The Knee xxx (2017) xxx–xxx

Contents lists available at ScienceDirect

The Knee

# Patellar instability treated with distal femoral osteotomy

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ARTICLE INFO

*Article history:*
Received 29 September 2016
Received in revised form 10 February 2017
Accepted 18 February 2017
Available online xxxx

*Keywords:*
Patellar instability
Genu valgum
Distal femoral osteotomy
Patient outcomes

ABSTRACT

*Background:* Patellar instability can cause significant disability in both pediatric and adult patients, and it is associated with several factors including genu valgum. In this study, we describe the role of a lateral opening wedge distal femoral osteotomy (DFO) combined with lateral retinacular release in addressing genu valgum with associated patellar instability. The rationale for this approach is to medialize the patellar tendon insertion and decrease the Q angle with DFO.

*Methods:* A consecutive series of patients were studied, and our outcomes of interest included improvements in radiographic measures and patient outcomes. Radiographic improvement was assessed using patella congruency angle (PCA), mechanical axis deviation (MAD), and lateral distal femoral angle (LDFA). Patient outcomes were assessed using Oxford Knee scores, KOOS-PS scores, VAS pain scores, and Kujala scores.

*Results:* We studied eight patients (10 knees) that underwent a lateral opening wedge DFO for genu valgum and patellar instability. Mean follow-up duration was 27 months. PCA improved from 30.4° lateral preoperatively to 5.7° lateral postoperatively ($p = 0.016$). Similarly, MAD improved from 33.1 mm lateral to 6.5 mm medial, and LDFA improved from 82.4° to 92.7° after surgery ($p = 0.002$). There were significant improvements in VAS pain and Kujala scores after surgery ($p < 0.05$), and a trend towards improvement in KOOS-PS scores ($p = 0.14$). The mean Oxford Knee score at follow-up was 36.25.

*Conclusion:* There is an important relationship between mechanical alignment and patellar instability. Lateral opening wedge DFO is an effective treatment for patellar instability in patients with genu valgum.



## 1. Introduction

Patellar instability including patella tilt, subluxation, and dislocation is a common cause of complaint and activity limitation in both pediatric and adult patients. The source of patellar instability may be secondary to congenital or developmental disorders in young patients or trauma in previously asymptomatic patients [1]. The patella tracks within the trochela of the femur, and the medial and lateral femoral condyles provide osseous stability. A multilayer soft tissue envelope encompasses the patellofemoral joint on the medial and lateral sides [2–5], and also plays a role in patellofemoral stability. Clinically, Q angle and patellar hypermobility are used to assess patellar maltracking and represent the laterally directed force on the patella [6]. All in all, abnormalities in bony architecture such as trochlear dysplasia and patella alta; mechanical malalignment such as genu valgum; abnormal

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http://dx.doi.org/10.1016/j.knee.2017.02.004
0968-0160/

Please cite this article as: Swarup I, et al, Patellar instability treated with distal femoral osteotomy, Knee (2017), http://dx.doi.org/10.1016/j.knee.2017.02.004

geometric vectors characterized by the Q angle; and tightness of the lateral patellar soft tissues may result in patellar maltracking, instability or dislocation [1,7,8].

Several risk factors for patella instability have been described including patient characteristics such as age, ligamentous laxity, patellofemoral dysplasia, and rotational abnormalities [1,7]; as well as environmental factors such as trauma [1]. Recent reports have also suggested that valgus instability [8] and genu valgum [9,10] may be associated with patellar instability. Various treatment strategies have been described for managing patellar instability, including soft tissue realignment or reconstruction procedures, distal realignment procedures involving the tibial tubercle, and even total knee arthroplasty in cases of neglected permanent patellar dislocation [11,12]. In addition, there are a handful of case reports in the literature of distal femoral realignment procedures for the treatment of patellar dislocation. More specifically, Kwon et al. performed a medial closing wedge ostetomy of the distal femur, medial reefing and lateral retinacular release for a patient with congenital patellar dislocation, genu valgum, and lateral compartment osteoarthritis [9]. Similarly, Purushothaman et al. performed a lateral opening wedge osteotomy of the distal femur and medial patellofemoral ligament (MPFL) reconstruction for a patient with chronic post-traumatic patellar dislocation and genu valgum [10].

