Tongue- and Jaw-Specific Contributions to Vowel Acoustic Changes: Towards a Mechanistic Model of Intelligibility Loss and Recovery in Dysarthria

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Tongue- and Jaw-Specific Contributions to Vowel Acoustic Changes: Towards a Mechanistic Model of Intelligibility Loss and Recovery in Dysarthria

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Research Abstract

7. Project Summary/Abstract Although it is well-known that articulators are often differentially

impaired in talkers with dysarthria, the articulator-specific contributions to speech intelligibility loss are poorly understood. Particularly knowledge about tongue- and jaw-specific contributions to vowel acoustic contrast, a strong speech acoustic predictor of intelligibility change in dysarthria, is still lacking. This knowledge is critically needed to identify the articulator that contributes most to speech intelligibility loss and needs to be targeted in treatment. Speech modifications (loud, clear, slow speech), which are known to elicit articulator-specific changes in typical talkers, are commonly used in therapeutic interventions to improve speech intelligibility in talkers with dysarthria. However, because specific guidelines for the selection of a specific speech modification are generally lacking, treatment decisions are often based on the talker's response to trial therapy. Knowledge about the articulator-specific mechanisms underlying improved vowel acoustics in response to loud, slow, and clear speech in talkers with dysarthria would provide the required scientific understanding to strategically select the speech modification approach that can precisely target the articulator that is most detrimental to speech intelligibility. Therefore, the long-term goal of this research is to establish a mechanistic model of speech intelligibility loss and recovery that addresses articulator-specific contributions to speech acoustic and, ultimately, speech intelligibility changes in talkers with dysarthria. As a logical first step, the objective of this research proposal is to identify the tongue- and jaw-specific contribution to changes in acoustic vowel contrast in talkers with Amyotrophic Lateral Sclerosis (ALS) and Parkinson's disease (PD). These two clinical groups are particularly well-suited because some literature about disease- and speech modification-related articulatory and speech acoustic changes has already been established and allow the formulation of theoretically-driven research hypotheses. Based on these studies, the central hypothesis is tested that disease- and cued speech modification-related changes in tongue and jaw articulatory performance and their contributions to vowel acoustic contrast will differ between these two groups. 3D electromagnetic articulography will be used to directly record tongue and jaw displacements during diphthong productions embedded in sentence utterances. Vowel acoustic analyses will examine the speech acoustic consequences of tongue and jaw displacements. This proposal is highly innovative because it directly compares the articulator-specific mechanisms of three frequently used behavioral treatment approaches for dysarthria in two clinical groups with distinctly different articulatory impairment profiles [tongue-dominant (ALS), jaw-dominant (PD) articulatory impairment types]. Such insights can be used in the future to identify articulator-specific impairment types in more heterogeneous etiologies (TBI, stroke) to aid clinical decisions. New findings therefore have the potential to transform clinical practice by providing a basis for scientifically-guided treatment selection, not only for ALS and PD, but also for many other etiologies.

Further information available at:

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