

Analysis of Differences in Oral Health behavior according to Neuroticism due to COVID-19

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ABSTRACT

The purpose of this study is to identify changes in neurosis caused by COVID-19 and to identify differences in oral health behaviors in response to neurosis changes. During of April to May 2021, 461 questionnaires in Korea were surveyed on change of neurosis and oral health behaviors. Paired t-test was conducted to confirm the change in neurosis before and after COVID-19, psychological change in mask wearing, and oral health behavior. In addition, a chi-squared test was conducted to confirm the differences in demographic characteristics and changes in oral health-related factors according to neurotic changes. As a result, it was confirmed that neurosis was higher after COVID-19 compared to before COVID-19 in all items ($p < 0.000$). Also, it was confirmed that the psychological change of wearing a mask was worse after COVID-19 compared to before COVID-19 ($p < 0.001$). Before COVID-19, non-smoking and caries-preventing food intake were significantly higher in the group with neurosis changes. After COVID-19, brushing your teeth before going to bed improved, but not delaying oral treatment decreased ($p < 0.001$). Therefore, it is necessary to reduce the anxiety of visiting the dentist in order not to miss the treatment time for oral diseases. In addition, effective educational promotion should be conducted using various media so that behaviors to care oral health can be taken at home.

Keywords

COVID-19, Neuroticism, Oral health, Pandemics

Introduction

Starting in early 2020, a new human coronavirus, SARS-CoV-2 or the COVID-19 disease, became a global health problem, causing severe respiratory tract infections in humans and leading to a large number of deaths (Wu et al., 2020). To date it is not known the pandemic's overall impact on health systems and/or on dental services. In fact, during the first months of the pandemic, we did not have universal guidelines for providing dental care during the pandemic. As a result of not having an official protocol, the provision of dental care was completely halted or significantly reduced to only urgent dental care, which could have harmed patients' oral health (ADA Interim Guidance for Management of Emergency and Urgent Dental Care., 2020). It is possible that after this pandemic, due to the increased fear of COVID-19, avoidance behaviour will develop in dental practices and also in other medical specialties. It is important to identify the people at risk of developing negative emotions and avoidance tendencies to try to reduce the impact on the population's overall health. Serious health threats might be imposed on the members of societies affected by Large-scale public health emergencies, particularly the COVID-19 pandemic. Generally, humans show negative responses to such threats, which may result in less psychological well-being and psychopathology (Brooks et al., 2020). Individual differences in personality during the COVID-19 pandemic play a key role in adopting the protective behaviors and modulating the relationship between the immune system and stressors. In other word, the subjects' risk perception of a pandemic, immunity, and progression of health problems are highly affected by stable individual differences, including personality traits (Cohen et al., 2012)(Khosravi., 2020).

Although there are differences among scholars on the definition of personality, the need for categorization is consistent, so various studies have been conducted to classify personality types. Various models have begun to appear based on previous research, and the two most commonly known models are the 'Five Factor Model' and the 'Big-Five Model'. Costa and McCrae (Costa et al., 1980) analyzed Cattell's 16 personality traits and found three factors: 'Neuroticism', 'Extroversion', and 'Openness to experience'. It was named 'NEO-I (NEO-Inventory)' after the first letter of each factor. Costa and McCrae additionally discovered 'Conscientiousness' and 'Agreeableness' and added relevant factors, renamed it 'NEO-PI (Personality Inventory)', and used it as a new test tool (Goldberg., 1992). In addition, by synthesizing various studies, he advocated the 'Big-Five Model', which divided personality into five factors (International Personality Item Pool) was produced. Neuroticism, known as one of the Big Five personality traits, represents the tendency of individuals towards experiencing negative emotions, including depression, anxiety, and anger. Individuals with high neuroticism scores perceive the world to be threatening, they are quickly distressed,

and it is difficult for them to cope with stressful situations (Cohen et al., 2012). In this respect, individuals with high neuroticism might 1) further concern themselves in the COVID19-related information and pandemic consequences (e.g., their health, crisis preoccupation), and 2) experience more adverse impacts during this preoccupation (i.e., affective reactivity) (Merino et al., 2016). As reported by some of the recent studies, neuroticism can play a crucial role in moderating the effects of stressors on the immune system. However, the neuroticism impacts on the immune system may be mediated by stressors. In other words, neuroticism might affect the immune system by changing the quality and quantity of stressors. Therefore, personality not only does lead to the presence of stressors (i.e., exposure) but also influences the response to stressors (i.e., reactivity) (Segerstrom., 2000).

In sum, these results developed a superior understanding of how individuals respond to the COVID-19 pandemic according to the relation of neuroticism with personal hygiene practices, immune system, and risk perception. Thus, the clinicians should highlight the significance of neuroticism in the prediction of individuals' protective behaviors during the COVID-19 pandemic. The literature has shown that patients commonly experience stress when undergoing dental treatment. In fact, the prevalence of dental fear has reached 24.3%, a figure which has been maintained over the last decade among the adult population (Oosterink et al., 2009). In addition, patients with greater neuroticism, such as high trait anxiety or other anxiety disorders, are more likely to fear dental care (Hagglin et al., 2001)(Lago-Mendez et al., 2006). These emotions are associated with avoidance of dental care, which can negatively impact the course, treatment, and outcome of dental pathologies (Nicolas et al., 2010). For oral diseases, prevention rather than treatment should be prioritized, and for this, an individual's oral care ability must be excellent. Oral health behaviors should be improved to protect oral health in a reality where it is difficult to visit the dentist due to COVID-19. Therefore, the purpose of this study is to confirm the changes in neurosis due to COVID-19 and to compare the oral conditions and oral health behaviors of those with and without neurosis. We want to provide basic data for effectively managing the oral health of people with high neuroticism due to COVID-19.

Materials and Methods

Study subjects and method

This study was conducted from April to May 2021 in Koreans. After understanding the purpose of the study, a Google questionnaire was distributed to the subjects who voluntarily participated in the study, and they responded in a self-filling format and immediately retrieved it. The G*Power 3.1 program was used for the number of subjects, and the significance level of 0.01, the power of 95%, and the effect size were set at the intermediate level of 0.15. A total of 119 people were used as the standard, and a total of 461 people were determined as subjects in consideration of uncertain answers.

Study tool

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

Demographic characteristics

Demographic characteristics consisted of gender and age, education, cohabitation type, systemic disease, drinking, and smoking. Ages were divided into under 30 years of age, 30s-50s, and over 51 years of age, and education was divided into high school graduation, university students, and university graduation. Cohabitation type was divided into spouse, child, sibling, parent, others, and systemic disease was divided into group without disease and group with disease. Drinking was divided into a non-drinking group and a drinking group, and smoking was divided into a non-smoker group and a smoker group.

Neuroticism

We used IPIP (International Personality Item Pool) created by Goldberg (Goldberg., 1999) and standardized by Yu and Lee (Yu et al., 2004) to measure the subject's personality traits. It consists of a total of 50 items and 5 sub-domains, and the 5 sub-domains are Neuroticism, Extroversion, Openness to Experience, Agreeableness, and Conscientiousness. All items are scored on a 5-point Likert scale with 1 point for 'not at all', 2 points for 'disagree', 3 points for 'just so', 4 points for 'agree', and 5 points for 'strongly agree'. , the higher the total score of each factor, the stronger the tendency is evaluated. In this study, the neurosis score was measured with 10 items, and Cronbach's α was .905. In this study, the difference in neurosis was confirmed by dividing into before and after COVID-19, and after COVID-19, 290 people in the group with a change in neurosis and 171 people in the group without change were analyzed.

Psychological changes about wearing a mask

The psychological wearing of the mask consisted of a total of 5 questions. In detail, there were discomfort, stress,

depression, and changes in life caused by wearing a mask, and it was composed of discomfort caused by colleagues who did not wear a mask. It was scored on a Likert 5-point scale, and a high score means that the psychology is worse due to wearing a mask. Cronbach's α was .783.

