

How to Evaluate and Treat Skeletally Mature Patients With Patellar Dislocation



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Abstract: Although patellar dislocation is a knee disorder prevalent in adolescence and young adults, the evaluation and treatment of patients are complex and even enigmatic. Much of the literature fails to provide a detailed description of patient management. The purpose of this study is to introduce a method for the evaluation and treatment of patellar dislocation. This Technical Note will help guide clinicians in the clinical evaluation of patients and formulation of treatment plans.

Patellar dislocation is a knee injury prevalent in young people in their 20s, with an annual incidence of 5 to 43 cases per 100,000.^{1,2} Despite the high incidence of this disease, there is still disagreement about the evaluation and treatment of patellar dislocation. Historically, some advocated nonsurgical treatment for patients with first-time patellar dislocation, and some highlighted the benefits of surgical treatment. Although some patients receive surgical treatment, the outcome may be barely satisfactory. Incorrect evaluation and treatment planning for patients may result in recurrent patellar dislocation after treatment.

How to evaluate patients with patellar dislocation and how to formulate an appropriate treatment plan are significant problems that can confuse orthopedists. The purpose of this Technical Note is to introduce a method for the evaluation and treatment of patellar dislocation (Video 1).

Technique

Medical History

Detailed inquiry about the dislocation events is very important for the evaluation. Swelling and pain of the

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involved knee joint are the main complaints of patients. The following information should be recorded: age, sex, skeletal maturity, activity and position of the knee at the first time of dislocation, and previous treatments. In some patients, recurrent dislocation of the patella occurs.

Physical Examination

Assessment of patients should begin with the evaluation of varus and valgus. Impingement between the patella and femoral condyle during dislocation and reduction usually causes tenderness of the lateral femoral condyle and medial facet of the patella. The apprehension sign can be positive in patients with medial patellofemoral ligament (MPFL) tears. A positive J-sign indicates maltracking of the patella. Beighton score can be calculated to assess generalized ligamentous laxity. Meniscus and cartilage injuries must be evaluated. A positive patella grind test indicates chondral injuries. The patella is then passively translated medially and laterally at 30° knee flexion to evaluate patellar constraints.

Radiological Evaluation

Imaging evaluations of patellar dislocation mainly include 3 parts: radiograph, computed tomography (CT), and magnetic resonance imaging (MRI). A standard standing long-leg anteroposterior radiograph should be performed to evaluate coronal malalignment (Fig 1). A true lateral radiograph is needed to evaluate the patella alta. The Caton-Deschamps index (CDI) is a relatively widely used method to evaluate the patellar alta (Fig 2). Axial radiographs are essential to evaluate trochlear depth and patellar track (Fig 3).

CT scans can provide evidence for surgical indications. Femoral anteversion and tibial torsion should be

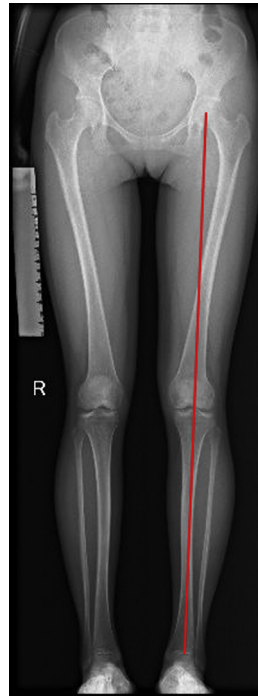


Fig 1. A standard standing long-leg anteroposterior radiograph to evaluate the coronal malalignment of the left leg (the line from the center of the femoral head to the center of the ankle).

measured using CT (Fig 4). For patients with femoral anteversion $>30^\circ$, derotational femoral osteotomy (DFO) should be performed to correct the excessive rotational deformity of the lower limb. Tibial tubercle-

trochlear groove (TT-TG) distance should be measured in this modality (Fig 5). TT-TG distance >20 mm indicates tibial tubercle osteotomy (TTO). This measurement may be hard to measure in patients with trochlear



Fig 2. The true lateral radiograph of left knee. Caton-Deschamps index (CDI) = a/b .

