

VEMPlitude: Is It Worth It?

Harry Akram, Laura Freeman, Patricia Castro
Department of Adult Diagnostic Audiology, University College London Hospitals, London, UK

Introduction & Objectives

Vestibular Evoked Myogenic Potentials (VEMPs) have become a relevant clinical test, especially to identify Superior Semi-circular Canal Dehiscence (SSCD) (1, 2). Moreover, ocular VEMPs (oVEMPs) have shown to have more sensitivity than cervical VEMPs (cVEMPs) for identifying SSCD. However, the amplitude of oVEMPs can be significantly smaller than cVEMPs, and a clean recording is more challenging. In 2013, Sandhu and Colebatch described a new montage which showed a significantly larger amplitude and improved trace robustness compared to conventional montage. This montage was called the “Belly-tendon” montage (3), as it records the contraction of the inferior oblique muscle closer to the tendon. We present a variation of the “belly-tendon” montage with only one reference electrode placed on the lower forehead (Fig 1). This montage variation, which we would like to call “Missy Elliott”, uses only four electrodes, which in consequence reduces the difficulty of electrode placement and the time of preparation for the test. In this study we seek to compare the amplitudes obtained with the montage variation versus the conventional oVEMP montage.

Methods

Twelve healthy subjects (8 female) participated in this study. All participants had their oVEMPs obtained using the conventional infraorbital oVEMP montage and the “Missy Elliott” variation (Fig 1). The skin was prepared before collection, to have an impedance of 5Ω or less with no more than 2Ω of difference between electrodes. Acquisition was achieved using the Sierra Wave software (Cadwell, UK). The N1-P1 amplitude in μV was collected for each subject on each montage to be compared later (Fig 2).

