RESEARCH

THE EFFECTS OF FACE MASK USE DURING COVID-19 ON SPEECH COMPREHENSION IN GERIATRIC PATIENTS WITH HEARING LOSS WHO USE LIP-READING FOR COMMUNICATION: A PROSPECTIVE CROSS-SECTIONAL STUDY

Turkish Journal of Geriatrics
DOI: 10.31086/tjgeri.2022.285
2022; 25(2): 274-281

■ Bilal SİZER[1]
■ Songül DEMİR[2]
■ Ümit YILMAZ[3]
■ Nureliş YENİCELİ[4]
■ Yakup BUDAK[5]
■ Argün Ediz YORGANCILAR[6]
■ İsmail TOPÇU[7]

CORRESPONDANCE

[1] Bilal SİZER

Phone: +905059578335
e-mail: bilalsizer@hotmail.com

Received: Dec 21, 2021
Accepted: June 01, 2022

[1] İstanbul Arel University, Faculty of Medicine, Department of Otorhinolaryngology Clinic, istanbul, Turkey

[2] Mardin Public Hospital, Department of Otorhinolaryngology Clinic, Mardin, Turkey

[3] Selahaddin Eyyubi Public Hospital, Department of Otorhinolaryngology Clinic, Diyarbakır, Turkey

[4] Mardin Public Hospital, Department of Audiology, Mardin, Turkey

[5] Dicle Universitiy Faculty of Medicine, Department of Audiology, Diyarbakır, Turkey

[6] Usküdar University, Faculty of Medicine, Department of Otorhinolaryngology Clinic, İstanbul, Turkey

[7] Dicle Universitiy Faculty of Medicine, Department of Otorhinolaryngology Clinic, Diyarbakır, Turkey

Abstract

Objective: Communication difficulties are considered the most significant consequence of hearing loss. This study aimed to determine whether surgical face masks, which have been mandatory throughout the COVID-19 pandemic, have an effect on speech comprehension scores in geriatric lip-reading patients with hearing loss and to raise awareness of the need for solutions to this problem.

Materials and Method: Patients with moderate and higher sensorineural or mixed bilateral symmetrical hearing loss who stated that they lip-read to better understand during communication were included in the study. The patients' speech comprehension scores were gathered while the audiologist wore a surgical mask and then a transparent mask, respectively.

Results: Twelve (33,3%) of the patients were female, and 24 (66.7%) were male. The mean age of the patients was 66.64±1.53 years. The mean speech comprehension scores of the patients when the audiologist was wearing a surgical mask (38.25±14.33) and a transparent mask (67.81 ± 14.30), respectively, were compared. The surgical mask significantly affected speech comprehension scores, and the Cohen d value of the effect size was 2.06. As such, the surgical face mask had a great effect on these patients' speech comprehension scores.

Conclusions: In elderly lip-reading patients who suffer from hearing loss, seeing the lip movements of the speaker, especially in hospital applications, promotes more effective communication. Transparent face masks can be considered a solution.

Keywords: COVID-19; Geriatrics; Pandemics; Masks; Hearing Loss; Lipreading.

INTRODUCTION

The incidence of chronic diseases tends to increase with advancing age. The incidence of chronic disease in individuals over the age of 65 is almost 80%. Hearing is also adversely affected by aging. Hearing problems are one of the three most common chronic diseases in the elderly (1).

Communication difficulties are considered the most significant consequence of hearing loss. Hearing-impaired individuals want to convey their thoughts and intentions easily by using different mechanisms to better understand what is being said (2). The term lip-reading refers to recognizing spoken words using visual speech information such as lip movements (3). In previous studies, the importance of lip- reading has been emphasized as a mechanism that facilitates the understanding of speech, the maintenance of speech, and the achievement of communication success. It is stated that individuals with hearing loss score higher in the speech perception test with the contribution of lip-reading, and that lip-reading is an important communication strategy for the hearing-impaired. Therefore, lip-reading improves social life (2).

To achieve this visual and auditory integration, anatomical regions, such as the face and lips, must be visible to the listener. However, throughout the COVID-19 epidemic, face masks have been mandatory to prevent the transmission of the coronavirus, and under mask mandates, lip-reading patients with hearing loss face great communication difficulties (4,5).

In this study, we aimed to determine whether surgical face masks, which have been mandatory during the COVID-19 pandemic, have an effect on speech comprehension scores in elderly lip-reading patients with hearing loss and to raise awareness of the need for relevant solutions to this problem.

METHODS

In this cross-sectional study, 36 patients who applied to the Dicle University Otorhinolaryngology outpatient clinic between 1 February 2021 and 30 April 2021 and met the inclusion criteria for the study were included.

