

Analysis of Influence on Oral Health Behavior after Wearing a Mask due to COVID-19

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ABSTRACT

The purpose of this study was to identify changes in oral health behaviors due to long-term wearing of masks due to COVID-19 and to identify factors influencing oral health behaviors. During the month of May 2021, 461 questionnaires in Korea were surveyed on the mask wearing status and oral health behaviors. The demographic characteristics, oral health status and oral health care, frequency analyses were conducted, and paired t-tests were carried out to compare the oral health behaviors before and after wearing a mask due to COVID-19. Finally, linear multiple regression analysis was performed to identify factors affecting oral health behaviors after wearing a mask. As a result, in gender, there was a significant difference in 'Average time to wear a mask per day' and 'Frequency of mask reuse', and in education, there was a difference in 'Average time to wear a mask per day' and 'Whether to reuse the mask'. For age, occupation, and systemic disease, there were significant differences in 'Average time to wear a mask per day', 'Whether to reuse the mask' and 'Frequency of mask reuse' ($p < .001$). Oral health behaviors have been lowered before and after wearing masks due to COVID-19, and factors affecting oral health behaviors after wearing mask were 'Gender', 'Who to use the mask', 'Scaling experience with in 1 year', 'The average brushing time', and 'Use of oral hygiene products' ($p < .001$). Therefore, we should try to manage their oral health well, which can be neglected as they wear masks for a long time due to COVID-19.

Keywords

COVID-19, Infections, Masks, Oral health, Pandemics

Introduction

The novel coronavirus (SARS-CoV-2) that causes the COVID-19 initiated in December of 2019 in China and triggered a global outbreak. Countries are maximizing their efforts to combat this pandemic and to minimize infection (Chu et al., 2020). Early symptoms of COVID-19 were respiratory symptoms such as fever and cough, similar to SARS, MERS and clinical symptoms, but stronger propagation was observed (Zunyou et al., 2020). Since interpersonal transmission occurs mainly via respiratory droplets and contact transmission, the governments worldwide have adopted many precautionary measures and the use of face masks in public places has been compulsory or recommended. Face masks are physical barriers. They are simple, cheap and efficient in reducing short distance transmission through direct or indirect contact and droplet emission (Chu et al., 2020)(World Health Organization., 2020)(Greenhalgh et al., 2020). The masks may be worn at home (particularly by the person showing symptoms) and also in public places (Greenhalgh et al., 2020). The purpose of wearing masks is to prevent infected people from transmitting the virus to others and offering protection to healthy people against infection (World Health Organization., 2020).

The health authorities in many countries, including China, the United States, South Korea, Canada, Israel, and Austria, have mandated or recommended the wearing of face masks in public settings (National Health Commission of the People's Republic of China., 2020)(Center for Disease Control and Prevention., 2020)(Lee., 2020)(Government of Canada ., 2020)(Mahase., 2020)(Marin., 2020). In addition, many comments or evidences have advocated precautionary mass masking, given the progress of the pandemic and the new evidence of transmission by asymptomatic or pre-symptomatic persons (Greenhalgh et al., 2020)(Desai et al., 2020)(Cheng et al., 2020)(Terry., 2020)(Leung et al., 2020)(Pleil et al., 2020)(Han et al., 2020)(MacIntyre et al., 2013). Despite the widespread debate on the possibility of airborne routes of COVID-19 transmission, only droplets and contact transmission have been confirmed (Li et al., 2020). The oral cavity is considered as one of the main portals of entry of the virus. This has been confirmed by the presence of numerous angiotensin-converting enzyme 2 for SARS-CoV-2 in the oral epithelium (Xu et al., 2020). Therefore, optimizing oral health (OH) is pivotal in preventing infection with COVID-19.

In particular, these days, if it is difficult to breathe through the nose due to wearing a mask for a long time, or if the

inside of the mask is touched and reused by hand, the risk of bacterial infection in the mouth may increase, resulting in tonsillitis and tonsil stones (Seo et al., 2021).

