SMART PHONES AND PERSONAL LISTENING DEVICES - TINNITUS & HEARING IMPAIRMENT IN ADOLESCENTAND YOUNGADULTEARPHONE USERS

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ABSTRACT

OBJECTIVES

To determine the frequency of tinnitus & hearing impairment in adolescent and young adult earphone users with smartphones and other personal listening devices.

METHODOLOGY

This prospective & descriptive study involving children with glue ears was conducted in the ENT Department of Medical Teaching Institute, Hayatabad Medical Complex, Peshawar, from Jan 1, 2022, to Sep 30, 2022. Personal listening device (PLD) users aged 12-25 years with complaints of tinnitus and hearing impairment were examined. Conductive hearing loss was excluded by audiological testing. The frequency of resultant hearing loss and tinnitus was calculated. The information obtained was analyzed using SPSS v 26.0 for windows. A Chi square test was performed to determine the significance of tinnitus & hearing impairment in earphones and other PLD users.

RESULTS

A total of 163 patients were included in the study. The patient's age range was 12-25 years, with a mean age of 18.03 years and a standard deviation of ± 3.575. There were 117 males and 46 females. The male: female ratio was of 2.54:1.Tinnitus was present in 73% and Hearing impairment in 54.4% of the patients. The chi-square test and p-values determined showed that both tinnitus and hearing loss occurred in many patients using personal listening devices.

CONCLUSION

Tinnitus and hearing impairment occurs in a significant number of those who use personal listening devices. Their inappropriate use can lead to auditory system damage. It is recommended that PLD users undergo periodic audiological testing to detect early hearing loss and tinnitus to minimize damage to the ear.

KEYWORDS: *Personal Listening Devices, Tinnitus, Tympanometry, Pure Tone Audiometry, Noise Induced Hearing Loss*

INTRODUCTION

In this era of the internet and advances in modern technology, access to various media is available at your fingertips. Newer trends in modern digital devices and their recreational use are always attractive for all and the young. Personal listening devices (PLD) are small electronic devices fitted into the ears and amplify sounds. One of the commonest observations these days is using various personal listening devices used in conjunction with different portable digital gadgets. The prevalence of PLD use in adolescents has been estimated to be 84%.[1] Personal listening devices (PLD), commonly known as earphones/headphones in our part of the world, are used for concentrating on listening material in noisy environments. Therefore there is a tendency to use high-intensity sounds. Intensity, duration of exposure and frequency of sound are the three parameters that determine sound energy that reaches the ear and are used to calculate the noise dose. Therefore, loud sounds, music or noise the regulatory and recommended noise levels are primarily derived from data in occupational settings. Daily exposure to 85 decibels for 8 hours/day for a 40 years lifetime is considered the maximum safe exposure limit. Increasing the intensity of sound drastically reduces the duration of exposure. For example, a sound of 100 decibels will reduce the permissible duration of exposure from 8 hours to 15 minutes/per day. Cochlear damage manifests as tinnitus, hearing loss and hyperacusis when the allowable levels are exceeded. These may be transient initially but can become permanent if such exposure continues.[2,3] Recreational use of PLD can cause auditory damage akin to occupational noise. Recreational noise exposure is among the most frequent causes of acquired sensorineural hearing loss. Loud or continuous low-intensity noise can damage membranes and hair cells in the cochlea. The damage continues as long as there is exposure to loud or continuous low-intensity noise for prolonged periods. Harmful effects in the form of tinnitus and hearing may continue even after the exposure has stopped.[4] Tinnitus, known to the common man as ringing in the ears, is the presence of sounds in the ear without a corresponding external stimulus. Worldwide its prevalence ranges from 12% to 30 % in the general population. However, its majority in the literature has been reported to be 49.6% in those using personal listening devices & earphones.[5] Those who use personal listening devices and earphones for longer duration without intervals are also at risk of developing hearing loss& tinnitus, as some degree of tinnitus is almost always present in those suffering from sensorineural hearing loss.[1,6] In 2016, a systematic review of 1032 studies was published by Rosing SN and colleagues involving young adults aged 12-19 years. While exploring tinnitus and hyperacusis, they found prevalence for tinnitus of 4.7% to 46% in the general paediatric population, those with normal hearing, and 23.5% to 62.2% in those with hearing loss.[7] Young adults tend to get exposed to undesirable noise levels while listening to music or playing games while using PLD. In a systematic review by Jiang W and colleagues, while exploring the impact on hearing of 'preferred listening levels and duration of music listening through personal listening devices in adolescents and young adults. The results showed that 58.2% of the participants exceeded the recommended 100% daily noise dose. They found significantly worse hearing thresholds on audiometry and otoacoustic emissions in such participants. Those with self-reported normal hearing were no exception.[8] The study aims to determine the frequency of tinnitus & hearing loss in young adults and adolescents who use personal listening devices & earphones for educational or recreational use. The study will help create awareness among the patients and treating physicians regarding the optimal use of personal listening devices and warning signs of auditory system damage. It will also enable them when to undergo screening tests for hearing by recognizing or looking for them. Irreversible acoustic trauma is more likely with prolonged exposure to noise. Timely detection of hearing loss in patients with tinnitus may spare them severe and irreversible auditory damage.

