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CLINICAL RESEARCH

Effect of the COVID-19 pandemic on anxiety in patients with masticatory muscle pain

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ABSTRACT

Statement of problem. Although psychological disorders have been established as one of the etiological factors for temporomandibular disorders, anxiety levels in individuals with masticatory muscle pain before and during the coronavirus 2019 (COVID-19) pandemic have not previously been compared.

Purpose. The purpose of this clinical study was to evaluate anxiety levels in patients with masticatory muscle pain at times before and during the COVID-19 pandemic.

Material and methods. Eighty patients (18 to 68 years) with masticatory muscle pain were included in the study. All participants had completed the Generalized Anxiety Disorder 7 questionnaire (GAD-7) before the first COVID-19 infection had been reported in Turkey. After the onset of the COVID-19 pandemic, all participants were contacted by telephone to repeat the GAD-7 to evaluate changes in their psychology during the first lockdown. However, 18 of the 80 patients were unreachable. A statistical analysis was performed by using the Mann-Whitney U test. Proportion comparisons between sociodemographic characteristics and GAD-7 levels were performed by using the Fisher exact test (α=.05).

Results. Forty-eight (60%) of the study population were women, and 32 (40%) were men, with a mean age ±standard deviation of 36.63 ±13.85 years. Both before and during the pandemic, GAD-7 scores were statistically similar as was each demographic parameter, including sex, educational status, and occupational status (P>.05). Also, no significant correlation was recorded between age and GAD-7 global scores obtained before and during the pandemic (r=-0.098 and r=-0.052, respectively, P>.05). However, during-pandemic GAD-7 scores were statistically higher than before-pandemic GAD-7 scores (P<.001).

Conclusions. Demographic parameters had no connection with anxiety levels in patients with masticatory muscle pain before and during the COVID-19 pandemic. However, the COVID-19 pandemic anxiety levels in the participants were higher than the levels before the pandemic. (J Prosthet Dent 2021;■:■-■)

In late December 2019, coronavirus 2019 disease (COVID-19), caused by the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) infection, began to spread around the world.[1] The World Health Organization (WHO) declared the COVID-19 outbreak a pandemic and public health emergency of international concern in March 2020.[2] In Turkey, the first individual with COVID-19 was diagnosed and reported on March 11, 2020. In the same month, a complete lockdown, which lasted until June 2020, was implemented throughout the country. As a result of these extensive quarantine conditions, disrupting people's daily lives, travel, and work, individuals had to cope with financial problems. All these conditions, which negatively affected human lives, may have had psychological impacts.[3,4]

Psychosocial factors have been reported in the etiology of temporomandibular disorders (TMDs), and psychological stress has been suggested to be a predisposing factor for TMDs.[5-8] TMD is a clinical term that covers problems involving the masticatory muscles, the temporomandibular joints (TMJs), or both.[9] Common symptoms of TMDs include facial pain, headache, pain and sensitivity in the masticatory muscles, reduced

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Clinical Implications

Patients with temporomandibular disorders have been reported to have higher levels of anxiety and depression than the general population. However, how patients with masticatory muscle pain were affected by the COVID-19 pandemic is unclear. When compared with before the pandemic, anxiety in individuals with masticatory muscle pain increased significantly during the pandemic. Hence, additional psychological evaluation alongside conventional physical treatment is indicated for these patients.

mobility of the mandible, and pain and sounds in the TMJs.[10-12] Orofacial pain is one of the most frequent reasons for a patient to consult a dentist[13-15] and has been defined as an unpleasant experience associated with a variety of aggravating factors such as depression and anxiety.[16,17]

Masticatory muscle pain has been defined as "local myalgia," "myofascial pain," and "myofascial pain with referral" in the diagnostic criteria for temporomandibular disorders (DC/TMD)[18] and has become a substantial social problem that affects about 12% to 14% of the adult population and is 1.5 to 2 times more frequent in women than in men. This term is defined as pain that originates in the masticatory muscles.[19] The importance of psychosocial factors in the development and maintenance of masticatory muscle pain and the high prevalence of psychological disturbances in patients diagnosed with the condition have been well established.[20-22] In additional a significant relationship among masticatory muscle pain, depression, and anxiety has been reported.[22-24] The association between orofacial pain and high stress levels might also be explained by their potential connection to parafunctions of the masticatory system, such as bruxism.[25]

