ORİJİNAL ARAŞTIRMA ORIGINAL RESEARCH

Effects of COVID-19 on Oral Health-Related Quality of Life, Temporomandibular Joint Dysfunction and Depression: A Cross-Sectional Study

COVID-19'un Oral Sağlığa Bağlı Yaşam Kalitesi,Temporomandibular Eklem Disfonksiyonu ve Depresyon Üzerine Etkileri: Kesitsel Çalışma

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ABSTRACT Objective: The purpose of the present study is to evaluate the outcomes of coronavirus and outbreak-induced pandemics in terms of temporomandibular dysfunction (TMD), depression and oral health-related quality of life. We also aimed to determine any associations between the coronavirus disease-2019 (COVID-19) positive group, the COVID-19 contact group and the control group and each patient's depression, TMD and their oral health-related quality of life. **Material and Methods:** One thousand-twenty participants in the 13-75 age range answered questions consisting of the Oral Health Impact Profile Questionnaire (OHIP-14), the Fonseca Questionnaire and the Patient Health Questionnaire-9 (PHQ-9). The present study was done online in Turkey. Participants who agreed to participate in the survey continued to answer the survey questions by stating their status regarding COVID-19. Participants were divided into 3 groups according to their COVID-19-related status: COVID-19 positive, COVID-19 contact and control group. **Results:** According to the results of present study, a statistically significant difference was found between the OHIP-14, Fonseca and PHQ-9 survey results and the groups (p<0.001, p<0.05, p<0.001 respectively). Of COVID-19 positives, 17.3% had poor oral health-related quality of life, 91.4% had any level of depression between mild and severe depression, and 66.4% had any level of TMD. **Conclusion:** According to the results of the present study in COVID-19 positives, the oral health-related quality of life was lowest, moderate TMD and severe TMD were higher, and symptoms of severe depression were more. Furthermore the coronavirus and pandemic increase depression and TMD, and reduce the quality of life related to oral health.

Keywords: COVID-19;
temporomandibular joint dysfunction syndrome;
depression; oral health

ÖZET Amaç: Bu çalışmanın amacı, koronavirüs ve salgın kaynaklı pandemilerin sonuçlarını temporomandibular disfonksiyon (TMD), depresyon ve ağız sağlığı ile ilişkili yaşam kalitesi açısından değerlendirmektir. Ayrıca koronavirüs hastalığı-2019 [coronavirus disease-2019 (COVID-19)] pozitif grup, COVID-19 temas grubu ve kontrol grubu ile her hastanın depresyon, TMD ve ağız sağlığı ile ilgili yaşam kalitesi arasındaki ilişkileri belirlemeyi amaçladık. **Gereç ve Yöntemler:** 13-75 yaş aralığındaki 1.020 katılımcı, Ağız Sağlığı Etki Profili Anketi [Oral Health Impact Profile Questionnaire (OHIP-14)], Fonseca Anketi ve Hasta Sağlığı Anketi-9'dan [Patient Health Questionnaire-9 (PHQ-9)] oluşan soruları yanıtladı. Bu çalışma, Türkiye genelinde çevrim içi olarak yapıldı. Ankete katılmayı kabul eden katılımcılar, COVID-19 ile ilgili durumlarını belirterek anket sorularını cevaplamaya devam etti. Katılımcılar, COVID-19 ile ilgili durumlarına göre 3 gruba ayrıldı: COVID-19 pozitif, COVID-19 temaslı ve kontrol grubu. **Bulgular:** Bu çalışmanın sonuçlarına göre OHIP-14, Fonseca ve PHQ-9 anket sonuçları ile gruplar arasında istatistiksel olarak anlamlı fark bulundu (sırasıyla p<0,001, p<0,05, p<0,001). COVID-19 pozitiflerin %17,3'ünün ağız sağlığıyla ilgili yaşam kalitesi kötüydü, %91,4'ünün hafif depresyon ile şiddetli depresyon arasında herhangi bir düzeyde depresyonu vardı ve %66,4'ü herhangi bir düzeyde TMD'ye sahipti. **Sonuç:** Mevcut çalışma sonuçlarına göre COVID-19 pozitiflerinde ağız sağlığı ile ilgili yaşam kalitesi en düşük, orta TMD ve şiddetli TMD daha yüksek ve şiddetli depresyon belirtileri daha fazlaydı. Ayrıca koronavirüs ve pandemi, depresyonu ve TMD'yi artırmakta, ağız sağlığı ile ilişkili yaşam kalitesini düşürmektedir.

