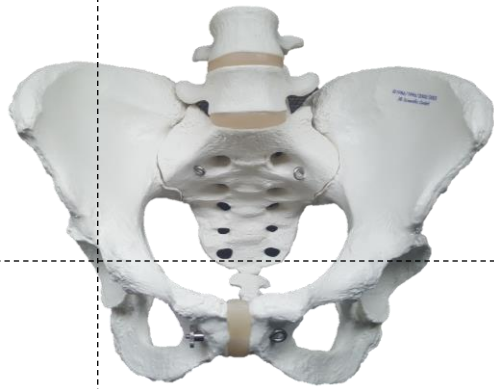


Hip joint orientation

Definitions of angles used to define joint orientation

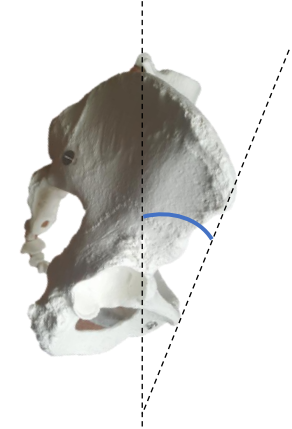
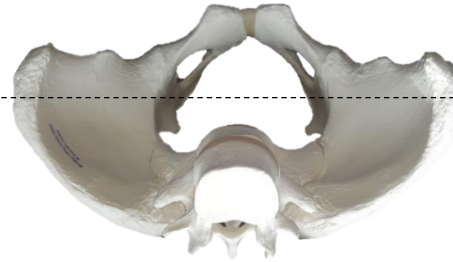
+ sources for the angle values used for this study

The joint orientation defined here is the neutral position of the joint, i.e. the orientation which would occur when all joint angles in kinematic activity data are set to zero.



Zero pelvic obliquity

Zero pelvic rotation



Non-zero pelvic tilt

Bone shape and orientation measures on femoral and acetabular side are set within the model. The relative orientation in each plane is reported to give a sense of clearance in the joint.

Coronal plane:

- Acetabular inclination
- Pelvic tilt
- Femoral neck-shaft angle
- Global femoral shaft angle
- **Relative abduction**

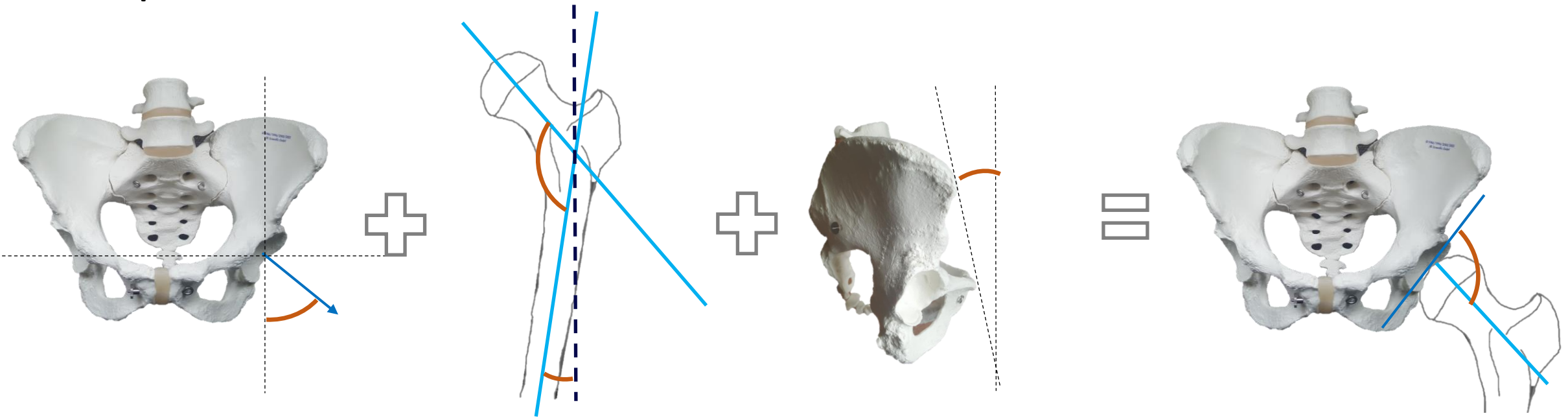
Axial plane:

- Acetabular version
- Pelvic tilt
- Femoral version
- **Relative version**

Axial plane:

- Acetabular tilt within pelvis
- Pelvic tilt
- (Zero femoral tilt)
- **Global acetabular tilt**

Coronal plane



Acetabular inclination (AI)
Angle between the acetabular outward facing normal and the superior-inferior axis in the coronal plane.

