

MULTIMODAL NAVIGATED 3D ULTRASOUND AND MRI REGISTRATION OF THE ANKLE: CASE REPORT

Muller S¹, Askeland C¹, Kok A.C.², Tuijthof G.J.M.^{2,3}, Hernes T¹

1 Dept. Medical Technology, SINTEF, Trondheim, Norway

2 Orthopaedic Research Center Amsterdam, Dept. Orthopaedic Surgery, Academic Medical Center, Amsterdam, The Netherlands

3 Dept. Biomechanical Engineering, Faculty of 3ME, Delft University of Technology, Delft, The Netherlands

Osteochondral defects (OCD) in the ankle are most often diagnosed using Magnetic Resonance Imaging (MRI) or Computer Tomography (CT) as X-ray fails to image the cartilage properly. For long term patient follow-up, CT is not adequate due to patient radiation dose while MRI is cumbersome, expensive and of limited access. Ultrasound (US) on the other hand can provide a detailed representation of the (osteo)chondral layer, in addition to being non-invasive, dynamic and affordable. However, US does not allow to view the full talar surface as the posterior part remains in the shadow of the tibia. **The goal** of this work was to achieve a multimodal visualisation of US and MRI for future evaluation of the maximal visible fraction of the talar surface in US compared to MRI. **A healthy volunteer** had both ankles secured in maximal plantar flexion with a standard cast. A hatch for US-transducer was cut on the frontal side of the cast and fiducials were glued to the cast and the skin. MRI of both ankles was acquired using a fat saturated proton density (PD Fat Sat) sequence and 2.5 mm slice thickness. Before US imaging, the MR-space was registered to the volunteer, using both cast and skin fiducials, in our prototype navigation system CustusX. The 2D US recording was made on Ultrasonix MDP with an L14 transducer at 10MHz. **The achieved** patient registration accuracy was in the order of magnitude of 2mm (depending on the number of fiducials used). The navigation system performed the 3D reconstruction of the US volume and allowed navigating through an overlay with MRI (Figure 1).

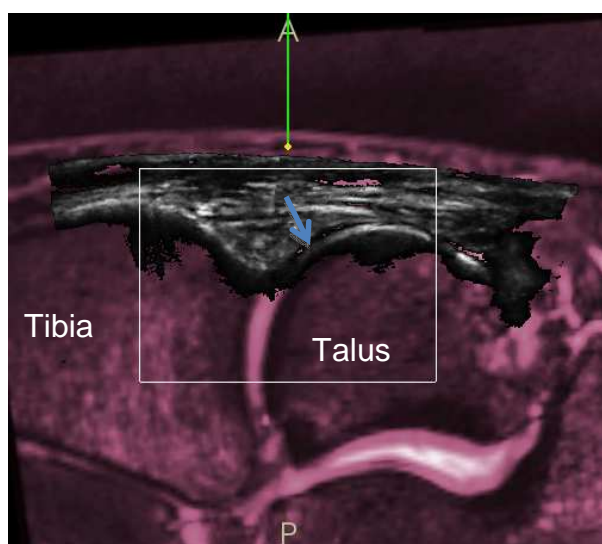


Figure 1. To the left, the distal end of the tibia, and in the middle, the talus. The multimodal display of US acquisition (black and white) and MRI (purple) shows excellent correspondence of anatomical structures: cortical bone (black in MRI, white in US), and the cartilage layer (purple in MRI) shows through the corresponding

black of the US (blue arrow).