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Original Article

Evaluation of Orthodontic Patients' Anxiety Levels During the COVID-19 Pandemic: A 1-Year Follow-Up

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Main Points

- The state anxiety levels of orthodontic patients decreased during the follow-up, while there was no significant change in their trait anxiety levels.
- The decrease in state anxiety scores was more pronounced in women and in individuals aged under 18 years.
- In the follow-up, gender-based difference in anxiety scores disappeared.

ABSTRACT

Objective: The aim of this study was to evaluate the anxiety levels of orthodontic patients during the 1-year period in the ongoing pandemic.

Methods: The study included patients between the ages of 12 and 30 years and who were continuing their fixed orthodontic treatment at Adıyaman University, Faculty of Dentistry, Department of Orthodontics and filled out the State-Trait Anxiety Inventory. A total of 266 patients filled out the questionnaire at their first clinical visit between June 8 and July 8, 2020 (T0) and 176 of 190 patients (response rate: 92.63%) that were still under treatment filled out the questionnaire for a second time between June 15 and July 16, 2021 (T1).

Results: In the total population, there was a significant decrease in the State-Trait Anxiety Inventory-S score ($P < .05$), while there was no significant change in the State-Trait Anxiety Inventory-T score ($P > .05$). Anxiety scores were significantly higher in women and individuals aged over 18 years at T0 ($P < .05$), whereas only the anxiety scores of individuals aged over 18 years were significantly higher in T1 than in individuals aged below 18 years ($P < .05$). The State-Trait Anxiety Inventory-S score showed a significant decrease at T1 compared to T0 for female patients (36.02 ± 11.32 vs. 38.82 ± 9.84) and patients aged under 18 years (34.26 ± 9.54 vs. 36.85 ± 9.26) ($P < .05$).

Conclusion: The state anxiety levels of orthodontic patients decreased during the 1-year period of the pandemic, while there was no significant change in their trait anxiety levels.

Keywords: Anxiety, COVID-19, orthodontics

INTRODUCTION

Coronavirus disease 2019 (COVID-19) has dramatically affected almost all medical fields including dentistry.[1] Of note, many countries suspended nonurgent dental procedures during this period.[2] Moreover, orthodontic patients were probably the most affected dental patient group during the COVID-19 quarantine since they need routine checkup. Yavan[3] reported that in the first year of the pandemic, new patient applications for orthodontic treatment also decreased by 48.3% compared to the previous year.

Numerous studies have reported significant increases in anxiety and depression levels in individuals as a result of increased health concerns and unemployment as well as decreased social contact caused by isolation and lockdown in the early stages of COVID-19.[4-7] Studies conducted on orthodontic patients in the first wave of the

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pandemic reported that the patients were highly worried about attending their appointments,[8] they were concerned about the delay and prolongation of their treatment,[9,10] and they were even worried that there could be an increase in the incidence of failure of orthodontic appliances and deterioration in their periodontal health.[11] Xiong et al.[12] reported that more than one-third of orthodontic patients experienced mental distress in the early phase of the pandemic and that the severity of this distress was affected by factors such as the type of appliance, time since the last dental visit, and the method of communication with the orthodontist.

Data from previous pandemics show that the effects of pandemics on mental health are not only acute, but that psychological distress may persist after the pandemic is over.[13] Additionally, it has also been suggested that the psychological impact of COVID-19 quarantine may be wide ranging, effective, and long lasting. A longitudinal study by Veldhuis et al.[14] evaluated the effects of COVID-19 pandemic on mental health in 2020 and reported that although the prevalence of depressive symptoms and suicidal thoughts and behaviors increased over the time between April 28 and September, the prevalence of acute stress symptoms decreased. In another longitudinal study, Pieh et al.[15] evaluated individuals' mental health during the COVID-19 lockdown and the subsequent 6 months after the lockdown and reported that there was a significant decrease in stress levels and a significant increase in well-being levels, while the proportion of participants with mental health problems did not decrease.

The aim of this study was to compare the clinical anxiety levels of individuals with ongoing fixed orthodontic treatment during the 1-year follow-up period from June 2020 to June 2021. Our null hypothesis was that there would not be a significant difference in anxiety levels in patients.

