Wideband Tympanometry in Unilateral Sudden Hearing loss

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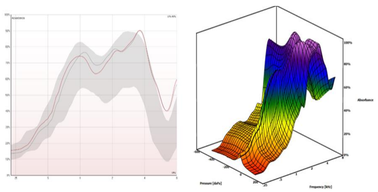
Introduction

-Single Sudden Sensorineural Hearing Loss (SSSD) is a complex condition with unknown causes, necessitating prompt diagnosis for effective management.
- Studies suggest links between SSSD and Wideband Tympanometry (WBT) changes (Attias et al., 2022).
-SSNHL affects inner ear structures, altering mass and stiffness, impacting high-frequency absorbance (Jacobs et al., 2013; Demir et al., 2019; Pieterse et al., 2022).
-WBT serves as a valuable tool for understanding SSSD's pathophysiology through measurements of sound reflectance and absorbance.



Objective

to determine whether the WBT measured from the SSSD ear is different for the contra-normal side using a within-subject design.

Method

-It involved 32 subjects (mean age 39±5 years) with unilateral SSSD, all showing type A tympanometry.

-WBT was assessed using Titan Suite software, measuring Wideband Absorbance (WBA) and reflecting sound properties under peak and ambient pressures.

-Audiometric thresholds for air and bone conduction were measured with calibrated equipment. Absorbance was analyzed across frequencies (226–8000 Hz) comparing affected and contralateral normal ears. Helsinki approval: 0246-23-RMB-D 2023.

Results

1. behavioral hearing test of the participants including AC thresholds from 250 to 8000 Hz, BC thresholds for frequencies 250-4000 Hz. while the ear affected SSSD(single side sudden deafness), the contralateral ear was above 25 dB. The hearing loss is pure sensorineural hearing loss. No Air bone gap was detected. SRT and discrimination tests were as expected (see figure 1).

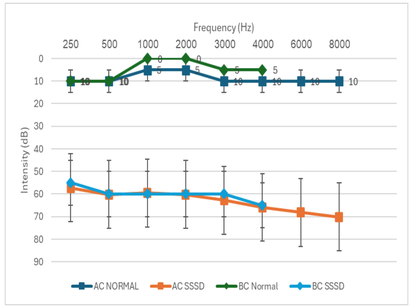


Figure 1*Average Behavioral hearing test- within Subjects- normal ears vs. Sudden sensorineural hearing (SSSD)loss ears.*

bibiology

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2. Absorbance measurements in SSSD group- highly significant differences (p<0.001) detected (400,500,800, 4000 and 5000) in both peak pressure and ambient conditions. (see figure 3)

3. **Effect of degree of hearing loss-Boxplot** -significant differences found (p<0.01), SSSD ears vs. contralateral normal ears(see figure 2).

3. **WBT Effectiveness at 5000 Hz-** ROC curve analysis for 1/3 octave band centered at 5000 Hz, Highly sensitivity (>0.9) for SSSD. Absorbance threshold <0.2 at 5000 Hz indicates likely hearing loss (see figure 4)

4**. Key findings- WBT at 5000Hz**- strong ability to identify SNHL, high sensitivity yet, not specific to SNHL intensity.

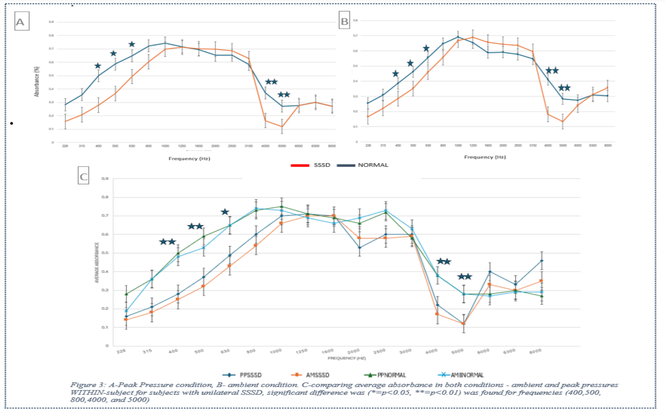

Figure 3: A-Peak Pressure condition, B- ambient condition. C-comparing average absorbance in both conditions - ambient and peak pressures WITHIN-subject for subjects with unilateral SSSD, significant difference was (=p<0.05, **=p<0.01) was found for frequencies (400,500, 800,4000, and 5000)*

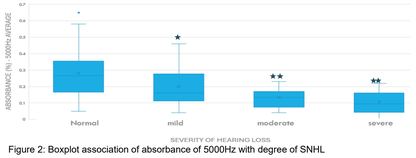

Figure 2: Boxplot association of absorbance of 5000Hz with degree of SNHL

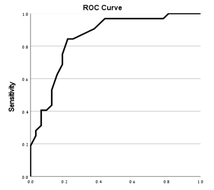

Figure 4- *ROC curve for WBT in ears SSSD for 5000Hz. sensitivity 0.84, specificity fair 0.92.*

Conclusion

Study Focus: First examination of ears with severe to profound sensorineural hearing loss (SNHL)

Key Finding: Significant reduction in absorbance at high and low frequencies, with negligible change in resonance frequency (RF) compared to normal hearing ears.

Mechanisms Explored: Investigates structural and mechanical changes in the Organ of Corti associated with SNHL.Structural Alterations: Potential loss or atrophy of cochlear neurons and sensory cells. Labyrinthine fibrosis affecting the stria vascularis. Anomalies or absence of the tectorial membrane.

Impact of Changes: Affects stiffness at low frequencies and mass at high frequencies, while RF remains unchanged.

Study Design: Within-subject design eliminates confounding factors like aging, providing clearer insights. Relation to Prior Research: Aligns with findings from Attias et al. (2022).

Clinical Utility of WBT: Highlights Wideband Tympanometry (WBT) as a non-invasive diagnostic tool for cochlear hearing loss.

Implications: Urges further exploration of WBT's application in different types of cochlear hearing loss. Contribution: Enhances understanding of inner ear dynamics in SNHL and emphasizes WBT's value in audiological assessments.

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