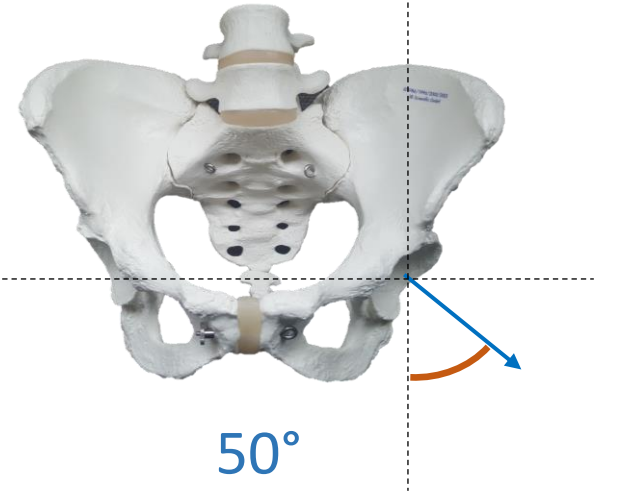
Femoral neck-shaft angle (FNS)
Angle between the centreline of the femoral shaft and the centreline of the neck.

Femoral shaft angle (FS)
Angle between the centreline of the femoral shaft and the superior-inferior axis.

Pelvic tilt (PT)
Angle between the anterior pelvic plane and the superior-inferior axis. (-ve posterior tilt pictured)

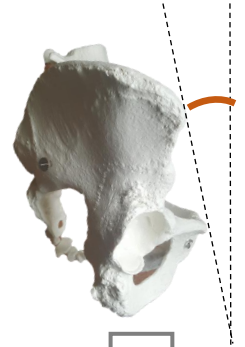
Relative abduction

Coronal plane orientation used in the study



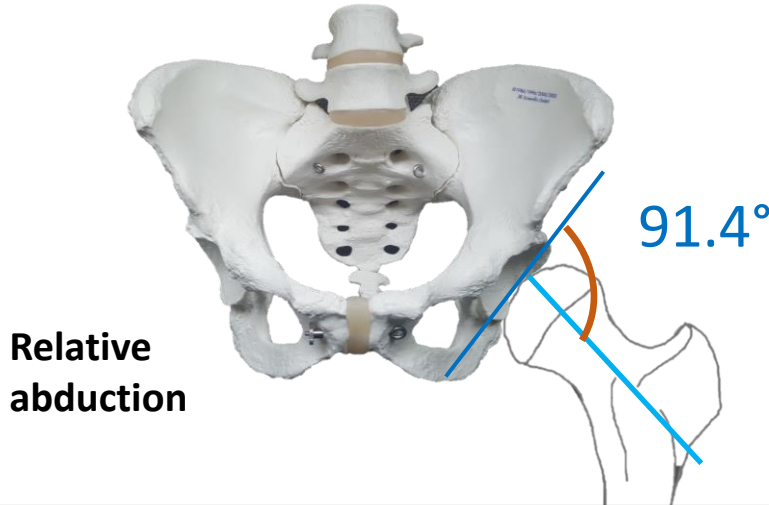
50°

Mean acetabular inclination angles, in pelvis system:
54° (Lubovsky 2010),
49° (Grammatopoulos 2018),
48° (Fujii 2012),
48° (Kohnlein 2009)