Oral health-related factors and oral health behaviors

As factors related to oral health, the presence or absence of oral disease, changes in oral status due to COVID-19, scaling experience for one year, average brushing time, tongue cleaning, and use of oral care products were checked. Oral health behavior was measured by modifying the tools of Kim et al. (Kim et al., 2010).

The score of oral health behavior is measured by composing a total of 10 questions in two sections (self oral health care behavior_1-8 questions, eating behavior_9,10 questions). The response to each question is composed of a 4-point Likert scale with 1 point for 'not at all', 2 points for 'disagree', 3 points for 'agree', and 4 points for 'strongly agree'. The higher the sum of the scores, the higher the oral health behavior. Cronbach's α was .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). Paired t-test was conducted to confirm the change in neurosis before and after COVID-19, psychological change in mask wearing, and oral health behavior. In addition, a chi-squared test was conducted to confirm the differences in demographic characteristics and changes in oral health-related factors according to neurotic changes.

Results

Changes in neurosis due to COVID-19

Table 1 shows the results of confirming the change in neurosis due to COVID-19.

Before COVID-19, the item with the most neurosis was 'I am very worried.', followed by 'I'm not laid-back.' and 'I am very upset.' After COVID-19, the item with the most neurosis was 'I am very worried.', followed by 'I am very upset.', 'I have severe mood swings. It was confirmed that neurosis was higher after COVID-19 compared to before COVID-19 in all items ($p < 0.000$).

Table 1. Changes in neurosis due to COVID-19 [obtained via by paired t-test, M $\pm$ SD]

	Before COVID-19	After COVID-19	p
<i>I'm not laid-back.</i>	2.33 $\pm$ 0.70	2.39 $\pm$ 0.74	0.000
<i>I feel very depressed.</i>	2.16 $\pm$ 0.75	2.27 $\pm$ 0.81	0.000
<i>I get anxious easily.</i>	2.07 $\pm$ 0.71	2.17 $\pm$ 0.79	0.000
<i>I am very worried.</i>	2.58 $\pm$ 0.77	2.66 $\pm$ 0.76	0.000
<i>I am very upset.</i>	2.28 $\pm$ 0.76	2.41 $\pm$ 0.79	0.000
<i>I am very angry.</i>	2.19 $\pm$ 0.70	2.29 $\pm$ 0.74	0.000
<i>I have severe mood swings.</i>	2.27 $\pm$ 0.70	2.40 $\pm$ 0.78	0.000
<i>I am very emotional</i>	2.24 $\pm$ 0.72	2.34 $\pm$ 0.80	0.000
<i>I get annoyed a lot.</i>	2.24 $\pm$ 0.72	2.40 $\pm$ 0.79	0.000
<i>I often get depressed.</i>	2.05 $\pm$ 0.66	2.19 $\pm$ 0.75	0.000
Total	22.41 $\pm$ 5.13	23.52 $\pm$ 5.69	0.000

Demographic characteristics according to changes in neurosis due to COVID-19

Table 2 shows the demographic characteristics of the change in neurosis due to COVID-19. Regardless of neurosis changes, there were more female than male, and there were more under 30 years of age, university graduates, without systemic disease, alcohol drinkers, and non-smokers. In the cohabitation type, the group living with children was the most in the group with no change in neurosis, and the group living with siblings was the most in the group with the neurosis change. There were significant differences between groups in gender, cohabitation type, systemic disease, and smoking ($p < 0.000$).

