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Comparative study of the Swallowing Motion in Healthy Adults and Patients with Parkinson's Disease

Woo Hyung Lee[1*], Min Hyuk Lim[1], Han Gil Seo[2], Hyung Seok Nam[1], Yoon Jae Kim[3], Byung-Mo Oh[2†], Sungwan Kim[1,3†]

Seoul National University College of Medicine, Department of Biomedical Engineering[1], Seoul National University Hospital, Seoul National University College of Medicine, Department of Rehabilitation Medicine[2], Seoul National University, Interdisciplinary Program for Bioengineering[3]

Objective
The aim of this study was to investigate the difference of the hyoid motion during swallowing between healthy adults and patients with Parkinson's disease (PD) using functional regression analysis.

Study Design
Retrospective observational study.

Methods
Total 38 patients with PD were retrospectively reviewed and compared with 29 healthy adults. Data of the hyoid motion during swallowing was collected from videofluoroscopic swallowing study. Parameters including displacement and velocity of the hyoid motion in horizontal and vertical planes, and association between the hyoid bone and liquid bolus were analyzed using functional regression analysis.
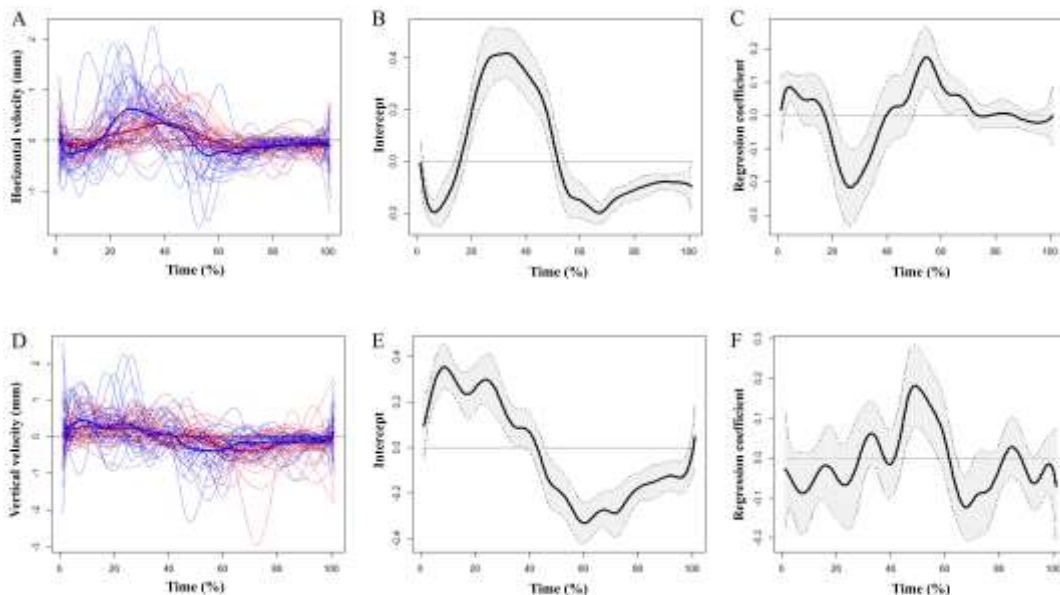
Results
The significant difference between the hyoid displacements of two groups lies in the 10-18th and 30-56th percentile in horizontal plane, and the 22-32nd and 54-64th percentile in vertical plane for swallowing duration. The significant difference between the hyoid velocity in each group lies in the 1-6th, 19-34th, and 49-68th percentile in horizontal plane, and the 44-55th and the 63-70th percentile in vertical plane for swallowing duration. Subgroup analysis for the hyoid displacement showed that there was significant difference only for horizontal displacement in 58-71st percentile of swallowing duration between young and old healthy adults. Healthy adults and PD patients showed significant association between the horizontal displacements of the hyoid bone with the vertical displacement of the liquid bolus lies in the 38-97th percentile and in the 45-85th percentile of swallowing duration, respectively. Significant association between the vertical displacements of the hyoid bone with the vertical displacement of the liquid bolus lies in the 37-56th percentile of swallowing duration, and between the vertical velocity of the hyoid bone and horizontal velocity of the bolus lies in the 20-83th percentile of swallowing duration.

