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Abstract Title: A Seven Segment Electrode Stimulation System for Retinal Prosthesis

Presentation Time: 3:00 PM - 4:45 PM

Reviewing Code: 299 retinal prostheses - RE

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Purpose: To provide flexible stimulation patterns for retinal prosthesis, a seven segment electrode stimulation system is introduced. The seven segment configuration is useful in retina prosthesis development because it can present visual cues for wide range of alphanumeric characters with minimum number of stimulation channels. The system is designed and fully characterized to be used in *in vivo* experiments on rabbits.

Methods: The seven segment electrode stimulation system consists of an electrical stimulation chip and a seven segment electrode. To deliver current pulses for retinal stimulation, an electrical stimulation chip was fabricated using 0.35 μ m technology. The chip has seven channels and 8-bit current drivers. Current amplitude is programmable, and both stimulation duration and inter-pulse delay can be modulated with a 4-bit resolution. The polarity of charge-balanced biphasic pulses can be selected between cathodic first pulses and anodic first pulses. Both monopolar stimulation and bipolar stimulation are possible. Rabbits were used for testing of the electrode stimulation system. The inserted seven segment electrode array based on polyimide was connected to electrical stimulation chip for *in vivo* stimulation experiment. Encapsulated electrical stimulation chip with batteries was placed on the back of rabbit. Electrically evoked potentials are measured from the animals.

Results: The seven segment electrical stimulation system operates as designed. Wide range of parameter selection is possible and stimulation pattern can be changed with simple control. The electrical stimulation chip can deliver stable currents from 8 μ A to 2 mA, simultaneously to all 7 channels. Both pulse width and inter-pulse delay can be modulated up to 3 ms. The stimulation rate can be increased up to 1 k pulses-per-second per electrode. Electrically evoked potentials recorded from rabbits following stimulation delivered according to various visual patterns will be reported.

Conclusions: The seven segment electrical stimulation system provides a useful tool for retinal implant development.

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