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NOISE EXPOSURE

Audiological methods for early hearing detection among noise- and chemical-exposed medical personnels

R. Dindamrongkul, W. Kaimook, T. Choosong

Abstract

Occupational hearing loss (OHL) is a primary concern in industrial settings. However, loud noise pollution also affects medical personnel. Additionally, individuals in chemotherapy units are usually exposed to chemical agents that can induce hearing loss. Therefore, we aimed to reveal the hearing thresholds among medical personnel exposed to loud noise and/or chemical environments. Hearing examination is routinely evaluated in the range of conventional frequencies, which may not detect hearing problems early. Thus, we also showed the prevalence of hearing loss using four different audiological methods; such as conventional audiometry (CA), extended high-frequency audiometry (EHFA), standard frequency DPOAE, and ultra-high-frequency DPOAE. Ultra-high-frequency DPOAE and EHFA were early determined to have a hearing loss. Early diagnosis of hearing loss should be evaluated hearing thresholds at frequencies higher than 8 kHz. It was believed that extended high-frequency was affected earlier than conventional frequencies, even in individuals who had been working for under 10 years. To facilitate early identification, ultra-high frequency DPOAE and EHFA should have been applied as a clinical test battery when evaluating and monitoring for hearing loss prevention purposes. This would have allowed us to implement protective measures to maintain normal hearing thresholds in conventional frequencies before the loss extended into speech frequencies and had a more detrimental effect on communication.

Objectifs

To address the prevalence of hearing loss by using four different audiological methods; such as CA, EHFA, standard frequency DPOAE, and ultra-high-frequency DPOAE among medical personnels who exposed to noise and/or chemical environments.

Méthodes et Matériels

One hundred and thirty-one medical personnel were recruited from various units in the hospital and grouped them into noise, chemical, and mixed exposure categories. Hearing thresholds were evaluated using four audiological methods. Pulsed tones were stimulated ranging from 0.25 to 8 kHz for CA, while EHFA was measured at frequencies of 9, 10, 11.2, 12.5, 14, and 16 kHz. DPOAE was evoked by two pure-tone frequencies, maintaining the f2/f1 ratio at 1.2, with f2 frequencies ranging from 552 to 7012 Hz for standard frequency DPOAE and recording from 8838 to 17671 Hz for ultra-high frequency DPOAE.

Références

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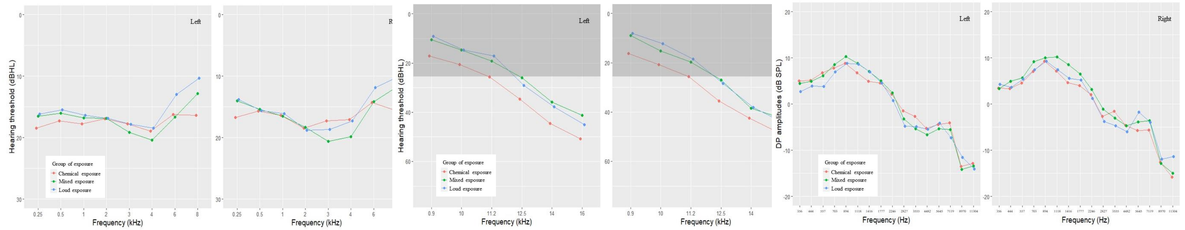
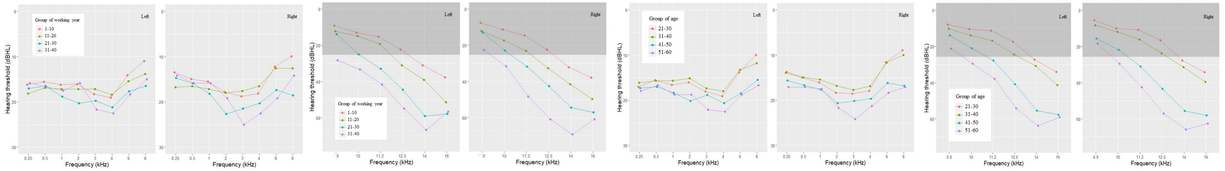
Résultats



- The EHFA and ultra-high-frequency DPOAE methods identified a higher prevalence of hearing loss. Based on the physiology of hearing, hair cells at the base of the cochlea are firstly affect the hearing threshold at higher frequencies. [1]
- The hearing threshold at ≥12.5 kHz is an early indicator of hearing loss, especially in chemical exposure group.
- The magnitude of reduction was maximally decreased lower than -10 dB SPL at frequencies of 8970 and 11304 Hz. Over 80% of abnormal DPOAE readings were detected at ultra-high frequencies.
- A notch audiogram demonstrated a similar pattern of declined progression in hearing loss over time at frequencies of 2 kHz, 3 kHz, and 4 kHz. Previous studies have shown a sign of noise-induced hearing loss at 3 kHz, 4 kHz, or 6 kHz. [2-4]
- It was observed a definite decline in hearing thresholds in participants aged over 40 years, particularly at frequencies of 6 and 8 kHz. This discovery established a biomarker for early signs of hearing loss, which resulted in a multifactorial process involving aging and noise exposure. This negatively affects hearing loss [5] and raises awareness of accelerated hearing loss, even though their hearing thresholds are within normal limits.



Conclusion

Outer hair cell damage and the identification of hearing loss using ultra-high-frequency DPOAE and EHFA might have occurred without a reduction in the hearing threshold at conventional frequencies. Therefore, to facilitate early identification, ultra-high-frequency DPOAE and EHFA should be applied as clinical battery tests when evaluating and monitoring hearing loss for prevention purposes. This would allow for the implementation of protective measures to maintain normal hearing thresholds at conventional frequencies before the loss extends to speech frequencies and has a more detrimental effect on communication.

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