

Effect of Listening to Music Over Ear Phones/Head Phones on Hearing.

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ABSTRACT

Background: Music has always been an effective way to pass time. With the advent of cell phones, most of the people have an easy means to access music as almost all the phones are capable of playing music. Low quality ear phones are available at an affordable price. Adolescent and young adults are potentially at risk of hearing loss by listening to music with ear phones / head phones. **Aim:** The present study is an effort to know the effect of listening to music for longer duration through ear phones in young adults. **Methods:** The present study is conducted at Government Medical College, Anantapuramu on 100 subjects. 50 subjects who listened to music through ear phones for more than 2 hours/day and for 2 years or more were included in group A. 50 subjects who very occasionally used ear phones were included in group B. All subjects were made to undergo Pure Tone Audiometry in the audiometry room in both ears using pure tones of 250 Hz – 12000 Hz frequencies. **Results:** None of the subjects in Group B reported any hearing problem. Self-reported hearing problems in group A participants recorded. In Group A, 66% of subjects had no hearing problems and 34% of subjects had different hearing problems. There is significant increase in hearing threshold of Group A subjects at high frequencies compared to Group B. **Conclusion:** The output levels from cell phone are high enough to cause music induced hearing loss when phones are used at high volume for long periods. It is necessary to educate oneself about the dangers and use methods to prevent its harmful effects. Regular audiometric screening of all mobile phone users is recommended.

Keywords: Ear phones, Mobile phones, Pure Tone Audiometry, Hearing threshold.

INTRODUCTION

Technology is both a boon and a curse. On one hand, it has made our life so much easier and convenient. But on the other hand, it comes with so many drawbacks and ill effects. Technology has made it super convenient for us to listen to our favourite music any time of the day (or night). But it is also responsible for our ignorant behaviour as well. It is surprising to learn that today 1 out of every 5 teens has some amount of hearing loss in US. Studies show hearing loss in teens is 30% higher than it was in '80s & '90s. Experts believe ear phones are part of the problem.

The adoption of mobile phone by young people has been a global phenomenon in recent years. The mobile phone has turned from technological tool to a social tool. Most of the youngsters enjoy listening to cell phone music from head phones or ear phones to pass time or to boost up their energies at work. During the past decade, the damaging effects of

excessive noise pollution from portable stereo earphones have gained attention. It's impossible to walk down the street in any city around the world without seeing at least one person with their ear buds in, listening to music.

Long term earphone usage to hear music may cause damage in the inner ear. In the present society these devices are indispensable and are part of day to day life. World Bank says mobile has a bigger impact on human kind in a shorter period of time than any other invention in human history.

There is rapid growth of mobile telecommunication. There are more mobile than fixed line users. Developing countries are establishing mobile telecommunication rather than the fixed line system. Thus if there is any impact on health from mobile telephones it will affect everyone in the world.^[1]

Music became transportable. We listen in car, work place, gym, home and even while falling asleep. Music is integrated into virtually every aspect of our life. This slowly and quietly steals hearing at a young age and people may not feel the difference till it is serious. WHO reported that 1.1 billion teens and young adults world-wide are at risk of hearing loss from unsafe use of earphones & from listening to music that is too loud.^[2]

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Hearing loss is often a natural phenomenon of ageing process. A leading cause for hearing impairments used to be excessive noise exposure in the work place. But today many young people are losing their hearing at alarming rates due to excessive noise exposure from portable stereo earphones. Studies show that hearing loss is becoming more common amongst younger age group. There is high frequency hearing loss due to chronic exposure to loud noise above 90 decibels. It depends on volume & duration of exposure. Louder the sound, faster the damage to hearing and change in hearing threshold. The threshold shift is more so in higher frequencies.

David A. Schenal, chief of Otolaryngology tells parents "If you can hear the music your child / teenager is playing through their ear phones, it means that the sound is too loud & can lead to permanent hearing loss. To protect hearing, limit exposure to moderately high noise levels and give ears a chance to recover after any period of noise exposure.

At 91 dB ears can tolerate up to 2 hours of exposure.

At 100 dB damage can occur within 15 minutes of exposure

At 112 dB damage occurs within only 1 minute of exposure

At 120 dB immediate nerve damage occurs

Most of the music systems produce sound in the range of 95-108 dB at level four & in excess of 115 dB at level eight.

