

Fabrication of Fork-Shaped Retinal Stimulator Integrated with CMOS Microchips for Extension of Viewing Angle

Toshihiko Noda*, Kiyotaka Sasagawa, Takashi Tokuda,
Hiroyuki Kanda¹, Yasuo Terasawa², Hiroyuki Tashiro³,
Takashi Fujikado¹ and Jun Ohta

Nara Institute of Science and Technology, 8916-5 Takayama, Ikoma, Nara 630-0192, Japan

¹Osaka University, 2-2 Yamadaoka, Suita, Osaka 565-0871, Japan

²NIDEK Co., Ltd., 13-2 Hama-cho, Gamagori, Aichi 443-0038, Japan

³Kyushu University, 3-1-1 Maidashi, Higashi-ku, Fukuoka 812-8582, Japan

(Received February 27, 2014; accepted July 30, 2014)

Key words: retinal stimulation, viewing angle, fork-shaped stimulator, CMOS microchip, *in vivo* experiment

A fork-shaped retinal stimulator for a wide viewing angle was fabricated and demonstrated. This stimulator has two flexible fork elements, each with a stimulus head. The two fork elements can be implanted at different places in the eyeball to cover a wider area of the retina. The stimulus head has stimulus electrodes with the same shape as the electrodes utilized in a clinical trial for six weeks. Complementary metal-oxide semiconductor (CMOS) microchips were integrated into the stimulator and mounted next to the stimulus electrodes. Since stimulus current generators are integrated into the microchips, no external wires for stimulus current are required. A multiplexer, which reduces the number of wirings, was also integrated into the microchips. The fabricated stimulator was evaluated through *in vivo* animal experiments. The stimulator was successfully implanted in two places of the eyeball. Retinal stimulation by the device evoked nerve responses from optic chiasma and produced a specific peak of evoked potential. Experimental results demonstrate the proof of concept of a fork-shaped stimulator and suggest that the same device configuration can realize multiple fork-shaped stimulators for a wider viewing angle. Moreover, increasing the number of fork elements of the multifork stimulator without additional wirings becomes possible.

*Corresponding author: e-mail: t-noda@ms.naist.jp