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UTILITY OF 3D BIOMODELS IN THE SURGICAL PLANNING OF FEMRAL DEROTATIONAL OSTEOTOMIES

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Faculty Disclosure Information

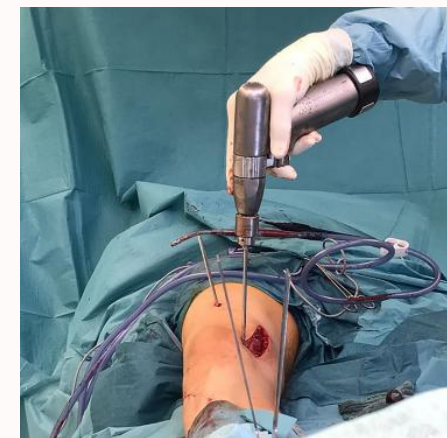
NOTHING TO DISCLOSURE

INTRODUCTION

Increased femoral anteversion (FAV) is crucial in the genesis of anterior knee pain (AKP) and a femoral derotational osteotomy (FDO) has demonstrated good clinical results. It remains unclear at what level of the femur the osteotomy should be performed. Resulting degrees of FAV measured by Murphy's method do not always correspond to the degrees that had been planned after an FDO.

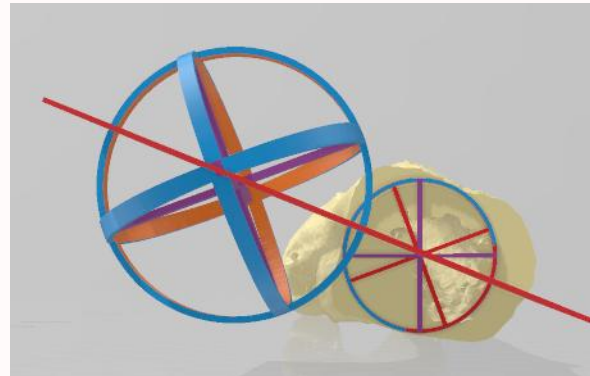
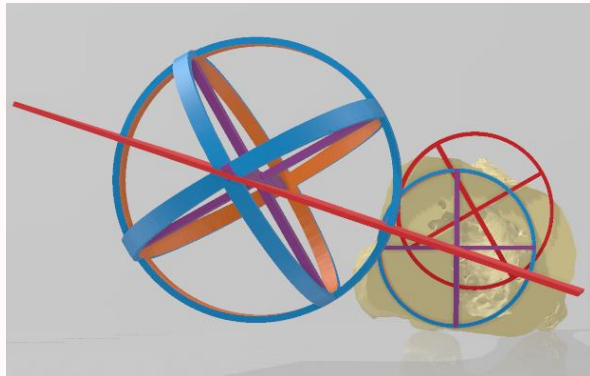
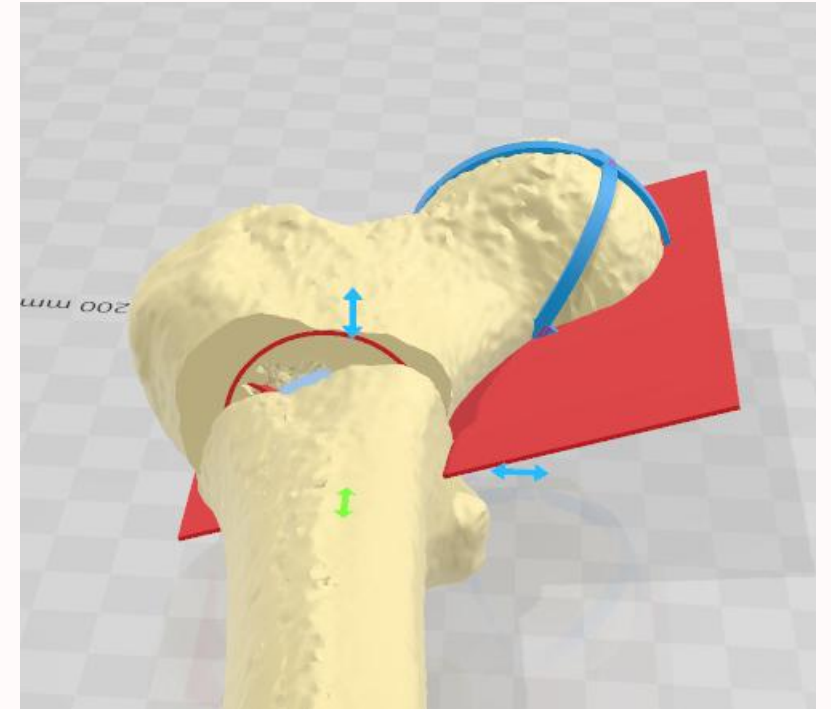
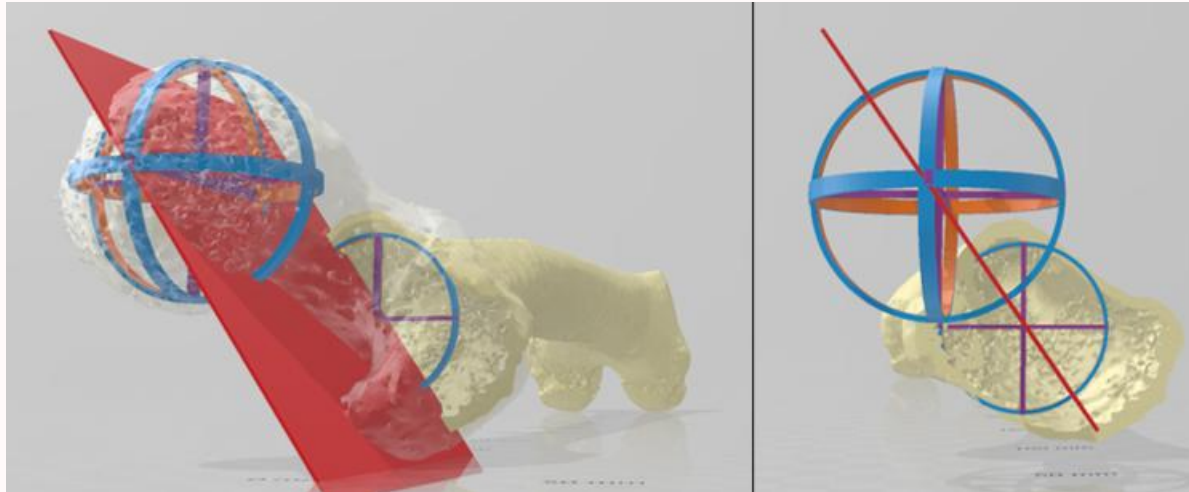


