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Reliability and Normalisation of Swallowing

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Abstract

Introduction: Surface electromyography (sEMG) objectively records muscle activity and is increasingly used in the assessment and treatment of dysphagia, but the reliability of these measurements has not been examined. International guidelines recommend normalising sEMG data to a reference measurement to enable fair comparison between sessions and individuals. However, the optimum reference measurement for swallowing is not known.

Methods: Fifteen dysphagic stroke survivors (<3 months post stroke, 9 male) and 85 healthy participants (42 male, aged 18- 89 years) attended two sessions one week apart and submental sEMG amplitude measurements were taken during swallowing. Intra-and inter-participant variability was examined within- and across-sessions with Bland-Altman plots and the coefficient of variation (CV). Data were normalised to the mean, maximum effortful and mean effortful swallow sEMG amplitudes and reliability compared.

Results: The maximum limits of agreement between swallows for healthy participants were -21.16 μV to 22.64 μV and -11.57 μV to 15.49 μV for the stroke group, with an increase between sessions. Interparticipant variability was high for all groups for absolute measurements (CV>70%). Normalising to the mean normal swallow significantly reduced intraparticipant ($p<0.001$) and inter-participant variability (CV<2.5%). Other normalisation methods did not improve variability.

Conclusion: This study provides reference data on the reliability of sEMG amplitudes in healthy and disordered swallowing. The high interparticipant variability argues against use of absolute sEMG measurements to compare individuals or groups and normalising to the mean normal swallow amplitude is recommended. Further studies are indicated to investigate other ways of controlling for influences on the sEMG signal.

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