Original Research Article

Study On Use of Bluetooth Technology in Hearing Aids Among Adults

ABSTRACT

Background: Hearing is one of the key features of communication. Hearing aids are prescribed when a person suffers from hearing loss. There have been many updates in the technology of hearing aids like speech enhancements, Noise reduction, microphone focus but still some people find difficulty in listening to phone calls and media streaming. Integration of Bluetooth technology with hearing aids is giving a satisfactory response and helping hearing aid users to overcome existing challenges with mobile phones. Objective: To measure the satisfaction level of hearing aid users with the use of Bluetooth technology. Method: Quantitative, Cross-sectional study was conducted in through different Audiology clinics across Delhi and National Capital Region for a period of 1 year. A total of 55 samples were taken in the study from the clinics for a duration of 1 year. pre-tested questionnaire was used for collecting the data and face to face interviews were conducted. Results: Bluet

ooth streaming when used with the hearing aids, participants reported a significant improvement on multiple parameters Improved listening on phone calls in both quiet and noisy environment, lesser repetitions, improved, music listening, confident in using hearing aids in public places, better listening over video calling and extended wearing time. Conclusion: Hearing aids with Bluetooth technology is becoming an essential aspect of hearing aid. this has been building confidence of using hearing aids and increasing wearing time. Bluetooth Hearing aids are also providing a solution to the limitation of using personal listening devices.

Key words: Hearing Loss, Bluetooth Hearing Aids.

Introduction

Hearing is one of the five senses which is vital for communication. It helps us to socialize, express thoughts and emotions and keeps us aware of environmental sounds which can keep us safe by warning against potential risk. It transports the sound signal from sound source to Cochlea via Ear canal, Tympanic Membrane, Middle ear ossicles and oval Window. It further sends the signal to cochlear nerve, cochlear nucleus, superior olivary complex, lateral lemniscus, inferior colliculus, medial geniculate body, and ultimately auditory cortex. **(Peterson, Reddy, and Hamel 2022).**

Hearing loss or hearing impairment is a partial or total failure to hear. It may occur in one or both ears. In children hearing problems can affect the ability to learn spoken language and in adults it can cause work related difficulties. In some people, particularly older people, hearing

loss can result in loneliness, and it can be temporary or permanent. The WHO definition of "deafness" refers to the complete loss of hearing ability in one or two ears. The cases include in this category will be those having hearing loss more than 90 dB in better ear (profound impairment) or total loss of hearing in both the ears. The WHO definition of "hearing impairment" refers to both complete and partial loss of ability to hear. Prevalence of hearing loss is 1.5 billion globally and in India 63 million people are suffering from hearing loss. WHO also states: "A person is said to have hearing loss if they are not able to hear as well as someone with normal hearing, meaning hearing thresholds of 20dB or better in both ears." **(Humes 2019)**

Hearing loss is determined in degree of hearing loss and type of hearing loss. There are 3 types of hearing loss: Conductive, Sensorineural and Mixed **(Alshuaib et al. 2015)**. A conductive hearing loss can happen due to some pathology or congenital deformity in either outer ear or middle ear or both. Sensorineural hearing loss is a condition of inner ear where cochlear hair cells are damaged or dead. A mixed hearing loss is the combination of both conductive hearing loss and sensorineural hearing loss. Audiogram is a graphical representation where an examiner tests the hearing sensitivity at some frequencies. Degree of hearing loss as Normal (–10 to 15 dB), Slight (16 to 25 dB), Mild (26 to 40dB), Moderate (41 to 55dB), Moderately Severe (56 to 70 dB), Severe (71 to 90) and Profound (91+ dB) **(Clark 1981)**, **(Olusanya, Davis, and Hoffman 2019)**We can test our hearing subjectively and objectively; subjective tests are Pure Tone Audiometry (PTA), Behaviour Observation Audiometry (BOA), and Visual Response Audiometry (VRA) and objective tests include Auditory Brainstem Response (ABR), Auditory Steady State Response (ASSR), Oto-Acoustic Emissions (OAE). Test battery approach is the most reliable way of identifying hearing loss. An Audiologist performs all the above test in a standardised audiological setup. **(Morgan et al., 2022).**

Management of conductive hearing loss may be medication and/or surgical intervention if hearing loss persists, hearing devices are prescribed **(Morgan et al., 2022).** For sensorineural hearing loss, hearing aid or cochlear Implant is prescribed based on the candidacy. Mixed hearing loss first requires medicinal treatment and then hearing devices. can be fitted to a patient starting from mild hearing loss to profound hearing loss.

