

Cell Phones and Hearing

Dr. Abhay Kr Singh¹, Dr Ravi Gupta², Dr Sushil Gaur³,
Dr Tarun Malhotra⁴, Dr Abhinav Raj⁵

¹ Associate Professor, Department of ENT, SMC & H, Santosh Deemed to be University, Ghaziabad, Uttar Pradesh, India.

² Junior Resident(3), Department of ENT, SMC & H, Santosh Deemed to be University, Ghaziabad, Uttar Pradesh, India.

³ Professor, Department of ENT, SMC & H, Santosh Deemed to be University, Ghaziabad, Uttar Pradesh, India.

⁴ Hod ENT, Department of ENT, SMC & H, Santosh Deemed to be University, Ghaziabad, Uttar Pradesh, India.

⁵ Assistant Professor, Department of ENT, SMC & H, Santosh Deemed to be University, Ghaziabad, Uttar Pradesh, India.

ABSTRACT:

Background: There have been several concerns raised about the potential health effects of exposure to radio frequency fields from mobile phones or their base stations. **Materials and Methods:** Over the course of three years, 120 mobile phone users and nonusers between the ages of 18 and 30 were evaluated for effects on hearing. Group 2 has no usage or uses their phones for less than an hour per day for less than a year, whereas Group 1 uses their phones for more than an hour per day for more than a year. **Results:** There was a loss of 5 dB in 10% of those using phones for 2–3 hours each day, 10 dB in 3.3%, and 15 dB in 1.6%. Also observed in individuals consuming 3–4 hours per day were losses of 5 dB in 6.6% and 10 dB in 3.3%. In the study group, 26.6% of the participants had sensorineural hearing loss, compared to 3.3% in the control group. **Conclusion:** Our research did not identify any appreciable hearing loss among mobile phone users.

Keywords: Hours of exposure, Mobile phone, Sensorineural hearing loss, Years of exposure.

INTRODUCTION:

The cell phone is a common object in the contemporary society. As of right now, 45% of Indians use it. The WHO is particularly concerned about the fact that, if any negative health effects from mobile phone use are discovered, they will be a worldwide issue because developing countries are installing this technology instead of more expensive fixed line systems. Radio frequency (RF) radiation emissions from mobile phones and the base stations that receive and broadcast signals are of concern. The need of this study was to observe how using a cell phone affects hearing.

MATERIALS AND METHODS:

Over the course of two years, from 2021 to 2022, the study was carried out at the Santosh Medical and College, GZB, department of otolaryngology. Mobile phone users and non-users between the ages of 18 and 30 were included in the study. Users of mobile phones for more than a year who used their phones at least an Hr/day were included in the study. The study excluded those who wear hearing aids, have a history of chronic suppurative otitis media, have had head injuries or fractures, have a family history of hearing loss, or have spent most of the time in noisy environments at work.

Every candidate underwent a thorough history check, with particular attention paid to the duration, pattern, usage, and type of hearing loss and mobile devices. A thorough investigation was conducted into the beginning and potential progression of hearing loss. Any related illnesses, such as systemic hypertension and diabetes mellitus, were investigated. We enquired about any prior history of ear discharge in children. Loud noise exposure at work as well as personal vices like drinking and smoking were queried and recorded. A thorough clinical examination was carried out, including a systemic general examination and an otoscope-based examination of the ears. In-depth observations were made of the tympanic membrane's characteristics. The Weber's, Rinne's, and absolute bone conduction tests—the three common tuning fork tests—were conducted. Pure tone audiometry (PTA), immitance investigations, and graphs were plotted for each candidate. The kind and degree of hearing loss were evaluated using pure tone audiograms.

RESULTS:

The study was divided into two groups: those who used mobile phones more than one hour each day for more than a year and those who used them either not at all or very briefly. Chi-square and Student's t-tests were used for the statistical analysis, and a P-value of 0.05 or lower was regarded as significant. Regarding sex and age distribution, it was discovered that the two groups were comparable ($P > 0.05$, which was statistically insignificant).

SYMPTOM AND PRESENTATION:

At the time of presentation, tinnitus (10%), blocked sensation (15%), and hearing difficulty (3.3%) were the most common symptoms in the study group [Table A]. At the time of presentation, 0 of the participants in the control group exhibited any symptoms. Blocking sensation and tinnitus were statistically significant with a P value of 0.05 or less, whereas hearing trouble, difficulty differentiating between different speech sounds, and loudness intolerance were statistically insignificant (P values of 0.05 or more) [Table A].

