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Brief communication

Radiographic assessment and clinical outcomes after total knee arthroplasty using an accelerometer-based portable navigation device

Hiroaki Shoji, MD [a], Atsushi Teramoto, MD [a, *], Tomoyuki Suzuki, MD [a], Yohei Okada, MD [a], Kota Watanabe, MD [b], Toshihiko Yamashita, MD [a]

[a] Department of Orthopaedic Surgery, Sapporo Medical University School of Medicine, Sapporo, Hokkaido, Japan
[b] Department of Physical Therapy, Sapporo Medical University School of Health Sciences, Sapporo, Hokkaido, Japan

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ABSTRACT

It has been reported that an accelerometer-based portable navigation device can achieve accurate bone cuts, but there have been few studies of clinical outcomes after total knee arthroplasty (TKA) using such a device. The aim of this study was to evaluate lower limb alignment and clinical outcomes after TKA using an accelerometer-based portable navigation device. Thirty-five patients (40 knees) underwent primary TKAs using an accelerometer-based portable navigation device. Postoperative radiographic assessments included the hip-knee-ankle angle, femoral component angle (FCA), and tibial component angle (TCA) in the coronal plane and the sagittal FCA and sagittal TCA in the sagittal plane. Clinical outcomes were evaluated by the Japanese Orthopedic Association score for osteoarthritic knees, Japanese Knee Osteoarthritis Measure, and the New Knee Society Score. The frequency of outliers (>3 degrees) was 10% for the hip-knee-ankle angle, 8% for FCA, 0% for TCA, 19% for sagittal FCA, and 9% for sagittal TCA. The Japanese Orthopedic Association score and Japanese Knee Osteoarthritis Measure were significantly improved postoperatively. The postoperative New Knee Society Score was 67.2% for symptoms, 50.3% for satisfaction, 58.6% for expectation, and 44.1% for function. TKA using an accelerometer-based portable navigation device achieved good results for both lower limb alignment and clinical outcomes.

Introduction

Accurate lower limb alignment is one of the most important factors for a successful total knee arthroplasty (TKA), and it has reportedly been associated with good postoperative clinical outcomes [1]. Recently, various devices have been used to achieve accurate lower limb alignment, such as computer-assisted surgery (CAS), an extramedullary alignment guide for femoral resection, and a patient-matched instrument (PMI) [2-4].

The KneeAlign 2 system (Orthalign Inc., Aliso Viejo, CA) is an accelerometer-based portable navigation device for TKA. This device can help achieve the correct angle of resection for the distal femur (flexion, varus/valgus) and the proximal tibia (posterior slope, varus/valgus). Although achievement of good lower limb alignment has been reported [5], little is known about the clinical outcomes using this device. The correlation between lower limb alignment after TKA and clinical outcomes is still controversial, but self-reported clinical outcomes may indicate the true clinical outcomes of TKA.

The aim of this study was to evaluate lower limb alignment and objective and self-reported clinical outcomes after TKA using an accelerometer-based portable navigation device.

Material and methods

This was a retrospective study approved by an institutional review board. Between March 2014 and November 2015, 35 patients (40 knees) underwent primary TKAs using the KneeAlign 2 system. These included 9 male patients with 9 knees and 26 female patients with 31 knees, with an average age of 75.5 years (range, 49-86 years). Overall, 36 knees had osteoarthritis, and 4 knees had

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* Corresponding author. South1 West 16, Chuo-ku, Sapporo, Hokkaido 060 8543 Japan. Tel.: +81 11 611 2111.
E-mail address: teramoto.atsushi@gmail.com

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rheumatoid arthritis. The average follow-up period was 14.6 months (range 6-26 months). The implant type was the Vanguard Complete Knee System (Zimmer Biomet, Warsaw, IN), and the posterior-stabilized type implant was used in all knees.

The trivector-retaining approach or the medial parapatellar approach was used. Bone cuts were performed by the modified gap technique. The KneeAlign 2 system was used for distal femoral resection and proximal tibial resection. In the coronal plane, both the distal femur and the proximal tibia were cut perpendicular to the mechanical axis. In the sagittal plane, the femoral flexion angle was set as the angle between the mechanical axis and the anterior distal femoral cortex line. The tibial posterior slope was set to 2 degrees.