Anahtar Kelimeler: COVID-19;
temporomandibular eklem disfonksiyon sendromu;
depresyon; oral sağlık

The new coronavirus disease-2019 (COVID-19) was first detected in Wuhan, the capital of Hubei province of China in December 2019, and it was described as a pandemic by the World Health Organization on March 11, 2020. Individuals infected with COVID-19 can have symptoms affecting many systems such as the central nervous system, peripheral nervous system, respiratory system and musculoskeletal system.[1]

Serious measures have been taken to prevent the spread of the disease in Türkiye as well as in the rest of the world. In addition to the quarantine practices initiated on COVID-19 positive patients, due to the serious spread speed of the virus, measures have been taken in the form of social isolation such as transition to online education in schools, restriction of travel and closure of the crowded places. The Ministry of Health has accepted masks, distance and cleaning as three main rules for personal precautions to be taken. Due to the presence of mutated viruses and the high rate of transmission, pandemic measures have been further increased.[2]

The temporomandibular joint (TMJ) is a part of the chewing system. Bone elements such as mandibular condyle, glenoid fossa, articular eminence and soft tissue elements such as joint disc, articular ligaments, and retro-discal tissues constitute TMJ. Temporomandibular dysfunction (TMD) is one of the main causes of painful conditions in the orofacial region and refers to the masticatory muscles, TMJ internal derangements and clinical problems in adjacent anatomical structures.[3] The etiologic factors of TMD are emotional and psychological problems, malocclusion, spasm of chewing muscles, craniofacial trauma, poor chewing habits, aging, clenching and grinding, malfunction.[4] The most common symptoms of TMD include stiffness and fatigue in chewing muscles (19%), headache (17%), muscle pain in function (11%), TMJ sounds (8%), limitation of jaw movements (6%), locking in the mandible (4%) and ear pain (4%).[5] The general approach in TMD formation is that it is caused by psychological and physical factors.[6] With the quarantine measures taken in the COVID-19 process, people who start to live in isolation from their social environment can be psychologically affected by thoughts such as the risk of getting sick or the fear of death. It can be thought that COVID-19, which can affect joints and muscles, may also have effects on TMJ. Thus, COVID-19 can be associated with TMD due to stress and psychosocial impairment.[7] Therefore, studies evaluating the effects of COVID-19 and its consequences on TMDs are important for the diagnosis and treatment of TMD. TMD and oral symptoms associated with COVID-19 may naturally affect the oral health related quality of life of individuals also.

The aim of this study was to evaluate the relationship between COVID-19 and TMD, psychological status and oral health-related quality of life between the COVID-19 positive group, the COVID-19 contact group, and the healthy control group.

MATERIAL AND METHODS

STUDY POPULATION

This cross-sectional exploratory-descriptive study was started with the approval of the Ethics Committee of Atatürk University Faculty of Dentistry (date: December 25, 2020, no: 50) in accordance with the principles of the Helsinki Declaration of Human Rights. Individuals between the ages of 13-75, those who agreed to participate in the study, and those without rheumatic, orthopedic and neurological problems including the cervical region and TMJ were included in the study. The exclusion criteria for the study are individuals under the age of 13- over 75 years old, patients who have undergone TMJ or cervical region surgery, received treatment from the relevant regions and used dental orthoses, and patients with a diagnosis of TMD.

