The Highs and Lows of Audiophiles.

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ABSTRACT-

Introduction: Music is considered one of the means of entertainment today. It has been evolved a long way from folk to rock music to instrumentals. With advent of gramophones and radio, listening to music had become easy and convenient. But with introduction to Walkman, ear devices have now been truly evolved with “music on the go” as the standard. The next generation hearing devices are now in vogue which are more appealing and trendy, with its own pros and cons.

Aims and Objectives: To study hazardous effects of overuse of ear devices and its relation between deafness and duration of usage.

Methodology: Data was collected from 650 self-confessed volunteers using portable hearing devices with help of questionnaire and were then subjected to audiometry

Results: Results were drawn after categorizing volunteers into 3 groups based on threshold of hearing and hearing loss and the unaffected ones.

Conclusion: A fine line between enjoying music and preventing damage to oneself is answered in this study.

Key words: Hearing devices, deafness, music, audiometry.

INTRODUCTION-

Music plays a pivotal role in many cultures since ages and also one of the mode of money spinners in the present time as its pure motto is entertainment. There goes a common saying- “its music to my ears” meaning music is pleasant to listen to. Ancient Greek and Indian philosophers defined music as “tones ordered horizontally as melodies and vertically as harmonies”(1,3,7). Music not only brings people together but can easily transcend any language barrier, and makes us close to ourselves with its essence. Music has been evolved since ages- right from folk - opera/classical- pop/filmi songs, rock (acid rock/death metal), jazz, rap, hip-hop music to instrumentals like flute/ sarod/ guitar(2,6,12). With advent of gramophones and radio, people preferred staying at home and listening to music as it was easy and convenient rather than attending performances which were expensive too. One of the most innovative ways to facilitate listening to music is through the use of headphones, which is in vogue since 100 years now. With the introduction of Walkman in 1979, ear devices got truly evolved into something that all music fans were thirsting for, as “music-on-the-go” became the standard. Then on, the next generation of hearing devices, ear plugs, ear buds and wireless headphones developed which eventually ushered in today’s selection of high fidelity portable listening devices(3,8,11,15).
AIMS AND OBJECTIVES-
To study hazardous effects of overuse of new ear devices.
To study relation between duration of use of hearing devices and deafness.

METHODOLOGY-
A prospective study was conducted in 650 mixed spectrum of volunteers (mainly students, neighbours, acquaintances). All of them were self-confessed regular users of portable ear devices since many years and also for increased duration in a day for various reasons-professionally and personally. The data was collected among them with the help of a questionnaire and all the volunteers were subjected to Pure Tone Audiometry (Figure 1, 2, 3).

Figure 1: Normal Audiogram
Figure 2: Audiogram showing temporary threshold shift.
Figure 3: Audiogram showing permanent threshold shift.
RESULTS

This is graphically represented below (Figure 4,5,6)-

Then a repeat audiometry was done for those participants who had temporary threshold shift after 3 days and the result was a near normal hearing audiogram.

**Figure 4:** ‘Doughnut graph’ showing the threshold of hearing among the sample size. Change in threshold shift of hearing were noted among 252 of them. Among which 211 of them had temporary threshold shift and 41 had permanent threshold shift while the remaining 398 had normal hearing audiogram.