Postoperatively, anterior–posterior radiographs of the lower limb were obtained for evaluation of the hip-knee-ankle (HKA) angle, femoral component angle (FCA), and tibial component angle (TCA). Lateral radiographs of the lower limb were obtained for evaluation of sagittal FCA and sagittal TCA. The HKA angle was defined as the angle between the line connecting the center of the femoral head to the center of the knee joint (femoral mechanical axis) and the center of the knee joint to the center of the ankle joint (tibial mechanical axis). FCA was defined as the angle between the femoral mechanical axis and the joint surface line of the femoral implant. TCA was defined as the angle between the tibial mechanical axis and the base plate of the tibial implant (Fig. 1a). Sagittal FCA was defined as the angle between the femoral mechanical axis and the distal end of the femur. Sagittal TCA was defined as the angle between the tibial mechanical axis and the base plate of the tibial implant (Fig. 1b). Outliers were defined as follows: more than 180 ± 3 degrees for the HKA angle; more than 90 ± 3 degrees for the FCA and TCA; and femoral flexion set angle

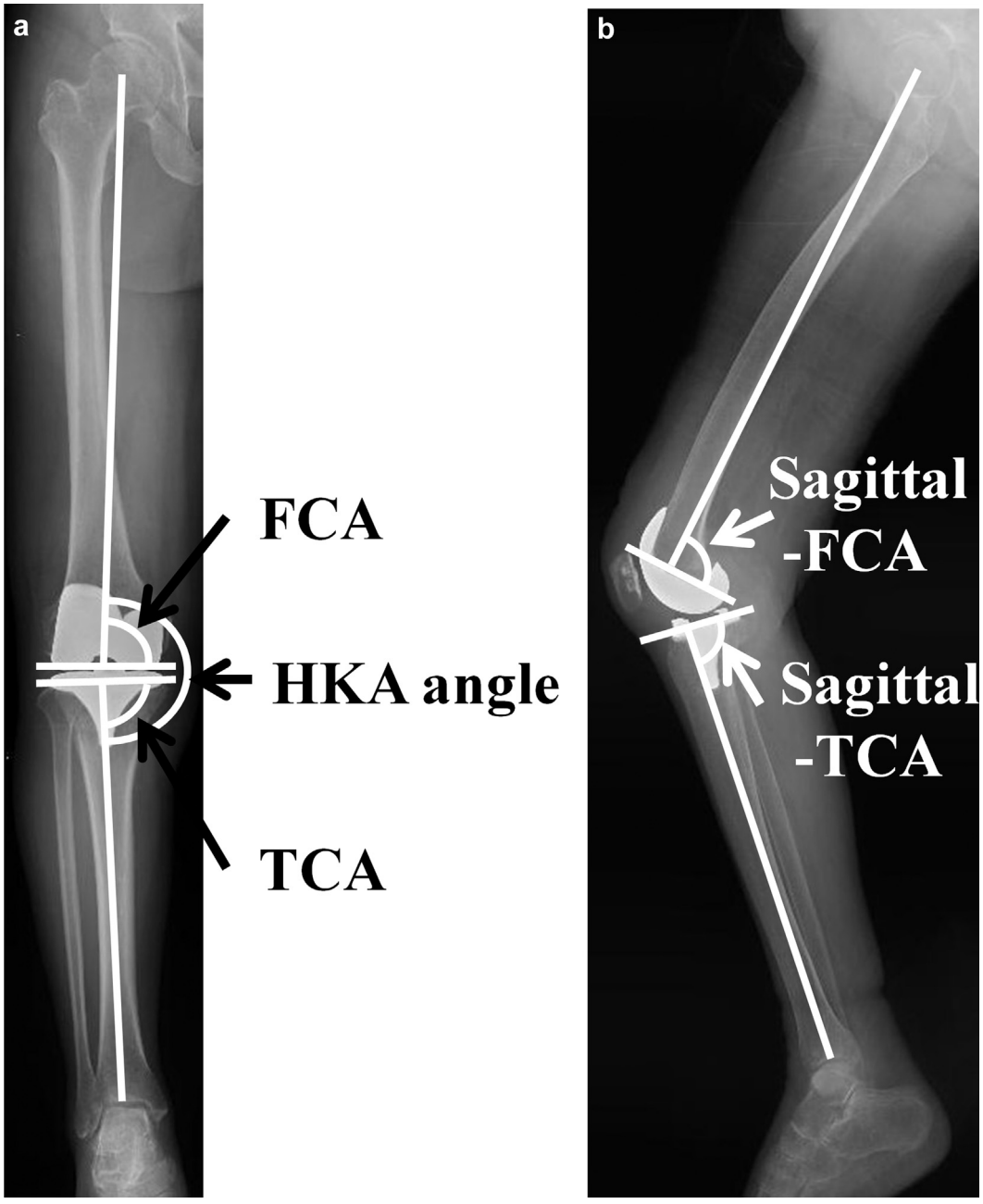

Figure 1. Postoperative lower limb alignment. (a) Coronal alignment. (b) Sagittal alignment.