Case Report

Total knee arthroplasty combined with medial patellofemoral ligament augmentation using a Leeds-Keio ligament for 'Windswept deformity' with ipsilateral valgus deformity and permanent patellar dislocation: A case report and a literature review

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ABSTRACT

We present a 'Windswept deformity' in patient who had osteoarthritis with a mild varus and very severe valgus with ipsilateral permanent patellar dislocation. An 83-year-old woman could not walk for the past a few years due to bilateral knee pain. The femorotibial angle was 196° in the right knee pre-operatively and 134° in the left knee with permanent patellar dislocation. She underwent a staged total knee arthroplasty (TKA) for the right knee, and a semi-constrained TKA for the left knee with medial patellofemoral ligament (MPFL) augmentation using a Leeds-Keio (LK) ligament. At the final follow-up three years after surgery, bilateral knee pain and the extension lag had disappeared and range of motion (ROM) was 0° in extension and 130° in flexion for both knees without patellar re-dislocation. This clinical case indicates that the unconstrained and semi-constrained type of TKA combined with the MPFL augmentation using an LK ligament is effective to treat a 'Windswept deformity'.

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1. Background

The 'Windswept deformity' is a bilateral condition in valgus deformity of one knee and varus deformity of the other knee. The etiology of the 'Windswept deformity' in children has been reported as an epiphyseal abnormality. On the other hand, in adults, several factors have been considered. Smillie proposed that the varus deformity appeared following the valgus deformity to compensate the initial valgus deformity. 'Windswept deformity' is rarely seen in severe osteoarthritic knees that undergo total knee arthroplasty (TKA). However, the strategy of severe valgus knee combined with permanent patellar dislocation including the turn of operation side is still remained unclear. No previous studies, moreover, have reported the 'Windswept deformity' with very severe valgus deformity of one knee, who were treated with a combination of semi-constrained total knee arthroplasty and a medial patellofemoral ligament (MPFL) augmentation using a Leeds-Keio (LK) ligament (Table 1). We present a case of the 'Windswept deformity' with mild varus deformity and very severe valgus deformity with permanent patellar dislocation.

2. Case report

The patient was an 83-year-old woman whose chief complaint was bilateral knee pain. She fell down the stairs when she was 7 years old and had experienced discomfort of left patellar dislocation. She had visited another hospital 5 years before due to bilateral knee pain and underwent conservative treatment. For the past three years, the bilateral knee pain increased during activities of daily living, and she gradually found it difficult to walk without a walker. When she visited our institution, her left knee was very valgus and her right knee was varus.

In her right knee, pre-operative range of motion (ROM) was -10°/90°. Her standing femorobital angle (FTA) was 196° (Fig. 1). The radiographic Kellgren-Lawrence (KL) classification was grade 4 (Fig. 1).

In her left knee, ROM was -5°/135°. Her standing FTA was 134° (Fig. 1). She could not fully extend the left knee with 45° of extension lag. The patella was dislocated laterally at all angles and could not be corrected throughout the entire ROM (Fig. 2B). The KL
classification was grade 4 (Fig. 1). The MRI showed a thin medial collateral ligament (MCL). The angle of valgus in a radiographic stress view at 0 and 30° was 4° and 10°, respectively, and showed medial instability under the valgus stress. The FTA with varus stress was 166°, and the valgus deformity was corrected from 134 to 166° in FTA. This was not fixed but incorrectable deformity. The Krackow classification was type 2. The hip was normal radiographically.

The JOA score and Lysholm score were 36 and 40 before surgery, respectively.

The patient was diagnosed with a ‘Windswept deformity’ with a very severe valgus left knee, with medial instability, and a mildly varus right knee (Figs. 1 and 2).

Surgery was done first on the right side because it was the more painful knee. A staged TKA was carried out (NRG, posterior stabilized type; Stryker, USA) using a parapatellar approach under tourniquet control.

Six months later, the left side was operated on using a subvastus approach to maintain the medial blood supply. The skin was incised with a gentle curve approximately 18 cm laterally. A thin and elongated vastus medialis was located in front of the femoral condyle.

First, the distal femoral resection was performed in 6° of femoral valgus and a 6° externally rotated position based on the other right side of surgical epicondylar axis evaluated using CT without over-resection of the medial condyle. Tibial resection was done 8mm distal from the surface of the medial tibial plateau and 0 mm to the most distal aspect of the region of bone lateral loss, which was evaluated by CT preoperatively. After the iliotibial tract was subperiosteally elevated from Gerdy’s tubercle, lateral tightness remained in flexion and extension. A lateral release was done at the

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**Table 1**

| Author | Year | Sample (average age) | Case number | Average FTA (range of varus, degree) | Average FTA (range of valgus, degree) | Patella position | Treatment | Soft tissue procedure | Complications |
|--------|------|----------------------|-------------|--------------------------------------|---------------------------------------|-----------------|-----------|----------------------|--------------|
| Oni2   | 1984 | Patient (Not described) | 8           | Not described                        | Not described                        | Not described   | Osteotomy of proximal tibia (2 cases) | Not described | Not described |
| Meding5 | 2000 | Patient (Varus group: 72 years, and Valgus group: 73 years (range, 51–87 years) | 22          | 5.9 varus (3-20)                     | 15.9 valgus (10-30)                   | Varus group Normal 16 Subluxation 3 Valgus group: Normal 14 Subluxation 5 | TKA | Varus group: Deep medial, Posterior with osteophyte, Lateral patella Valgus group: Deep medial Posterior with osteophyte Iliotibial band, Lateral patella | Revision TKA Patellar subluxation Superficial infection |
| Shetty6 | 2016 | Patient (Not described) | 66          | 188±6 (range, 181–207)               | 171±7 (range, 137–178)               | Not described   | TKA | Not described | Not described |
| Ours   | 2021 | Patient (83)         | 1           | 134                                  | Permanent dislocation                 | Semi-constrained TKA MPFL augmentation Lateral release iliotibial band Vastus medialis advancement | No major complications |

