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Case Report

# Amelioration in Ankle Pain and Improvement in Function After Total Knee Arthroplasty for Ipsilateral Knee and Ankle Osteoarthritis: A Report of Two Cases

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ABSTRACT

We report 2 cases of ipsilateral ankle and knee osteoarthritis (OA), with the chief complaint being chronic ankle and knee pain. In the first patient, the ankle pain was more severe than the knee pain, whereas the second patient had more severe pain in the knee than in the ankle. In both cases, varus malalignment of the knee and varus tilt of the ankle joint were detected on standing radiographs. The severity of OA was found to be grade 4 in the knee, according to the Kellgren–Lawrence grading system, and stage IIIa in the ankle, according to the modified Takakura ankle OA classification system. Navigation-assisted total knee arthroplasty was performed in both cases, leading to a decreased degree of varus malalignment in the knee and ankle, as well as a significantly improved patient-based outcome in both joints. Correction of malalignment of the ankle by total knee arthroplasty relieved the severe pain and restored optimal function in the ankle without surgical intervention.


## Introduction

A global orthopaedic disease knee osteoarthritis (OA) is the leading cause of disability among the elderly [1,2]. Occurring as a result of a long-lasting process, knee OA causes compensatory changes in the adjacent joints because of abnormal joint loading. There is a significant correlation between varus knee OA and ankle joint malalignment [3,4].

In patients with end-stage knee OA, tibial varus deformity has been shown to be associated with the development and progression of ankle OA [5]. Moreover, it has been suggested that the greater the tilt of the ankle is, the more degenerative the changes are in the knee joint [6]. In addition, the incidence of ankle OA in patients with end-stage knee OA before total knee arthroplasty (TKA) is reported to be 24.2%–36.8% among ethnic Asian populations [5,7]. In a previous prospective multicenter cohort study, the presence of foot/ankle symptoms in people with symptomatic radiographic knee OA was proven to be associated with an increased risk of knee pain aggravation [8]. It is known that TKA not only corrects the varus deformity of the knee but also improves the tilt of the ankle. The ankle alignment correlates with the knee alignment both preoperatively and postoperatively. Hence, preoperative malalignment of both the knee and ankle could be simultaneously corrected after TKA [9]. We report 2 cases of ankle OA ipsilateral to varus knee OA in 2 female patients who had chronic ankle and knee pain and were treated with TKA.

## Case history

In this study, we report 2 patients with ankle OA coexisting with ipsilateral varus knee OA who received TKA. Self-administered questionnaires were used to assess the severity of symptoms related to the ankle and knee joints, whereby their alignment and the severity of OA were subsequently evaluated by means of digital radiographs. We assessed the clinical outcomes of TKA through 2 patient-based outcome measures, namely the New Knee Society

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Knee Scoring System (2011 KSS) for the knee joint and Self-Administered Foot Evaluation Questionnaire (SAFE-Q) for the foot and ankle joint. These were completed by patients preoperatively and postoperatively. The 2011 KSS is an instrument based on patient-generated data, adapted to the diverse lifestyles and activities of patients who underwent TKA [10,11]. The SAFE-Q is developed by the Japanese Society for Surgery of the Foot, the main body of which comprises 34 questionnaire items that provide 5 subscale scores (1: Pain and Pain-Related; 2: Physical Functioning and Daily Living; 3: Social Functioning; 4: Shoe-Related; and 5: General Health and Well-being) [12].

For evaluation of the lower limb, ankle joint, standing anteroposterior radiographs of the ankle and full-length lower extremity were taken before and more than 1 year after the operation to measure and compare the following 3 parameters: (1) the hip-knee-ankle (HKA) angle, defined as the angle between the mechanical axis of the femur and that of the tibia. By definition, the mechanical axis of the femur is the line drawn from the center of the femoral head to the center of the intercondylar notch, whereas the mechanical axis of the tibia is the line connecting the center of the talus to the midpoint of the medial and lateral tibial spine tips. A positive HKA angle indicates varus alignment of the knee joint; (2) the talar tilt (TT) angle, defined as the angle between the distal tibial plafond and the upper surface of the talar dome. A positive value shows varus alignment of the ankle joint; and (3) the ankle joint line orientation angle (AJOA), defined as the angle between the upper surface of the talus and the ground surface. Here, a positive value suggests varus tilt of the ankle joint (Fig. 1) [5]. The severity of knee OA was assessed according to the Kellgren–Lawrence (KL) grading system [13,14]. The modified Takakura ankle OA classification system was used to determine the severity of ankle OA on radiographs [15,16].

