

Shock wave energy deposition near model bone

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Device and producing company:

Dornier, Epos Ultra; Storz, Masterpuls

Introduction:

The characterization of shock waves at the focal zone is well understood for some shock wave devices. For these devices the focal volume is shaped liked a small cigar. However, it should not be a surprise that the presence of bone will dramatically alter the shape of the focal zone. For a flat surface, reflected energy is simple to predict. For actual bone with more complicated geometries, the focal zone is much more difficult to predict. In particular, energy deposition needs to be better understood under these conditions. Our objective is to better understand energy deposition in the presence of musculoskeletal structures.

Methods:

A disarticulated model plastic talus bone was used for in-vitro studies. Electrohydraulic shock waves generated cavitation near the surface, the bubbles being imaged with a high speed camera. Comparisons were made with numerical simulations of shock wave interactions with the model talus.

Results:

Measurements of cavitation and pressure fields show that the presence of bone deflects shock wave energy. Simulations agree qualitatively with the data. Our interpretation of deflected energy deposition also agrees qualitatively with our observations of cavitation observed off-focus during in-vivo clinical ESWT.

Discussion:

Modeling the interaction of the shock wave with bone yields important information about shock wave deflection. The degree of deflection, and ultimate deposition of energy, will depend on the relative orientation of the shock wave and bone structure.

Conclusion:

It is important to better understand ESWT energy deposition. These studies should lead to improvements in designing standardized protocols. (Research partially supported by NIH DK43881).