Hearing devices can be categorised into hearing aids and cochlear implant. Cochlear implant is a surgically implanted device which is implanted in the case where hearing aids doesn't

help in profound hearing loss. Hearing aid is an acoustic, non-invasive amplification device which fits on the ear, worn by hearing impaired. Hearing aids are clearly associated with impressive improvements in the social, emotional, psychological, and physical well-being of people with hearing loss in all hearing loss **(Taneja 2014)**

There are many types of hearing aids available. Hearing aids are found in digital technology and analogue technology where in today's scenario only digital hearing aids are prescribed and are very common. Prescription of hearing it is dependent on the factors like degree of hearing loss, types of hearing loss, age of the client, and configuration of audiogram. Types of digital hearing aids are behind the ear (BTE), Receiver in the Canal (RIC), In the canal (ITC), Completely in the canal (CIC), Invisible in the canal (IIC) **(Hearing Aids | FDA, 2022).**

Now a days, hearing aids are equipped with latest technology like speech enhancement, noise reduction, speaker focus, rechargeability, automatic analysis or listening environment, remote adjustments, app control and Bluetooth connectivity. **(Kim et al. 2014; Smith and Davis 2014)**

There are certain reasons why people are not opting for hearing aids. Few of the reasons includes high cost of the hearing aids, difficulty in management, and visibility. **(Wallhagen 2010)**. Maximum of the hearing aids candidates are not comfortable if hearing aids is visible on the ear. everyone is not the candidate of that pe of hearing aid which goes inside the ear canal. hearing aid like BTE and RIC sits behind the ear, and they are visible. Due to the integration of the latest technology in hearing aid there has been a massive change in the product and users are motivated to use the hearing aids **(Sun, 2019).** Due to rechargeable options, patients are not struggling for changing the battery and the less availability of batteries in tier 2 or 3 cities was a concern. With app connectivity now a user can control his hearing aid of his own which has reduced follow up visits to audiologists, features like Bluetooth connectivity loaded in the hearing aids is being appreciated by the users and they are much interested to use the hearing aids. Hearing aids are functioning as a Bluetooth device with mobile phones or tablets, one can listen to music, make call, or watch videos along with the amplification provided in the hearing aids.

Integration of Bluetooth has been helping the user in many ways like direct streaming calls from mobile phone connection with remote microphone distance listening which makes signal to noise ratio better. it is also breaking the stigma of hearing aid worn by a deaf person.

It also connects TV with the hearing aid which send the sound directly into the ear. Now a days almost all the Hearing aid manufacturing companies are using Bluetooth connectivity with hearing aids. But MFI (Made for iPhone) is more popular where as Sonova group with their brand Phonak and Unitron has developed a technology MFA (Made for all) where the hearing aids can be paired with all kinds of phone be it iPhone, Android Phone or Featured phone. Majority of the hearing aid user with Bluetooth feature were Android users. **(Thibodeau, 2020)**

Objective:

To measure the satisfaction level of hearing aid users with the use of Bluetooth technology.

Methodology

Type of Study: Quantitative, Cross sectional

Study Area: The study was conducted in through different Audiology clinics across Delhi and National Capital Region.

Study period: Data was collected from January 2018 to January 2019 (i.e., 1 year).

Study Population: A total of 55 samples were taken in the study from the clinics for a duration of 1 year.

Tools & Technique:

1. pre-tested questionnaire was used for collecting the data.

2. face to face interview was conducted.

Inclusion:

- Age of 15 years or above
- Have an experience of non- Bluetooth hearing aids
- Active user of mobile phones with Bluetooth connectivity
- The subjects are users of Hearing aids with Bluetooth connectivity technology
- Using Bluetooth technology for both calling and Media streaming
- User of binaural fitting
- Minimum experience of 3 months
- Aided responses above or under speech banana.

Exclusion:

- First time users were excluded
- Patients with unilateral hearing
- Children below 15 years of age were excluded from the study

RESULTS:

A total of 55 samples who used Bluetooth technology and hearing aids as hearing device were included in study with a mean age of 46± (17) years. Out of total study subjects, 75% (41) were males and 26% (14) were females.

To measure the quality of life with the use of Assistive Listening Devices when paired with Hearing aid for the quality-of-life section, the responses were recorded as Yes, or No.