HYPOTHESIS: The hypothesis of this study is that the femur rotation axis and the osteotomy rotation axis do not coincide. 3D technology is used to objectify the discrepancy between these two axes and to find solutions so that the two axes can coincide



OBJECTIVE: to demonstrate the reliability and reproducibility of the 3D technique for osteotomy adjustment through an intraobserver and interobserver study

3D technology helps us to demonstrate our hypothesis



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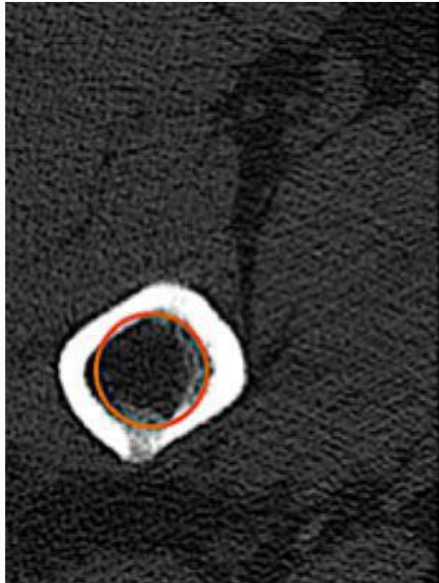


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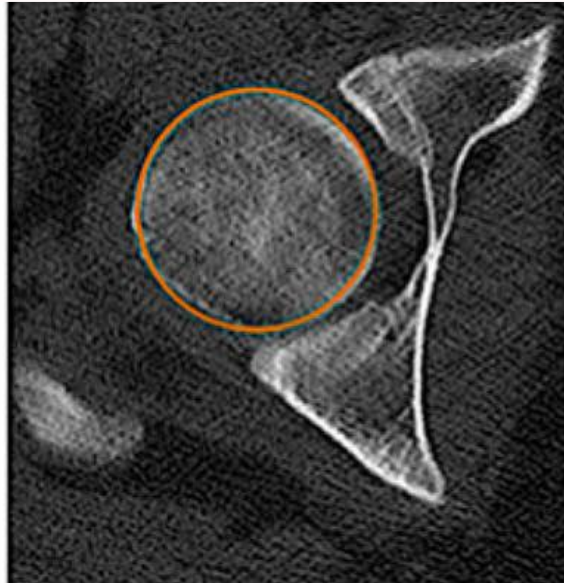
Murphy's method

