A fMRI Study in Anisometropic Amblyopes before and during occlusion therapy: Comparison of responders and non-responders on basis of cortical activity pattern

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Introduction: Amblyopia is associated with functional loss of vision with no organic cause. This may be associated with decrease in colour vision, contrast sensitivity, Vernier acuity, Stereoaucity and spatial localisation. In our study, we observed BOLD responses on visual stimulation using black and white checkerboard flickering at 8 Hz in unilateral Anisometropic Amblyopes in response to occlusion therapy.

Material and method: 10 left eye affected amblyopes were recruited (mean age 12.10±2.88yrs), all were started on occlusion therapy after appropriate refractive correction and followed for 4m±6wks. Responders and non-responders (at least two line improvement in visual acuity was taken as responders) were compared on basis of fMRI cortical activity, age, visual acuity at first and final follow-up, refractive error in both eyes. The studies were carried out using 1.5T whole body MR scanner (Magnetom Avanto, M/s. Siemens Erlangen, Germany) with 12 channel head coil. Visual cues were projected using a MR compatible Binocular LCD goggles (NordicNeuroLab, Norway). The stimulus was developed using Superlab (version 4.2, Cedrus Inc, USA) and was presented to affected eye and fellow eye separately (with the other eye closed). 75 whole brain volumes were acquired using echo planar imaging (EPI) sequence, with parameters: no. of slices 29 (axial orientation), slice thickness: 4.5mm, TR:2000 ms, 64x64 matrix resolution (3.6x3.6x4 mm3 voxel dimension), and FOV of 230mm. Pre and post-processing were carried out using SPM8 (Wellcome Department of Cognitive Neurology, London, UK). The BOLD clusters were converted from mni template to the Talairach and Tornoux coordinates, for estimation of anatomical areas. Two sample-t-test (p<0.001, cluster threshold 10) was used for group analysis.

Results: On comparing age, visual acuity (both eye), refractive error (both eye) at baseline, there was no significant difference between responders and non-responders, but the two groups showed significant difference in cortical activation pattern on BOLD (Table 1, 2). On viewing with amblyopic eye, responders showed more cortical activation in visual cortex and visual association areas. Non-responders exhibited more activity in contralateral attention area.

Discussion: An increase in cortical activity in visual cortex areas on viewing with amblyopic eye in responders in comparison to non-responders may suggest that response to occlusion therapy is better if visual cortex is activated on BOLD task at 8 Hz in anisometropic amblyopia subjects1. Though there are various factors like visual acuity, age, severity and refractive errors, that can be indicative of the same, but fMRI based cortical pattern can better prognosticate the responders and non-responders for amblyopia therapy.

References: