Variability in cortical excitability – a TMS-EMG study with stimulus-response curves
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Introduction
➢ The general rule of thumb in TMS studies is to use an interstimulus interval (ISI) of at least 5s to avoid any cumulative effects on the responses.
➢ The 5s rule is based on studies in which TMS has been applied with a constant stimulation intensity (SI).
➢ A previous study by Mathias et al., 2014 [1] found that using varying stimulation intensities would allow shorter ISIs than 5s, without the any effects on the responses. However, these results were presented only on the group level, and thus, in this study, we aimed to evaluate the individual level results.

Methods
➢ The study included 12 healthy subjects (8 females, 22-60 years, one subject excluded due to miscalculated rMTguess).
➢ At the optimal representation site of the right APB, the rMTguess was calculated by using 3 pulses according to the following formula [2]:

\[ rMT_{guess} = \frac{SI + 8.83e^{-3} \times (4 - 50)}{1 + 0.363e^{-3} \times (4 - 50)} \]

(A=median MEP amplitude of the 3 repeated single-pulses in microvolts).
➢ rMTguess did not differ from rMTs estimated with conventional methods (data not shown).
➢ Thereafter, 3 single-pulse TMS sequences were applied with varying ISI (1–2s, 2–3s, 3–4s) in a random order. The SI was varied randomly between 0.75 and 1.25 of the rMTguess at 0.05 intervals (total 108 pulses/sequence).
➢ The rMT for each sequence was calculated from the stimulus-response curves formed from the data [2].
➢ The effect of ISI on the resulting rMT and on the MEP amplitudes was evaluated with repeated measures ANOVA.

Results
➢ The ISI had no effect on the rMT estimated from the curves (F=0.24, p=0.683) nor single-trial MEP amplitudes (F=0.90, p=0.405), but a significant subject by ISI interaction (F=3.64; p<0.001) was observed in MEP amplitudes (Figures 1 & 2).

Conclusions
➢ On the group level, the ISI seems to have no clear effect on the rMT or MEP amplitudes.
➢ On the individual level, the ISI affects the MEP amplitudes differently between subjects and therefore, the rMT or stimulus-response curves cannot be reliably estimated with short ISIs.

References: