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Comparison of distortion product otoacoustic emissions and pure tone audiometry in occupational screening for auditory deficit due to noise exposure

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Dear Editors,

It was a pleasure for us to read the article titled 'Comparison of distortion product otoacoustic emissions and pure tone audiometry in occupational screening for auditory deficit due to noise exposure' by Wooles *et al*.,[1] in your esteemed journal. It is a succinctly written article and we would like to commend the authors on their excellent effort. The topic is significant to us, as we have been conducting a similar study in our institution for the past three years, involving factory workers. Based on our experience in this area, we would like to mention a few points that we feel would enrich the above article.

Exposure to short duration, high-level noise can cause either temporary or permanent hearing loss depending on the level, duration and spectral content of the traumatising stimulus. Various studies have validated the use of high-frequency pure tone audiometry in the detection of noise-induced hearing loss, and shown that extended high frequencies may be affected by noise sooner than is revealed by conventional audiometry.[2] We feel that high-frequency audiometry is an effective and cost-efficient screening tool for occupational hearing loss, and distortion product otoacoustic emissions testing may be considered if the high-frequency pure tone audiometry results warrant it.

Noise, as we know it, is excessive auditory stimulation. It elicits shear forces in the cochlea, leading to two pathways of cochlear injury, mechanical and metabolic. When the metabolic or mechanical stress is excessive, it leads to apoptosis or necrosis, and subsequent cell death.[3] Vibration-induced hearing loss, another oft neglected but frequently important factor under the umbrella of occupational hearing loss, acts via vibratory energy. This energy reaches the cochlea, and generates segmental compressions and expansions of the cochlear shell, affecting the fluid pathways of the inner ear.[4] Although the iatrogenic role of vibration-induced hearing loss and the effect of vibration on the upper limbs have been studied in some detail, the role of occupational exposure to high-frequency vibration as a cause of hearing loss has not been fully explored, and we feel that this area warrants future research.

We found very few articles in the available literature regarding short-term exposure to noise as an occupational hazard for health professionals.[5] Specialists in otolaryngology, dental surgery and orthopaedic surgery are routinely exposed to short duration, high-frequency noises in the operating theatre. It would be worthwhile to study the long-term effects of this noise as an occupational hazard in these specialties; if warranted, protocols may be introduced to bring in measures for hearing protection in these specialties.

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References

1 Wooles N, Mulheran M, Bray P, Brewster M, Banerjee AR. Comparison of distortion product otoacoustic emissions and pure tone audiometry in occupational screening for auditory deficit due to noise exposure. *J Laryngol Otol* 2015;**129**:1174–81
2 Porto MA, Gahyva DL, Lauris JR, Lopes AC. Audiometric evaluation in extended high frequencies of individuals exposed to occupational noise [in Portuguese]. *Pro Fono* 2004;**16**:237–50
3 Ylikoski J, Xing-Qun L, Virkkala J, von Numers M, Pirvola U. Molecular mechanisms of the death of auditory hair cells by noise. In: Henderson D, Prasher D, Kopke R, Salvi R, Hamernik R, eds. *Noise-Induced Hearing Loss: Basic Mechanisms, Prevention and Control*. London: Noise Research Network Publications, 2001;89–98
4 Sohmer H, Freman S, Geal-Dor M, Adelman C, Savion I. Bone conduction experiments in humans - a fluid pathway from bone to ear. *Hear Res* 2000;**146**:81–8
5 Dodenhoff RM. Noise in the orthopaedic operating theatre. *Ann R Coll Surg Engl* 1995;**77**(1 suppl):8–9

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Authors' reply

Dear Editors,

We appreciate the kind comments of the above team and their endeavours to employ high-frequency pure tone audiometry as an extended audiometric screening tool. Distortion product otoacoustic emissions, whilst representing a potentially useful adjunct test, should never supplant the 'gold standard' of carefully conducted audiometric testing.

The corresponding author has also had some experience, at Leicester, in using high-frequency pure tone audiometry in patient groups exposed to ototoxic drugs. He agrees that they can enhance the inferential sensitivity of standard pure tone audiometry. However, their routine use is circumscribed by the absence of internationally accepted threshold standards. The recognised sensitivity of high frequencies to various ototrauma means there are other sources of measurement variability that the clinician must account for.

Notwithstanding these limitations, the proposal to conduct repeated measures of high-frequency pure tone audiometry thresholds in specified subject groups is a sensible one. We would certainly be in favour of the systematic deployment and development of high-frequency pure tone audiometry measurement as described by the above correspondents. It will of course be important to complement the psychophysical measurement with the dimensions of any known noise exposure (i.e. frequency range, intensity and duration).

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