Decreased activation in left hemisphere speech processing regions in adults who stutter during both speech perception and production

S. Chang, T. Loucks, MK Kenney, C. Poletto, C. L. Ludlow

A consistent finding from neuroimaging studies on adults who stutter (AWS) includes right-biased hyperactivity in cortical motor regions, and attenuated activity in the left temporal auditory regions during disfluent speech, which normalized during fluency inducing speech tasks [1, 2]. In this study we asked whether differences in right and left hemisphere activation between AWS and fluent healthy volunteers (HV) occur during perception and/or production and are specific to speech or also occur during non-speech perception and/or production. We hypothesized that AWS would have reduced left sensorimotor activation during perception and have right hyperactivity during production only for speech but not for non-speech stimuli. Event-related fMRI with sparse sampling was used to compare hemodynamic activity in 20 right-handed AWS and 20 HV during speech and nonspeech perception and production tasks. Results showed that AWS had reduced activation of speech motor regions during perception compared to HV and reduced left posterior superior temporal gyrus activation during speech production. On the other hand, there were significant right sided increases in oral motor regions (insula, sensorimotor operculum and putamen) during speech production in AWS. The left hemisphere activation deficits tended to normalize during non-speech tasks in AWS. These findings indicate that AWS have reduced activation in left hemisphere motor regions during perception and reduced activation of left auditory perception regions during speech production. We propose that the integration of left hemisphere regions involved in both the perception and production of speech stimuli are reduced in those who stutter and may result in compensatory right sided increases particularly during speech production.