Despite wearing a mask for a long time, its impact on social life, behavior and oral hygiene habits is still unknown. At the least decades, people have shown a desire for a more pleasant physical appearance. Many patients seek dental treatment with esthetics complaints (Dudea et al., 2012)(Lawson et al., 2008). The mouth is one of the first features observed during interpersonal interactions (Baker et al., 2018)(Richards et al., 2015). However, the masks cover the lower third of the face so people may have been neglecting aspects related to oral hygiene and dental esthetics. The COVID-19 pandemic and social distancing are causing economic effects on dental practices (Schwendicke et al., 2020) and influencing people's dental care-seeking behavior (Guo et al., 2020)(Peloso et al., 2020).

A dental expert said that the risk of infection of COVID-19 in dental clinics is high, and it is a situation that can become a potential carrier because the face of the patient and the medical staff must meet directly due to the nature of dentistry (Coulthard., 2020). Also, they said that dental handpieces used in dentistry should be very careful because they rotate with water at high speed and generate a significant amount of droplets and aerosols mixed with the patient's saliva and blood(Harrel et al., 2004). Therefore, Peng et al (Peng et al., 2020) have reported that there is a possibility of COVID-19 spreading because not taking appropriate precautions leads to cross-contamination with patients through aerosols.Overseas dental clinics have been closed because they are most vulnerable to COVID-19 transmission, and even in the case of in-South Korea dental clinics, patients with potential oral diseases avoid visiting the dentist (NHS England and NHS Improvement., 2020)(Coulthard., 2020)(Kowoon et al., 2020). Infection risk in the dental environment is a serious problem for both professional practitioners and patients (Checchi et al., 2020). Reductions in activities were observed at prevention, periodontics, prosthetics (Schwendicke at al., 2020) and maxillofacial surgery practice (Maffia et al., 2020). As such, as the public avoids visiting the dentist, the number of potential oral diseases will increase further. In addition, there is a possibility of neglecting oral health care while wearing a mask for a long time due to COVID-19. When oral health deteriorates, not only physical problems of oral function and appearance, but also social and psychological problems such as interpersonal relationships and somatic symptoms have a significant impact on an individual's quality of life (Hebling et al., 2007). Therefore, we want to check the wearing status of masks due to COVID-19 and identify their oral health status and oral health care. In addition, the purpose of this study is to identify changes in oral health behavior before and after wearing a mask, and to provide basic data to identify factors influencing these oral health behaviors.

Materials and Methods

Study subjects and method

For about one month from May 2021, the purpose of this study was explained to dental hygienists, and a questionnaire was distributed to the dental hygienists who decided to participate in the study as subjects. The subjects accomplished the self-administered questionnaire, and the accomplished questionnaires were retrieved. Of the 300 online questionnaires collected via Google and the 200 collected written questionnaires, 461 questionnaires, excluding those with non-uniform and unfaithful responses, were included in the final analysis. To verify the adequacy of the sample size, the G*power 3.1.9.7 program was used. The analytical test was done with linear multiple regression and set to two-tails test. Considering a 0.15 median effect size, 0.95 power (1- β error probability), and a 0.01 significance level (α), at least 123 subjects were needed.

Study tool

For the study tool that was used, a questionnaire consisting of four sections was prepared.

Demographic characteristics

Demographic characteristics consisted of gender, age, education, occupation, and systemic disease. Ages were divided into under 30s, 30s-50s, and over 51 years of age, and education was divided into high school graduates or younger, university students, and university graduates or older. Occupation was divided into office workers, students, housewives, and others, and divided into groups with and without systemic disease.

The mask wearing status

As for the mask wearing state, the average daily mask wearing time, whether the mask was reused, and the number of times the mask was reused were checked. The average daily mask wearing time was divided into less than 4

hours, more than 4 hours - less than 5 hours, more than 6 hours - less than 8 hours, and more than 8 hours. Whether or not to reuse the mask was divided into a group that reused the mask and a group that did not use it again, and the number of times of mask reuse was divided into less than 4 times, 4 to 5 times, and 6 or more times.