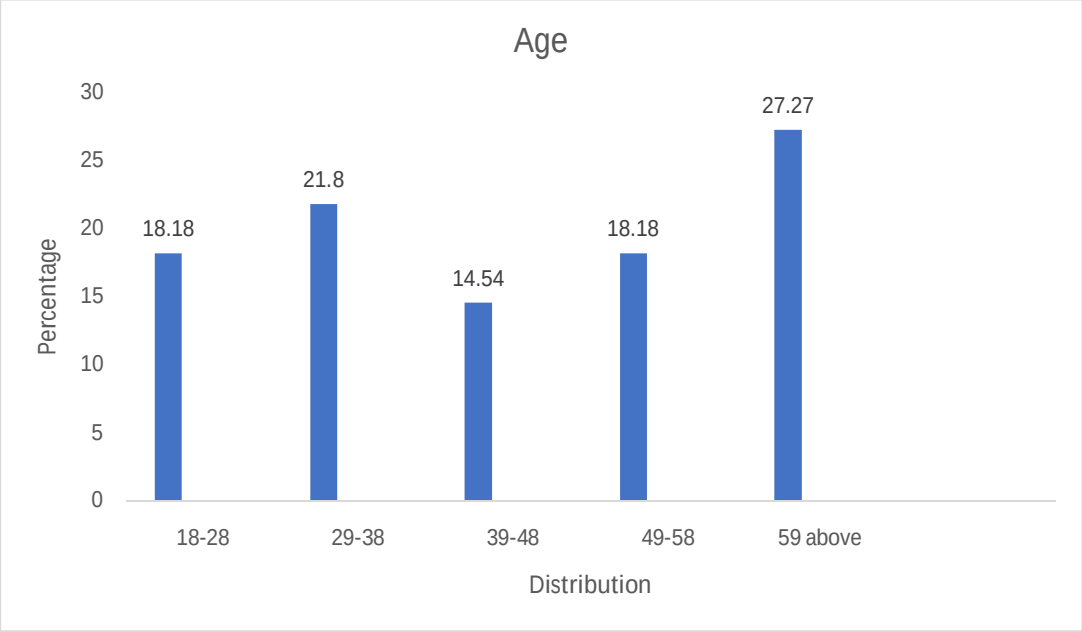

Figure 1: Age Wise Distribution

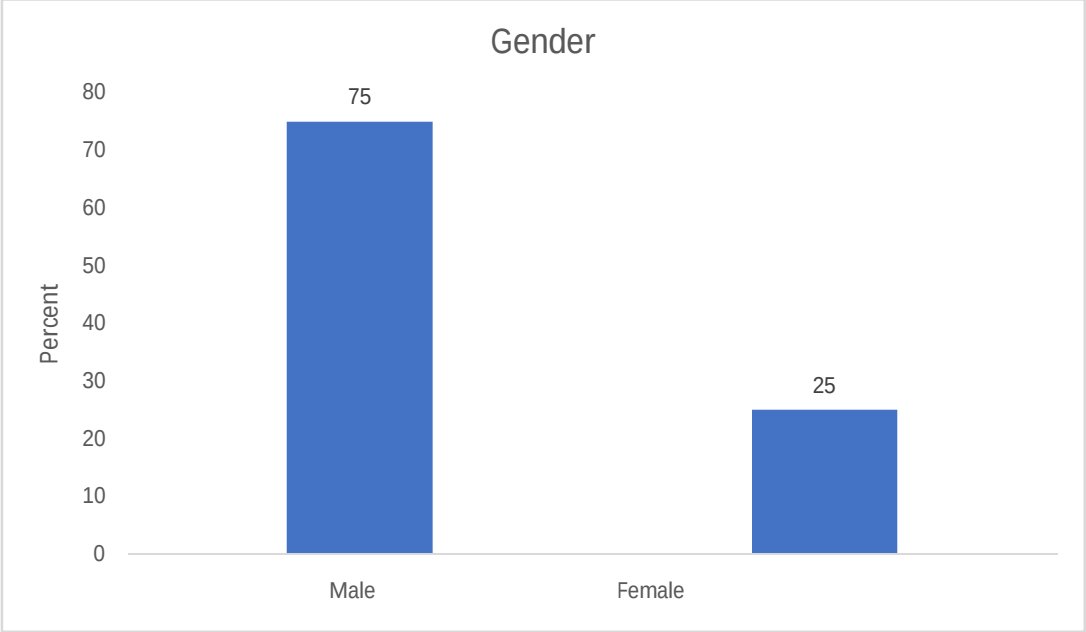

Figure 2. Gender wise distribution

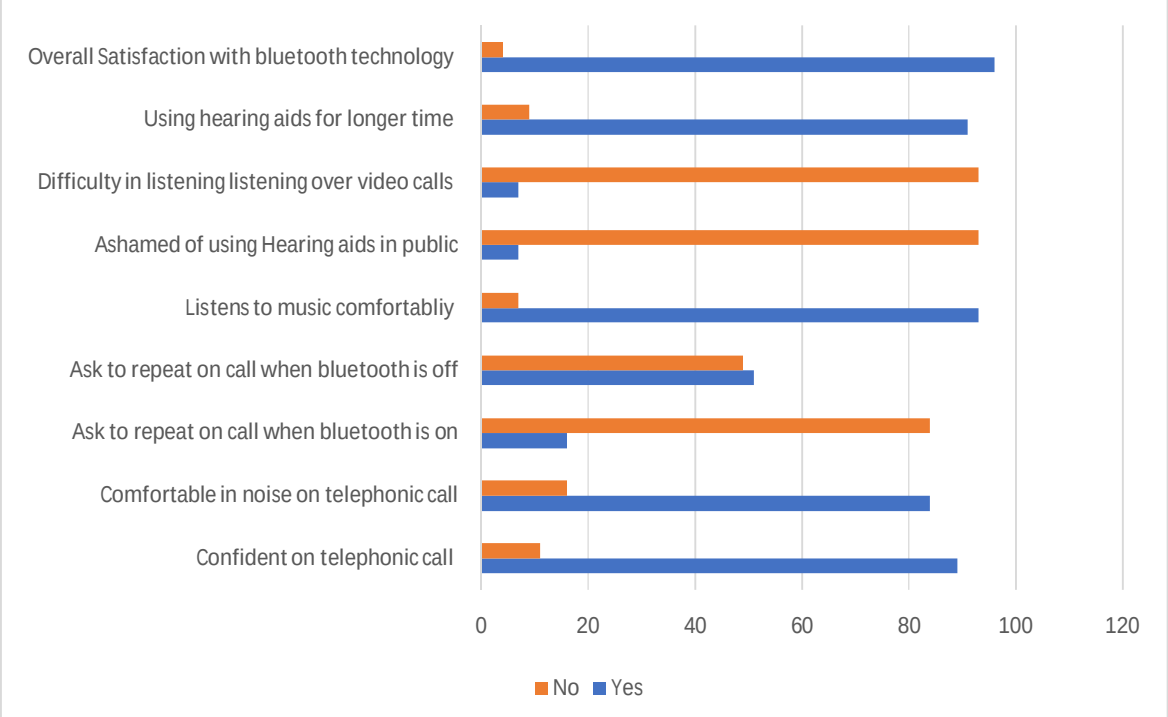

Figure 3: Assessment of satisfaction of using hearing aids with enabled feature Bluetooth

DISCUSSION:

There is an increasing need to study ways of benefit for Bluetooth hearing aid connectivity devices that not only include objective procedures, but also patients' perception of benefit. **(Clark et al., 2017).** This Study consisted of 55 participants which included 75% males and 25% females. Age of youngest participant was 18 years and eldest was of 79 years. When participants were asked if they are confident enough in talking to people on call, 89 % said reported that they were confident, and eighty four percent of the subjects said they can speak comfortably with people in public place while talking on telephone. **(Kim et al. 2014)** observed significant improvements in sentence and word recognition scores with Bluetooth mode compared to conventional mode in both quiet and noise conditions. When asked their experience with the hearing aids while Bluetooth feature is turned off, 49% reported that they ask other person on other end of call to repeat frequently whereas 51% were comfortable in quiet environment. Most of the participants, (84 percent) do not have to ask to repeat what is being said on call when hearing aids paired to mobile phone. Remaining sixteen percent still had difficulty in conversation. In a similar study **(Smith & Davis, 2014)** observed an improved ability to listening and having long conversations over the telephone. Music perception is one of the challenging conditions for a hearing aid user. In this study 93% of the subjects reported they were comfortable listening to music. Ninety three percent of the participants do not you feel ashamed of using HA in public and they do not avoid talking to strangers. Few of the users reported that due to Bluetooth functionality of the hearing aids, they pretend that the worn device is not a hearing aid but a conventional earphone. Ninety Three percent participants are comfortable in listening over video call or face time. Few of the subjects reported that when media streaming and phone call features is integrated with the hearing aids, it is more convenient to use the hearing aids. As a result, 91% of the users reported that they are using hearing aids for longer time. When asked their overall satisfaction with Bluetooth technology, 96 percent of the subjects are satisfied with their experience.

CONCLUSION:

Integration of communication technology like Bluetooth is becoming an essential aspect of hearing aid. this has been building confidence of using hearing aids and increasing wearing time. Bluetooth Hearing aids are also providing a solution to the limitation of using personal listening devices.

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