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Successful treatment of valgus knee osteoarthritis involving external tibial torsion with a double level osteotomy: A case report

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ABSTRACT

INTRODUCTION: : Abnormal torsion of the lower leg affects the alignment of the knee joint and foot, and causes impairment of both knee joint function and gait. We here present a successful adult case treated with a double level osteotomy at the distal femur and tibia.
PRESENTATION OF CASE: : A 59-year-old woman complained of right knee pain for three years and had a deformity of her right lower limb since childhood. An advanced right tibial external torsion deformity with valgus alignment was revealed. We performed a double level osteotomy to correct both the valgus knee osteoarthritis and the external tibial torsional deformity. At the 2 year follow-up, the patient could run without pain and sit normally.
DISCUSSION: : The indications for surgery for abnormal rotation in the lower extremity are also not clear. In addition, most prior surgical reports on torsional deformity of the lower leg have been on childhood cases. Surgical treatment of valgus knee osteoarthritis involving external tibial torsion in adult has been rarely reported.
CONCLUSIONS: : In our current report, we present an adult case of valgus knee osteoarthritis involving external tibial torsion that was successfully treated using a double level osteotomy. A longer follow-up is still needed however despite these positive outcomes.
LEVEL OF EVIDENCE: : V.

1. Introduction

Abnormal torsion of the lower leg affects the alignment of the knee joint and foot, and causes impairment of not only joint function but also gait [1,2]. Previous reports have suggested an association between a lower limb rotational deformity and knee osteoarthritis (OA) [3]. However, few previous studies have been conducted on surgical treatment in adults (we reported previously on 8 of the adult cases we included also in this current study [4] because a torsional deformity of the lower leg, and subsequent correction by osteotomy, mainly occurs in childhood [4,5]. To our knowledge, no examples of a successful osteotomy treatment of a combined tibial rotatory deformity with valgus knee OA in adults have been described. We here present a successful adult case treated with a double level osteotomy at the distal femur and tibia.

This work has been written in accordance with the SCARE criteria [6].

2. Presentation of case

A 59-year-old woman visited our institution with a chief complaint of right knee pain and difficulty in standing for the previous three years, and a deformity of the right lower limb since childhood. Surgical treatment had been recommended by a local hospital due to a lateral knee OA and tibial torsional deformity. There were no relevant family or trauma histories. A physical examination at our hospital revealed a thigh-foot angles of 30 degrees on the right and 10 degrees on the left, and this 20 degree difference resulted in sitting with her legs out to one side when she attempted to sit straight (Fig. 1A, B). Radiographs indicated an Ahlbäck classification of grade 3 in the lateral compartment of the knee. According to the deformity analysis, her % mechanical axis (%MA) was 69 %, the femoro-tibial angle (FTA) was 168 degrees, the hip-knee-ankle angle (HKA) was 4 degrees, the mechanical lateral distal femoral angle (mLDFA) was 87 degrees, and the medial proximal tibial angle (MPTA) was 88 degrees (Fig. 2A, B). Computed tomography (CT) further revealed a

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Fig. 1. (A) External rotation of the right lower extremity was observed. (B) The patient could sit straight but her posture was like a 'mermaid'.