THREE POINTS OF
REFERENCE

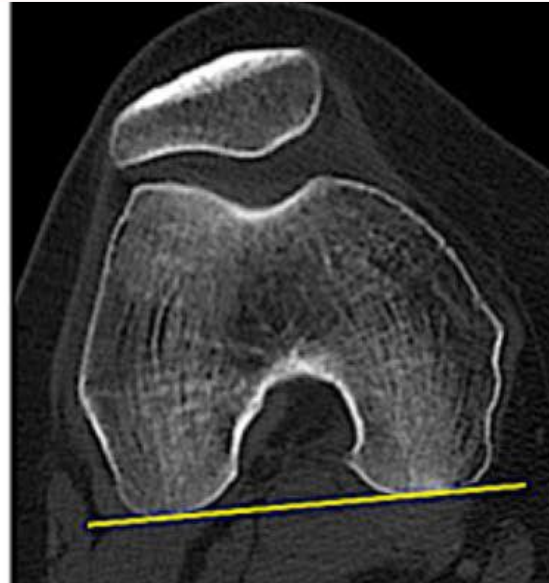
- ✓ Better clinical-radiological correlation
- ✓ High reproducibility



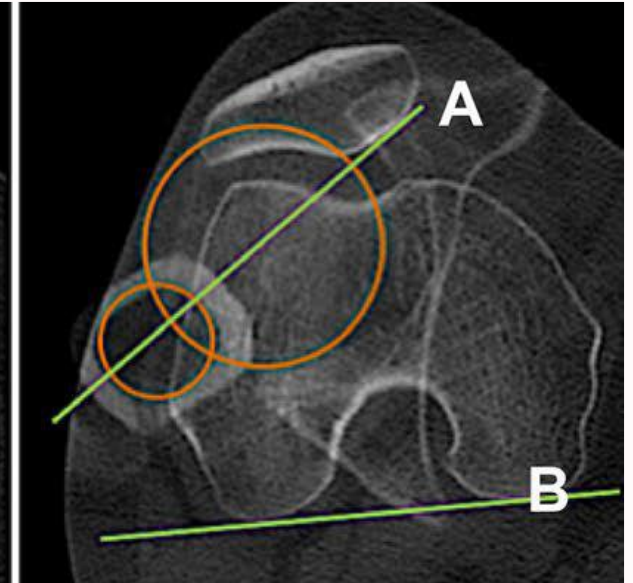
1. The center of the femoral diaphysis (lesser trochanter).



2. The center of the femoral head



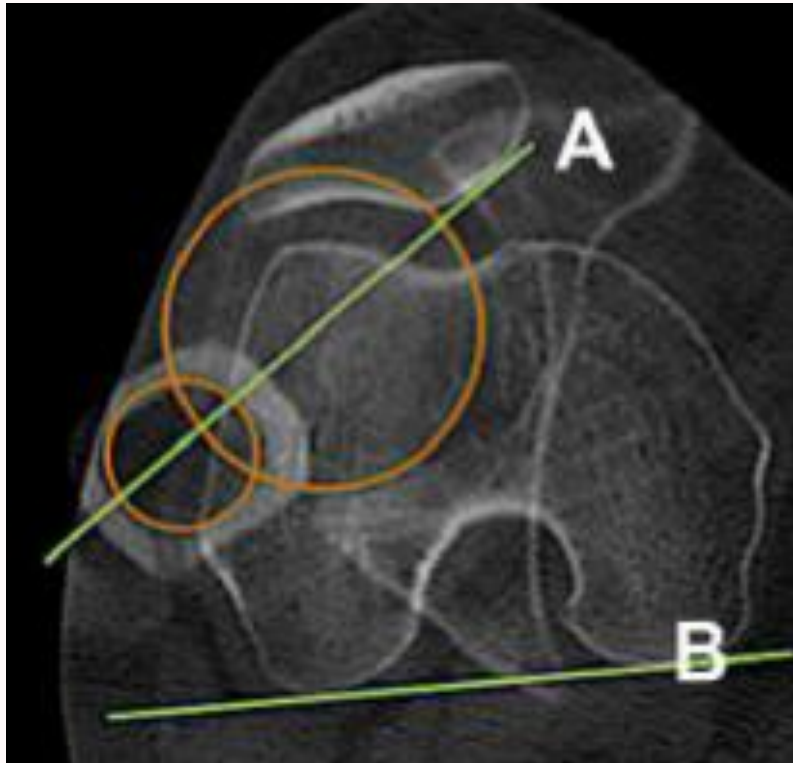
3. Tangent to the posterior aspect of the femoral condyles.



Murphy angle: intersection of line A with line B.

MATERIAL AND METHODS: Study population and design

8 femur CT scans (7 female patients 4 Right and 4 Left)



EXCLUSION CRITERIA:

- Previous knee surgeries.
- Patellar instability
- Previous femur and/or knee fractures.