During the study, patients who were suspected to have been infected with COVID-19 were not included in the study and were referred to the pandemic outpatient clinic with appropriate protective equipment. The inclusion criteria for the study were as follows:

The degree of hearing loss was calculated based on the average of four frequencies (500, 1000, 2000, and 4000 Hz) for each ear. Normal hearing was defined as 25 dB and below, mild hearing loss was 26–40 dB, moderate hearing loss was 41–60 dB, and severe hearing loss above 61 dB (6). Patients with moderate and higher sensorineural or mixed bilateral symmetrical hearing loss who did not use a hearing aid or a device even though it was recommended and who stated that they read lips to better understand what is spoken during communication were included in the study. Using these criteria, the aim was to select those who were most likely to have been affected by the use of masks among patients with hearing loss. Patients who did not agree to participate in the study, who had visual problems (e.g., they could not see the face and lip movements of the other person), who met the definition of sudden hearing loss, who had a foreign nationality (resulting in language differences) and who had communication problems and could not cooperate on the test were excluded.

The bilateral tympanic membrane and tympanometric examinations of all patients included in the study were normal. After the examinations, pure tone audiometry was first performed by the audiologist. Hearing thresholds and speech reception thresholds (SRTs) were determined and recorded. The patients who came to this stage were then consulted with the ophthalmologist. As a result of

the evaluation made by the ophthalmologist, those with good visual acuity enough to select the facial expressions of the person opposite them in detail from 1.5 meters away were included in the study. (Since the social distance was determined as 1.5 meters by the Ministry of Health in Turkey within the scope of Covid-19 transmission measures at the time of the study, this value was taken into account in the study). Patients who could not pass this stage were excluded from the study. Patients who fully met the inclusion criteria were subjected to a two-stage evaluation.

In the first stage, the audiologist wearing a surgical mask was positioned at the same eye level as the patient after the distance between them was adjusted to 1.5 meters. The sound intensity was adjusted for each patient at their own predetermined SRT level. A microphone (Carol MUD-316 IMP.600, USA) and loudspeaker (Spekon Control-6) were used. Then, the surgical mask-related speech comprehension (SMRSC) scores were recorded for each patient using the phonetically balanced word list created for speech audiometry in Turkish (7). For this test, a list of 25 monosyllabic words was used. The word lists were read in the audiology unit accompanied by the natural noise of the environment (40-45db), in a room arranged for study outside the quiet cabin. The audiologist asked the patients to repeat the words they heard by looking carefully at the audiologist's face. The SMRSC [(correctly repeated word count/25) x100] was created according to the answers from the patients. The second stage determined the effects of the surgical mask on speech comprehension. In this stage, the audiologist performed the same procedure with a transparent mask (Oxy, TR), through which lip movements could be easily seen, instead of a surgical mask. Transparent mask-related speech comprehension (TMRSC) scores were generated and recorded according to the answers.

This study was approved by the Dicle University Medical Faculty Ethics Committee for Noninterventional Clinical Studies (Meeting date/number: 26.11.2020/214) and written informed consent was obtained from all participating patients.

Statistical Analysis

IBM SPSS 21.0 for Windows was used for the statistical evaluation of the research data. Measured variables are presented as mean ± standard deviation (SD), and categorical variables are presented as numbers and percentages (%). We checked whether the data conformed to the normal distribution. A paired sample T-test was used to compare the two normally distributed dependent groups. The effect size value (Cohen d) was calculated. A statistically significant result was accepted if $p < 0.05$.

The sample size to be used in the research was calculated with the G Power 3.1 analysis program before the study. In the power analysis, the sample size required for the 0.05 (α) significance level, 80% statistical power (1-β), and the medium effect size was calculated as 34 patients. Considering that there may be data loss, the sample size of the study was initially planned as 40 patients. Considering the current pandemic conditions, the study was terminated with 36 patients after reaching a sufficient number.

RESULTS

Twelve (33.3%) of the patients were female, and 24 (66.7%) were male. The mean age of the patients was 66.64±1.53 years. The mean hearing thresholds of 500 Hz, 1000 Hz, 2000 Hz, and 4000 Hz measured in pure tone audiometry were 59.83±13.39dB for the airway in the left ear and 50.86±8.52 dB for the bone conduction. The mean hearing thresholds in the right ear were 58.25±12.94 dB for the airway and 49.81±9.65 dB for bone conduction. The mean duration of hearing loss complaints of the patients was 9.92±6.51 years (Table 1). Speech comprehension scores were compared to determine whether the surgical face mask had a significant effect on speech comprehension scores in lip-reading patients with

hearing loss, and TMRSC (67.81±14.30) was found to be significantly higher (t = -15.772, p<0.001) than SMRSC (38.25±14.33). The Cohen d value calculated was 2.06. This shows that the difference between the TMRSC and SMRSC values was great and that the surgical face mask affected speech understanding in these patients (Table 2).