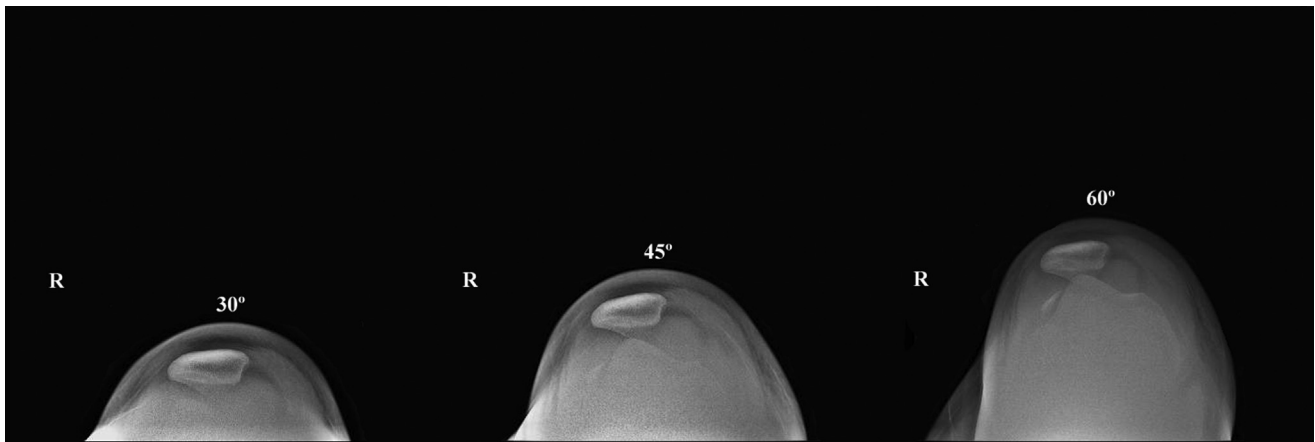


Fig 3. Axial radiographs of the right knee at 3 different flexion angles.

dysplasia. In this condition, tibial tubercle-posterior cruciate ligament (TT-PCL) distance or tibial tubercle-Roman arch (TT-RA) distance can substitute for TT-TG distance in the assessment of tibial tubercle position (Figs 5 and 6). According to the literature, TT-RA distance >26 mm is an indication for the TTO procedure.³ Some authors have advocated that in patients with patellar dislocation, femoral anteversion in different femur segments should be evaluated to know which segment needs osteotomy.⁴ DFO should be performed before TTO, because the DFO procedure will change the TT-TG distance.⁵ Patellar tilt >20° is evidence for lateral retinaculum contracture (Fig 7). In this condition, lateral retinaculum release should be considered.

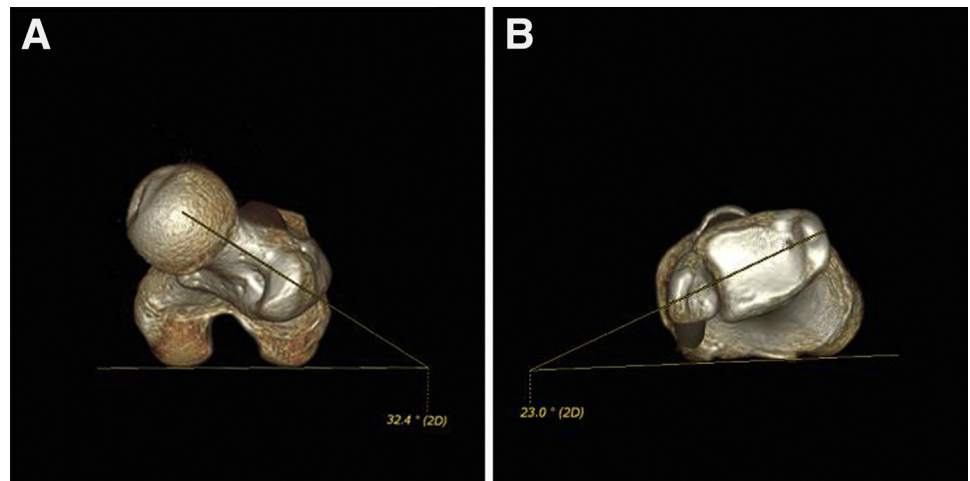
MRI allows inspection of the patellofemoral cartilage and ligaments without radiation exposure. The status of MPFL, meniscus, and the cartilage of the knee joint should be evaluated in this modality (Fig 8). The morphology of the trochlea is divided into normal,

