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Invited Paper

The catenary principle of tympanic membrane function – time to put it to rest?

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Proposal: Helmholtz in 1863 was the first to propose that part of the pressure transformation produced by the tympanic membrane (TM) was due to a conical lever action of the TM. This was also based on experiments to verify his theory that the radial collagen fibers within the TM connecting the annulus to the malleus handle produced a lever action so that sound pressure reaching the gently curved surface of the TM produced an increase in force at the apex of the TM. This theory was later called the catenary theory based on an engineering principle in suspension bridges. Theories expressed by a genius must be taken seriously but questions were raised regarding this theory by Bekesy and later, and more convincingly, by Wever and Lawrence in 1954. However, in 1972 Khanna and Tonndorf revived the concept stating it was the most important mechanism the TM had for impedance matching. Today, the concept has waned but is still mentioned in some texts. This paper will discuss the various experiments performed pro and con and attempt to put the concept into its proper place.

Material and Methods: Review of the literature Results Genius on both sides of the controversy. However, experiments and clinical results in reconstructed TMs support the fact that while this effect may exist to some extent in normal TM's, it is minor. Flat TMs do not have significant conductive hearing loss all else being equal and the effects of positive and negative pressure both show a loss in sound transmission, which would not be the case if the mechanism were active.

Conclusion: It is time to put the theory to rest.