



Can Excessive Usage of Earphones Affect OAE's?

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Introduction

Otoacoustic emissions (OAEs) are audio signals that originate from the cochlea. It can be recorded by a probe which contains microphones that is inserted into the external auditory canal^[1]. For the sake of discussing their main features and characters otoacoustic emissions have been classified on the basis of the type of stimulus needed to evoke them, on that basis Otoacoustic emissions have been categorized into two main categories, Spontaneous oaes are elicited without a stimulus while evoked Oae's require stimulus to be elicited. Evoked oaes are further classified into 3 different types which are Transient evoked oaes (TEOAEs), distortion product oaes (DPOAEs), stimulus frequency oaes (SFOAEs)^[2]. Otoacoustic emissions make a great audiological test as they give a brief description about the functional status of the outer hair cells^[3]. DP OAE's show integrity of outer hair cells and how the cochlea functions. When used correctly in a clinical setting, they are a very useful assessment tool for diagnosing hearing loss with accuracy. DP OAE's are readily recorded in newborns and preteens and can provide us with basic hearing screening information as well as diagnostic information in case hearing loss is suspected^[4]. DPOAEs also provide audiologists with a frequency specific and non-invasive view of the cochlea and cochlear

amplification function. Non-linear inter-modulation between the two stimulus tones given while recording DPOAEs produces multiple new frequency components within the cochlea which travels via the auditory canal. They offer us an opportunity to get the view of the whole cochlea from base to apex, since they are frequency specific in nature^[5]. The study of DPOAEs can help us greatly when it comes to the site of lesion testing of the cochlea due to their frequency specific nature. Otoacoustic emissions, according to a number of studies, can signal cochlear injury before the pure tone audio-metric threshold changes^[6]. Now a days listening to music has become one of the most common leisure activities and among the youngsters, using earphones for listening to music at high volume is the most common and preferred way. However this new habit that most teens and youngsters have inculcated into their lifestyle has resulted in many social and health problems. Majority of the problems the prevalent use of earphones are causing, the affect on hearing of a person is mostly ignored. The human ear is a very delicate organ which can be damaged easily if it is exposed to high intensity sounds for a longer duration of time. According to OSHA Standards permissible noise level limit depends on the duration of exposure to the sound. A 90-dB noise level limit is specified for an exposure time of 8

hours. Noise is a health hazard. According to review of literature leisure noise is a considerable risk to auditory health especially to preteens, teenager and young adults^[7]. Tinnitus, a ringing, buzzing, or roaring in the ears or head, can also be brought on by exposure to loud noise^[8]. Research efforts have indicated that exposure to loud sounds over a long period of time may lead to difficulty understanding speech (NIDCD, 2007). Due to the social factors, some users despite being aware of the effects of excessive usage of earphones chose to ignore the possibility of damage. There is also a lack of awareness among the youth about the consequences of noise exposure.

Need for the Study -

We live in an era where life without technology seems impossible. There is an increasing drift about the latest technology among the general public. This advancement in technology is both a boon and a curse for everyone because as much as we are benefiting from the technological advancements there are some downsides to the use of technology as well. One such advancement is earphones which come with various standards and form. However, all the brands that are manufacturing the products within the defined norms have completely seemed to ignore the norms from an audiological point of view. There it becomes important to find out how excessive earphone usage might affect the auditory system even before pure tone thresholds of a person have shifted beyond the normative range. Therefore, there is a dearth to study the effect of excessive usage of earphones on the inner ear functioning by measuring the OAE's.

Aim and Objective-

Aim of the research is to study the impact on otoacoustic emissions due excessive usage of earphones.

Methodology

A questionnaire consisting of 2 parts was developed. The first part of the questionnaire was all about the awareness regarding exposure to noise and if it affects our hearing in any way. The second part included questions such as the duration of earphone use, intensity of the volume, type of earphones and

if the earphone use is continuous or there are breaks in between and many more. The final questionnaire was sent out to the students of SGT University, Gurugram. A total of 68 students responded to the survey. According to the questionnaire 40 students out of the 68 that responded to the questionnaire were found to have excessive earphones usage in their day to day life. The age range of the subjects was 18-23 years of age 54 % of which were male and 46% of them were females.