For the sample collection techniques, given the unfolding situation with the COVID-19 outbreak, the choice was made to use a Google Forms questionnaire (https://forms.gle/f4BxerVpsixTKG6G9). Data were collected via WhatsApp (Meta, Inc., Mountain View, California, USA) between November 2020-December 2020. The present study was conducted online in Türkiye on a voluntary basis and consists of 1,020 volunteers, 350 men and 670 women. The participants were informed about the aims, risks and benefits of the research and informed consent was obtained.

DATA COLLECTION

After the sociodemographic information was recorded, the participants stated their participation in the survey, such as COVID-19 positive, COVID-19 contact but in quarantine, or no COVID 19 exposure/contact. Participants who did not have COVID-19 positive/contact were considered as the healthy control group.

Three patient-centered outcome measures, the 14 item Oral Health Impact Profile Questionnaire (OHIP-14) and the 10 item Fonseca and the 9 item Patient Health Questionnaire-9 (PHQ-9) measure were used in this study. The questionnaires were translated into Turkish, in accordance with cross-cultural adaptation guidelines, to produce a Turkish version of the OHIP-14 and the Fonseca and the PHQ-9. There were validity and reliability studies of the Turkish version of PHQ-9 and OHIP-14.[8,9]

DATA ANALYSIS

OHIP-14 was used to evaluate the oral health related quality of life. Scores were derived from questionnaires by summing the responses to each of the individual questions within the measures. The questions for OHIP-14 were asked as "………………..because of your teeth, mouth or denture?" For the OHIP-14, each item was scored: "never"-score 0, "hardly ever"-score 1, "occasionally"-score 2, "fairly often"-score 3, "very often"-score 4. Higher scores indicate poorer oral health-related quality of life.

The Fonseca Questionnaire, which was used to determine the severity of TMJ, includes factors such as chewing, parafunctional habits, movement limitations, joint noise, and dizziness. For each question, "yes", "no" and "sometimes" answer options were provided. The participants were asked to mark only one option for each item, and they were informed that the options "yes" referred to 10 points, "sometimes" to 5 points 'no' to 0 point. The revealed scores were used to determine the severity of the TMJ disorder.

PHQ-9 questionnaire queries depression symptoms according to Diagnostic and Statistical Manual of Mental Disorders-4 criteria. The questionnaire includes 9 questions and each question is scored between 0 (never) and 3 (almost every day). Points are added up for each question. According to the scoring system of the original questionnaire, scores between 1-4 were graded as minimal, 5-9 mild, 10-14 medium, 15-19 moderate and 20-27 severe depression.

STATISTICAL ANALYSES

The data obtained by the survey in the study were loaded into the computer in the Excel program (Microsoft, Albuquerque, New Mexico, USA) within a certain coding and included under the descriptives analysis using the SPSS 20.0 (Statistical Package for Social Science, Inc., Chicago, Illinois, USA) statistical program, it was used in crosstabs analysis and in the analysis of the % distributions of the variables and in the chi-square test. $p<0.05$ was considered statistically significant. Power analysis was performed for the sample size.

RESULTS

A total of 1,020 people, including 670 females and 350 males, were included in the study. The individuals included in the study were divided into three groups: COVID-19 positive (266 people), COVID-19 contact (146 people) and healthy control group (608 people). Of the individuals participating in the study, 9.6% were between the ages of 13 and 17; 26.2% were between 18 and 24 years, 32.7% were between 25 and 34 years, 18.6% were between 35 and 44 years, 11.4% were between 45 and 59 years, and 1.6% were 60 years or older.

The distribution of the groups based on demographic data is shown in Table 1. According to this, there was no statistically significant difference between the groups depending on gender (p>0.05). The proportion of female participants was higher in all 3 groups. Of the women, 59.7% were healthy controls, 14.0% were COVID-19 contact, 26.3% were COVID-19 positive. And 59.4% of the males were healthy controls, 14.9% were COVID-19 contact, and 25.7% were COVID-19 positive.