The present study was approved by our institutional review board. The patients were contacted and gave informed consent for the use of their health data in this case report.

## Case 1

A 72-year-old woman with a body mass index of 22.5 kg/m$^2$ who had varus knee OA and ankle OA on the left side presented with a 2-year history of persistent knee and ankle pain, despite wearing an ankle brace. She had undergone right TKA 5 years ago. She had more severe pain in the left ankle than in the left knee, with no symptoms of subtalar joint arthritis. The range of movement (ROM) was −5° of extension and 135° of flexion in the left knee and 10° of dorsiflexion and 30° of plantarflexion in the left ankle. Plain radiographs showed varus malalignment of both the left knee (HKA angle of 7°) and the

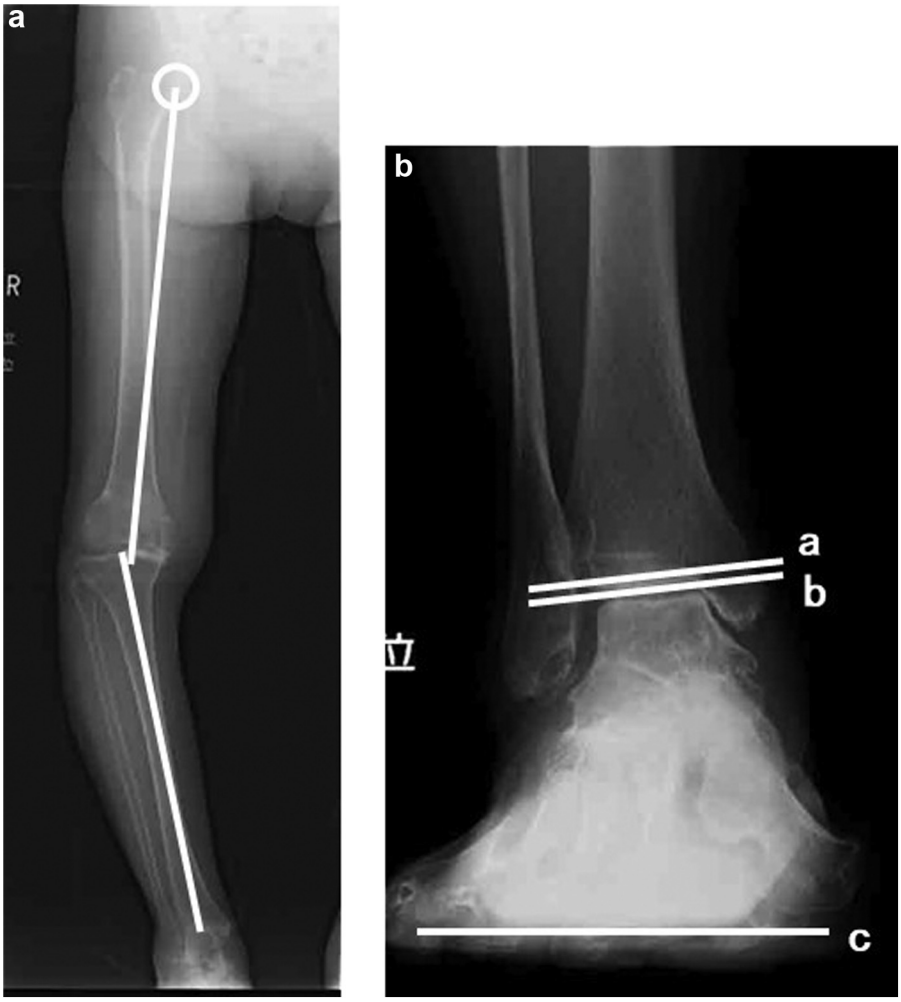


**Figure 1.** Measurement of knee and ankle parameters based on standing anteroposterior radiographs. (1) The hip-knee-ankle angle (HKA), the angle between mechanical axis of the femur and tibia. (2) The talar tilt angle (TT), the angle between the distal tibia plafond and the upper surface of the talar dome (the angle between a and b). (3) The ankle joint line orientation angle (AJOA), the angle between the upper surface of the talus and the ground surface (the angle between b and c).

