Effects of Long Term Use of Mobile Phones on Hearing Status of Healthy Individuals Compared to Infrequent Mobile Phone Users in Age Group of 15-40 Years

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Abstract: ***Background & objectives*** ***: The electromagnetic waves can affect the human health including hearing impairment. Several studies have shown increased degree of hearing loss with long term use of mobile phones. The present study was conducted to find out the severity of hearing loss with long term use of mobile phones.*** ***Method*** ***: The study was conducted at District Disability & Rehabilitation Centre (DDRC), civil hospital campus, Ahmedabad on 30 subjects of 15-40 years age group using mobile phones more than 1 hour a day as study group and another 30 subjects with same age group using mobile phones less than 15 minutes a day as control group. The pure tone Audiometry was conducted in both groups using Elken eda 3 N 3 mille instrument.*** ***Results:*** ***The study shown an increased mean hearing loss with long term mobile phone usage in study groups compared to control group and difference was statistically significant (P<0.05). Interpretation & conclusion: Similar to earlier studies done in India & abroad, increased degree of hearing loss was found in long term mobile phone usage than control subjects with mean hearing loss was more in dominant ear compared to non-dominant ear. Cut short the duration of mobile phone usage can reduce this problem.***

Keywords: High Frequency Hearing Loss, Pure Tone Audiometry, Mobile Phone

1. Introduction

Mobile phone uses electromagnetic waves to transmit the signal from mobile phone to mobile towers and vice versa. The electromagnetic waves can affect the human health ranging from increase the blood pressure, cause memory loss and induce migraines, hearing impairment to even cancer can also occur. Several studies have shown increased degree of hearing loss with long term use of mobile phones. The present study was conducted to find out the severity of hearing loss with long term use of mobile phones.

2. Aims & Objective

1. To study the effect of total duration of daily usage of mobile phones on hearing.
2. To study the effect of duration of dialogue period of daily mobile phone usage on hearing.
3. To study the effect of total duration (in years) of mobile phone usage on hearing.
4. To compare the hearing status of right & left ears of mobile phone users.
5. To assess the severity of hearing loss in mobile phone users with the history of tinnitus, warm sensation in the ear & earache.

3. Material and Methods

The study was conducted at District Disability & Rehabilitation Centre (DDRC), civil hospital campus, Ahmedabad. 30 subjects of 15-40 years age group using mobile phones more than 1 hour a day were taken as study group and another 30 subjects with same age group using mobile phones less than 15 minutes a day were taken as control group. The pure tone Audiometry was conducted in both groups using **Elken eda 3 N 3 mille instrument**.

4. Result

There was an increase in mean hearing loss (especially at higher frequencies) with increase in duration of daily mobile phone usage with longer the duration of dialogue period over mobile phone, higher is the mean hearing loss (especially at high frequencies). There was also increase in mean hearing loss (especially at higher frequencies) with increase in total years of mobile phone usage. Hearing loss (especially at higher frequencies) was more marked in right ear (mobile phone using ear) as compared to left ear (Non mobile phone using ear).

Table 1: Showing standard Anthropometrical Measurement of Control (n=30) and study subjects (n = 30)

Parameters	Study group		Control group	
	Mean	SD	Mean	SD
Age (yrs.)	26.17	2.65	26	3.93
Height (cm)	168.27	5.32	168.00	4.14
Weight (kg)	70.77	4.99	71.23	4.14
A	106.0	40.73	9.33	3.65
B	42.50	15.30	1.83	0.65
C	2.93	1.36	3.10	1.06
D	12.17	9.53	0.33	1.83
E	12.50	10.15	0.33	1.83
F	5.16	9.14	0.33	1.83
G	5.16	8.85	0.33	1.83

A-Total duration of daily usage of mobile Phones (in hours),

B-Longest dialogue duration over mobile phones in a day (in minutes),
C-Total duration of mobile usage (in years),
D-Hearing loss in db at 4000 Hz frequency in Right ear, **E**-Hearing loss in db at 8000 Hz frequency in Right ear, **F**-Hearing loss in db at 4000 Hz frequency in Left ear, **G**-Hearing loss in db at 4000 Hz frequency in Left ear

Table 2: Relationship between total duration of daily usage of mobile Phones (in hours) and hearing status

A	No of subjects	Hearing Status			Mean Hearing loss in db
		Normal	Mild HFHL	Moderate HFHL	
<1	11	6	5	0	8.15 ± 3.68
1-2-Jan	15	1	9	5	10.58 ±
2-4-Feb	4	0	2	2	13.75 ±
Total	30	7	16	7	8.47 ± 4.15

A-Total duration of daily usage of mobile Phones (in hours), HFHL-High frequency hearing loss

Table 3: Relationship between longest dialogue duration over mobile phone & hearing status