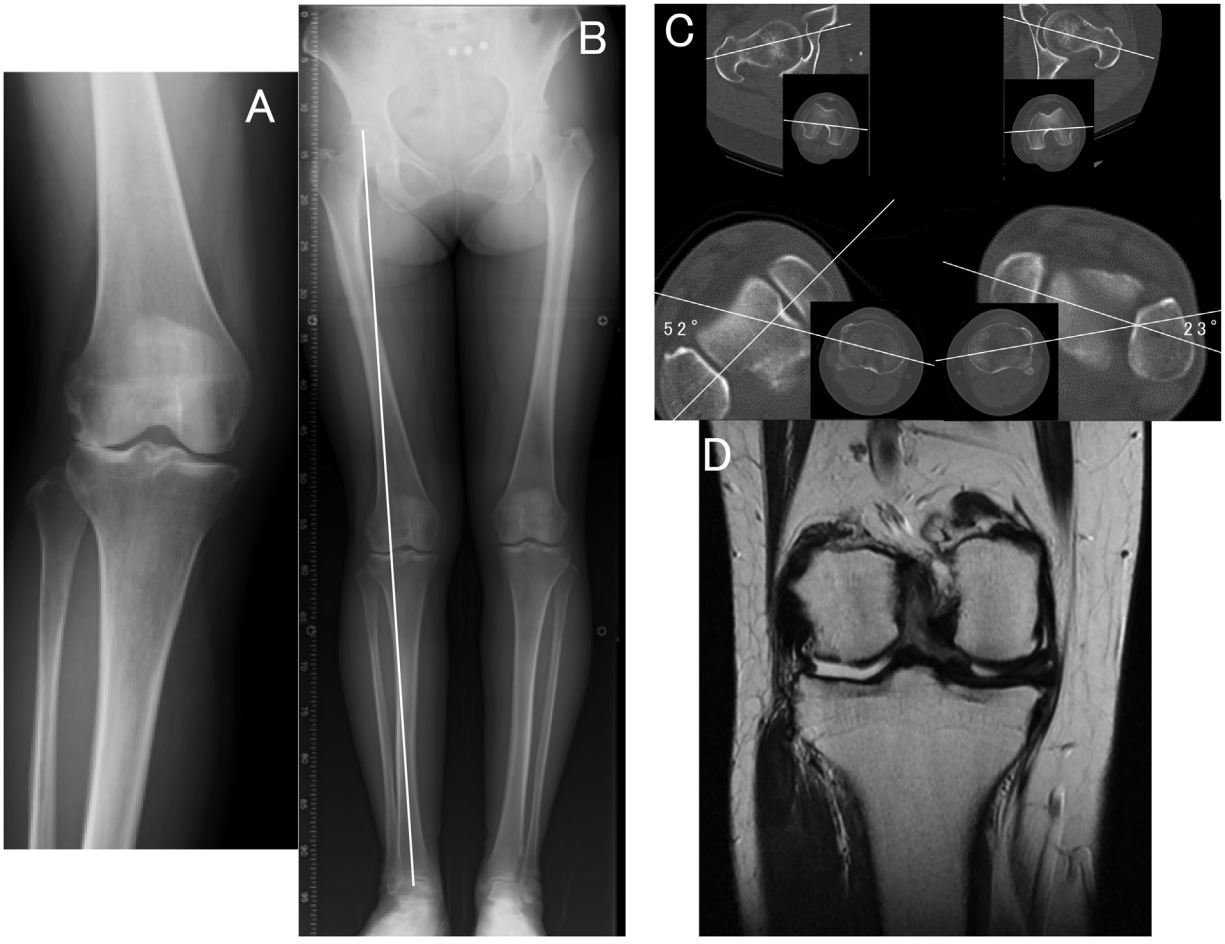

Fig. 2. (A) Rosenberg view. The right knee had an Ahlbäck classification of a 3rd degree valgus knee OA.(B) A long leg standing X-ray revealed that the weight bearing line passed laterally through to the medial tibial plateau.(C) Anterior hip rotation and tibial external torsion were evident.(D) MRI (proton density-enhanced imaging) scan indicating that the lateral cartilage was severely worn.

femoral neck anteversion of 27 degrees on the right and 29 degrees on the left, and a tibial external torsion of 52 degrees on the right and 23 degrees on the left (Fig. 2C). Magnetic resonance imaging (MRI) indicated moderate to severe cartilage wear of the lateral femoral tibial joint (Fig. 2D).

Based on the results of our deformity analysis, we decided to perform a double level osteotomy with medial closing wedge dis-