A statistically significant difference was found between groups depending on age (p<0.001). That is, while 81.6% of the 13-17 age group was healthy, 56.2% of those aged 60 and over were COVID-19 positive. The positivity rate increased in direct proportion with the increase in age. A statistically sig-

TABLE 1: The distribution of the groups based on demographic data.					
		Control group	COVID-19 contact	COVID-19 positive	Total	p value
Gender		n (%)	n (%)	n (%)	n (%)	
	Female	400 (59.7)	94 (14.0)	176 (26.3)	670 (100)	0.932
	Male	208 (59.4)	52 (14.9)	90 (25.7)	350 (100)	
	Total	608 (59.6)	146 (14.3)	266 (26.1)	1,020 (100)	
Age		n (%)	n (%)	n (%)	n (%)	
	13-17 years	80 (81.6)	11 (11.2)	7 (7.1)	98 (100)	
	18-24 years	149 (55.8)	48 (18.0)	70 (26.2)	267 (100)	
	25-34 years	194 (58.3)	48 (14.4)	91 (27.3)	333 (100)	0.000**
	35-44 years	122 (64.2)	18 (9.5)	50 (26.3)	190 (100)	
	45-59 years	58 (50.0)	19 (16.4)	39 (33.6)	116 (100)	
	60+	5 (31.2)	2 (12.5)	9 (56.2)	16 (100)	
	Total	608 (59.6)	146 (14.3)	266 (26.1)	1,020 (100)	
Education		n (%)	n (%)	n (%)	n (%)	
	Primary school	20 (57.1)	7 (20.0)	8 (22.9)	35 (100)	
	Secondary school	44 (68.8)	9 (14.1)	11 (17.2)	64 (100)	
	High school	177 (64.4)	45 (16.4)	53 (19.3)	275 (100)	0.023*
	University	282 (57.1)	69 (14.0)	143 (28.9)	494 (100)	
	Master	85 (55.9)	16 (10.5)	51 (33.6)	152 (100)	
	Total	608 (59.6)	146 (14.3)	266 (26.1)	1,020 (100)	
Marital status		n (%)	n (%)	n (%)	n (%)	
	Single	333 (63.9)	77 (14.8)	111 (21.3)	521 (100)	
	Married	258 (54.4)	66 (13.9)	150 (31.6)	474 (100)	0.021*
	Divorced	13 (68.4)	2 (10.5)	4 (21.1)	19 (100)	
	Widow and widower	4 (66.7)	1 (16.7)	1 (16.7)	6 (100)	
	Total	608 (59.6)	146 (14.3)	266 (26.1)	1,020 (100)	
Income status		n (%)	n (%)	n (%)	n (%)	
	Less than 1,499 TL	23 (65.7)	4 (11.4)	8 (22.9)	35 (100)	
	1,500 TL-2,499 TL	67 (63.2)	19 (17.9)	20 (18.9)	106 (100)	
	2,500 TL-3,499 TL	84 (60.4)	18 (12.9)	37 (26.6)	139 (100)	
	3,500 TL-4,499 TL	86 (58.1)	28 (18.9)	34 (23.0)	148 (100)	0.309
	4,500 TL-5,999 TL	106 (60.6)	17 (9.7)	52 (29.7)	175 (100)	
	6,000 TL-7,999 TL	103 (57.9)	31 (17.4)	44 (24.7)	178 (100)	
	More than 8,000 TL	139 (58.2)	29 (12.1)	71 (29.7)	239 (100)	
	Total	608 (59.6)	146 (14.3)	266 (26.1)	1,020 (100)	

Chi-squared test **p<0.001; *p<0.05.

nificant difference was found between the groups depending on the level of education (p<0.05). The group with the highest education level was the group with the highest COVID-19 positivity. A statistically significant difference was found between the groups depending on the marital status (p<0.05). Accordingly, COVID-19 positivity was the most in married people. No statistically significant difference was found between the groups depending on the income level (p>0.05).

Table 2 shows the distribution of the OHIP-14 depending on the groups. Higher OHIP-14 scores indicate poorer oral health-related quality of life. A statistically significant difference was found between OHIP-14 and the groups (p<0.001). Accordingly, oral health-related quality of life was poor in 2.1% of the control group, 4.8% of COVID-19 contacts, and 17.3% of COVID-19 positives. In other words, while oral health-related quality of life was

higher in the control group, it was poorer in COVID-19 patients.

