

ICCN abstract

D. Other topics

7. Sensory/motor physiology

Somatosensory-evoked delta brush activity in very pre-term infants

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Delta brushes – slow waves with over-riding alpha-beta oscillations - are a hallmark of the pre-term EEG, and can be evoked by somatosensory stimulation (Whitehead et al. 2017). As such, they may be a biomarker of early sensory processing, with their attenuation indicating maturation of somatosensory circuits. In animal models, the somatosensory system is known to mature in a rostro-caudal progression, with hindlimb somatosensation last to develop, but little is known about the development of somatosensory processing in the human infant brain. Here we investigated the attenuation of delta brush activity following tactile stimulation of hands and feet over the pre-term period.

We recorded 16-channels EEG and evaluated the somatosensory evoked response following tactile mechanical stimulation of hands and feet in 38 pre-term infants at low-risk of adverse neurodevelopment (exclusion: (i) intra-ventricular haemorrhage \geq grade III; (ii) severe growth restriction (defined as $<2^{\text{nd}}$ birth weight centile)). We then looked at changes in the amplitude of the slow delta wave and of the over-riding alpha-beta frequency content in the evoked response between very pre-term (28+2-31+2 weeks+days, $n = 13$) and moderately pre-term (32+2-35+4 weeks+days, $n = 25$) infants using point-by-point t-tests (statistical significance set at $p < 0.01$ to account for multiple comparisons).

Tactile stimulation of hands and feet evoked a long-lasting diffuse negative delta slow wave, with onset latency at ~ 100 ms, peak latency at ~ 500 ms, and peak amplitude of ~ 100 μV and ~ 50 μV for hand and foot stimulation respectively, and an alpha-beta amplitude increase concurrent with the peak latency of this slow wave.

We first looked at changes in the amplitude of the slow delta wave. The slow delta wave attenuated in amplitude in the older age group most prominently over the contralateral parietal-temporal region for hand stimulation, and most prominently over the midline parietal and bilateral temporal regions for foot stimulation.

Next, we looked at changes in the amplitude of the alpha-beta oscillations which co-occurred with the peak latency of this slow delta wave. Alpha-beta amplitude attenuated in the older age group over bilateral parietal regions for hand stimulation, while there was no difference between the age groups for foot stimulation.

This is the first developmental study of delta brushes evoked by stimulation of the upper and lower limbs. Our results indicate that in very pre-term infants tactile stimulation evokes diffuse delta brush activity, which attenuates across development most markedly over the parietal-temporal regions. Interestingly, delta brush alpha-beta oscillations only decrease with development for hand stimulation, but not foot stimulation, suggesting that somatosensory maturation may occur earlier for the hands in line with studies of older infants (Whitehead et al. submitted).