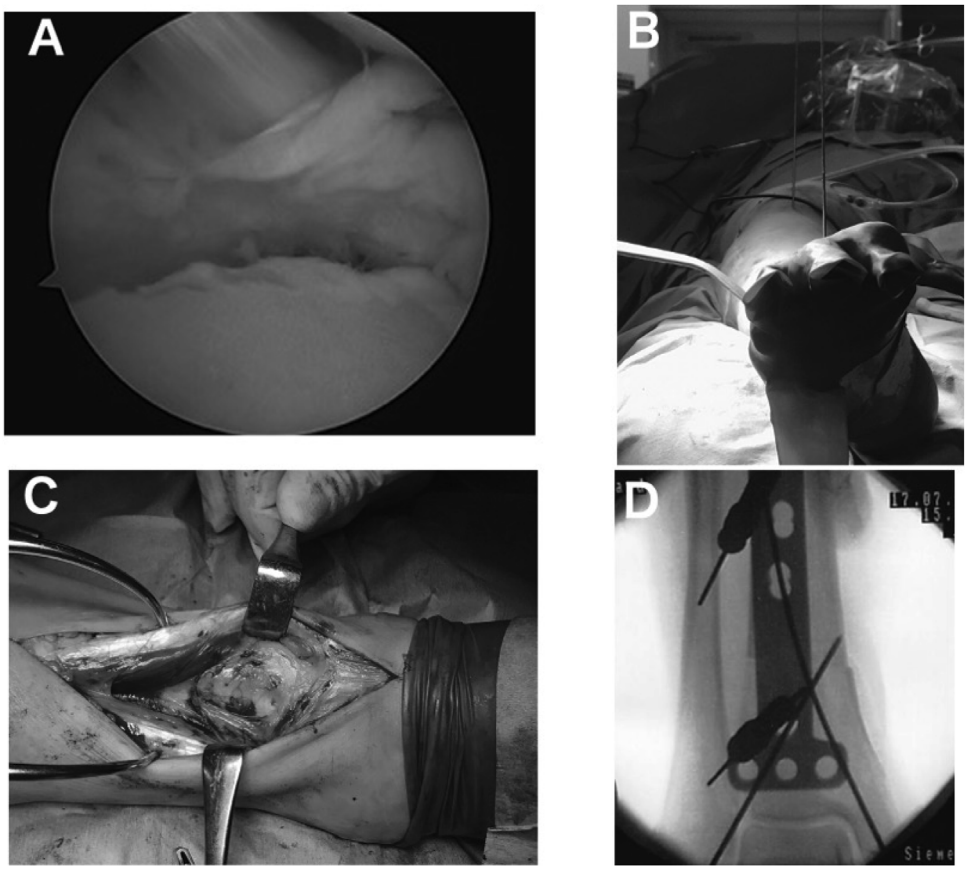

Fig. 3. (A) The cartilage of the lateral compartment with the lateral meniscus was absent and the subchondral bone could be observed. (B) K-wires were inserted both proximal and distal to the tibia as references.(C) A distal tibial osteotomy was performed through a longitudinal skin incision.(D) A 30 degree rotational correction was performed and with subsequent fixation achieved using a TomoFix plate which was placed upside down.

tal femoral osteotomy (MCWDFO) for the valgus knee deformity in this patient and a distal tibial derotational osteotomy (DTDO) procedure to correct her external tibial torsion. The surgical procedures used were based on the methods described by Lobenhoffer et al [7], in which the patient was placed in a supine position without a tourniquet. From an arthroscopy assessment, we found that the cartilage in the lateral compartment was absent and that the subchondral bone could be observed (Fig. 3A). An MCWDFO of as much as 7 degrees was performed at the distal femur to correct the valgus deformity, with the aiming point at 40 % of the weight bearing line from the medial margin of the tibial plateau. Prior to the DTDO, an incurvated flexiated fibular osteotomy [8] was performed to obtain the bending required for the subsequent tibial derotational osteotomy.

During the DTDO, K-wires were first inserted proximal and distal to the tibia as references to control the tibial rotation (Fig. 3B). We then performed an osteotomy perpendicular to the longitudinal axis of the tibia using a bone saw (Precision® Oscillating Tip Saw; Stryker, Kalamazoo, MI) at 3 cm from the distal tibial plafond after exposing the tibia between the extensor hallucis longus and tibialis anterior tendon (Fig. 3C, D). We then rotated a distal tibial fragment internally by as much as 30 degrees. TomoFix® plates (Depuy Synthes, West Chester, PA) were then placed upside down. In order to apply compression between the osteotomy site, we first fixed the distal portion with locking screws (screw holes A–D) after temporary fixation using 2.4 mm K-wires and generated dynamic compression force using two combination holes (screw holes 1 and 2) into which two cortical screws were inserted. After confirming crimping of the osteotomy site crimped, locking head screw fixation of the proximal hole (screwhole3,4) was conducted and the cortical screws were replaced with locking screws (screw holes 1 and 2). We next inserted drainage tubes into the femur and tibia prior to skin closure which were removed 48 h after surgery. ROM exercise was permitted after the drainage tubes were removed and partial weight bearing was permitted when pain could be tolerated with crutches. Full weight bearing was permitted after the osteotomy site had healed. At the final postoperative evaluation (28 months), the %MA was 20 %, the FTA was 179 degrees, the valgus alignment was improved, the external torsion was 22 degrees, and the side-to-side difference was 1 degree, respectively (Fig. 4A-E, respectively). At 28 months after surgery, this patient had no knee pain during walking, could run, and could sit straight (Fig. 5A, B), although careful follow-up continued to be needed.