Normal conversation is about 60 decibels - considered a safe level. Increase to 85 decibels (volume of vacuum cleaner) - critical level. Extended or repeated exposure to sounds at or above 85 dB can cause hearing problems. Exposure to noise between 90 and 140 dBA (dBA denotes a decibel measure with a filter that adjusts for human auditory sensitivity) damages cochlea metabolically rather than mechanically. Sensory cells within cochlea are killed by excessive exposure. Early loss occurs in high frequency range.^[3] Long term and intensive GSM & CDMA mobile phone use may cause damage to cochlea as well as auditory cortex.^[4] The incremental in decibel levels is in logarithmic scale and not linear scale.^[5]

The potential damage from hearing loud music heard through the ubiquitous ear buds is increasing every day. Recent WHO reports estimate more than one billion young people are at risk of permanent hearing loss, simply from listening to music that is too loud. Now a days the music is more energetic & uplifting rock.

The present study is an effort to know the effect of listening to music for longer duration through ear phones in young adults. Several studies have been conducted to assess the effect of mobile phone on hearing. In this study an effort is made to study the risk of hearing loss by listening to music with ear phones/head phones for more than 2 hours/day.

MATERIALS AND METHODS

The study was conducted on 100 mobile phone users with in the age group of 18 – 30 years at Government Medical College, Anantapuram. Participants chosen had good general health with out any known Diabetes, Hypertension.

Patients with History of otalgia, ear discharge, recent upper respiratory tract infections, prolonged usage of ototoxic drugs, ear surgery were included under exclusion criteria. The subjects were informed about the study and procedure details. Questionnaire was given to be filled up by the subjects. An informed consent was obtained. Prior approval from Institutional Ethical Committee was obtained.

The subjects were categorized into 2 groups based on the duration of listening to music through ear/head phones.

Group A: 50 students who listened to music through ear phones for more than 2 hrs / day and for 2 years or more.

Group B: 50 students who listened to music very occasionally using ear/head phones

Their anthropometric parameters – Height in centimetres, Weight in kilograms, BMI (Kg/m²) were recorded. Otoscopic examination was performed following which PTA was performed by audiologist at frequencies of 250,500,1000,2000,4000,8000,10000,12000 Hz. All these parameters were entered into spread excel sheet. Statistical analysis of the data were expressed in Mean ± Standard Deviation. P < 0.05 was considered significant.

RESULTS

The subjects in two groups did not show significant difference in number, age & anthropometric profile. The reported circumstances when listening with head phones in group A participants shown in [Table 1]. Majority were listening to music using ear/head phones during transportation (80%) followed by during other routine daily activities like walking (60%), jogging (42%), relaxing (30%).

Table 1: Circumstances when Listening with Head phones in Group A.

Activities	Percentage of persons listening to music
Transportation	80%
Walking	60%
Biking	4%
Jogging	42%
Relaxing	30%
During studying	28%
Lunch time	10%
During lesson	2%
Starting off to sleeping	26%

As per this study, regular mobile phone users reported health complaints, such as tiredness, stress,

headache, anxiety, concentration difficulties and sleep disturbances more often than less frequent users.

None of the subjects in Group B reported any hearing problem. Self-reported hearing problems in group A participants recorded. In Group A, 66% of subjects had no hearing problems and 34% of subjects had different hearing problems [Table 2]

Table 2: Self-reported hearing problems in Group A.

Hearing problems	Percentage
Sensitive to sound	12 %
Feeling of occlusion	2%
Tinnitus	4%
Sound fatigue	6%
Distorted	2%
Bad hearing	8%
No hearing problem	66%

The study shows that hearing threshold in all the subjects at all frequencies is within the normal range. But hearing thresholds at higher frequencies is more in group A compared to group B as shown in [Table 3].

Table 3: Frequency specific mean hearing thresholds in Group A and Group B.

Frequency	Mean Hearing Threshold + SD (In Db)		P Value	Significance
	Group A	Group B		
250 Hz	5.26 + 6.14	5.41+3.12	0.8779	Not Significant
500Hz	5.87 + 6.33	5.62+4.43	0.8195	Not Significant
1000Hz	6.01 + 4.15	6.18+3.28	0.8207	Not Significant
2000Hz	10.58 + 4.07	9.20+4.00	0.0904	Not Significant
4000Hz	12.41 + 5.68	10.88+4.16	0.1276	Not Significant
8000 Hz	13.27 + 4.14	12.16+3.84	0.1677	Not Significant
10,000 Hz	14.06 + 3.67	12.12+4.0	0.0131	Significant
12,000 Hz	15.48 +2.54	13.64+2.24	0.0002	Significant

DISCUSSION

In Group A 80% of the subjects used earphones during transportation in the present study. [Figure 1] shows different setting when the subjects use the earphones to listen to music. None of the subjects in Group B reported any hearing problem. In Group A, 66% of subjects had no hearing problems and 34% of subjects had different hearing problems which they reported are given in [Table 2].