Oral health status and oral health care

After wearing a mask, it was divided into groups with changes in oral health and groups with no changes in oral health. When there was a change in oral health status, the items were divided into dry mouth, halitosis, mouth breathing, tooth decay, periodontal disease, and temporomandibular joint disease. Changes in oral health care after wearing a mask were divided into a group with scaling experience within 1 year and a group without scaling experience within 1 year. The average brushing time was divided into 1 minute, 2 minutes, 3 minutes, and 4 minutes. Oral hygiene products were divided into groups using and groups not using. Oral hygiene products were classified into interdental toothbrush, dental floss, mouthwash, tongue cleaner, and water flosser.

Oral health behaviors

Oral health behavior was measured by modifying the tool of Kim et al. (Kim et al 2010) Oral health behavior is divided into two sections (self-oral health care behavior_1-8 questions, eating behavior_9,10 questions), and there are a total of 10 questions. Each question was composed of a Likert 4-point scale, with 1 point for 'not at all', 2 points for 'disagree', 3 points for 'agree', and 4 points for 'strongly agree'. Questions 7 and 9 were inversely calculated, and the higher the sum of the total scores, the higher the level of oral health behavior. Cronbach's α was 0.615.

Data analysis

For data analysis, IBM SPSS ver. 21.0 (IBM Co., Armonk, NY, USA) was used, and testing was conducted based on a 0.05 significance level (α). For the demographic characteristics, oral health status and oral health care, frequency analyses were conducted, and paired t-tests were carried out to compare the oral health behaviors before and after wearing a mask due to COVID-19. Finally, linear multiple regression analysis was performed to identify factors affecting oral health behaviors after wearing a mask.

Results

Demographic characteristics

As for the demographic characteristics of the subjects, there were more females than males at 71.4%, and the age of the subjects under 30 was the most at 48.8%. As for education, those who graduated from university accounted for the most at 46.9%, and for occupation, students accounted for the most at 40.6%. 91.8% had no systemic disease (Table 1)

Table 1. Demographic characteristics [obtained via frequency analysis, N(%)]

Characteristics	Division	
Gender	Male	132 (28.6)
	Female	329 (71.4)
Age	<30	225 (48.8)
	30s-50s	116 (25.2)
	51<	120 (26.0)
Education	High school graduates	55 (11.9)
	University students	190 (41.2)
	University graduates	216 (46.9)
Occupation	Office workers	167 (36.2)
	Students	187 (40.6)
	Housewives	48 (10.4)
	Others	59 (12.8)
Systemic disease	Without systemic disease	423 (91.8)

Comparison of mask wearing status due to COVID-19 according to demographic characteristics

The results of checking the mask wearing status according to demographic characteristics are showed in Table 2. In the case of male, the average daily time of wearing a mask was the most at 50% in 'more than 8 hours'. In addition, 62.1% of male said that they reused the mask, and frequency of mask reuse was 'less than 4 times' at 75.8%. In the case of female, the average daily time of wearing a mask was 'more than 8 hours' the most, but it was relatively evenly distributed in all time zones compared to male. In addition, 68.1% of female said that they reused the mask, and frequency of mask reuse was 'less than 4 times' at 84.5%. There was a significant difference between the groups in 'Average time to wear a mask per day' and 'Frequency of mask reuse' by gender ($p < 0.05$).

In the case of under 30s, the average daily time of wearing a mask was 'more than 8 hours' the most, but it was relatively evenly distributed in all time zones compared to other age groups. In addition, 60% of under 30s said that they reused the mask, and frequency of mask reuse was 'less than 4 times' at 84%. In the case of 30s-50s, the average daily time of wearing a mask was the most at 50.9% in 'more than 8 hours'. In addition, 72.4% of 30s-50s said that they reused the mask, and frequency of mask reuse was 'less than 4 times' at 87.9%. In the case of over 51 years of age, the average daily time of wearing a mask was the most at 45% in 'more than 8 hours'. In addition, 72.5% of over 51 years of age said that they reused the mask, and frequency of mask reuse was 'less than 4 times' at 72.5%. There was a significant difference between the groups in 'Average time to wear a mask per day', 'Whether to reuse the mask' and 'Frequency of mask reuse' by age ($p < 0.05$).

