

SMALL CHANGES OF FEMORAL TORSION AFTER DISTAL FEMORAL OSTEOTOMY USING PATIENT-SPECIFIC INSTRUMENTS EVEN IN CASE OF A HINGE FRACTURE

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DISCLOSURES

The authors have no conflicts of interest

INTRODUCTION

- Indication for varus / valgus distal femoral osteotomy (DFO) ^{1,2,3}
 - Unicompartimental overload / osteoarthritis
 - Patellofemoral instability
- Common techniques: lateral opening- and closing wedge DFO or medial closing wedge DFO
 - Opening: technically easier, height restoration
 - Closing: faster healing

INTRODUCTION

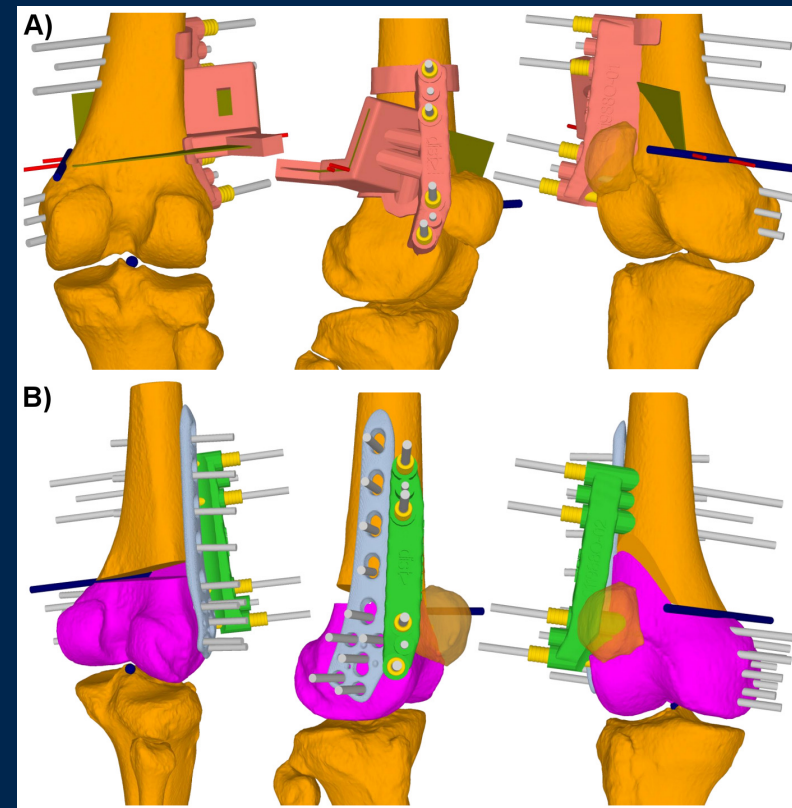
- Fracture of cortical hinge – possible complication of any technique
 - Incidence up to 70% ^{4,5,6}
 - Increased risk for delayed or non-union ^{7,8}
 - Increase of femoral torsion by + 9.5° on average ⁹
- Increased femoral torsion
 - Provoke patellofemoral degeneration or instability ^{10,11}
- Use of patient-specific instruments (PSI) beneficial to prevent hinge fracture and concomitant increase of femoral torsion?

MATERIALS AND METHODS

- Inclusion criteria
 - All patients who underwent varus or valgus DFO using PSI from 01/2014 - 09/2023 at our institution
 - Preoperative available long leg radiograph (LLR) and computed tomography (CT) scan
 - Postoperative (6 weeks) available knee radiograph
 - Postoperative (4.5 months) available LLR and CT scan

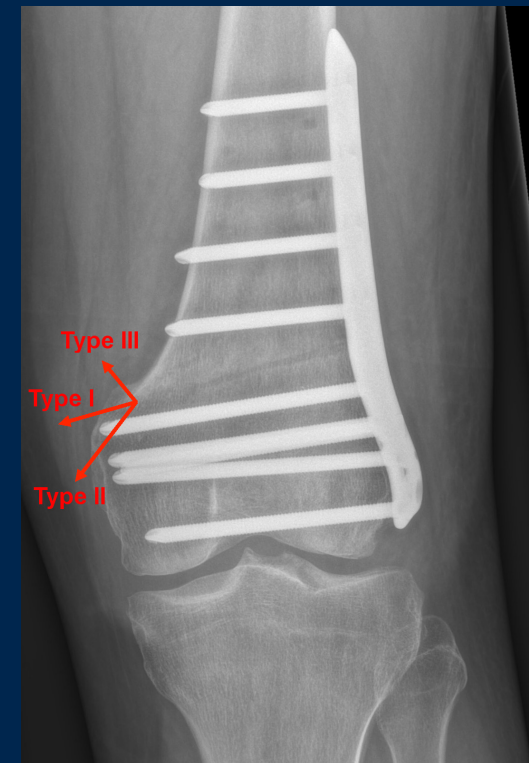
SURGICAL TECHNIQUE

- Medial / lateral subvastus approach
- Positioning of osteotomy guide (red, Figure A) and fixation with four Schanz pins
- Performing the biplanar osteotomy
- Positioning of the reduction guide over the same four Schanz pins and plate fixation of the osteotomy (green, Figure B)