METHODOLOGY

A prospective and descriptive study was carried out at ENT Department Medical Teaching Institution, Hayatabad Medical Complex, Peshawar, from Jan 1, 2022, to Dec 31, 2022. The study includes included 163 patients fulfilling the inclusion criteria. The sampling technique was a "convenient sampling technique". The sample size was calculated using the Calculator.net sample size calculator, assuming a 12% prevalence of disease in the population, keeping a 95% confidence interval with a margin of error of 5%. The 12-25 years patients presenting with tinnitus in one or both ears, normal otoscopic examination and tinnitus persisting for ≥ 3 weeks in one or both ears, using PLD such as earphones of both the conventional& Bluetooth types and PLD average daily usage for one hour or more and using these devices regularly for ≥ than three months were included in the study. Patients with acute and chronic suppurative otitis media or dry ears with tympanic membrane perforations, with otitis media with effusion as confirmed on audiological testing and a history of head and temporal bone injury, were excluded. Ethical approval was sought from the institutional ethical review board. The patient's chief complaints were the heaviness or buzzing in one or both ears that had been present for weeks. Informed consent was taken from the patients or their parents. Patients detailed history was obtained regarding the duration and, mode of onset and severity of hearing loss & tinnitus. Tinnitus was further qualified as aural, binaural, or central. Questions were asked about its annoyance, pitch, intensity and whether continuous or intermittent. Associated symptoms like hearing impairment, vertigo, sleeplessness & irritability were looked for in the history. Any previous history of ear discharge and head injuries were also enquired. An enquiry was made into using sound amplification devices such as Bluetooth ear plugs and conventional earphones with smart phones and other portable music devices. The duration since using an average daily exposure to these devices was noted. A clinical ENT examination followed, focusing on otoscopy. The color, integrity, retraction pockets in the tympanic membrane and any discharge in the canals. The tympanic membrane was labelled as normal. The color was pearly or greyish, glistening white with the cone of light in its anteroinferior quadrant. The nose and throat were examined to exclude local inflammation. Patients were advised pure tone audiometry which was carried out using Labat AUDIOLAB Audiometer Model SN AUL 16127. Patients with an air-bone gap of >15 dB over the speech frequencies 500, 1000, 2000 and 3000 Hz were excluded from the study, except those with unilateral loss in the affected ear or non-symmetrical loss with no air-bone gap in both ears over the frequency range ≥ of 4000 Hz and above. Tympanometry was performed with a probe tone frequency of 226 Hz using FLUTE inventions MIDDLE EAR ANALYZER tympanometer Model R04. Using Jerger's classification, patients with Type A tympanogram were included, and those with tympanogram of the types As, Ad, B and C were excluded from the study. For analysis, laterality, bilaterality, tinnitus severity, and hearing impairment were ignored. Tinnitus is a subjective symptom; for it being present or absent, the patients statement was considered adequate. The data were recorded on a proforma, and the percentage of patients with tinnitus the in these users personal listening devices/ sound amplifiers was calculated. The information obtained was analyzed using SPSS v 26.0 for windows. The frequencies of tinnitus and hearing impairment in patients using personal listening devices and sound amplifiers were calculated. Descriptive statistics for gender and age were analyzed to determine their frequencies. Cross tables were used to determine the relationship between tinnitus and hearing impairment. Chi square test was performed to assess the significance of tinnitus & hearing impairment in earphone users and whether gender and age had any significant effect.

RESULT

A total of 163 patients were included in the study. The patient's age range was 13-25 years, with a mean age of 18.03 years and a standard deviation of ± 3.575. There were 117 males and 46 females. The male: female ratio was 2.54:1.

Table 1: Frequency of Tinnitus & Hearing Impairment in Personal Listening Devices Users

		No. of Patients	%age
Tinnitus	Present	119	73%
	Absent	44	27%
Hearing Impairment	Present	89	54.6%
	Absent	74	45.4%

Table 2: The Frequency of Hearing Impairment & Tinnitus in Various Age Groups

		Hearing Impairment		Total
		Present	**Absent**	
Age Groups	12-15 yrs	37	07	44
	16-19 yrs	31	37	68
	20-22 yrs	11	17	28
	23-25 yrs	10	13	23
		Tinnitus		**Total**
		Present	**Absent**	
Age Groups	12-15 yrs	10	34	44
	16-19 yrs	58	10	68
	20-22 yrs	28	0	28
	23-25 yrs	23	0	23

Table 3: The Frequency of Tinnitus & Hearing Impairment in Various Age Groups

Gender	Tinnitus		Total
	Present	**Absent**	
Male	79	38	117
Female	40	06	46
Gender	**Hearing Impairment**		**Total**
	Present	**Absent**	
Male	66	51	117
Female	23	23	46

