Variability of BOLD response evoked by foot vibrotactile stimulation: influence of vibration amplitude and stimulus waveform.

The aim of the present was study to evaluate cortical and subcortical neural responses on vibrotactile stimulation of the foot and to assess somatosensory evoked BOLD responses in dependence of vibration amplitude and stimulus waveform. Sixteen healthy male subjects received vibrotactile stimulation at the sole of the right foot. The vibration stimulus was delivered through a moving magnet actuator system (MMAS). In an event-related design, a series of vibration stimuli with a duration of 1 s and a variable interstimulus interval was presented. Four stimulation conditions were realized using a 2 (amplitudes 0.4 mm or 1.6 mm) x 2 (waveform sinusoidal or amplitude modulated) factorial design. Stimulating with 0.4 mm amplitude compared to 1.6 mm stimulus amplitude more strongly activated the pre- and postcentral gyrus bilaterally and the right inferior, medial and middle frontal gyrus. In the reverse comparison significant differences were observed within the left inferior parietal lobule, the left superior temporal gyrus, and the left temporal transverse gyrus. In the comparison of sinusoidal versus modulated waveform and vice versa no significant activation differences were obtained. The inter-subject variability was high but when all four stimulation conditions were jointly
analyzed, a significant activation of S1 was obtained for every single subject. This study demonstrated that the BOLD response is modulated by the amplitude but not by the waveform of vibrotactile stimulation. Despite high inter-individual variability, the stimulation yielded reliable results for S1 on the single-subject level. Therefore, our results suggest that vibrotactile testing could evolve into a clinical tool in functional neuroimaging.