

The metabolic demands of visual stimulation can be assessed by measurement of the haemodynamic response, and several studies have indicated that stimuli that are uncomfortable give rise to a relatively large haemodynamic response in the visual cortex. Haigh, Barningham et al. (2013) used near infra-red spectroscopy of the visual cortex and found that coloured patterns gave a larger oxyhaemoglobin response if they had large colour differences and were uncomfortable. Huang, Cooper et al. (2003) measured the occipital blood oxygenation level dependent (BOLD) response to achromatic gratings with a range of spatial frequencies and showed that those with mid spatial frequency (which are uncomfortable to view) gave the largest response.

It is also quite generally the case that individuals who are susceptible to discomfort show a larger BOLD response than those who are not. Huang, Cooper et al. (2003) showed that patients with migraine who reported relatively high levels of discomfort from patterns gave a BOLD response with relatively high amplitude. Martin, Sanches del Rio et al. (2011) compared 19 patients with migraine with 19 controls. Patients with migraine had a larger number of activated occipital voxels than controls. Cucchiara, Datta et al. (2014) found that in migraine patients who experienced aura the number of symptoms of discomfort they reported by questionnaire correlated with the amplitude of the BOLD response to visual stimulation.

The relationship between discomfort and cortical oxygenation is not confined to patients with migraine. Alvarez-Linera Prado, Rios-Lago et al. (2007) compared 20 photophobic patients with 20 controls when they viewed a light source with different intensities. There was a direct relationship between stimulus intensity and the BOLD response and the response was higher in the photophobic patients, particularly at low and medium light intensities. Chouinard, Zhou et al. (2012) reported a case study of an individual with visual stress. They measured the BOLD response when lists of words were read and found an elevated activity in a variety of visual and somatosensory areas. Bargary, Furlan et al. (2015) compared participants with high and low discomfort glare thresholds while

they identified the orientation of a Llandolt C. The group that was sensitive to discomfort glare had an increased BOLD response localized at three discrete bilateral cortical locations, in the cuneii, the lingual gyri and in the superior parietal lobules.

There is therefore a relationship between discomfort and the magnitude of the haemodynamic response in the visual cortex, both in terms of the stimuli that evoke discomfort, which generally induce a larger response, and in terms of the individuals who are susceptible to discomfort, in whom the response is larger than in others.

4. References

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