

Physical Activity after High Tibial Osteotomy for Treatment of Medial Compartment Knee Osteoarthritis

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Abstract

Background: High tibial osteotomy (HTO) is the preferential treatment for the symptomatic osteoarthritis of the medial compartment of the knee. Even though HTO is recommended for the active patient, there is few information describing sports and recreational activities after HTO.

Purpose: The objective of this study is to evaluate the physical activity and functional outcome of a group of patients presenting with medial compartment osteoarthritis of the knee.

Methods: 174 patients who had been submitted to HTO were evaluated after a mean follow-up period of 47.9 months by interview and questionnaire. Functional and physical activities were scored according to published rating systems.

Results: 142 (81.6%) patients were satisfied (mean satisfaction 2) with the outcome of surgery, 64.3% of the patients had normal work duties after surgery without limitation or decline in performance and 58.6% had resumed physical activities at pre-operative levels: some patients had started the exercises (18.4%). The mean preoperative score for physical activity according to the Tegner and Lysholm scale was 2.9 ± 1.9 , while the mean postoperative score was 3.2 ± 2.9 ($p > 0.05$). According to Lysholm and Gillquist ratings, the mean preoperative score for physical performance was 57.1 ± 16.2 while the mean postoperative score had increased to 77.3 ± 17.5 ($p < 0.05$).

Conclusion: Based on this study, HTO allow the resumption of physical activities for many individuals with symptomatic osteoarthritis of the medial compartment of the knee, resulting in improvements of the clinical conditions and, consequently, in their daily working and recreational activities.

Keywords: High tibial osteotomy; Knee osteoarthritis; Varus knee deformity; Physical activity

Introduction

High tibial osteotomy (HTO) is a surgical option in the treatment of medial femorotibial osteoarthritis [1-30]. Although the lateral closing-wedge proximal tibial osteotomy is well documented in the literature, several shortcomings have been reported, such as the lack of precision of the correction and difficulties in conversion to a total knee arthroplasty (TKA) [2,4,7,14,15,17,18,27]. To avoid these problems, medial opening-wedge proximal tibial osteotomies have been advocated. The clinical outcome after HTO is satisfying, even though long-term results have been shown to deteriorate [15,17,22]. When successful, HTO can improve pain and function; postpone disease progression and early TKA [12,15,17,20,22,30]. In young active individuals, it can facilitate a return to sports and allow them to continue to participate in sporting activity into later life [3,10,25,28,30].

There is a plethora of literature that describes the return to sports and recreational activities after other surgical procedures, including knee arthroscopy, osseous procedures, anterior cruciate ligament

replacement, and joint arthroplasty [1,3,5,6,8,9,10,11,21,23,24,28]. Even though HTO is recommended for the active patient, there is few information describing sports and recreational activities after HTO [3,25,28,30].

To our knowledge, there are only three studies that reported clinical results after HTO for arthritic genu varum that included return to sports and heavy work [3,25,28]. It is hypothesized that that HTO improves physical activity and functional outcome in these patients. The objective of this study is to evaluate the physical activity and functional outcome of a group of patients presenting with medial compartment osteoarthritis of the knee after this surgery.

Patients and Methods

Patients

Details of this study were approved by the Ethical Committee of the Hospital Madre Teresa/Brazil (IRB - 35204214.0.0000.5127) and written informed consent was obtained from each participant prior to the commencement of the study. No financial incentives were offered to encourage subjects to participate in the study.

A total 180 of patients with symptomatic medial osteoarthritis of the knee and varus deformity were submitted to HTO performed by the senior author (E.F.T.). Conservative treatment (exercises, weight loss, medications) was attempted in all patients before surgical treatment. Surgeries were done between June 2005 to August 2012 at the Hospital Madre Teresa/Brazil. The exclusion criteria for surgical treatment included grade III obesity (body mass index > 35 kg/m²), grade III or IV chondral lesions in the lateral compartment [26], symptomatic osteoarthritis of the patellofemoral joint, movement arch <90°, local or systemic infections, inflammatory arthropathies and radiological osteoarthritis scoring system (Kellgren/Lawrence) ≥ 3 [16]. 174 (96.6%) of the HTO patients were subsequently followed-up through the analysis of medical records and by telephone interviews performed by one author who did not participate of the surgical procedures, previously validated in pilot project. 6 patients were lost in follow-up. Of the 174 patients enrolled in the follow-up study, 56 (32.2%) were females and 118 (67.8%) were males and the mean age of the group at the time of surgery was 53 ± 6.7 years (range 34 to 70 years). The mean postoperative follow-up time was 5.4 ± 2.1 years (range 2 to 9 years). For the majority (n =98; 56.3%) of patients, surgery was performed on the left leg, while 76 patients (43.7%) had the right leg operated.

The interviews were based on a questionnaire relating to the level of satisfaction with the surgery (scored as 1= very satisfied, 2 = satisfied, 3 = partly satisfied, and 4 = dissatisfied) and complications. The stability and endurance of the knee during sporting and occupational activities were scored according to the systems proposed by Tegner and Lysholm [29] and by Lysholm and Gillquist [19].