In the case of high school graduates, the average daily time of wearing a mask was 'more than 8 hours' the most, but it was relatively evenly distributed in all time zones compared to other education groups. In addition, 60% of high school graduates said that they reused the mask, and frequency of mask reuse was 'less than 4 times' at 83.6%. In the case of university students, the average daily time of wearing a mask was 'more than 4 hours - less than 5 hours' the most, but it was relatively evenly distributed in all time zones compared to other education groups. In addition, 61.6% of university students said that they reused the mask, and frequency of mask reuse was 'less than 4 times' at 84.7%. In the case of university graduates, the average daily time of wearing a mask was the most at 51.9% in 'more than 8 hours'. In addition, 72.2% of university graduates said that they reused the mask, and frequency of mask reuse was 'less than 4 times' at 79.2%. There was a significant difference between the groups in 'Average time to wear a mask per day' and 'Whether to reuse the mask' by education ($p < 0.05$).

In the case of office workers, the average daily time of wearing a mask was the most at 64.1% in 'more than 8 hours'. In addition, 68.9% of office workers said that they reused the mask, and frequency of mask reuse was 'less than 4 times' at 86.8%. In the case of students, the average daily time of wearing a mask was 'more than 4 hours - less than 5 hours' the most, but it was relatively evenly distributed in all time zones compared to other occupation groups. In addition, 61% of students said that they reused the mask, and frequency of mask reuse was 'less than 4 times' at 85.6%. In the case of housewives, the average daily time of wearing a mask was 'less than 4 times' the most, but it was relatively evenly distributed in all time zones compared to other occupation groups. In addition, 68.8% of housewives said that they reused the mask, and frequency of mask reuse was 'less than 4 times' at 68.8%. There was a significant difference between the groups in 'Average time to wear a mask per day' and 'Frequency of mask reuse' by occupation ($p < 0.001$).

In the case of group of without systemic disease, the average daily time of wearing a mask was 'less than 4 times' the most, but it was relatively evenly distributed in all time zones compared to group of with systemic disease. In addition, 64.8% of group of without systemic disease said that they reused the mask, and frequency of mask reuse was 'less than 4 times' at 84.4%. In the case of group of with systemic disease, the average daily time of wearing a mask was the most at 52.6% in 'more than 8 hours'. In addition, 84.2% of group of with systemic disease said that they reused the mask, and frequency of mask reuse was 'less than 4 times' at 55.3%. There was a significant difference between the groups in 'Average time to wear a mask per day', 'Whether to reuse the mask' and 'Frequency of mask reuse' by systemic disease ($p < 0.01$).

Table 2. Comparison of mask wearing status due to COVID-19 according to demographic characteristics
[obtained via by chi-squared t-test, $M \pm SD$]

