

Introduction

➤ The inferior colliculus is a key relay station in the primary auditory pathway that is disrupted by early auditory deprivation.^{1,2}

➤ The cells of the inferior colliculus project to the deep layers of the superior colliculus.^{1,3,4}

➤ Multisensory cells of the deep layers of the superior colliculus project to the motor areas involved in the control of eyes movements.^{4,5,6,7,8}

Hypothesis

Given that sensory deprivation during early infancy alters the auditory input to the superior colliculus and leads to cerebral reorganization^{9,10}, we hypothesize that:

- individuals with early auditory deprivation will have abnormal patterns of eye movements.

Methods

Participants

12 profound deaf adults (mean age = 29 years old):

- from birth (n = 10)
- < 3 months (n = 2)

Communication:

- each participant used sign and oral language

12 adults with normal hearing and without otologic problems (mean age = 26 years old)

Paradigm

EyeLink 2000, SR Research, Canada



Fixation task

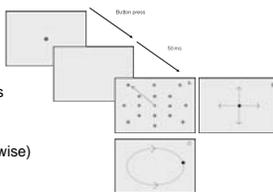
For each trial, the participant fixated a circle of 0.5° in the middle of the screen, and then, with one saccade, had to direct his gaze to:

- 16 targets randomly presented 3 times each
 - 8 positions (0°, 45°, 90°, 135°, 225°, 180°, 270°, 315°)
 - 2 distances from central fixation (5° and 10°)

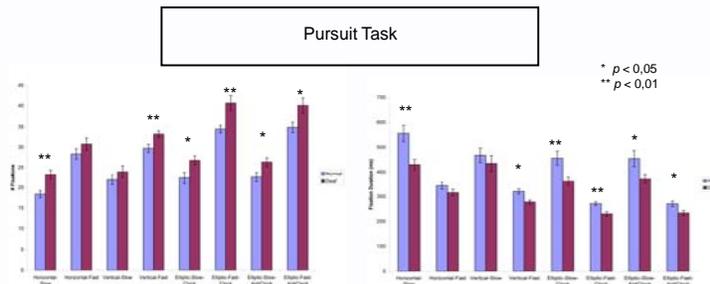
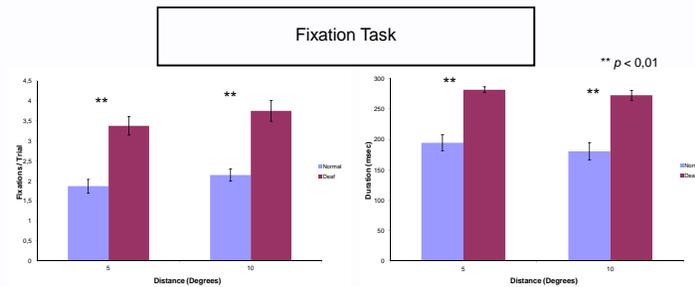
Pursuit task

The eyes followed of a 0.5° circular target that made 8 trajectories randomly presented 3 times each:

- trajectories: horizontal, vertical and elliptic (clockwise & counter-clockwise)
- speeds: 2 and 4 deg/s⁻¹



Results



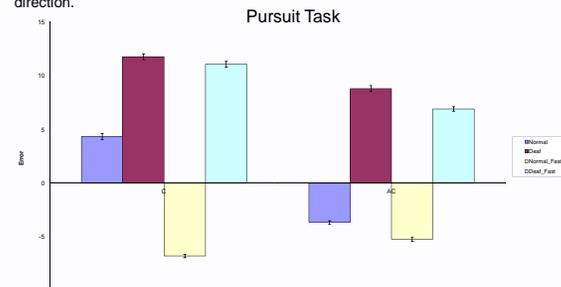
Localised analyses indicate:

Fixation Task

- Deaf individuals make more saccades and take longer pause when they direct their gaze to a stimuli presented in their parafovea or in their peripheral visual field.

Pursuit Task

- Number of fixations
 - significantly more saccades for the deaf than for the hearing, regardless of the speed and direction.
- Duration of fixation
 - significantly shorter for the deaf compared to the hearing, again regardless of speed and direction.



Pursuit:

- Hearing participants anticipated the position of the target, while the individuals with a hearing loss lagged behind the target.

Conclusions

➤ Eyes movements are disrupted in profound deaf individuals when they have to do a fixation task and follow a target:

- ❖ they make more saccades and take longer pause during the fixation task.
- ❖ they make more saccades (less fluidity) and are not able to keep up with the trajectory of the target.

➤ The presence of deficits for both the fixation task and the pursuit task suggests that these two measures tap cerebral mechanisms that seem to be equally affected by auditory deprivation.

Clinical Implication and future considerations

➤ Measuring eyes movements during reading:

Could the deficits found in pursuit eye movements have an impact on the reading abilities of the deaf?

- deaf individuals rarely reach a normal reading level.¹¹

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