



Service evaluation of Somatosensory Evoked potential (SSEP) recording in the West Midlands

Miss Bryony Carr, Mr Peter Bill, Professor Stefano Seri & Dr Lesley Notghi – Birmingham Children's Hospital

Introduction

Somatosensory evoked potentials (SSEP's) are electrical potentials generated in the cortex in response to electrical stimuli, applied to either the median or tibial nerves. They assess the integrity of the somatosensory pathways. Waveforms are recorded from the peripheral nerves, the spine, sub cortical structures and the cortex (figure 1).

Previously, Fz has been the favoured reference point for both upper and lower limb SSEP's. Recent literature has highlighted considerable inter-subject variation in the dipole orientation of cortical SSEP components leading to conflicting reports of the optimum reference point.

Papers published in 2008¹ and 2014² discussed the use of alternative reference sites for upper limb SSEP recordings looking at the issue of contamination of cortical components with sub-cortical source inputs when an Fz or non-cephalic reference is used. In 2003³, recommendations of recording parameters for lower limb SSEP recordings were published with a contralateral reference found to give favourable responses.

This audit focused on the use of 3 differing reference electrode sites for maximising the recording of cortical SSEP components. There is a range of literature available citing advantages and disadvantages for the use of differing reference sites. At Birmingham Children's Hospital (BCH) we use a 9 channel evoked potential system so have the capacity to record 3 simultaneous cortical responses utilising different reference points.

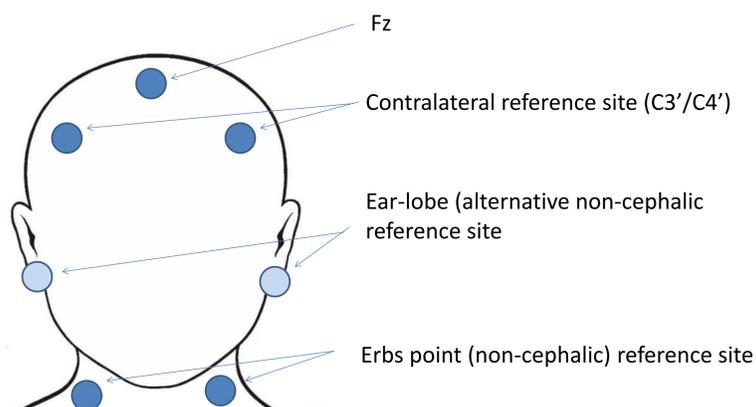
Aim

To provide a service evaluation of montages used in SSEP recordings performed in Neurophysiology departments within the West Midlands

Methods

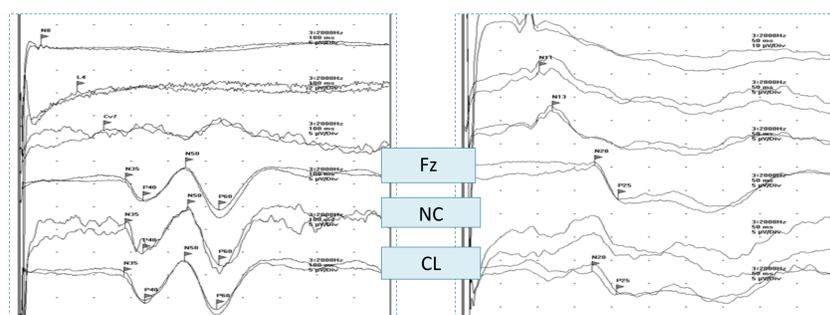
This was a prospective regional audit performed over a 2 month period with 5 regional centres choosing to participate. The majority of waveforms were gathered from healthy test subjects and some from patient data from BCH where simultaneous recording from multiple cortical channels is part of standard recording protocol. Centres were asked to provide raw traces of waveforms with active recording channels referenced to Fz, the contralateral (CL) hemisphere and a non-cephalic (NC) point such as Erb's point (figure 1).

Waveforms scored on **AMPLITUDE** of the response; **ARTEFACT CONTAMINATION** including baseline stability and **MORPHOLOGY** of the waveform.

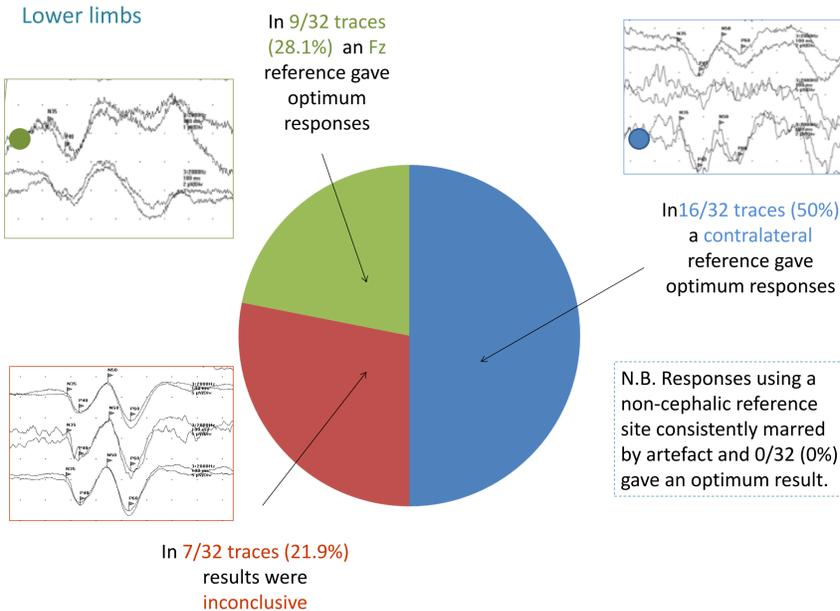


Results

A total of 54 traces were returned for analysis. Of these, 32 were from lower limb SSEPs (59.26%), 22 of which used all 3 of the recommended reference sites (10 only Fz and contralateral cephalic sites); and 22 (40.74%) were from upper limb SSEP recording, all using the three recommended reference sites. Two non-cephalic reference sites were used; Erb's point (20/22 for lower limb SSEP; 16/22 for upper limb SSEP) and the earlobe (2/22 for lower limb SSEP; 6/22 for upper limb SSEP).



Lower limbs



Upper limbs

All 22 traces returned had utilised all 3 reference sites with an Fz reference giving the most consistent responses throughout, based on amplitude and baseline stability.

Conclusions

Lower limb – A contralateral reference gave rise to more favourable responses in 50% of traces returned. This favourability was based predominately on amplitude prevalence. The variability in results supports literature suggestive of inter-subject variability in dipole orientation.

Upper limb – A favourable or equally favourable response was found utilising the Fz reference site from 100% of the traces returned, again with favourability based predominately on amplitude prevalence.

Previous published research and guidelines recommend the simultaneous recording of multiple cortical channels with differing reference sites and this is not widely the case outside of IOM. This audit supports the adoption of this in routine SSEP recordings.

With man thanks to Neurophysiology departments in the West Midlands.