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# HEARING AIDS IN THE MANAGEMENT OF TINNITUS

**[1]Neha Taneja and [2]Dr. Udit Saxena**

[1]Assistant Professor-II, Amity Medical School, Amity University Haryana, India
[2]Associate Professor, Sweekaar Academy of Rehabilitation Sciences, India

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**ABSTRACT**

Tinnitus is defined as the perception of sound in the absence of any external sound which may arise from the activity of the nervous system without any corresponding activity within cochlea. This sound can be experienced as buzzing, hissing or ringing. Tinnitus can occur in one or both ears, or be experienced as arising within the head, and can have on the sufferer. The basic goal of any line of treatment is to reduce the severity of tinnitus. Some patients are able to cope with the disturbing noise and their lives continue as normal. At the other extreme, some patients suffer so much that daily become is difficult. Most patients with tinnitus have some degree of hearing loss. Hearing aids acts as a maskers which helps to reduce the tinnitus in the way that it increases the brain activity to distinguish between true sounds and pseudo sounds (tinnitus) by the increased neural activity. Hearing aids also acts a stress barrier for the tinnitus sufferers after its use. They help to stimulate the auditory deprived areas. Evidence support the use of hearing aids for tinnitus management. Clinicians should feel reassured that some evidence shows support for the use of hearing aids for treating tinnitus.

***Corresponding author:***



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## INTRODUCTION

Tinnitus is defined as the perception of sound in the absence of any external sound which may arise from the activity of the nervous system without any corresponding activity within cochlea (Jastreboff, 1995). It may sound like ringing, whistling, clicking, pulsing buzzing etc. Tinnitus has been reported to be associated with many otologic disorder (Sweetow and Sabes, 2010) which can be continuous or intermittent and unilateral or bilateral. Subjective and objective tinnitus are the two varieties of tinnitus. Common among the two varieties is subjective tinnitus which can only be heard by sufferers whereas objective tinnitus is uncommon and can be recorded and heard by the external examiner (Swain *et al* 2016). Tinnitus can affect any age or population. Reports suggest that tinnitus affects approximately 5% population (Heller, 2003). As per the documented reports 10-15% of the adult population suffers from tinnitus (Davis and Refaie, 2000) and as many 70-85% of the hearing impaired population report tinnitus (Henry *et al* 2005). Tinnitus can also be found in children also. Tinnitus is a very common yet poorly understood disorder. The reason for the origin of tinnitus is not yet clear. The major causes are noise exposure, acoustic trauma (Syka, 2002) and age-related changes (Syka, 2002). Disorders which can elevate tinnitus are occlusion of the ear canal, Ménière's disease, alteration in blood flow, cholesteatoma, otosclerosis, barotrauma and head trauma (Baracca *et al.* 2011), Vestibular schwannoma (Gimsing, 2010), and cerebrovascular diseases (Lainez et 2011) also can lead to tinnitus. The other factors are jaw and neck disorders or temporomandibular joint dysfunction (Bjorne, 2007). Tinnitus can have devastating effects on quality of life of sufferers. It makes a person unhappy and low in life. It can affect the social wellbeing of an individual, life and can be a cause of unhappiness. Several researchers have supported that there exists a link between tinnitus and hearing loss through the studies on tinnitus patients and animal models. Majority of tinnitus patients have hearing loss (Axelsson and Ringdhal, 1989). Many approaches have been put forth to manage tinnitus but owing to heterogeneous nature of tinnitus "one fit all" strategy or treatment line does not fit every patient. The various management options for tinnitus are hearing aid amplification, hypnosis, counselling, cognitive behavioural therapy, habituation, electrical stimulation, tinnitus maskers,

combined masker and hearing aids, sound machines, self help and support groups, educational groups, stress management, pharmacology etc (Beck, 2011). Hearing loss is often the most important underlying cause associated with tinnitus hence hearing aids finds the first place in the management of tinnitus. Hearing aids plays a multiple role to combat tinnitus sufferings. In the present review important findings of the research studies are mentioned which highlights the important role of amplification in the management of tinnitus. The amplification provided by the hearing aids also serves to enhance the neural activity.