**Figure 5:** ‘Line diagram’ showing number of volunteers V/S deafness in decibels among them. 276 had a hearing loss of 1-10dB, 177 had a hearing loss of 11- 20dB, 149 had a hearing loss of 21-30 dB and 48 had a hearing loss of 31-40dB.
The hair cells in the Organ of Corti situated in cochlea constantly use energy to convert sound waves to nerve impulses that are transmitted to brain and over exposure to loud sounds can lead to damage to these complex structures. Excessive loud sound causes metabolic exhaustion, where glycogen reservoirs and oxygen used for energy and respiration by cells are depleted leading to production of free radicals and reactive oxygen species, which injure proteins in the cell. Cellular overstimulation causes temporary, reversible damage known as a “temporary threshold shift” (Figure 2) as the cells stop functioning normally. Over next 16-48 hours, cells recover if damage is not too severe. If cells cannot recover, the damage is permanent and cells will die, producing a “permanent threshold shift” (Figure 3). Usage of headphones (Figure 9) cause 110dB hearing loss while ear plugs/ear buds (Figure 7,8) nearly 120dB. As per Thumb rule (60/60 rule), use mp3 players at levels up to 60% of maximum volume for total of 60min/day. Loud music through hearing devices like ear plugs cause more hearing loss as compared to headphones. Headphones delivering sound at 110dB for over 30mins can lead to cognizant hearing loss while earplugs can cause similar damage due to its anatomical fitting in the ear canal. Noise induced hearing loss depends on duration and intensity of exposure. Ear devices lead to noise induced hearing loss based on duration and intensity of exposure as shown in the chart below:

<table>
<thead>
<tr>
<th>dB loss</th>
<th>95</th>
<th>100</th>
<th>105</th>
<th>110</th>
<th>115</th>
<th>120+</th>
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<tbody>
<tr>
<td>Hours of exposure</td>
<td>4</td>
<td>2</td>
<td>1</td>
<td>1/2</td>
<td>1/4</td>
<td>immediately</td>
</tr>
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The availability of high fidelity portable audio gizmos, earlier Walkman players (Figure 10) and now at present mp3 players (Figure 11) and ipod players (Figure 12), with very loud output have spurred the youth of this generation to preferentially listen to very loud music even when they are cell phones. Usage of ear devices while driving often leads to accidents as people are engrossed in the tunes and unaware of the surroundings, so even while walking on busy roads the sound of traffic could be masked leading to inadvertent mishaps. Persons who regularly use intoxicants are usually unaffected by pain and may suffer from hearing loss due to excessive loud noise. Usage of ear devices have a lot of cons and minimal pros that is it gives a sense of relaxation and a certain extent of convenience in the busy life. Among the list
of cons not just it causes hearing loss gradually as mentioned earlier, but even can cause local ear infection specially by using in the canal ear devices. Also among alcoholics, not all it causes psychological ill effects but also disastrous effects on hearing and secondary damage to hearing based on usage of hearing devices. As among youth, consumption of alcohol is ‘on a go’, so maximum catastrophic events are seen among them\(^{(2,5,6,13)}\). It is not only justified that by listening to music with help of ear devices with your own portable hearing devices, hearing loss is resulted, but even by attending classical music concerts and checking in into rock clubs and discs frequently, the dreadful effects of deafness are noted. Not just among the participants is the hearing loss noted, but even among the musicians the devastating effects of hearing loss are seen\(^{(6,9,15,18)}\). Not just while walking, travelling or while ideally sitting it is used as a style statement, but while exercising over treadmill and while even jogging its now become a rage of fashion statement. At one end by exercising healthwise its getting good results but on other end it is gradually and progressively tending to cause some amount of deafness on a long run\(^{(7,12,13,16)}\). Some of them are professionally inclined to use ear devices as in BPO, call centres. Usually people complain of after effects following using ear devices like tinnitus, otalgia which persists for a while to accustom to the normal and regular environment as they block the normal sound waves to penetrate the ear. People prefer using this mode of recreation while transportation. First of all the noise ambience present in the surrounding cause hearing loss and using PMP’s adds on to it further causing distressing events\(^{(1,5,7,10)}\). Custom fit earplugs, worn by musicians, are made from an impression of the ear canal taken by an audiologist or other hearing health professionals. The impression is then sent to a laboratory where the final earmold is made. Custom earplugs are comfortable, easy to insert correctly, and filter sound better than disposable plugs. The ER-15 and ER-25 models better than disposable ones are popular with musicians because of a special filter that lets the listener hear music at a safe level without sacrificing quality. Instead of cutting out the high frequencies, musician's plugs attenuate all the frequencies evenly in relation to your hearing\(^{(4,5,9,14)}\).

