



Effect of Use of N-95 Mask on Aided Speech Identification Scores in Older Adults with Hearing Loss

Mysore Dwarakanath Vikas¹ · Chandni Jain¹ · Abhishek Umashankar¹

Received: 7 February 2022 / Accepted: 23 September 2022 / Published online: 27 November 2022
© Association of Otolaryngologists of India 2022

Abstract

The present study aimed to investigate the effect of use of N-95 masks on aided speech identification scores (SIS) in older adults with hearing loss. A total of 35 older adults in the age range of 60 years to 79 years (mean age of 64.97 years) participated in the present study. All the participants were diagnosed with moderate to severe sensorineural hearing loss. A prospective pre-test post-test study design was used in the present study with purposive convenient sampling method. The study was carried out in two phases. Phase 1 included the hearing aid fitting and verification. Phase 2 included measuring the speech identification scores (SIS) with and without N-95 mask. The results of the present study showed that aided SIS scores obtained in without mask condition was significantly better than with N-95 mask condition. Thus it can be concluded that wearing of mask has detrimental effect of SIS in older adults. Hence audiologists can use this as a condition to counsel during hearing aid fitting and also to counsel about the decreased clarity issues due to wearing of mask.

Keywords N-95 masks · speech identification scores · older adults

Introduction

Corona virus disease (COVID-19) caused by the SARS CoV-2 virus was found to be an infectious disease that can be spread to one person to other. World Health Organization has recommended use of face mask, social distancing, and sanitizing hands frequently to be the best precautions to avoid the spread of the virus. The use of mask is important for the prevention of spread of virus, but the use of masks has shown to have a negative impact on communications skills [1]. Different types of masks used during COVID-19 include cloth mask, surgical masks and N-95 masks. N-95 masks have been shown to have maximum protection against COVID-19 disease [2]. However, communication skills are affected as speech sounds are attenuated due to the use of masks and it also prevents us to use the facial expression and lip movement cues. Studies have found a decrement in speech perception scores in individuals with normal hearing with the use of surgical masks [3, 4].

As wearing masks is challenging for normal people, these can have a larger impact on individuals with hearing loss [5]. Studies have shown that use of masks have an effect on speech perception in adults with hearing loss [6]. Trecca, Gelardi, and Cassano [7] also reported that 86% of the patients with hearing impairment had communication problems during the visit to hospitals with the use of surgical masks. Older adults who suffer from age related hearing loss would have a greater challenge in communication after the use of masks. As all masks have shown greater attenuation above 1000 Hz, these can affect older adults maximally [8]. Hence individuals with higher loss at high frequencies will face lot of difficulty in communication as the signal in these frequencies are lost due to the face mask. Further, the speech communication depends on factors such as acoustic cues, visual cues, talker intensity and clarity, and also the listener hearing and understanding ability etc. As the use of face mask affects lot of these factors such as the acoustic cues [8], the visual cues [9] and also the listener hearing which is affected due to age related hearing loss, and the speech perception ability which is affected in older adults [10], especially in presence of noise or difficult situations [11].

Individuals with hearing loss rely on visual cues for communication especially in difficult situations [6, 9].

✉ Mysore Dwarakanath Vikas
vikasmdaud@gmail.com

¹ Department of Audiology, All India Institute of Speech and Hearing, University of Mysore, Mysore, India

Atcherson et al. (2017) reported that visual cues play an important role for communication in hearing impaired population. They compared the use of conventional and transparent mask on speech perception in noise ability and found that hearing impaired population had better scores when visual input was provided. These studies have not compared the speech perception scores when the individual is wearing hearing aids. As most of the individuals with hearing loss wear hearing aids, there are limited studies which focus on the effect of use of masks on speech identification ability after wearing the hearing aids. In the current scenario, the use of masks are mandatory in the audiological setup and individuals are allowed inside the testing rooms only with proper and adequately face covered masks. Hence the present study aimed to investigate the effect of use of N-95 masks on aided speech identification scores (SIS) in older adults with hearing loss.