Conclusion

This study revealed that the hyoid kinematics during swallowing in PD patients showed different spatiotemporal characteristics compared to healthy adults in terms of displacement, velocity of the hyoid bone in horizontal and vertical planes, and association between the hyoid bone and liquid bolus. Functional regression analysis can be a good methodology to analyze time series data of swallowing motion and to investigate features of swallowing impairment.
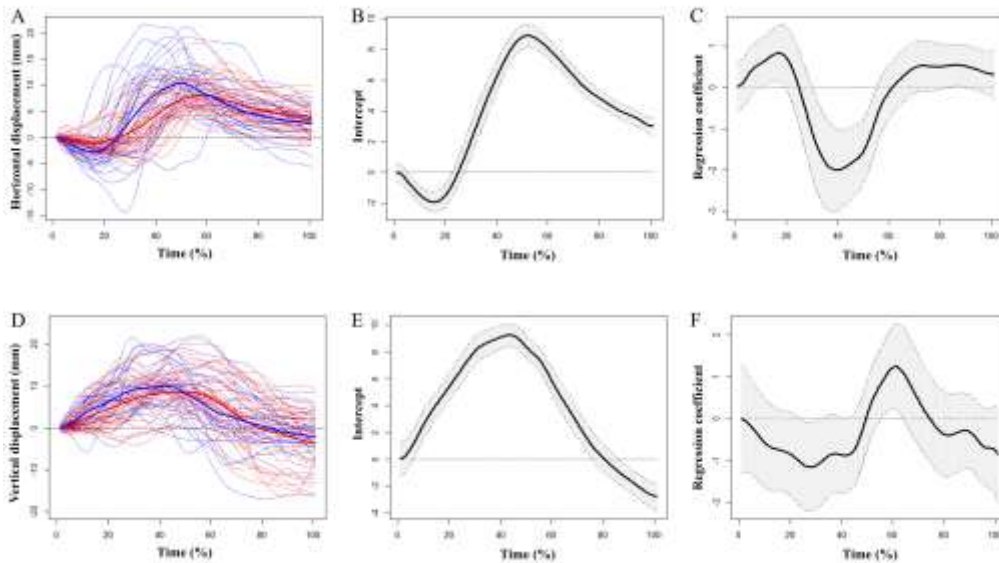
Results of functional regression analysis for horizontal and vertical displacement of the hyoid bone.

Results of functional regression analysis for horizontal and vertical velocity of the hyoid bone.
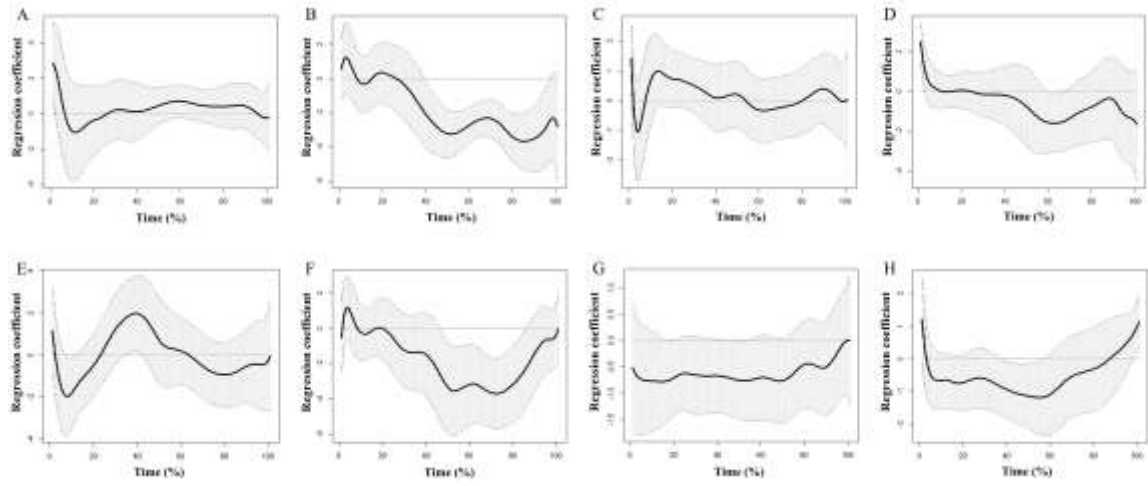
Estimated regression coefficient functions for the hyoid and bolus displacements in healthy adults (A-D) and patients with Parkinson's disease (E-H) using the functional regression model