INCLUSION CRITERIA:

- AKP
- Diagnosis of FAV > 35° (Murphy's method)
- Whole femur torsional CT scan



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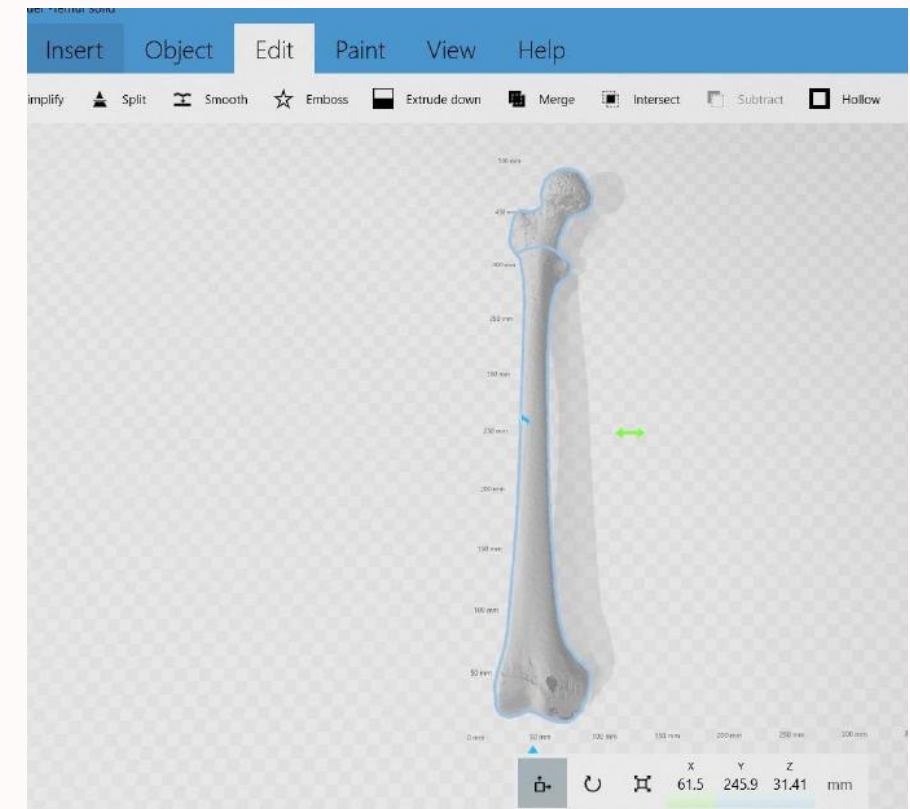
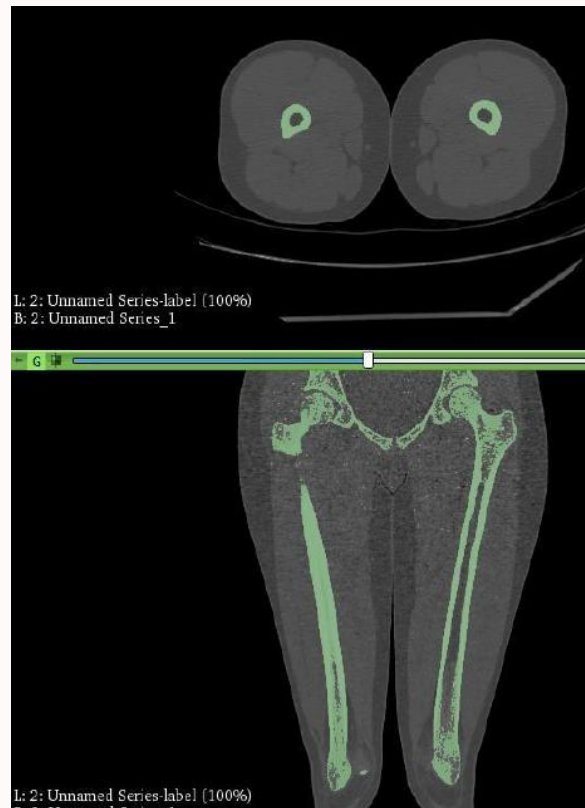
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MATERIALS AND METHODS: 3D Biomodel

3D SLICER ver
4.11.20210226
(www.slicer.org)

MESHMIXER ver 3.5
(<https://meshmixer.com>)

3D BUILDER
(Microsoft.com)



