Tibial Tubercle Osteotomy Decreases Femorotibial Rotation in Patients with Patellar Instability

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DISCLOSURES

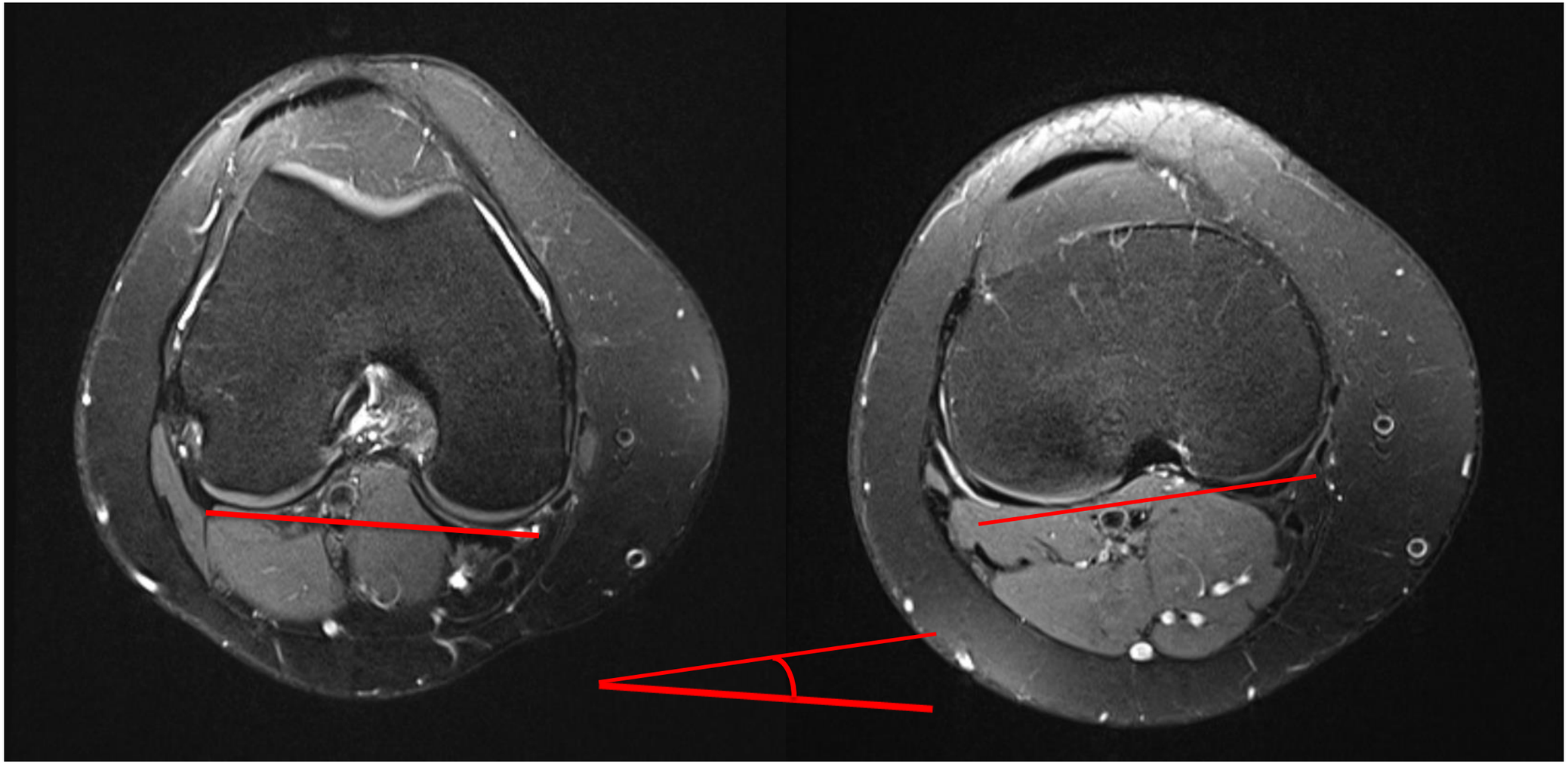
- The authors have no conflicts of interest

Background

- Patellofemoral instability is multifactorial [1,2,3]
- Coronal malalignment
- Femoral / tibial torsional malalignment
- Dysplastic trochlea
- Patella alta
- Position of tibial tuberosity (TTTG- /TT-PCL distance)
- Tibial tuberosity (TT) torsion
- Increased tibiofemoral (TF) rotation contributes to patellofemoral instability by further lateralizing the muscle force vector acting on the patella [4,5]

