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Research Article

High Frequency Audiometry As a Tool for Early Detection of Hearing in Young People

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Abstract

Hearing loss in adolescents is a topic of increasing interest due to exposure to high-intensity noise in the environments frequented by young people. Detecting hearing loss at the beginning is a way to prevent and slow down hearing impairment that progresses to hearing loss of varying degrees. In this sense, high-frequency audiometry has proven to be an effective tool when it comes to the early detection of hearing disorders in these populations. This article attempts to encourage the use of high-frequency audiometry as a diagnostic tool for hearing loss due to noise injury in adolescents.

Aims: This article aims to encourage the use of high-frequency audiometry as a diagnostic tool for hearing loss due to noise injury in adolescents, with the aim of encouraging prevention and timely treatment. Statistical and graphical methods demonstrate evidence of their effectiveness and propose recommendations are proposed for their implementation in clinical settings.

Keywords: Hearing Loss; Adolescence; High-Frequency Audiometry; Early Detection; Hearing Loss

Introduction

Today's life shows us a reality that we should not ignore or put aside. We live in a highly noisy world, mainly in large cities where there is a greater concentration of the population and it is there where the human ear is not prepared to withstand sound pressures that exceded the noises of nature. Normally, the human ear can perceive sounds between 20 and 20,000 Hz. (up to around 18 years of age), however, in conventional audiometry frequencies between 125 and 8000 Hz are considered, because the frequency spectrum of speech sounds is framed within these ranges.

Hearing loss in adolescents is a topic of increasing interest due to exposure to high-intensity noise in environments frequented by young people such as parties, discos, meetings, concerts, rock bands, use of headphones to listen to music, as well as in work environments.

Hearing loss, or hearing loss caused by noise, is a common disorder in the world's population, and manifests itself more frequently in this age group due to continuous exposure to high-intensity sounds, such as those that come from sound sources mentioned above. According to the World Health Organization (2022), it is estimated that more than 1.1 billion young people between the ages of 12 and 35 are at risk of hearing loss due to exposure to harmful noises. Early detection of this condition is crucial for timely intervention and improving the quality of life of adolescents [1,6].

It has been proven that as a result of exposure to noise of intensities greater than 85 db or more, it produces multiple effects that have an impact on performance at work, psychologically, and physically (heart, digestive disorders, etc.).

One of the most effective methodologies for detecting hearing loss in adolescents and which is often not taken into account is high-frequency audiometry. This is because not all audiometers have frequencies that exceed 8000 Hz included to be able to perform this evaluation. With suitable measurement equipment for this purpose, this type of audiometry allows hearing loss to be detected at frequencies above 8,000 Hz, which are the first to be affected in most cases of noise exposure. The aim of this article is to analyze the effectiveness of this diagnostic tool in the identification of hearing loss in adolescents and its potential to prevent long-term hearing damage.

Figure A: (EHF, Extended High Frequencie). The frequencies evaluated in this area are 9,10,11.2, 12.5, 14, 16, 18 and 20 kHz, although the specific frequencies available may depend on the brand and model of the audiometer.

Two investigations are described below that show how important it is to apply high-frequency audiometry to early determine hearing loss that will evolve to varying degrees of hearing loss if it is not stopped in time.

Sample 1

Methods: studies carried out by specialists provide scientific evidence on the statements presented in this article, such is the case to exemplify a study carried out by Dr García Ortiz MJ., *et al*. (2021) [3] in 85 adolescents exposed to noise; of which 45 were in the tenth grade at a pre-university in the province of Havana, and 40, in the first year of medical school, underwent a survey, physical examination of otorhinolaryngology, conventional audiometry and high-frequency audiometry.

Results

Conventional audiometry was normal in all cases. In the high-frequency audiometry of all the adolescents studied, hearing began to decrease from 13,000 Hz and sensorineural hearing loss increased to 85 decibels in the right ear and 78 decibels in the left ear at 20,000 Hz frequency (figure D).

Conclusion

It was detected that the adolescents evaluated had hearing habits that impaired their hearing, not yet manifested through conventional audiometry but through high-frequency audiometry in the different exposures to high-decibel noises. Other research studies such as those of Dr Wang., et al. [8], where the age sample covers a wider age range, still determined that hearing loss in high-frequency audiometry (from 9 to 20 KHz) began to be perceived from the age of 35 in individuals without an otologic history.

Sample 2

Methods

The sample included 162 healthy participants (aged 21 to 70 years) with conventional normal pure-tone audiograms and were divided into five age groups. A conventional average of pure tones of 125 to 8000 Hz under air conduction and 125 to 4000 Hz under bone conduction was performed. EHF audiometry from 9000 to 20000 Hz was determined under air conduction.