DISCUSSION

Although hearing loss affects all age groups, it is more common in elderly individuals. The prevalence of hearing loss, which may affect speech intelligibility, is around 39.3%, especially in individuals aged 60-69 years (8). Considering that two-thirds of elderly individuals, especially those over the age of 70, have significant hearing loss, it is thought that they will have a very difficult time understanding a speech made through a mask. Therefore, in this new order, it is necessary to raise awareness for healthier communication with elderly individuals (4,9).

In this new order, where wearing a mask is mandatory, communication becomes more difficult both in daily life and in health centers for this group of patients who do not take clues from lip-reading and facial expressions. In this study, we aimed to clarify the communication difficulties faced by elderly patients with hearing loss in the new masked world order caused by the COVID-19 pandemic. We determined that the speech comprehension scores of elderly lip-reading patients with hearing loss were low because of the masks.

Since face masks cover a part of the face and lips, the visual clues necessary for stronger communication cannot be used, and lip-reading cannot be

Table 1. Data on age, gender, hearing thresholds and duration of hearing loss

Gender	**Female n (%)**	12 (33.3%)	
	Male n (%)	24 (66.7%)	
	Total n (%)	36 (100%)	
Age (year; $\bar{X}$ ± SD)	66.64±1.53		
Pure Tone Audiometry (500, 1000, 2000 and 4000 Hz) Hearing thresholds (mean±sd)		**Left (dB)**	**Right (dB)**
	Airway	59.83±13.39	58.25±12.94
	Bone	50.86±8.52	49.81±9.65
Duration of hearing loss (year; $\bar{X}$ ± sd)	9.92±6.51		

$\bar{X}$: mean, SD: standard deviation

Table 2. Comparison of the speech comprehension scores of the patients

Groups	N	$\bar{X}$	SD	DF	t	p
1. SMRSC	36	38.25	14.33	35	-15.772	<0.001
2. TMRSC	36	67.81	14.30	35		

SMRSC: Surgical mask-related speech comprehension, **TMRSC**: Transparent mask-related speech comprehension, N: number, $\bar{x}$: mean speech comprehension score, SD: standard deviation, DF: degrees of freedom, t: dependent t-test value, p: statistical significance value. Effect size (Cohen d) value, d=2.06

performed (4). In a study that stated that 60–70% of communication is based on non-verbal clues, it was emphasized that visual clues, such as facial and lip movements, are very important (10). Since face masks prevent effective communication among individuals with hearing loss, they have been associated with increased levels of anxiety, fatigue, and stress (11).

It is thought that there is a significant relationship between the degree of hearing loss and signs of depression in elderly individuals with hearing loss independent of the face mask (12). In the study conducted by Marinkov et al. during the pandemic period in which the average age of the participants was 67.97 years, it is emphasized that there is a significant relationship between the degree of hearing loss and depression-anxiety. It is also stated that there is a relationship between the degree of hearing loss and the communication disorder experienced due to the use of a face mask (13). Therefore, this situation becomes much more serious when considering the psychiatric problems that may be caused by the communication difficulties caused by the face mask, together with the hearing loss. Therefore, it is necessary to bring practical solution methods to this issue.

In a study conducted in Italy during the pandemic period, 55.9% of the participants stated that their main concern about face mask-wearing was the lack of ability to engage in lip-reading (14). Additionally, in a study conducted in Turkey during the pandemic period, a much greater increase in hearing aid demands than usual was found (15). This situation indirectly shows that this group of patients, who were living in an unmasked world order before the pandemic, were seeking solutions to the communication problems they had experienced during the pandemic. In this study, the patient group consisted of lip-reading patients with moderate or higher hearing loss who did not use hearing aids, so the aim was to evaluate the patient group most affected by this condition. Although it is known that hearing aids increase the quality of life, only one out of five patients who could benefit from a hearing aid wears one (16,17).

