Asia-Pacific Journal of Sports Medicine, Arthroscopy, Rehabilitation and Technology 26 (2021) 53–57

Contents lists available at ScienceDirect

Asia-Pacific Journal of Sports Medicine, Arthroscopy, Rehabilitation and Technology

journal homepage: www.ap-smart.com

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

Nobuyuki Kumahashi*, Suguru Kuwata, Hiroshi Takuwa, Yuji Uchio

Department of Orthopedics, Shimane University, School of Medicine, 89-1 Enya-cho, Izumo-shi, Shimane, 693-8501, Japan

ARTICLE INFO

Article history:
Received 4 January 2021
Received in revised form
30 May 2021
Accepted 26 July 2021

Keywords:
Bilateral total knee arthroplasty
Medial patellofemoral ligament reconstruction
Permanent patellar dislocation

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'.

1. Background

The 'Windswept deformity' is a bilateral condition in valgus deformity of one knee and varus deformity of the other knee.[1] The etiology of the 'Windswept deformity' in children has been reported as an epiphyseal abnormality.[2,3] 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.[4] 'Windswept deformity' is rarely seen in severe osteoarthritic knees that undergo total knee arthroplasty (TKA).[5,6] 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 femorotibial 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

* Corresponding author.
E-mail address: n-kuma@med.shimane-u.ac.jp (N. Kumahashi).

https://doi.org/10.1016/j.asmart.2021.07.001

Table 1
Literature review of surgical treatment of 'Windswept deformity'.

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
Oni[2]	1984	Patient (Not described)	8	Not described	Not described	Not described	Osteotomy of proximal tibia (2 cases)	Not described	Not described
Meding[5]	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 Subluxation3 Valgus group: Normal 14 Subluxation5	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
Shetty[6]	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	196	**134**	Permanent dislocation	Semi-constrained TKA MPFL augmentation	Lateral release Iliotibial band Vastus medialis advancement	No major complications

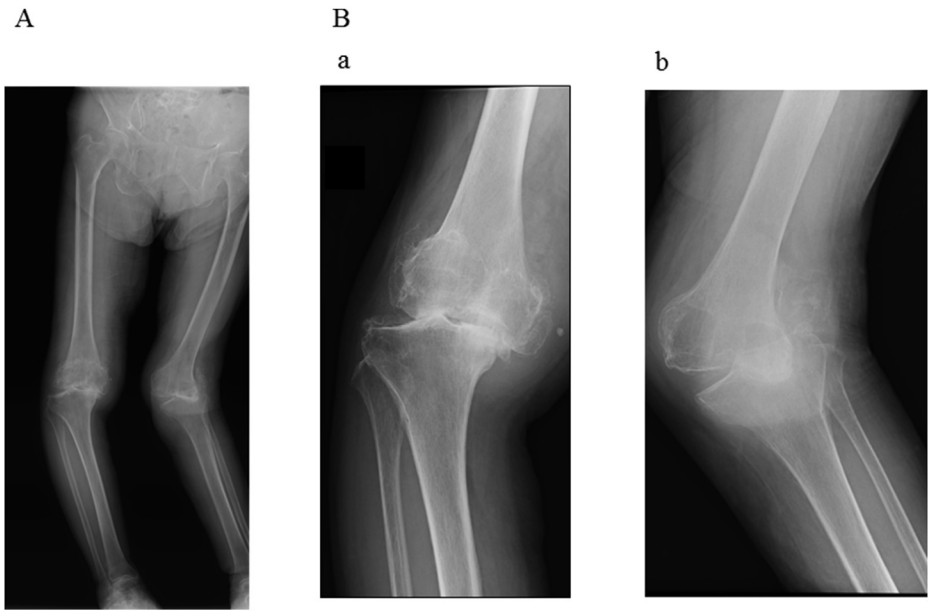

Fig. 1. Preoperative standing radiograph of both sides (a: right side, b: left side), (A) whole lower extremity standing view (B) anteroposterior standing view.

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.[7] The hip was normal radiographically.