The latest gadgets in market have an inbuilt mechanism in the sound system, safe precautionary level for volume beyond which volumes cannot be raised as it may harm the hearing. And this volume safe limits inbuilt in the devices which is one of the precautionary measure taken by the manufacturers to avoid certain amount of hearing loss among the population\(^{(3,6,13)}\). On comparing threshold shift among sample size-change in threshold shift of hearing were noted among 252 of them. Among which 211 of them had temporary threshold shift and 41 had permanent threshold shift while the remaining 398 had normal hearing audiogram. This infers that 32% had temporary threshold shift based on hours of hearing and 6% of them permanent threshold shift in hearing\(^{(1,2,8,16)}\). While comparing, number of volunteers/deafness in decibels among them. 276 had a hearing loss of 1-10dB, 177 had a hearing loss of 11-20dB, 149 had a hearing loss of 21-30 dB and 48 had a hearing loss of 31-40dB. Hence, inferring that almost 30% of them had a hearing loss of 20-40DB\(^{(2,10,16,17)}\). On comparison, number of volunteers/duration of usage of ear device per day. 249 of them used for minimum 2 hours per day, 183 of them used for about 2-4 hours per day, 167 of them used for about 4-6 hours per day and the rest 51 of them used for > 6 hours per day. As duration of exposure is directly proportional to hearing loss, 26% of them used hearing devices for 4-6 hours of day and 8% for more than 6 hours of day\(^{(2,8,11,17)}\). There is a dictum that goes by saying, “MUSIC” as a means of precautionary measure...M- mp3 players can be too loud for your ears...so turn it down, U- use chill out zones in clubs and take regular breaks from loudest areas, S- stand back from speakers...as your ears will thank you, I- invest in some noise cancelling headphones, C- carry earplugs with you...they won’t block music out, just make it safer\(^{(1,15,18)}\).
Figure 7: Ear hugging ear devices (Ear buds)

Figure 8: Ear plugs

Figure 9: Wireless headphones

Figure 10: Walkman player
CONCLUSION
Music is a soul soothener and listening to it has become easy and convenient due to various kinds of ear devices and using them has become a fashion statement and an addiction among the youth. These hearing devices must be used cautiously and should not be used for prolonged duration at high volumes. As in the long run it acts like a slow poison, causing hearing loss with compounded problem due to age related deafness, and the damage once done cannot be reverted back. Take home message- “Personal hearing protection is your responsibility”, as “music on the go” through these ear devices is now the anthem among the youth.

REFERENCES


PROFORMA - Ear devices: Do they lead to hearing loss??!

<table>
<thead>
<tr>
<th>Name-</th>
<th>Age/Sex-</th>
<th>Phone number-</th>
<th>Occupation-</th>
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1. Do they use personal hearing devices?
   * Yes  * No

2. Mode of ear device used-
   * Headphones  * ear plugs  * ear buds

3. Type of gadget used with ear device-
   * Mobile phones  * I pods  * portable mp3 players

4. Purpose of using gadget-
   * Recreation  * work related  * any others - telephonic conversation, internet chat

5. Duration of gadget usage in terms of (hours/day)-
   * 0-2  * 2-4  * 4-6  * > 6

6. Duration of gadget usage in terms of years-
   * 0-2  * 2-4  * 4-6  * > 6

7. Are you suffering from any hearing loss otherwise?
   * Yes  * No

8. After effects, following usage of ear device-
   * Heaviness in ear  * headache  * pain in ear (otalgia)  * itching

9. Do you think ear devices cause hearing loss?
   * Yes  * No

10. Most common listening environment-
    * Home  * workplace  * during transportation  * any others

11. Volume setting used in the gadget during usage of ear devices-
    * Low (60dB)  * medium (60-90dB)  * high (90-120dB)

12. Does your profession demands usage of ear device?
    * Yes  * No