Articulatory Correlates of Speech Intelligibility in ALS
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INTRODUCTION

Amyotrophic lateral sclerosis (ALS) is a neurodegenerative disease affecting motor neurons in the brain, brainstem and spinal cord. It results in progressive muscle weakness, atrophy and eventually paralysis. In a subgroup of patients, the disease is associated with progressive dysarthria. Currently research in speech production in ALS is focused on topics such as early detection of bulbar symptoms, determination of the course of disease progression in different subtypes of ALS, and functional consequences of the disease. Among these questions, the latter is the most commonly studied. The known functional consequence of the speech disorder in ALS is loss of speech intelligibility and impaired communication.

Understanding factors that affect speech intelligibility is one of the main objectives of dysarthria research (Kent et al., 1989). This issue is crucial because it links the perceptual level of dysarthria assessment common in clinical practice with objective measures of motor performance and points directly to identification of targets for intervention. At this point, acoustic measures such as slope of the second formant (F2) and acoustic vowel space have been shown to moderately relate to speech intelligibility in ALS (Turner, Tjadens & Weismer, 1995; Weismer et al., 2001). Movement measures (e.g., movement amplitude, duration, speed, interarticulatory lags) have rarely been studied in relation to intelligibility and have not yet been shown to relate to it directly (see Forrest, Weismer & Turner, 1988).

Why kinematic measures might be expected to relate to speech intelligibility? Acoustic measures (e.g., F2 slope and vowel space) are often interpreted in relation to speech movements and they have been associated with speech intelligibility. Clear speech is characterized by increase in movement magnitude, speed and duration (Adams, 1990; Perkell et al. 2002) and at the same time results in improved intelligibility (Pichony et al., 1985). Moreover, articulatory movements in ALS are usually described as being smaller than normal in magnitude, slower in speed and longer in durations (Hirose et al., 1981; Yunusova et al., in press), while the disease is known to produce significant reduction in speech intelligibility.

HYPOTHESES

Speech-related movement will show change with progression of ALS
Changes in movement characteristics will be related to speech intelligibility

METHOD

Participants:

| AM1, 44, M | Recorded at 1, 6, 9, 12 months | Diagnosed 5 months prior to the first recording |
| AM2, 46, M | Recorded at 1, 2, 5 months | Diagnosed 10 months prior to the first recording |
| AM7, 53, F | Recorded at 1,3,6,9 months | Diagnosed 12 months prior to the first recording |
| AM6, 49, M | Recorded at 1,3,6,9 months | Diagnosed 12 months prior to the first recording |

RESULTS

Changes in Speech Intelligibility and Speaking Rate across Sessions:

DISCUSSION

Articulatory movements associated with word production show non-linear change with ALS progression
Different patterns of disease effects between speakers possibly indicative of subgroups
Change in movement duration seems to be directly related to change in speech intelligibility
Articulatory adjustments reflected through changes in movement size and speed seem to “anticipate” future changes in speech intelligibility
Changes in jaw function might reflect neuropathology in the tongue (compensatory articulation) or instability (re-organization) in the speech motor system

REFERENCES


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