RADIOLOGICAL ASSESSMENT

- Measurement of femoral torsion ¹²
 - Preoperative and 4.5 months postoperative
- Measurement of hip-knee-ankle angle (HKA)
 - Preoperative and 4.5 months postoperative
- Screening for and classification of hinge fractures ¹³
 - Intraoperative fluoroscopic images, knee radiographs 6 weeks postoperative, and LLR and CT scan 4.5 months postoperative



RESULTS

DEMOGRAPHICS

n	89 knees (82 patients, ♀ 40, ♂ 42)
Side	51 right knee, 38 left knee
Age	37.0 ± 13.1 years
BMI	28.0 ± 5.1 kg/m ²

- 35 medial closing-wedge DFO (MCW-DFO)
- 27 lateral closing-wedge DFO (LCW-DFO)
- 27 lateral opening-wedge DFO (LOW-DFO)

RESULTS

All (n=89)	
PreOP HKA (°)	1.1 ± 8.0 (-19.8 to 15.8)
PostOP HKA (°)	0.2 ± 2.0 (-8.6 to 5.3)
Planned HKA correction (°)	-1.3 ± 8.3 (-10.0 to 16.3)
Reached HKA correction (°)	-1.3 ± 8.5 (-13.3 to 16.9)

- Overall 55 hinge fractures (61.8%)
 - 39 Type I hinge fractures
 - 16 Type III hinge fractures
- 25 in MCW-DFO (71.4%)
- 13 in LCW-DFO (48.1%)
- 17 in LOW-DFO (63%)

RESULTS

	Femoral torsion preop (°)	Femoral torsion postop (°)	p-value
All (n=89)	15.2 ± 9.1 (-13.2 to 30.2)	13.7 ± 9.2 (-10.3 to 29.9)	< 0.001
No hinge fracture (n=34)	14.9 ± 8.7 (-6.2 to 29.3)	14.2 ± 8.9 (-3.7 to 29.3)	n.s.
Hinge fracture (n=55)	15.4 ± 9.3 (-13.2 to 30.2)	13.5 ± 9.4 (-10.3 to 29.9)	0.002
Type I hinge fracture (n=39)	14.9 ± 10.3 (-13.2 to 30.2)	12.8 ± 9.7 (-10.3 to 29.9)	0.007
Type III hinge fracture (n=16)	16.8 ± 6.5 (3.5 to 26.5)	15.1 ± 8.6 (-5.5 to 25.5)	n.s.
MCW-DFO with hinge fracture (n=25)	11.7 ± 10.2 (-13.2 to 28.8)	9.9 ± 10.1 (-10.3 to 29.9)	n.s.
LCW-DFO with hinge fracture (n=13)	16.0 ± 6.1 (8.6 to 26.7)	17.6 ± 7.3 (5.5 to 25.5)	n.s.
LOW-DFO with hinge fracture (n=17)	20.5 ± 7.7 (3.5 to 30.2)	15.5 ± 8.1 (-5.5 to 24.0)	<0.001

RESULTS

	Mean change of femoral torsion postop (°)
All (n=89)	-1.5 ± 4.4 (-11.1 to 12.9)
No hinge fracture (n=34)	-0.7 ± 2.3 (-4.0 to 4.4)
Hinge fracture (n=55)	-2.0 ± 5.3 (-11.1 to 12.9)
Type I hinge fracture (n=39)	-2.1 ± 5.5 (-11.1 to 12.9)
Type III hinge fracture (n=16)	-1.7 ± 4.9 (-9.0 to 11.0)
MCW-DFO with hinge fracture (n=25)	-1.7 ± 5.5 (-11.1 to 12.4)
LCW-DFO with hinge fracture (n=13)	1.6 ± 5.3 (-4.5 to 12.9)
LOW-DFO with hinge fracture (n=17)	-4.9 ± 3.0 (-10.9 to 0.8)

CONCLUSION

- Overall low changes of femoral torsion after DFO using PSI compared to literature of conventional performed DFO
- Change of femoral torsion depending on DFO technique
- Significant changes only in case of hinge fracture in LOW-DFO ($-4.9^{\circ} \pm 3.0^{\circ}$)

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