B	No of subjects	Hearing Status			Mean Hearing loss in db
		Normal	Mild HFHL	Moderate HFHL	
30 - 45	15	7	7	1	4.08 ± 2.83
45 - 60	14	0	9	5	12.41 ± 5.68
> 60	1	0	0	1	30 ± 5.77
Total	30	7	16	7	8.47 ± 4.15

B-Longest dialogue duration over mobile phones in a day (in minutes), HFHL-High frequency hearing loss

Table 4: Relationship between total duration of mobile usage (in years) and hearing status

C	No of subjects	Hearing Status			Mean Hearing loss in db
		Normal	Mild HFHL	Moderate HFHL	
1-2-Jan	11	5	6	0	4.08 ± 2.65
2-4-Feb	16	2	10	4	8.43 ± 4.08
> 4	3	0	0	3	24.16 ± 5.69
Total	30	7	16	7	8.47 ± 4.15

C-Total duration of mobile usage (in years), HFHL-High frequency hearing loss

Table 5: Comparison of degree of hearing loss in right & left ears at 4000 Hz & 8000 Hz frequencies in mobile phone users

Frequency in Hz	Degree of hearing loss in db in study subjects		No of subjects having hearing loss	
	Right ear	Left ear	Right ear	Left ear
4000 Hz	12.17 ± 9.53	5.16 ±9.143	23	10
8000 Hz	12.50 ± 10.15	5.16 ± 8.85	23	9

5. Discussion

Table-1 shows standard anthropometric measurements of Long term mobile phone users (n=30) and Infrequent mobile phone users (n=30). The mean age of study group was (26.17 ± 2.65 years) and that of control subjects was (26 ± 3.93 years).The mean usage of mobile phones for study group was 106.0 ± 40.73 minutes and for control group was 9.33 ± 3.65 minutes, the difference was found statistically significant. The mean duration of a dialogue period of daily mobile usage in study group was 42.50 ± 15.30 minutes and for control group was 1.83 ± 0.65 minutes that was also found statistically significant. The Mean total years of mobile phone usage in study group was 2.93 ± 1.36 years and in control group was 3.10 ± 1.06 years which was statistically insignificant. The mean hearing loss at high frequencies in both ears in study group was 8.47 ± 4.15 db and in control group was 0.33 ± 1.826 db that was statistically significant.

Table-2 shows that in 11 subjects with mobile usage <1 hour per day, 5 subjects (45.45 %) were having mild HFHL with mean hearing loss was 8.15 ± 3.68 db. In 15 subjects with mobile usage between 1-2 hours per day, 14 subjects (93.33 %) were having mild to moderate HFHL with mean hearing loss was 10.58 ± 6.07 db. In 4 subjects with mobile usage between 2-4 hours per day were having mild to moderate HFHL with mean hearing loss of 13.75 ± 6.33 db.

Table-3 shows that In 15 subjects with mobile usage between 30-45 minutes per day during dialogue period, 8 subjects (53.33 %) were having mild to moderate HFHL with mean hearing loss was 4.08 ± 2.83 db. In all 14 subjects with mobile usage between 45-60 minutes per day during dialogue period were having mild to moderate HFHL with mean hearing loss of 12.41 ± 5.68 db. In 1 subject with mobile usage between > 60 minutes per day during each episode was having moderate HFHL with mean hearing loss of 30 ± 5.77 db.

Table-4 shows that In 11 subjects with mobile usage for 1-2 years, 6 subjects (54.54 %) were having mild HFHL with mean hearing loss of 4.08 ± 2.65 db. In 16 subjects with mobile usage for 2-4 years, 14 subjects (87.5 %) were having mild to moderate HFHL with mean hearing loss of 8.43 ± 4.08 db. In 3 subjects with mobile usage for > 4 years were having moderate HFHL with mean hearing loss of 24.16 ± 5.69 db.

Table-5 shows that 23 subjects (76.67 %) were having HFHL with Mean hearing loss of 12.17 ± 9.53 in right ear (dominant ear), and 10 subjects (33.33 %) were having HFHL with Mean hearing loss of 5.16 ±9.143 in left ear(non dominant ear).

6. Conclusion

The above study shown that there was some hearing impairment in long term mobile phone users compared to infrequent users. The dominant ear was affected more than non dominant ear. Further studies on large sample size will be required to strengthen our knowledge on deleterious effects of long term and intensive mobile phone use on hearing. At present we can guide young mobile phone users with potentially longer lifetime exposure to cut short the dialogue periods and use the hand-sets for essential purposes only. By using speaker phones or hands-free system, the direct exposure to electromagnetic radiations emitted by

mobile phones can be minimized. Regular audiometric screening of all mobile phone users is recommended.

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