Major gaps in glaucoma diagnosis and management are the lack of objective tools for functional measurements that permit earlier diagnosis and improved progression detection. Furthermore, the improved sensitivity of functional measurements would greatly benefit clinical trial endpoints in future neuroprotection and neuro regeneration studies that are independent of intraocular pressure (IOP)-based outcomes. In diagnosing early glaucoma, optic nerve imaging can identify changes that precede the development of visual field defects. However, in more advanced glaucoma, a “floor effect” is reached and this imaging is no longer effective at identifying disease progression. Another major clinical tool is visual field testing, which is a subjective test requiring patient cooperation and is not sensitive enough to identify early changes when RGC function is diminished but not yet irreversibly damaged. Indeed, it has been estimated that up to 35% of RGCs are lost prior to detectable visual field loss (Ker認為Baumrind et al., 2000; Medeiros et al., 2015). Therefore, major gaps in glaucoma management include the inability to a) identify early functional perturbations and b) monitor glaucoma progression in patients using an objective test that can identify functional impairment of specific visual pathways that are vulnerable early in the disease.

This pilot project seeks to exploit recent evidence generated in our laboratory that OFF ganglion cells are selectively vulnerable in glaucoma (Della Santina and Ou, 2016; Ou et al., 2016). Our central hypothesis is that OFF ganglion cells and the OFF pathway are damaged earlier and to a greater extent than ON ganglion cells and the ON pathway. The goal of this project is to determine the cell type and visual pathway specificity of RGC dysfunction in a mouse model of experimental glaucoma, with the goal of identifying novel ERG protocols that could be adopted in clinical practice to yield photographs in the retinal function of glaucoma patients, especially when visual field defects are not yet detectable or their progression cannot be followed with sufficient sensitivity.

INTRODUCTION

ERG RECORDINGS

SINGLE CELL RECORDINGS

This study was supported by the Glaucoma Research Foundation, San Francisco, CA. This work was also made possible in part by NIH-NEI EY002162 – Core Grant for Vision Research and the Research to Prevent Blindness Unrestricted Grant to the Department of Ophthalmology, UCSF.