Distributions of Cortical Activities in Cat area 17/18 in Response to Visual and Electrical Retinal Point Stimuli: Investigations for a Retina−Implant

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Blind persons with receptor degeneration and intact retinal ganglion cells can perceive phosphenes with electrical intraocular stimulation (Humayun et al 1999). **Goal:** Estimate the spatial resolution achievable with electrical stimulation at the retinal surface. **Methods:** We made cortical recordings by a linear array of 16 µ−electrodes from anesthetized cats (electrode pitch: 0.35 mm), while stimulating retinotopically corresponding and non−corresponding locations with short charge−balanced impulses directly at the inner limiting membrane (7 retinal electrodes, hexagonal arrangement). For comparison, the distribution of cortical activation was measured with dynamic multifocal visual point stimuli. The reverse analysis, determination of visual and electrical *receptive fields* (RFs) of local cortical populations (MUA− and LFP−signals), was also performed. Recordings from stimulation electrodes helped to monitor their tip location relative to the retinal surface and to the cortical RFs. **Results:** The cortical distributions of visual and electrical point stimuli is at about the same scale, with the electrically evoked distributions being on average slightly larger than their respective visual equivalents. More confined distributions and hence, higher resolutions, can be obtained if cortical single unit activity is used. **Conclusions:** The cortical distributions, activated by focal electrical stimuli in the retina, provide a coarse estimate for an upper bound of the possible perceptual resolution achievable with retina implants. However, the cats had an intact visual system that might be considerably different to that of a blind with retinitis pigmentosa.

- Humayun MS, deJuan E, Weiland JD, Dagnelie G, Katona S,Greenberg RJ, Suzuki S (1999) Pattern electrical stimulation of the human retina. Vis Res 15:2569−76

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