The JOA score and Lysholm score[8] 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 bood 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

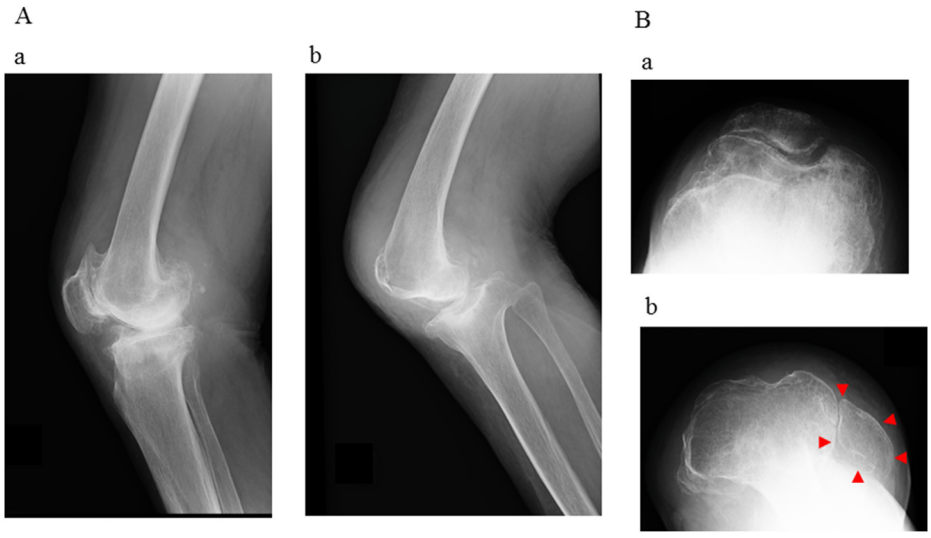

Fig. 2. Preoperative radiograph of both sides (a: right side, b: left side). (A) lateral view (B) axial view (red arrows show the dislocated patella, 45°skyline view). (For interpretation of the references to colour in this figure legend, the reader is referred to the Web version of this article.)

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 1cm 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

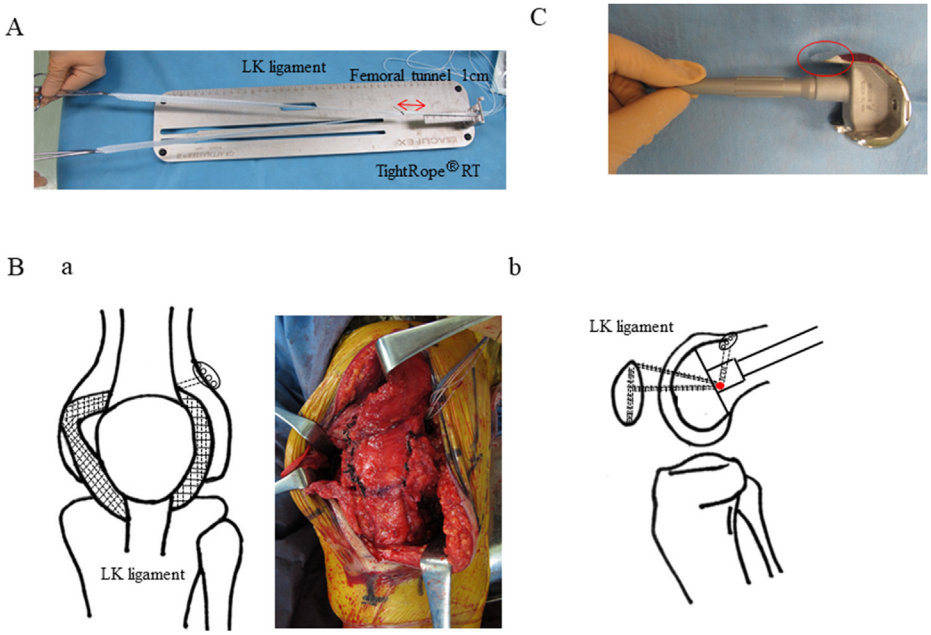

Fig. 3. Operative findings and schema. (A) LK ligament with TightRope® RT. Double red arrow shows the insertion of femoral tunnel in MPFL augmentation. (B) Schema and intraoperative picture of MPFL augmentation with LK ligament. Red circle shows the tunnel position of the femoral side. a: anteroposterior 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.)

