#3524256

# Functional vision in the real-world environment with a 44-channel suprachoroidal retinal prosthesis

#### Lewis Karapanos<sup>1,2</sup>, Carla J. Abbott<sup>1,2</sup>, Lauren N. Ayton<sup>1,2,3</sup>, Maria Kolic<sup>1</sup>, Myra B. McGuinness<sup>1,4</sup>, Elizabeth K. Baglin<sup>1</sup>, Samuel A. Titchener<sup>5,6</sup>, Penelope J. Allen<sup>1,2</sup>

<sup>1</sup>Centre for Eye Research Australia, Royal Victorian Eye and Ear Hospital, Australia; <sup>3</sup>Department of Optometry and Vision Sciences, University of Melbourne, Australia; <sup>3</sup>Department of Surgery, Melbourne, Australia; <sup>3</sup>Department of Surgery, Melbourne, Australia; <sup>3</sup>Department of Surgery, Melbourne, Australia; <sup>4</sup>Melbourne, Australia; <sup>4</sup>Mel <sup>6</sup>Medical Bionics Department, University of Melbourne, Melbourne, Australia; <sup>9</sup>Research School of Engineering, Australia; <sup>9</sup>Research School of Engineering, Australia; <sup>10</sup>Department of Pathology, University of Melbourne, St. Vincent's Hospital, Australia

#### Introduction

- The Bionic Vision Technologies Australia suprachoroidal retinal prosthesis has been shown to improve functional vision in patients with late-stage retinitis pigmentosa (RP) in a laboratory setting (See Kolic talk #3544660)
- AIM: To determine if late-stage RP patients implanted with a prosthesis could increase their performance in real-world functional visual tasks with the device ON than OFF

## Methods

### SUBJECTS (N=3)

• Three subjects with advanced RP (bare light perception only) who received a 44channel suprachoroidal retinal implant as part of a clinical trial (NCT03406416; 2017-2021)

#### **FLORA**

#### Functional Low-Vision Observer Rated Assessment<sup>1,2</sup> (FLORA<sup>™</sup>) instrument

- **FLORA<sup>™</sup>** consists of 35 functional vision tasks spanning across 4 domains ('Visual Orientation', 'Visual Mobility', 'Interaction with Others' and 'Daily Life')
- Ease of task was assessed by an independent orientation and mobility specialist using a four-point scale from impossible to easy
- There was an 8-week post-surgery recovery period prior to switch on
- Post-fitting & training baseline assessments were conducted at 17 weeks after switch on
- FLORA was conducted pre-surgery, at post-fitting & training baseline and then 3-monthly for 2 years.