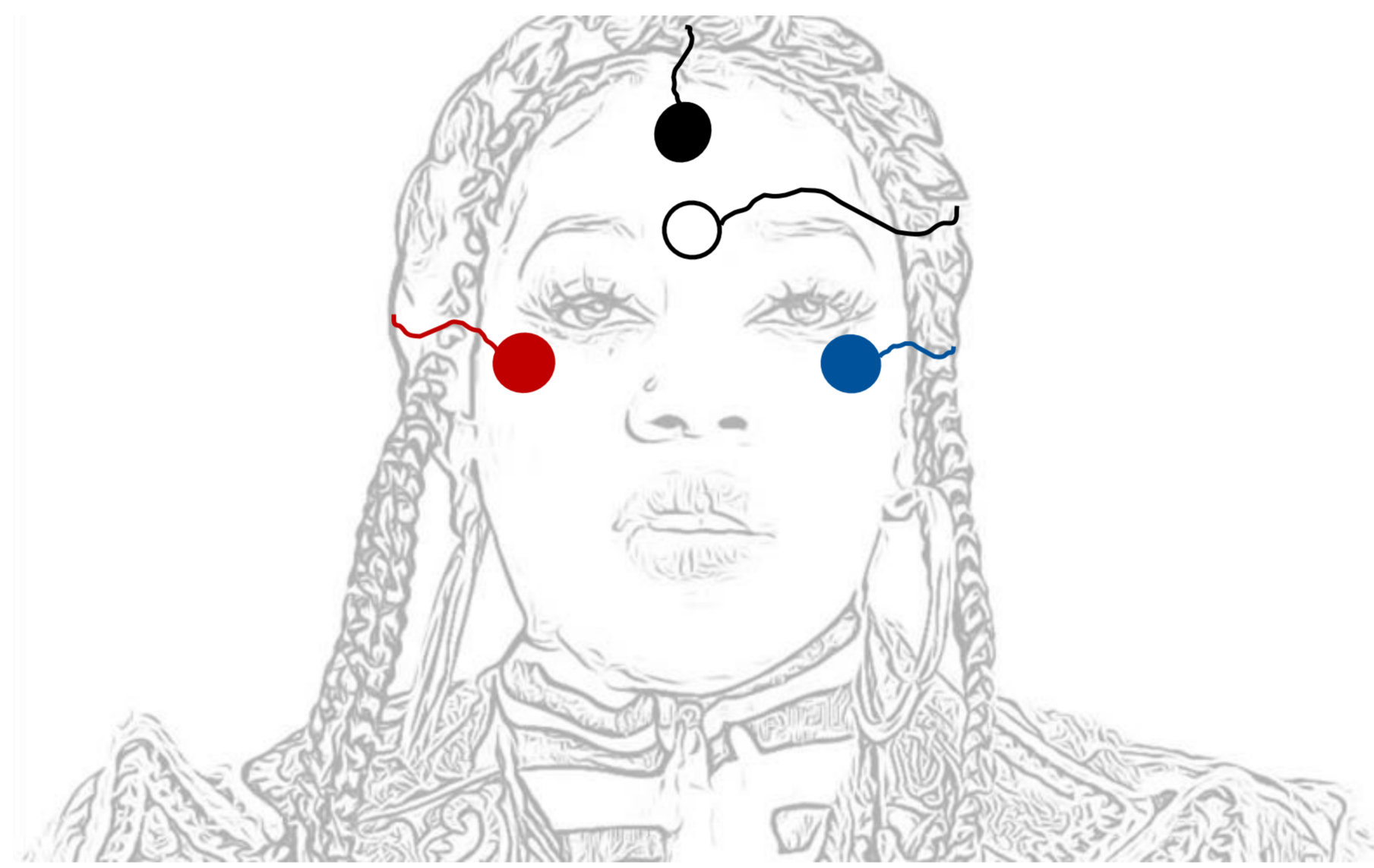


Fig 1. The “Missy Elliott” montage variation of the “Belly-tendon” montage. The active electrodes (red on the R eye and blue on the L eye) are placed in the curve of the bone eye orbit in the opposite side to that stimulated. The ground electrode (black) is on the high forehead and a single reference electrode (white) is placed in the lower forehead, between both eyebrows equidistant to the active electrodes.

