



PROLONGED MOBILE PHONE USE ON HEARING AMONG ADULTS

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Abstract

Background- Mobile phones have become an inevitable part of our daily life. With the increase in the number of mobile phones, the fear of health hazards is also raised due to exposure to the radiofrequency fields by these wireless technologies. The main aim of our study is to understand the percentage of sensorineural hearing in adults after prolonged mobile phone use.

Methods: In our study 100 adults were enrolled. By using a preliminary questionnaire straightforward information was collected from each of them. All the mobile phone users who use the dominant right ear for long-term were subjected to otoacoustic emissions (OAE) and pure tone audiometry.

Results: The results of OAE were normal in all the adults. None of them experienced a significant hearing loss of more than 25 dB. However, we discovered that those who use their phones for more than two hours every day experience the least hearing loss.

Conclusions: We concluded that using a cell phone for an extended period did not cause any noticeable hearing loss in the population under study.

INTRODUCTION

Mobile phones have become a part of us in this modern era. This wireless technology relies upon a huge network of fixed antennas or base stations. Radio-frequency signals are used by the base stations to transmit their information. With the advent of new technologies, the number of base stations, which currently stands at 1.4 million, is growing rapidly. Wireless networks, such as high-speed internet access, are also primarily growing in public settings, such as shopping malls, schools, colleges, and residential areas.¹ Since the number of base stations and wireless local area networks increases simultaneously the concern about possible health hazards from exposure to the radio frequency fields by these wireless

technologies also increases.^{1,2} The main goal of this study is to assess prolonged mobile phone usage on hearing among students in a medical college and to calculate the percentage of sensorineural hearing loss.

MATERIALS AND METHODS

The study was carried out from Jan 22 to nov 22 at Santosh Medical College and Hospital, Department of ENT. The study population consisted of adults in the age of 18-22yrs visiting the OPD and using mobile phones for three years or more. Moreover, participants who had no interest in the study, a history of ear disease, exposure to loud noise, extended use of headphones for more than one hour per day, or individuals with any systemic

ailment were eliminated. Individuals with a history of medications for ototoxicity and those with a history of viral infections were also excluded. Smokers and alcoholics were also excluded from the study.

A pilot study in institutions other than the research location served to pretest the study instrument, a self-administered, semi-structured questionnaire. The questionnaire was later modified and corrected in a few places. In addition to other health issues, information was gathered about sociodemographic factors, mobile phone usage trends, and self-reported ear complaints. It includes the years of total mobile phone use, the number of calls made each day, the lengthiest call made in a day, the modes of use (normal, speaker, headphone, Bluetooth), the ears that are most frequently used (right or left or both), the use of music media in mobile phones, and any ear symptoms like hard of hearing, dizziness, tinnitus were noted.

All of the students underwent thorough clinical examinations following the questionnaire, including an otoscopic examination of the ear. Before conducting further research, the tympanic membrane was inspected, and its normality was confirmed. The Rinne's, Weber's and Absolute bone conduction tests were conducted on all of the candidates. Pure tone audiometry (PTA) was performed on each student, and graphs were created. An experienced audiologist used a diagnostic pure tone audiometer to perform audiometry at frequencies of 250Hz, 500Hz, 1000Hz, 2000Hz, 4000Hz, and 8000Hz.

To measure the otoacoustic emissions (OAE) produced by the outer cochlear hair

cells, distortion product otoacoustic emissions (DPOAE) were applied to all of the participants. In this study, all of the candidates had GSM 3G and 4G mobile phones. The audiologist did not know which ear was the frequently used dominant ear, so this study was single-blinded. The type and degree of hearing loss were looked up on the audiograms. The results are evaluated using SPSS software, version 16.

RESULT

This study included 100 patients in total. Among them 50 were men and 50 were women. The average age was 20 years, with ages ranging from 18 to 22. A questionnaire was employed to assess each individual, with particular attention paid to the duration, usage pattern, commonly used ears, and type of mobile phone. In our study, all the patients frequently used the right ear as the dominant ear while using mobile phones.