Despite the relationship between mechanical alignment, soft tissue dynamics, and patellar instability, there is a paucity of data regarding the clinical and radiographic outcomes after distal femoral realignment procedures for patellar instability. The current literature is limited to single case reports with limited outcomes and follow-up [9,10,13]. In this paper, we present our experience with distal femoral osteotomy (DFO) for genu valgum with associated patellar instability. We will describe clinical presentation, surgical planning, surgical technique, and radiographic and clinical outcomes after surgery. Our goal is to increase the awareness of the relationship between genu valgum and patellar instability, as well as describe a successful and reliable treatment option for this complex problem.

## 2. Methods

We retrospectively reviewed the clinical charts and radiographs of a consecutive series of patients with symptomatic genu valgum deformity and patellar subluxation or dislocation. All patients were treated with lateral opening wedge DFO and lateral retinacular release. The indication for surgery was symptomatic genu valgum deformity and patellar instability. Symptomatic genu valgum deformity was defined as the presence of lateral knee pain. Patellar instability was defined as a history of patellar subluxation or dislocation, or findings of patellar instability on physical exam or preoperative radiographs. Patients with advanced osteoarthritis were excluded from this study. This study was approved by our IRB and all authors vouch for the accuracy of the presented data and analyses.

### 2.1. Patient characteristics

Eight patients underwent a lateral opening wedge DFO between June 2010 and October 2014. A total of 10 knees were included in the analysis (six unilateral and two bilateral DFO with lateral retinacular release). Nine knees were noted to be subluxed on preoperative exam, and one knee was completely dislocated. Approximately half of all knees had evidence of patella alta as measured by the Blackburne-Peel ratio (Mean: 1.24, Range: 0.92–1.52). All knees had evidence of trochlear dysplasia, with Dejour type B being the most common (type A – three knees; type B – five knees; type C – one knee). The patient with the complete patellar dislocation underwent a concomitant tibial tubercle ostetomy; two patients underwent a tibial osteotomy for additional coronal plane deformity; and one patient underwent a proximal femoral derotational osteotomy. None of patients in our study demonstrated evidence of advanced cartilage wear on preoperative radiographs. However, two patients were noted to have a one centimeter Grade III lesion in the lateral patellar facet intra-operatively that was micro-fractured. The mean age of patients at the time of surgery was 50 (Range 23–68), and all patients were female (Table 1).

**Table 1**
Patient demographics and outcomes.

| Patient | Age | Gender (M/F) | Laterality (L/R) | Patella position | Pre-op KOOS-PS | Post-op KOOS-PS | Pre-op VAS | Post-op VAS | Pre-op Kujala | Post-op Kujala | Oxford Knee Score |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 59 | F | L | Subluxation | 37 | 35.3 | – | 2 | – | 65 | – |
| 2 | 53 | F | L | Subluxation | 100 | 18.6 | 10 | 0 | 11 | 70 | 23 |
| 3 | 68 | F | L | Subluxation | 0 | 0 | – | – | – | – | 41 |
| 4 | 53 | F | R | Subluxation | – | – | – | – | – | – | – |
| 5 | 52 | F | R | Subluxation | 22 | 24.9 | 7 | 4 | 73 | 71 | 40 |
| 6 | 33 | F | R | Dislocation | 10.5 | 14.8 | 0 | 0 | 76 | 95 | 38 |
| 7 | 60 | F | Bilateral | Subluxation | L 35.3 | L 31.8 | L 5 | L 1 | L 56 | L 90 | 40 |
| | | | | | R 37 | R 33.6 | R 6 | R 2.5 | R 42 | R 80 | |
| 8 | 23 | F | Bilateral | Subluxation | L 31.8 | L 5.6 | L 5.5 | L 2 | L 56 | L 68 | 34 |
| | | | | | R 31.8 | R 5.6 | R 5.5 | R 2 | R 59 | R 68 | |

Please cite this article as: Swarup I, et al, Patellar instability treated with distal femoral osteotomy, Knee (2017), http://dx.doi.org/10.1016/j.knee.2017.02.004