ICA derived cortical responses to auditory pitch and duration deviance in six-month-old infants

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Several studies have suggested that the auditory mismatch-response (MMR) elicited in infants is a predictor of later language skills (Choudhury & Benasich, 2011;van Zuijen et al. 2013). However, there is little knowledge of what brain source activities the infant MMR reflects (Näätänen et al., 2014) and Independent Component Analysis (ICA) has not been used to address this issue. Scalp-channel averaged EEG and MMRs may sum volume-conducted contributions from many cortical source areas. ICA applied to the unaveraged EEG data can be used to identify the complex spatiotemporal dynamics underlying the MMR, allowing identification of the contributions of the cortical generators that contribute to the scalp averages (Rissling et al., 2014). We recorded 60-channel EEG data in 34 typically developing six-month-old infants during a passive acoustic oddball paradigm involving 'standard' interspersed with occasional pitch- or duration-deviant tone-pairs. Adaptive-Mixture-ICA (Palmer et al., 2006, 2008), applied to EEG data produced an average of 56 (SD=1.8,min=51,max=59) independent components (ICs) per subject for which the 3-D brain location of the best-fitting equivalent dipole (or of two position-symmetric dipoles) could be estimated using a four-layer template infant head model. These brain-source ICs were clustered across subjects by equivalent dipole locations and ERP morphology. Results showed: 1) Multiple cortical areas contributed to the two deviance MMRs. 2) A dominant cluster, located near posterior cingulate cortex, displayed marked inter-subject variability. 3) ICs requiring dual-dipole models appeared relatively frequently. These results show the potential of the ICA method for deriving more detailed functional information about the MMR in infancy.