low-grade trochlear dysplasia (Dejour type A), and high-grade dysplasia (Dejour types B, C, and D).⁶ Patients with high-grade trochlear dysplasia can be chosen to perform trochleoplasty. The TT-PCL distance can be measured in this modality to evaluate the relative position of the tibial tubercle; 26 mm is the pathological threshold of excessive TT-PCL distance.

Treatment Choice

Patients with first-time patellar dislocation in the absence of the loose body and osteochondral fragments can be treated nonsurgically. Immobilization and strength exercises of the involved knee joint can be performed to shorten healing time of the medial structures. For patients with multiple anatomic risk factors for patellar dislocation, such as patella alta, trochlear dysplasia, and excessive tibial tubercle lateralization, recurrent patellar dislocation may still occur after isolated conservative treatment.

Fig 4. Measurement of femoral anteversion and tibial torsion. (A) Femoral anteversion of the right leg. (B) Tibial torsion of the left leg.



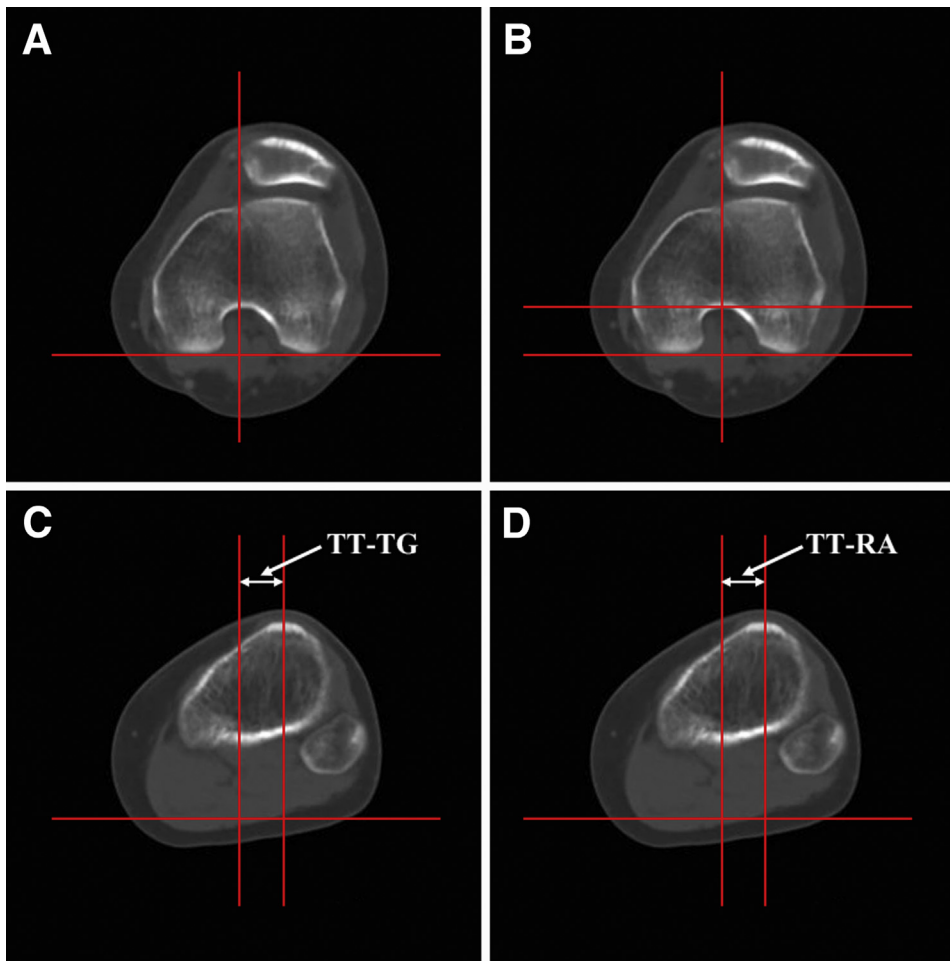


Fig 5. The measurements of tibial tubercle-trochlear groove (TT-TG) distance and tibial tubercle-Roman arch (TT-RA) distance. (A) The CT slice for the evaluation of the trochlear groove and posterior condyles. (B) The CT slice for the evaluation of the highest point of