

Speech Intelligibility Index (SII) and sentence recognition in noise: A study in elderly with and without cognitive disorders users of hearing aids

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ABSTRACT

Introduction: Sensorineural hearing loss is one of the consequences of aging, which significantly impairs the quality of life of older individuals. Elderly with Age-Related Hearing Loss (ARHL) present decreased audibility and consequently reduced speech intelligibility. Fitting hearing aids is one of the steps towards the rehabilitation of these individuals. Amplification aims at providing audibility of speech sounds at safe and comfortable levels. One of the electroacoustic verification procedures of hearing aids includes aided and unaided Speech Intelligibility Index (SII). The Speech Intelligibility Index determines the percentage of speech signal that is available for the patient. It is known that not all speech sounds will be audible, even with amplification, depending on the degree and configuration of the hearing loss. The purpose of amplification is to provide audibility of most speech sounds. However, it is also known that speech recognition involves both audibility and the cognitive processes that are determinant for the effective communication. The most frequent complaint of older listeners refers to their difficulty in understanding speech in situations of unfavourable communication, such as in the presence of noise, in reverberant environments, and with increased speech rate of interlocutors. In this context, the hypothesis that guided the present survey was that older individuals with the same audibility of speech signals and with better cognition present greater speech recognition in the presence of competitive noise.

Purpose: Investigate the effects of cognitive processes and Speech Intelligibility Index in speech recognition in noise among elderly users of hearing aids with and without cognitive disorders.

Method: After analysis of sixty-one medical records, the final sample of the study was composed of thirty-four older individuals with bilateral moderate sensorineural hearing loss aged 64-87 years users of hearing aids for over a year. Participants were divided into two groups according to cognitive status and the results obtained in the 10-CS, they were divided in groups of individuals without (GA; n=21) and with (GB; n=13) evidence of cognitive impairment. Besides the cognitive screening, participants of both groups were submitted to the audiological assessment (which included otoscopy, pure-tone and vocal audiometry), electroacoustic verification of hearing aids (Speech Intelligibility Index). The participants were submitted also to the Brazilian Portuguese Sentence List Test (SLT-BR). The evaluation consisted of the search for the speech perception in noise (S/N ratio). This research was performed in free field in the condition without and subsequently with the hearing aids. One list was used for training the patients and two other lists were presented to obtain S/N ratios with and without hearing aids. Statistical analysis included the Chi-Square and Mann-Whitney. The significance level was set at 5%.

Results and Discussion: Group GA (without evidence of cognitive disorders) was composed of 21 older individuals (thirteen women and eight men) aged 64-87 years and group GB (with evidence suggestive of cognitive disorders) composed of 13 older individuals (eight women and five men) aged 71-84 years. No statistically significant differences were found between groups GA and GB with respect to the

variables gender and education level as well. Although no statistically significant difference was observed between the groups with respect to the variable gender, the number of women was larger than that of men in both groups. In this survey, Incomplete Elementary School was the predominant education level in both groups. Schooling should always be analyzed, because normally individuals with higher education level present better performance in communication situations. There was no significant difference between the results of Speech Intelligibility Index obtained in both groups either with or without hearing aids. These results demonstrate that the elderly of group A (without evidence of cognitive disorders) and group B (with evidence suggestive of cognitive disorders) have the same percentage of access to speech sounds. Data of this research suggest that the older individuals in both groups presented access to 50% of the speech sounds on average, which is considered appropriate. It is known that not all speech sounds will be audible, depending on the degree and configuration of the hearing loss. However, the provision of audibility by amplification is not sufficient for understanding speech. Therefore, the auditory information depends on several aspects, such as auditory processing, cognitive processes, cultural and educational level. The higher the S/N ratio, the greater the difficulty for speech comprehension in the presence of competitive noise. It was observed that the elderly of group A (older individuals without evidence of cognitive disorders) presented lower mean S/N ratio in conditions with and without hearing aids. Under the condition with hearing aids, this difference was statistically significant between the groups. This data are compatible with the hypothesis that older individuals with better cognition present greater speech recognition in the presence of competitive noise. Understanding speech is one of the most important elements in human communication, and this is the reason why the use of sentences is considered the most accurate instrument to assess the communication of individuals, because tests that use sentences as stimuli are considered the most appropriate to assess the communication of individuals everyday speech situations. Habitual speech situations are typically associated with presence of competitive noise. Therefore, in this survey, was used sentence recognition tests with presence of competitive stimulus (noise), under free-field conditions, so that the individuals could be assessed in a situation more closely related to the daily lives. The higher the cognitive level, the better the performance of the older individuals. Results of the present study demonstrated that the access to the speech signal, reported by the SII, was similar in the two groups and, therefore, did not determine speech recognition performance in noise. The complaint about difficulty in understanding speech in noise should always be investigated, since they can interfere in the process of rehabilitation in the elderly population.

Conclusion: Audibility (access to speech sounds) does not determine the performance of older individuals with hearing loss in the presence of competitive noise. Assuming similar audibility of the participants in both groups, elderly with better cognition present better speech recognition under difficult listening, since they required lower signal-to-noise ratios, on average, to recognize 50% of the sentences under the conditions with or without hearing aids.