Ultrasound Evaluation of Swallowing in People with Neurological Diseases – A Pilot Study

Joan, K-Y. Ma[1], Gabriella Quezada[1, 2], Jodi, E. Allen[2], Corinne Mossey- Gaston[3] & Alan, A. Wrench[1, 4]

[1]Clinical Audiology, Speech and Language Research Centre, Queen Margaret University, UK

[2]National Hospital for Neurology and Neurosurgery, UK

[3]Royal Papworth Hospital, UK

[4]Articulate Instruments Ltd, UK

Ultrasound evaluation of swallowing (USES) is an emerging tool for assessing swallowing. With the ultrasound probe placed under the chin, USES provides a mid-sagittal image of the vocal tract from the mandible to the hyoid, and the movement of the tongue and hyoid bone can be measured. The clinical translation of this tool can potentially provide an accessible and non-invasive option to observe the swallowing function. Studies that have previously explored using ultrasound to assess swallowing lack consensus on standard measurements for image acquisition and analysis (Allen, et al., 2021). Allen et al. (2022) presented a prioritised research agenda to support the translation of ultrasound as a swallowing assessment tool into clinical practice. The priority items were reliability of data acquisition, image analysis and validity. This pilot study investigates the feasibility and requirements of data acquisition for USES in people with neurological diseases. It will also compare the hyoid metrics based on USES to findings from videofluoroscopy.

Five people with neurological diseases, who were undergoing routine VFS due to suspected swallowing problem, were recruited for this study. USES was carried out on the same day as their VFS assessment. A pocket-sized ultrasound system (Micro, Articulate Instruments Ltd, Edinburgh, UK) operating in standard B-mode was used for recording. A 2–4 MHz 60 mm radius convex probe was fitted on the UltraFit headset to maintain the probe in the midsagittal plane and reduce movement relative to the head. Five 5-ml bolus swallows were recorded for each participant.

The movement of the hyoid bone was tracked throughout a swallow using the DeepLabCut with Mobile Network 1.0 network (Wrench & Balch-Tomes, 2022). From the tracked movement of the hyoid, a range of parameters were used to evaluate the amplitude, duration and velocity of the hyoid movements. The hyoid metrics were then compared to the results of the videofluoroscopy based on the Modified Barium Swallow Impairment Profile (MBSImP). Specifically, the correlation between the hyoid metrics and the Pharyngeal Total Sum and anterior hyoid excursion (component 9) were explored to evaluate the reliability of USES.

Qualitative analysis was also conducted to evaluate the clinicians' and the patients' experience in USES. This included the patients' overall experience in participating in the USES assessment and their ability in understanding the image. The technical challenges in data recording from the clinicians' perspective were evaluated.

This study is the first step to validate USES as a clinical tool for dysphagia assessment. The results showed potential for USES to be developed as an adjunct to measure swallowing function, and potentially in clinical settings where instrumental evaluation is not commonly used, such as in community clinics. Further adaptions of the recording protocol may also be required for different clinical populations.

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