MATERIALS AND METHODS: Measurement of anteversion

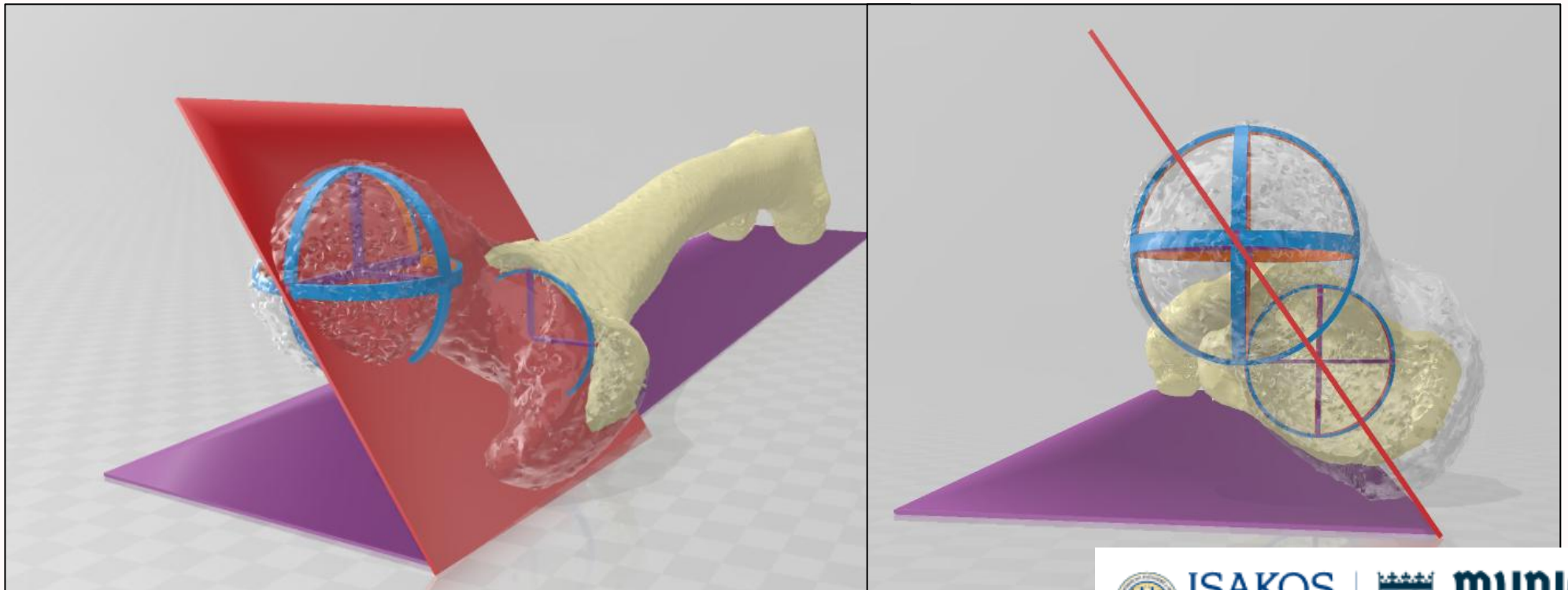
- 2 surgeons measure the FAV and simulate the femoral derotational osteotomy
(**Interobserver**)
- Each surgeon repeats the measurements after 15 days (**Intraobserver**)

3D Guides are used:

- Sphere
- Red and purple circumferential guides

Interobserver
concordance
ICC 0.930
(95%CI 0.799-
0.975)

Intraobserver
concordance
ICC 0.986
(95%CI 0.959-
0.995)