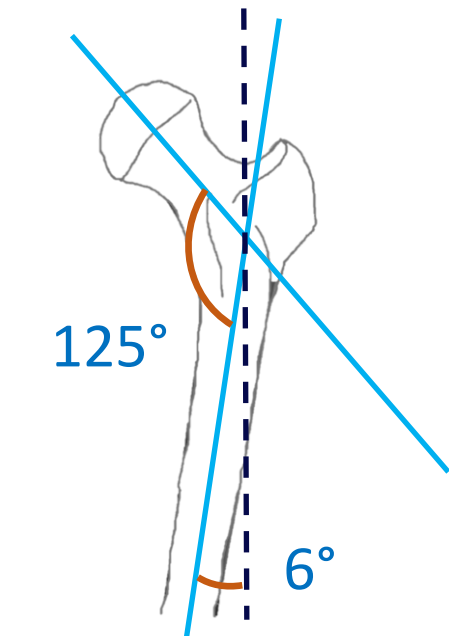
-2°

Inclination modified by pelvic tilt 50.4°



91.4°

Relative abduction



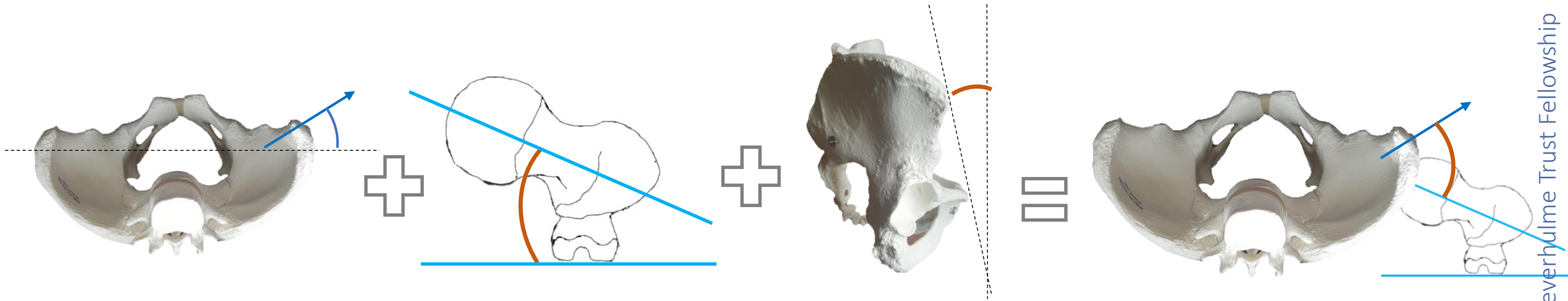
125°

6°

Typical femoral neck-shaft angle:
125° (Nakahara 2010, Soames & Palastanga 7th Edition p254)
125° (Nordin & Frankel 3rd Edition p204)
+-stdev 120-130 (Nakahara 2010)
Coxa vara 111, high angle 146 (Lerch 2019)

Typical femoral shaft to ground angle:
6° (Soames & Palastanga p254)

Axial plane



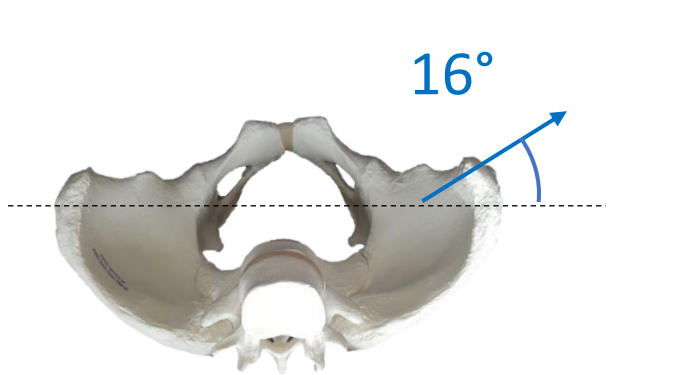
Acetabular version
Angle between the acetabular outward facing normal and the medial-lateral axis in the axial plane.
(+ve anterior version pictured)

Femoral neck version
Angle between the centreline of the femoral neck and medial-lateral axis.
(+ve anterior version pictured)

Pelvic tilt (PT)
Angle between the anterior pelvic plane and the superior-inferior axis.
(-ve posterior tilt pictured)