Table 3 shows the distribution of Fonseca-TMD survey depending on the groups. In all participants, the mild TMD rate was 40.2%, the moderate TMD rate was 19.5, and the severe TMD rate was 6.7%. It was determined that 64% of the control group, 65.8% of the contact group and 66.4% of the positive group had TMD at any level according to the Fonseca-TMD questionnaire evaluation. A statistically significant difference was found between the groups in terms of TMD severity ($p < 0.05$). When examined separately according to the groups, 41.4% mild TMD, 17.3%

moderate TMD, and 5.3% severe TMD were found in the control group. While mild TMD was 37.7%, medium TMD 19.22%, severe TMD 8.9% in the contact group, mild TMD was 38.7%, medium TMD 24.8%, and severe TMD 8.6% in the positive group. Briefly, while "no TMD" and "mild TMD" were higher in the control group, "severe TMD" was low. "Moderate TMD" and "severe TMD" increased in COVID-19 contacts and COVID-19 positives.

Table 4 shows the distribution of the patient health questionnaire PHQ-9 depending on the groups. In all participants, the rate of mild depression was 29.4%, moderate depression rate 23.0%, moderately

TABLE 2: OHIP-14 scores according to control group, COVID-19 contact and COVID-19 positive.					
	Control group	COVID-19 contact	COVID-19 positive	Total	
OHIP scores	n (%)	n (%)	n (%)	n (%)	p value
0-30 point	437 (71.9)	71 (48.6)	96 (36.1)	604 (59.2)	
31-50 point	158 (26.0)	68 (46.6)	124 (46.6)	350 (34.3)	0.000*
51-70 point	13 (2.1)	7 (4.8)	46 (17.3)	66 (6.5)	
Total	608 (100)	146 (100)	266 (100)	1,020 (100)	

Chi-squared test *p<0.001; OHIP-14: Oral Health Impact Profile Questionnaire.

TABLE 3: Fonseca scores according to control group, COVID-19 contact and COVID-19 positive.					
	Control group	COVID-19 contact	COVID-19 positive	Total	p value
Fonseca scores	n (%)	n (%)	n (%)	n (%)	
Absence of signs and symptoms of TMD	219 (360)	50 (34.2)	74 (27.8)	343 (33.6)	
Mild TMD	252 (41.4)	55 (37.7)	103 (38.7)	410 (40.2)	0.028*
Moderate TMD	105 (17.3)	28 (19.2)	66 (24.8)	199 (19.5)	
Severe TMD	32 (5.3)	13 (8.9)	23 (8.6)	68 (6.7)	
Total	608 (100)	146 (100)	266 (100)	1,020 (100)	

Chi-squared test *p<0.05; OHIP-14: Oral Health Impact Profile Questionnaire. TMD: Temporomandibular dysfunction.

TABLE 4: PHQ-9 scores according to control group, COVID-19 contact and COVID-19 positive.					
	Control group	COVID-19 contact	COVID-19 positive	Total	p value
PHQ-9 scores	n (%)	n (%)	n (%)	n (%)	
Minimal depression	106 (17.4)	21 (14.4)	23 (8.6)	150 (14.7)	
Mild depression	205 (33.7)	30 (20.5)	65 (24.4)	300 (29.4)	
Moderate depression	141 (23.2)	36 (24.7)	58 (21.8)	235 (23.0)	0.00*
Moderately severe depression	77 (12.7)	26 (17.8)	50 (18.8)	153 (15.0)	
Severe depression	79 (13.0)	33 (22.6)	70 (26.3)	182 (17.8)	
Total	608 (100)	146 (100)	266 (100)	1,020 (100)	

Chi-squared test p<0.001; OHIP-14: Oral Health Impact Profile Questionnaire.

severe depression rate 15.0%, and severe depression rate 17.8%. According to the PHQ-9 survey evaluation depending on groups, it was found that there was any level of depression between mild depression and severe depression with a rate of 82.6% in the control group, 85.6% in the contact group, and 91.4% in the positive group. And a statistically significant difference was found between the groups in terms of the severity of PHQ-9 depression (p<0.001). While mild depression was higher in the control group, moderate depression was higher in COVID-19 contacts, and severe depression was higher in COVID-19 positives. Accordingly, the severity of depression increased in COVID-19 positives.

