Combined Biplanar High Tibial Osteotomy, Anterior Cruciate Ligament Reconstruction, and Abrasion/Microfracture in Severe Medial Osteoarthritis of Unstable Varus Knees

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Purpose: To determine survivorship and functional results of medial open-wedge high tibial osteotomy (HTO) combined with anterior cruciate ligament reconstruction (ACLR) and a chondral resurfacing (CR) procedure (abrasion/microfracture) in patients with Kellgren-Lawrence grade 3 and 4 osteoarthritis with full-thickness cartilage defects, anterior cruciate ligament (ACL) insufficiency, and varus malalignment. **Methods:** From October 2005 to March 2009, all combined HTO (fixation with angular stable internal fixator), ACLR, and CR procedures in knees with symptomatic medial osteoarthritis (Kellgren-Lawrence grade 3 and 4), ACL insufficiency, varus malalignment (>4°), and full-thickness large-area cartilage defects were prospectively surveyed with a minimum follow-up period of 5 years regarding survival (not requiring arthroplasty), functional outcome (subjective International Knee Documentation Committee [IKDC] score), and subjective satisfaction. Clinical evaluation (objective IKDC parameters and KT-1000 [MEDmetric, San Diego, CA] measurement), radiologic evaluation, and revision arthroscopy were performed between 1 and 2 years postoperatively. **Results:** Twenty-three knees (mean age, 47.0 ± 5.8 years) were included. The rate of follow-up was 100% at 6.0 ± 0.8 years (range, 5.2 to 7.5 years), with no arthroplasty until then. The mean subjective IKDC score improved from 47.7 ± 11.1 to 72.8 ± 15.0 at 1 year, 70.9 ± 16.0 at 3 years, and 73.1 ± 16.4 at 5 years ($P < .001$). Clinical examination and revision arthroscopy were performed in 22 cases (95.5%) at 1.3 ± 0.5 years (range, 1.0 to 2.0 years). Four ACL grafts (18.1%) were insufficient, and 2 grafts (9.1%) were stable but showed signs of degeneration. Good cartilage regeneration was seen in most cases, but no correlation with subjective IKDC score was apparent ($P = .528$). **Conclusions:** HTO in combination with ACLR and a CR procedure is effective in the treatment of severe medial osteoarthritis with concomitant ACL insufficiency and varus malalignment. The effect of the CR, as well as the reason for the considerable rate of graft insufficiency, remains unclear. **Level of Evidence:** Level IV, therapeutic case series.

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Anterior cruciate ligament (ACL) injury with subsequent instability is a well-known risk factor in the development of osteoarthritis, especially in cases with consequential meniscus loss.[1,2] In combination with pre-existing or acquired varus deformity, medial unicompartmental osteoarthritis is common, with a rather posteriorly located pattern of arthritis due to anterior subluxation.[2-4] Anterior cruciate ligament reconstruction (ACLR) can reliably restore stability but is controversially discussed in patients with advanced osteoarthritis.[5,6]

In recent years, osteotomies have gained increasing popularity to address unicompartmental osteoarthritis. Excellent functional outcomes have been reported especially for early osteoarthritis.[7-10] Limited data are available for more severe osteoarthritis, although midterm results are promising.[11,12] Cartilage procedures such as microfracture and abrasion might be additionally performed.[11,12] Stability of the knee and the absence or correction of malalignment are preconditions for all

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types of cartilage procedures.[13-15] Apart from deformity correction in the coronal plane, osteotomies can strongly influence the sagittal plane by consciously or unconsciously altering the tibial slope.[16-19] Although being well accepted in the treatment of posterior and posterolateral instabilities, the role of slope modifications in ACL-deficient knees is still not well understood.[16]

Numerous studies have investigated combined approaches of osteotomy and ACLR in early or imminent osteoarthritis as salvage procedures for young patients.[20-33] Only 1 of these studies (including 4 patients) has used the latest generation of implants (angular stable plate fixator).[20] So far, no study has investigated cases of severe osteoarthritis or combined chondral resurfacing (CR) or cartilage restoration procedures. However, young patients with a high degree of unicompartmental osteoarthritis and chronic ACL insufficiency are especially difficult to treat because total knee arthroplasty (TKA) is not a desirable option, and an intact ACL is seen as a precondition for unicondylar knee arthroplasty (UKA).[4] Although promising short-term to midterm results of combined UKA and ACLR have been reported, for these patients, a joint-preserving procedure might be more favorable.[34]

