Braz J Otorhinolaryngol. 2016;xxx(xx):xxx–xxx

Brazilian Journal of
OTORHINOLARYNGOLOGY
www.bjorl.org

ORIGINAL ARTICLE

Effect of hearing aids use on speech stimulus decoding through speech-evoked ABR☆

Renata Aparecida Leite[a,*], Fernanda Cristina Leite Magliaro[a], Jeziela Cristina Raimundo[b], Mara Gândara[b], Sergio Garbi[b], Ricardo Ferreira Bento[b], Carla Gentile Matas[a]

[a] *Universidade de São Paulo (USP), Curso de Fonoaudiologia, São Paulo, SP, Brazil*
[b] *Universidade de São Paulo (USP), Fundação Otorrinolaringologia do Hospital das Clínicas, Ambulatório de Saúde Auditiva Reouvir, São Paulo, SP, Brazil*

Received 16 August 2016; accepted 15 November 2016

KEYWORDS
Auditory evoked potentials;
Hearing loss;
Child;
Hearing aids;
Hearing

Abstract
Introduction: The electrophysiological responses obtained with the complex auditory brainstem response (cABR) provide objective measures of subcortical processing of speech and other complex stimuli. The cABR has also been used to verify the plasticity in the auditory pathway in the subcortical regions.
Objective: To compare the results of cABR obtained in children using hearing aids before and after 9 months of adaptation, as well as to compare the results of these children with those obtained in children with normal hearing.
Methods: Fourteen children with normal hearing (Control Group – CG) and 18 children with mild to moderate bilateral sensorineural hearing loss (Study Group – SG), aged 7–12 years, were evaluated. The children were submitted to pure tone and vocal audiometry, acoustic immittance measurements and ABR with speech stimulus, being submitted to the evaluations at three different moments: initial evaluation (M0), 3 months after the initial evaluation (M3) and 9 months after the evaluation (M9); at M0, the children assessed in the study group did not use hearing aids yet.
Results: When comparing the CG and the SG, it was observed that the SG had a lower median for the V–A amplitude at M0 and M3, lower median for the latency of the component V at M9 and a higher median for the latency of component O at M3 and M9. A reduction in the latency of component A at M9 was observed in the SG.
Conclusion: Children with mild to moderate hearing loss showed speech stimulus processing deficits and the main impairment is related to the decoding of the transient portion of this

☆ Please cite this article as: Leite RA, Magliaro FC, Raimundo JC, Gândara M, Garbi S, Bento RF, et al. Effect of hearing aids use on speech stimulus decoding through speech-evoked ABR. Braz J Otorhinolaryngol. 2016. http://dx.doi.org/10.1016/j.bjorl.2016.11.002

* Corresponding author.
E-mails: realeite@yahoo.com.br, realeite@usp.br (R.A. Leite).

http://dx.doi.org/10.1016/j.bjorl.2016.11.002

stimulus spectrum. It was demonstrated that the use of hearing aids promoted neuronal plasticity of the Central Auditory Nervous System after an extended time of sensory stimulation.

PALAVRAS-CHAVE
Potenciais evocados auditivos;
Perda auditiva;
Criança;
Auxiliares de audição;
Audição

Efeito do uso do AASI na decodificação do estimulo de fala por meio do PEATE-fala

Resumo
Introdução: As respostas eletrofisiológicas obtidas com o Potencial Evocado Auditivo de Tronco Encefálico complexo (PEATEc) fornecem medidas objetivas do processamento subcortical dos estímulos de fala e outros estímulos complexos. O PEATEc também vem sendo utilizado para verificar a plasticidade na via auditiva nas regiões subcorticais.
Objetivo: Comparar os resultados do PEATEc obtidos em crianças usuárias de Aparelho de Amplificação Sonora Individual (AASI), antes e após 9 meses da adaptação, bem como comparar os resultados destas crianças com os obtidos em crianças com audição normal.
Método: Foram avaliadas 14 crianças com audição normal (Grupo Controle – GC) e 18 crianças com perda auditiva neurossensorial de grau leve a moderado bilateral (Grupo Estudo – GE), na faixa etária de 7 a 12 anos. As crianças foram submetidas às Audiometrias Tonal e Vocal, Medidas de Imitância Acústica e PEATE com estímulo de fala, sendo submetidas às avalições em três momentos diferentes: avaliação inicial (M0), 3 meses após avaliação inicial (M3) e 9 meses após a avaliação inicial (M9), sendo que no M0 as crianças do grupo estudo ainda não faziam uso do AASI.
Resultados: Na comparação entre GC e GE, observou-se que o GE apresentou menor mediana para a amplitude V–A no M0 e no M3, menor mediana para a latência do componente V no M9 e, maior mediana para a latência do componente O no M3 e no M9. Observou-se no GE, redução na latência do componente A no M9.
Conclusão: Crianças com perda auditiva de grau leve a moderado apresentaram déficit no processamento do estímulo de fala sendo que o principal prejuízo está relacionado à decodificação da porção transitória do espectro deste estímulo. Evidenciou-se que o uso do AASI promoveu a plasticidade neuronal do Sistema Nervoso Auditivo Central após um tempo prolongado de estimulação sensorial.

Introduction

The auditory brainstem response (ABR) is widely used in clinical practice to assess the auditory pathway integrity in the brainstem, as well as the electrophysiological threshold in children and infants. Although of great importance in clinical practice, the ABR with click and tone burst stimuli provides a few information on auditory processing for environmental sounds.[1]

The terminology used in the literature to refer to the electrophysiological responses, captured in the brainstem and elicited by complex sound stimuli, is varied, and thus, there is complex-ABR (cABR), speech-evoked ABR and music-evoked ABR.

The electrophysiological responses obtained with the cABR provide objective measurements of subcortical processing of speech and other complex stimuli.[2,3] The generation of these responses involves a neural circuit that interacts with cognitive processes and is influenced by top-down processing.[4]

Therefore, cABR corresponds to the neural decoding (or coding) of complex sound stimuli, such as music, speech, environmental sounds, among others. One of the characteristics of the cABR is that the captured electrophysiological responses are similar to the spectrum of the complex acoustic stimulus used, thus reproducing its spectral and temporal characteristics.[4]

Several stimuli can be used to investigate how temporal and spectral characteristics are preserved in ABR; one of the most often studied is the speech stimulus, especially the syllable-evoked (vowel–consonant) responses.[3]

Considering that the acoustic characteristics of the speech stimulus are directly involved in the responses that will arise in the ABR (or speech-evoked ABR), some studies have used syllables in the consonant–vowel format (ex: /da/) with duration of 40 ms, and identified the emergence of seven components (V, A, C, D, E, F and O), which would represent the transient (brief) and sustained characteristics of the acoustic stimulus.[3,5–7] The components V, A and C correspond to the transient characteristics of the stimulus,