Table 2. Demographic characteristics according to changes in neurosis due to COVID-19 [obtained via by chi-squared test, N(%)]

	Without change	With change	p
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Gender	Male	99 (34.1)	33 (19.3)	0.001
	Female	191 (65.9)	138 (80.7)	
Age	<30	136 (46.9)	89 (52.0)	0.563
	30-50	76 (26.2)	40 (23.4)	
	50<	78 (26.9)	42 (24.6)	
Education	High school graduates	37 (12.8)	18 (10.5)	0.589
	University students	122 (42.1)	68 (39.8)	
	University graduates	131 (45.2)	85 (49.7)	
Cohabitation type	With spouse	15 (5.2)	24 (14.0)	0.000
	With child	130 (44.8)	54 (31.6)	
	With sibling	90 (31.0)	68 (39.8)	
	With parents	29 (10.0)	18 (10.5)	
	Others	26 (9.0)	7 (4.1)	
Systemic disease	Without systemic disease	273 (94.1)	150 (87.7)	0.022
	With systemic disease	17 (5.9)	21 (12.3)	
Drink alcohol	Non-drinking	86 (29.7)	66 (38.6)	0.052
	Drinking	204 (70.3)	105 (61.4)	
Smoking	Non-smoker	245 (84.5)	166 (97.1)	0.000
	Smoker	45 (15.5)	5 (2.9)	

Psychological changes in mask wearing due to neurosis changes due to COVID-19

Table 3 shows the results of confirming the psychology of wearing a mask according to the change in neurosis due to COVID-19. In the group with no change in neurosis, the highest item was 'Discomfort when wearing a mask', followed by 'Discomfort towards colleagues who do not wear masks' and 'Changing your life when wearing a mask'. In the group with changes in neurosis, the highest item was 'Discomfort when wearing a mask', followed by 'Discomfort towards colleagues who do not wear masks' and 'Stress when wearing a mask'. In all items, it was confirmed that the psychological change of wearing a mask was worse after COVID-19 compared to before COVID-19 ($p < 0.001$).

Table 3. Psychological changes in mask wearing due to neurosis changes due to COVID-19 [obtained via by paired t-test, $M \pm SD$]

	Without change	With change	p
Discomfort when wearing a mask	3.69 $\pm$ 1.11	4.19 $\pm$ 0.85	0.000
Stress when wearing a mask	3.11 $\pm$ 1.11	3.69 $\pm$ 0.88	0.000
Depression when wearing a mask	1.99 $\pm$ 1.11	2.81 $\pm$ 1.17	0.000
Changing your life when wearing a mask	3.26 $\pm$ 1.26	3.66 $\pm$ 1.08	0.001
Discomfort towards colleagues who do not wear masks	3.60 $\pm$ 1.32	3.92 $\pm$ 1.11	0.006
Total	15.66 $\pm$ 4.29	18.26 $\pm$ 3.58	0.000

Changes in oral health-related factors due to changes in neurosis due to COVID-19

Table 4 shows the changes in oral health-related factors according to the change in neurosis due to COVID-19. Regardless of neurosis changes, the proportions of the group without oral disease, without changes in oral status, in the group within 1 year of scaling experience, in the group with an average daily brushing time of 3 minutes, in the group with tongue cleaning, and in the group using oral care products were higher was high. There was no significant difference in all items except changes in oral status.

Table 4. Changes in oral health-related factors due to changes in neurosis due to COVID-19 [obtained via by chi-squared test, N(%)]

		Without change	With change	p
Oral disease	Without oral disease	222 (76.6)	131 (76.6)	0.542
	With oral disease	68 (23.4)	40 (23.4)	
change in oral status	No change	233 (80.3)	123 (71.9)	0.039
	Change	57 (19.7)	48 (28.1)	
Scaling experience within 1 year	No experience	121 (41.7)	64 (37.4)	0.378
	Experience	169 (58.3)	107 (62.6)	
Average daily brushing	≥ 1 minute	24 (8.3)	17 (9.9)	0.146
	2 minutes	81 (27.9)	32 (18.7)	
	3 minutes	132 (45.5)	83 (48.5)	
	4 minutes ≤	53 (18.3)	39 (22.8)	
Tongue cleaning	No cleaning	22 (7.6)	17 (9.9)	0.391
	Cleaning	268 (92.4)	154 (90.1)	
Oral care products	Don't use	93 (32.1)	65 (38.0)	0.223
	Use	197 (67.9)	106 (62.0)	

