# Shock Wave Energy Deflection due to the Presence of a Model Bone

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The success of Shock Wave Therapy (SWT) for treating various musculoskeletal conditions has been mixed. Fundamentally, the physical mechanisms leading to observed biological responses are not understood. While basic research into specific biological pathways has been gaining momentum, no research is being performed to characterize shock wave propagation through heterogeneous musculoskeletal tissues, and cavitation and shear waves generated by SWT devices. Without an understanding of the physical characteristics and effects of shock wave interactions at the bone interface, it will be difficult to understand (and thus optimize) biological responses. Disarticulated model hard plastic bones were used in these studies. The simple structure of a calcaneus provides a good starting point for model validation and study. An electro hydraulic source was used for cavitation studies, while a ballistic source was used in the pressure field. A high speed camera was used to capture cavitation bubbles generated by SWT, and a needle hydrophone measured the pressure field. High-resolution numerical simulation of SW pulses propagating from a water pillow from an electro hydraulic source into an ankle were performed using the software package CLAWPACK.
All three methods (simulations, cavitation and pressure field measurements) show that the presence of bone deflects the energy of the shock wave. Modelling the interaction of the SW with bone yields important information about SW deflection. The degree of deflection will depend on the relative orientation of the SW axis of symmetry and bone structure. These results suggest that focused energy may arise at unexpected locations. (Partially supported by NIH DK43881)