Patellar Tendon to Lateral Trochlear Ridge (PT-LTR) as an Indicator of Patellar Instability with Malalignment

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Disclosures

There is nothing to disclose that pertains to this particular study.

General Author Disclosures:

Beth E. Shubin Stein: Arthrex: Paid consultant/speaker; Conmed: Paid consultant, Research support; Orthopaedics Today: Editorial Board; AJSM: Publishing board; AOSSM/OREF/AAOS: Multicenter grant

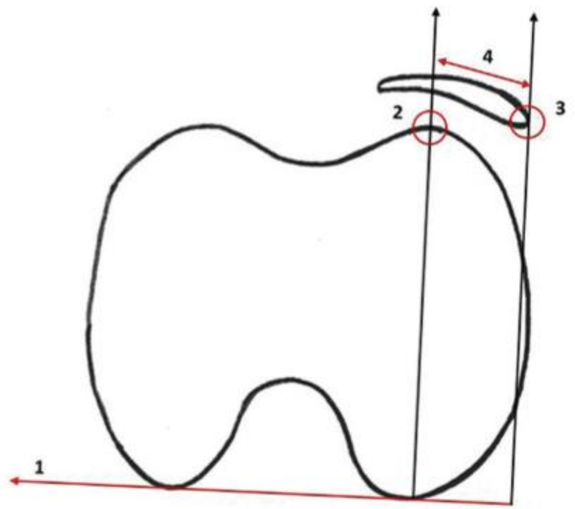
Elizabeth R. Dennis: Conmed: Paid consultant, ISAKOS: Committee Member

Background

> Am J Sports Med. 2018 Dec;46(14):3400-3406. doi: 10.1177/0363546518809982. Epub 2018 Nov 14.

Patellar Tendon–Lateral Trochlear Ridge Distance: A Novel Measurement of Patellofemoral Instability

R Justin Mistovich [1], John W Urwin [2], Peter D Fabricant [3], J Todd R Lawrence [2]



1. Posterior condylar axis
2. Lateral trochlear ridge
3. Most lateral aspect of patellar tendon
4. Axial width of patellar tendon beyond lateral trochlear ridge (PT-LTR)

215 MRIs for patients with and without patellofemoral dislocations

TT-TG > 13.5

- **AUC 0.806**
- **76% sensitive, 77% specific for dislocation**

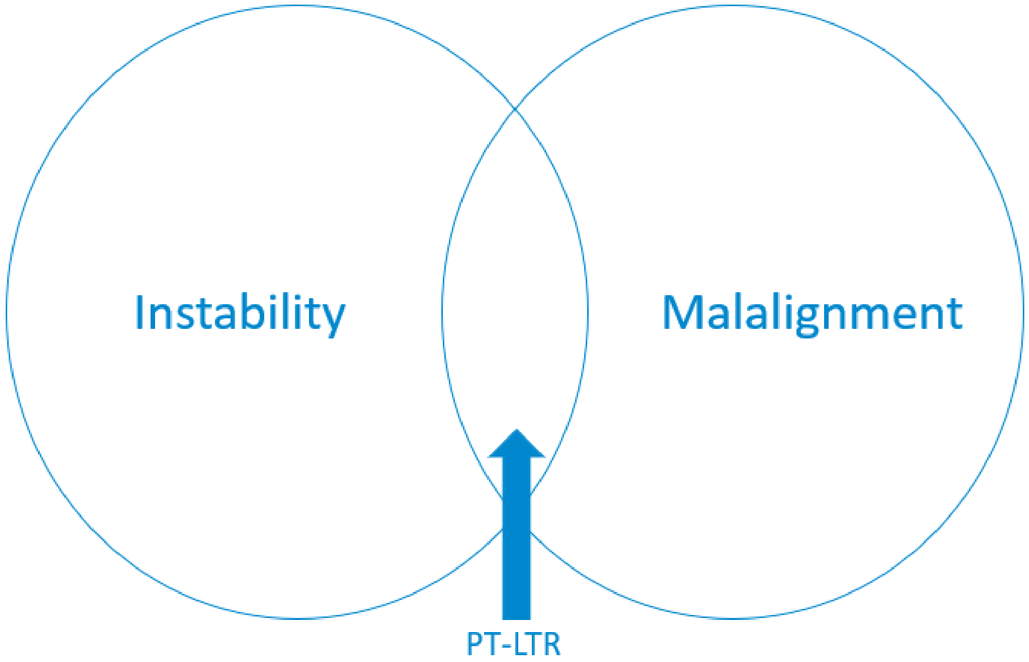
PT-LTR > 5.55 mm

- **AUC 0.876**
- **73% sensitive, 89% specific for dislocation**

Purpose

Assess PT-LTR in patients **with instability with and without concomitant malalignment** to explore the hypothesis that **PT-LTR may be a significant measurement of patients who exhibit patellar maltracking in addition to patellar instability.**

We also sought to explore the relationship between **PT-LTR, patellar height, and TT-TG (Tibial tuberosity to trochlear groove distance).**



PT-LTR may help conceptualize the patients who present with both patellar instability and patellar malalignment.