In the study of Brown et al., in which they evaluated the effects of the mask on audiovisual speech intelligibility with 180 young and 180 elderly individuals during the pandemic period, hearing loss has been determined as the exclusion criterion from the study. It has been emphasized that, although it is especially evident in the presence of ambient noise, elderly individuals are behind in terms of speech intelligibility compared to younger individuals (18). In another study investigating the effects of surgical face masks and transparent visors on speech intelligibility on individuals with moderate and severe hearing loss, it was emphasized that surgical masks have negative effects on speech comprehension because they prevent lip-reading and facial mimic movements. It has been emphasized that as hearing loss deepens, the negative effect of surgical masks on speech comprehension scores increases (19). Considering that even individuals without hearing loss have difficulties in communication in this new order, where wearing a mask is mandatory, it is an expected result that elderly individuals who have hearing loss and do not use any hearing aids will be affected much more by this situation.

In their study, Brawn et al. emphasized that face masks used within the scope of pandemic measures have more negative effects on speech intelligibility, especially in the presence of ambient noise. In the study by Homans et al., in which individuals with hearing loss were included, external noise was neglected and the study was carried out in a quiet cabin (18,19). Our study, on the other hand, was carried out in the audiometry unit, but in a room outside the quiet cabin modified for the study, by taking measurements accompanied by natural am-

bient noise (40-45 dB). Although these conditions cannot fully represent a communication performed in the presence of external ambient noise, they can represent an examination environment performed in outpatient clinic conditions.

Successful and effective communication can be achieved with the listener's access to both auditory and visual information. With the face mask, this communication network is disrupted (20,21). In a clinical study conducted with 200 patients during the pandemic period, surgeons received higher scores on empathy, trustworthiness, and better communication when they wore a transparent face mask instead of a conventional surgical mask (22). For this reason, this communication problem becomes more serious in applications to health institutions.

For this patient group, the communication difficulty created by this new masked world order has become even more evident in healthcare institutions. Healthcare workers pay great attention to protective gear usage due to current conditions. Naturally, this disrupts the visual-auditory integration for patients who engage in lip-reading and have hearing loss, and this disruption causes serious communication difficulties (23). We also conducted our study in hospital conditions for patients who visited the otolaryngology outpatient clinic, and we found that the surgical face mask had a significant negative effect on speech comprehension scores.

Regarding solutions, encouraging the use of hearing aids, speaking louder and slower by reducing background noise when communicating with these patients, using applications that transfer spoken words to text, using transparent face masks, etc. have been among the various suggestions (24). In their study, Atcherson et al. emphasized that transparent face masks positively affected visual and auditory integration. This study was conducted before the COVID-19 pandemic (25).

In our study, to embody the negative effects of surgical masks on lip-reading, surgical face mask usage was compared to transparent face mask usage through which lip movements can be seen easily. It was determined that transparent masks had a positive and statistically significant effect on comprehension scores.

CONCLUSIONS

The use of surgical face masks has been mandated during the pandemic period. In elderly lip-reading patients with hearing loss, seeing the lip movements of the speaker, especially in hospital applications, will help to improve the ease of communication. This study determined that surgical face masks had negative effects on speech comprehension scores in elderly lip-reading patients with hearing loss. However, transparent face masks can be considered a solution.

Limitations of the Study

The word lists were read in the audiology unit accompanied by the natural noise of the environment (40-45db), in a room arranged for study outside the quiet cabin. Therefore, the effect of external environmental noise has not been fully evaluated. Because only elderly patients with moderate and severe hearing loss were included in the study, the sample size was kept small.