3. Discussion

We have here demonstrated that a combination of MCWHTO and DTDO can successfully treat a lateral knee OA in an adult involving tibial external torsional deformity. The clinical outcomes in this case remained excellent after more than 2 years of follow-up. To our knowledge, this represents the first case report of a successful double level osteotomy performed in a single operation to correct a valgus knee OA with a tibial torsional deformity.

The tibia has a 2–4 degree abduction torsion at birth, which gradually increases with growth to an average external torsion of about 25 degrees in adults [1]. It has been reported that any internal deformity in the tibia tends to improve spontaneously by 8–9 years of age, whereas an external deformity may be exacerbated by growth without spontaneous improvement [1]. The indications for surgery for abnormal rotation in the lower extremity are also

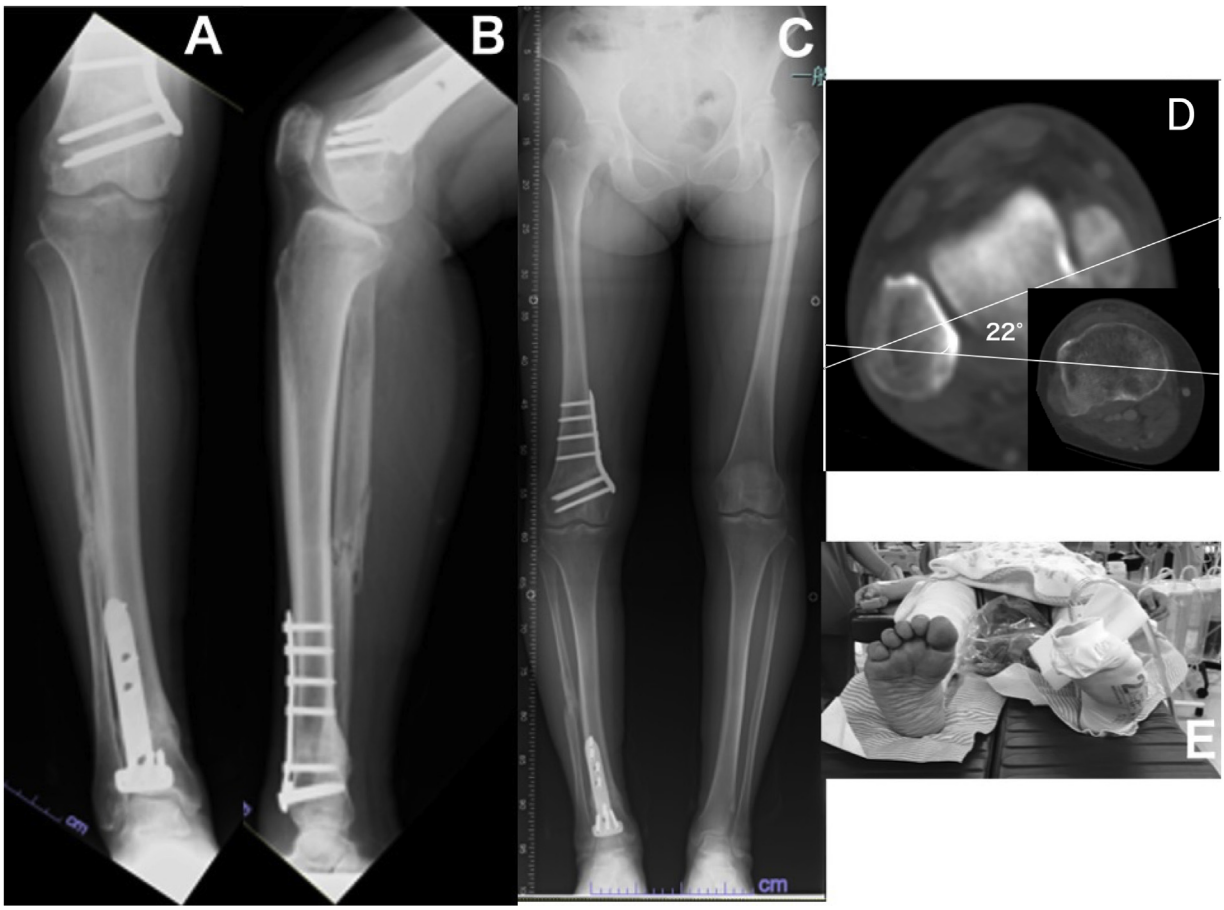

Fig. 4. (A, B) Frontal and lateral views of a postoperative X-ray.(C) A postoperative long leg standing X-ray revealed that the weight bearing line passed medially through to the medial tibial plateau.(D, E) The postoperative right tibial external torsion angle was 22 degrees (23 degrees on the healthy side).

Fig. 5. (A, B) Following surgery the patient could attain a normal straight sitting position.

not clear [2,10]. The surgical decisions in such instances have often been based on the presence of dysfunctions such as gait disturbance, joint pain, cosmetic problems, and maturity according to age [2]. In addition, most of the current literature on surgeries for lower leg torsion relate to pediatric cases, with few reports in adults.

Regarding coronal alignment, although hypoplasia of the lateral femoral condyle is currently thought to be the main cause of lateral knee OA [9], the mLDFA in our current case was 87 degrees, although 4 degrees of valgus alignment, there was no evidence of femoral condyle hypoplasia [10]. Chang et al. [3] had previously investigated the relationship between distal tibial torsion and alignment of the lower extremity using preoperative CT scans of 422 OA knees that received a prosthesis. These authors reported that an increased valgus malalignment was significantly related to an increased tibial external torsion. In our current case, we thus speculated that valgus knee OA might be caused by tibial external torsion since childhood. Hence, we performed the osteotomies at the two levels of the distal femur for valgus correction and the distal tibia for derotation, based on deformity analysis.