The COVID-19 pandemic and related restrictions continued for months, and this situation led to serious health threats, economic uncertainty, and social isolation, with potential detrimental effects on human psychology.[26,27] The common psychological responses by individuals to this pandemic included stress, anxiety, and depression.[1,28] All these can influence TMDs and bruxism, which could further aggravate orofacial pain.[2,29]

Psychosocial questionnaires assessing anxiety in patients with TMD have been well documented.[18] These instruments include the Graded Chronic Pain Scale (GCPS), Patient Health Questionnaire-4 (PHQ-4), Patient Health Questionnaire-9 (PHQ-9), Patient Health Questionnaire-15 (PHQ-15), and Generalized Anxiety Disorder-7 (GAD-7).[18,30] The GAD-7 is a 7-item scale based on Diagnostic and Statistical Manual of Mental Disorders (DSM-V) criteria; it was developed to identify individuals with probable generalized anxiety disorder and has shown strong properties for screening psychological disorders.[31,32]

Anxiety levels in patients with masticatory muscle pain have been evaluated.[20-22] However, the authors are unaware of a previous study that evaluated the connection of the COVID-19 pandemic to anxiety levels in patients dealing with masticatory muscle pain. Thus, the aim of the present study was to evaluate the anxiety levels, by using the GAD-7, in patients with masticatory muscle pain before and during the COVID-19 pandemic in Turkey. The null hypothesis was that no adverse link would be detected between the coronavirus pandemic and anxiety in patients with masticatory muscle pain.

MATERIAL AND METHODS

The first part of this prospective study, which evaluated the anxiety levels in patients diagnosed with MMP, was performed between May 2019 and December 2019 by 3 blinded clinicians (O.A., C.K.S., B.Y.) in the Department of Dentomaxillofacial Radiology and Department of Prosthodontics at the Baskent University Faculty of Dentistry, Ankara, Turkey. The second part, assessing the effect of the COVID-19 pandemic on the same patient group, was undertaken between May and June of 2020 by the same clinicians. The number of participants was determined by power analysis statistics.[21] The study had been approved by the Baskent University Institutional Review Board and Ethics Committee (project no.: D-KA17/15). Eighty patients diagnosed with TMDs (age range: 18 to 68 years), all with masticatory muscle pain, were diagnosed according to the Turkish version of the DC/TMD Axis I form[30] and were included in the study. All participants read and signed a written consent form and were informed and assured that their answers in the questionnaire would not affect their treatment protocol. Exclusion criteria were the presence of acute or a history of a COVID-19 infection, psychiatric diseases, acute systemic disorders that might affect TMJs or associated structures, a history of orthodontic treatment, absence of more than 3 teeth for each jaw, pregnancy, and breastfeeding.

All participants had completed the Turkish version of the GAD-7[30] before the first reported individual with COVID-19 in Turkey. Demographic information, including age, sex, and educational and occupational status, was also collected; the participants were categorized according to these groups, and the GAD-7 scores were compared within each category.

After the onset of the COVID-19 pandemic in Turkey on March 11, 2020, the government initiated a complete lockdown. Controlled normalization started at the beginning of June 2020. All participants were contacted

Table 1. Comparison of GAD-7 global scores before COVID-19 pandemic within sex and educational and occupational status

	Group	N	GAD-7 Global (Mean ±SD)	Median (Min-Max)	P
Sex	Women	48 (60%)	8.04 ±4.60	9 (0-20)	.505
	Men	32 (40%)	8.41 ±3.55	10 (3-14)	
Educational status	Secondary and high school	22 (27.5%)	8.32 ±4.06	9.5(1-17)	.944
	University and postgraduate	58 (72.5%)	8.14 ±4.27	9 (0-20)	
Occupational status	Working	52 (65%)	7.96 ±4.27	9 (0-20)	.497
	Nonworking	28 (35%)	8.61 ±4.07	9 (2-17)	
–	Total	80 (100%)	–	–	–

Table 2. Comparison of GAD-7 global scores during COVID-19 pandemic within sex and educational and occupational status