Changes in oral health behaviors due to changes in neurosis due to COVID-19

Table 5 shows the changes in oral health behavior according to neurosis changes before and after COVID-19. In all items except 'I use oral care products.' and 'I don't eat foods that cause tooth decay.', the group with changes in neurosis was higher than the group without changes in neurosis. In the case of before COVID-19, there were significant differences among the group with changes in neurosis compared to the group without changes in neurosis in 'I don't smoke.' and 'I eat foods that prevent tooth decay.' After COVID-19, 'I never delay treatment when I need it.' and 'I brush my teeth before bed.' were added and there was a significant difference ($p < 0.01$).

Table 5. Changes in oral health behaviors due to changes in neurosis due to COVID-19 [obtained via by paired t-test, M±SD]

	Before COVID-19			After COVID-19		
	Without change	With change	p	Without change	With change	p
<i>I brush my teeth before bed.</i>	3.43±0.79	3.55±0.63	0.085	3.44±0.78	3.62±0.61	0.012
<i>I use oral care products.</i>	2.54±0.95	2.39±1.03	0.106	2.58±0.95	2.51±1.06	0.476
<i>I recently received oral health education.</i>	2.83±0.88	2.87±0.77	0.672	2.68±0.93	2.76±0.84	0.370
<i>I have regular oral examinations.</i>	2.48±0.92	2.54±0.95	0.514	2.48±0.92	2.48±0.95	0.971
<i>I get regular preventive care.</i>	2.56±0.92	2.66±0.89	0.230	2.53±0.90	2.62±0.85	0.315
<i>If I have an oral disease, I get treatment right away.</i>	3.01±0.87	3.16±0.77	0.057	3.00±0.86	3.05±0.78	0.541
<i>I never delay treatment when I need it.</i>	3.15±0.79	3.00±0.81	0.056	3.06±0.85	2.79±0.90	0.001
<i>I don't smoke.</i>	3.29±1.04	3.68±0.69	0.000	3.29±1.04	3.70±0.67	0.000
<i>I don't eat foods that cause tooth decay.</i>	2.23±0.89	2.22±0.82	0.861	2.24±0.89	2.21±0.86	0.747
<i>I eat foods that prevent tooth decay.</i>	2.87±0.77	3.03±0.64	0.021	2.88±0.76	3.08±0.66	0.004
Total	28.63±3.91	29.29±4.22	0.091	28.43±3.89	29.05±4.15	0.105

Discussions

The epidemic coronavirus disease 2019 (COVID-19), caused by severe acute respiratory syndrome-

coronavirus 2 (SARS-CoV-2), is an international public health emergency, which through the exacerbation of mental health problems such as stress, anxiety, depressive symptoms, insomnia, denial, anger, and fear raised a challenge to psychological resilience (Shigemura et al., 2020). Among them, neurosis refers to emotional stability and is a factor that determines the level of sensitivity to negative phenomena experienced in the surrounding environment. This can be seen as a factor that reflects the ability to adapt to various events experienced in daily life (McCrae., 1991). As a result of confirming the neurosis changes in subjects due to COVID-19 in this study, neurosis was higher after COVID-19 compared to before COVID-19 in all items. People with high neurosis have negative psychological attributes such as anxiety, depression, loneliness, anger, and low self-esteem, and negative emotions are easily expressed even with minor stimuli (Brotheridge et al., 2002). On the other hand, people with low neurosis are emotionally stable and can easily face a variety of events. However, people with excessively low neurosis can be seen as a sign of psychological insensitivity, and they may have difficulty in properly recognizing the problematic situation, and may suspect low productivity and lack of appropriate countermeasures for emergency situations (Costa et al., 1980). Therefore, it is important to keep the propensity for neurosis not too high or too low. Fears from COVID-19 are greater for women than men, which may be because women know better than men how to recognize and express their feelings and uncertainties (Tomason et al., 1996). Recent COVID-19 studies have also endorsed the fact that gender is a consistent predictor of negative affective states such as anxiety, stress, or depression (Wang et al., 2020). as well as showing that women are more careful in implementing hygiene measures than men are in general. Therefore, in a pandemic situation, they are more aware of the risk of COVID-19 disease from failure to comply with appropriate hygiene measures (Guzek et al., 2020)(Suen et al., 2019). However, In this study, the majority of subjects were women, so they were not affected by the neurosis changes due to COVID-19. Therefore, the relevance of gender to neurosis changes needs to be confirmed by further investigation of subjects. Cowling et al. (Cowling et al., 2010) showed that the higher the level of anxiety, the less personal protective practices such as washing hands and wearing masks. However, in this study, the psychological change of wearing a mask after COVID-19 was higher than before COVID-19. Consistent with these results, Zajenkowski et al. (Zajenkowski et al., 2020) and Abdelrahman (Abdelrahman., 2020) demonstrated that the neuroticism personality trait is positively associated with adopting social distancing to avoid COVID-19 infection.