Methods

Participants

A total of 35 older adults in the age range of 60 years to 79 years (mean age of 64.97 years) participated in the present study. Participants were asked to participate during their regular visit at our outpatient clinic. All of them had undergone routine audiological evaluation including pure tone audiometry, speech audiometry, immittance evaluation after which the diagnosis of hearing loss was made. The individuals who were diagnosed with moderate to severe hearing loss and referred to hearing aid trial were included for the present study. None of the individuals had any history of neurological or critical ailments. Informed consent was obtained from all the individuals or caregivers prior to the study.

Procedure

A prospective pre-test post-test study design was used in the present study with purposive convenient sampling method. The study was carried out in two phases. Phase 1 included the hearing aid fitting and verification. The individuals were fitted with digital hearing aids with the features being constant among all the individuals. The individuals were fitted with nine to twelve channel hearing aids with NAL-NL2 fitting formula (first fit), with features such as noise reduction algorithm to be switched on, and the directionality feature to be activated to adaptive directionality. The fitting formula was verified using lings six sounds perception presented through calibrated audiometer at 40 dBHL. Phase 2 included testing the speech identification scores (SIS)

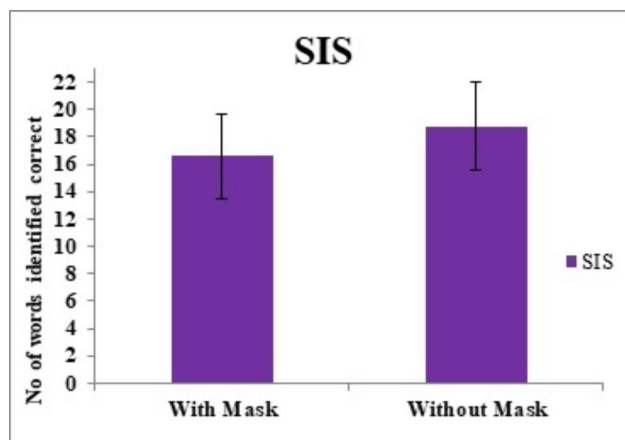


Fig. 1 Speech identification scores obtained across with and without mask condition. Error bars show ± 1 SD

with and without N 95 mask. The SIS were obtained using phonemically balanced word list in Kannada developed by Yathiraj and Vijayalakshmi [12]. The list 1 of the word list was presented with N-95 mask worn by the audiologist and the list 2 was presented by the same audiologist with mask removed. During testing with removed mask removed condition, it was made sure that no visual cues were given. The test condition was randomized across participants. The data of the SIS with and without mask were tabulated and subjected for analysis.

Results

The obtained data were subjected to descriptive and inferential statistics using Statistical Package for the Social Sciences (SPSS) version 21. The mean aided SIS of with and without mask condition are represented in Fig. 1. It can be seen from the Fig. 1 that the mean SIS scores of without mask condition was higher when compared to with mask condition.

The data were further subjected to Shapiro-Wilk test of normality and the results showed that the data was normally distributed ($p > 0.05$). The paired t-test was administered for pairwise comparison of with and without mask condition. Results showed that there was a highly significant effect of mean between with and without mask condition [$t(34) = -10, p < 0.001$].

Discussion

The results of the present study showed that aided SIS scores obtained in without mask condition was significantly better than with N-95 mask condition. Hearing aids provide

adequate amount of gain and clarity that can aid one to improve the speech perception and communication in daily life [13]. But the present study highlights the acoustic sounds that are modified at the speaker end due to wearing of masks that affects the speech identification ability in older adults with hearing loss. The modification in acoustic cue could be attributed to the fact that masks show greater attenuation for speech concentrated at frequencies above 1000 Hz [8]. The results of the present study are in line with the previous researchers [3, 4] where they attributed that the mask worn can worsen the acoustic signal significantly causing degraded clarity of speech. These effect is more pronounced for older adults with hearing loss, as they depend on visual cues during difficult to listen situations.

