

# Defining Metadata for PIPER Positioning Tool in TUC

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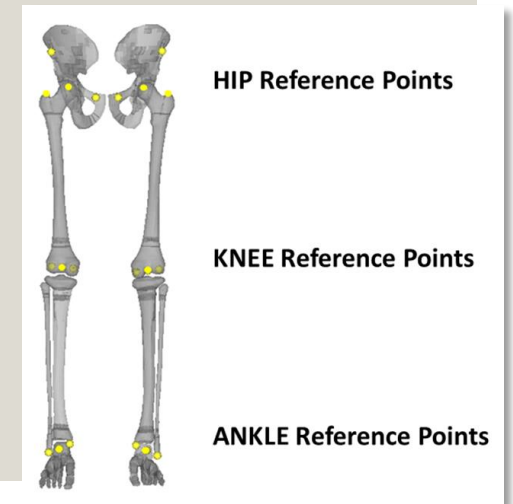
- **Motivation**

- Applicability and accuracy of PIPER Positioning Tool highly depending on definition of metadata
- Metadata provided only for a limited number of FE HBMs (**GHBMC M50-O v4.1, THUMS AM50 v4.0.2, PIPER child, ViVA**)
- Different institutions working on different ways of metadata definition (i.a. Elemance, University of Stuttgart, LMU)

- **Challenges**

- Definition of anatomical reference points obligatory to obtain anatomical metadata
- Definition of metadata subject to model changes/updates & user

**TUC Reference Points for Metadata definition**



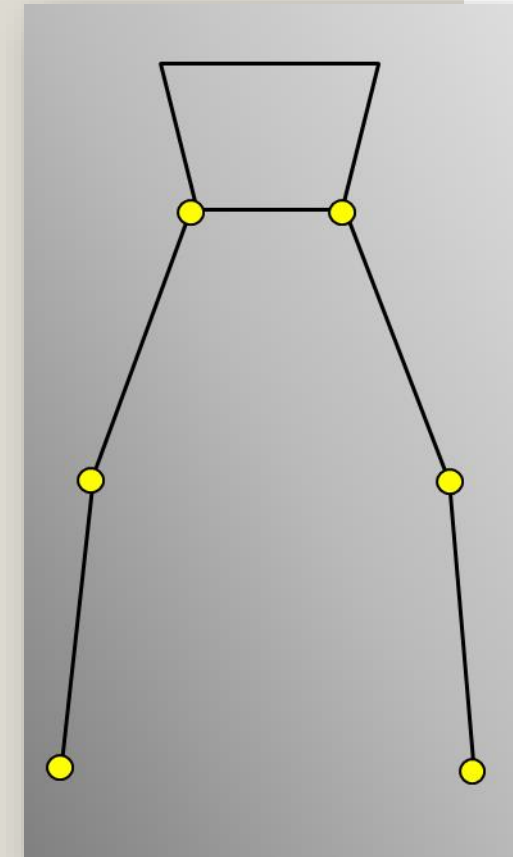
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- **TUC Reference Points**

- Joint Rotation Centers/Axes: Building a kinematic chain for pedestrian/occupant positioning
- Bony Landmarks: Points describing e.g. Pelvic Plane, Frankfurt Plane
- Defining angles and distances to non-ambiguously describe the position of the pedestrian/occupant in the global CS

- **Challenges**

- Definition of anatomically meaningful metadata obligatory to obtain anatomically meaningful postures
- Definition of metadata subject to model changes/updates & user



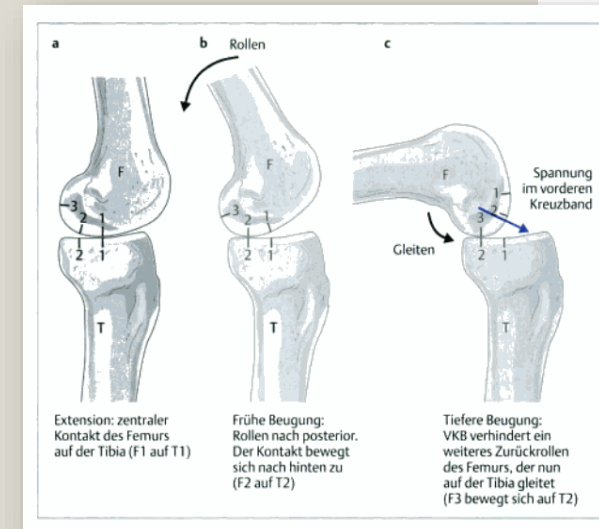
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- **TUC Reference Points**

- Definition of Points based on biomechanical testing/data published in literature
- Definition of a clear instructions/distinct methodology for each Reference Point
- Methodology anatomy based/independent of mesh: can be applied to any HBM

- **Challenges**

- Definition of anatomically meaningful metadata obligatory to obtain anatomically meaningful postures
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Adam (2005)

