Imagent: Comparison with fMRI

Operational differences between the instruments

A magnetic resonance imaging (MRI) examination is not an easy undertaking for every person. Let us look at the external conditions: the patient is enclosed by the narrow tunnel while the instrument is generating a rattling noise and the patient is instructed not to move while the machine is taking measurements, which may take up to twenty-thirty minutes. In a word, the examination is not conducive to relaxation. These limitations of fMRI are severe when the subjects to examine are children or infants, adolescents with attention deficit hyperactive disorder and when the patient is confused and feels claustrophobic.

Imagent™ does not have these limitations. Fiber optics sensors are placed on the head of the patient who can be sitting on a chair in a friendly environment and move freely; no noise is generated by the instrument. The instrument also frees the scientist to conduct extended neural analysis studies of brain activity during movement - research that is impossible or impractical with fMRI. As fibers can be as long as 10 meters, the operator of the Imagent can be sitting at a distance from the subject or close to the subject, which opens several interesting options for investigational purposes.

In some applications the researcher wants to monitor the brain activity for an extended time period; when using Imagent™ there is no time limitation as the electrodes can be left in place even for several hours.

Comparison of the signals measured by Imagent and by fMRI

Functional MRI (fMRI) is a powerful technique for the study of cerebral activation. It does not have any penetration limits, provides high spatial resolution and allows event related measurements. Most studies of cerebral hemodynamics are based on the use of blood oxygen level dependent (BOLD) signal. The increase of the BOLD signal is typically interpreted as a decrease in the concentration of deoxy-hemoglobin (washout) due to the increased supply of oxy-hemoglobin.

Although the technique is widely used, it also suffers some severe limitations. The BOLD signal depends not only on the deoxy-hemoglobin concentration changes but also on changes in the total blood volume. In addition, a positive BOLD signal can be due to an increase in the water fraction in the measured volume. As more than one variable contributes to the signal, fMRI does not provide the biochemical specificity needed to distinguish physiological parameters.

Imagent™ measures changes in both oxy- and deoxy-hemoglobin concentration, therefore providing the researcher with two simultaneous parameters unequivocally related to the brain hemodynamics. The instrument, in addition to the hemodynamics signals, is also capable of directly detecting the neuronal activity that manifests through the fast signal (event related optical signal - EROS). NIRS techniques have the inherent capability to distinguish physiological parameters.

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