

# How Does a History of Otitis Media with Effusion Impact Spatial Auditory Processing and Listening Effort in Children?

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## Introduction

Conductive hearing loss (CHL) due to otitis media with effusion (OME) is a common impairment in childhood. An increase in hearing thresholds appears in one or both ears, and it can be fluctuating. As a result, children receive inconsistent auditory signals, especially during the first years of life, when the auditory system specializes in processing of complex auditory cues. It is assumed that these impairments affect only the hearing threshold and compensation of intensity will enable good speech perception abilities. However, recent findings have shown long-term effect of early conductive hearing loss on auditory processing abilities, even when the hearing thresholds have returned to a normal range.

## Objective

To examine spatial auditory processing abilities in presence of background noise, among children with OME history, and aged matched control group.

To measure the listening effort (LE) invested during performing a speech recognition task, using pupillometry.

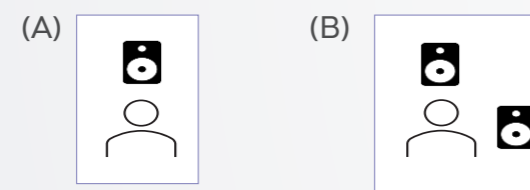
## Method

### Participants

- 39 children aged 6-10 years participated in the study:
- 17 children with a history of conductive hearing loss due to OME
- 22 children who had no history of conductive hearing loss

### Measures and Procedure

- Hearing evaluation
- Adaptive speech recognition in noise task under two conditions:
  - speech and noise are presented from 0°.
  - Spatial separation between the target speech and the background noise



- Auditory working memory was assessed using the forward and backward digit span subtest of the WAIS-III.
- Measurement of changes in pupil dilation during sentence recognition in noise (Figure 1).

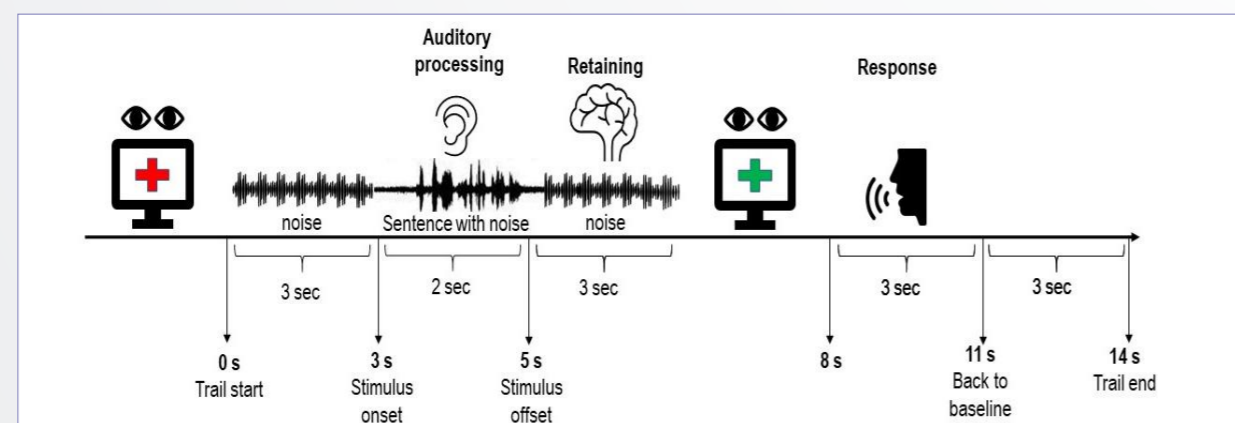


Figure 1 The timeline during presentation of auditory task while measuring pupil diameter

## Results

Children with a history of OME had higher thresholds in the spatial separation condition compared to the control group (Figure 2).

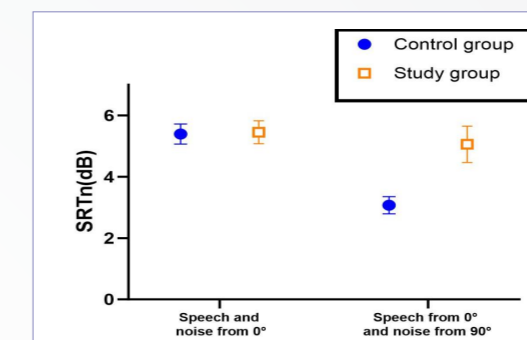


Figure 2 Speech Reception Threshold in noise (SRTn) scores in both groups under two conditions: with and without spatial separation.

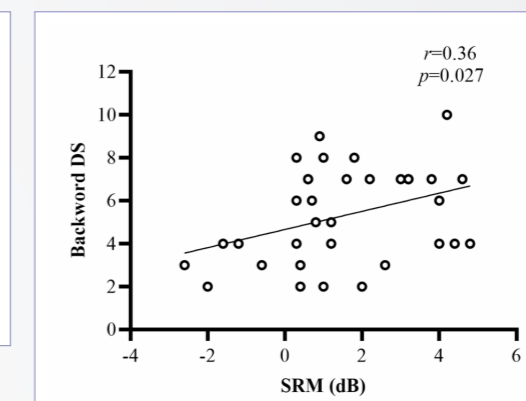


Figure 3 Scatterplot of the Spatial Release from Masking (SRM) measure against the backward auditory digit span (DS) score.

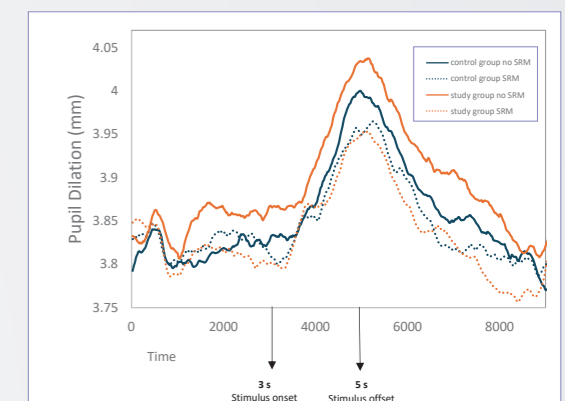


Figure 4 Change in pupil diameter during listening task in two conditions with and without spatial separation.

Significant positive correlation between spatial release from masking and backward digit span (Figure 3). Both groups showed greater pupillary dilation in the absence of spatial separation, but the difference between conditions was more pronounced in the study group (Figure 4).

## Conclusion

Children with a history of CHL (OME) in early childhood exhibit a reduced advantage in spatial listening compared to children without such a history.

The current study has demonstrated for the first time that children with a history of CHL (OME) invest more listening effort during speech perception in the presence of both speech and noise originating from the same source. These findings have clinical implications for the importance of early identification and treatment of children with fluctuating conductive hearing loss.