The Use of Real Time MRI in the Assessment of Articulatory Outcomes of Partial Glossectomy

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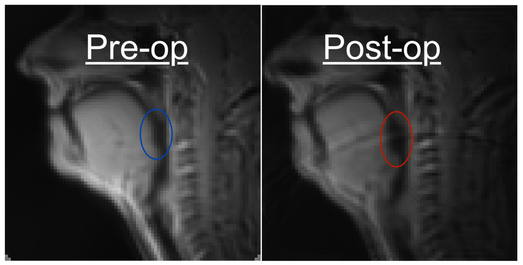
Introduction

Partial Glossectomy

Removal of cancerous tongue tissue



Provides *isolated* morphological change

Forward Map

Maps articulator position to constriction degree

Hypothesis & Predictions

Coordinated Articulator Accommodation

Jaw will compensate for change in tongue

Scarring Lessens Tongue Mobility

Post-op will have fewer degrees of freedom

Methods

Subject

Adult male speaker of British English with advanced stage tongue cancer

Scanned just before and 6 months after surgery

Real Time MRI

Images dynamic vocal tract at 83-90 fps

Crucial to observe global coordination

Stimuli

Sentences and monosyllabic words

Analysis

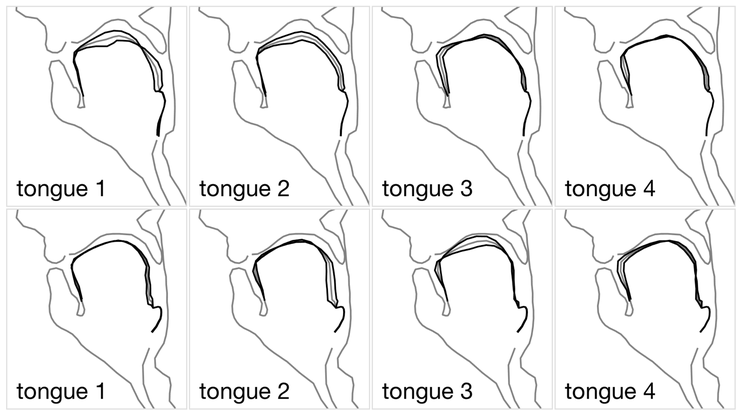
Air-Tissue Boundary Segmentation [1]

Estimates each articulator's position in every MRI frame (see highlighted frame below)

Guided Factor Analysis [3]

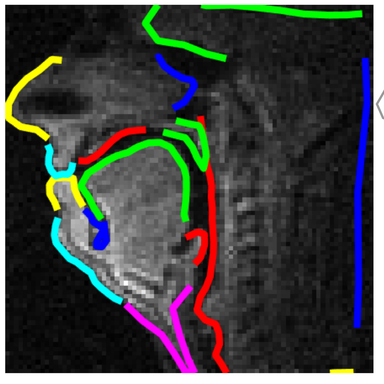
Extracts independent movement of jaw, tongue, lips, and velum

Pre-op (Top) and Post-op (Bottom) Tongue Factors

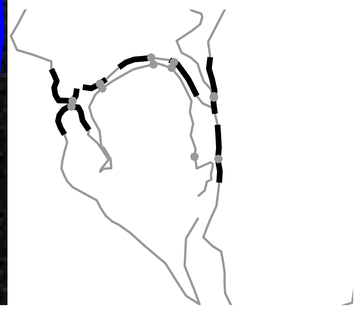


Post-op factors are *more* independent

Forward Map Estimation [2]



Constriction Degrees



Determines activation of each factor comprising an MRI frame

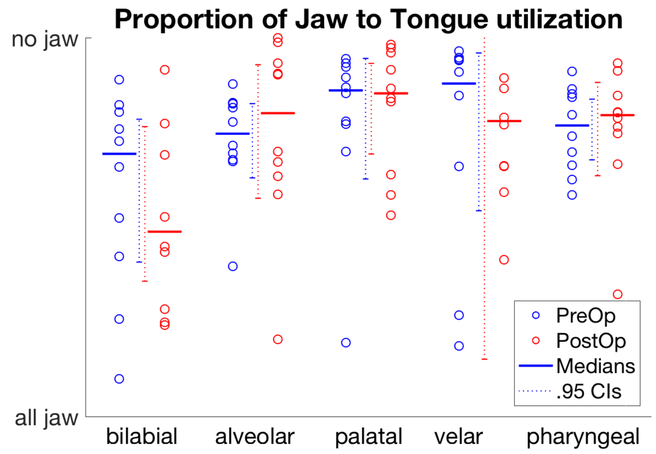
Dataset Subsampling

Created 10 subsets for each allowing within as well as across condition comparison

Results & Discussion

No Significant Jaw Compensation Found

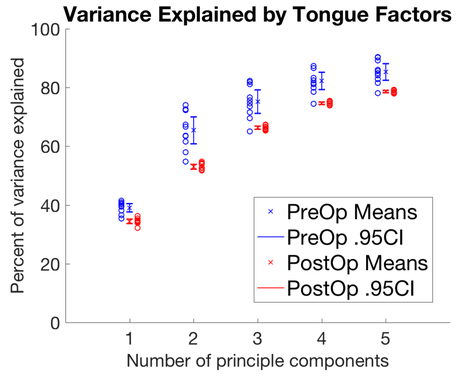
Simulated constriction task goals reveal no significant difference in articulatory strategy



Intact genioglossus and basal surgery site may mean relatively unaffected tongue [4,5]

Reflects qualitative impression of relatively unaffected post-op speech intelligibility

Post-op Tongue Exhibits More Variance



Smaller tongue may require more movement to achieve same articulatory goals

Tongue backing and raising more correlated pre-op, possibly due to tumor presence