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## The Knee



# Good functional results following high tibial opening-wedge osteotomy of knees with medial osteoarthritis☆

## A prospective study with a mean of 8.3 years of follow-up

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## ABSTRACT

**Background:** To report time dependent functional improvement and predictive risk factors for failure when the load in varus knees with medial osteoarthritis is shifted from the medial to the lateral knee compartment.

**Methods:** Forty-nine consecutive patients (52 knees), mean age 47 (31–64) years, underwent a high tibial opening-wedge valgus osteotomy stabilized with a Puddu plate and bone grafting. The patients were evaluated with the Knee Injury and Osteoarthritis Outcome Score (KOOS) preoperatively and at three and six months, one, two, five and 10 years postoperatively with a mean follow-up time of 8.3 years (2.0–10.6).

**Results:** Mean angular correction was 8.0° (four to 12). The five subscores of KOOS increased significantly during the first year by 40–131% from preoperative values, the good results remaining throughout the 10-year follow-up for those with a surviving osteotomy. The outcome was related to the grade of preoperative osteoarthritis. Seven knees were converted to total knee arthroplasty (TKA) mean 6.2 years (two to nine) post-operatively, and had a lower KOOS preoperatively than those of surviving osteotomies. The osteotomy survival rate at five years was 94% and at 10 years 83%. Patients with KOOS subscore quality of life (QoL) <44 at the two-year follow-up had a 11.7 times higher risk for later TKA than those with QoL ≥44 (P = 0.017).

**Conclusion:** High tibial opening-wedge osteotomy for medial knee osteoarthritis resulted in good functional recovery after one year and favorable mid-term results. It may be a good treatment option for middle-aged patients with varus knees and medial osteoarthritis in order to prevent or postpone TKA.

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## 1. Introduction

The medial knee compartment is loaded by an adduction moment in the stance phase during walking with peak forces approximately three times the body weight, temporarily unloading the lateral compartment [1,2]. Large medial meniscal resections

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with loss of cartilage thickness increase knee adduction and loading of the medial compartment with further cartilage destruction and development of osteoarthritis [1]. Unloading the medial compartment by a corrective valgus osteotomy will relieve the osteoarthritic symptoms, and destroyed hyaline cartilage may later be replaced by fibrocartilage [3–5]. A high tibial valgus osteotomy (HTO) may be performed either as lateral closing-wedge [6,7] or as medial opening-wedge osteotomy [8,9]. The surgical procedure may be less demanding with the opening-wedge technique, saving bone stock and avoiding complications related to fibula osteotomy or disruption of the proximal tibiofibular joint which is part of the closing-wedge technique [10]. In the late 1990s Puddu et al. [9] introduced a spacer plate to secure the planned opening of the medial osteotomy cleft of the proximal tibia.

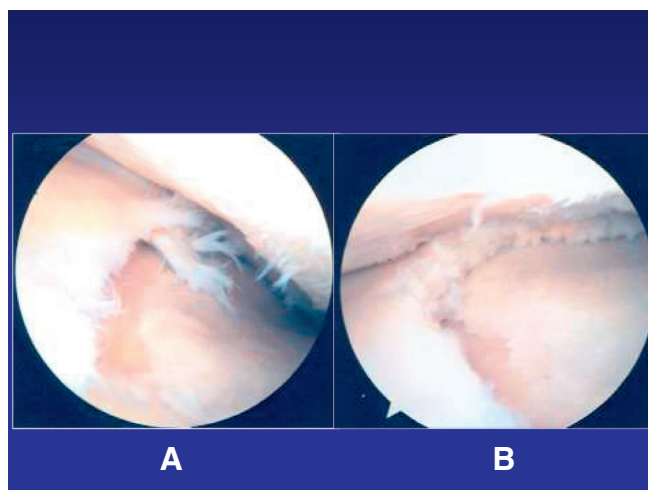
The purpose of this study was to evaluate the time dependent functional outcome of this surgical technique in 49 patients with medial knee osteoarthritis, and to identify predictive risk factors for later conversion of the osteotomy to total knee arthroplasty (TKA).

## 2. Patients and methods

Forty-nine consecutive patients (19 females and 30 males) with medial knee osteoarthritis were operated on with a high tibial valgus opening-wedge osteotomy in the period 2000–2008. Three patients had bilateral operations at different time points, including 52 knees in the study. The mean age of the patients was 47 years (confidence interval, CI 44.8–49.2, range 31–64). Osteoarthritis was due to one or several medial meniscal resections performed arthroscopically ( $n = 32$ ) or by open surgery 20–30 years previously ( $n = 13$ ), fracture of the medial tibia plateau ( $n = 4$ ), fracture of the tibial shaft healed in varus ( $n = 1$ ) and idiopathic medial knee osteoarthritis ( $n = 2$ ). Inclusion criteria were severe pain in a knee with medial osteoarthritis and varus malformation which had not responded to conservative treatment and where knee arthroplasty was not the first treatment of choice due to a relatively young age.

All patients were subjected to a preoperative arthroscopy six weeks to four months before the osteotomy where the degree of osteoarthritis of the medial knee compartment was recorded according to the International Cartilage Repair Society (ICRS) [11], and any meniscal flaps or loose articular cartilage were removed (Figure 1) [10,12]. A decision was made following arthroscopy if the joint surfaces of the lateral compartment could tolerate the increased weight load following a correcting osteotomy (Figure 2). Small osteoarthritic changes with an intact lateral meniscus were accepted. The clinical examination included knee range of motion (ROM) measured with a goniometer, and body weight and body mass index (BMI). The patients also filled in a questionnaire for calculation of the Knee Injury and Osteoarthritis Outcome Score (KOOS) [13]. KOOS has five subscales: Pain, other symptoms, activities of daily living (ADL), sports and recreational function, and knee related quality of life (QoL). A score from 0 to 100 is calculated for each subscale, with 100 representing the best result. A score improvement of 10 is supposed to have clinical relevance [14], and a QoL below 44 is considered a treatment failure [15].

Radiological evaluation was made on weight-bearing radiographs with straight knees and lateral knee radiographs. The radiographs were graded for osteoarthritis according to Kellgren–Lawrence [16]. Also the tibiofemoral anatomical axis angle was recorded. The angular correction was calculated on standing (full leg length), hip, knee and ankle (HKA) radiographs according to Dugdale et al. [17], aiming for the mechanical axis to pass just lateral to the intercondylar eminence corresponding to 62% of the width of the tibial plateau, measured from the medial side (Figure 3). Osteotomy failure was defined as conversion to TKA. Data from TKA converted patients were only included in the study until they received a TKA.



**Figure 1.** Arthroscopic view of a left knee with medial osteoarthritis, ICRS grade 3 before (A) and after (B) a meniscal flap resection.

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