Site-specific monitoring of cerebral vascular hemodynamics with dynamic optical tomography


1 SUNY Downstate Medical Center, 2NIReS Medical Technologies, LLC, and 3NYU Child Study Center

INTRODUCTION

Dynamic near-infrared optical tomography is presently being applied in investigations of neural function, being primarily based on current model and routine measures of brain activity. The remarkably faster kinetics of light and associated indices in optical systems compared to macroscopic vibrational or thermal changes of the tissue are the main factors leading to a new branch of experimental and clinical neuroscience. The unique advantages of optical tomography include its ability to estimate solute mass transport, blood volume changes, and hemodynamic fluctuations in vivo. The main limitations of standard optical methods are the depth of optical detection and the tissue absorption coefficient, which are caused by the scattering properties of the tissue. Optical smoothing, dispersion, and attenuation determine the components of the transmitted light (peak at 700 nm), which vary across tissue types, with higher absorption and scattering coefficients in the skull, muscle, and fat, respectively.

In the present work we focus on the analysis of neurovascular coupling, where light detection is performed using a near-infrared light source. The optic nerve is a connective tissue that forms the main nerve fibers for the retina, which project into the brain. The primary source of energy for the optic nerve is a green light (532 nm), which is commonly used for ophthalmic surgery. The primary function of the optic nerve is to transmit signals from the retina to the brain, where the information is processed and interpreted. The optic nerve is responsible for the transmission of visual information from the retina to the brain, which is crucial for the processing and interpretation of visual information, and for the coordination of motor and sensory functions. The optic nerve is a crucial component of the visual system, playing a vital role in the transmission of visual information from the retina to the brain, where it is further processed and integrated with other sensory inputs.