HOUR AND EXPOSURE:

In our study group, 14 (23.3%) patients used mobile phones for three to four hours a day, compared to 21 (35%) subjects who used them for one to two hours. A statistically significant Chi-square value of 120 and a P value of 0.000 were discovered [Table B].

HOURS OF EXPOSURE VS HEARING LOSS:

A 5 dB loss was recorded in 10%, a 10 dB loss in 3.3%, and a 15 dB loss in 1.6% of the study participants who used mobile phones for 2–3 hours per day. Additionally, 5.6% of users experienced a loss of 5 dB, while 3.3% had a loss of 10 dB [Table C].

YEARS OF EXPOSURE:

The mean years of exposure in group 1 were 2.47 years, but it was only 0.12 years in group 2 with a statistically significant P value of 0.05 [Table D].

In our study group, sensorineural hearing loss affected 32% of individuals who had used a cell phone for 2 years and 22% of those who had used one for 3 years [Table E].

TYPES OF EXPOSURE:

There were two different types of exposure noticed in the study group: intermittent and continuous. Continuous exposure was seen to be more connected with the study group's minimum sensorineural hearing loss, and this association was made stronger by the exposure's rising hours and years. The control group experienced occasional exposure.

In comparison, 10% and 16.6% of cases in group 1 had limited sensorineural hearing loss in both the right and left ear, respectively, whereas 3.3% of patients in group 2 had sensorineural loss in only the right ear.

DISCUSSION:

Over the past ten years, the general use of mobile phones has skyrocketed, becoming a necessary component of industry, trade, and society. The sheer number of mobile phone owners reflects the public's perception of their significance. Widespread worries have been expressed regarding the potential health effects of exposure to RF fields from mobile phones or their base stations. Such has been the mobile telecoms industry's explosive rise. Health could be negatively impacted by RF radiation exposure in two different ways. ¹These are thermal (heating) consequences that could occur from holding mobile phones close to the body as well as other potential causes. According to a common misconception, the heating impact of GSM radiation is primarily responsible for severe health effects. The claimed negative health consequences and broad range of non-thermal impacts that have been documented in the scientific literature over the past few years suggest that the radiation type now utilised in GSM phones can and does have an impact on living things in a variety of non-

thermal ways. The scalp and the skull may be penetrated by the pulsing high frequency electromagnetic field that phones emit. ²It is known that these ^{4,5}electromagnetic fields change specific components of the brain's electrical response to audio inputs. Numerous brain functions, including electrical activity, electrochemistry, permeability of the blood-brain barrier⁶, and ⁷immune systems have been reported to be negatively impacted by prolonged exposure to microwave radiation³. ⁷It is well known that microwaves have non-thermal effects on the brain's dopamine-opiate system^{8,9} and enhance the blood-brain barrier's permeability. ¹⁰The testis, eyes, and other tissues may all suffer negative effects from exposure to high density microwaves, which can also cause major biological alterations through thermal actions. ¹¹The temporal area closest to the phone antenna seems to be heating up the fastest. Significant changes in local temperature and physiologic characteristics of the cardiovascular and central nervous systems are brought on by ultrahigh frequency radiation¹². Along with a hypotonic effect¹³ that reduced sleep onset latency, it was also discovered that REM suppression reduced the duration and proportion of REM sleep. When compared to users of the analogue Nordisk Mobile Telecommunication¹⁴ (NMT) system, complaints were more common for those utilising digital (GSM) systems with pulse modulated fields. The auditory nerve is among the tissues that are most exposed to RF radiation from mobile phones¹⁵. Effects on neuronal electrical activity, energy metabolism, genetic reactions, neurotransmitter balance, blood-brain barrier permeability, cognitive function, auditory function, sleep, and many brain illnesses including brain malignancies are of concern. As long as the radiation intensity stays in the non-thermal range, the majority of the reported impacts are negligible, and none of the evaluated studies indicates the mechanisms at play at this range. The WHO is particularly worried about the potential worldwide impact of any negative health effects from mobile phone use because developing nations are creating this technology instead of the more expensive fixed line systems. The use of the this study was to look at the relationship between mobile phone use and hearing loss while taking the risks associated with them into consideration.

AGE AND SEX:

The Male female distribution between the study and control groups was found to be similar.

SYMPTOMS:

In our investigation, tinnitus (10%), blocked feeling (15%), and hearing difficulty (3.3%) were the three predominant symptoms at the time of presentation. At the time of presentation, 0 of the participants in the control group displayed any symptoms. The aggregate mean percentage of complaints reported in all groups in a research by I-Khlaiwi et al¹ was headache (21.6%), sleep disturbance (4%), tension (3.9%), weariness (3%), and dizziness (2.4%). According to a research by Meo and Drees¹⁶, roughly 34.59% of complaints involved hearing loss, earaches, or warmth in the ear, while 5.04% had decreased or obscured vision.