As a consequence, some people may develop a set of negative psychological responses (eg, aversion, anxiety (Schaller et al., 2008)(Mortensen et al., 2010) and make negative cognitive assessments(Ackerman et al., 2009) as a means of self-protection. Previous research has shown that negative emotions (eg, dental fear, anxiety, neuroticism) are associated with a lower frequency of dental visits (Armfield et al., 2007). Dental avoidance increases the prevalence of caries (Armfield et al., 2009) and leads to a deterioration of the quality of life related to oral health (Svensson et al., 2018). Therefore, it is necessary to improve the ability to take care of the oral cavity by oneself so that oral diseases do not worsen. Before COVID-19, non-smoking and caries-preventing food intake were significantly higher in the group with neurosis changes. After COVID-19, brushing your teeth before going to bed improved, but not delaying oral treatment decreased. Furthermore, the prevention-based approach to dentistry may be negatively influenced by this new era of COVID-19 fear, which may bring the patient to the dental clinic only for urgent or curative treatments and discard the preventive support so important for oral health. Specialists recommend that patients be examined every 6 months or at least once a year. People with high neurosis will refrain from visiting the dentist during the COVID-19 pandemic. Therefore, it is necessary to lower the anxiety about dental treatment so as not to miss the treatment time for oral diseases. Above all, it is necessary to make effective oral care by using various media so that you can take action to manage oral health at home. The limitations of this study are linked to the sample used, which has an associated bias in that it is not random, which may have influenced the results and limited the generalisation of the findings to a broader population, although the gender of the participants was chosen in an equitable manner. A possible second limitation comes from the use of self-reporting measures, which may be affected by responses based more on social desirability than reality. Nevertheless, there are few studies on oral health behaviors on neurosis changes caused by COVID-19. Therefore, we think that our study is meaningful as basic data for customized oral health behavior management according to changes in neurosis. Based on the results obtained, we propose the inclusion of psychology professionals in the circuit of evaluation and intervention of patients who come to dental clinics. A psychological evaluation prior to the dentistry consultation could help to detect the patients who need a previous intervention. In this way, health psychologists could attend to patients who require this with psychoeducation, relaxation techniques, rational- emotive therapy or the use of virtual reality (Lahti et al., 2020)(Gordon et al., 2013), so that when they arrive at the consultation, their level of discomfort will be reduced. These techniques, among others, could be applied in an online group format where patients could increase their level of social support, but the chances of contagion would be reduced. In addition, we must inform that dental treatment is safe from COVID-19, and continuous and effective publicity will be needed so that individuals can take care of their own oral hygiene.

Conclusion

During the COVID-19 pandemic, people with high neuroticism are more likely to delay dental visits. Therefore, it is necessary to reduce the anxiety of visiting the dentist in order not to miss the treatment time for oral diseases. In addition, effective educational promotion should be conducted using various media so that behaviors to care oral health can be taken at home.

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