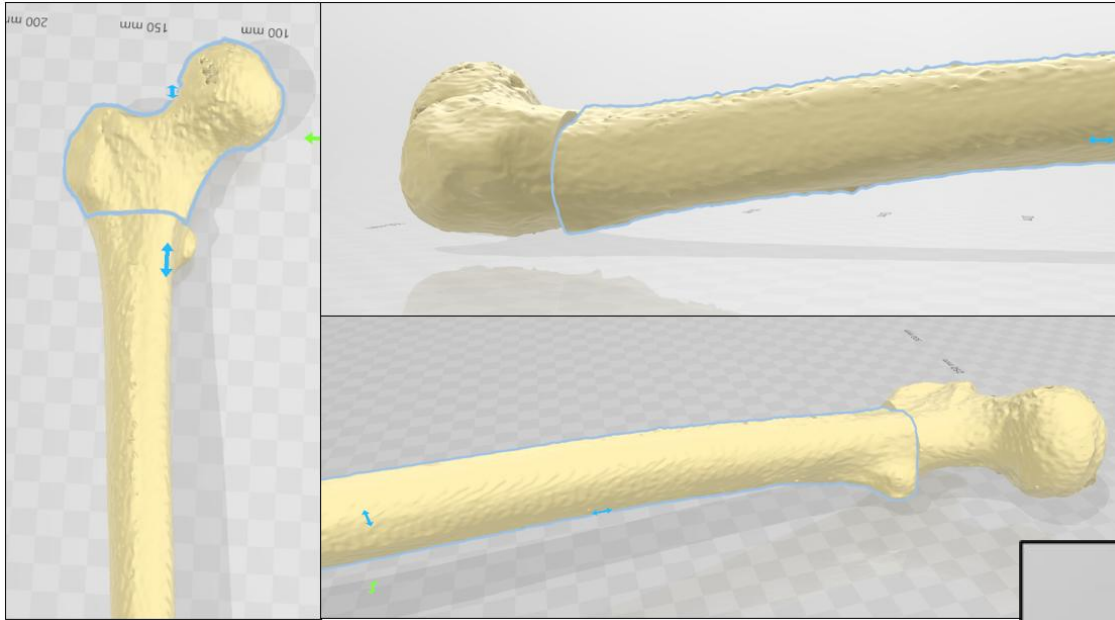


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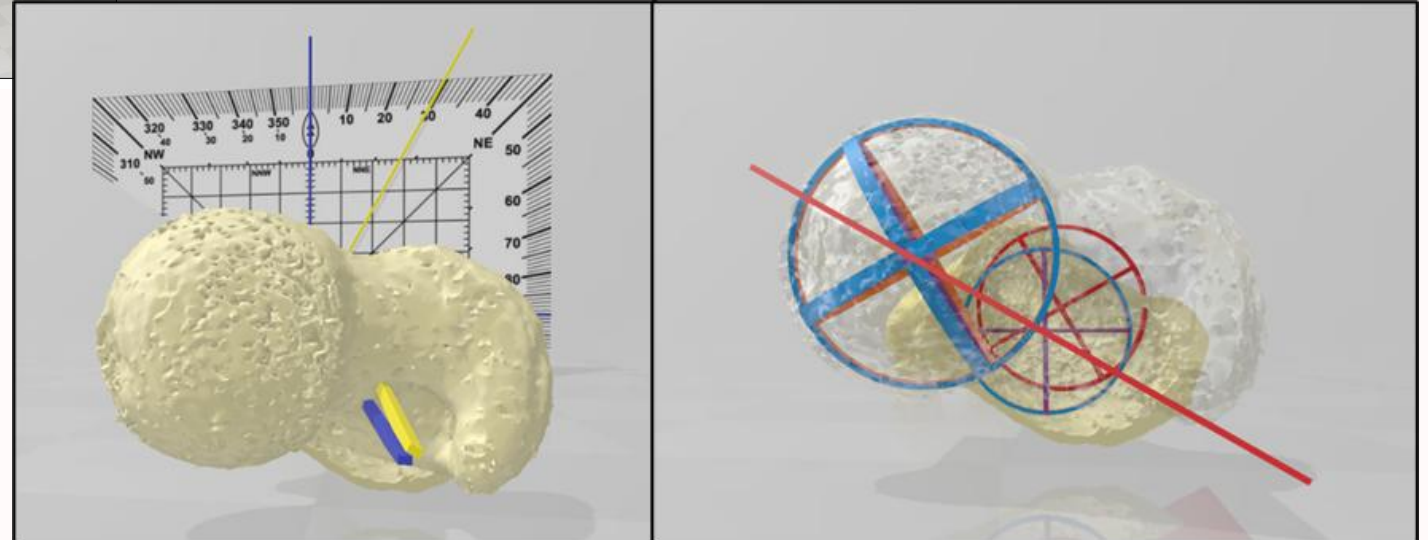
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MATERIAL AND METHODS: Simulation of osteotomy



- Osteotomies at 3 levels: intertrochanteric, diaphyseal, supracondylar.
- At 10°, 20° and 30° of external rotation.
- Total of 32 osteotomies

The **PROXIMAL** and **DISTAL** longitudinal axes **do NOT** coincide in the intertrochanteric osteotomy.