DISCUSSION

COVID-19 can affect all people regardless of differences such as age, gender, educational status ...etc. In one study, men and women had the same prevalence for COVID-19.[10] In present study, the distribution of women and men in the groups was similar.

The most important risk factor for death from COVID-19 is the advanced age group with chronic disease.[11] At the same time, those with chronic diseases are at greater risk of developing the disease.[12] In the present study, the age group with the highest positivity rate was over the age of 60 (56.2%). Chronic diseases that occur with increasing age and a decrease in the immune system may be the reason of this. Prevention is even more important in the elderly, due to the high rate of positivity and serious symptoms.

In the present study, the COVID-19 positive rate of those whose educational status was university and master was higher. Since an increase in the education level of the individual may increase his/her social environment and the number of people he/she may be in contact with, the percentage of being positive may be high.

When the marital status was examined, it was seen that the vast majority of those who did not have COVID-19 were single, while more than half of the COVID-19 positives were married. In married individuals, the different social environment of men and women may be a factor in this situation. Married people communicating with different people in their so-cial lives may increase the contagiousness of the disease.

In addition to having to comply with quarantine rules, COVID-19 can also cause anxiety and depression and have negative effects on mental health and social behavior that can affect daily activity.[13]

In the present study, the quality of life of the patients was decreasing due to increasing positivity and depression. The authors can say that, for COVID-19 positive patients affected by the disease, the psychological state and quality of life are negatively affected, depending on both the symptoms caused by the disease and the rules required by the quarantine. In addition, a study found that the relationship between quality of life and psychological state is obvious.[14] In the present study, the quality of life due to oral health was high in 71.9% of the control group, 48.6% of COVID-19 contacts and only 36.1% of COVID-19 positives.

In one study, it was stated that the quality of life of patients with depressive state and anxiety symptoms was significantly lower than those without (p<0.01).[15] In the present study, a statistically significant difference was found between the groups in terms of oral health related quality of life (p<0.001). As a result of the quarantine of those who participated in the present study, who had contact with COVID-19 and positive for COVID-19, the quality of life may have decreased as the psychology of the person was negatively affected, or the psychology of the person may be negatively affected as the quality of life of the person decreased. Although the oral health-related quality of life was high in the control group, it was low in COVID-19 positives. It cannot be said that the control group is not affected by the pandemic at all, pandemic conditions may affect each participant more or less.

One of the most important causes of TMD is stress and psychosocial disorders and the prevalence of psychological disorders is high, especially in TMD patients with masticatory muscle disorders and there is a strong relationship between TMD pain, depression, and anxiety.[7,16]

One study found that the coronavirus epidemic increased TMD symptoms on the psycho-emotional

state of both the Israeli and Polish populations.[17] In the present study, moderate and severe TMD was the highest in the positive group with 33.4%, while this rate was 28.1% in the contact group. According to the results of the present study, the authors can say that COVID-19 is effective on TMD.

In studies conducted considering the physiological mechanism, it was found that anxiety, depression and stress affect the regulation of the hypothalamic-pituitary-adrenal axis, cause more release of adrenocortical steroids, and cortisol and high sympathetic activity affect the TMD.[18-21] It has also been reported that TMD symptoms worsen during the pandemic. The coronavirus pandemic can cause the symptoms of bruxism and TMD to intensify and thus increase orofacial pain.[17] In the present study, a statistically significant difference was found between the groups in terms of TMD severity.