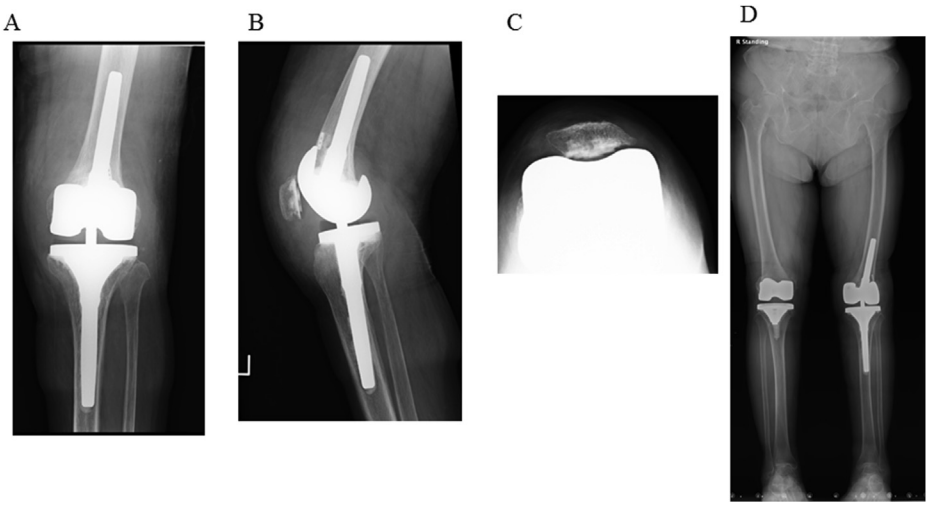

Fig. 4. Postoperative radiograph of left side three years after surgery. (A) anteroposterior view (B) lateral view (C) axial view (45°skyline view) (D) whole lower extremity standing view.

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.

Osteotomy[2] and TKA[5,6] 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 advancement[11,12] and MPFL reconstruction,[9,13] 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] (Fig. 3B, b), and a good tracking course was achieved (Fig. 4C). In addition, the direction of the guide pin was restricted due to the limited area between the long stem and the anterior flange (Fig. 3C) and careful pin insertion was done under an intraoperative image intensifier. After this procedure, the knee was flexed 90° and the tracking of the patella was good. Interestingly, the range of motion gradually improved after TKA and the patient could flex 130° at the final follow-up without patella re-dislocation. This technique provided a good clinical result.

A different type of bilateral TKA combined with ipsilateral MPFL augmentation using LK ligament was useful to successfully treat a patient who had a very severe valgus with permanent patellar dislocation and mild varus deformities, respectively.

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.

Funding

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors, and no material support of any kind was received.

Declaration of competing interest

All authors declare that they have no conflict of interest.

References

1. Al Kaissi A, Farr S, Ganger R, et al. Windswept lower limb deformities in patients with hypophosphataemic rickets. *Swiss Med Wkly*. 2013;143:w13904.
2. Oni OO, Keswani H. Idiopathic or primary windswept deformity: the etiological significance of the radiological findings. *J Pediatr Orthop*. 1984;4:293–296.
3. Smyth EHJ. Windswept deformity. *J Bone Joint Surg*. 1980:166–167, 62-B:2.
4. Smillie IS. *Disease of the knee joint*. 1980:330–386. London, Churchchill Livingston, second ed.
5. Meding JB, Anderson AR, Ritter MA, et al. Windswept deformity in bilateral total knee arthroplasty. *J Arthroplasty*. 2000;15:562–566.
6. Shetty GM, Mullaji A, Khalifa AA, et al. Windswept deformities - an indication to individualise valgus correction angle during total knee arthroplasty. *J Orthop*. 2016 Oct 27;14(1):70–72.
7. Krackow KA, Jones MM, Teeny SM, et al. Primary total knee arthroplasty in patients with fixed valgus deformity. *Clin Orthop Relat Res*. 1991 Dec;(273):9–18.
8. Lysholm J, Gillquist J. Evaluation of knee ligament surgery results with special emphasis on use of a scoring scale. *Am J Sports Med*. 1982;10:150–154.
9. Sato H, Ishibashi Y, Tsuda E, et al. Total knee arthroplasty for gonarthrosis with patellar dislocation. *J Orthop Sci*. 2005 Nov;10(6):656–660.
10. Piedade SR, Pinaroli A, Servien E, et al. Tibial tubercle osteotomy in primary total knee arthroplasty: a safe procedure or not? *Knee*. 2008;15:6.
11. Bergquist PE, Baumann PA, Finn HA. Total knee arthroplasty in an adult with congenital dislocation of the patella. *J Arthroplasty*. 2001;16:3.
12. Kumagi M, Ikeda S, Uchida K, et al. Total knee replacement for osteoarthritis of the knee with congenital dislocation of the patella. *J Bone Joint Surg Br*. 2007;89:11.
13. Matsushita T, Kuroda R, Kubo S, et al. Total knee arthroplasty combined with medial patellofemoral ligament reconstruction for osteoarthritic knee with preoperative valgus deformity and chronic patellar dislocation. *J Arthroplasty*. 2011 Apr;26(3), 505.e17-20.
14. Ikuta Y, Adachi N, Deie M, et al. A novel functional correction method for habitual patellar dislocation using autologous hamstring tendon: a case report. *J Pediatr Orthop B*. 2017 Sep;26(5):465–469.