Roman arch and posterior condyles. (C) and (D) The center of tibial tubercle. TT-TG distance (the overlapping image of A and C): the distance between the trochlear groove and the center of tibial tubercle. TT-RA distance (the overlapping image of B and D): the distance between the highest point of Roman arch and the center of tibial tubercle.

The purpose of surgical treatment is to restore the normal anatomic structure of the patellofemoral joint and obtain a favorable patellar track. Repair or reconstruction of MPFL is routinely performed to enforce

medial constraint. Other combined procedures, such as lateral retinaculum release, tibial tubercle osteotomy, derotational femoral osteotomy, and trochleoplasty, can be performed based on preoperative radiological

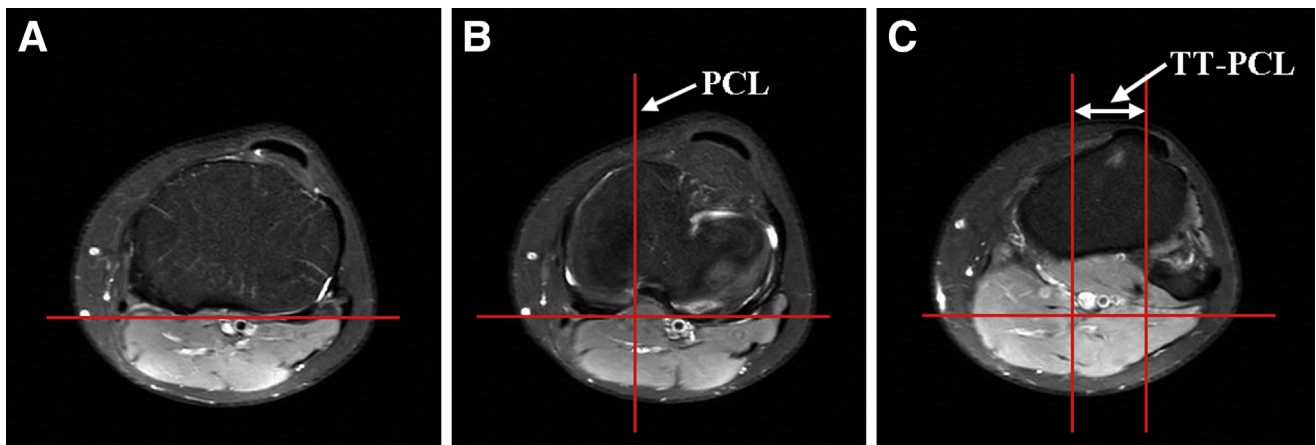


Fig 6. The measurement of tibial tubercle-posterior cruciate ligament (TT-PCL) distance. (A), The dorsal condylar line was drawn in this slice. (B), The PCL is defined as a line passing through the medial border of posterior cruciate ligament. (C), The landmark of the tibial tubercle of TT-PCL distance: the midpoint of the patellar tendon with total attachment to the tibial tubercle. TT-PCL distance: the distance between the midpoint of the patellar tendon with total attachment to the tibial tubercle and the medial border of the PCL.

