Conductive Hearing Loss Estimated from Acoustic Measurements in Ears with Otitis Media with Effusion

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INTRODUCTION

The observation that the CHL estimates in the lower cluster (23/34) are consistently lower than PTA while the CHL estimates in the upper cluster (11/34) are larger than PTA by a factor of two suggests a scheme for improving the CHL estimate (CHL3). For ears in the lower cluster, which we suppose detect pressure (PRS), CHL was added to CHL2. For ears in the upper cluster, which we suppose detect power (PWR), CHL will be divided by two (Fig. 5).

RESULTS

The correlation of CHL with PTA is 95% and the prediction error, quantified as the mean absolute difference, is 3.2 dB. Although the calculation of CHL is empirically motivated, its application requires prior knowledge of whether an ear belongs to the PRS or PWR cluster. A logistic regression approach could be used to predict whether an ear belongs in the PWR cluster, and our data thus far support the feasibility of this. Additionally, subjects with OME and PTA measurements in both ears almost always had either two PRS ears or two PWR ears. The strong within-subject correlation of PWR status suggests that this feature may have a biological origin.

CONCLUSIONS

• Model results provide a good description of the measured data. The presence of OME causes an increase in stiffness below 0.8 kHz and an increase in damping above 1 kHz, with larger changes resulting from larger volume effusions.

• WAI, combined with our model, can estimate behavioral audiometric thresholds (CHL) within a clinically meaningful margin of error. This is a significant finding given the challenges associated with behavioral audiometric testing in pediatric populations where OME is most common.

• The discovery of two distinct types of ears, pressure detectors and power detectors, warrants further investigation.

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