- 1 Lin KM, KSSTA 2021
- 2 Jud L, KSSTA 2024
- 3 Bernholt D, Orthop. J. Sports Med 2018
- 4 Wu G, Orthop. Surg 2022
- 5 Flury A, KSSTA 2022

BACKGROUND



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normal value: 1.3°± 3.9 [2]

- 1 Bernholt D, Orthop. J. Sports Med 2018
- 2 Huettner F, Am J Sports Med. 2023

BACKGROUND

Tibial tubercle osteotomy (TTO) serves to realign the muscle vector acting on the patella and the proximal tibia by reducing the TTTG distance [1,2]

Hypothesis

TTO reduces TF rotation in patients with patellofemoral instability

- 1 Franciozi CE, J. Arthrosc. Relat. Surg. 2019
- 2 Fucentese SF, KSSTA 2007

METHODS

Retrospective analysis

- All patients with patellar stabilizing surgery
- January 2010 - December 2020
- Pre- and postoperative MRI
- No previous bony procedures

→144 knees

RADIOGRAPHIC ASSESSMENT

Pre- and postoperative:

- Caton-Deschamps index (CDI)[1]
- Tibial-tubercle-trochlear-groove distance (TTTG)[2]
- Tibial tubercle (TT) torsion[3]
- Tibial tubercle-to-posterior cruciate ligament distance (TT-PCL)[4]
- TF rotation[5]

1 Caton J, Acta Orthop Belg 1989
2 Schoettle PB, Knee 2006
3 Jud L, KSSTA 2024
4 Seitlinger G, Am J Sports Med 2012
5 Bernholt D, Orthop J Sports Med 2018

PATIENTS: 4 GROUPS (n=144)

1: Isolated medial patello-femoral ligament (MPFL) reconstruction (n=51)
2: MPFL reconstruction and TTO (n=24)
3: MPFL reconstruction and trochleoplasty (n=37)
4: MPFL reconstruction, trochleoplasty and TTO (n=32)

DEMOGRAPHICS

	Group 1	Group 2	Group 3	Group 4
Age (years)	22.6 ± 8.0	24.0 ± 10.5	24.5 ± 8.4	24.2 ± 7.5
Sex (m/f)	15/36	8/16	7/30	14/18
BMI (kg/m^2)	24.8 ± 5.4	24.3 ± 3.8	25.1 ± 5.6	25.8 ± 4.6

- 1: Isolated MPFL reconstruction
- 2: MPFL reconstruction and TTO
- 3: MPFL reconstruction and trochleoplasty
- 4: MPFL reconstruction, trochleoplasty, and TTO

RESULTS

	Group 1	Group 2	Group 3	Group 4
Preoperative TF rotation, °	-0.2 ± 6.1	3.1 ± 6.7	5.0 ± 5.5	9.5 ± 6.0
Postoperative TF rotation, °	0.4 ± 6.0	1.8 ± 8.1	5.0 ± 7.3	7.5 ± 5.7
p-Value	n.s.	n.s.	n.s.	0.003