Comparison Waveforms

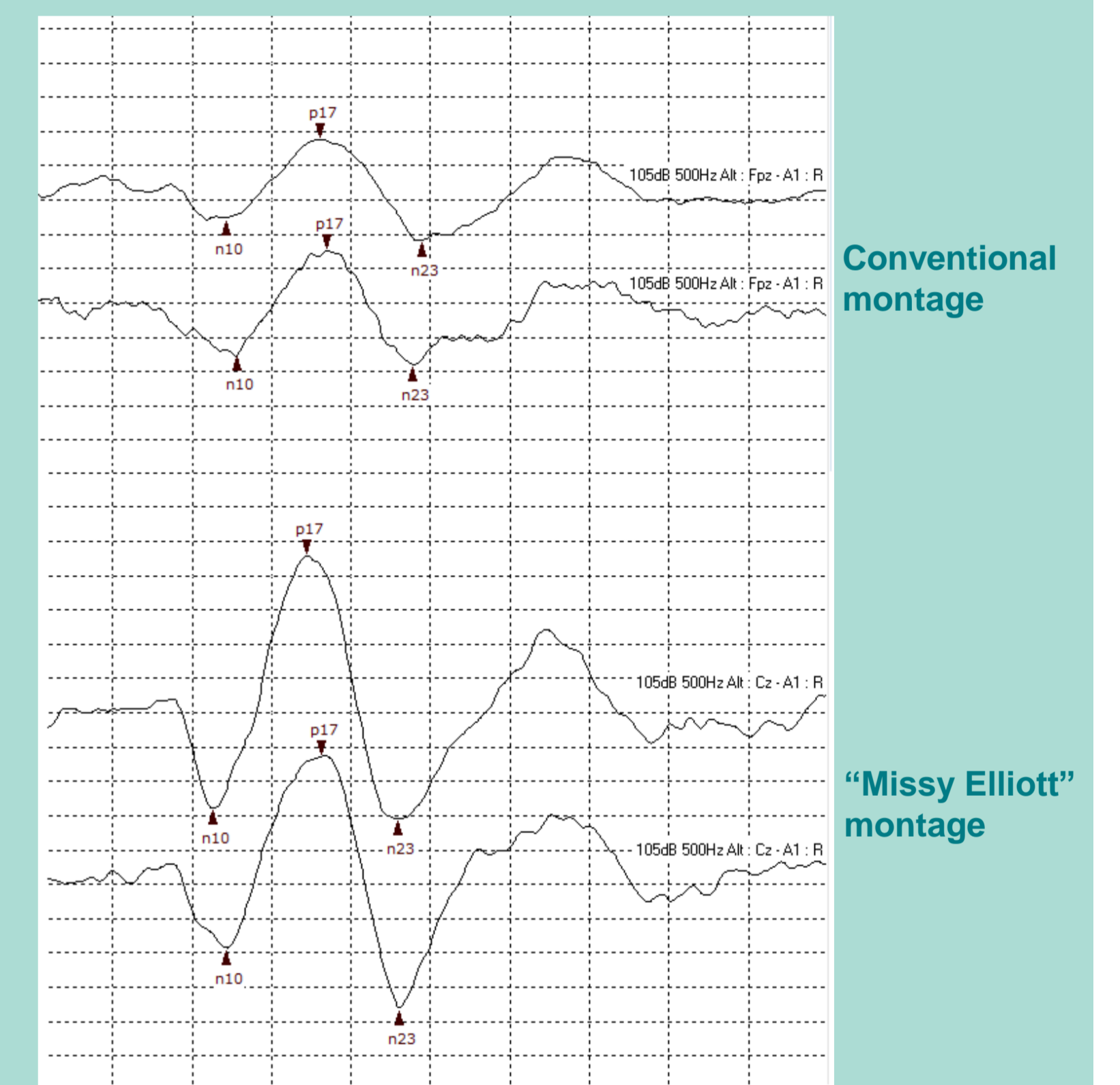


Fig 2. Representative traces of the same subject to show amplitude and clarity differences between the two montages (x axis: 4ms per div/ y axis: 5 μV per div).

Results

The “Missy Elliott” montage showed significantly larger oVEMP amplitudes in all subjects when compared to the conventional montage ($p < 0.001$) (Fig 3).

The percentage difference between both montages was always positive, with a median close to a 100% increase with the use of the modified montage (Fig 4).

The recordings were also more robust and clear, making the identification of the peaks easier (Fig 2).

