Neurocognitive Plasticity in Young Deaf Adults: Effects of Cochlear Implantation and Sign Language Experience (Funding Source: NIH R01DC016346 (PI: Matthew Dye))

According to the latest data from the NIDCD, approximately 2 to 3 out of every 1,000 children born in the United States have a measurable hearing loss at birth. For some of these children, that hearing loss is profound and can preclude typical acquisition of spoken language. As of 2012, around 38,000 children in the United States had received a cochlear implant (CI). For many of these children, the implant has permitted access to spoken language. However, what is perhaps most striking about spoken language outcomes following cochlear implantation is the variability. Understanding this variability is the first step in developing effective interventions to move a greater number of children towards a more successful outcome. The research proposed here will be one of the first large-scale studies to examine spoken language outcomes in young deaf adults who received their implants in childhood and are now enrolled at the National Technical Institute for the Deaf (RIT/NTID) in Rochester NY. The majority of these students were born with profound hearing losses, and they vary in terms of whether or not they use a CI, the age at which they received a CI and their primary mode of communication. This project aims to characterize cognitive deficits in young deaf adults as a function of their atypical central auditory development, determine the impact of cochlear implantation on the remediation of those cognitive deficits, and carefully examine the impact of communication mode (signed versus spoken) on cognitive deficits and spoken language outcomes. In a large sample of 480 young deaf adults: (i) high-density EEG will be used to document the effect of congenital profound deafness on central auditory cortical development by recording cortical responses to both auditory (CAEPs) and visual stimuli (VEPs), and (ii) domain-general measures of cognitive (sequence processing, executive function) and language outcomes will be obtained. Mediation analyses will be used to determine whether it is atypical auditory cortical development or cross-modal recruitment of auditory brain areas by vision that best predicts cognitive deficits and subsequent spoken language development. We will then test the hypothesis that one source of variability in CI outcomes stems from the extent to which age of implantation modulates auditory cortical maturation to remediate cognitive deficits. Finally, the unique sample of young adults at RIT/NTID, many of whom learned a natural sign language in infancy and wear a cochlear implant, affords the possibility of examining the role of early exposure to American Sign Language (ASL) in mitigating deficits in sequence processing and executive control, potentially boosting spoken language outcomes.