Near-infrared spectroscopy technology in typically fluent speakers and persons who stutter

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Abstract

Near-infrared spectroscopy (NIRS) is a biomedical optical imaging technique that is used to measure real-time functional brain activity. NIRS uses non-invasive infrared light to measure oxy-, de-ox, and total hemoglobin concentration at the surface of the cerebral cortex. Hemoglobin concentration is monitored through the use of light scattering and tissue absorption. NIRS is advantageous over other techniques (e.g., EEG, MRI, PET etc.) because it does not utilize harmful radiation or an extrinsic contrast agent. It is also portable and is a low cost technology to administer. NIRS can also be used with infants, young children, and adults. Since its discovery, NIRS has been used to study Alzheimer’s disease, verbal fluency, language processing, epilepsy, frontal lateralization in speech tasks, cerebral hemodynamics, visual stimulation, odor stimulation, chronic schizophrenia, and other conditions. We have used NIRS to measure hemoglobin changes in typically fluent speakers (TFS) and persons who stutter (PWS). Our NIRS device has 16 sources and 24 detectors to measure haemoglobin concentration changes during speech and non-speech tasks for TFS and PWS. Our participants ranged in age from 10 to young adulthood. Measurements were taken during three conditions: Speakers were asked to read out loud, to engage in spontaneous speech, and to sit for a rest period. The purpose of this study was to determine whether there were haemoglobin concentration changes in TFS and PWS while they engaged in speech and non-speech tasks. Initial results indicate that speech tasks caused hemoglobin concentration changes. A more in-depth analysis of our technology and pilot data will be presented.

Keywords: Suttering; Near-infrared spectroscopy; Fluency; Brain