Device ON Device OFF

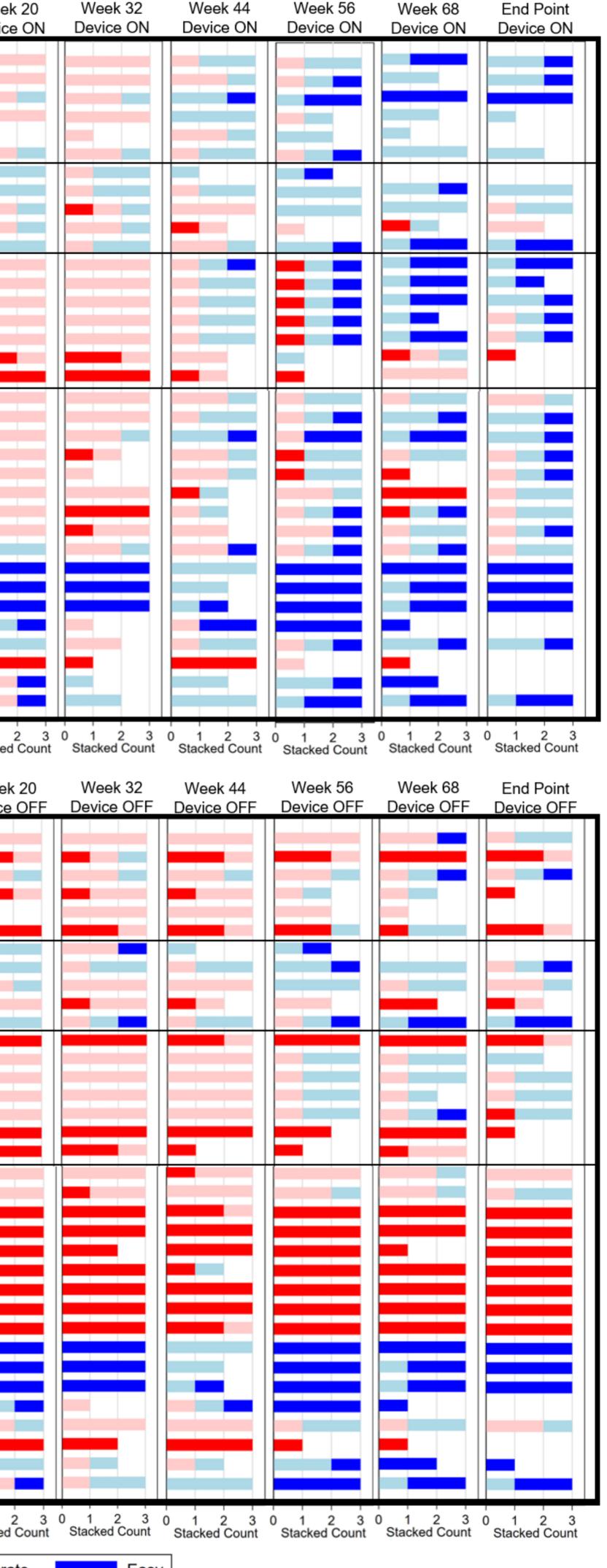
А		Pre-Surgery Device OFF	Week 17 Device ON	Wee Devic
Visual Orientation	Locate lights in the environment Visually find doorways Use light from windows to determine orientation Use artificial light to determine orientation Use the sun to determine orientation			
	Recognise and use shapes for orientation and environmental information Independently cross residential streets by following the lines of a crosswalk			
Visual Mobility	Avoid obstacles while walking Estimate the size of an obstacle Avoid low-hanging branches, plants, head-high shelves and so on Detect curbs			
Interaction with Others	Visually locate people in a non-crowded setting Determine when people walk by Detect the approach of another person Determine the direction of movement of people walking by Track another person Visually locate people in a crowded setting Determine direction another person is facing			
Daily Life	Determine whether room lights are on or off Locate ordinary objects at various distances (familiar environment) Visually locate a place setting on a dining table Visually locate/identify things in the bathroom (familiar environment) Visually locate/identify things in the bathroom (unfamiliar environment) Visually locate dishes while washing Visually locate clothes Visually find pots/pans/utensils in the kitchen Sort light from dark laundry Travel within home independently Identify top step/bottom step Negotiate stairways independently Cut/chop food Identify ordinary objects at various distances Visually identify food on a plate Heat/reheat food Maintain safety: falls/spills/burns			
В		0 1 2 3 Stacked Count Pre-Surgery Device OFF	0 1 2 3 Stacked Count Week 17 Device OFF	0 1 Stacked Weel Device
Visual Orientation	Locate lights in the environment Visually find doorways Use light from windows to determine orientation Use artificial light to determine orientation Use the sun to determine orientation			
Visual Mobility	Recognise and use shapes for orientation and environmental information Independently cross residential streets by following the lines of a crosswalk Avoid obstacles while walking Estimate the size of an obstacle Avoid low-hanging branches, plants, head-high shelves and so on Detect curbs			
Interaction with Others	Visually locate people in a non-crowded setting Determine when people walk by Detect the approach of another person Determine the direction of movement of people walking by Track another person Visually locate people in a crowded setting			
Daily Life	Determine direction another person is facing Determine whether room lights are on or off Locate ordinary objects at various distances (familiar environment) Visually locate a place setting on a dining table Visually locate/identify things in the bathroom (familiar environment) Visually locate/identify things in the bathroom (unfamiliar environment) Visually locate dishes while washing Visually locate clothes Visually locate clothes Visually find pots/pans/utensils in the kitchen Sort light from dark laundry Travel within home independently Identify top step/bottom step Negotiate stairways independently Cut/chop food Identify ordinary objects at various distances Visually identify food on a plate Heat/reheat food Maintain safety: falls/spills/burns			
		0 1 2 3 Stacked Count	0 1 2 3 Stacked Count	0 1 Stacked
	Impossible	Diffici	ılt	Moder