REFERENCES

1. Erdoğan AA. Hearing Loss and Approaches to Hearing Loss in Elderly. Turkish Journal of Family Medicine and Primary Care 2016;10(1):25-33. (in Turkish) (DOI:10.5455/tjfmpc.204524)
2. Dell'Aringa AHB, Adachi ES, Dell'Aringa AR. Lip reading role in the hearing aid fitting process. Rev Bras Otorrinolaringol 2007;73:101-05. (PMID: 17505606)
3. Demorest ME, Bernstein LE. Sources of variability in speechreading sentences: a generalizability analysis. J Speech Lang Hear Res 1992;35(4):876-91. (PMID: 1405543)
4. Chodosh J, Weinstein BE, Blustein J. Face masks can be devastating for people with hearing loss. The BMJ 2020;370:m2683. (PMID: 32646862)
5. Garg S, Deshmukh CP, Singh MM, Borle A, Wilson BS. Challenges of the deaf and hearing impaired in the masked world of COVID-19. Indian J Community Med 2021;46(1):11-4. (PMID: 34035568)
6. Health Organization. (1980). *International classification of impairments, disabilities, and handicaps: a manual of classification relating to the consequences of disease, published in accordance with resolution WHA29. 35 of the Twenty-ninth World Health Assembly, May 1976*. City: World Health Organization, 1980.
7. E Belgin. Konuşma Odyometrisi, In: Erol Belgin, A. Sanem Şahlı (Eds). Temel Odyoloji. 2th edition, Güneş Tıp Kitabevleri, Turkey 2017, pp 107-112).
8. Hoffman HJ, Dobie RA, Losonczy KG, Themann CL, Flamme GA. Declining Prevalence of Hearing Loss in US Adults Aged 20 to 69 Years. JAMA Otolaryngol Head Neck Surg 2017;143(3):274-85. (PMID: 27978564)
9. Lin FR, Ferrucci L. Hearing loss and falls among older adults in the United States. Arch Intern Med 2012; 172(4):369-71. (PMID: 22371929)
10. Grote H, Izagaren F. COVID-19: The communication needs of D/deaf healthcare workers and patients are being forgotten. The BMJ 2020;369:m2372. (PMID: 32540861)
11. Saunders GH, Jackson IR, Visram AS. Impacts of face coverings on communication: an indirect impact of COVID-19. Int J Audiol 2021;60(07):495-06. (PMID: 33246380)
12. Lawrence BJ, Jayakody DMP, Bennett RJ, Eikelboom RH, Gasson N, Friedland PL. Hearing Loss and Depression in Older Adults: A Systematic Review and Meta-analysis. Gerontologist 2020 ;60(3):e137-e154. (PMID: 30835787)
13. Zivkovic Marinkov EM, Rancic NK, Milisavljevic DR, Stankovic MD, Milosevic VD, Malobabic MM, Popovic IN, Ignjatovic AM, Bojanovic MR, Stojanovic JD. Impact of Sensorineural Hearing Loss during the Pandemic of COVID-19 on the Appearance of Depressive Symptoms, Anxiety and Stress. Medicina 2022;58:233. (DOI:10.3390/medicina58020233)
14. Trecca EMC, Gelardi M, Cassano M. COVID-19 and hearing difficulties. Am J Otolaryngol 2020; 41(4): 102496. (PMID: 32327217)
15. Ertugrul S, Soylemez E. Explosion in hearing aid demands after COVID-19 outbreak curfew. Eur Arch Otorhinolaryngol 2021;278(3):843-44. (PMID: 32737646)
16. Cohen SM, Labadie RF, Dietrich MS, Haynes DS. Quality of life in hearing-impaired adults: the role of cochlear implants and hearing aids. Otolaryngol Head Neck Surg 2004;131(4):413-22. (PMID: 15467610)
17. McCormack A, Fortnum H. Why do people fitted with hearing aids not wear them? Int J Audiol 2013;52(5):360-68. (PMID: 23473329)
18. Brown VA, Van Engen KJ, Peelle JE. Face mask type affects audiovisual speech intelligibility and subjective listening effort in young and older adults. Cogn Res Princ Implic 2021; 18;6(1):49. (PMID: 34275022)
19. Homans NC, Vroegop JL. The impact of face masks on the communication of adults with hearing loss during COVID-19 in a clinical setting. Int J Audiol 2021;28:1-6. (PMID: 34319825)
20. Little P, White P, Kelly J, Everitt H, Mercer S. Randomised controlled trial of a brief intervention targeting predominantly non-verbal communication in general practice consultations. Br J Gen Pract 2015;65(635):e351-6. (PMID: 26009529)
21. Schlögl M, A Jones C. Maintaining Our Humanity Through the Mask: Mindful Communication During

COVID-19. J Am Geriatr Soc 2020;68(5):E12-E13. (PMID: 32282056)

22. Kratzke IM, Rosenbaum ME, Cox C, Ollila DW, Kapadia MR. Effect of Clear vs Standard Covered Masks on Communication With Patients During Surgical Clinic Encounters: A Randomized Clinical Trial. JAMA Surg 2021;156(4):372-378. (PMID: 33704389)

23. Ten Hulzen RD, Fabry DA. Impact of Hearing Loss and Universal Face Masking in the COVID-19 Era. Mayo Clin Proc 2020;95(10):2069-72. (PMID: 33012338)

24. Tavanai E, Rouhbakhsh N, Roghani Z. A review of the challenges facing people with hearing loss during the COVID-19 outbreak: toward the understanding the helpful solutions. Aud Vestib Res 2021;30(2):62-3. (DOI:10.18502/avr.v30i2.6091)

25. Atcherson SR, Mendel LL, Baltimore WJ, et al. The effect of conventional and transparent surgical masks on speech understanding in individuals with and without hearing loss. J Am Acad Audiol 2017;28(1):58-7. (PMID: 28054912)