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TT-TG Ratio Provides a More Accurate Estimation of the Amount of Tibial Tubercle Medialization Needed in Patellofemoral Instability

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Faculty Disclosure Information

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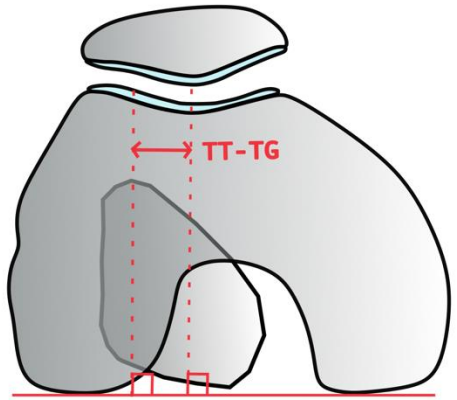
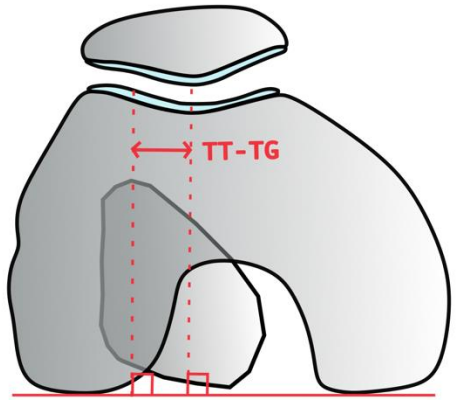
TT-TG Distance Limitations



- TT-TG distance is widely used but does **not adjust for patient size or sex**.[1]
- **Alternative ratios** improve accuracy but are **complex**, limiting clinical use.[2]
- The posterior Bicondilar Line (**PBCL**) is part of a **new patellofemoral MRI** study protocol.[3]
- Posterior Bicondilar Distance (**PBCD**) correlate with **femoral and patient size**.[4]

TT-TG Ratio



- The **main objective** of our study was to propose an index combining **TT-TG/BCPD** (TT-TG Ratio).

- Our **hypothesis:**
  - More precise in distinguishing patients with patellar instability
  - It provides a more accurate determination of the required medialization.

Methods

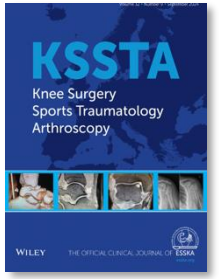
Retrospective (2020 – 2022)
Patellofemoral Instability versus
Control Group

Exclusion:
- Revision Surgery
- OA

MRI institutional protocol
- Axial + Sagittal (T2 Fat S)

MRI measurements
HOROs DICOM software
(version 3.3.6)

Methods



Adapting the Dejour classification of trochlear dysplasia from qualitative radiograph- and CT-based assessments to quantitative MRI-based measurements

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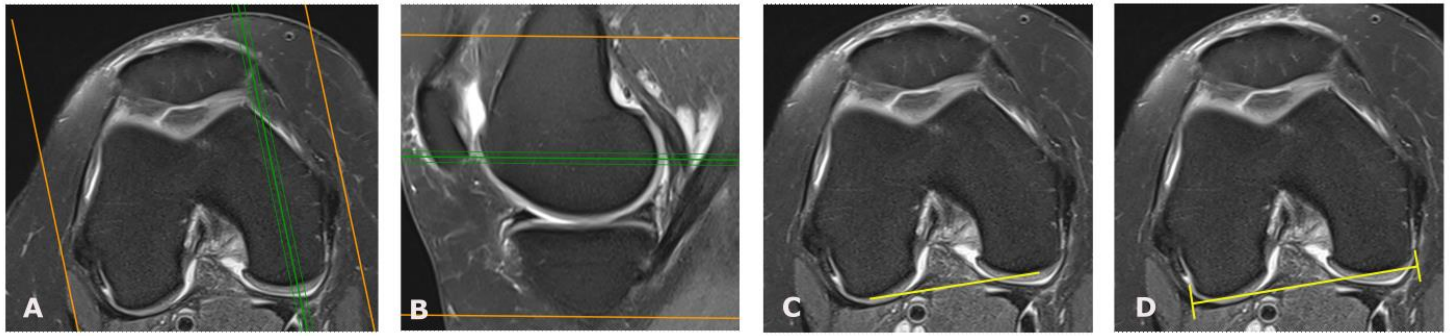
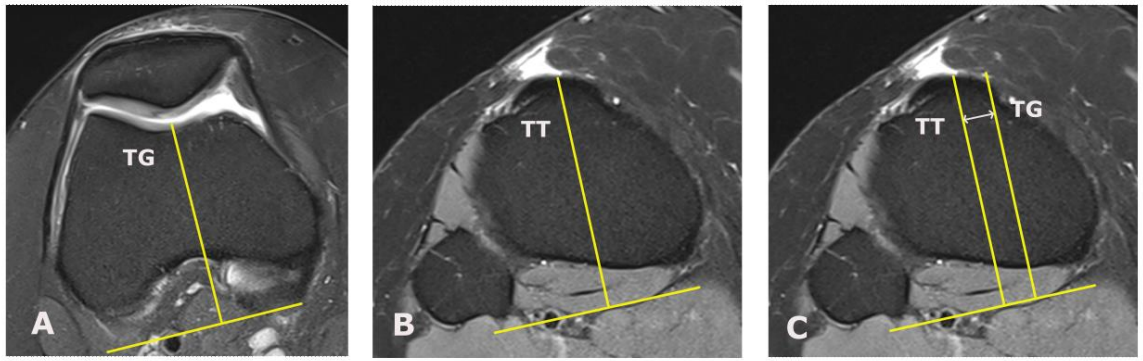
PBCL and PBCD