Conclusion

The present study is one of its salient types as we investigated the effect of mask on aided SIS in older adults with hearing loss. The older adults were tested for SIS with N-95 mask and without mask conditions. Results show that the SIS scores obtained in without mask condition was better than with mask condition. This infers that the wearing of mask has detrimental effect of SIS in older adults. Hence audiologists can use this as a condition to counsel during hearing aid fitting and also to counsel about the decreased clarity issues due to wearing of mask.

Declarations

Statements and Declarations The authors declare that there is no financial interests directly or indirectly related to the present work submitted for publication.

Disclosure of Potential Conflicts of Interest The authors have no conflicts of interest in publishing this paper.

References

1. Saunders GH, Jackson IR, Visram AS (2021 Jul) Impacts of face coverings on communication: an indirect impact of COVID-19. *Int J Audiol* 1(7):495–506

2. Dugdale CM, Walensky RP (2020 Dec) Filtration Efficiency, Effectiveness, and Availability of N95 Face Masks for COVID-19 Prevention. *JAMA Intern Med* 180(1):1612–1613
3. Cohn M, Pycha A, Zellou G (2021 May) Intelligibility of face-masked speech depends on speaking style: Comparing casual, clear, and emotional speech. *Cognition* 210:104570
4. Toscano JC, Toscano CM (2021 Feb) Effects of face masks on speech recognition in multi-talker babble noise. Fu Q-J. editor *PLOS ONE* 24(2):e0246842
5. Homans NC, Vroegop JL (2021 Jul) The impact of face masks on the communication of adults with hearing loss during COVID-19 in a clinical setting. *Int J Audiol* 28:1–6
6. Atcherson SR, Mendel LL, Baltimore WJ, Patro C, Lee S, Pousson M et al (2017 Jan) The Effect of Conventional and Transparent Surgical Masks on Speech Understanding in Individuals with and without Hearing Loss. *J Am Acad Audiol* 28(01):058–67
7. Trecca EMC, Gelardi M, Cassano M (2020 Jul) COVID-19 and hearing difficulties. *Am J Otolaryngol* 41(4):102496
8. Corey RM, Jones U, Singer AC (2020 Oct) Acoustic effects of medical, cloth, and transparent face masks on speech signals. *J Acoust Soc Am* 148(4):2371–2375
9. Thibodeau LM, Thibodeau-Nielsen RB, Tran CMQ, de Jacob RT (2021 Jul) Communicating During COVID-19: The Effect of Transparent Masks for Speech Recognition in Noise. *Ear Hear* 42(4):772–781
10. Tremblay P, Brisson V, Deschamps I (2021 Feb) Brain aging and speech perception: Effects of background noise and talker variability. *NeuroImage* 227:117675
11. Heidari A, Moossavi A, Yadegari F, Bakhshi E, Ahadi M (2018 Jun) Effects of Age on Speech-in-Noise Identification: Subjective Ratings of Hearing Difficulties and Encoding of Fundamental Frequency in Older Adults. *J Audiol Otol* 22(3):134–139
12. Yathiraj A, Vijayalakshmi CS (2005) Phonemically balanced wordlist in Kannada. AIISH, Mysore
13. Ohlenforst B, Zekveld AA, Jansma EP, Wang Y, Naylor G, Lorens A et al (2017) Effects of Hearing Impairment and Hearing Aid Amplification on Listening Effort: A Systematic Review. *Ear Hear* 38(3):267–281

Publisher's Note Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.

Springer Nature or its licensor holds exclusive rights to this article under a publishing agreement with the author(s) or other rightsholder(s); author self-archiving of the accepted manuscript version of this article is solely governed by the terms of such publishing agreement and applicable law.