

Imaging of the Microstructural Failure Mechanism in the Human Hip

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Materials

Name	Company	Catalog Number	Comments
Absorbent tissue	N/A		Maintain the bone moisture throughout the experiment
Alignment rig	Custom-made		Rig for positioning the specimen in the potting cup
Aluminium potting cup	Custom-made		Potting cup
Bone saw	N/A		Cut the specimen to size
Calibration phantom QCT Pro	Mindways Software, Inc., Austin, USA	CT Calibration 13002	Calibrate grey levels in the images into equivalent bone mineral (ash) density levels
Clinical Computed-Tmography scanner	General Electric Medical Systems Co., Wisconsin, USA	Optima CT660	Preliminary imaging for the prediction of the load step to fracture
Compressive stage	Custom-made		A 10 kg, radiotransparent compressive stage for applying and maintaining throughout imaging a prescribed deformation to the specimen.
Dental cement	Soesterberg, The Netherlands	Vertex RS	
Femur specimen	Science Care, Phoenix, USA		
Finite-element analysis software	ANSYS Inc., Canonsburg, USA	ANSYS Mechanical APDL	Finite-element software package
Freezer	N/A		Store specimens at -20 °C
Hard Drive	Dell		Disk space: 500 GB per volume
Image binarization and segmentation software	Skyscan-Bruker, Kontich, Belgium	CT analyzer	Image processing software
Image elastic segmentation	The University of Sheffield	Bone DVC	https://bonedvc.insigneo.org/dvc/
Image processing and automation software	The MathWork Inc.	Matlab	Image processing software
Image registration software	Skyscan-Bruker, Kontich, Belgium	DataViewer	Image processing software
Image segmentation and FE modelling software	Simpleware, Exeter, UK	Scan IP	Bone egmentation software
Image stitching script	Australian synchrotron, Clayton, VIC, AU		The script is available at IMBL
Image visualization	Kitware, Clifton Park, NY, USA	Paraview	Image visualization

Image visualization	Australian National University	Dristhi	Image visualization: doi:10.1117/12.935640
Imaging and Medical beamline	Australian synchrotron, Clayton, VIC, AU		Large object micro-CT beamline at the Australian Synchrotron
Laptop	Dell Inc., USA		
Low-friction x-y table	THK Co., Tokyo, Japan		
NI signal acquisition software	National Instruments, Austin, TX	NI-DAQmx	
Phosphate-buffered saline solution	Custom-made		Maintain the bone moisture throughout the experiment
Plastic bag	N/A		Maintain the bone moisture throughout the experiment
Rail	SKF Inc., Lansdale, PA, USA		
Screw-jack mechanism	Benzlers, Örebro, Sweden	Serie BD (worm gear unit)	stroke: 150 mm, maximal load: 10,000 N, gear ratio: 27:1, a displacement per revolution: 0.148 mm
Single pco.edge sensor, lens coupled scintillator	Australian synchrotron, Clayton, VIC, AU		Detector Ruby FOV: 141 x 119 mm; 2560 x 2160 px; 55 µm/px; 50 fps
Six axis load cell	ME-Meßsysteme GmbH, Hennigsdorf, GE	K6D6	Maximal measurement error: 0.005%; maximal force: 10000 N; maximal torque: 500 Nm
Strain amplifier	ME-Meßsysteme GmbH, Hennigsdorf, GE	GSV-1A8USB K6D/M16	