Active Nonlinear Mechanics of the Organ of Corti Including the Stereocilia-Tectorial Membrane Complex

There is a large amount of knowledge about the different components of the organ of Corti (OC), but little is known about how these components act together in vivo. To clarify the complex mechanical behavior of the OC, anatomic results are carefully analyzed and used to develop a finite element model of a short section of OC, which includes 8 outer hair cells (OHC) and their supporting structures. The modal analysis shows the frequency-dependent phase reversal of the radial stereocilia displacement. The transient computation confirms the amplification of OC displacements when the ability of the OHC to contract and elongate is considered. The inclusion of a nonlinear function describing the mechanoelectrical transduction in OHC amplifies and distorts the displacement of the OC when it is stimulated by a sinusoidal input pressure function. These results are in agreement with other psychoacoustic, electrophysiologic and otoacoustic measurements.

Stichworte:
Organ of Corti; Cochlear amplifier; Outer hair cell; Nonlinearity; Stereocilia; Tectorial membrane

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