'End Point' of study was defined as the last time point in the study where FLORA measures were taken. This was at 136-, 110- and 109-weeks post-device fitting for each of the participants.

Difficult

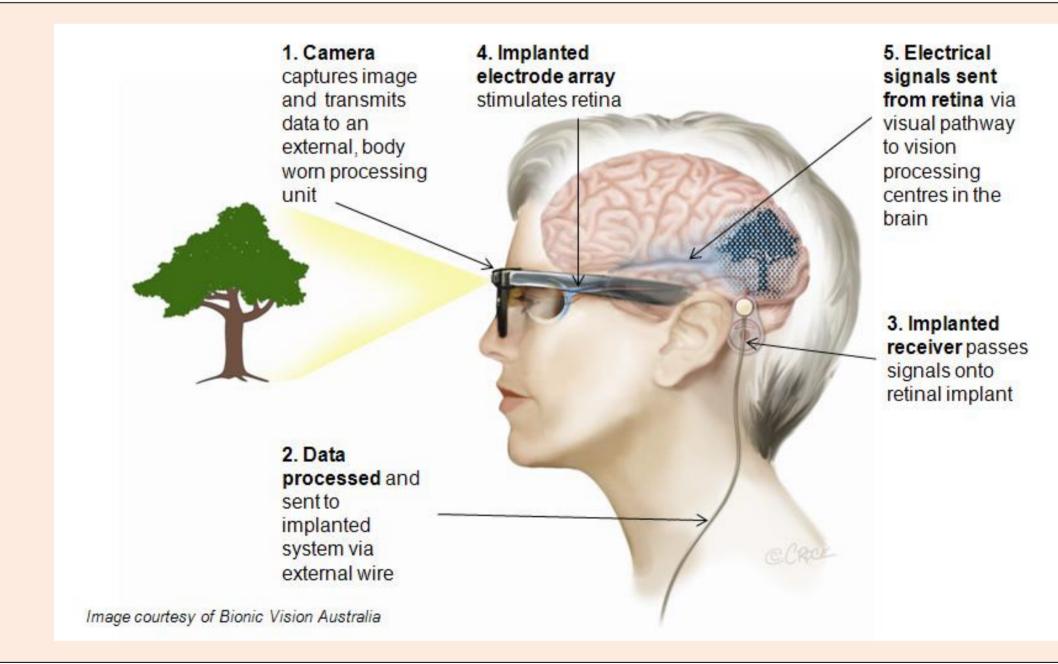
Impossible





## Results

- rehabilitation training.
- study endpoint (2 years).



Participants with late-stage RP implanted with the second-generation suprachoroidal retinal prosthesis demonstrated improved ease of task scores with the device ON over 2 years

# Conclusion

• Functional vision tasks were easier to complete over time with device ON, trending towards 'moderate' and 'easy'

compared to 'difficult' at pre-surgical baseline.

• With device OFF, many tasks were 'impossible' or

'difficult' to complete throughout most time points.

• Most striking improvement is seen with device ON in the

first 6 months from the post-fitting baseline (week 17 to

week 44) indicating a learning effect from visual

• Ease of task scores remained stable from week 44 to the

• Tasks highly dependent on vision showed the greatest improvement (i.e., visually finding doorways in Visual Orientation, and 7 tasks in Daily Life).

The device shows potential utility in everyday life, and further research into its real-world use is warranted. Except for a single neutral experience at week 20, there was an overall positive impact of the retinal prosthesis on daily life for all participants at all time points