Listening to music for long periods of time and at a high intensity are associated with several auditory symptoms, such as temporary threshold shifts, tinnitus, noise sensitivity, and distortion, which eventually may increase the risk of developing permanent hearing loss.^[6]

Panda NK, Jain R study shows that there was no significant difference between users & controls for any of the audio logic parameters. Trends for audiologic abnormalities were seen with in the users.^[7] Another study shows there was prevalence of hearing loss among a sample of US adolescents aged 12 – 19 years.^[8] Study by Hitesh Palal shows that there was some hearing impairment in long term mobile phone users compared to infrequent users.^[9] Study by C S Ramya et al revealed significant increase in the hearing threshold in mobile phone users associated with the duration of usage.^[10] Mean hearing threshold was more in dominant ear of mobile phone user compared to non –dominant ear in higher frequencies and the difference was statistically significant.^[11] Their study shows that with more use of mobile phones, more was the threshold change. Review by Zhao F, Manchaiah KC highlights the dangers of significant exposure to music on hearing mechanics in adolescents and young adults and increasing dangers with modern music culture.^[12]

Regular mobile phone users reported health complaints, such as tiredness, stress, headache, anxiety, concentration difficulties and sleep disturbances more often than less frequent users. The risk of suffering from these symptoms was higher in those reporting mobile phone use of >15 mins a day.^[13]

Ear phones, particularly when put up at high volume, deliver louder sound exposures than over-the-ear headphones. They also deliver them directly into the ear. They sound awesome because of it but they carry bigger risks when it comes to damaging precious hearing. Study by Nasab et al found that pure tone threshold of all subjects were in normal range but there was a significant difference between mean pure tone threshold of users and nonusers.^[14] Prajapati et al study shows an increase in the mean hearing loss at high frequencies in both ears with increase in duration of daily mobile phone usage.^[15] Study by Santos L, Morata TC shows music exposure was associated with temporary and permanent auditory dysfunction among professional DJs.^[16] Some studies report an increase in developing future NIHL in the high frequency area.^[17] Similar study shows that prolonged usage of loud ear phone music is harmful to ears.^[18] In the present study the hearing threshold in all the subjects in both the groups at all frequencies is within the normal range. But there was significant difference in mean hearing threshold at higher frequencies (10,000Hz and 12,000Hz) in group A (listening to music through ear phones for more than 2 hrs /day) compared to group B (occasionally used ear phones). When ears are subjected to loud input, the fluid in your inner ear moves more, which can damage the hair cells that send signals to the brain.

Most adolescents with hearing loss demonstrate high-frequency hearing loss (HFHL), which is often

related to noise exposure. Specifically, the use of ear phones and headphones when listening to music is adding to the rising concern. Due to the damage that is occurring during adolescent years, it's leading to high numbers of adults with hearing loss. The possible reason for causing hearing loss is the exposure to continuous sound very close to ear causing permanent damage to the hair cells in the inner ear. Mobile phone use for more than 30 min in a day can change the hearing threshold. The hearing threshold shift is more so in higher frequencies. The changes occurred were temporary and reversible if abstained from ear phone music.

There appears to be a correlation between the duration of usage of mobile daily and length of years using mobile phones to the degree of hearing loss. And Louder the sound, the faster the damage to hearing. Hearing loss develops slowly and gradually over years & people may not feel the difference until it is serious. Hearing loss and other health hazards resulting from chronic use of mobile phones are important factors that need further research.

Almost all the headphones expose your ears to high-decibel sound waves which can cause some serious damage your ears. If you listen to music on a high volume which is equivalent or higher than 90 decibels, then it may cause some serious damage to your ears as well as permanent hearing loss.

Cell phones and smart phones aren't going away, but certain things can be done to protect hearing. Educating oneself about its hearing dangers can go a long way towards protecting hearing. Suggested safety guide lines to preserve hearing without sacrificing music are:

1. Limit the volume
2. Limit listening time
3. Use of high quality ear phones

CONCLUSION

Present study shows a significant increase in the hearing threshold of subjects hearing music for longer duration through ear phones at higher frequencies. Loud noises cause hearing loss by damaging the stereocilia. longer life time exposure in a year, louder volumes, higher listening frequencies are associated with poor hearing threshold and self-reported hearing problems. Study also shows that subjects listening > 3 hours at every occasion reported Tinnitus more often. It is not known whether the threshold shift is temporary or permanent. This study was conducted to create awareness regarding prolonged exposure to loud noise with cell phone music. The out put levels from cell phone are high enough to cause music induced hearing loss when phones are used at high volume for long periods.

Mobile phones stay and further improve. One cannot stay away from them and lag behind when the technology is progressing. It is necessary to educate oneself about the dangers and use methods to

prevent its harmful effects. Regular audiometric screening of all mobile phone users is recommended. Higher quality ear buds or head phones that transmit the low frequency bass more effectively are a good start. Always take breaks while listening to music on earphones and maintain the volume at a moderate level.

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