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Ultrasonic Assessment of the Radius. Jonathan Kaufman[*1], Gangming Luo[1], Mark Lieberman[2], Stanley Rosenfeld[2], Alfred Rosenbaum[2], Robert Siffert[3]. [1]CyberLogic, Inc., USA, [2]Computerized Diagnostic Scanning Associates, Inc., USA, [3]The Mount Sinai School of Medicine, USA

The long-term objective of this research is to establish ultrasound as a safe, effective, and non-invasive method for assessing osteoporotic fracture risk. The purpose of this study was to design, fabricate and test a novel device that can assess the radius at the 1/3rd location. A new ultrasound device (*UltraScan 650*, CyberLogic, Inc. was used in this study. The device emits a 3.5 MHz broadband ultrasound signal from a single element rectangular source that propagates through the radius and soft tissue to a 64-element linear array rectangular receiver. Computer simulations and *in vitro* experiments were used to determine the specifications and expected performance of the device[1,2]. In brief, nineteen radii were used in a thru-transmission configuration in a water tank and analogously in computer simulations (*Wave2000*, CyberLogic, Inc.). Time delays associated with three distinct ultrasound propagation pathways were evaluated, and two net time delay (NTD) parameters were defined. Both *in vitro* and computer simulated data demonstrated a high correlation ($R > 0.9$) between a non-linear function of the NTDs and the cortical cross-sectional area. A clinical study using seven subjects was also carried out. Both arms were measured with DXA (Hologic QDR 4500) and with ultrasound. Short term precision was also evaluated and found to be better than three percent. The data showed that the linear correlation coefficient between radial bone mineral density (BMD) and an ultrasound based estimate was $R = 0.92$ ($P < 0.01$). A different nonlinear combination of the NTDs produced similar results for radial bone mineral content (BMC). These results are consistent with the *in vitro* and computational studies. The UltraScan 650 therefore has the potential to become a simple, safe and effective screening tool for bone loss and fracture risk assessment. 1. Le Floch V et al. (2008) Ultrasound in Med & Biol 34:1972-1979, 2008. 2. Kaufman JJ et al. (2008) IEEE Trans Ultrason Ferroelectr Freq Control 55:1205-18.