SUPRAHYOID MUSCLE COMPLEX: A RELIABLE NEURAL ASSESSMENT TOOL FOR DYSPHAGIA?

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Background

1. The process of swallowing involves a complex and semi-automatic sequence of events requiring the coordination of 32 paired muscles (mouth to oesophagus) being regulated by seven cranial nerves.
2. Assessment of swallowing musculature using motor evoked potentials (MEPs) are used to evaluate neural pathways.
3. Recording of the swallowing musculature is often invasive, uncomfortable and unrealistic in normal clinical practise.

Objectives

To investigate the suitability of the suprahyoid muscle complex (SMC) as a target muscle by determining the reliability of measurements in healthy participants over days.

Methods

1. Seventeen healthy participants (mean age: 39.4 ± 10.7 years; all right hand dominant) were recruited.
2. Measurements were performed twice with one week between sessions.
3. Single pulse (120% and 140% of the resting motor threshold (rMT)) and paired pulse (2 ms and 15 ms paired pulse) transcranial magnetic stimulation (TMS) were used to elicit MEPs in the SMC.

Results

1. A large stimulus artefact resulted in MEP responses that could not be assessed in four participants.
2. There was no significant difference between day 1 and day 2 for the resting motor threshold (day 1: 46.2 ± 6.8% of MSO, day 2: 47.1 ± 8.1% of MSO, P = 0.64).
3. ≈50% of participants (range: 42%-58%; depending on stimulus type/intensity) had significantly different MEP values between day 1 and day 2 for single pulse and paired pulse TMS (Fig 1 and 2).

Conclusion

1) The assessment of the SMC using sEMG following TMS was poorly reliable for ≈50% of participants.
2) Although using sEMG to assess swallowing musculature function is easier to perform clinically and more comfortable to patients than invasive measures, the measurement of muscle activity using TMS is unreliable.
3) The use of sEMG for this muscle group is not recommended and requires further research and development.

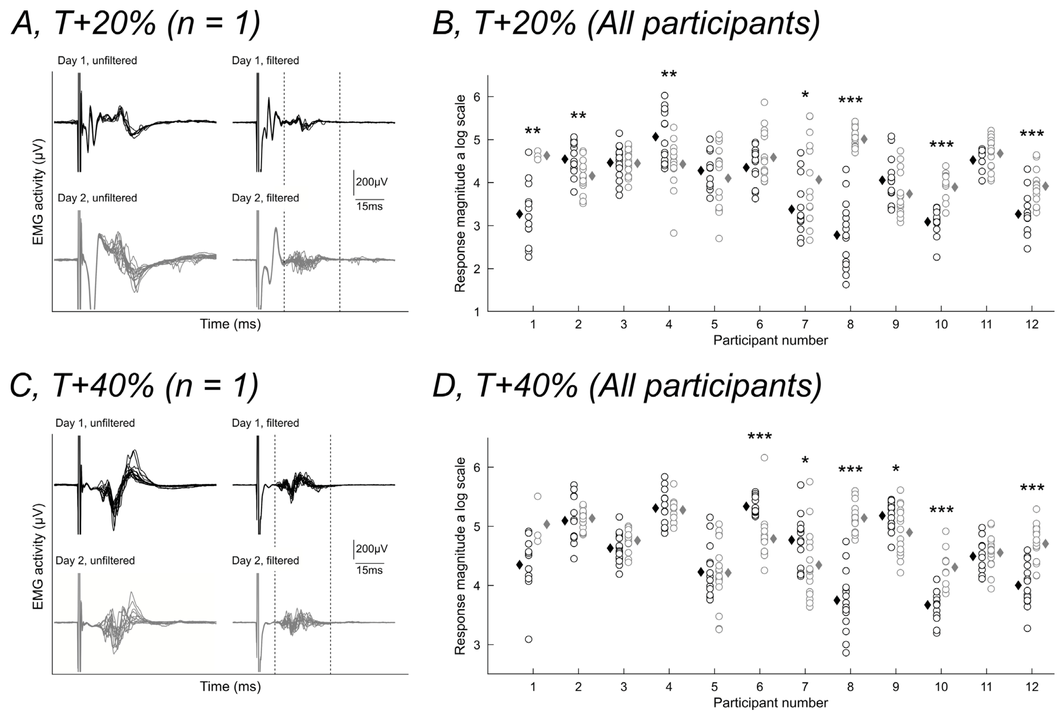

Figure 1:

Figure 1A and 1C: Raw unfiltered and heavily filtered (150–1000 Hz) EMG signals on day 1 (black lines) and day 2 (grey lines) for one participant for T+20% (Fig. 1A) and one participant for T+40% (Fig 1C). The vertical dotted lines represent the analysis window post stimulation, 15–45-ms for the participant in Figure 1A and 10–40-ms for the participant in figure 1C. The participant in figure 1A has 7 trials shown on day 1 and 15 trials shown on day 2 and the participant in figure 1C has 14 trials shown on day 1 and 12 trials shown on day 2. Both participants originally had 16 trials however, trials were removed due to background EMG that exceeded the limit.