Methods

Group 1: ACL (Control):
Patients with an ACL tear without a history of patellar instability
n=30

Group 2: Isolated MPFL-Reconstruction
Patients with a history of patellofemoral instability
n=30

Group 3: MPFL-Reconstruction + Tibial Tubercle Transfer (TTT)*
Patients with a history of patellofemoral instability
n=30

- Patient demographics and pre-operative characteristics collected
- PT-LTR, CDI (Canton-Deschamps Index), and TT-TG were measured
- Pre-operative MRI's were reviewed by 5 independent readers (all ICC's appeared to be moderately-highly correlated)

Surgery	ICC
Full Cohort	0.93
ACL	0.67
MPFL	0.80
MPFL+TTT	0.93

*Group 3 patients were a subset of excluded patients from the PI's prospective clinical study (2).

Am J Sports Med. 2024 Jul;52(9):2196-2204. doi: 10.1177/03635465241260039.

Isolated Medial Patellofemoral Ligament Reconstruction for Recurrent Patellar Instability Regardless of Tibial Tubercle–Trochlear Groove Distance and Patellar Height: Minimum 5-Year Outcomes

Elizabeth R Dennis [1], William A Marmor [2], Bennett E Propp [3], Brandon J Erickson [4 5], Simone Gruber [3], Jacqueline M Brady [6], Joseph T Nguyen [7], Beth E Shubin Stein [3]

Affiliations + expand

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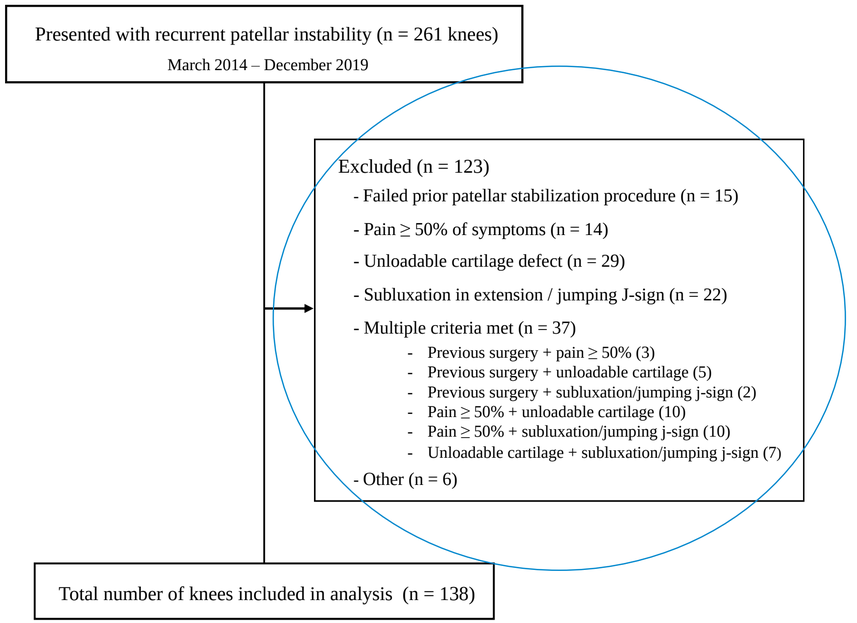


Results: Patient Demographics & Imaging Measurements

Table-1 Patient Demographics, Imaging Measurements and Surgery Performed							
Variable	**ACL**		**MPFL**		**MPFL+TTT**		**P-value**
Age	29.31	13.79	18.82	6.55	26.65	9.68	**0.0001**
Sex							0.0812
F	25.00	83.33	18.00	60.00	24.00	80.00	
M	5.00	16.67	12.00	40.00	6.00	20.00	
CDI	1.07	0.17	1.18	0.16	1.29	0.24	**0.0009**
Alta (CDI >1.2)							**0.0065**
N	24.00	80.00	16.00	55.17	12.00	40.00	
Y	6.00	20.00	13.00	44.83	18.00	60.00	
TT-TG	10.99	3.00	16.23	3.78	19.36	3.46	**<.0001**
TT-TG >15							**<.0001**
N	27.00	90.00	12.00	40.00	1.00	3.33	
Y	3	10	18	60	29	96.67	
TT-TG >20							**<.0001**
N	30	100	25	83.33	17	56.67	
Y	0	0	5	16.67	13	43.33	
Patella Alta and TT-TG >15							**<.0001**
N	29	96.67	20	66.67	13	43.33	
Y	1	3.33	10	33.33	17	56.67	
Patella Alta and TT-TG >20							**0.0081**
N	30	100	28	93.33	23	76.67	
Y	0	0	2	6.67	7	23.33	