The study was divided into the experimental and the control group both consisting of 40 participants each. Basic demographic details such as name, age, gender were taken from each participant. Those respondents who had earphone usage of at least 4-5 hours a day consistently for the last 6 months, normal hearing thresholds, no conductive component were selected to be the part of the experimental group and the ones with a history of surgery were excluded from the study. The inclusion criteria for the control group was the minimal usage of earphones (less than 30 minutes a day) , normal hearing and no history of conductive component. A complete medical and audiological history was taken from each participant of the two groups. PTA and Immitance audiometry was done on the participants from both the groups. Only the participants who had a normal hearing threshold, type "A" tympanogram and acoustic reflexes present were included in the study. After finding no discrepancies in their history that can affect OAEs except for the excessive earphones usage. Diagnostic OAE was done using the intelligent hearing system (IHS) instrument in a sound treated room to make sure there was minimal background noise. The passing criteria for diagnostic OAEs were a signal to noise ratio of ≥ 6 dB. The data obtained was further compared within the groups.

Results -

The questionnaire that consisted of 13 questions was sent out for validation by 5 Audiologists with at least 7 years of research experience. Out of 13 questions 10 were selected to be part of the final questionnaire. Reliability for both parts of the questionnaire was measured separately using Cronbach

alpha. The alpha for both part 1 and part 2 was 0.83 and 0.88 respectively which means both parts of the questionnaire had good internal consistency.

Out of the 40 participants from the control group, the result showed "PASS" with good SNR values obtained which indicated healthy outer hair cells functioning. Although the oae result showed "PASS" in 8 (20%) of the participants, the SNR values were between 6-8 dB, which means the result was barely passed, after going through the questionnaire it was concluded that even though the subjects were excessive earphone users their oae showed "PASS" only because their earphone use had begin relatively recently as compared to the other members of the experimental group. The rest of the experimental group all had "REFER" as their OAE result. The amplitude obtained from the experimental group varied differently based on the listening habits of the participant. SNR obtained from the group that used earphones for the most amount of time was found to be lower as compared to the SNR of the group that used earphones for the least amount of time in the experimental group.

A similar trend was noted in subjects that used earphones at high intensities as their SNR was significantly poor than the subjects who used earphones at a relatively low volume. Following the same trend the subjects that used earphones continuously without breaks had a significantly poorer SNR when compared to the subjects that took breaks in between earphone use. The case where SNR was found to be most affected was in subjects who used earphones continuously at a higher intensity for a longer amount of time.

Discussion -

The present study aims to examine the affects of earphone use on OAE's in students that use earphones for more than 4-5 hours a day. Even though students who use earphones for more than 4-5 hours per day are more prone to develop auditory issues, it was found that they had no awareness regarding the affects even the noise from earphones can have on a person's auditory system. It was also found that the subjects that had more awareness regarding the affects of noise on the auditory system had a lower usage rate and thus better

SNR than compared to those who had no awareness regarding the affects of noise on the auditory system.

Conclusion -

The result of this study shows that excessive use of earphones is very harmful for auditory system. Although pure tone thresholds are not affected at first, but the harm done by the excessive sound via earphones and other such devices are clearly visible in the result of oae's in the experimental group. Awareness arises when knowledge accompanies action. Therefore, awareness should be created among the students about the usage of earphones in terms of duration and permissible sound level which in turn can help them monitor their usage and save their ears from irreversible hearing loss.

References

1. Kemp, D. T. (2002). Otoacoustic emissions, their origin in cochlear function, and use. *British medical bulletin*, 63(1), 223-241.
2. Martin, G. K., Probst, R., & Lonsbury-Martin, B. L. (1990). Otoacoustic emissions in human ears: normative findings. *Ear and Hearing*, 11(2), 106-120.
3. Lonsbury-Martin, B. L., McCoy, M. J., Whitehead, M. L., & Martin, G. K. (1993). Clinical testing of distortion-product otoacoustic emissions. *Ear and hearing*, 14(1), 11-22.
4. Abdala, C., & Visser-Dumont, L. (2001). Distortion product otoacoustic emissions: A tool for hearing assessment and scientific study. *The Volta Review*, 103(4), 281.
5. Glatke, T. J., & Kujawa, S. G. (1991). Otoacoustic emissions. *American Journal of Audiology*, 1(1), 29-40.
6. Prasher, D., & Sułkowski, W. (1999). The role of otoacoustic emissions in screening and evaluation of noise damage. *International journal of occupational medicine and environmental health*, 12(2), 183-192.
7. Maassen, M., Babisch, W., Bachmann, K. D., Ising, H., Lehnert, G., Plath, P., ... & Zenner, H. P. (2001). Ear damage caused by leisure noise. *Noise and Health*, 4(13), 1.

8. National Institute on deafness and other communication disorders.
9. Levey, S., Fligor, B. J., Ginocchi, C., & Kagimbi, L. (2012). The effects of noise-induced hearing loss on children and young adults. *Contemporary Issues in Communication Science and Disorders*, 39(Fall), 76-83.