Functional near-infrared spectroscopy (fNIRS) neuroimaging for infants, people with disabilities, and healthy adults: advantages and problems.

Takeo Kondo[a], Ippeita Dan[b], Sotaro Shimada[c]

[a] Research Center for Advanced Science and Technology, The University of Tokyo
[b] Sensory & Cognitive Food Science Lab, National Food Research Institute
[c] School of Science and Technology, Meiji University

Our objectives in this presentation are 1) to explain a basic measurement principle of this neuroimaging method which is called functional near-infrared spectroscopy (fNIRS) and 2) to discuss about their advantages (non-invasive, unconstraint, robust against movement artifacts, low cost, space-saving) and problems (unstandardized data analysis method, some practical limitations for conducting experiments) in the comparison with other neuroimaging methods, and additionally, 3) to give some examples of analysis methods and practical usage in some actual research for infants, people with disabilities, and healthy adults.

fNIRS is a neuroimaging technique to investigates status of neural activation in brain tissue through hemodynamic changes which are measured from the extinction ratio of near-infrared lights which was passing through the brain tissue. It is known that the near-infrared semiconductor laser which is used as near-infrared light source is harmless when it directly exposes to human body. Thus fNIRS is considered as a *non-invasive* neuroimaging method unlike other functional neuroimaging methods such as PET, fMRI, MEG. The non-invasiveness is one of the reasons why this technique attracts attentions of researchers except for healthy adult participants like infants, people with disabilities. Additionally, the NIRS sensor is small-sized so that the sensor itself can be attached on participants' scalp, thus their body movement is *unconstraint* and the measurement is *robust against movement artifacts*. This makes possible to conduct experiments involved in comparatively large body movements unlike other neuroimaging methods.

Using fNIRS has many advances though, the method to analyze fNIRS data is *not standardized* yet. We will introduce a SPM-like analysis method which recently we have been working on establishing and other candidates for analyzing fNIRS data. And as the examples of practical fNIRS usage, we will introduce our several infant and disability studies (e.g., prefrontal oxygenations for pain of injection treatment in ultra low birth weight infants; neural basis of nonverbal information involved in finger-braille translation of speech language in deaf-blind people) or others.