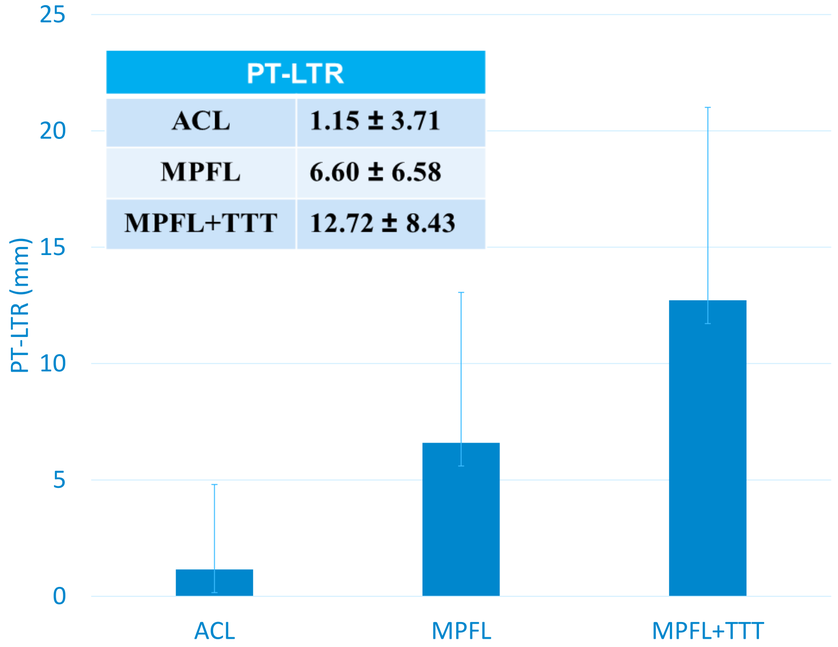
- Patients differed significantly by age.
  - Oldest: ACL
  - Youngest: MPFL
- No significant differences in sex between each group, though the study sample was majority female.

Groups differed significantly by:

- CDI
- Patella Alta (CDI>1.2)
- TT-TG
- TT-TG > 15
- TT-TG > 20
- Patella alta + TT-TG >15
- Patella alta + TT-TG >20

Results

Average PT-LTR For Each Surgery Group



PT-LTR	
ACL	1.15 ± 3.71
MPFL	6.60 ± 6.58
MPFL+TTT	12.72 ± 8.43

The mean PT-LTR differed significantly between groups ($p<0.001$).

Patella Alta

	No		Yes		P-value
PT-LTR	5.32	7.53	9.07	8.20	0.03

TT-TG >15

	No		Yes		P-value
PT-LTR	1.05	4.07	11.42	7.36	<.0001

TT-TG >20

	No		Yes		P-value
PT-LTR	4.83	6.87	14.92	7.35	<.0001

Patella Alta + TT-TG >15

	No		Yes		P-value
PT-LTR	4.63	7.19	11.63	7.69	0.0001

Patella Alta + TT-TG >20

	No		Yes		P-value
PT-LTR	5.92	7.63	15.26	6.85	0.0037

Higher PT-LTR with:

- Patella Alta
- Elevated TT-TG
- Combination of both

Pairwise Comparisons

Surgery Comparison	Between	Simultaneous 95%		
MPFL + TTT - MPFL	6.124	2.081	10.167	***
MPFL + TTT - ACL	11.567	7.524	15.61	***
MPFL - MPFL + TTT	-6.124	-10.167	-2.081	***
MPFL - ACL	5.443	1.435	9.452	***
ACL - MPFL + TTT	-11.567	-15.61	-7.524	***
ACL - MPFL	-5.443	-9.452	-1.435	***

Discussion/Conclusion & Future Work

- PT-LTR, originally described by Mistovich et al[1] as a novel measurement on MRI of patellar instability was determined to be reliable, predictable, and discriminative for patellofemoral dislocations.
- Our results demonstrate that **mean PT-LTR is significantly higher in patients who underwent MPFLR+TTT compared to controls and patients who underwent isolated MPFLR**, which **may reflect its role as an additional measurement of patellar malalignment in the setting of patellar instability**.
- **PT-LTR may be a useful tool in predicting which patients may benefit from a bony realignment procedure in addition to a soft tissue stabilization procedure**

Future work with the JUPITER Cohort will seek to understand if patients with recurrent instability or suboptimal outcomes after isolated MPFL-R have a significantly elevated PT-LTR compared to those patients successfully managed with an isolated MPFL-R.

JUPITER
JUSTIFYING PATELLAR INSTABILITY TREATMENT BY RESULTS

References

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;46(14):3400-3406. doi:10.1177/0363546518809982

2. Dennis ER, Marmor WA, Propp BE, et al. Isolated Medial Patellofemoral Ligament Reconstruction for Recurrent Patellar Instability Regardless of Tibial Tubercle-Trochlear Groove Distance and Patellar Height: Minimum 5-Year Outcomes. *Am J Sports Med*. 2024;52(9):2196-2204. doi:10.1177/03635465241260039