**Table 1**
Preoperative and postoperative 2011 Knee Society Scores of both cases.

| Factor | Case 1 | | Case 2 | |
|---|---|---|---|---|
| | Preoperative | Postoperative | Preoperative | Postoperative |
| I. Symptoms (25 points) | 7 | 21 | 2 | 23 |
| II. Satisfaction score (40 points) | 24 | 34 | 20 | 30 |
| III. Expectation Score (15 points) | 14 | 9 | 14 | 12 |
| IV. Functional Activities Score | | | | |
| i. Walking and Standing (30 points) | 9 | 30 | 12 | 18 |
| ii. Standard activities (30 points) | 22 | 30 | 16 | 25 |
| iii. Advanced activities (25 points) | 15 | 21 | 5 | 18 |
| iv. Discretionary activities (15 points) | 12 | 12 | 9 | 13 |
| v. Total (100 points) | 58 | 93 | 54 | 74 |

left ankle (AJOA of 19°). The severity of knee OA and that of ankle OA were classified as KL grade 4 and stage IIIa, respectively. We expected an improvement in both the alignment and pain in the ankle after TKA. With this goal in mind, we performed navigation-assisted left TKA (Kolibri Navigation system, Knee 2.1 BrainLAB, Munich, Germany) (Legion Posterior-Stabilized Knees; Smith & Nephew, London, UK). The HKA angle (as a measure of the knee alignment) improved from 7° to 0° and the AJOA (as a measure of the ankle


**Figure 2.** Preoperative radiographs of the ankle (a), knee (c), and full-length lower extremity (e) and postoperative radiographs of the ankle (b), knee (d), and full-length lower extremity (f) in the standing position for case 1.

**Table 2**
Preoperative and postoperative SAFE-Q results of both cases.

| Factor | Case 1 | | Case 2 | |
|---|---|---|---|---|
| | Preoperative | Postoperative | Preoperative | Postoperative |
| Pain and Pain-Related (100 points) | 27.2 | 96.1 | 39.4 | 97.2 |
| Physical Functioning and Daily Living (100 points) | 34.1 | 90.9 | 38.6 | 84.1 |
| Social Functioning (100 points) | 12.5 | 100 | 87.5 | 100 |
| Shoe-Related (100 points) | 58.3 | 100 | 66.7 | 75 |
| General Health and Well-Being (100 points) | 15 | 100 | 35 | 85 |

alignment) from 19° to 12°. The TT angle remained unchanged (7°) (Fig. 2). One year after the operation, the knee ROM was 0° of extension and 130° of flexion and the ankle ROM was 10° of dorsiflexion and 30° of plantarflexion. In addition, remarkable improvements were observed in the 2011 KSS Symptoms, Functional Activities Score, and SAFE-Q Pain and Pain-Related, Physical Functioning and Daily Living (Tables 1 and 2). Now, 2 years after the operation, she feels almost no pain in the knee and ankle and is able to walk without a cane.

## Case 2

A 76-year-old woman with a body mass index of 21.6 kg/m$^2$ who had bilateral varus knee OA and left ankle OA presented with bilateral knee and left ankle pain. Her symptoms had appeared 6 years earlier and persisted since then, irrespective of conservative treatment. The pain was more severe in the knee than in the ankle, but she had no symptoms indicative of subtalar joint involvement. The ROM of the left knee was −10° of extension and 125° of flexion,