Surgical procedures

All patients were submitted to video-arthroscopy during surgery, prior to HTO, to evaluate the integrity of the lateral compartment and the patellofemoral joint, and to address any intra-articular cartilage pathology. Surgery was performed under pneumatic tourniquet applied to the upper-thigh with the patient positioned supine on a radiolucent operating table. Following video-arthroscopy, a straight medial incision was made in the proximal third of the tibia and pes anserine and superficial medial collateral ligament were detached. Once this was completed, fluoroscopy was used to visualize a 3-mm guide pin placed from a medial to lateral direction approximately 1 cm distal and parallel to the proximal tibial joint line. An oscillating saw was used to initiate the osteotomy. Osteotomes were used to complete the cuts on the anterior and posterior cortex under direct visualization and under fluoroscopic control. At no time was the lateral cortex breached by the osteotomes or saw. After this, the opening wedge osteotomy tines were placed into the osteotomy site, and the opening-wedge osteotomy was initiated with a handheld mallet in 5-mm increments. The magnitude of correction was determined by the weightbearing line, visualized by tensioning the electrocautery cord over the center of the femoral head to the center of the tibial-talar joint under fluoroscopic control. The osteotomy was opened until the weight-bearing line reached a point on the lateral aspect of the tibia that was 62% of the width of the tibial plateau. Then, a T locked plate was placed in the osteotomy site and gently tamped. A tricortical iliac wing autograft was placed next to the plate for additional support. Once this was completed, the superficial medial collateral ligament was sutured to the pes anserinus with No. 1 Vicryl and the skin was closed.

The overall goals of rehabilitation after osteotomy are pain control, reduction of swelling; regain lower extremity muscle strength, proprioception, balance, and coordination for desired activities;

achieving the best possible outcome. Patients were discharged from hospital on the day after surgery and were advised to perform joint mobilization without loading weight onto the operated limb. Postoperative evaluations was carried out at 7, 14, 45, 90 and 180 days after surgery, and annually thereafter. Generally, patients were allowed to walk with partial-weight bearing after 2 weeks and full-weight bearing between 4 and 6 weeks. The patients who undergo HTO are advised to progressively return or start sports activities after healing of osteotomy and recovery of muscle strength to maintain an active and healthy lifestyle and weight control.

Statistical analyses

Statistical analyses were carried out with the aid of Epi Info 2000 software (Centers for Disease Control and Prevention, Atlanta, GA, USA) with the level of statistical significance set at p<0.05. Data were tested for normality of distribution using the Shapiro-Wilk. Mean values (± standard deviations) were compared using Student's t test.

Study design:

Case series; Level of evidence IV

Results

In analysis, 78 patients were grade 1 and 96 patients were grade 2 for medial tibiofemoral compartment of radiological osteoarthritis scoring system (Kellgren/Lawrence). The average of preoperative varus deformity (tibiofemoral angle) was 12° ± 2° (range 8° to 15°), a value that was significantly different (p<0.05) from valgus 8° ± 1° (range 6° to 10°) determined postoperatively. Thirty four patients required treatment concomitant with HTO, comprising thirty partial medial meniscectomies and ten medial compartment chondroplasties to grade II chondral lesions. No significant differences in physical activity and functional score were detected between these subjects and those submitted exclusively to HTO, either during the pre- or the postoperative periods (p>0.05). In six patients was documented grade I chondral lesion in medial compartment. None of the patients presented delayed union, pseudoarthrosis, radiological osteoarthritis progression, persisting medial, patellofemoral osteoarthritic symptoms or clinical symptoms that required hardware removal.

According to follow-up interviews, 142 patients (81.6%) were either very satisfied (n=65) or satisfied (n=77) with the outcome of surgery, while twenty patients were partly satisfied and twelve (6.8%) were dissatisfied. The average value for the level of satisfaction with the surgery was 2 (corresponding to satisfied). 140 (80.5%) of the 174 patients involved in the study had resumed some work after surgery and 112 (80%) of them had resumed normal work duties after surgery at their preoperative functional level without limitation or decline in performance.

The average preoperative score for physical activity according to the Tegner and Lysholm [29] system was 2.9 ± 1.9 (range 1 to 7), a value that was not significantly different (p>0.05) from that 3.2 ± 2.9 (range 1 to 7) determined postoperatively. Evaluation of physical performance according to Lysholm and Gillquist [19] ratings produced a mean preoperative score of 57.1 ± 16.2 (range 12 to 95) with patients classifying their preoperative performance as poor (n=144; 82.7%), fair (n=28; 16.1 %) and good (n=2; 1.2%). The mean postoperative score of physical performance (77.3 ± 17.5; range 13 to 100) showed a significant (p<0.000003) improvement over the preoperative value, with patients rating their postoperative performance as poor (n=32;

