

Neurocognitive alteration associated with auditory tasks in early and late blind subjects

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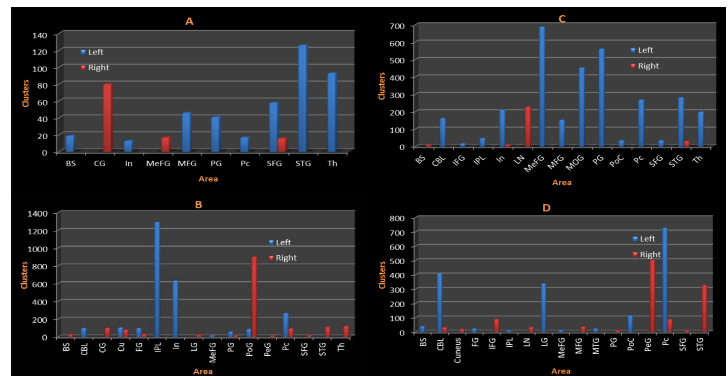
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Introduction: Cortical reorganization takes place due to neurological or ophthalmological disorders, which may be compensated by other senses. Functional magnetic resonance imaging (fMRI) used to study the processes involved in phonological processing of noun pair antonyms and synonyms in early and late blind children.

Material and methods: Ten right handed subjects in the early blind group (mean age \pm SD 15.1 \pm 3.6 years) and late blind group (mean age \pm SD: 12.9 \pm 1.3 years), each from the clinics of our institute and six sighted controls were recruited (Table 1). Standard diagnostic and exclusion criteria were followed. BOLD sessions were carried out using 3T MR scanner (Achieva 3.0T TX, Philips, Netherlands). For Phonological processing: Patients were presented with antonyms and synonym noun pairs, through auditory cue with the help of E-prime and MR compatible headphone and microphones (NordicNeuroLab, Norway). Single-shot echo planar imaging (EPI) sequence was used for the studies with parameters: number of slices: 30, slice thickness 4.5 mm; TR: 2000 ms, TE: 30 ms, FOV: 231.7 mm, flip angle: 90°, number of dynamics: 192, resolution: 64 x 64. Pre- and post-processing was carried out using SPM8 (Wellcome Department of Cognitive Neurology, London, UK). One sample t-test ($p < 0.001$, cluster threshold 10) was used for group analysis.

Results: BOLD activation during **synonyms** task by **late blind** subjects (Figure. J, K, L and graph 1A) showing in left precuneus, inferior parietal lobule, transverse temporal gyrus, and right superior temporal gyrus, precentral gyrus, claustrum.. In **early blind** (Figure. G, H, I and graph 1B) activation was observed in left superior frontal gyrus and superior temporal gyrus.. During **antonyms task early blind** (Figure. A, B, C and graph 1C) activation was observed in Left Superior Occipital Gyrus, Inferior Frontal Gyrus, Uncus, Thalamus, and Parahippocampal Gyrus, right Medial Frontal Gyrus. For **antonyms task bold activation in late blind as shown in**

Late Blind	Age years	Onset of blindness	Diagnosis	Vision	Early blind	Age	Onset of blindness	Vision
LB1	14	3	Atrophic bulbi	None	EB1	11	At Birth	none
LB2	12	4	Corneal ulcer	low	EB2	12	<6 months	low
LB3	13	3	Nystagmus	low	EB3	13	<6 months	low
LB4	13	3	Nystagmus	low	EB4	14	At Birth	none
LB5	12	5	Accident	none	EB5	17	At Birth	none
LB6	16	3	Phthisis bulbi	none	EB6	12	< 6months	low
LB7	12	5	Accident	low	EB7	17	At birth	none
LB8	12	3	Adherent leucoma Resolved endophthalmitis	low	EB8	23	At birth	low
LB9	12	3	Retinitis pigmentosa	moderate	EB9	17	<6 months	low
LB10	13	4	Jaundice	low	EB10	15	<6 months	low
Mean	12.9	3.6			Mean	15.1		



Graph 1. BOLD activation in response to lexical semantic antonym and synonyms task in Early blind (antonyms:C;synonyms: A) :Late blind (antonyms: D;synonyms:A) in sagittal, coronal and axial sections

figure D,E,F and in graph 1D was located in right inferior frontal gyrus, left posterior cingulate, cuneus and Precuneus.

Discussion: Lexical semantic task, activate peripheral regions of visual cortex when subjects attended to sound sources [5] Recently, it has also been suggested there may be functional connections between auditory cortex and visual cortex.[6] Functional MRI revealed reliable blood oxygen- level dependent (BOLD) activity in auditory association areas are involved in the auditory processing of language suggesting that phonological processing does not necessarily recruit Broca's area.[5] The involvement of Broca's area in phonological processing may be a function of task demands.[3] Semantically associated antonyms noun pair word evoked robust activity throughout visual cortical regions for blind people; The lexical semantic task elicited greater activity in medial cortical areas (supplementary motor area and cingulate sulcus) that have been possible due to participants may be covertly vocalized heard words when trying to remember lexical semantic.[1] In late and early blind groups, the lexical semantic task elicited stronger activity in the posterior left inferior frontal gyrus adjoining the middle frontal gyrus, and nearby inferior parts of the pre-central gyrus helping in finding the level of difficulty [2]. Recently, it has also been suggested that the cerebellum is involved in purely sensory tasks, such as visual and auditory motion perception [4].

References

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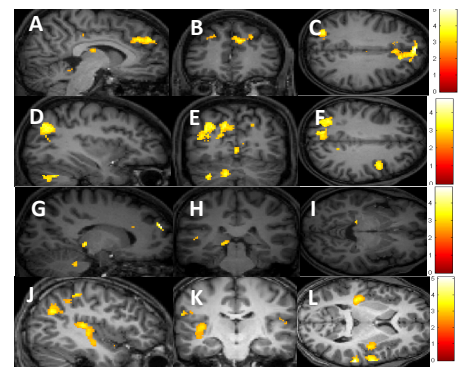


Figure1. BOLD activation in response to lexical semantic antonym and synonyms task in Early blind (antonyms:A,B,C;synonyms: G, H, I) :Late blind (antonyms: D,E,F;synonyms: J, K, L) in sagittal, coronal and axial sections