Average time to wear a mask per day	Whether to reuse the mask	Frequency of mask reuse
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		<4h	4-5h	6-8h	8h<	No	Yes	<4	4-5	5<
Gender	Male	10 (7.6)	18 (13.6)	38 (28.8)	66 (50.0)	50 (37.9)	82 (62.1)	100 (75.8)	16 (12.1)	16 (12.1)
	Female	55 (16.7)	78 (23.7)	75 (22.8)	121 (36.8)	105 (31.9)	224 (68.1)	278 (84.5)	35 (10.6)	16 (4.9)
	p	0.001				0.232		0.016		
Age	<30	32 (14.2)	64 (28.4)	55 (24.4)	74 (32.9)	90 (40.0)	135 (60.0)	189 (84.0)	23 (10.2)	13 (5.8)
	30s-50s	6 (5.2)	26 (22.4)	25 (21.6)	59 (50.9)	32 (27.6)	84 (72.4)	102 (87.9)	10 (8.6)	4 (3.4)
	51<	27 (22.5)	6 (5.0)	33 (27.5)	54 (45.0)	33 (27.5)	87 (72.5)	87 (72.5)	18 (15.0)	15 (12.5)
	p	0.000				0.018		0.016		
Education	High school graduates	9 (16.4)	13 (23.6)	11 (20.0)	22 (40.0)	22 (40.0)	33 (60.0)	46 (83.6)	6 (10.9)	3 (5.5)
	University students	31 (16.3)	58 (30.5)	48 (25.3)	53 (27.9)	73 (38.4)	117 (61.6)	161 (84.7)	20 (10.5)	9 (4.7)
	University graduates	25 (11.6)	25 (11.6)	54 (25.0)	112 (51.9)	60 (27.8)	156 (72.2)	171 (79.2)	25 (11.6)	20 (9.3)
	p	0.000				0.044		0.451		
Occupation	Office workers	6 (3.6)	16 (9.6)	38 (22.8)	107 (64.1)	52 (31.1)	115 (68.9)	145 (86.8)	13 (7.8)	9 (5.4)
	Students	31 (16.6)	60 (32.1)	49 (26.2)	47 (25.1)	73 (39.0)	114 (61.0)	160 (85.6)	20 (10.7)	7 (3.7)
	Housewives	18 (37.5)	12 (25.0)	12 (25.0)	6 (12.5)	15 (31.3)	33 (68.8)	33 (68.8)	12 (25.0)	3 (6.3)
	Others	10 (16.9)	8 (13.6)	14 (23.7)	27 (45.8)	15 (25.4)	44 (74.6)	40 (67.8)	6 (10.2)	13 (22.0)
	p	0.000				0.186		0.000		
Systemic disease	Without systemic disease	53 (12.5)	93 (22.0)	110 (26.0)	167 (39.5)	149 (35.2)	274 (64.8)	357 (84.4)	39 (9.2)	27 (6.4)
	With systemic disease	12 (31.6)	3 (7.9)	3 (7.9)	20 (52.6)	6 (15.8)	32 (84.2)	21 (55.3)	12 (31.6)	5 (13.2)
	p	0.000				0.009		0.000		

Changes in oral health status and oral health care after wearing a mask due to COVID-19

Table 3 shows the changes in oral health status and oral health care after wearing a mask due to COVID-19. In the change of oral health status, 22.8% said that there was a change in oral health after wearing a mask. The group that had halitosis accounted for the most at 31.7%, and 14.5% said that there was a problem with mouth breathing. In the change of oral health care, 40.1% of the group didn't perform scaling for 1 year after wearing a mask. The average brushing time of 3 minutes or more was 46.5%, and 2 minutes was 24.5%. 65.7% used oral hygiene products. The use of dental floss was 31.2%, inter dental brush 28.2%, mouthwash 24.9%, tongue cleaner 15.4%, and water flosser 6.1%.

Table 3. Changes in oral health status and oral health care after wearing a mask due to COVID-19 [obtained via frequency analysis, N(%)]

Variable			
Oral health status	changes in oral health status	No change	356 (77.2)
		Change	105 (22.8)
	The items of oral disease	Dry mouth	52 (11.3)
		Halitosis	146 (31.7)
		Mouth breathing	67 (14.5)
		Tooth decay	11 (2.4)
		Periodontal disease	15 (3.3)
		Temporomandibular joint disease	12 (2.6)

Oral health care	Scaling experience within 1 year	No experience	185 (40.1)
		Experience	276 (59.9)
	The average brushing time	1 minute	41 (8.9)
		2 minute	113 (24.5)
		3 minute	215 (46.6)
		4 minutes	92 (20.0)
	Use of oral hygiene products	Not using	158 (34.3)
		Using	303 (65.7)
	Type of oral hygiene products	Interdental toothbrush	130 (28.2)
		Dental floss	144 (31.2)
		Mouthwash	115 (24.9)
		Tongue cleaner	71 (15.4)
		Water flosser	28 (6.1)

