Exploring Anatomic Risk Factors Contributing to Patellar Instability: Pathological elevations in CDI are associated with a higher PT-LT.

V.R. Tadepalli, A. Tagliero, R. Le, W. Novicoff, D. Diduch

Introduction

Patellar instability is a multifactorial condition in which several anatomic risk factors can play a role. A lateral vector of pull can contribute to patellar instability. Patellar height and a lateralized vector of pull have been classically described with a Caton-Deschamps Index (CDI) and Tibial Tubercle-Trochlear Groove (TT-TG) measurements. More recently Mistovich et al. introduced the patellar tendon-lateral trochlear ridge measurement (PT-LTR) as a surrogate for quantifying the lateralized vector of pull contributing to patellar instability[1]. We postulate that patella alta can contribute to a lateralized vector of pull by allowing the extensor mechanism to drape over the lateral trochlea more proximally where there is less bony restraint. The goal of this study is to identify any relationship between CDI and PT-LTR.

Methods

Patients undergoing MPFL reconstruction at a single institution between 2010 and 2023 were identified. 309 patients were identified who had a documented CDI measurement by MRI. The preoperative MRI was utilized to obtain a PT-LTR measurement which was calculated as described by Mistovich et al.[1] A CDI value of >1.4 represents more severe patella alta and is the senior author's measurement cutoff to perform a distalizing tibial tubercle osteotomy. A two-tailed student's T test with a 95% confidence interval was used to compare the means of the PT-LTR values for the elevated-CDI cohort as previously described and a control CDI cohort defined as a value ≤ 1.4. A correlation coefficient was calculated between CDI and PT-LTR.

Results

Patients with high CDI values (>1.4) had a statistically significant elevated mean PT-LTR (15.3) when compared to the mean control CDI values (≤1.4) (mean:12.4) ($p= 0.003$). A weak but significant positive correlation was identified between CDI and PT-LTR (CC: 0.185, $p = 0.001$).

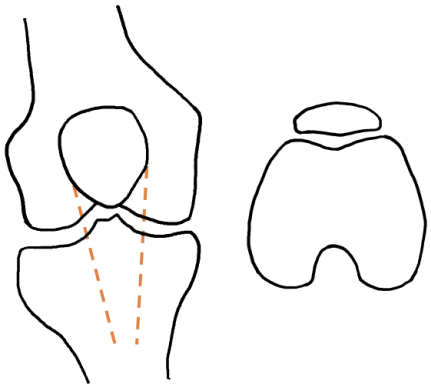
Discussion/Conclusion:

The results demonstrated a correlation between patella alta (CDI> 1.4) and an excessive lateral vector of pull of the extensor mechanism as represented by PT-LTR. This supports the theory that in more significant cases of patella alta the propensity for the extensor mechanism to drape laterally over the femur and predispose to patellar instability is increased. Likely due to the diminished osseous restraints of the femur proximally relative to the trochlear groove (Figure 1) Therefore, the PT-LTR measurement may better reflect the lateral vector of pull contributing to patella instability and, in effect, reflect the combination of multiple anatomic risk factors of coronal malalignment while including the contribution of patella alta.

1. Mistovich RJ, Urwin JW, Fabricant PD, Lawrence JTR. Patellar Tendon-Lateral Trochlear Ridge Distance: A Novel Measurement of Patellofemoral Instability. Am J Sports Med. 2018 Dec;46(14):3400-3406. doi: 10.1177/0363546518809982. Epub 2018 Nov 14. PMID: 30427701.

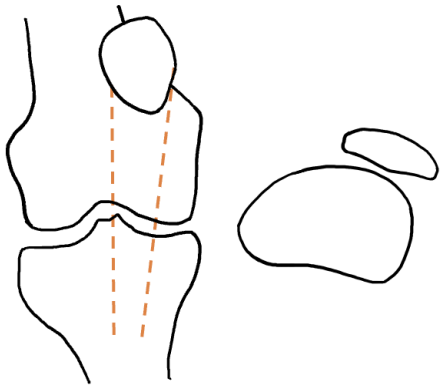
Figure 1

A.



No patella alta.
The patella rests within the trochlear groove.
Normal PT-LTR

B.



Patella alta.
The patella rests laterally on the curved femur.
Elevated PT-LTR