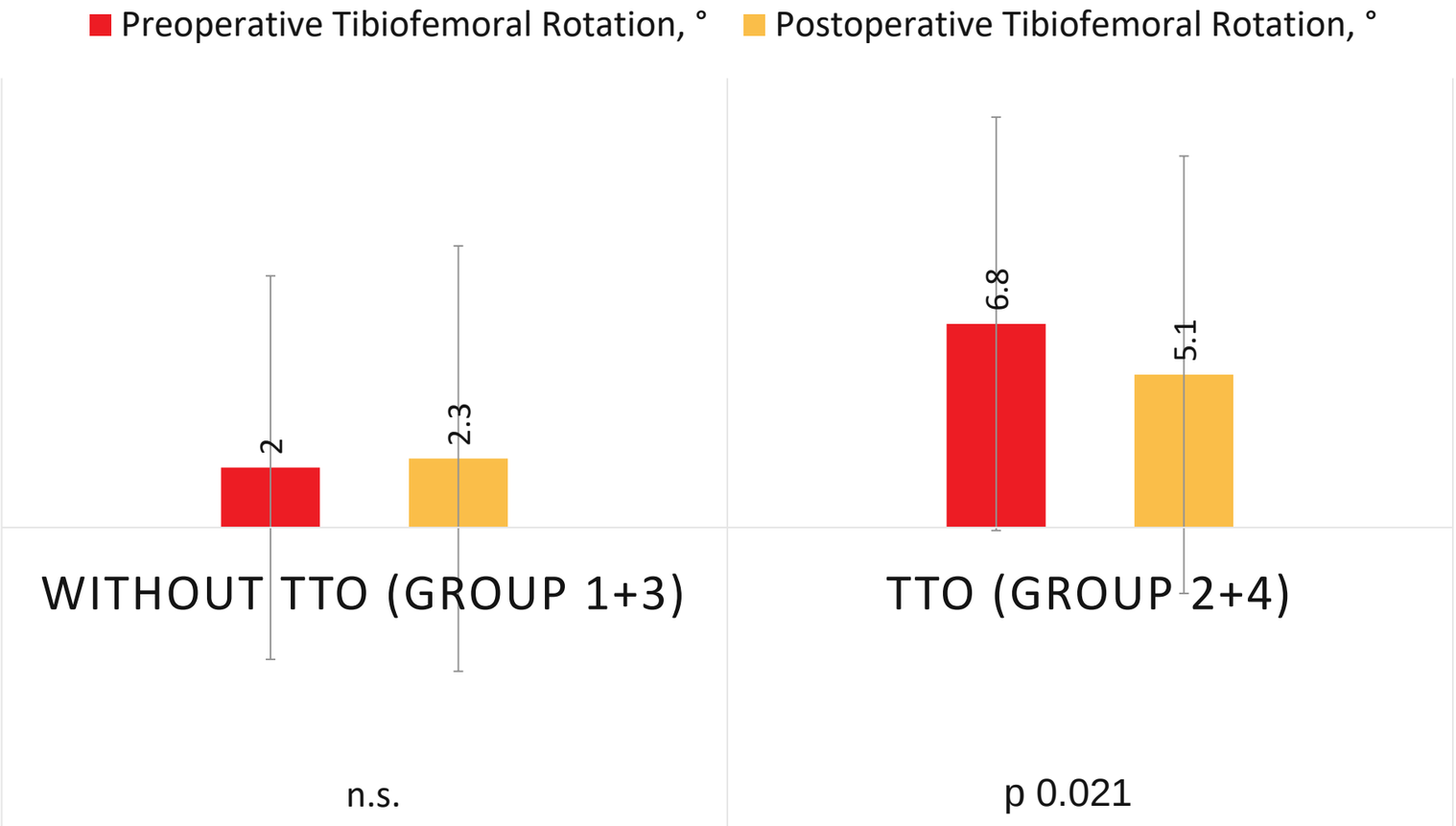
- 1: Isolated MPFL reconstruction
- 2: MPFL reconstruction and TTO
- 3: MPFL reconstruction and trochleoplasty
- 4: MPFL reconstruction, trochleoplasty, and TTO

RESULTS

	Without TTO	With TTO	p-Value
CDI			
Preoperative	1.1 ± 0.2	1.1 ± 0.2	n.s
Postoperative	1.0 ± 0.2	1.0 ± 0.2	n.s
TT-torsion, °			
Preoperative	15.1 ± 7.2	19.2 ± 7.0	0.001
Postoperative	14.2 ± 6.7	14.3 ± 7.2	n.s
TTTG distance, mm			
Preoperative	12.1 ± 3.6	16.4 ± 3.6	<0.001
Postoperative	12.5 ± 4.2	8.2 ± 4.8	<0.001
TT-PCL distance, mm			
Preoperative	18.1 ± 3.2	19.7 ± 3.3	0.008
Postoperative	17.8 ± 3.3	12.6 ± 4.3	<0.001

RESULTS

COMPARISON OF THE COMBINED GROUPS WITHOUT TTO AND WITH TTO



RESULTS

- Reduction of TF rotation was significantly correlated with the reduction of the TT-torsion ($r=0.511$, $p<0.001$) but not medialization achieved by TTO ($r=0.185$, $p= 0.173$)

- Reduction of TF rotation was also directly associated with the amount of preoperative TF rotation ($r=0.316$, $p=0.018$)

CONCLUSIONS

- TTO reduces tibiofemoral rotation in patients with patellar instability

- TTO should be considered not only in patients with increased TTTG, but also with increased tibiofemoral rotation