	Group	N	GAD-7 Global (Mean ±SD)	Median (Min-Max)	P
Sex	Women	37 (59.7%)	11.56 ±3.22	11 (3-19)	.889
	Men	25 (40.3%)	11.12 ±2.06	12 (6-16)	
Educational status	Secondary and high school	17 (27.4%)	11.41 ±3.22	12 (3-15)	.091
	University and postgraduate	45 (72.6%)	11.37 ±2.67	11 (6-19)	
Occupational status	Working	42 (67.7%)	11.23 ±2.92	11 (3-19)	.650
	Nonworking	20 (32.3%)	11.70 ±2.57	11.5 (6-17)	
–	Total	62 (100%)	–	–	–

Table 3. Comparison of before- and during-pandemic mean ±standard deviation GAD-7 scores

GAD-7				
Before	**After**	**Mean Differences**	***P***	**Power**
8.23 ±4.1	11.39 ±2.81	3.16 ±3.37	**<.001**	99.9%

Statistically significant ($P<.001$) with paired t test is indicated in bold.

Table 4. Comparison of proportions of GAD-7 severity levels before and during the COVID-19 pandemic

	GAD-7 Post					
	Minimal	**Mild**	**Moderate**	**Severe**	**Total**	***P***
GAD-7 pre						
Minimal	1	6	11	0	18 (18%)	**<.001**
Mild	1	1	15	0	17 (27.4%)	
Moderate	0	1	19	4	24 (38.7%)	
Severe	0	0	0	3	3 (4.8%)	
Total	2 (3.2%)	8 (12.9%)	45 (72.6%)	7 (11.3%)	62 (100%)	–

Statistically significant ($P<.001$) with McNemar-Bowker test is indicated in bold.

by telephone to repeat GAD-7 to evaluate change in their psychologic status during the lockdown period. However, 18 of the 80 patients were unreachable, so the final study population consisted of 62 participants.

The GAD-7 was used to assess the anxiety levels in patients diagnosed with masticatory muscle pain. Global scores, ranging from 0 to 21, were calculated by the sum of all the responses for each item. According to the global GAD-7 scores, the severity of a psychological disorder is graded as minimal (0–4), mild (5–9), moderate (10–14), or severe (15–21).[31]

The sample size had been calculated for the paired t test, which was used to test the main hypothesis of the study. As a result of the sample size analysis performed by using a Cohen effect size value of 0.42, a minimum of 62 participants were required to reveal significant differences between the GAD-7 scores obtained before and during the pandemic with minimum 90% power and α=.05. However, it was decided to include 80 participants (an additional 25% to 30%) based on the consideration that participants could leave the study during the research process. As data from 18 participants could not be obtained during the pandemic, the data of 62 participants were evaluated.

A post hoc power analysis was conducted to determine the power of the study with a Type I error value of 0.05 for the main hypotheses that were found to be statistically significant. A software package (G*power v3.1.9.7; Heinrich-Heine-Universität) was used for sample size estimation and the post hoc power analysis.

A statistical analysis was performed by using a statistical software program (IBM SPSS Statistics, v22.0; IBM Corp). Descriptive statistics of categorical variables were presented with numbers and percentages. Normality distribution of the data was examined by using the Shapiro-Wilk and Kolmogorov-Smirnov tests. Descriptive statistics of continuous variables were presented with mean ±standard deviation (min-max) or median (min-max) based on the data normality distribution. As GAD-7 scale scores were not normally distributed among groups, they were compared with the Mann-Whitney U test. The relationships between age and scale scores were investigated by using the Spearman correlation coefficient. A paired t test was used in accordance with the data normality distribution to compare the GAD-7 scores before and during the COVID-19 pandemic, measuring the anxiety levels in patients with masticatory muscle pain. A comparison of the GAD-7 total score according to the sociodemographic characteristics of the participants was performed with the Mann-Whitney U test because the data were not normally distributed. The McNemar-Bowker test was used to compare before- and during-pandemic-correlated proportions for more than 2 categories of the GAD-7 severity levels. Proportion comparisons between sociodemographic characteristics and GAD-7 levels were performed by the Fisher exact test, as more than 25% of the cells in the cross-tabulation had an expected value <5 (α=.05).

