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A comparison of contralateral acoustic suppression of transient-evoked otoacoustic emissions measured in a group of individuals at risk of mild traumatic brain injury through participation in contact sports and a group of controls

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Introduction

Concussion is an ever present risk in contact sports. While the majority of currently used tests are subjective^[1], there is the potential for objective testing to be conducted through the assessment of contralateral acoustic suppression (CAS) of transient-evoked otoacoustic emissions (TEOAEs), either at the “pitch-side” or as part of a “return-to-play” protocol.

Previous studies have shown reduced CAS TEOAEs in subjects with concussion where auditory symptoms are also present^[2]. However, if CAS TEOAEs are to be an effective test, the effect of the repeated sub-concussive injuries inherent in participation in contact sports on CAS TEOAEs must also be addressed as this could negate the use of baselines derived from population-based normative data.

This small scale preliminary study aims to assess whether athletes participating in sports with a high occurrence of sub-concussive injury with no auditory symptoms present with reduced CAS TEOAEs.



Method

CAS TEOAEs was measured in accordance with the test paradigm described by Hood et al^[3]. That is, TEOAEs were recorded in response to 60 dB p.e. SPL clicks with and without a 65 dB SPL broadband noise presented to the contralateral ear, with suppression defined as the ratio of the rms amplitude of the TEOAE recorded with and without the broadband noise between 8 and 18 ms and expressed in dB.

Measurements were made from both ears of nine athletes who regularly play sport with a high occurrence of sub-concussive injury and fifteen control subjects who had not previously played such sports.

For each subject four CAS TEOAEs measurements were obtained. These were CAS TEOAEs in the (i) right ear and the (ii) left ear; (iii) the sum of CAS TEOAEs obtained in both ears (RE+LE); and (iv) the magnitude of the difference in CAS TEOAE between the right and left ears (|RE-LE|).

References

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Results

The results are shown in Table 1 and Fig. 1. Table 1 shows the mean (and 95% CIs) for each group for the four measurements made. Fig.1 shows the percentile distribution for each measurement. Substantial inter-subject variability in CAS TEOAEs values is evident.

Table 1. Mean suppression (and 95% CIs) for the four measurements made for athletes and controls.

	Control	Athletes
RE	1.24 dB (0.85-1.64)	1.22 (0.82-1.61)
LE	1.20 (0.78-1.62)	1.30 (0.81-1.80)
RE + LE	2.44 (1.68-3.20)	2.52 (1.68-3.36)
RE – LE	0.52 (0.38-0.66)	0.43 (0.30-0.55)

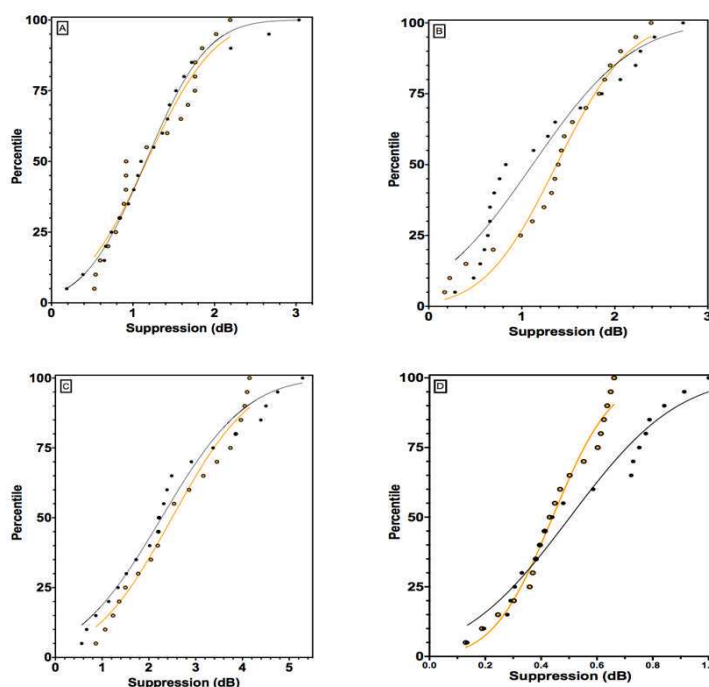


Fig 1. Percentile distribution of CAS TEOAEs for at risk (orange) and control (black) groups for the A. right ear B. left ear C. RE + LE and D. |RE – LE|.

T-tests showed no significant difference between athletes and controls for all four measurements.

Conclusions

The results of this preliminary study show no difference in CAS TEOAEs measured from athletes at risk of acquiring cumulative sub-concussive injury. This is at odds with other studies that have shown differences in neuropsychological performance between at-risk athletes and controls^[4]. A possible interpretation of our findings is that CAS TEOAEs is not sensitive to cumulative sub-concussive injury (assuming the sample of athletes tested had experienced sub-concussive injury). A second implication is that because of large inter-subject variation in CAS TEOAEs, the use of individual baseline measurements is indicated, rather than population-based normative data.