Results

As age increases, hearing loss appears after 4000 Hz. The hearing thresholds of EHF were less than 26 dB HL before the age of 30 years. Hearing abilities in EHF deteriorated from the 31~40 group and were more obvious in the 51~60 group and the 61~70 group with the maximum thresholds of 75 dB HL.

Conclusions

In individuals with no otological history, the auditory thresholds decrease from the frequency of 8000 hz in relation to age. In fact, the auditory thresholds at frequencies of 9000 to 20000 Hz were more sensitive than at frequencies below 8000 Hz for the measurement of hearing, which makes it possible to predict how the hearing state of that individual will evolve and to be able to detect it in time to act accordingly.

Discussion

Hearing loss in adolescents has been a widely studied topic in recent years. Previous research, such as that by Stephens., *et al*. (2014) and Gómez., *et al*. (2019), has pointed out that hearing loss at high frequencies is an early indicator of hearing damage due to noise exposure. Conventional audiometry, while effective in detecting losses at lower frequencies, is not always sufficient to identify damage in the upper ranges, where the first effects of noise may manifest.

Studies such as that of Kujawa and Liberman (2009) highlight that alterations in high frequencies can precede evident hearing loss in lower frequencies, and that early detection of these changes can prevent irreversible damage. High-frequency audiometry offers a window to detect these alterations early, before adolescents experience difficulties understanding speech or realize that their hearing is affected.

In this study, it was corroborated that high-frequency audiometry is a fundamental tool for the hearing evaluation of adolescents,

since it allows the detection of subtle losses that may not be evident by conventional tests. The data obtained suggest that early detection can facilitate the implementation of preventive interventions, such as education on the responsible use of sound devices and the promotion of hearing protection habits. In addition, as shown in Figure C, the auditory field can be explored more widely than with conventional audiometry.

Another important fact is that it is also used to take in children and also serves to detect pathology of ototoxic, genetic or autoimmune origin. In addition, according to authors from Harvard University, prolonged high-frequency hearing improves speech perception in noisy environments [2].

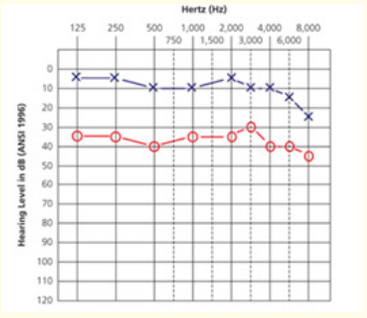

Figure B: Conventional audiogram.

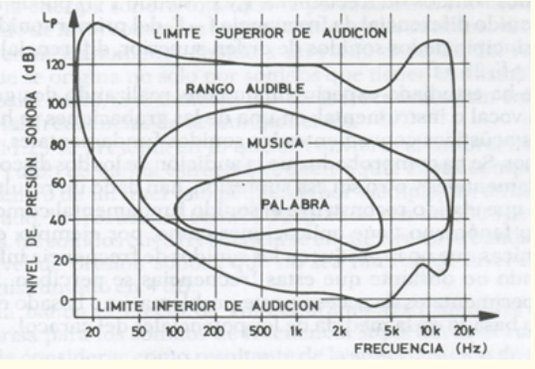

Figure C: High frequency audiogram.

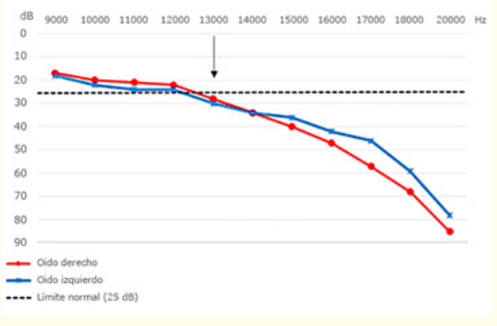

Figure D: High frequency audiometry (3) exposed to High frequencies due to mp3 use.

Conclusion

Hearing loss in adolescents, particularly that caused by exposure to loud noise, is increasingly being recognized as a public health problem. High-frequency audiometry is an effective tool for the early detection of hearing loss, allowing the identification of alterations that would not be detected by conventional audiometry tests. Research results show that a high proportion of adolescents have losses in frequencies above 8,000 Hz. And that as age advances, the loss detected in high frequencies becomes more evident (from the age of 35 onwards), which underlines the importance of incorporating high-frequency audiometry in routine hearing health examinations.

Recommendations

Implementation of high-frequency audiometry testing: It is recommended that all adolescents and children at risk for hearing loss, especially those exposed to loud noise, undergo high-frequency audiometry as part of routine hearing evaluations. Education and prevention: It is essential to educate young people and children about the risks of exposure to loud noise and the importance of protecting their hearing by using hearing aids with volume limiters and hearing protection in noisy environments.

Continuous monitoring

Since hearing damage can progress over time, it is crucial to carry out regular follow-ups to assess the evolution of hearing and take preventive measures if necessary.

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