Figure 1B and 1D: Peak-to-peak response magnitudes on a log scale for the filtered EMG data for all participants and all included trials for each participant on day 1 (black unfilled circles) and day 2 (grey unfilled circles) and the mean of these trials on day 1 (black filled diamonds) and day 2 (grey filled diamonds) for T+20% (Fig. 1B) and T+40% (Fig. 1D). '*', '**' and '***' represent significant differences between day 1 and day 2 to P < 0.05, P < 0.01 and P < 0.001.

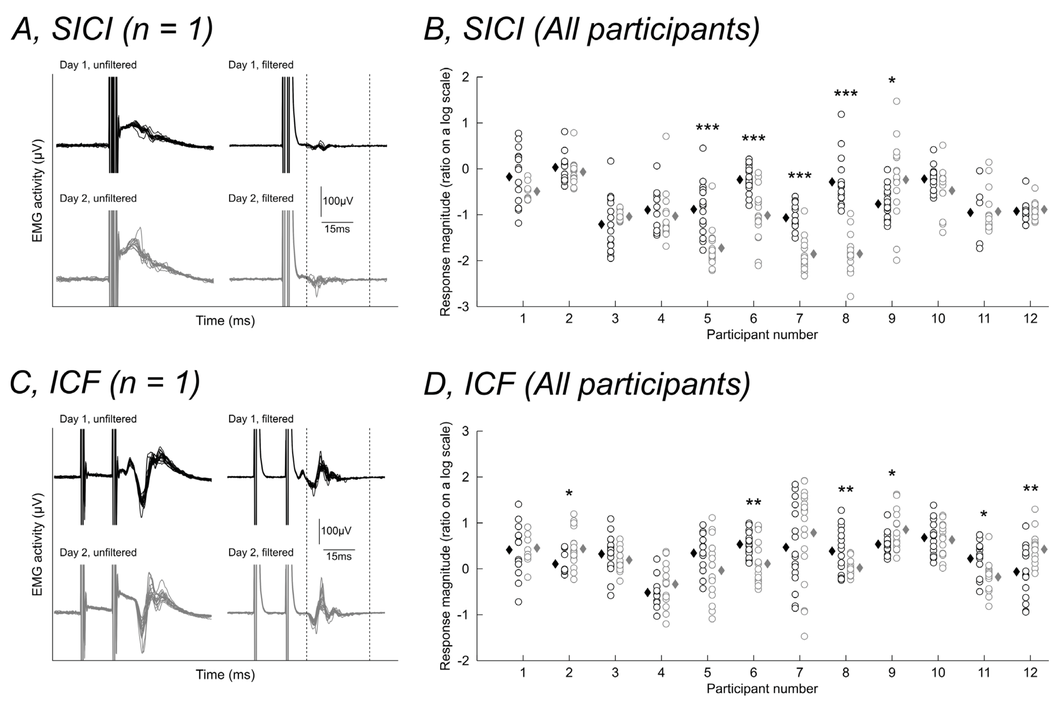

Figure 2:

Figure 2A and 2C: Raw unfiltered and heavily filtered (150–1000 Hz) EMG signals on day 1 (black lines) and day 2 (grey lines) for one participant for short interval intracortical inhibition (SICI: Fig. 2A) and one participant for intracortical facilitation (ICF) (Fig. 2C). The vertical dotted lines represent the analysis window 10–40-ms post the test stimulation. The participant in figure 2A has 15 trials shown on day 1 and 12 trials shown on day 2 and the participant in figure 2C has 16 trials shown on day 1 and 16 trials shown on day 2. The participant in figure 2A originally had 16 trials and trials were removed due to background EMG that exceeded the limit. No trials were removed for the participant in figure 2C.

Figure 2B and 2D: Peak-to-peak response magnitudes on a log scale for the filtered EMG data as a proportion of the mean peak-to-peak amplitude of the filtered EMG data for T+20% for all participants and all included trials for each participant on day 1 (black unfilled circles) and day 2 (grey unfilled circles) and the mean of these trials on day 1 (black filled diamonds) and day 2 (grey filled diamonds) for SICI (Fig. 2B) and ICF (Fig. 2D). '*', '**' and '***' represent significant differences between day 1 and day 2 to P < 0.05, P < 0.01 and P < 0.001.

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