Changes in oral health behaviors after wearing a mask due to COVID-19

Table 4 shows the changes in oral health behavior before and after wearing a mask due to COVID-19. The items that showed better oral health behavior after wearing the mask than before wearing the mask were 'I brush my teeth before bed.', 'I use oral care products.', and 'I eat foods that prevent tooth decay.'. The items that showed worse oral health behavior after wearing the mask than before wearing the mask were 'I recently received oral health education.', 'I have regular oral examinations.', and 'I get regular preventive care.'. 'If I have an oral disease, I get treatment right away.', 'I don't get treatment even if I have an oral disease.'. The total score of oral health behavior was lower after wearing the mask than before wearing the mask, and there was a significant difference ($p < 0.001$). The items with no significant difference were 'I have regular oral examinations.', 'I get regular preventive care.', 'I don't smoke.', and 'I eat foods that cause tooth decay.'.

Table 4. Changes in oral health behaviors after wearing a mask due to COVID-19 [obtained via by paired t-test, M $\pm$ SD]

	Before wearing a mask	After wearing a mask	p
<i>I brush my teeth before bed.</i>	3.47 $\pm$ 0.74	3.51 $\pm$ 0.72	0.000
<i>I use oral care products.</i>	2.49 $\pm$ 0.98	2.56 $\pm$ 0.99	0.000
<i>I recently received oral health education.</i>	2.84 $\pm$ 0.84	2.71 $\pm$ 0.89	0.000
<i>I have regular oral examinations.</i>	2.50 $\pm$ 0.93	2.48 $\pm$ 0.93	0.170
<i>I get regular preventive care.</i>	2.59 $\pm$ 0.91	2.57 $\pm$ 0.88	0.149
<i>If I have an oral disease, I get treatment right away.</i>	3.07 $\pm$ 0.84	3.02 $\pm$ 0.83	0.002
<i>I don't get treatment even if I have an oral disease.</i>	3.09 $\pm$ 0.80	2.96 $\pm$ 0.88	0.000
<i>I don't smoke.</i>	3.44 $\pm$ 0.95	3.44 $\pm$ 0.94	0.782
<i>I eat foods that cause tooth decay.</i>	2.23 $\pm$ 0.87	2.23 $\pm$ 0.88	0.858
<i>I eat foods that prevent tooth decay.</i>	2.93 $\pm$ 0.72	2.95 $\pm$ 0.73	0.025
Total	28.87 $\pm$ 4.04	28.66 $\pm$ 3.99	0.001

Factors affecting oral health behavior before and after wearing a mask due to COVID-19

The results of confirming the effect on oral health behavior after wearing a mask due to COVID-19 are presented in

Table 5. In demographic characteristics, gender ($\beta=1.532$, $p=0.000$) was an influencing factor, and in the mask wearing status, mask reuse ($\beta=0.921$, $p=0.006$) was an influencing factor. In oral health, scaling experience within 1 year ($\beta=3.375$, $p=0.000$), the average brushing time ($\beta=0.884$, $p=0.000$), and use of oral hygiene products ($\beta=1.913$, $p=0.000$) had statistically significant effects. The Durbin-Watson index was 2.043, confirming that there was no autocorrelation of the residuals, and all tolerances were 0.1 or more. All variance inflation factors (VIF) were confirmed to be less than 10, so there was no problem of multicollinearity ($p<0.001$).