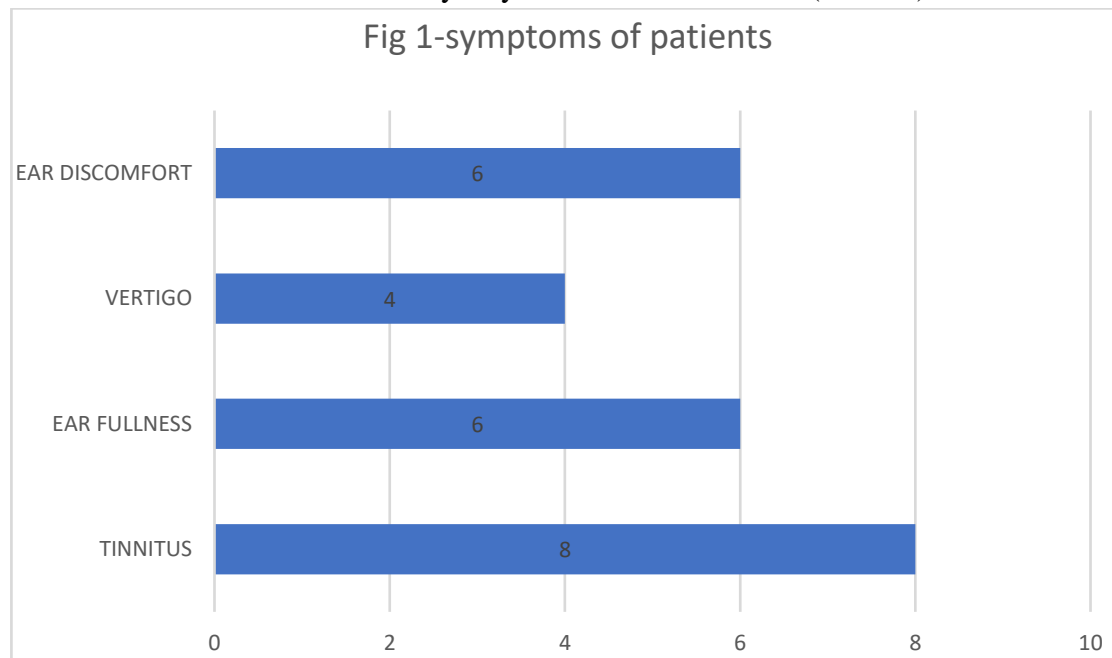
Patients were asked if they experienced any otological symptoms, such as hearing loss, ear ache, vertigo, tinnitus or fullness. A pre-tested questionnaire was used to evaluate 100 students, and of them, 8 reported tinnitus after using a phone, 6 reported ear fullness, 5 reported vertigo, and 5 reported developing ear discomfort. (Fig 1)

In our study, mobile phones were used by 30 subjects for three years, 45 for four years, and 25 for five years. According to our questionnaire's evaluation, 28 respondents had daily exposure to mobile phones for 1 to 2 hours, 36 had daily exposure for 2 to 3 hours, and 18 had daily exposure for 3 to 4 hours. (Table 1)

In this study, it was discovered that 12.9% of the applicants who used mobile phones

every day for two to three hours had a 5 dB loss, 6.45% had a 10 dB loss, and none had a 15 dB loss. Subjects who used their phones for three to four hours every day

saw a reduction of five decibels (20%), ten decibels (13.3%), and fifteen decibels (6.6%). This was noticed in all patient's dominant ears. (Table 3)



Duration of mobile phone usage among adults n= 100 (Table 1)

Years of exposure	No of patients
3	30
4	45
5	25

Average daily exposure of mobile phone users among adults according to the questionnaire (Table 2)

Hours of exposure	No of students
1-2	28
2-3	36
3-4	18

Hours of exposure and degree of hearing loss among adults (Table 3)

Hours of exposure	Db loss	Percentage
2-3	5	12.9
2-3	10	6.45
3-4	5	20
3-4	10	13.3
3-4	15	6.6

DISCUSSION

Mobile phones have become an indispensable part of our everyday lives. In this modern era, they are almost like an extension of ourselves. This wireless technology is supported by a massive network of fixed antennas or base stations.¹ Radio-frequency signals are used by these base stations to relay information. The widespread establishment of base stations has led to huge concern about the

possible hazardous effect of radio frequency emissions. There are two possible reasons why radio frequency field exposure may lead to health hazards. Thermal effects from keeping mobile phones close to the body and conversions over time may pose health risks. Another possibility is that non-thermal effects from base stations and mobile phones are particularly dangerous to people who live near base stations.³⁻⁵ However, radiofrequency emissions from mobile phones are below the international commission on non-ionizing radiation protection guidelines. Such radio frequencies are not sufficient enough to produce toxic effects like DNA mutations.⁶ SAR (specific absorption rate) is a measure of mobile phone users' exposure to electromagnetic fields. SAR is measured in W per kg. Because the ear is closest to mobile phones while in use, it has a higher specific absorption rate (SAR) than the rest of the body. The inner ear, in particular, is more vulnerable to electromagnetic radiation deposition. The organ of Corti contains delicate hair cells with no regenerative properties. As a result, if the hair cells are damaged, the chances of recovery are slim.⁸

According to the study we conducted in Santosh Medical college and Hospital, none of them experienced significant hearing loss of more than 25dB, and among them who used cellphones for more than 2 hours everyday revealed no significant hearing loss. All of the students' OAE results were reported normal in our research for the given duration of 1year.