## MATERIALS AND METHODS

Various databases like Pubmed, Medline (National Center for Biotechnology information, U.S. National library of Medicine), Google, Google Scholar were searched for the terms tinnitus and hearing aids in the articles published from 2000 till date. The important findings were documented in narrative manner.

**Review of Literature**

Tinnitus is mostly found to be associated with hearing loss (Nicolas Puel et al., 2002). Hearing aids are reported among the most common tool used for the management of tinnitus by the practioners for their clients (Beck, 2011). Hearing aids acts as a maskers which helps to reduce the tinnitus in the way that it increases the brain activity to distinguish between true sounds and pseudo sounds (tinnitus) by the increased neural activity (Shekhaw at et 2013). The amplification provided by the hearing aids also improves the communication stress (Newman, 1999, Del Bo and Ambrosetti, 2007). Studies on animals report that the stimulation of frequency regions of hearing loss and tinnitus can help in reversing tinnitus related cortical reorganisation and homeostatic plasticity (Norena and Eggermont, 2005; Yang *et al* 2011). Similar reorganisation effects in humans can be achieved through hearing aids (Moffat *et al* 2009). Trotter and Donaldson (2008) in their study found digital hearing aids were superior as compared to analog hearing aids in tinnitus suppression. (Kochkin and Tyler,2008) reported in their study 554 (67%) and 424 (69%) participants with unilateral and binaural hearing aids respectively showed improvement in tinnitus perception following hearing aid fitting. Statistically significant improvement was observed in tinnitus perception with digital hearing aids as compared to analog hearing aids. Digital hearing aids play significant role in tinnitus intervention when hearing loss is associated with tinnitus. With the technological development the digital hearing aids have changed the world. Finest of the possible solution is now available in terms of the sound quality and options for tinnitus management. Hearing aids are considered to be a primary option for tinnitus is reversible in nature. If the client doesnot feel positive through its use of hearing aids for tinnitus, it can be reversed or discontinued in use (Beck 2011). Stess has been commonly linked with the tinntus perception. Hearing aids also acts a stress barrier for the tinnitus sufferers after its use. They help to stimulate the auditory deprived areas (Henry *et al* 2008). In a study done by Trotter and Donaldson (2008) with 1440 participants fitted with hearing aids (826 unilateral and 614 binaural). 554 (67%) and 424 (69%) participants with unilateral and binaural hearing aids respectively showed improvement in tinnitus perception following hearing aid fitting.

Surr *et al* (1985) in their survey study on 200 new hearing aid users reported that 62% had tinnitus and half of them reported a total or partial relief from tinnitus facilitated by the use of hearing aids. Binaural hearing aids have been found to be useful for tinnitus suppression as compared to monaural hearing aids (Brooks and Bulmer, 1981). (Searchfield *et al* 2010) in their study of 58 participants, mean age of 64.17 years, subject divided in two groups. One group received only counselling and the other group received counselling along with hearing aids. The results were that hearing aids were found to be effective in tinnitus management. Patients who received hearing aids and counselling together showed significant better results and reduced tinnitus handicap than the other group which received only counselling. Tinnitus has also been found in ageing population associated with hearing aid. Zagoiski (2006) reported in their study 28 out of 33 participants reported significant reduction in tinnitus after being fitted with hearing aids.