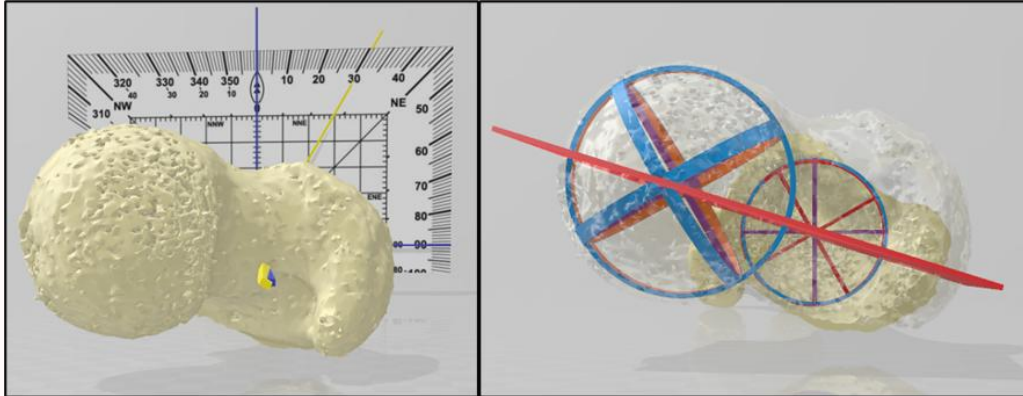


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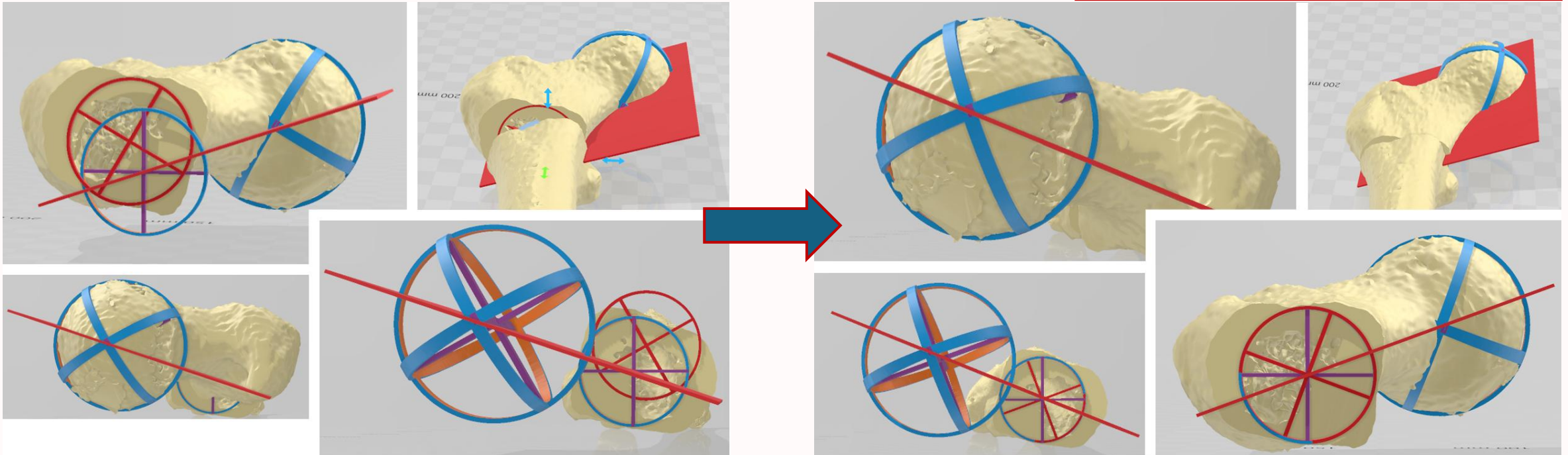
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MATERIAL AND METHODS: Adjustment of the osteotomy



The adjustment consists of realigning the axes

ADJUSTMENT:
The longitudinal axes
PROXIMAL and **DISTAL**
coincide



RESULTS



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Descriptive statistics					
	N	Minimum	Maximum	Average	IC95%
ANTEVERSION	8	35	45,1	39,7	3,8
OT IT 10°	8	28,9	37,9	33,2	3,7
OT IT 10° ADJ	8	25,1	35,2	29,8	3,8
OT IT 20°	8	21,3	30,5	25,1	3,3
OT IT ADJ 20°	8	15	25	19,7	3,8
OT IT 30°	8	13,6	24,7	17,9	3,6
OT IT 30° ADJ	8	5	15,5	9,7	4
OT DIAF 10°	8	25	35,1	29,7	3,8
OT DIAF 20°	8	25	35,1	29,7	3,8
OT DIAF 30°	8	25	35,1	29,7	3,8
OT DIAF ADJ 10°	8	25	35,1	29,7	3,8
OT DIAF ADJ 20°	8	25	35,1	29,7	3,8
OT DIAF ADJ 30°	8	25	35,1	29,7	3,8
OT SC 30°	8	5	15,1	9,7	3,8
OT SC 30° AJUSTE	8	5	15,1	9,7	3,8

