An audiological and vestibular evaluation in children with auditory processing disorders

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Background

Children with auditory processing disorders (APD) have problems with speech perception in noisy conditions despite normal peripheral auditory functions. APD is a complex disorder in which a comprehensive test battery, based on behavioral and objective measurements, is required for a correct diagnosis. However, little is known about the specific audiological and vestibular problems in these children. An overview of an audiological and vestibular protocol, that can be used in addition to the existing test battery for APD, is given. These audiological and vestibular techniques, whereby central disorders might be detected, can provide more insight into APD.

Methods

The processing and interpretation of speech is a complex task which consists of sensory and cognitive processes (Figure 1). Measuring listening effort can evaluate the cognitive functions important for speech understanding. In addition, previous research has suggested that the medial olivocochlear bundle (MOCB) plays an important role in speech understanding in noise. The MOCB function can be evaluated by the suppression effect of the transient evoked otoacoustic emissions (TEOAEs) in response to contralateral acoustic stimulation (CAS). Finally, recent studies suggested a role of the vestibular system in cognitive processes. Therefore, vestibular evaluation in children with APD could be useful to explore their peripheral and central vestibular functions.

Listening effort

Listening effort can be measured using a dual-task paradigm. This paradigm, which implies performing a primary task while conducting a concurrent secondary task, exploits the limited capacity of the brain to process information. Performance on the primary task is believed to use the mental capacity it requires, while the spare mental capacity is used to complete the secondary task (Figure 2).

Efferent suppression of OAEs

The linear stimulation method can be used to measure TEOAEs with and without CAS of continuous white noise in alternating blocks of 10 seconds. The amount of efferent suppression (ES) can be calculated as the difference (in dB) in TEOAE amplitude with and without CAS (Figure 3).

Vestibular evaluation

The vestibular system consists of five parts: three semicircular canals (SCC) and two otolithic organs (the sacculus and utricule). Several vestibular tests can be used to evaluate the different parts of the vestibular system (Table 1).

References