RESULTS

Of the 80 patients diagnosed with masticatory muscle pain before the COVID-19 pandemic in Turkey, 48 (60%)

Table 5. Relationship between GAD-7 score levels of participants during COVID-19 pandemic according to sex, educational status, and occupational status

Demographic Parameter	Group		GAD-7 Total Scores				Total	*P*
			Minimal	Mild	Moderate	Severe		
Sex	Women	n	2	4	25	6	37	.339
		%	5.4%	10.8%	67.6%	16.2%	100%	
	Men	n	0	4	20	1	25	
		%	0.0%	16.0%	80.0%	4.0%	100%	
Educational status	Secondary and high school	n	2	0	13	2	17	**.036**
		%	11.8%	0.0%	76.5%	11.8%	100%	
	University and postgraduate	n	0	8	32	5	45	
		%	0.0%	17.8%	71.1%	11.1%	100%	
Occupational status	Working	n	2	5	31	4	42	.791
		%	4.8%	11.9%	73.8%	9.5%	100%	
	Not working	n	0	3	14	3	20	
		%	0.0%	15.0%	70.0%	15.0%	100%	
Total		n	2	8	45	7	62	
		%	3.2%	12.9%	72.6%	11.3%	100%	

Statistically significant ($P<.05$) with Fisher's exact test is indicated in bold.

were women, 32 (40%) were men, and the mean age was 36.63 ±13.85 years. Comparisons of the GAD-7 global scores according to sex, educational status, and occupational status are presented in Table 1. The scores were statistically similar between the GAD-7 and each demographic parameter, including sex, educational status, and occupational status ($P>.05$). Also, the correlation analysis between age and GAD-7 global scores did not reveal a significant correlation between age and before-pandemic GAD-7 global scores (r=-0.098, $P>.05$).

After the first COVID-19 lockdown, 62 of the total study population participated in the second part of the study. The mean ±standard deviation age was 37.92 ±14.2 years. The distribution of demographic parameters, including sex, educational status, and occupational status, is shown in Table 2. When the during-pandemic GAD-7 global scores were compared within each of these demographic parameters, the results were similar ($P>.05$). The correlation analysis showed no significant correlation between age and during-pandemic GAD-7 global scores (r=-0.052, $P>.05$).

The comparison of the before- and during-pandemic GAD-7 global scores is shown in Table 3. The during-pandemic GAD-7 scores were statistically higher than the before-pandemic GAD-7 scores ($P<.001$).

Comparisons of the ratios of before- and during-pandemic GAD-7 severity levels (minimal, mild, moderate, and severe) are given in Table 4. During-pandemic GAD-7 severity levels were statistically higher than before-pandemic GAD-7 levels ($P<.001$). In 6 participants with minimal before-pandemic GAD-7 scores, the during-pandemic GAD-7 scores increased to mild, and the scores of 11 participants increased from minimal to moderate. The before-pandemic GAD-7 scores of 15 participants were mild, but their during-pandemic scores increased to moderate. Finally, the GAD-7 scores of 4 participants increased from moderate before the pandemic to severe during the pandemic.

During-pandemic GAD-7 severity levels were compared according to the sex, educational status, and occupational status, and the results were similar for the before- and during-pandemic periods in terms of sex and occupational status ($P>.05$; Table 5). The GAD-7 severity levels were statistically different in terms of education ($P<.05$; Table 5). Within the educational status, moderate and severe levels were similar ($P=1.00$); however, minimal and mild levels were statistically different between the subgroups (secondary and high school versus university and postgraduate) ($P=.022$).

DISCUSSION

A few studies have related to TMDs and anxiety in individuals during the COVID-19 pandemic,[3,4,29] but the authors are unaware of a previous study comparing the anxiety levels in patients diagnosed with masticatory muscle pain before and during the COVID-19 pandemic. The null hypothesis was rejected as COVID-19 had a strong association with anxiety in patients who were already suffering from masticatory muscle pain.

The study was completed in the period when the COVID-19 pandemic was intensely felt in Turkey: Curfews were in effect, and only elective dental treatments were performed. For this reason, the GAD-7s were completed by telephone instead of recalling the patients to the clinic.

A relationship between psychological disorders and TMDs has been documented.[5-7,21,22,32] The first part of

the present clinical study included only patients with masticatory muscle pain and investigated the connection between demographic parameters and the participants' psychological situation.