Numerous studies have been conducted to assess the health risks posed by mobile phones. The existing data suggest that

mobile phone usage in long term can cause health-related problems like headache, dizziness, fatigue, sleep disturbances, etc. However, little is known about the effects of mobile phones on the human auditory system and hearing. The primary goal of our research is to better understand the effects of long-term mobile phone use on hearing. In this study, those candidates who used mobile phones daily for 2 to 3 hours had a 5 dB loss of 12.9%, a 10 dB loss of 6.45%, and none had a 15 dB loss. Also, a 5 dB loss was observed in 20% of subjects who used mobile phones for 3 to 4 hours per day, a 10 dB loss in 13.3%, and a 15 dB loss in 6.6%. This minimal hearing loss is found only in the students' dominant ears. All 100 adults were evaluated using distortion product otoacoustic emission (DPOAE) before PTA. All of the candidates tested for OAE passed it, indicating the integrity of cochlear outer hair cells. According to WHO guidelines, hearing loss of 0 to 25 dB is considered normal in our study. Our study of mobile phone users revealed no significant hearing abnormalities.

Several studies published to date have failed to establish a link between hearing loss and chronic mobile phone use. Panda et al investigated audiological disturbances in long-term mobile phone users.⁹ The participants in their study had high-frequency hearing loss. According to a study conducted by Sahoo et al, sensorineural hearing loss was prevalent in habitual mobile phone users and was directly correlated with the duration of mobile phone usage.¹⁰ Oktay et al study on the effect of mobile phone radiations on hearing found that mobile phone users had a higher degree of hearing loss.¹¹

Karthikeyan and colleagues conducted a study to assess hearing mobile phone

users.¹²

In pure tone audiometry, brain stem evoked response audiometry, and distortion product otoacoustic emissions, they discovered a variable degree of hearing loss in mobile phone users. Approximately 73% of the study population was found to use mobile phones for at least 30 minutes or more per call. They came to a conclusion that the duration of mobile phone use is directly proportional to the severity of hearing loss. According to Kerekhanjanarong et al., the hearing threshold in the dominant most ear of candidates who used mobile phones is lower than in the non-dominant ear.¹³

Ramya et al concluded that a longer duration of mobile usage was associated with a significant increase in hearing threshold.¹⁴ The study conducted by Joshi et al, showed increased auditory threshold shift in the frequently used ear among mobile phone users.¹⁵

According to a study conducted by Philip et al, hearing loss is more prevalent in people who use their mobile phones for more than one hour per day.¹⁶ They hypothesised that the length of time spent on mobile phones played a significant role in the progression of hearing loss. Several studies, including ours, show that chronic mobile phone use is not associated with significant hearing loss. Sievert et al research revealed that mobile phones have no negative effects on the inner ear or auditory system.¹⁷ The findings of Davidson et al study concluded that mobile phone use has no effect on the auditory and vestibular systems.¹⁸ Uloziene et al. studied the effect of minutes of exposure to EMFs emitted by a mobile phone on hearing.¹⁹ They discovered that EMFs emitted by

mobile phones had no effect on pure tone audiometry transient evoked OAE in young subjects. There was no evidence of significant hearing loss.

Chander et al. conducted a study to determine the physical and functional effects of mobile phone usage on the ear and hearing patterns of mobile phone users.²⁰ The subjects who used mobile phones had a hearing loss of less than 15 decibels. They had no significant hearing loss. Similarly, Hegde et al. conducted a study on 120 mobile phone users and non-users aged 18 to 30 years to assess the effect on hearing.⁵ They discovered a minor hearing loss of 5 to 15 decibels among mobile phone users but no significant hearing loss. The current study's findings are consistent with the previous studies.

CONCLUSION

Our study included one hundred adults. Preliminary questionnaires were used to collect basic information from each student. OAE and PTA were performed on all chronic mobile users who use the right ear as their dominant ear. All of the students' OAE results were normal. We also discovered that none of the people in our study had significant hearing loss(>25 dB) However, we discovered that those who used mobile phones for more than two hours per day had minimal hearing loss. As a result, we cannot reach a definitive conclusion about the harmful effect of mobile phones on hearing. Because the young population is becoming more addicted to this fancy multipurpose device, mobile phones may become a risk factor in the near future. As a result, a large population-based long-term follow-up study is required.

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