

Label-free optical recording of neural activity in brain slices using optical fiber

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Electrical neural probe is important tool in the neural activity study from recording membrane potential to study of brain activity. But electrical neural probe has some problem. When recording neural activity congenital artifact arises, artifact and in case of silicon based electrode, it can break easily by external stress. Also for long term recording, fibrous and cellular sheath growth around the electrode, so it becomes hard to recording neural activity. It is well known that neural activity can be recorded from detecting intrinsic optical signal (IOS). By using IOS and optical fiber, new method of neural probe - optical neural probe which differs with electrical neural probe may be produced. Optical signal doesn't have an artifact, and optical fiber is flexible so it does not break easily. Also, light can penetrate a cellular sheath, it is expected that long term neural recording is possible. In this study, we recorded neural activity elicited by electrical stimulation. Also we tried to detect neural activity by recording reflectance change using optical fiber simultaneously. To obtain reflectance change, we did not use any voltage sensitive dye or pharmacological agent. We stimulated brain slice using alternative monophasic voltage pulse of 5V to 50V every second. Then we recorded monophasic reflectance change in the neural pathway of brain slice. Reflectance change didn't be seemed when stimulate the site where has no neural pathway. Reflectance change was recorded simultaneously with electrical recording and has a maximum change of 0.01% and 3ms duration. Also, with decreasing stimulation amplitude, both neural activity and reflectance change are diminished. These data provide that neural activity can be recorded by fast intrinsic optical signal. Moreover, we expect that this study can be a primary study of development optical neural probe for brain activity imaging.

Key word: Neural activity, intrinsic optical signal, optical fiber, reflectance, brain slice