

The interaction between auditory, visual and cognitive abilities in normal-hearing and hearing-impaired adults

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Objectives: Cochlear implantation is the standard-of-care for individuals with severe to profound hearing loss. Although cochlear implants (CI's) can improve the participation in daily life, a large variation in the benefit obtained from CI's has been reported, especially pertaining to speech understanding. It is suggested that the variation in CI outcome may not solely be due to peripheral auditory factors. Speech understanding is considered a multisensory process, whereby visual information from mouth movements and face expressions is integrated with auditory information in order to increase intelligibility. Besides auditory-visual integration, also cognitive functions (i.e. top-down processes) are involved in the process of speech understanding. More specific, working memory, processing speed, selective attention, and cognitive flexibility and inhibition are required for speech processing, especially when a speech signal is distorted due to background noise, hearing impairment or listening through a CI. The aim of the current study was to unravel the fundamental role of the Auditory, Visual and Cognitive abilities (AVC-abilities) in speech processing in normal-hearing and hearing-impaired individuals. In particular, the specific contribution of these abilities to speech understanding and the interaction between these AVC-abilities were investigated.

Materials and methods: Three groups of subjects participated in this study: (1) normal-hearing adults, (2) adults with moderate to severe hearing loss who are using hearing aids, (3) adults with a post-lingually acquired severe to profound hearing loss with CI. It was aimed to include 30 participants per group. All participants were matched for age, gender and educational level. An AVC-test protocol was set up to investigate the AVC-abilities behaviorally. The auditory test battery consisted of pure-tone audiometry, speech audiometry in quiet and in noise. For evaluation of the visual speech processing abilities the Test for (Audio-)Visual Speech Perception (TAUVIS) was used [1]. The cognitive test battery consisted of the subtest 'Repeating Digits and Letters' from the WAIS IV-NL [2] for evaluation of working memory and processing speed. For measuring selective attention, and cognitive flexibility and inhibition, the subtest 'Letter Detection' from the Cognitive Test Battery for Seniors [3] and an auditory Stroop test were used [4], respectively. Furthermore, the subjective impact of hearing loss on

quality of life was investigated using the hearing-related quality of life questionnaire for Auditory-Visual, COgnitive and Psychosocial functioning (hAVICOP)[5].

Results and conclusions: This study aimed to investigate the interaction between auditory, visual and cognitive abilities in three groups of subjects with a distinct hearing status. As such, more insight in the different abilities contributing to speech processing can be provided. Currently, data collection is still ongoing, and the results will be presented at the World Congress of Audiology 2022.

References:

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