

66th International Astronautical Congress 2015

SPACE LIFE SCIENCES SYMPOSIUM (A1)
Human Physiology in Space (2) (3)

Author: Prof. Yi-Xian Qin
State University of New York, United States, yi-xian.qin@stonybrook.edu

Dr. Jesse Muir
Stony Brook University, United States, jesse.muir@stonybrook.edu

ULTRASOUND IMAGING RECONSTRUCTION AND ASSESSMENT IN PERIPHERAL SKELETON

Abstract

Disuse osteoporosis, such as during long term space mission, affect mineral density, microstructure and integrity of bone, which lead to increased risk of osteoporosis and fracture during long term space mission. In order to provide a non-ionizing, repeatable method of skeletal imaging, a novel hand-held scanning confocal quantitative ultrasound (QUS) device has been developed. A mobile scanning ultrasound images were collected using 10 sheep tibia and 8 human volunteers at the wrist, forearm, elbow, and humerus with the arm submerged in water. A custom MATLAB software used a least-error algorithm to adjust adjacent lines and remove unwanted image waver from hand movement. Ultrasound attenuation (ATT) values of 42.40.6 dB and 41.51.0 dB were found in water and gel coupling, respectively. Scans of the human subject revealed detailed anatomy of the humerus, elbow, forearm, and hand. Repeat measures of the distal radius found an attenuation of 37.23.3 dB, with negligible changes cause by wrist rotation of 10 (36.4 to 37.3 dB) indicating small changes in scan angle would not significantly affect bone quality measurements. The hand-held QUS device allows for rapid skeletal imaging without ionizing radiation. Information gathered from ultrasonic attenuation and velocity can provide detailed information on localized bone fragility as well as identify fractures.