Table 5. Factors affecting oral health behavior before and after wearing a mask due to COVID-19 [obtained via by regression analysis, Before wearing a mask $R^2=0.332$, Durbin-Watson=2.099), After wearing a mask ($R^2=0.363$, Durbin-Watson=2.043)]

		Before wearing a mask				After wearing a mask			
		β	t	p	VIF	β	t	p	VIF
Demographic characteristics	Gender	1.098	1.261	.000	3.564	1.532	4.393	0.000	1.098
	Age	1.458	-0.024	.913	-0.109	0.290	1.334	0.183	1.458
	Education	1.429	-0.404	0.133	-1.506	-0.397	-1.505	0.133	1.429
	Occupation	1.211	-0.065	0.704	-0.381	-0.038	-0.226	0.821	1.211
	Systemic disease	1.238	0.582	0.349	0.938	0.232	0.381	0.703	1.238
Mask wearing status	Average time to wear a mask per day	1.198	-0.138	0.375	-0.889	-0.085	-0.561	0.575	1.198
	Whether to reuse the mask	1.085	0.643	0.059	1.896	0.921	2.775	0.006	1.085
	Frequency of mask reuse	1.137	0.019	0.946	0.068	0.205	1.152	0.250	1.137
Oral health	Changes in oral health status	1.066	3.386	0.000	10.287	-0.022	-0.059	0.953	1.066
	Scaling experience within 1 year	1.105	1.016	0.000	5.585	3.375	10.459	0.000	1.105
	The average brushing time	1.058	1.934	0.000	5.585	0.884	4.951	0.000	1.058
	Use of oral hygiene products	1.145	1.261	0.000	3.564	1.913	5.641	0.000	1.145

Discussions

From June 5, 2020, the World Health Organization (WHO) advised that to effectively prevent COVID-19 infection in areas of community transmission, governments should encourage the general public to use masks in specific situations and settings as part of a comprehensive approach to suppress SARS-CoV-2 transmission (World Health Organization., 2020). Due to COVID-19, many everyday habits such as wearing masks have changed. The use of these masks has shown that many people brush less a day, and people are less concerned about oral hygiene (Axelsson P et al., 2004). The decrease of toothbrushing frequency is associated with a higher risk for the incidence or increment of new carious lesions (Kumar S et al., 2016). Moreover, this practice is important to maintain periodontal health (Axelsson P et al., 2004). Oral diseases such as dental caries, gingivitis and periodontal infection may affect oral health and can lead to teeth loss. Therefore, it is necessary to check the factors related to oral health depending on the wearing status of the mask. In this study, 71.4% of women accounted for more than men, with the majority of female respondents. It was not surprising since women are more willing to participate in surveys and researches (Peloso RM et al., 2020)(Peloso RM et al., 2020)(Qiu J., 2020). Among the respondents, more were under 30 years of age, students, university graduates, and people without systemic disease. The groups with 'less than 4 hours' the most were 'housewives' and 'more than 4 hours - less than 5 hours' the most were 'university students' and 'students'. In all other groups, 'more than 8 hours' were wearing masks. However, this study did not confirm how the mask was worn, only checking the time it was worn. According to a study by Min et al. (Min Tan et al., 2021), a few people indicated that they often or always hung their masks under their chins (of- ten 7.0%, always

9.4%) or uncovered their mouths or noses for a breath (often 2.9%, always 1.3%) while using it. Therefore, additional investigation will be needed not only on the time to wear the mask, but also on how to wear the mask.

