

Predicting face recognition ability using macular focal cone electroretinography in patients with macular degeneration

Presentation No.4786

Understanding how visual deficits affect a patient's everyday life is a crucial aim of clinical research.

For patients with macular degeneration (MD), one such domain in which they particularly struggle is that of face recognition.

Here, we sought to find a suitable method for predicting face recognition ability from measures of visual function in patients with MD in cone-rod dystrophy

The Problem

Various measures of visual function have been hypothesized to relate to face recognition ability:

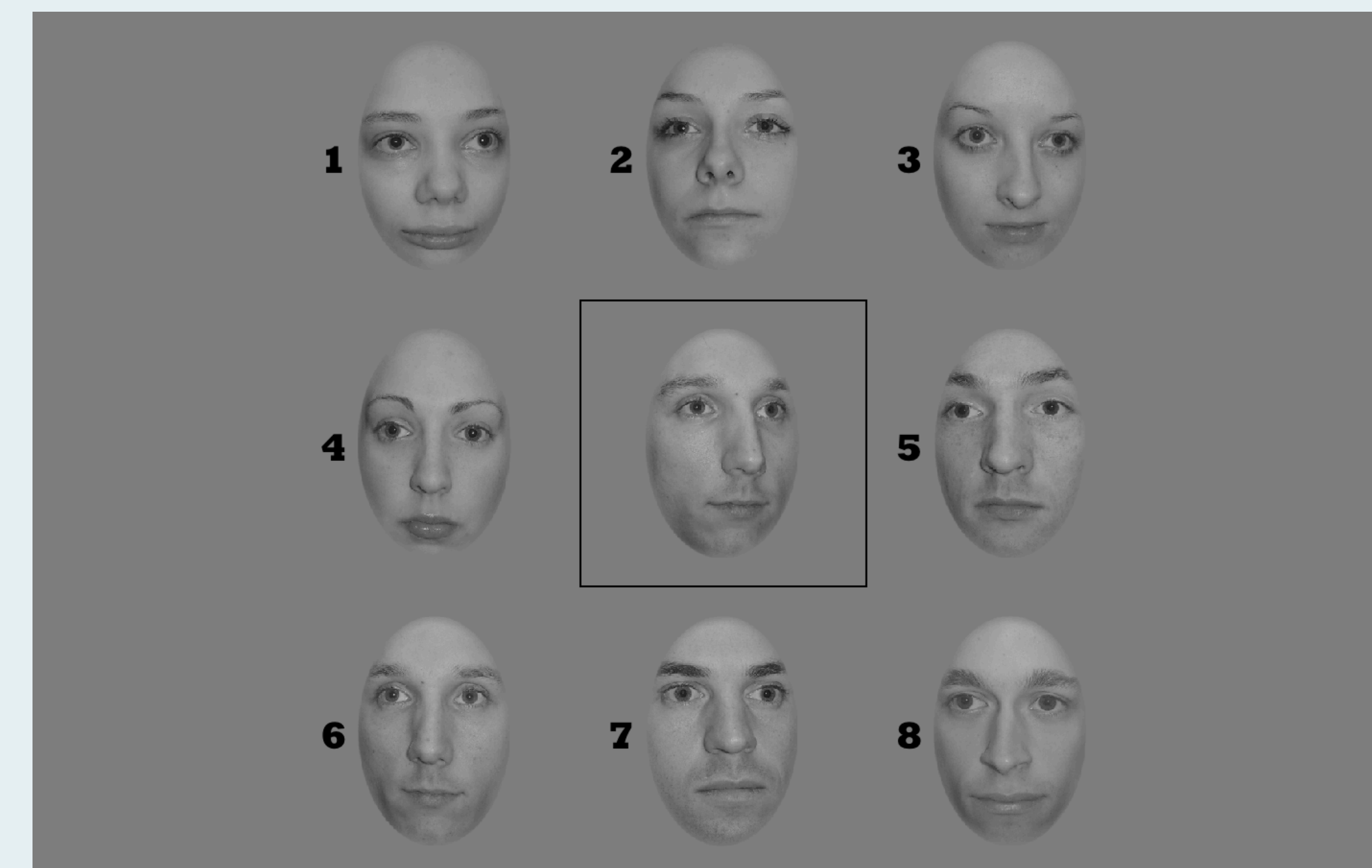
- **Visual Acuity**
 - Bullimore *et al.* (1991): statistically significant correlation, $p < .005$
 - Alexander *et al.* (1988): statistically insignificant correlation, $p = .53$
- **Contrast sensitivity**
 - Barnes *et al.* (2011): statistically significant correlation, $p < .001$
 - Bullimore *et al.* (1991): statistically insignificant correlation, $p > .05$

Contradictory results pervade the literature

We hypothesize that part of the problem may lie in the imprecision of behavioral measures of visual function: **a more precise predictor may be found in electrophysiological measures**

Specifically, we investigated the relationship between macular focal cone electroretinogram (fERG) signal amplitude and face recognition ability in patients with macular degeneration.

