittal slope. Therefore, in selected patients, flexion contracture may not be a restraint for osteotomy, especially if the slope increase is prevented.

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None.

Ethics Committee Approval

Approved by the local ethics committee.

Informed Consent

Retrospective study.

Peer-review

Internally peer-reviewed.

Authorship Contributions

Concept: H.S.Y.; Design: H.S.Y.; Data collection &/or processing: Ö.E.; Analysis and/or interpretation: Ö.E.; Literature search: Ö.E.; Writing: Ö.E.; Critical review: H.S.Y.

Conflict of Interest

None declared.

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Medial Açık Kama Yüksek Tibial Osteotomi Sonuçlarının Değerlendirilmesi

Amaç: Medial açık kama tibial osteotomisi planlanan olgularda kabul edilebilir ameliyat öncesi fleksiyon kontraktürü miktarı hakkında tartışmalar halen devam etmektedir. Bu çalışmada medial açık kama tibial osteotomisinin orta dönem klinik, radyolojik bulguları ve komplikasyonları araştırıldı.

Gereç ve Yöntem: Ocak 2001 ile Şubat 2012 tarihleri arasında 42 hastanın 44 dizi geriye dönük olarak incelendi. Ortalama takip süresi ise 92±7 (aralık, 70–113) ay idi. Tüm hastalar ameliyat öncesi ve sonrası HSS (Hospital for Special Surgery) Diz Skoru, OKS (Oxford Knee Score) ve KOS-ADLS (Knee Outcome Survey-Activities of Daily Living Scale) ile değerlendirildi.

Bulgular: Ortalama yaş 45.7±18.3 (aralık, 17–84), Olguların 34'ü (%81) kadın, sekizi (%19) erkek idi. Ameliyat sonrası ortalama diz hareket açıklığı 120±11 dereceden 130±9 dereceye çıkmıştı. Ameliyat sonrası HSS skorları 29 (%69) hastada mükemmel, dokuz (%21) hastada iyi, dört hastada (%10) orta olarak saptandı. Ameliyat öncesi ADLS ve Oxford skorları sırasıyla 35.83±2.8 ve 42.58±4.5 iken ameliyat sonrasında 71.24±5.2 ve 21.62±4.4 olarak saptandı.

Sonuç: Fleksiyon kontraktürü ve sagital tibial eğim arasındaki ilişkiyi anlamak için daha ileri çalışmalara ihtiyaç vardır. Bununla birlikte seçilmiş hastalarda tibial eğim artışı önlenebilirse ameliyat öncesi fleksiyon kontraktürü osteotomiye engel teşkil etmeyebilir.

Anahtar Sözcükler: Açık; fleksiyon; kama; kontraktür; medial; osteotomi; tibia; yüksek.