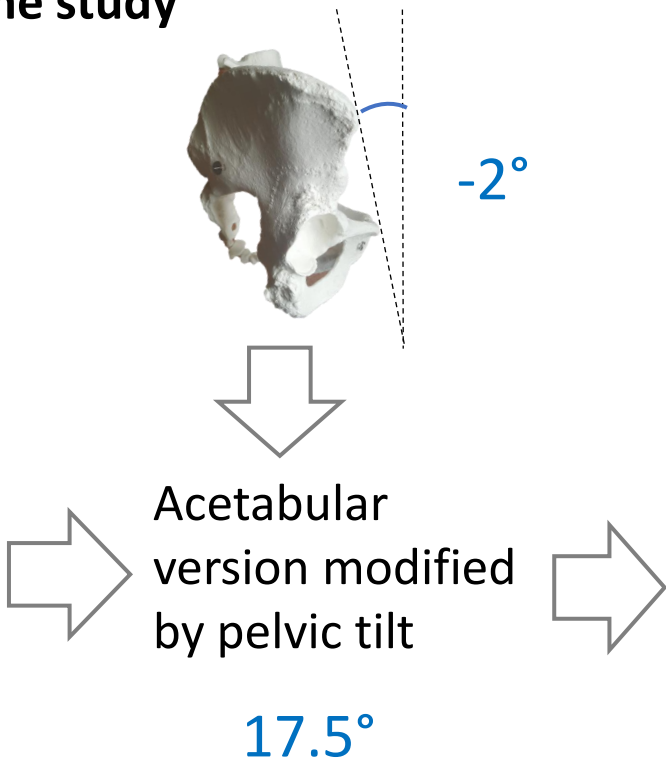
Relative version

Axial plane orientation used in the study

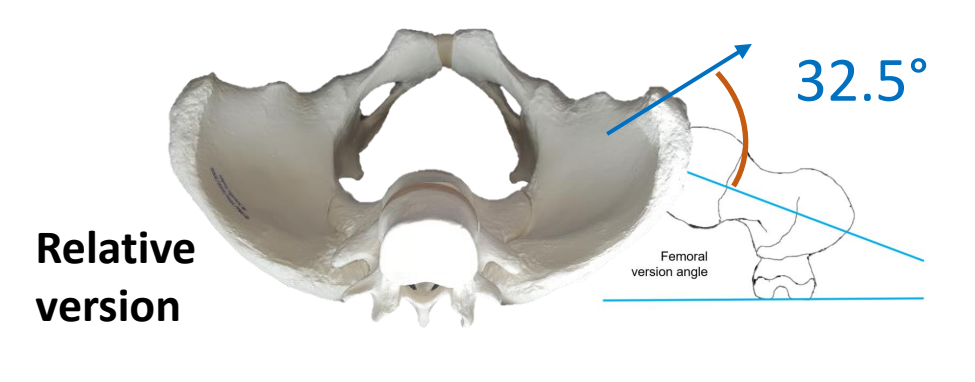


Acetabular anteversion angle:
Mean 22°, range 10°-39°
(Nakahara 2011, Kohnlein 2009, Fujii 2012)

‘Opening plane angle’ mean 16°, range 4°-34° (Lubovsky 2010, Kohnlein 2009, Grammatopoulos 2018)



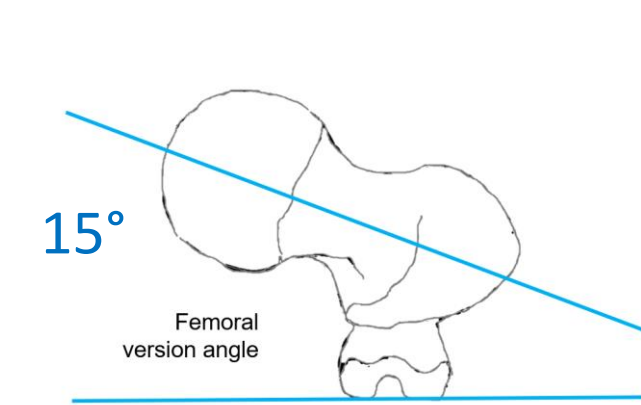
Soames & Palastanga (7th Edition) p254 gives relative version as 30 – 40°.



