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Clinical and radiologic evaluation of medial epicondylar osteotomy for varus total knee arthroplasty

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ABSTRACT

Background: In varus total knee arthroplasty (TKA), a pathologic contracture of the medial soft tissue should be released for ligament balancing. A medial epicondylar osteotomy has been performed as an alternative method for this. The purpose of this study was to demonstrate the clinical and radiologic results of medial epicondylar osteotomy for varus TKA, focusing on the union type of osteotomy site.

Methods: The study retrospectively evaluated 61 cases with a mean femorotibial angle of 10.4° varus and a mean flexion contracture angle of 8.5 ± 9.8°. Intraoperative medial and lateral gap difference in extension and 90° flexion was accepted at <2 mm. Clinical outcomes (Knee Society Scores, range of motion) and radiologic outcomes (coronal alignment and valgus stability) were compared between the two groups divided by the union type of osteotomy site (bony union or fibrous union).

Results: The clinical and radiologic outcomes were significantly improved at the latest follow-up. Bony union was achieved in 39 (63.9%) patients, whereas 22 patients showed fibrous union. There was no difference in the varus–valgus angle on the stress radiographs between the bony union and fibrous union group (1.6 ± 1.2° vs. 1.6 ± 0.8°, $P < 0.916$). The Knee Society Scores (knee, function), range of motion and radiographic alignment did not differ between the two groups.

Conclusion: Medial epicondylar osteotomy was a good option for gap balancing during TKA, as it provided satisfactory clinical and radiological results, regardless of union type of the osteotomy site.

1. Introduction

The common goals of total knee arthroplasty (TKA) are to achieve the desired alignment in a relative and consistent way and to obtain functional stability with gap symmetry throughout the range of motion. Appropriate ligament balancing is necessary for the success of TKA and a crucial factor in preventing deleterious long-term effects, including instability, increased polyethylene wear, aseptic loosening, pain, and dysfunction [1–4].

In varus TKA, a pathologic contracture of the medial soft tissue should be released for ligament balancing. Every surgeon has his/her own surgical technique for performing a sequential medial release [5–10]. The superficial medial collateral ligament (MCL) is the structure of maximal and final correction during a medial release [8,11,12]. There are three components of the superficial

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MCL for a medial release: femoral origin, midsubstance, and tibial insertion. Most surgeons perform a periosteal release of the superficial MCL on the tibial insertion; [13] however, an overzealous release of superficial MCL can cause detachment of the superficial MCL, which may lead to TKA instability such as medial joint opening and medial condylar lift-off [8,12,14]. Several surgeons have suggested superficial MCL release on the midsubstance by pie-crusting or multiple needle puncturing [5,6,15]. It can be debilitating if over-release or unpredictable tears of superficial MCL occur [16,17].

Engh introduced superficial MCL release with bone on the femoral origin and called it medial epicondylar osteotomy [18]. In can enable easy management of a knee with severe combined varus and flexion contracture deformity [11]. In spite of the theoretical advantage of medial epicondylar osteotomy, which can prevent unintended medial laxity during gap balancing, its clinical and radiological outcomes have not been thoroughly reported [11,19]. Furthermore, there is concern over nonunion or fibrous union of the bony wafer, which might affect TKA stability [11,20].

The purpose of the current study was to demonstrate the clinical and radiologic results of medial epicondylar osteotomy for varus TKA, focusing on the union type of osteotomy site. The hypotheses were as follows: (1) Medial epicondylar osteotomy for varus TKA would provide satisfactory clinical and radiologic outcomes, as well as stability after TKA over time; (2) The union type of bony wafer would not affect the clinical and radiologic results, including stability.

2. Material and methods

2.1. Study design

From November 2004 to December 2012, 63 cases (of 909 cases of primary TKA, 6.9%) in 54 patients with primary TKA using medial epicondylar osteotomy and a minimum follow-up of two years were enrolled. Of the 63 cases, two were excluded due to lack of follow-up. Therefore, this study retrospectively reviewed 61 cases: 48 women (55 knees) and six men (six knees). The mean age was 72.4 years (range 53–87) and the mean BMI was 25.7 $\pm$ 4.2 kg/m^2 (range 15.8–36.8). The diagnoses were osteoarthritis in 54 cases, rheumatoid arthritis in two cases, osteonecrosis in two cases, traumatic arthritis in two cases, and Charcot arthropathy in one case. Posterior-stabilized fixed bearing TKAs were used in 48 cases (17 Advantim, 13 Vanguard, eight NexGen, eight PFC Sigma, and two Maxim) and mobile bearing TKAs in 13 cases (13 PFC Sigma RP-F). The mean follow-up period was 50.6 $\pm$ 29.8 months (range 24–116). This study was approved by the Institutional Review Board.

2.2. Surgical procedure and postoperative management

All TKAs were performed by two surgeons (BKL, JAS) through the medial parapatellar approach and with the modified gap balancing technique [21]. The patient's legs were manually pulled into neutral rotation to assess extent of varus and predict the extent of medial release [22]. After removal of osteophytes, menisci, and cruciate ligaments, the distal femur was cut perpendicular to the mechanical axis by preplanning, and the proximal tibia perpendicular to the anatomical axis. The intramedullary guide was used for the distal femur cut and the extramedullary guide was used for the proximal tibia cut in a standard fashion. The medial and lateral gaps were then measured in extension using two laminar spreaders. When the medial gap in extension was tight, sequential medial release was performed as follows: (Step 1) release of the deep MCL; (Step 2) release of the posterior oblique ligament and/or semimembranous tendon; (Step 3) release of the posterior capsule; (Step 4) limited release of the superficial MCL $\pm$ medial epicondylar osteotomy [22]. This limited superficial MCL release procedure typically involves only proximal tibial attachment of the superficial MCL, which has been described by LaPrade et al., and the distal attachment is left mostly intact [23].

When the balanced extension gap was not achieved after limited superficial MCL release in the current study, a medial epicondylar osteotomy was performed as an additional component of step 4 of the medial release (Figure 1) [11]. Intraoperative medial and lateral gap differences in extension and 90° flexion were accepted at <2 mm. After medial epicondylar osteotomy was performed, the extension gap was measured again both laterally and medially using two calipers. On the medial side, a laminar

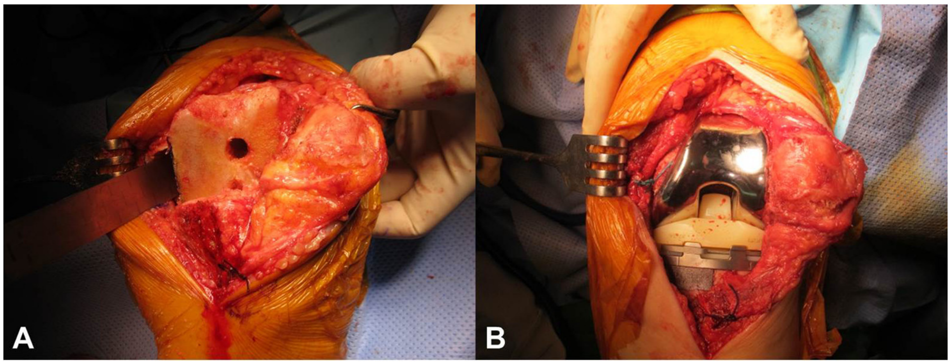

Figure 1. Medial epicondylar osteotomy with osteotome (A), and reattachment with non-absorbable sutures after component implantation (B).