Methods



“Who is the guy in the center?”

adapted from Barnes *et al.* (2011)

Stimuli

Adapted from Gaspar *et al.* (2008)

4 women and 4 men

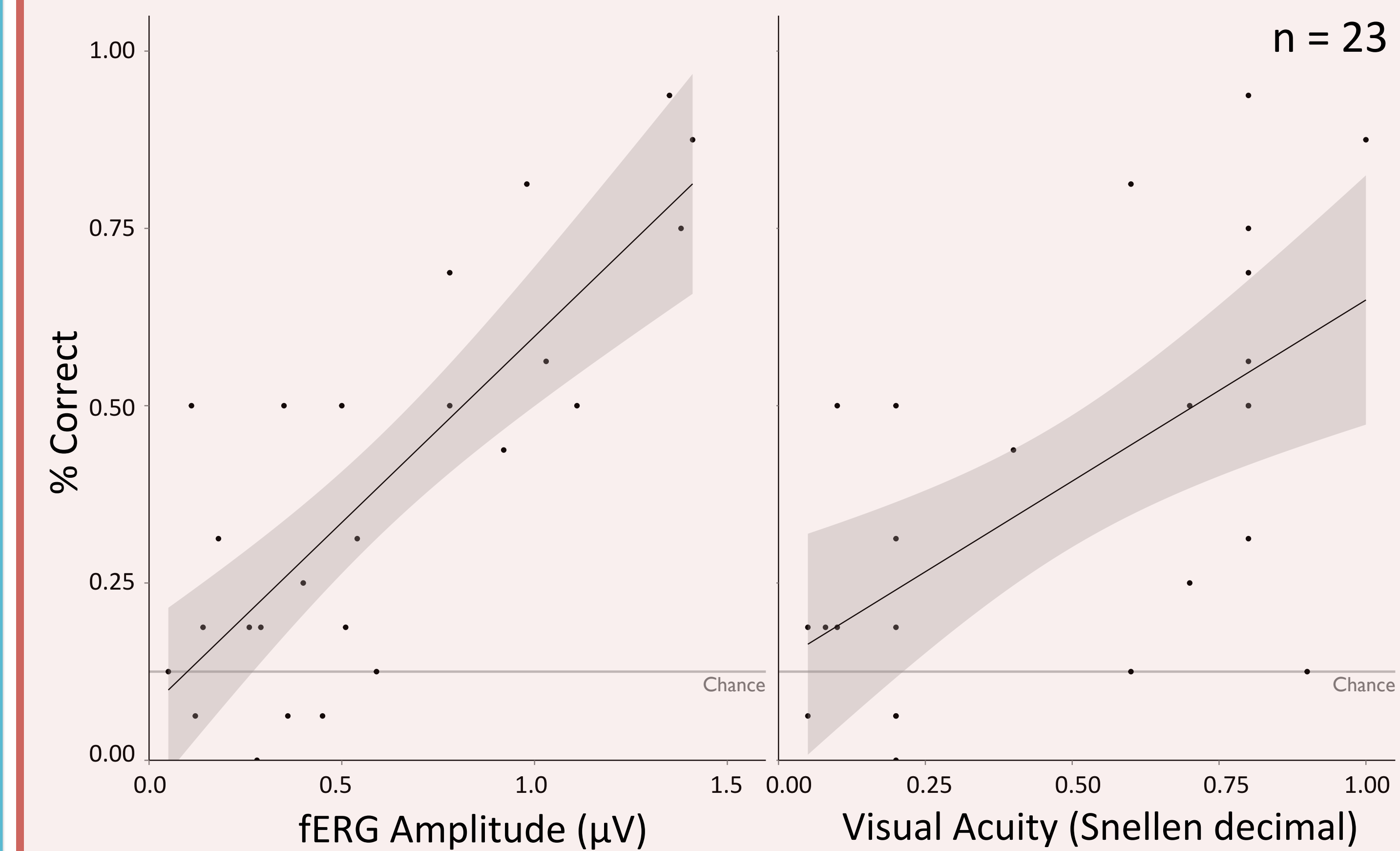
Images cropped to exclude clothing and hair
Grayscale

RMS contrast equated across images

Focal cone electroretinogram

- Recorded from central 18° region
- Flickering uniform red field superimposed on a constant equiluminant steady adapting background minimizing stray-light modulation
- Skin electrode taped on the skin of the lower eyelid, with another placed on the contralateral eye as a reference
- We measured the amplitude of the response first harmonic, quantified at 41 Hz using discrete Fourier analysis

Results



Linear regression analysis: r^2

	fERG	VA	Score
fERG	1.0	.431	.640
VA	--	1.0	.368
Score	--	--	1.0

Replicated previously found correlations:

- **VA and face recognition**
Tejeria *et al.* (2002): $r^2 = .48, .37$
- **VA and fERG signal**
Gallis-Resta *et al.* (2013), Moschos *et al.* (2013)
- **VA and response time**
Barnes *et al.* (2011)

Whereas visual acuity accounts for 37% of variability in face recognition performance, fERG accounts for up to 64%

The results suggest that fERG signal amplitude is a reliable predictor of face recognition ability, perhaps more reliable than visual acuity

On broader scope, the findings here support the hypothesis that electrophysiological measures of visual function may be more sensitive and precise than behavioral ones for examining the effect of visual deficits on performance of complex everyday tasks such as recognizing faces.

References

Barnes CS, De L'Aune W, Schuchard RA. A test of face discrimination ability in aging and vision loss. *Optom Vis Sci.* 2011;88:188–199.
Gaspar C, Sekuler AB, Bennett PJ. Spatial frequency tuning of upright and inverted face identification. *Vision Res.* 2008;48: 2817–2826.

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