Relative version

32.5°

Femoral version angle

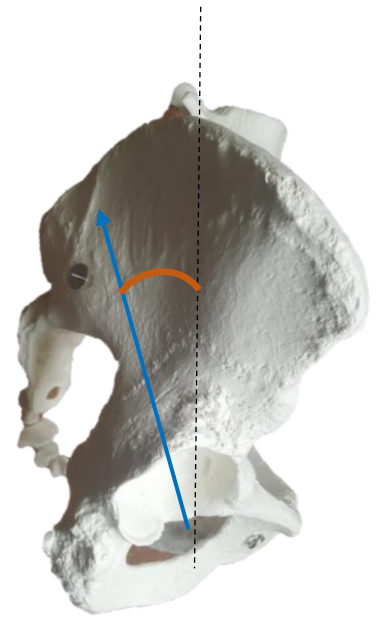
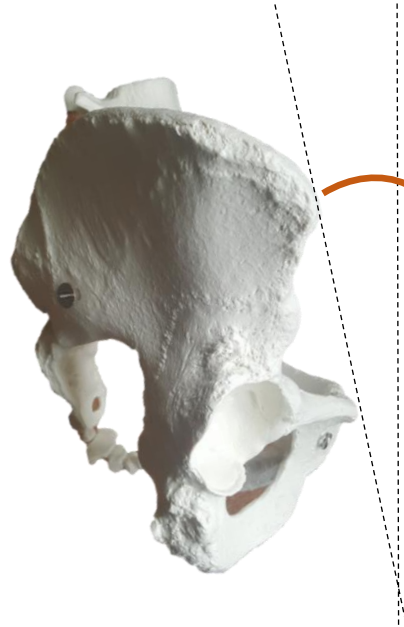
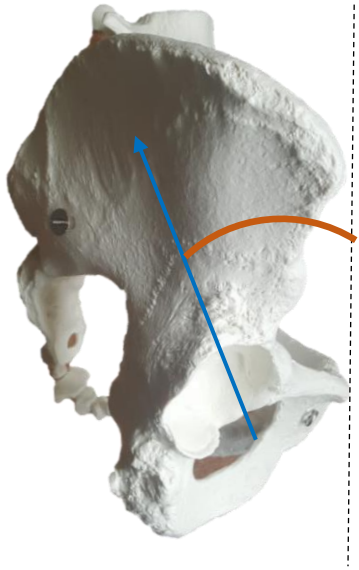


15°

Femoral version angle

Femoral neck anteversion mean angles
23° (Nakahara 2011),
22° (Lerch 2019 asymp group)
7° (Grammatopoulos 2018)
10° (Soames & Palastanga)
12° (Nordin & Frankel)

