

The Efficacy of Digital and Analog Hearing Aids in the Management of Tinnitus - A Comparative Study

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Introduction

Tinnitus is known as a squeaky or continuous flat sound. Tinnitus is a perception of sound in the ear or the head without any kind of external sound sources. The effect of Tinnitus is very bothersome. Tinnitus can affect the individuals with normal hearing and also those who are suffering from hearing loss. It can affect individuals in many ways both physiologically and psychologically. There are several causes of tinnitus. However, the etiology of tinnitus is still unknown. Tinnitus may occur after a sudden exposure to loud and high intense sounds. Ototoxicity, Presbycusis, Hypertension, Stress, Ear diseases, Physical trauma and Psychological trauma etc. The treatment of tinnitus is basically symptomatic, there are several treatment options to improve their quality of life. Tinnitus treatment includes otological surgeries, use of medication, use of sound maskers in case of normal hearing individuals and use of hearing aids amplification specifically for individuals with hearing loss. The Hearing aids are popular as they are used from decades onwards both for sound masking and providing audibility to the individuals with sensorineural hearing loss. The hearing aids are basically of two types i.e. Analog and Digital Hearing aids. Analog hearing aids are basically provides only amplification, whereas the digital hearing aids have can be programmed with many added features to the individual audiometric and comfort levels.

This study focuses on effectiveness of body level analog hearing aids and digital hearing aids in the management of tinnitus. To know which of the models show better performance in the inhibition of tinnitus and providing relief to the patients or to study the impact and compare the different hearing aid technologies (Analog and Digital) in the management of tinnitus with sensorineural hearing loss.

Aim & Objectives

The objective of the study is to find out the efficacy of the hearing aids with different technologies in the tinnitus management of the patients suffering with hearing loss. This study carried by comparing and evaluating the responses of the patients who are using different hearing aids technology.

- To study the impact of analog and digital hearing aids on patients suffering with tinnitus and hearing loss.
- To compare the responses on THI between the patients using analog hearing aids, digital hearing aids.

Method:

A total of forty participants comprising twenty in each group with mild to moderate sensori-neural hearing loss with tinnitus were selected for the study. Age range of 16 to 80 years of both gender were included.

The Patients suffering with ear disorders, profound hearing loss, those chronic diseases, neurological disorders, those who were attending any other management and patients having less than mild THI severity were excluded.

Patients were divided into two groups (twenty each):

- Analog hearing aid users and Digital hearing aid users.

Tests:

Patients were tested with Pure Tone Audiometry, Impedance Audiometry, Oto Acoustic Emission and Speech Audiometry and Hearing Aid(s) Trail. The specialized tests like pitch and loudness matching, residual inhibition (RI), Minimum Masking Level and Loudness discomfort level to assess the type and severity of tinnitus and Hearing aid trial for selection of hearing aid. Patients were provided with suitable hearing aids and counseled to use the hearing aids at least two hours per day for a period of minimum 6 months followed by the post treatment analysis.

Tinnitus Handicap Inventory (THI) (Newman et al, 1996) questionnaire was used. The THI Questionnaire comprises of 25 questions with self-assessment on three point rating scale, Yes/ Sometime/No with scores of 4, 2 and 0 respectively.

Statistical Procedure:

A pre and post THI analysis was done to all the participants. The detailed statistical analysis was carried out within the population as well as across the two groups. Statistical analysis included paired sample t-test to determine the changes across the two groups. Mann-Whitney U test has been done to know whether the data was distributed normally across the two populations.

Results & Discussion:

The following results were obtained. The pre and post values of both the conditions i.e. usage of analog or digital hearing aids, showed significant improvement in the pre and post Mean scores in both analog and digital hearing aid groups. The tinnitus severity level greatly reduced after usage of hearing aids. This shows

that usage of any amplification device shall benefit the tinnitus problem, be it analog or digital hearing aid. A clear statistical significance is seen when a paired sample correlation was carried out across the data. The results showed in pre and post scores and severity levels of Analog, Digital hearing aid usage with high level of significance. ($p=0.000$)

The paired sample-t test suggested that any hearing aid shall give relief from tinnitus when being used by them on a regular basis. The Kolmogorov-Smirnov with Shapiro-Wilks Test was done and the results showed that the data was not normally distributed across the group.

Since the data was not normally distributed, A Mann-Whitney U test was done to determine the changes across the two groups of participants. The results showed that there was no significant difference across the two groups. Hence it showed that both the hearing aids have the similar impact in alleviate tinnitus equally when compared as a whole. This shows that there is no difference between two hearing aids technology.

Discussion & Conclusion

The study showed significant relief of tinnitus for both groups who have used hearing aids viz. analog and digital type of aids. Though patients didn't prefer at the beginning may be because of the compromised aesthetic conditions but eventually due to its significant relief from tinnitus, the individuals started accepting it.

The study had supported the study done by Kochkin and Tyler (2008) who also found benefits for tinnitus individuals who had used hearing aids respectively and found alleviating symptoms for nearly 60% of the population.

This study also supported with the studies conducted by Häberle and Kristensen (2012) and Saltzman et al in 1947, Melin et al 1987 who found tinnitus being a more severe problem and being relieved to some extent by usage of hearing aids respectively.

Hoare et al, 2014 conducted a study on amplification characteristics through hearing aids for patients with tinnitus and simultaneous hearing loss and they had found improvement in the tinnitus inhibition after usage of hearing aids but there was no change in the quality of the tinnitus being perceived. Now this study was in support with our study but in our study the quality has not been assessed by us. Hence in our future indications, our study can be carried forward in terms of quality assessed too.

The functioning of hearing aids have been effective in reducing tinnitus, it is of opinion that due to the noise created inside the instrument that masked the tinnitus and the higher amplification characteristics of the hearing aid that is causing the masking of the tinnitus noise being heard by the patient.

Hence the present study suggests all future audiologists to counsel patients to opt for cost effective procedures, thus indicating analog and digital hearing aid respectively.