Binaural hearing loss patients required binaural fitting whereas unilateral hearing loss required fitting on impaired ear. Stacey (1980) stated through study that there was complete disappearance of tinnitus with the help of binaural hearing aids (Parazzini *et al* 2011) and Del Bo *et al* (2006) . On the contrary there were some studies which also reported that hearing aids were not effective in masking tinnitus (Melin *et al* 1987). This study followed a different methodology and used scaling methods instead of questionnaires which the other set of studies used which supported that hearing aids are efficient. Tinnitus had been reported to be cause of stress. Tinnitus is mostly bothersome when a meaning is attached to this unwanted sound. If this involuntary sound becomes focal it gets associated with negative emotions like anxiety, helplessness etc. Such negative emotions may involve limbic system and reactions such as stress which involves autonomic system (McKenna and Andersson, 2007; Henry *et al* 2002). When a person is stressed by such situation tinnitus becomes extreme, worsens and prompts this cycle to repeat and is referred as “Vicious cycle” of tinnitus. The present approaches for tinnitus treatment mainly focuses on to break this vicious cycle where individuals can attend to their tinnitus but instead of treating it negatively they tend to become aware and accept this tinnitus. This can control the negative emotions and stress related to it. The main focus is to enable a patient to habituate this tinnitus at times this habituation may not be complete. The tinnitus treatment approaches presently focuses on the habituation of tinnitus or retraining the brain to accept this sound. Sound therapy adjunct to amplification becomes a focal goal. Through with the use of sound generator there is a possibility to provide different varieties of sound as per preferred by the tinnitus patient. As a normal individual to a single music or sound can be monotonous if it been listened every time so is for the tinnitus sufferer. This formed a basis for the introduction of multiple type of sounds through the tinnitus generator in the hearing aid. These offer a cosmetic and customised solution to provide the relief from tinnitus. The ultimate goal is to provide relief from tinnitus along with amplification. With the advancement in technology over time the wireless streaming of the sounds in digital hearing aids has enabled tinnitus patients to select the sounds they prefer based on many factors at the single press of button. This flexibility has allowed many possible options in the hearing aids for tinnitus sound generation (Piskosz, 2016). Hearing aids amplification tends to stimulate the neural activity, during silence tinnitus is exacerbated and in turn brain may seek

neural stimulation which is decreased due to hearing loss. Amplification provided by hearing aid tends to correct brain inhibitory function due to lack of neural inhibition. Hearing aids help to amplify background noise which can act to mask tinnitus. It also helps the brain to attend to true sound versus pseudo sound. Thus hearing aid reduces fatigue and stress, the ability to cope with tinnitus (Sweetow and Sabes, 2010). Amplification thus can be very crucial in the tinnitus treatment when combined with counselling (Sweetow and Sabes, 2010). Another study by Newman (1999) reported that hearing aid amplification has been found to be useful to mask tinnitus by providing amplification to ambient background sound which aids in masking. Secondly, with the use of hearing aid there can be improvement in the communication abilities which provides relief from stress.

Del Bo and Ambrosetti (2007) in their study stated that tinnitus patients received two major benefits from hearing aids: the patient became less aware of their tinnitus and the communication abilities of the patient were improved. They reported tinnitus was often resulted from the result of neural plasticity, evoked via deprivation of auditory input (i.e., hearing loss), and as hearing aid amplification activates the auditory nervous system, the perception of tinnitus was reduced (Moffat *et al* 2009). The authors recommended that for the best possible results binaural amplification with open fittings and widest possible bandwidth brings better results. (Forti *et al* 2010) further highlighted that open canal fittings for the mild hearing loss is useful for the mild hearing loss patients. In the study by (Kochkin and Tyler,2008) it was further mentioned that tinnitus is more than just the perception of unwanted sound. Tinnitus may impact a person's emotional wellbeing and may negatively impact socialization, relaxation, and job performance, and may contribute to psychological problems such as depression, stress, anxiety, anger, and even suicidal thoughts. Further (Newman *et al* 2008) added that tinnitus is a distressing symptom which negatively impacts the health-related quality of life of many individuals. These above review findings support that hearing aids plays an important role in tinnitus treatment for better communication and reduce the burden of stress perceived due to tinnitus. But at the same time there are limitations too with the hearing aid usage for tinnitus management when it comes to technology part, like in analog hearing aid where there is lot of unwanted noise in unregulated. Rather than providing the amplification support such type of hearing aid becomes cumbersome to the patients hence we need to be selective in choosing the hearing technology to facilitate the smoother way forward. There is a dearth to find the efficacy of digital hearing aids for the tinnitus treatment which may be uptaken in future.

**Conclusion**

The weight of evidence support the use of hearing aids in tinnitus treatment along with the amplification it provides. Clinicians should feel reassured that hearing aids plays an important role in tinnitus treatment. It is important to note that there are multiple options for the tinnitus treatment. The present article does not recommended any one treatment program over another but on the role of sound it plays in different treatment programs. Sound requirements can vary from treatment to treatment but the potential of wireless streaming allows hearing health professionals to customise the treatment as per the different patient requirement. In total, hearing instruments and counselling plays a crucial role. There is still a detail need to explore the effectiveness of hearing aid with support of literature findings for tinnitus treatment.

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