YEARS OF EXPOSURE:

In our study, sensorineural hearing loss was present in 32% of those who had used a mobile phone for less than two years and 22% of people who had used one for more than three years. This shows that the mild hearing loss (5-15 dB) observed in the research group varied not only on yrs of exposure but also on exposure type, exposure hours, and exposure type. In their study, Panda et al¹⁷ examined how long-term use of electromagnetic waves from GSM mobile phones affected users' ability to hear. For high v hearing loss, distortion product oto-acoustic emissions (DPOAE), auditory brain stem response (ABR), and middle-latency responses (MLR) in the users, no significant changes were discovered. Subjects who had used phones for more than 4 years demonstrated high frequency hearing loss (P = 0.04). In our investigation, we also noticed that none of the participants in the study group had a hearing loss that was considered to be serious (>25 dB). The results of Davidson and Lutman's¹⁸ "survey of mobile phone use and their chronic effects on the hearing of a student population" are consistent with this. Low or short-term users reported hearing loss, tinnitus, or loss of balance more frequently than high or long-term users.

HOURS OF EXPOSURE:

Although no one in our study group had a major hearing loss, we did notice a rise in hearing threshold in the range of 5 to 15 dB (26.6% of study group participants and 3.3% of control group participants had a hearing loss of 5 dB). Particularly in those who were exposed to mobile phone usage for more than 2 hours per day, and especially if the usage pattern is continuous, 6.6% of the study group showed a hearing loss of about 10 dB and 1.6% of them of 15 dB. This relates to a study by Callejo and Santamaria²⁰ that involved 323 healthy, normoacoustic volunteers who regularly used mobile phones and had their audiometric hearing tested at the beginning of their use and again three years later to determine how much time per day and which ear they used for direct contact with the phone. The study also included a healthy, normoacoustic control group of non-users. At the start of the investigation, the audiometric curves of the patients and controls were comparable. Following this follow-up, cases demonstrated an increase in speech tonal hearing threshold between 1 and 5 dB greater than controls (P 0.001).

Our findings concurred with a study by Oktay and Dasdag²¹ from the department of otolaryngology at the medical school in Diyarbakir, Turkey, who looked at how mobile phone radiation affected users' hearing. Three groups of 20 men each participated in the study: (1) 20 men who spoke on their cell phone regularly for about 2 hours per day for 4 years; (2) 20 men who spoke on their cell phone for 10 to 20 minutes per day for 4 years; and (3) 20 healthy men who never used a cell phone (control group). The effects of exposure on the individuals' hearing function were assessed using the brainstem-evoked response audiometric (BERA) and PTA techniques. In PTA assessments, there were no differences between the control patients and moderate mobile phone users (10–20 minutes per day),

according to the BERA data ($P > 0.05$). However, it was discovered that detection thresholds were higher in people who chatted for about two hours a day than in moderate users or control subjects. For the mean hearing threshold, differences at 4000 Hz for both bone conduction and air conduction for the right ear and 500 and 4000 Hz for bone and air conduction for the left ear were significant. This study demonstrates a link between prolonged exposure to the electromagnetic field produced by cellular phones and a higher level of hearing loss.²² In contrast, participants in our study who used their phones for less than two hours per day displayed normal audiometric curves, which can be related to a study by Sievert et al²³ in 12 healthy test participants with normal hearing. Prior to, during, and following exposure to electromagnetic emissions from standardised mobile phone devices, auditory brain stem reactions were recorded. Pulse and continuous types of electromagnetic emissions fields were used. Special "pug-in" earbuds had to be worn for sound stimulation concurrent with field exposure. At least in the near term, cell phone emissions have no negative consequences on ear function.

WHO RECOMMENDS:

In the mean time, WHO suggests:

- a) Strict attention to recommendations based on health. International regulations have been created to safeguard everyone in society, including mobile phone users, those who live or work close to base stations, and those who do not.
- b) Current scientific research does not support the requirement for any additional safety precautions when using mobile phones. If people are worried, they may decide to use "hands free" devices to keep mobile phones away from the head and body or limit the length of talks in order to reduce their own or their children's RF exposure.

CONCLUSION:

Due to the fact that hearing loss between 0 and 25 dB is considered to be normal in most situations, our study did not reveal any substantial hearing loss among mobile phone users. Nevertheless, we found that people who used their phones continuously for more than two hours every day had a modest hearing loss of 5–15 dB. Therefore, before we can draw a firm conclusion, we advise doing a long-term follow-up study among long-term mobile users.

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