18.4%), fair (n=76; 43.7%), good (n=54; 31%) and excellent (n=12; 6.9%). Detailed analysis of the Lysholm and Gillquist [19] score (Table 1) revealed that clinical symptoms improved in all patients submitted to HTO. 95 patients (54.6%) reported that during the preoperative period they had performed routine physical activities such as hydro-gymnastics, hydrotherapy, swimming and muscle building exercises, while others 20 (11.5%) patients had also taken part in sports (18 soccer practice and the other two volleyball). 102 (88.6%) of the 115 active individuals resumed their normal physical practices (with the exception of volleyball) after surgery. Of that not realize any activity preoperatively, 32(18.4%) patients started physical activity, all in water, after surgical procedure. There was no statistical difference when compared gender in demographic and functional scores (p>0.05). None of the patients had entered in physical competitions of any type either prior to or after surgery.

Clinical Symptoms	Mean Score		P value
	Preoperative	Postoperative	
Claudication (max. 5 points)	2.1	3.4	p<0.05
Support points (max. 5 points)	4.7	8.2	p<0.05
Locking points (max. 15 points)	11.6	13.6	p>0.05
Instability (max. 30 points)	17.5	21	p>0.05
Pain (max. 25 points)	6.5	19.5	p<0.05
Swelling (max. 10 points)	3.6	7	p<0.05
Stair climbing (max. 10 points)	4.7	6.2	p>0.05
Squatting (max. 5 points)	2.1	2.8	p>0.05

p>0.05 = not significant. p<0.05 = significant

Table 1: Pre- and Post-operative mean scores of patients submitted to high tibial osteotomy evaluated according to the lysholm and gillquist rating system

Discussion

Historically, the outcome of HTO depends on the condition of the patient, the surgical procedures performed, the alignment obtained post-operatively and follow-up time [4,12,13,14,15,18,27]. Evaluations of this surgical procedure also suggest that age and preoperative physical activities are determining factors in the outcome of surgery [2,4,7,12,13,14,15,17,18,20,22,27,30]. This study reported that there was no difference in score for physical activity with the HTO, although improves the clinical conditions of individuals and, consequently, their recreational and work activities. Additional surgical procedures realized with HTO did not influence negatively the clinical prognosis of patients, however, prospective studies are needed to confirm this. Most patients were able to resume physical activities, since some physical practice already exists in preoperative. None of patients had entered in physical competitions of any kind either prior to or after surgery. To our knowledge there are only three studies that reported

clinical results after HTO that included return to sports and heavy work after HTO [3,25,28].

There is little published literature that specifically evaluates return to sporting activities after HTO. In Odenbring et al study, 9 of 27 patients (33.3%) below the age of 50 years were able to return to high-activity sports or heavy work after an HTO [25]. Salzmann et al. showed similar results to this series. At the time of survey, 90.9% of patients were engaged in sports and recreational activities, compared with 87.9% before surgery (p=0.182). The number of different sporting activities declined from 3.5 preoperatively to 3.0 after surgery (p=0.178). The Lysholm score (42.4) and the visual analog scale (6.9) illustrated significant improvements (69.6, p=0.001; and 2.9, p<0.001, respectively) [28]. Bonnin et al. retrospectively investigated activities, sports participation, and the level of satisfaction of in 139 patients with unilateral no complicated HTO. 63% of patients reported that their knee was “normal,” 62% felt that their activities were limited by their knee, and 56% reported that they were as active as they expected to be before the intervention. This study shows that young motivated patients are able to resume strenuous activities following HTO. However, patients must be informed that they will typically not recover their pre-pathology level and that residual pain during strenuous sports is not exceptional [3].

The significant improvements in the physical performance scores in this series, especially those regarding the experience of pain, swelling, support and claudication, indicate that HTO improves the clinical conditions of individuals and, consequently, their recreational activities. Furthermore, it was demonstrated that 81.6% of the patients were pleased with the outcome of the surgery and that 64% of them returned to normal work without limitation or decline in performance.

The fact that we use Tegner and Lysholm [29] and by Lysholm and Gillquist [19] scores, instead of osteoarthritic ones as WOMAC or KOOS, was explained by the first objective: evaluate physical activity improvement, functional outcome and knee disorders, which made the first ones more appropriate than the others. The main limitations of the present study are to be found in the retrospective design. Patients were asked for activities and clinical information that, in some cases, dated back several years. The short-term nature of the study did not allow drawing conclusions concerning arthroplasty avoidance, the continuation of sporting activities, or the relationship between continued sporting activities and the progression of knee OA. These issues should be investigated in future studies.

This study is important from a practical standpoint because surgeons can consider HTO in patients presenting medial compartment osteoarthritis of the knee refractory to conservative follow-up, improving clinical conditions, recreational and work activities.

Conclusion

Based on this study, HTO allow the resumption of physical activities for many individuals with symptomatic osteoarthritis of the medial compartment of the knee, resulting in improvements of the clinical conditions and, consequently, in their daily working and recreational activities.

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