DISCUSSION

Recreational noise-induced hearing loss is a common but preventable cause of hearing loss. It is one of the major health concerns these days. This is because of unsafe listening habits in educational or recreational activities. Safe listening is a strategy to prevent damage to the ear from sound-related recreational activities such as concerts, nightclubs, gaming and listening to music. Noise can cause hearing disorders such as tinnitus, hearing loss and hyperacusis.[9] In 2002-11, a cross-sectional study investigating tinnitus prevalence in Korean adolescents aged 12-19 years was carried out. While analyzing risk factors for tinnitus, they found that, among others, noise exposure, both momentary and prolonged, increased the risk for the development of tinnitus.[10] In Australia, Megan Gilliver and colleagues conducted a study on hearing health involving 4185 PLD users. MP3 devices, computers and phones were the most commonly used PLD in 88% of the study population. They found a significant relationship between auditory symptoms such as tinnitus & sensorineural hearing loss and PLD use concerning duration, volume and daily use. They further stated that young adults were the most prolific users of PLDs since early childhood. As the young are not likely to have age-related sensorineural hearing loss, any such failure directly results from PLDs use. Overall 15% of PLD users were at risk of hearing damage in their study.[11] Sulaiman AH & colleagues evaluated early hearing damage in 35 young adult PLD users (listening for > 1hr/day, at 50% of the maximum volume setting of the device). The mean listening duration was 2.7 ± 1.0 h/day, and the estimated listening volume was 81.3 ±9.0 decibels. Conventional pure-tone audiometry (using tones of 250 - 8000 Hz) showed normal hearing thresholds. Extended high-frequency pure tone audiometry (using tones of 9000 - 16000 Hz) revealed significantly higher thresholds than controls. The deterioration in high-frequency thresholds and decrease in amplitude of transient evoked otoacoustic emission (TEOAE) distortion product otoacoustic emission (DPOAE) was directly related to noise exposure level and duration. They recommended that preventive steps should be taken at the initial signs of hearing damage before it becomes permanent.[12] Gupta and colleagues studied hearing impairment in young adults who used PLD and were exposed to noise. Out of the 241 young adults, 201 (83.4%) suffered subclinical hearing loss who used the headphone for music and gaming users. The subclinical loss was 74.1% in those who used headphones for other purposes.[13] Degeest S and colleagues studied the prevalence of noise-induced hearing loss in 540 young Flemish adults aged 18-30 years who were regularly exposed to recreational noise. Using pure tone audiometry (PTA), transient evoked otoacoustic emissions (TEOAEs) and distortion product otoacoustic emissions (DPOAEs) for evaluation. They found that only 15.7% of subjects had subclinical hearing loss, and none had clinical hearing loss. The study found an insignificant relationship between sensorineural hearing loss and noise exposure due to PLDs.[13] However, Mario R Serra and colleagues studied hearing effects due to loud sound exposure in 14-15-year-old PLD users in Argentina. Their results showed a significant difference between the audiometric profiles of those with low exposure and those with high exposure to loud music sounds.[15] Rhee J and colleagues conducted a study involving 2879 middle and high school children. They observed that noise-related habits and behaviors did not differ among these children. There was no significant difference between the two groups regarding high-frequency loss. However, it was severe among the PLD users and clubgoers compared to those who did not attend clubs. About 17% of these adolescents exhibit at least slight hearing impairment. Frequent exposure to loud, high-intensity leisure noise can affect the hearing threshold. Hearing loss was associated with a decline in self-rated school performance. They recommended that it was important to avoid excessive exposure to leisure noise when seeking to prevent hearing loss in adolescents.[16] A Saudi Arabian study conducted by AlQahtani AS and colleagues conducted a study involving 1086 participants aged 18 to 40 years. They found sensorineural hearing loss in a significantly high proportion of those participants (34% vs 16.5%) who used PLD for more than 5 hours/day. Only 50% of the participants knew of the adverse effects of improper use of personal listening devices.[17] Gopal KV & colleagues assessed international behavior toward personal listening devices. The study results indicated that about 61% had at least one symptom of recreational noise-induced hearing loss, and 38% had experienced more than one symptom of recreational noise-induced hearing loss while using PLD. The commonest symptom was tinnitus (33%), ear pain (28%), and lack of concentration (22%). Multiple signs were reported in 38% of the study population.[18] Whereas studies abound in the international literature covering various aspects of PLD induced hearing loss in almost all age groups, the study's results could not be compared with national studies as data for comparison is lacking. The study highlights a cause of preventable hearing loss usually acquired through personal listening devices (PLD). The recreational use of PLD is very popular among teenage and young adults. The study's results will impress upon the youth the importance of optimal use of PLD. Awareness among patients and physicians about the issue will persuade them to early screen hearing thresholds in susceptible individuals when the auditory damage may be reversible or not be extensive.

LIMITATIONS

The sample size is small to draw meaningful conclusions. To date, no objective test is available for detecting the presence or absence or measuring the intensity of tinnitus. The statement of the patient has to be relied on. Moreover, case-controlled and cohort studies are needed to ascertain if personal listening devices cause deleterious effects on the ear.

CONCLUSION

Tinnitus and hearing impairment occurs in a significant number of those who use personal listening devices. Their inappropriate use can lead to auditory system damage. It is recommended that PLD users undergo periodic audiological testing to detect early hearing loss and tinnitus to minimize damage to the ear.

CONFLICT OF INTEREST: None

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