Can smartphone vibration provide a valid alternative to tuning forks following tympanomastoid surgery?

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Background and Aims

The British Society of Otolaryngology stipulate that all patients undergoing tympanomastoid surgery should be assessed post-operatively for a 'dead ear' due to the risk of damage to the inner ear intra-operatively¹. This is typically assessed by performing Weber's test with a 512Hz tuning fork to ensure sound is detected in the operated ear. Weber's test indicates a conductive hearing loss when the sound lateralises to the affected ear. Regrettably, tuning forks are frequently inaccessible on hospital wards resulting in this examination frequently being omitted, and subsequently a patient missing a critical window of opportunity in which to resolve the problem.

Our objective was therefore to establish a suitable, more readily available alternative. We thus wanted to demonstrate that smartphone-based vibration applications provide equivalent accuracy to tuning forks when performing Weber's test for assessment inner ear function post-tympanomastoid surgery.

Results

On occlusion of the left ear canal, sound from the tuning fork lateralised to the left in 18/20 (90%) cases. In 20/20 (100%) cases sound lateralised to the left with the iPhone app (chi squared test, $p=0.82$). On Occlusion of the right ear, sound from the tuning fork lateralised to the right in 19/20 (95%) cases. In 19/20 (95%) tests sound lateralised to the right with the iPhone (chi squared test, $p>0.999$). These findings substantiate the accuracy of Weber's test with tuning forks in determining a simple conductive hearing loss, furthermore they demonstrate the comparability of the vibration applications on the iPhone.

One limitation of the study is that we have used healthy subjects with otherwise normal hearing. In reality many patients have underlying conditions affecting their hearing which can have implications for the accuracy of tuning fork examinations².

Methods

Data were collected prospectively on 20 lay participants with no underlying hearing impairment. Earplugs were used to simulate a conductive hearing loss, similar to that of packing post aural surgery. Both the right and left ears were tested with the iBrateMe© application on iPhone and a 512Hz tuning fork, where the subject was asked to identify which ear the sound was perceived loudest. The edge of the phone was cleaned with Chlorhexadine 2% wipes to ensure decontamination.

Conclusions

Smartphone-based vibration applications represent a viable, more accessible alternative to tuning forks when assessing inner ear function following tympanomastoid surgery.

References

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2. Stankiewicz JA, Mowry HJ. Clinical accuracy of tuning fork tests. [Laryngoscope](#). 1979 Dec;89(12):1956-63.