Psychological factors such as stress, mental strain, anxiety, or depression can cause TMD.[22] In the present study, while 26.2% of all participants had moderate and severe TMD, this rate was 33.4% in positive and 22.6% in contacts. The severity of TMD was also the highest in the positive group most affected by coronavirus and pandemic.

Because of the similarities of severe acute respiratory syndrome-CoV-2 (SARS-CoV-2) with SARS-CoV-1, patients with severe COVID-19 may have symptoms in the musculoskeletal system.[23] It has been reported that proinflammatory molecules and inflammation caused by COVID-19 can cause damage to the musculoskeletal system and play a role in bone and joint tissue physiology.[24] Based on the results of the present study, the authors can say that one of the reasons for the highest rate of TMD in COVID positives is the changes in the physiological mechanism of COVID-19 that can affect the TMJ and muscles. In the present study which was conducted in a pandemic environment, while "no TMD" and "mild TMD" were higher in the control group, "severe TMD" was low. Rates of "moderate TMD" and "severe TMD" were higher in COVID-19 contacts and COVID-19 positives. If the authors look at the rates in 3 groups, the authors can say that COVID-19 has an effect on TMD.

Quarantines applied in epidemic diseases can adversely affect the psychology of people.[25] More stress, anxiety and depression can be seen in the COVID-19 outbreak.[7] Data from the current study confirm that stress, anxiety and depression are on the rise during the pandemic. By following the rules required by the pandemic, people have moved away from their social environment, abandoned their routine life rituals and had to get used to a new order.

This situation can cause mental changes in people. Additionally, emotional stress has been shown to cause circulatory changes in the masticatory muscles that can cause TMD symptoms.[26] In the present study during the pandemic process, it is obvious that the participants were emotionally affected by the pandemic. Currently, there are studies that widely accept the association between depression and the different physical symptoms of stress and TMD.[27] In the present study, the pandemic caused highly varying levels of depression in all three groups. Due to the uncertainty of COVID-19, a new disease, and the unpredictability of its consequences, different levels of depression symptoms may have occurred in all individuals.

Public health emergencies have historically been proven to affect mental health.[28] There are even reported suicides after quarantine.[29]

A recent study conducted in China found that 35% of the participants were psychologically affected by the pandemic and more than half of the Chinese population rated the psychological impact as moderate to severe.[30,31] In a study conducted in India, it was reported that almost one third of the participants showed significant psychological effects.[32] In the present study, 32.8% of the participants also had a significant level of depression. In this respect, the results of the present study are similar. The psychological state that the pandemic can negatively affect can increase the symptoms of TMD.

In a study conducted in Italy and Iran, it was found that the fear of COVID-19 was significantly associated with depression and anxiety, and it was reported that fear can exacerbate psychological problems.[33,34] The COVID-19 pandemic can lead to TMD with the psychological and physical consequences of anxiety, depression and stress. COVID-19 may be as-

sociated with TMD, as one of the main causes of TMD is stress and psychosocial disorder.[7] In the present study, mild depression was higher in the control group, moderate depression in the contact group, and severe depression in the positive group.

The COVID-19 outbreak affected the mental health of not only those infected with the coronavirus, but also those who comply with pandemic restrictions or were quarantined.[25] According to the PHQ-9 survey, in the present study, not only the COVID-19 positive group, but the COVID-19 contact group and the control group also showed significant depression symptoms. The authors can say that the pandemic can negatively affect psychology of people with COVID-19 positive, COVID-19 contacts and healthy people respectively.

CONCLUSION

As a result, it has been determined that the coronavirus and pandemic increase depression and TMD, and reduce the oral health related quality of life. Considering that coronavirus and pandemic increase depression and TMD and cause a decrease in oral health related to quality of life, dentists should try to reduce the negative impact of the pandemic by raising awareness of the psychologically affected public about TMD and improving oral health.

Conflict of Interest

No conflicts of interest between the authors and / or family members of the scientific and medical committee members or members of the potential conflicts of interest, counseling, expertise, working conditions, share holding and similar situations in any firm.

Authorship Contributions

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