Theoretical models for ultrasonic propagation in cancellous bone: biot theory and a new stratified model

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Theoretical models for the propagation of ultrasonic waves through cancellous bone are discussed here. Previously, Biot theory has been used by other authors to predict velocity and anenuation in cancellous bone, but with limited success. Possible explanations for this poor performance include the effect of specific mechanical conditions which exist in cancellous bone, and the effect of frequency range on the Biot slow wave. A simpler model, which treats cancellous bone as a stratified medium of alternating fluid-solid layers, with supporting in *vitro* experimental data, is presented here for the first time. Two waves are seen when trabeculae are dominantly parallel to the propagation direction, but only one mode is seen for propagation normal to this. This behaviour can be explained in terms of an angular-dependent inertial coupling effect.