INTERTROCHANTERIC LEVEL: HYPOCORRECTION

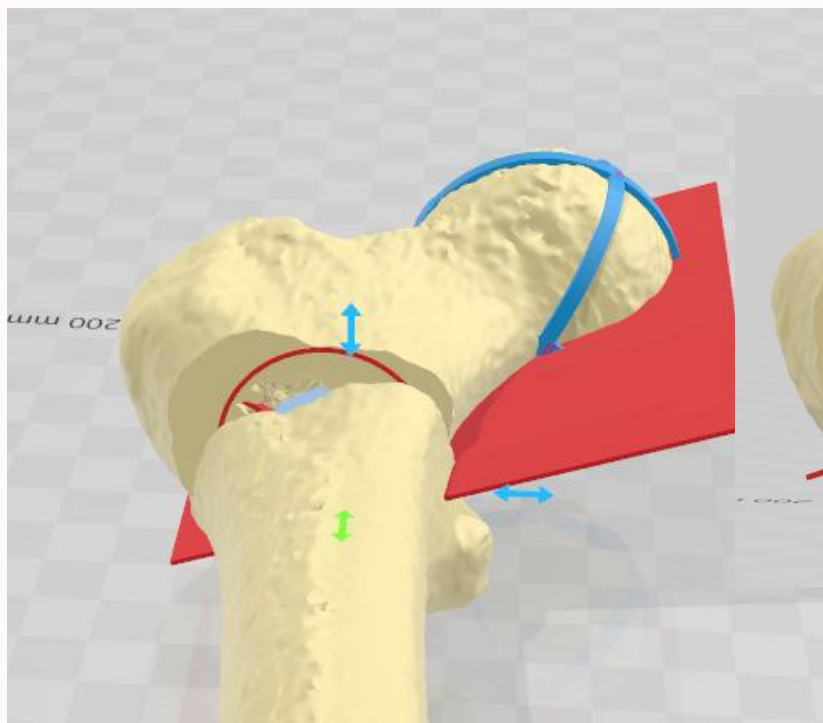
- 34% with 10° osteotomy (3.4° CI95% 0.5-2.3)
- 27% with 20° osteotomy (5.4° CI95% 0.6-3.8)
- 30% with 30° osteotomy (8.2° CI95% 1-5.9)

DISCUSSION

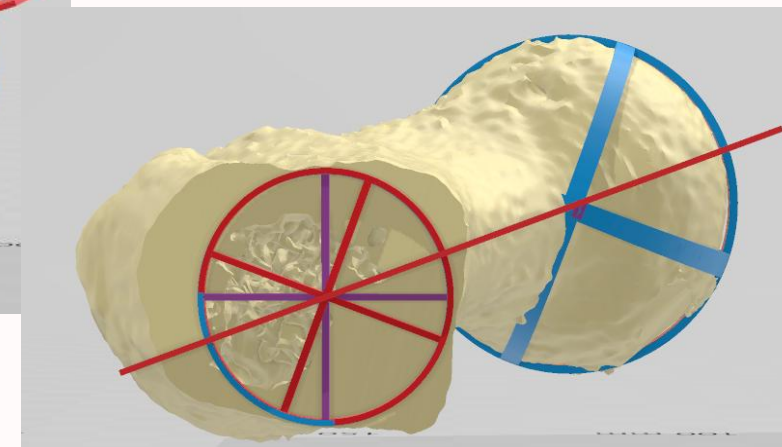
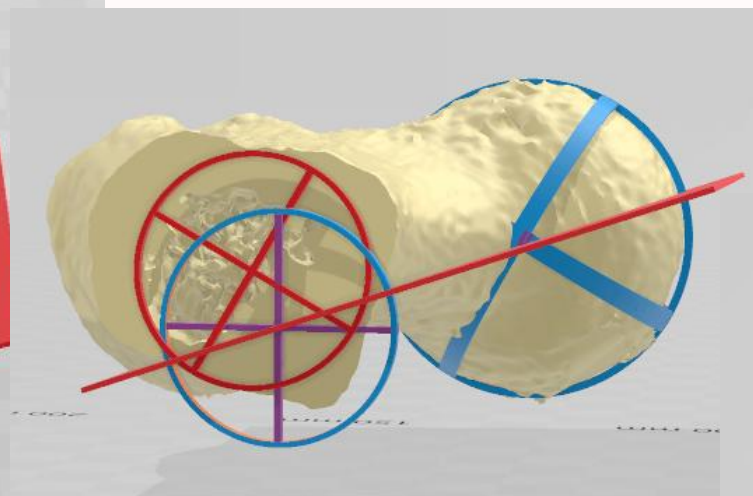
WHEN WE PERFORM AN
INTERTROCHANTERIC
OSTEOTOMY

Murphy's method proximal
plane references are
altered.

AN
ADJUSTMENT
IS NECESSARY



The discrepancy between planned
and achieved correction can be
catastrophic for the knee.



PatelloFemoral pressures increases
as FAV increases

CONCLUSION

- In diaphyseal and supracondylar osteotomies at 10°, 20° and 30°, the calculated FAV degrees coincide with the planned FAV degrees because the level of the osteotomy does not alter the proximal plane of Murphy's method.
- In Jeanmart's method, no discrepancies are found when performing an intertrochanteric osteotomy.
- When using Murphy's method in the surgical planning of a derotational femoral osteotomy at the intertrochanteric level, an adjustment of the osteotomy should be made.
- Adjustment of the osteotomy prevents under- or overcorrection.

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