Digital Speech Recording for Quantifying Language Deficit in Brain Tumor Patients: Measuring the Subclinical

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INTRODUCTION

- Language deficits are commonly encountered in patients with dominant hemisphere tumors
- Detailed assessment of language is often limited by clinician interpretation and feasibility of serial neuropsychological testing
- Use of a tablet-based platform which decomposes speech samples to analyze 500 acoustic and linguistic variables may have potential to identify and monitor language deficits

OBJECTIVES

- Determine feasibility of detecting language deficits with automated software in patients with dominant hemisphere brain tumors

METHODS

- 20 patients with brain tumors (19 left sided, 1 right; 12/20 with clinical language deficit) had speech recorded prior to surgical resection, including a task describing an illustration depicting an event
- 14 variables of interest were analyzed for these patients and compared to results from 20 control subjects matched by age, sex, and level of education
- Kruskal-Wallis testing was utilized to identify differences in variables between symptomatic patients, asymptomatic patients and control subjects

RESULTS

- 9 variables differed between symptomatic patients and control subjects: number of words in description; Brunet score (lexical richness), familiarity, and Honore score (lexical richness); number of content units in description; long pauses; phonation rate; speech rate; uh, uhms, pauses
- Number of words, Brunet score, number of content units, and uh, um, pauses differed between asymptomatic tumor patients and control subjects
- Honore score was decreased in symptomatic patients compared to asymptomatic.
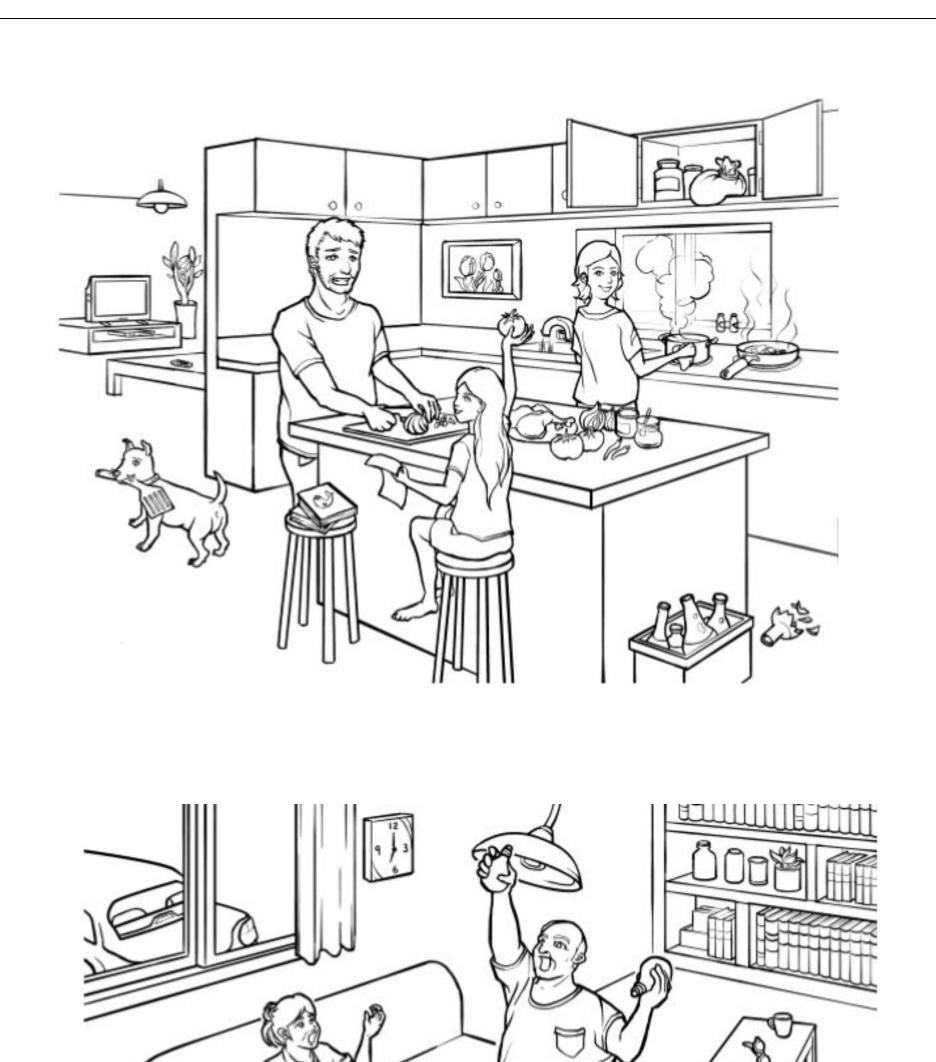
CONCLUSIONS

- Quantifiable features of speech differed in patients with language deficit compared to control subjects
- Several features differed between asymptomatic patients and controls, suggesting detection of subclinical deficits
- Further comparisons with larger normative sets could be used perioperatively and intraoperatively to aid in subtle detection of deficit and to trend deficits over time

Quantifiable features of speech differed in patients with language deficit compared to control subjects

Several features differed between asymptomatic patients and controls, suggesting detection of subclinical deficits

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Variable	Deficit vs no deficit	No deficit vs control	Deficit vs control
MLS	1.00	1.00	.302
W	.912	<.001	.001
Articulation	.283	.244	1.00
Brunet score	.885	.001	.014
Familiarity	.986	.814	.039
Hesitation	1.00	.067	.224
Honore score	.012	1.00	.005
Imageability	1.00	1.00	1.00
Info units	1.00	<.001	.001
Medium pauses	1.00	1.00	1.00
Long pauses	1.00	.310	.026
Phonation rate	1.00	.065	.008
Speech rate	1.00	.101	.006
uh, um, pause	.402	<.001	.008

MLS – mean # of words in a sentence
W – total # of words
Articulation rate– syllables per second
Brunet score – quantification of lexical richness
Familiarity – average familiarity for all words
Hesitation – utterances beginning with a pause
Honore score – quantification of lexical richness
Imageability – ex) rainbow: high; phenomenon: low
Info units – distinct units described
Medium pauses – 1-2s
Long pauses – >2s
Phonation rate – ratio of voiced samples to silence
Speech rate – words per minute
*Uh, um, pause – sum of "uh", "um" "pause"
*statistically greater in controls than patients