Surgical procedures to correct rotation of the lower extremity have been reported as one-stage correction using wires or plates, or gradual correction using an external fixator [4,11]. Excessive rota-

tional correction in a single surgery has been reported to cause complications such as impaired blood flow and nerve palsy [4]. Previous studies have highlighted that the maximum rotational correction in a single stage operation to correct a rotational deformity is 40 degrees [4].As to the level of the osteotomy in a tibia, an isolated derotational osteotomy at the distal tibia has been recommended to avoid complications [5].

In addition, good bone healing has been reported with conventional T-plate fixation for supramalleolar derotational osteotomy of the tibia [4]. The TomoFix® plate has been reported to provide significant stability and to achieve good bone healing, which enables early rehabilitation [12]. Therefore, we performed a DTDO and fixation with a TomoFix® plate in present case.

We conclude from our present case that to obtain the desired clinical outcomes when correcting 30 degrees of tibial rotatory deformity in a case of valgus knee OA, it would be worthwhile to focus on preserving the knee joint via an osteotomy and to therefore realign the lower extremity to reacquire a satisfactory straight sitting ability.

Declaration of Competing interest

The authors report no declarations of interest.

Sources of funding

No funds have been received in support of this work.

Ethical approval

This is a case report; therefore it did not require ethical approval from ethics committee. However, we have got permission from the patient to publish her data.

Consent

Written informed consent was obtained from the patient for publication of this case report and accompanying images. A copy of the written consent is available for review by the Editor-in-Chief of this journal on request.

Author contribution

1 Surgery was performed by HS and KS.
2 SM was the major contributor in writing the manuscript.
3 TY, NM and YS have been involved in drafting the manuscript and revising it critically for important intellectual content.
4 All authors read and approved the final manuscript.

Registration of research studies

This is a case report, not a clinical study.

Guarantor

Shohei Murata,M.D. and Hidetomo Saito, M.D., Ph.D.

Provenance and peer review

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