Varying frequencies of flickering checkerboard in Anisometropic Amblyopes: an fMRI Study
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Introduction: Amblyopia refers to decrease of visual acuity in one eye when caused by abnormal binocular interaction or occurring in one or both eyes as a result of pattern vision deprivation during visual immaturity. This may be associated with decrease in colour vision, contrast sensitivity, Vernier acuity, Stereoaucuity and Spatial localisation. In this study, we observed BOLD responses visual stimulation using black and white checkerboard flickering at different frequencies (4, 8 and12Hz) in unilateral Anisometropic Amblyopes.

Material and method: 10 left eye affected amblyopes were recuited (mean age 12.10± 2.88 yrs, right eye visual acuity (VA) 0.06 ± 0.13, left eye VA 0.77± 0.21 ). The studies were carried out using 1.5T whole body MR scanner (Siemens Magnetom Avanto, 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: 4.5 mm, TR:2000 ms, 64x64 matrix resolution (3.6x3.6x4 mm3 voxel dimension), and FOV of 230 mm. 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. One way Anova (p<0.001, cluster threshold 5) was used for group analysis.

Results: In the visual cortex, BOLD activation (Table 1) was maximum at 8 Hz (as compared to 4 and 12 Hz) while viewing with dominant or amblyopic eye in patients (Figure 1). In addition (Figure 2), amblyopic eye exhibited activity in extra-striate (BA 18) cortex and fellow eye showed more activity in striate cortex (BA 17).

Discussion: The maximum visual cortex BOLD activation observed at 8 Hz correlates with an earlier PET study2, suggestive of use of 8Hz in studying visual cortex in Anisometropic amblyopes. Anisometropic amblyopes exhibited decreased activation in visual cortex both in striate and extrastriate areas on viewing with amblyopic eye3. The increased activation of BA 18 in amblyopic eye and BA 17 in fellow eye in our study may be ascribed to neuroplasticity, wherein extrastriate area subserve the function of striate cortex3.

References