Reusing face masks is an inevitable issue when facing a mask availability crisis. Under the severe situation of mask shortage, the general population were recommended to reuse disposable masks if they are clean, but should be replaced with new masks if dirty or used for more than 8 hours (National Health Commission of the People's Republic of China., 2020). In this study, re-use of masks was higher in all groups, and the number of re-use of masks was the highest in less than 4 times. This is the same result as the study by Tan M et al. (Tan Met al., 2021) where more than half of the respondents reused disposable masks. As the wearing time of the mask increases, it is important to wear the mask properly. It has been reported that good mask wearing habits depend on how much training you have received in using masks rather than on the level of education (Tan Met al., 2021). Therefore, mask compliance will need to be trained through various methods to ensure good compliance with mask wearing methods, suggesting that social media may be the most helpful to the public. There will be a change in oral health as oral care will be neglected due to wearing a mask for a long time. In this study, after wearing a mask, 22.8% said that there was a change in oral condition, and halitosis was the most common. This result is consistent with the study of Tan M et al. (Tan M et al., 2021) Although changes in temporomandibular joint disorders were low in this study, a study by Vercelino C.R.M.P et al. (Vercelino C.R.M.P et al., 2021) found that the prevalence of self-perceived bruxism increased significantly after the onset of the COVID-19 pandemic. This result probably is related with the increase in anxiety and stress (Peloso RM., 2020)(Vahia IV., 2020), since these problems are associated with bruxism (Almeida-Leite CM et al., 2020)(Manfredini D et al., 2009). Therefore, in-depth research on the psychological changes and temporomandibular joint disorder caused by COVID-19 should be added. Regular and effective toothbrushing and flossing can significantly reduce halitosis, especially in people with poor oral hygiene (Morita M et al., 2001). The average brushing time after wearing a mask was 3 minutes or more, and 65.7% said that they used oral hygiene products. Among them, dental floss use was 31.2%, interdental toothbrush was 28.2%, oral toothbrush was 24.9%, tongue cleaner was 15.4%, and water pick was 6.1%. 'I brush my teeth before bed', 'I use oral care products', and 'I eat foods that prevent tooth decay.' showed that oral health behavior improved after wearing the mask compared to before wearing it. On the other hand, 40.1% of the group did not perform scaling for 1 year after wearing a mask, and 'I recently received oral health education', 'I have regular oral examinations.', 'I get regular preventive care', 'If I have an oral disease, I get treatment right away.', 'I don't get treatment even if I have an oral disease.' got worse after wearing the mask. As such, we confirmed that the number of visits to the dentist for oral examination or treatment decreased, while the ability of patients to manage their own oral hygiene at home improved. People are reluctant to go out and are staying home, less willing to go to dental offices due to the fear of contracting COVID-19 (Peloso RM et al., 2020)(Guo H et al., 2020)(Long L et al., 2020). Only 18.1% scheduled dental care in the last 30 days, and the most frequent answers for dental care appointment were to continue a dental treatment started before the pandemic, to replace fillings, regular dental care and orthodontic treatment. If the reality is that visiting the dentist is difficult due to anxiety caused by COVID-19, we will have to suggest specific ways for patients to implement oral health behaviors at home by themselves to prevent further progression of oral diseases. Excluding demographic characteristics and oral health factors, among the influencing factors on oral health behavior, mask reuse ($\beta=0.921$, $p=0.006$) was identified as the main influencing factor. This means that those who reuse the mask have higher scores for oral health behavior.

Therefore, it is thought that the interest in oral health is as high as the frequent use of a mask. Open surveys generate interesting data (even if not necessarily generalizable), in particular when a qualitative analysis is the aim and the objective is to study current trends in a specific issue (Eysenbach G et al., 2002), like in the present study. Regarding the representativeness of the sample, the internet community is becoming more representative of society as a whole (Houston JD et al., 1998). This way, the number of participants and the representativeness of the sample were quite sufficient and suitable, allowing reliable conclusions to the objectives of this study. A possible limitation of the present study was the representativeness of the sample of convenience that does not allow population inferences or generalizations. However, online surveys allow easier access and preserve participants' anonymity, reducing the tendency of socially desirable responses. Even so, the methodology expanded the sample to all Korean regions and covered all age ranges. As far as we know, these data were not yet reported in the literature, and it is strongly important, due to the particularities of the current situation.

Conclusion

Due to the highly contagious characteristics of COVID-19 and the continued severe situation globally, mask-wearing has become a part of our ordinary lives. Our results confirmed that the oral health behaviors that can be performed at

home improved compared to before wearing a mask, but the oral health behaviors of visiting the dentist were worse. In addition, it was confirmed that re-use of the mask is an influencing factor on oral health behavior. Therefore, in order to prevent the progression of oral diseases, it is necessary to educate them on how to wear a mask correctly, and various efforts will be required to facilitate dental visits.

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