TT-TG Distance



Results

Table 1. Comparison of OPI Group and Control Group

Variables	OPI Group	Control Group	P Value
Patients, no.	129	105	
Knees, no.	138	107	
Age	29.1 ± 59.3	42.6 ± 14.6	**<.001**
Male (%)	49/138 (35%)	68/107 (64%)	**<.001**
Bilateral, no.	9	2	

OPI, Objective Patellofemoral Instability; No, number; F, female;M, male. Bold figures indicate statistical significance (P < .05)

Table 2. Comparison of the Mean Values Between the OPI Group and the Control Group

Measurement	OPI		Control		P Value
	Mean	SD	Mean	SD	
TT-TG distance (mm)	15	5.2	8.6	3.6	**<.001**
PBCW (mm)	67.4	6.8	73.6	7.3	**<.001**
TT-TGr (%)	22.3	3	11.7	4.6	**<.001**

OPI, Objective Patellofemoral Instability; TT-TG, Tibial Tuberosity - Trochlear Groove distance;PBCW, Posterior Bi-Condylar Width, TT-TGr, Tibial Tuberosity - Trochlear Groove Ratio. Bold figures indicate statistical significance (P < .05)

Results

Table 3. Sensitivity and Specificity of the Cutoff Values

Value	AUC	Cutoff value	Sensitivity %	Specificity %
TT-TG Ratio				
All	0.892	16%	0.83	0.81
Male	0.911	15.78%	0.86	0.81
Female	0.874	15.75%	0.83	0.79
TT-TG Absolute				
All	0.848	11.15 mm	0.78	0.75
Male	0.883	11.75 mm	0.80	0.77
Female	0.850	10.45 mm	0.80	0.77

TT-TG, Tibial Tuberosity-Trochlear Groove distance.

Table 4. Comparison of TT-TG and TT-TG Ratio Between Groups

Instrument	Total			Male			Female		
	OPI (n=138)	Control (n=107)	P value	OPI (n=49)	Control (n=68)	P value	OPI (n=89)	Control (n=39)	P value
TT-TG absolute	15.09 (5.29)	8.64 (3.60)	**<0.001**	16.57(5.86)	8.86(3.88)	**<0.001**	14.28 (4.79)	8.26 (3.07)	**<0.001**
TT-TG Ratio	22.33 (7.32)	11.74 (4.67)	**<0.001**	22.49(7.71)	11.42(4.75)	**<0.001**	22.23 (7.14)	12.29 (4.54)	**<0.001**

OPI, Objective Patellofemoral Instability; TT-TG, Tibial Tuberosity - Trochlear Groove distance. Values reported as mean (SD). Bold figures indicate statistical significance (P < .05)

Results

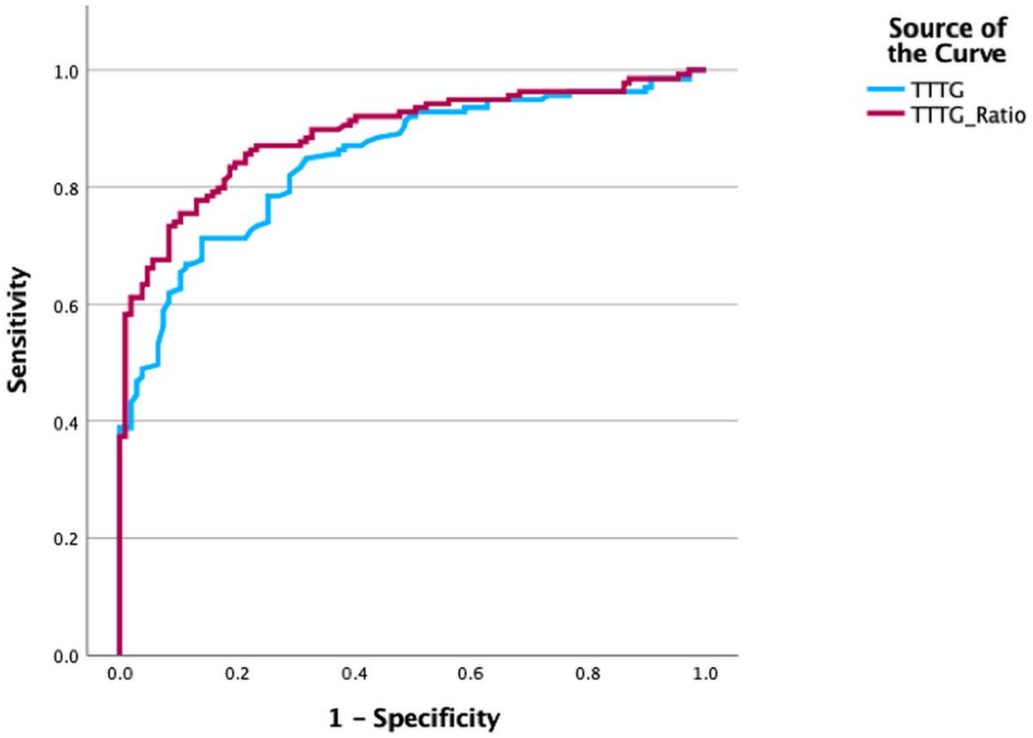
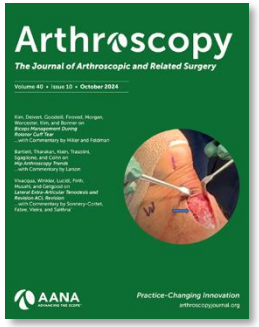


