# ACOUSTIC PROPERTIES OF HUMAN SKULL BONE+

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The ultrasonic properties of human skull bone, both adult and child, have been studied over the frequency range of 300 kHz to 2 MHz. Fresh autopsy material, formalin fixed material, and fresh to formalin fixed sequences have been characterized. Longitudinal and shear wave velocities, reflection coefficients, transfer functions and densities have been measured.

The dominant feature which emerges from the experimental data is the characterization of the diploe as an acoustic scatterer, having an insertion loss following approximately a fourth power with frequency law. At frequencies in the range of 500 kHz, the overall insertion sound pressure loss (reflection, scatter, absorption) for the thickest region of the adult skull is in the range of 6 dB to 9 dB, even though the insertion loss approaches 60 dB at 1.7 MHz. For small children the loss is essentially entirely dominated by reflection losses with sound pressure transmission values at 500 kHz equal to 75% of the incident sound pressure.

At 500 kHz, loss in the diploe for other than temporal bone in the adult is essentially similar to the sum of skull reflection losses at the outer and inner ivory table interface with the soft tissue. Both fresh autopsy and formalin fixed material are essentially similar in acoustic properties.

An analytic model which treats the skull as a multi-element transmission line with appropriate lengths and losses seems to comprehensively describe the experimentally determined acoustic results.

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