Therefore the purpose of this study was to determine survivorship and functional results of high tibial osteotomy (HTO) combined with ACLR and a CR procedure (abrasion/microfracture) in patients with Kellgren-Lawrence grade 3 and 4 osteoarthritis with full-thickness large-area cartilage defects, chronic ACL insufficiency, and varus malalignment. Our hypothesis was that this combined approach would lead to significant functional improvements, could restore stability, and could postpone arthroplasty in patients for whom this would have been the alternative surgical treatment.

Methods

From October 2005 to March 2009, a total of 23 consecutive cases of HTO in combination with ACLR and CR were performed at our institution. Patients were referred for joint preservation rather than arthroplasty. All were included in this observational therapeutic case study. Data were collected prospectively and analyzed retrospectively. The study protocol was approved by the research ethics board.

The inclusion criteria for this study were as follows: (1) medial-sided knee pain as the major complaint, (2) symptomatic ACL insufficiency, (3) grade 3 or 4 osteoarthritis of the medial compartment on radiologic assessment according to Kellgren and Lawrence[35] (Fig 1 A and B), (4) malalignment with more than 4° of varus (angulation between femoral and tibial mechanical axes on hip-to-ankle standing anteroposterior radiograph) (Fig 1C),[36] and (5) full-thickness large-area articular cartilage defects in the medial compartment (Fig 2) as confirmed during arthroscopy according to the recommendations of the International Cartilage Repair Society.[37] Contraindications included a body mass index greater than 30 kg/m^2, posterior cruciate ligament insufficiency, absence or extensive loss of the lateral meniscus, and grade 3 to 4 chondral lesions of the lateral compartment.

Surgical Technique

Surgery was performed with the patient supine on the operating table and the leg placed in a leg holder with an inflated tourniquet (350 mm Hg). ACLR was

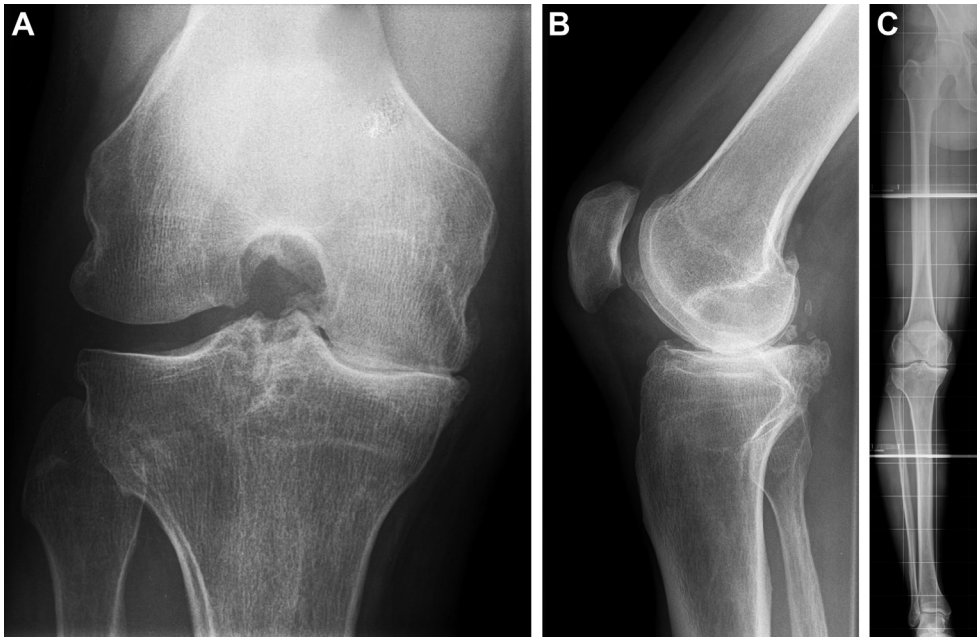

Fig 1. Preoperative (A) Rosenberg, (B) lateral, and (C) axis views of a right knee.