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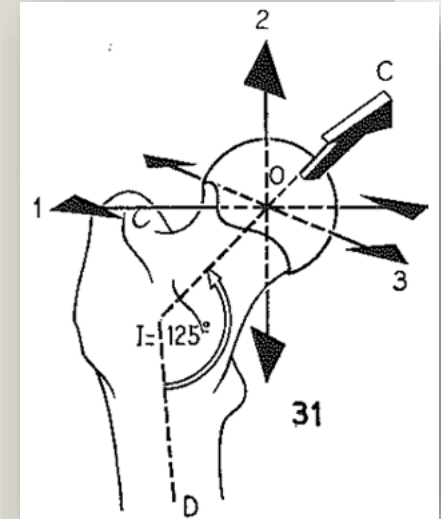
- **Example**

- **Hip Reference Point**

- Hip = synovial ball-and-socket joint with the joint center located in the center of femoral head/acetabulum representing 2/3 of a boule with a diameter of 40-50mm

- Instruction for defining Hip Reference Points:

*Define the Center of the acetabulum on the left and right hip bone by (1) selecting all nodes belonging to the hemi-sphere's surface of the acetabulum and (2) calculating the point equidistant from the selected nodes.*



Kapandji (1985)

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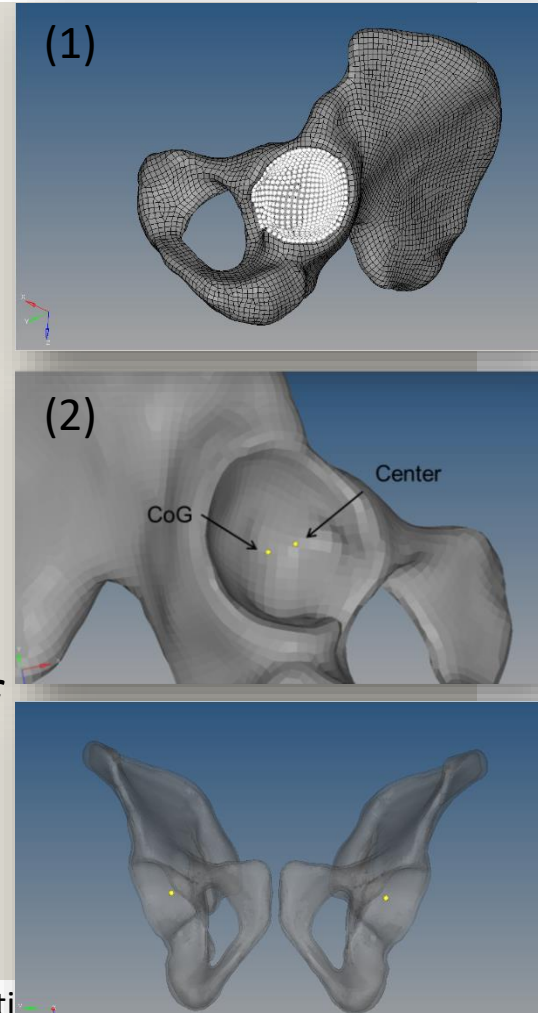
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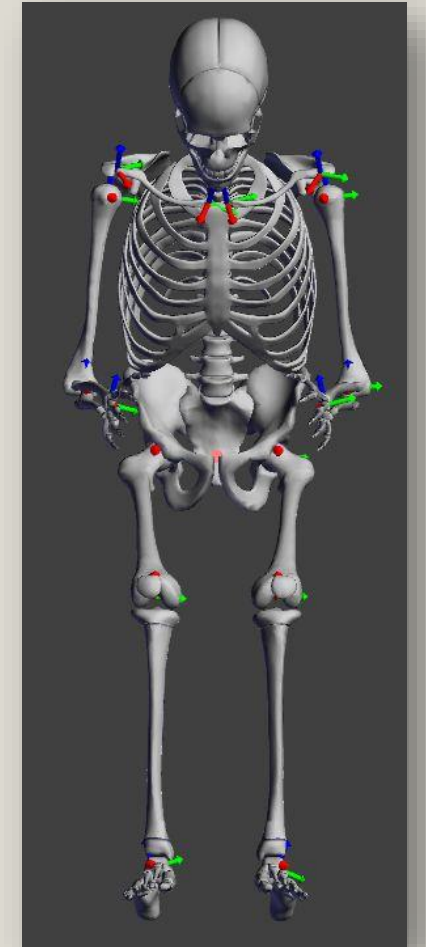
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- **Status – completed:**
  - Definition of Reference Points for **lower extremities, upper extremities** and **thorax** in **THUMS TUC ped. & occ.** (Abaqus, LS-DYNA, VPS), **GHBMCM50-O v4.5** (LS-DYNA), **THUMS V4 occ. & ped.** (LS-DYNA)
  - Definition of PIPER metadata for **THUMS TUC ped. & occ.** (LS-Dyna)
- **Status - ongoing:**
  - Definition of TUC Reference Points for **spine** and **head**
  - Instructions for TUC Reference Points definition to be made publicly available via TUC homepage



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THANK YOU!