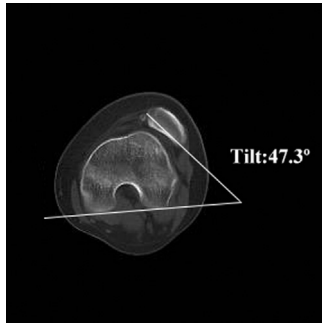


Fig 7. Measurement of patellar tilt. The patellar tilt angle is defined as the angle between the mediolateral axis of the patella and the posterior femoral condyle line.

measurements. Indications for these procedures are presented in [Table 1](#).

Discussion

This note introduces the experience and process in the evaluation of patients with patellar dislocation. Inquiry, physical examination, radiological examination, and the treatment advice based on clinical evidence are presented.

Although patellar dislocation is prevalent, the evaluation and treatment of patients are very complex. The methods and recommendations provided in this study are based on consensus guidelines and our clinical practice. Previous studies have also introduced how to manage patients with patellar dislocation.^{7,8} They either elaborated on this disease in all aspects or only in a particular risk factor. However, the overall process of patient evaluation and formulation of treatment plans have rarely been described in these kinds of review articles or original articles. Thus this note is helpful to guide clinicians in the clinical evaluation of patients and the formulation of treatment plans.

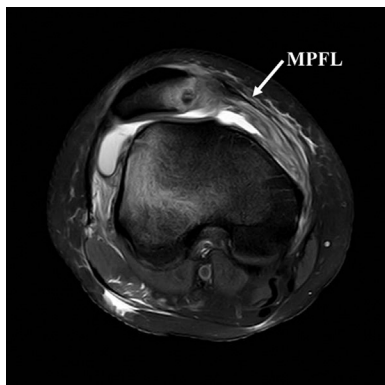


Fig 8. Axial T2-weighted magnetic resonance imaging view of the right knee joint. The medial patellofemoral ligament (MPFL) was completely ruptured, and the contusions of patella and lateral femoral condyle were obvious.

Table 1. Indications for Combined Procedures in patients With patellar Dislocation

Procedure	Indication	Purpose
Lateral retinaculum release	<ul style="list-style-type: none"> Excessive patellar lateral tilt 	<ul style="list-style-type: none"> Decrease the patellar lateral tilt and restore the neutral position of the patella
Tibial tubercle osteotomy	<ul style="list-style-type: none"> Lateral retinaculum contracture TT-TG distance >20 mm CDI >1.2 	<ul style="list-style-type: none"> Concomitant procedure To correct excessive lateralization of the tibial tubercle To correct patellar alta (make CDI = 1)
Derotational femoral osteotomy	Femoral anteversion >30°	To correct the excessive rotational deformity of the femur
Trochleoplasty	High-grade trochlear dysplasia (Dejour B, C, D)	To regain the normal morphology of the femoral trochlea

CDI, Caton-Deschamps index; TT-TG, tibial tubercle-trochlear groove.

Limitations to this article include that all the evaluating methods included in this study were widely accepted by others. Some relatively new parameters, such as TT-PCL distance, TT-RA distance, and femoral anteversion in different segments, are not fully introduced because the clinical application of these parameters has not been fully validated. Moreover, surgical methods for the treatment of patellar dislocation are varied. We recommend only some kinds of operations whose therapeutic effects have been confirmed. Some surgical methods, such as medial patellar tibial ligament reconstruction and derotational tibial osteotomy, are not discussed in this study because of the lack of experience in these methods.

In conclusion, a comprehensive evaluation of patients is of great significance for the treatment of patellar dislocation.

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