Distortion Product Otoacoustic Emission modulation by the medial olivocochlear efferent pathway using an ipsilateral suppressor tone

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ABSTRACT

The medial olivocochlear (MOC) pathway comprises a complex network of descending efferents from the central nervous system to the outer hair cells (OHCs) in the periphery. In this way, auditory input can be modulated before it reaches the brain thus having clinical implications related to hearing loss, tinnitus, and trauma. This study presented a method for estimating the effect of the CAS-mediated efferent pathway on DPOAE fine structure. The CAS as a pure tone stimulus was added to one ear and the contralateral ear served as a control. The pure tone was swept 1 octave at a time (50/20 dB) from 125 to 8000 Hz. This was repeated n times for a given frequency, and the relative amount of fine structure was recorded (Fig. 2). Each subject was tested for spontaneous otoacoustic emissions (SOAEs) to confirm whether the suppression tone had any effect. The data was analyzed using an FFT and fit techniques. Fine structure depth was calculated to estimate amount of suppressor and activator DPOAE levels.

OBJECTIVES

To isolate DPOAE components using an ipsilateral and individualized suppressor tone.

To demonstrate the modulation of DPOAEs by the MOC efferent pathway once component interference has been eliminated.

METHODS AND MATERIALS

Subjects:

•Fifteen undergraduate students from Northwestern University in Evanston, Illinois were recruited for the study. Data from the 7 right ears who demonstrated DPOAE fine structure depth greater than 3 dB were used in the analysis. All subjects denied a history of hearing loss, recurrent ear infections, ear surgery, and tinnitus.

Screening:

•Normal middle ear status for all subjects was confirmed by otoacoustic examination (i.e., intact tympanic membranes, clear middle ears, no cerumen impaction).

•Infrantimetric measurement and clinical audiometry were performed using a Mir-22 clinical audiometer and Tecno ET480 - a standard audiologic procedures (ASHA, 2005). All subjects were found to have audiometric thresholds at or below 15 dB HL between 250 and 8000 Hz.

•Each subject was passed through a custom amplifier to MB Quart 13.01HX drivers with an ideal suppressor, one that reduced DPOAE fine structure without decreasing the level of its component interference. The CAS broad band noise (BBN) was added to the input channel of the custom amplifier. This was done using MB Quart 13.01HX drivers, which were passed through a custom amplifier to MB Quart 13.01HX drivers. The ideal suppressor was determined per subject based on a visual analysis of DPOAE frequency OF the MOC. The efferent auditory system has been implicated in differential suppression of OHCs and their efferents through the sound channel of an ER10B+ OAE probe fit to subjects' ear canal DPOAE is primarily due to a differential reduction in the magnitude of different DPOAE components that are out of phase with each other.

A controlled measurement technique is pivotal to exploring the functional role of the auditory efferents in humans.

The efferent auditory system has been implicated in differential susceptibility to noise induced cochlear damage and ability to detect signals in noise.

REFERENCES

•Giraud, Andrew J; and James M. Hall, III. Otolaryngology, Principles, and Procedures From Normal Development to Disease. 2011. Lippincott Williams & Wilkins.

CONCLUSION

These results suggest that the residual DPOAE originates from the ipsilateral ear, thus demonstrating the differential suppression of OHCs and their efferents through the sound channel of an ER10B+ OAE probe fit to subjects' ear canal. This was done using MB Quart 13.01HX drivers, which were passed through a custom amplifier to MB Quart 13.01HX drivers. The ideal suppressor was determined per subject based on a visual analysis of DPOAE frequency OF the MOC. The efferent auditory system has been implicated in differential suppression of OHCs and their efferents through the sound channel of an ER10B+ OAE probe fit to subjects' ear canal DPOAE is primarily due to a differential reduction in the magnitude of different DPOAE components that are out of phase with each other.

SUMMARY

•Adding an ipsilateral suppressor tone leads to more consistent results while examining efferent modulation of cochlear mechanism.

•A controlled measurement technique is pivotal to exploring the functional role of the auditory efferents in humans.

•The efferent auditory system has been implicated in differential susceptibility to noise induced cochlear damage and ability to detect signals in noise.

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