

# Is tactile sensory processing regulation in preterm neonates an early determinant of neurodevelopmental outcomes at age 2 years

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## Background

Premature birth heightens the risk of later Neurodevelopmental Disorders (NDD). However, this link remains to be fully explained, and we lack reliable vulnerability markers that would allow us to propose early screening and effective interventions. Exploring sensory processing regulation holds promise: a core process in cognitive development is sensory prediction (SP), which modulates sensory processing via repetition suppression (RS) during irrelevant stimuli or amplification during relevant ones. NDDs often entail sensory deficits, especially tactile. Altered tactile SP and RS may constitute early mechanisms of cognitive deficits seen in autism and attention disorders. This study assesses tactile SP and RS in preterm neonates and their link with neurodevelopment at 2 years.

## Methods

At 35 weeks of corrected Gestational Age (GA), we measured EEG evoked potentials in 62 preterm infants born between 26 and 34 weeks GA, during a tactile oddball-omission paradigm (290 vibrations simulating a stroke on the forearm). The first and last 40 stimuli served as standards for assessing RS. Interspersed were blocks of stimuli (5 standards, 1 deviant, and an omission in pseudo-random order). All patients take part in an ongoing 2-year follow-up with NDD screening, cognitive and social milestone assessments (BRIEF-P/ESSENCE 2-5, ASQ), neurosensory evaluation (infant/toddler sensory profiles questionnaire for parents), and sleep quantity/quality analysis. Neonatal somatosensory processing measures will be compared with these outcome measures.

## Results

Prematurity significantly influences somatosensory processing measures: lower GA at birth is associated with greater RS ( $r=0.38$ ,  $p=.002$ ), increased EEG amplitude during stimulation omission ( $r=0.33$ ,  $p=.007$ ), but lower amplitude of the mismatch response to deviants ( $r=0.49$ ,  $p<.001$ ). Preliminary findings from the first 25 patients with outcome measures at age 2 will be discussed, emphasizing the link between the three neonatal measures and attention/executive functions assessments.

## Discussion

Prematurity and postnatal experience in the NICU impact tactile sensory processing modulation in premature infants at term equivalent age, potentially compromising subsequent sensory development and impacting neurodevelopment. Our cohort's 2-year follow-up, including NDD screening and cognitive/social milestone assessments, will elucidate whether neonatal somatosensory processing predicts cognitive development at 2 years. If so, these measures could serve as early determinants of neurodevelopmental outcomes in vulnerable patients, informing early prevention strategies.