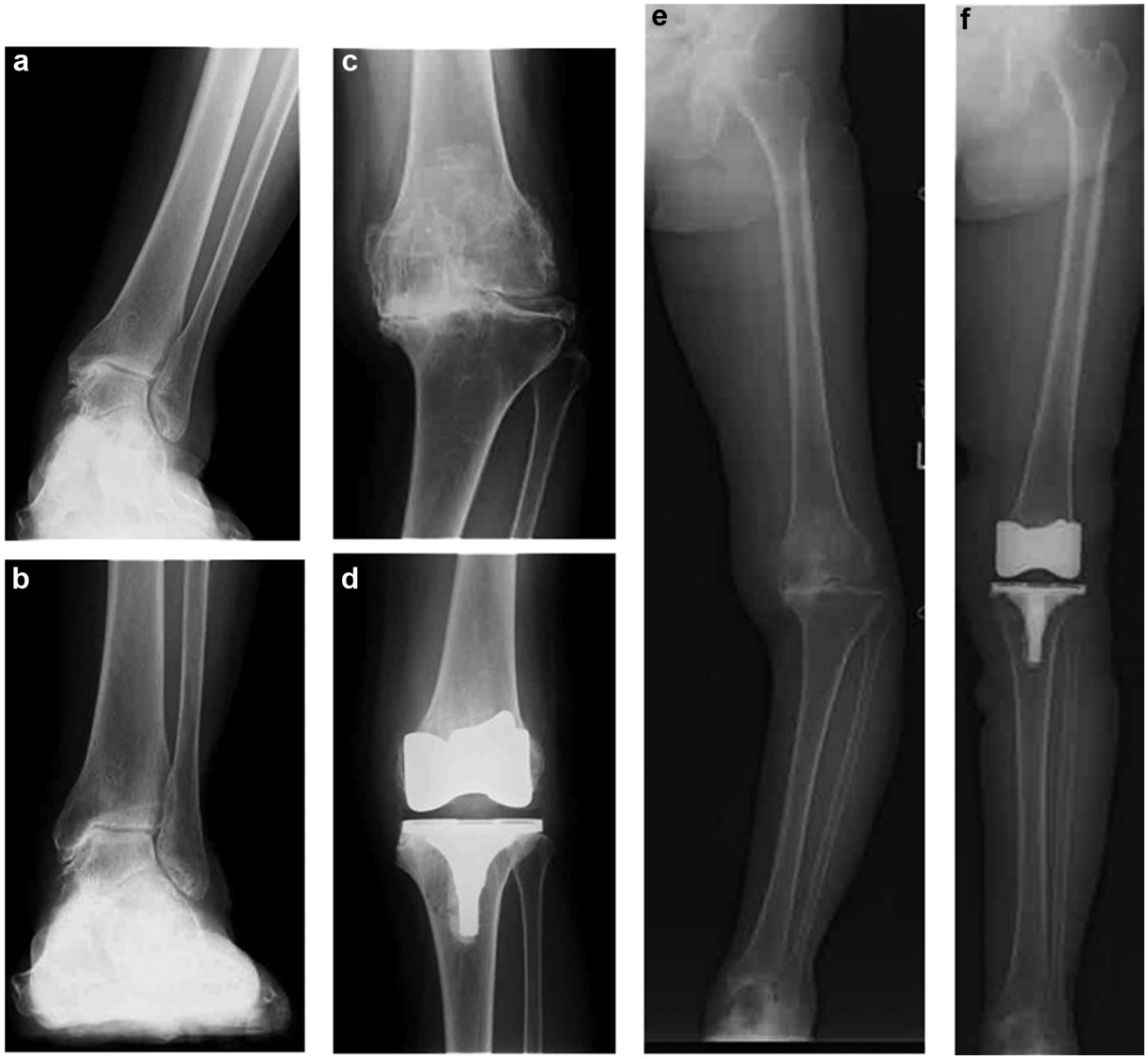


**Figure 3.** Preoperative radiographs of the ankle (a), knee (c), and full-length lower extremity (e) and postoperative radiographs of the ankle (b), knee (d), and full-length lower extremity (f) in the standing position for case 2.

and the ROM of the left ankle was 10° of dorsiflexion and 40° of plantarflexion. Plain radiographs indicated varus malalignment of the left knee (HKA angle of 23°) and of the left ankle (AJOA of 21°). The severity levels of knee OA and ankle OA were classified as KL grade 4 and stage IIIa, respectively. We expected an improvement in both the alignment and pain in the left ankle after left TKA. Hence, navigation-assisted left TKA (Kolibri Navigation system, Knee 2.1) (Legion Posterior-Stabilized Knees) was carried out, improving the HKA angle (as a measure of knee alignment) from 23° to 0° and the AJOA (as a measure of ankle alignment) from 21° to 3°. The TT angle remained unchanged (0°) (Fig. 3). Four years after the surgery, the left knee ROM was 0° of extension and 135° of flexion and the left ankle ROM was 20° of dorsiflexion and 40° of plantarflexion. Remarkable improvements were observed in the 2011 KSS Symptoms, Functional Activities Score, and SAFE-Q Pain and Pain-Related, Physical Functioning and Daily Living (Tables 1 and 2). Now, 4 years after the operation, the patient feels almost no pain in the knee and ankle and is able to walk without a cane.