Figure 3. The receiver operating characteristic (ROC) curve shows the area under the ROC curve (AUC) for a TT-TG distance with a cutoff value of 11.15 mm and a TT-TG Ratio with a cutoff value of 16%.

Discussion



Tibial Tubercle—Trochlear Groove/Trochlear Width Is the Optimal Indicator for Diagnosing a Lateralized Tibial Tubercle in Recurrent Patellar Dislocation Requiring Surgical Stabilization

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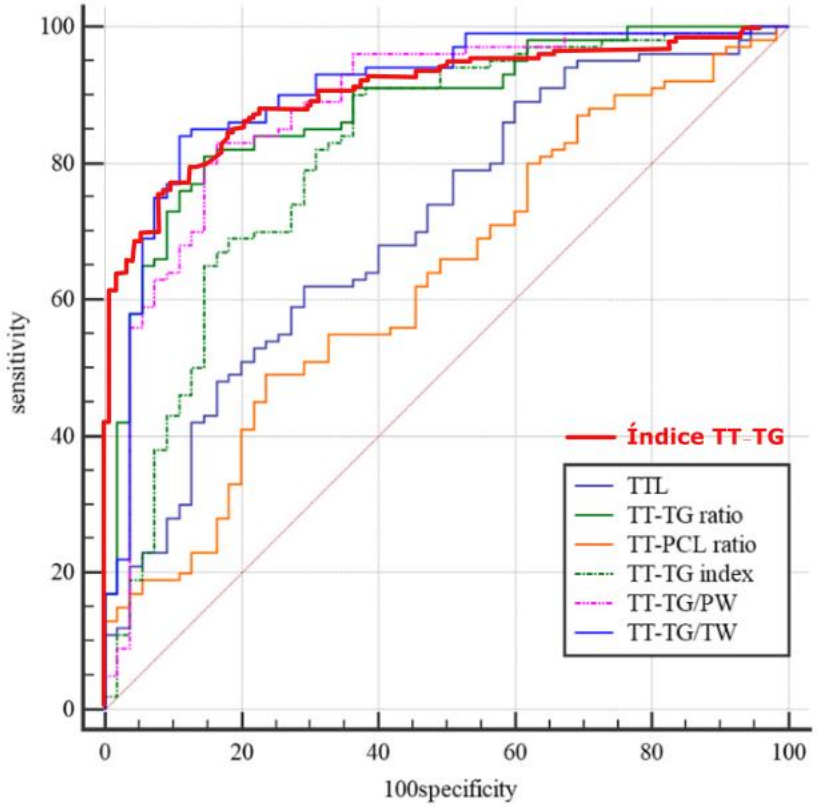

1.- The main finding of our study was that our index demonstrated **higher sensitivity and specificity** than the TT-TG distance and most indices proposed in the literature.

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Discussion

2.- Considering that our normal value was **11.7%**, we can determine the required medialization by multiplying the PBCD by the normal value and subtracting the result from the TT-TG distance.

3.- While previous studies have shown **no specific gender-based differences** in TT-TG, our study revealed gender-based differences in the TT-TG distance.

$$Correction = TT - TG\ Distance - (PBCD \times 0.117)$$

Conclusion

1. Provides an **enhanced discriminant value** compared to the TT-TG distance in distinguishing patients with patellofemoral instability from controls.

2. **Accounts for gender and size-based differences** inherent to TT-TG distance without introducing additional steps seen with other proposed TT-TG ratios.

3. A proposed threshold of **16%** enables differentiation between patients with objective patellar instability and those from the control group.

4. This personalized approach allows a **more individualized assessment** when considering the need for tibial tubercle osteotomy and the extent of medialization required.

References

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3. Dejour DH, de Sanctis EG, Müller JH, et al. Adapting the Dejour classification of trochlear dysplasia from qualitative radiograph- and CT-based assessments to quantitative MRI-based measurements. Knee Surgery, Sports Traumatology, Arthroscopy. Published online November 18, 2024.

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