Depth sensitivity analysis of functional near-infrared spectroscopy measurement using three-dimensional Monte Carlo modelling-based magnetic resonance imaging

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Résumé en anglais	Theoretical analysis of spatial distribution of near-infrared light propagation in head tissues is very important in brain function measurement, since it is impossible to measure the effective optical path length of the detected signal or the effect of optical fibre arrangement on the regions of measurement or its sensitivity. In this study a realistic head model generated from structure data from magnetic resonance imaging (MRI) was introduced into a three-dimensional Monte Carlo code and the sensitivity of functional near-infrared measurement was analysed. The effects of the distance between source and detector, and of the optical properties of the probed tissues, on the sensitivity of the optical measurement to deep layers of the adult head were investigated. The spatial sensitivity profiles of photons in the head, the so-called banana shape, and the partial mean optical path lengths in the skin-scalp and brain tissues were calculated, so that the contribution of different parts of the head to near-infrared spectroscopy signals could be examined. It was shown that the signal detected in brain function measurements was greatly affected by the heterogeneity of the head tissue and its scattering properties, particularly for the shorter interfibre distances.
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