Before the onset of the COVID-19 pandemic, the anxiety levels in the individuals with masticatory muscle pain were found to be similar within each demographic parameter, including age, sex, and occupational and educational status. Concerning age and sex, the results were consistent with those from previous research performed on patients diagnosed with general TMDs.[8,9,11] In contrast, Miettinen et al[17] concluded that women exhibited worse psychological conditions than men among patients diagnosed with TMDs. Regarding occupational and educational status, the authors are unaware of a study that assessed anxiety in patients diagnosed with TMDs within the demographic parameters in the present study. Demographic parameters appear to have no link to anxiety in individuals with masticatory muscle pain.

The most striking result of the present study was that during-pandemic anxiety levels in patients with masticatory muscle pain were much higher than the levels before the pandemic. Also, the severity of psychological disturbance increased in more than half the study population, while the condition of the remainder of the participants remained the same. None of the participants reported being in a better psychological condition during the pandemic. According to the evaluation of anxiety by the GAD-7 scale, disorders occurred or worsened in 17 participants who previously had no or minimal anxiety. The severity of the disorders was aggravated in 19 participants who had previously experienced mild or moderate anxiety. Considering these findings, the COVID-19 outbreak probably led to occurrences of anxiety and to the exacerbation of existing psychological disease for patients with masticatory muscle pain. Emodi-Perlman et al[29] also studied psychological conditions of patients diagnosed with TMDs during the COVID-19 outbreak. They reported that the pandemic had adverse effects on their psycho-emotional status and might intensify an existing disorder for patients with TMDs. However, comparative data of patients with TMDs and mental health before the pandemic were not presented, unlike in the present study.

Although the mental health of the patients diagnosed with masticatory muscle pain included in this study was negatively affected during this pandemic lockdown, comparisons within the demographic parameters, including age, sex, educational status, and occupational status, showed that the anxiety levels of patients with masticatory muscle pain were similar to those of the during-pandemic period. When the correlation between age and mental health was examined, a consensus could not be reached in previous studies. Chew et al[26] concluded that anxiety increased in the elderly, while Huang and Zhao[27] reported that younger individuals were more prone to depression. In a study describing the psychological responses during the initial stage of COVID-19, it was reported[1] that the psychological state was similar within age groups, which is consistent with the present study results.

Women have been reported to undergo greater psychological disturbances than men,[1,4] in contrast to the results of the present study. The variations in the results may be related to the differences in the number of participants among studies.

Zhou et al[33] studied the mental health and educational status during the COVID-19 pandemic in the general population and reported that the higher the level of educational status is, the more prevalent and severe the anxiety symptoms were. Although the global scores of the GAD-7 for education levels were similar, when the severity of anxiety during the COVID-19 period was compared, minimal anxiety was found to be less prevalent and mild anxiety was more prevalent in university or postgraduate individuals than those in less-educated individuals consistent with the results of Zhou et al.[33] However, this difference was only between the 2 lowest anxiety levels. The highest rate, observed in the moderate anxiety for both subgroups, indicates a similar level of anxiety in that population, which was not greatly affected as a result of their intellectual situation. It may be necessary to work with a larger study population to consider this difference.

Considering the relationship between occupational status and anxiety, the studies investigating the general population found that nonworking individuals and students had higher anxiety levels. Within occupational status, students showed higher levels of anxiety than both employed and unemployed individuals.[1,28] However, in the present study, the anxiety levels and severity of psychological disorders were similar between working and nonworking individuals. All these differences in results, when compared with other studies, may be because of the anxiety assessment being limited to a specific group in the present study, which only included patients who suffer from masticatory muscle pain and, hence, could not be generalized.

Limitations of the present study included that the change in the anxiety levels of patients diagnosed with masticatory muscle pain was evaluated before and during COVID-19, but the connection of this change to the severity of TMDs was not examined because the participants were not recalled to the clinics. In addition, the study was conducted on a limited number of participants within a certain population group. Further studies are needed, with a larger study population, to assess the pandemic's possible mental consequences and the change in severity of TMDs.

CONCLUSIONS

Based on the findings of this prospective clinical study, the following conclusions were drawn:

1. Demographic parameters are not associated with anxiety levels in patients with masticatory muscle pain both before and during the COVID-19 pandemic.
2. However, the COVID-19 pandemic increased anxiety in the population with masticatory muscle pain compared with the situation before the pandemic.
3. These consequences may lead to a greater risk of developing and worsening TMDs.

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