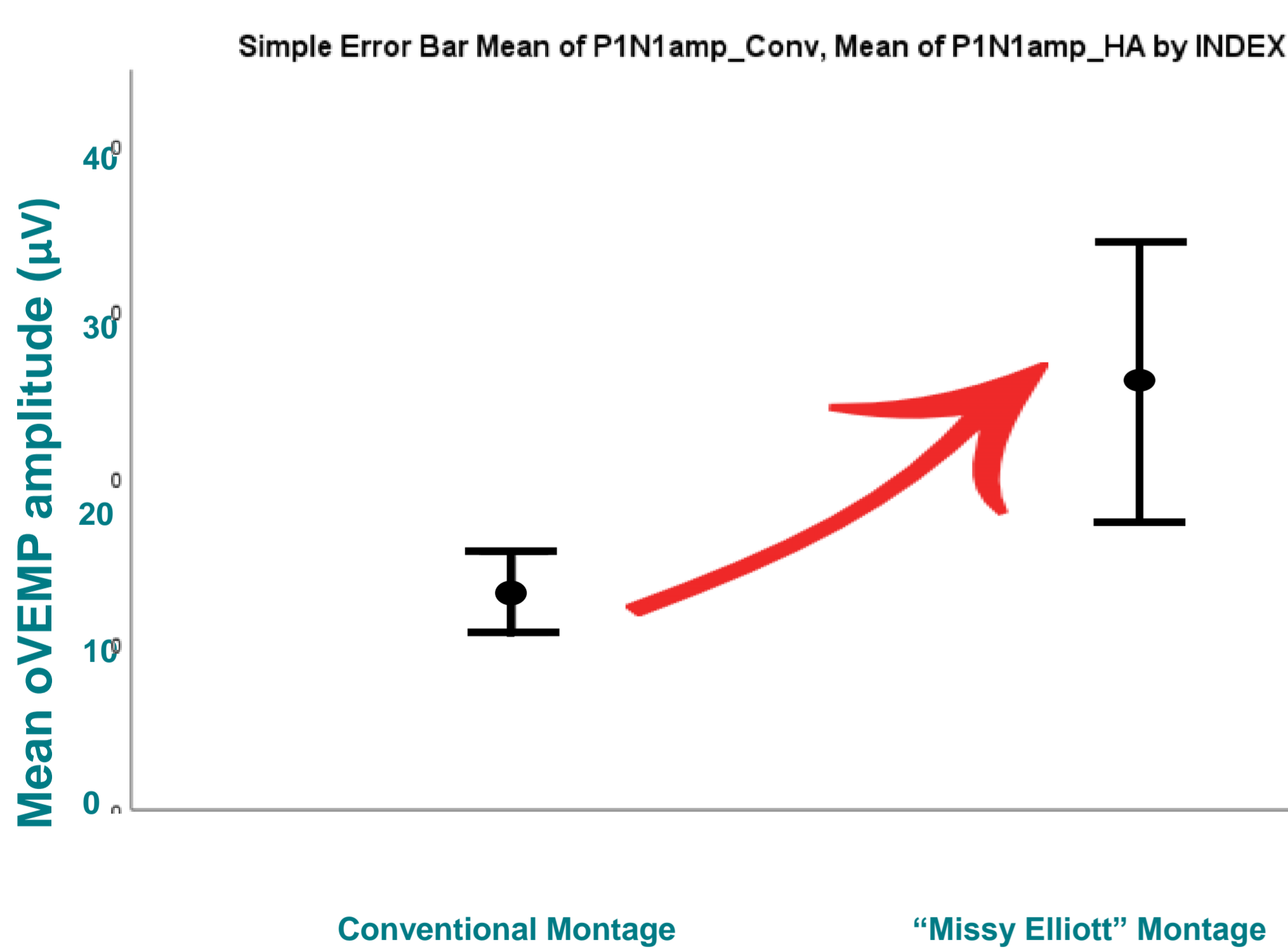


Fig 3. Average amplitude difference in μV between the conventional oVEMP montage and the “Missy Elliott” montage. It can be observed a significantly larger amplitude for the later electrode placement. Bars are 95% CI.