Coronal plane



Acetabular tilt

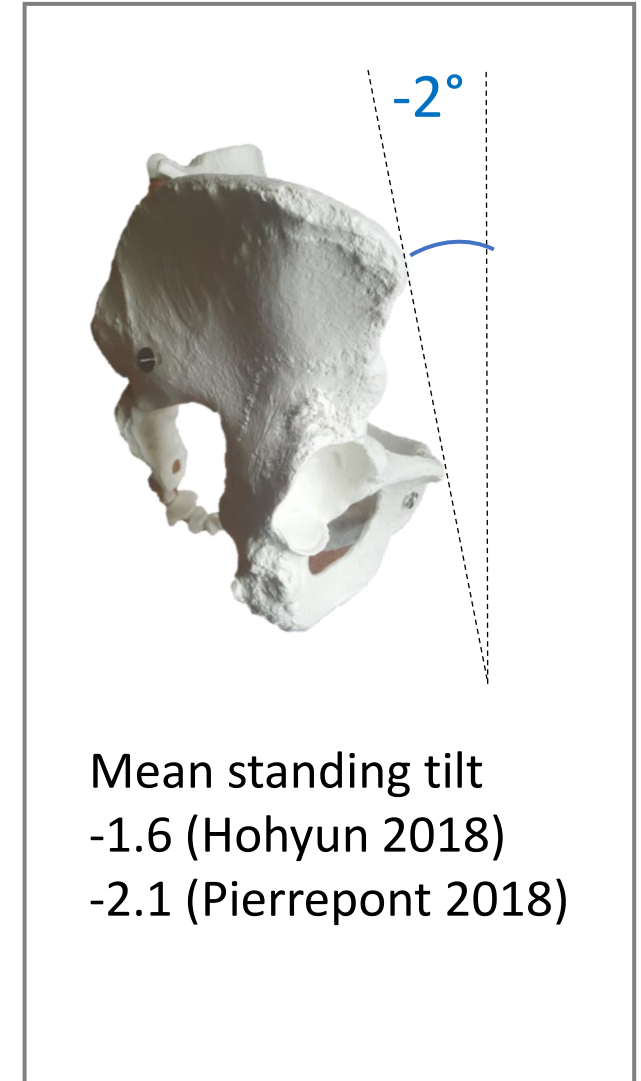
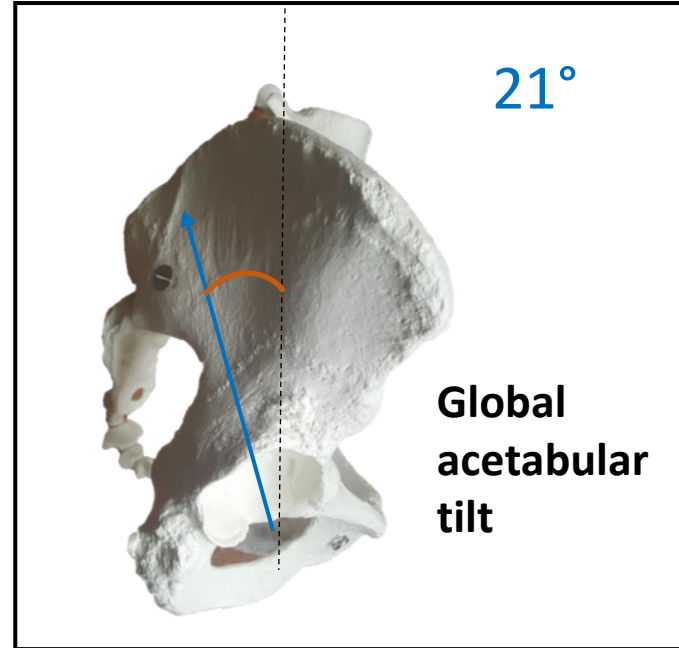
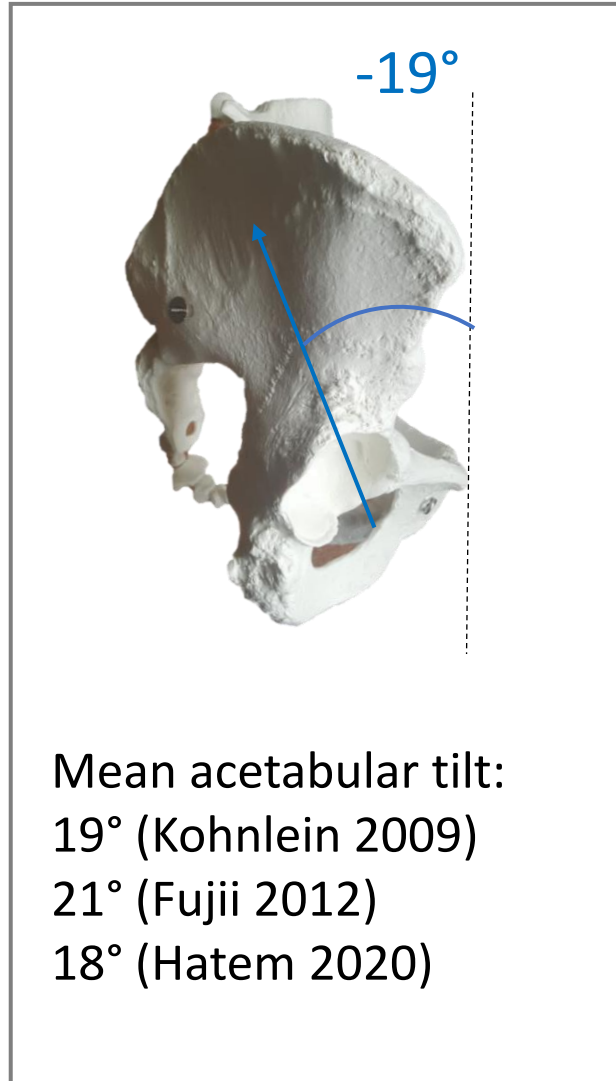
Angle between a line from the middle of acetabular notch through the centre of the socket and the anterior pelvic plane.

Pelvic tilt (PT)

Angle between the anterior pelvic plane and the superior-inferior axis.
(-ve posterior tilt pictured)

Global acetabular tilt

Coronal plane orientation used in the study



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