## Discussion

One of the most important findings of the present study is that TKA, because it restores the malalignment of both the knee and the ankle, proved to be an effective treatment for medial knee OA and ankle OA. In the cases reported here, severe pain in the ankle and knee had been relieved and optimal function restored in these joints without surgical intervention in the ankle.

TKA is a very common procedure for treating patients with varus knee arthritis [17]. In a recent study, the relative tilt of the talus and distal tibial plafond to the ground increased in women as varus knee deformities progressed, suggesting that compensatory changes in the ankle should be taken into account before performing TKA for end-stage knee OA [18].

The alignment of the ankle is usually altered after correcting long-standing varus deformity of the knee through TKA [3]. The effect of alignment change in the knee joint for the alignment change in ankle alignment would be more influential than the effect of alignment change in the ankle joint for the alignment change in knee alignment.

Biomechanical studies have shown that varus tilt of the distal articular surface of the tibia causes stress concentration on the medial side of the ankle and have demonstrated the usefulness of valgus correction [16]. Corrective osteotomy of the distal part of the tibia, also known as low tibial osteotomy, for the varus ankle malalignment produces a valgus ankle alignment by shifting the load-bearing axis laterally. Symptoms of ankle OA reportedly improve after these alignment changes [19]. In the same vein as low tibial osteotomy, TKA for varus knee OA brings about a curative laterally inclined shift in the ankle and thus promotes its alignment.

There are 2 reports in the literature about patients with OA of the knee and the ipsilateral ankle who received treatment in the knee joint. In a study by Takeuchi, the treatment of varus knee malalignment via closing-wedge high tibial osteotomy significantly reduced ankle pain and improved its function [20]. However, Chang et al reported that the presence of ankle OA was associated with increased ankle pain and a worse clinical outcome after TKA, presumably due to the reduced valgus compensation of the hindfoot for the preoperative varus tilt of the ankle [7]. In the present study, hindfoot alignment after TKA was found to be 4° of valgus in case 1 and 25° of valgus in case 2, where the normal alignment of the hindfoot could be restored manually by passive stress. In both cases, no pain or arthritic change was observed in the subtalar joint (data not shown). Hindfoot alignment usually changes after TKA, with the changes being variable and about half the amount of those in knee alignment [21,22]. Hence, future research can explore the effect of deformity and alignment change of the hindfoot after TKA on foot-related symptoms.

In this study, we presented 2 cases of ipsilateral varus OA of the knee and ankle. Marked pain reduction in the ankle and knee joints and improvement in subjective ankle scores were confirmed by alignment change of the ankle after TKA.

TKA may improve the symptoms of ankle OA by reducing varus ankle malalignment. In cases of varus knee OA coexisting with ipsilateral varus ankle OA, knee surgery might prove to be an effective procedure for the simultaneous treatment of both conditions in 1 leg. Future studies of the subjective and objective assessment of the ankle joint, before and after TKA, would be favorable.

The primary limitation of the current research is that only 2 cases were studied. Hence, further studies with a larger number of cases are required to confirm the results. Moreover, both cases had stage IIIa ankle OA and varus deformities, whereas subjects with more severe ankle OA or valgus ankle malalignment may exhibit different clinical outcomes. Finally, neither of the cases reported subtalar pain, which, if present, would affect the clinical results.

## Summary

TKA was performed in 2 patients with OA of the ipsilateral ankle and knee joints who had chronic pain in both joints. Consequently, varus malalignment of the knee and varus tilt of the ankle joint were decreased, followed by a significant improvement in patient-based outcomes in both the joints. In summary, in cases with concurrent ipsilateral varus OA of the knee and ankle, TKA might relieve the severe pain and restore optimal function in the ankle without surgical intervention.

## Conflict of Interests

The authors declare there are no conflicts of interest.

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