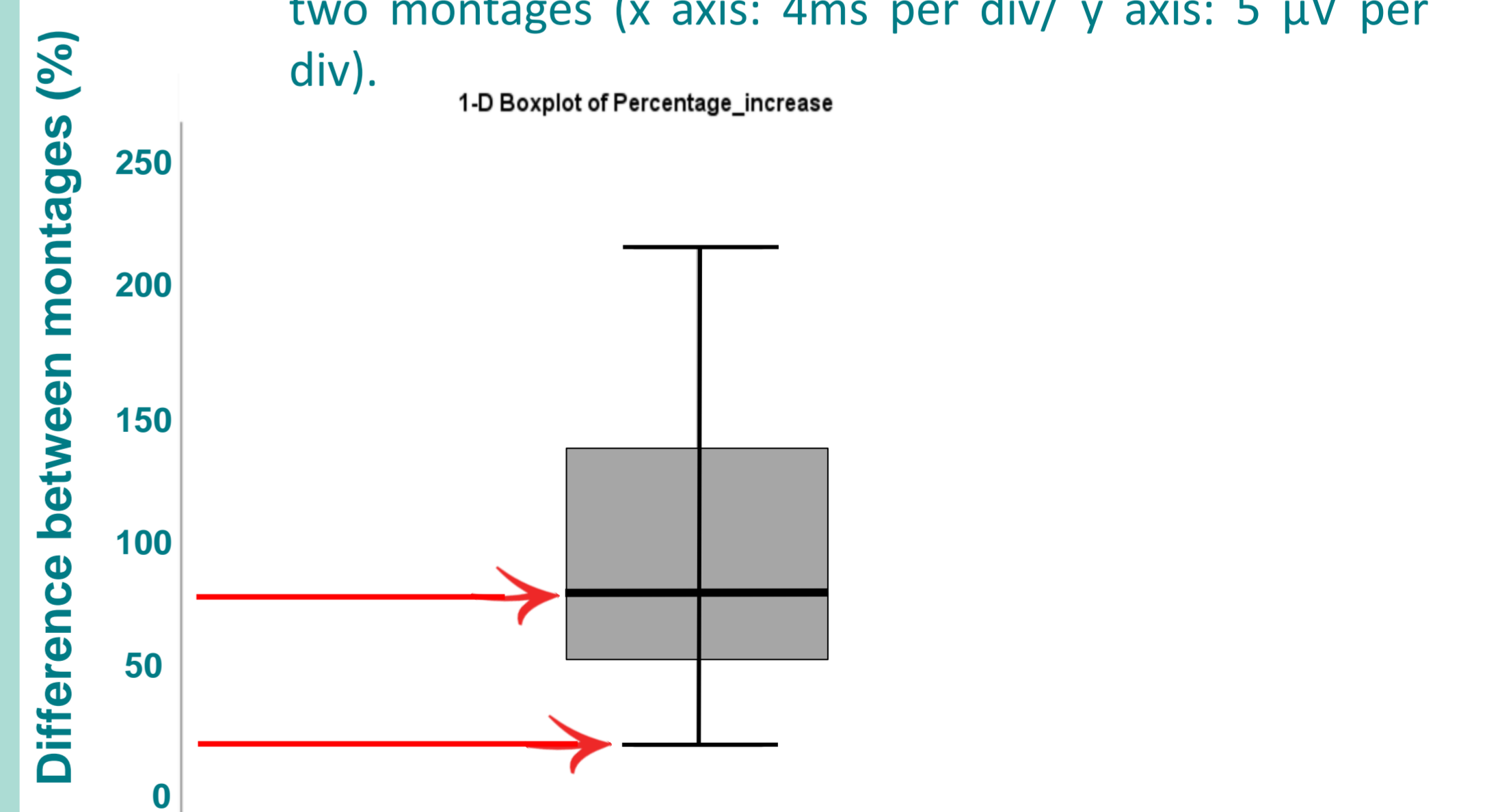


Fig 4. Box plot of the percentage difference between both montages. It can be observed that the percentage observed was positive for all subjects meaning a larger amplitude with the “Missy Elliott” montage. The black line represents the median, the box is the interquartile range and the bars is the maximum and minimum. Red arrows highlight the minimum range and median.

Discussion

Our data shows how the amplitude of the oVEMPs recorded with our montage variation is significantly larger than when measured using the conventional montage. The use of the “Missy Elliott” montage variation for the collection of oVEMPs reduces the preparation time for the test and uses one less electrode, maintaining large amplitudes, making it more sustainable over time.

In the pandemic climate, infection control officials approve because the patient keeps their surgical mask on. Further research comparing other variations of the “belly-tendon” montage would be of use. Additionally, investigating the effect of electrode montage on patients with different vestibular conditions is of potential use in diagnose. In short - **it's worth it.**

Acknowledgement: We would like to thank the Adult Diagnostic Audiology and Neuro-otology teams at RNTED Hospitals for their ongoing support.

References

1. Janky KL, Nguyen KD, Welgampola M, Zuniga MG, Carey JP. Air-conducted oVEMPs provide the best separation between intact and superior canal dehiscence labyrinths. *Otol Neurotol* (2013) 34:127–34.10.1097/MAO.0b013e318271c32a
2. Zuniga MG, Janky KL, Nguyen KD, Welgampola MS, Carey JP. Ocular versus cervical VEMPs in the diagnosis of superior semicircular canal dehiscence syndrome. *Otol Neurotol* (2013) 34:121–6.10.1097/MAO.0b013e31827136b0
3. Sandhu JS, George SR, Rea PA. The effect of electrode positioning on the ocular vestibular evoked myogenic potential to air-conducted sound. *Clin Neurophys* (2013) 124(6):1232–6. 10.1016/j.clinph.2012.11.019.