Language Phoneme Discrimination in Infants with Sagittal Craniosynostosis: An ERP Study

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PURPOSE: Neurocognitive deficits associated with craniosynostosis in infancy are poorly characterized. With school-age neurocognitive studies of craniosynostosis revealing impairments in language-related abilities (e.g., reading and spelling), early language processing is of particular interest. We compared neural response to speech sounds in infants with nonsyndromic sagittal craniosynostosis (NSC) using event-related potentials (ERPs) to characterize differences in language processing. Given its association with language impairments in infancy (e.g. dysphasia, cleft palate), we analyzed the mismatch negativity (MMN) component evoked by distinct speech sounds. Studying the MMN expands on our previous work examining other auditory ERPs in NSC infants.

METHODS: EEG was recorded while 39 infants (12 NSC, 27 control; ages 2 to 8 months) listened to the Hindi dental /da/ and retroflex /da/ phonemes (non-native phonemic discrimination task). Frontal and central electrodes were used for analysis. The MMN was extracted as the peak amplitude of the largest negative deflection in the difference wave (retroflex minus dental) over 80-300ms post-stimulus. Differences in MMN were analyzed using repeated measures analysis of variance (group as between subjects factor; region, hemisphere as within subjects factors) .

RESULTS: MMN amplitude was lower in magnitude in the NSC infants compared to controls (p=0.047). A significant region by group interaction (p=0.045) was observed, and pairwise comparisons revealed that NSC infants displayed attenuated MMN in the frontal electrodes compared with controls (p=0.010). A significant region by hemisphere interaction (p=0.012) was also observed, and pairwise comparisons revealed a trend of higher magnitude MMN in the frontal region compared to central region in the left hemisphere (p=0.074).

CONCLUSION: The MMN was significantly attenuated in NSC infants compared to controls. This finding suggests atypical neural response to language in NSC infants. Given the association of these brain responses with phoneme discrimination, our findings have important implications for the understanding the later language impairments observed in school-aged individuals with NSC.