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**Fig. 1.** Preoperative standing radiograph of both sides (a: right side, b: left side). (A) whole lower extremity standing view (B) anteroposterior standing view.
anterior side of the iliotibial band at the height of the superior patella to maintain the blood supply of the patella. After checking the placement of the 18 mm gap insert, the medial side was still slack, so a semi-constrained type of TKA (TS, total stabilized type; Stryker, USA, Fig. 3C) was used. Then the tibial component was also inserted with cement in a relatively externally rotated position. The patella was resurfaced and positioned medially. Patellar tracking was checked and the patella was still dislocated at all angles. We decided to perform the MPFL augmentation using the artificial ligament, LK Ligament (Fig. 3A). A 1 cm skin incision was made over the medial epicondyle. The guide pin was inserted approximately 1 cm antero-proximal to the site of the original femoral insertion of the MPFL to increase the graft tension in flexion (Fig. 3B, b). The passing pin was passed between the anterior flange and long stem under an image intensifier (Fig. 3C). A 4.0mm drill hole was then created over the guide wire. LK ligament was passed through the TightRope® RT (Arthrex, Naples, USA) (Figs. 3A and 4A, B). The patella was repositioned by hand and surrounded with a double looped LK ligament from top end to bottom end around the patella (Fig. 3B). The patella was sutured to the LK ligament at 90° of knee flexion. In addition, a vastus medialis advancement was added. After these procedures, the knee was flexed up to 90°, and the patella did not dislocate throughout this range of motion.

A range of motion exercise was started one week after the surgery.

Fig. 2. Preoperative radiograph of both sides (a: right side, b: left side). (A) lateral view (B) axial view (red arrows show the dislocated patella, 45° skyline view). (For interpretation of the references to colour in this figure legend, the reader is referred to the Web version of this article.)

Fig. 3. Operative findings and schema. (A) LK ligament with TightRope® RT. Double red arrow shows the insertion of femoral tunnel in MPFL augmentation. (B) Schema and intraoperative picture of MPFL augmentation with LK ligament. Red circle shows the tunnel position of the femoral side. a: anteroposterior view b: lateral view (C) Red circle shows the narrow space between the anterior flange and long stem of the femoral implant. (For interpretation of the references to colour in this figure legend, the reader is referred to the Web version of this article.)
postoperatively. Partial weight-bearing was started two weeks postoperatively as tolerated.

There were no major complications after surgery, including common peroneal palsy. Three months after the 2nd operation, she could walk with a walker and live alone. At the final follow-up three years after the operation, the patient could walk with a T cane and felt no pain in either knee. The ROM of both knees was 0° in extension and 130° in flexion, without an extension lag. The JOA score and Lysholm score improved to 80 and 80 points, respectively. Radiological findings showed no loosening of the components and no patellar re-dislocation during the follow-up period (Fig. 4).

3. Discussion

The principal finding of the present case was ipsilateral MPFL augmentation using LK ligament combined with left semi-constrained TKA and right unconstrained TKA for ‘Windswept deformity’ and good clinical results were gained without major complications in both knees.

Osteotomy7 and TKA9,10 have been used as surgical treatments for the ‘Windswept deformity’ (Table 1). Osteotomy was not indicated for the current case because of the large deformities of both knees and the advanced age of the patient. To the best our knowledge, there has been no report of a very severe valgus knee (FTA 134°) with permanent patellar dislocation in a ‘Windswept deformity’ as in this current case (Table 1). The difficulties of a severe valgus knee with permanent patellar dislocation include: (1) the turn of operation side (2) correction of the valgus knee; (3) augmentation of the bone defect; and (4) reduction of the patellar dislocation. First, the right varus side in the current case was more painful than left valgus side and firstly un-constrained TKA was underwent, however, the left pain was remained. Next, Sato reported good clinical results using MPFL augmentation and TKA simultaneously with the LK ligament.9 However, the cases were 18° of valgus and 10° of valgus of the knee, respectively, and not a ‘Windswept deformity’. The current case was a very severe valgus knee with permanent patellar dislocation, and not staged but simultaneous semi-constrained TKA with MPFL augmentation using artificial LK ligament without bone graft was performed due to the advanced age of the patient.

Several proximal alignments, such as medialization of the tibial tuberosity,10 vastus medialis advancement11,12 and MPFL reconstruction9,13 have been performed if the patella still dislocates after correction of alignment, proper external rotation of the femoral and tibial components, and lateral retinaculum release in TKA. In the current case, MPFL augmentation was chosen considering the patient’s age, bone quality and the remaining permanent patellar dislocation after semi-constrained TKA. The difficulty of this operation is MPFL augmentation combined with a semi-constrained type of TKA. There has also been no report of an MPFL reconstruction following a semi-constrained type TKA. In our case, the patella dislocation was not corrected initially after the soft tissue release and remained MCL insufficiency, so MPFL augmentation was underwent after a semi-constrained TKA. The site of the femoral tunnel was intentionally made in the antero-proximal position from the original femoral insertion of the MPFL 14 and good clinical results were gained without major complications in both knees.

ethical approval

All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards.

Human and animal rights

This article does not contain any studies with animals performed by any of the authors.
**Informed consent**

Informed consent was obtained from all individual participants included in the study. The patient and her family were obtained informed consent from the case would be submitted for publication.

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**Declaration of competing interest**

All authors declare that they have no conflict of interest.

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