METHODS

Ethical Approval

An ethical approval was obtained both from Republic of Turkey Ministry of Health (No: 2021-05-06T15_11_38) and Adıyaman University Non-Interventional Clinical Research Ethics Committee (No: 2021/06-13). An informed consent was obtained from each participant and/or parent/guardian. Questionnaires were kept anonymous and the study protocol was conducted in accordance with the Declaration of Helsinki.

Study Design

The study included patients who applied to Adıyaman University Dentistry School Orthodontics Clinic for fixed orthodontic treatment. The patients were asked to fill out the State-Trait Anxiety Inventory (STAI) at 2 time points: (i) between June 8 and July 8, 2020, when the first national lockdown ended in Turkey (T0) and (ii) between June 15 and July 16, 2021 (T1). During the study, individuals were able to enter the clinic by automatically verifying the security code given to them by a tracing mobile application, which is part of official precautionary measures.[16] Both questionnaires were filled out immediately after the treatment and by using disposable pens.

Study Sample

The study reviewed the medical records of 266 patients (out of 281, response rate: 94.66%) who had resumed their fixed orthodontic treatment at Adıyaman University and filled out the STAI questionnaire at their first clinical visit between June 8 and July 8, 2020, when the national lockdown was lifted in Turkey.[9] One year later (between June 15 and July 16, 2021), 190 patients that were still under treatment. Of these 190 patients, 176 (response rate: 92.63%) of them consented to participate in the study and filled out the questionnaire for a second time. Patients between the ages of 12 and 30 years at T0 and who were continuing their fixed orthodontic treatment during this 1-year period were included in the study. The exclusion criteria were as follows: patients that refused to fill out the questionnaire, whose treatment was completed during this 1-year period, patients using psychiatric drugs, and those that missed more than two appointments.

State-Trait Anxiety Inventory

State-Trait Anxiety Inventory is an anxiety measure developed by Spilberger et al.[17] This inventory has 2 subscales with 20 items each: (i) the State Anxiety Inventory (STAI-S) and (ii) the Trait Anxiety Inventory (STAI-T). State Anxiety Inventory determines how a person feels at a particular time and under a particular condition and STAI-T determines how a person feels regardless of the time and situation. Each item has a 4-point Likert-type response format ranging from (1) "Not at all" to (4) "Very much so" depending on the severity of the situation. The STAI-S score ranges between 20 and 80 and is calculated by subtracting the sum of opposite statements from that of direct statements and adding a predetermined number to the resulting score. By contrast, the STAI-T score ranges between 20 and 80 and is calculated by subtracting the sum of direct statements from that of opposite statements and adding a predetermined number to the resulting score. The Turkish adaptation study was conducted by Öner and Le Compte,[18] and the internal consistency coefficient (Cronbach's alpha) of STAI-S and STAI-T were 0.83 and 0.87, test-retest reliability values were 0.71 and 0.86, and item reliability values were 0.34 and 0.72, respectively.

Statistical Analysis

Sample size was calculated using G*POWER. Using an effect size of 0.19,[15] a critical t value of 1.65, an alpha level of 0.05, and 80% power, the minimum required sample size for each group was 172. Statistical analyses were performed using Statistical Package for Social Sciences for Windows version 22 (IBM SPSS Corp., Armonk, NY, USA). Normality of distribution was determined using Shapiro-Wilk test. Binary comparisons were conducted using Independent-samples t-test and more than 2 variables were compared using 1-way analysis of variance test. Comparison of categorical variables between the 2 time periods was performed using Chi-square test. A P value of $<.05$ was considered significant.

RESULTS

Table 1 presents demographic characteristics of patients at both time points. Of the 266 patients that filled out the questionnaire

Table 1. Demographic characteristics

		T0	T1	
		n (%)	n (%)	P^{μ}
Gender	Female	195 (73.3)	126 (71.60)	.692
	Male	71 (26.7)	50 (28.40)	
Age (years)	12-18	160 (60.15)	109 (61.93)	.707
	18-30	106 (39.85)	67 (38.07)	
Educational status	Secondary school	46 (17.29)	26 (14.66)	.781
	High school	188 (70.68)	128 (72.72)	
	University	32 (12.03)	22 (12.5)	

T0, 2020; T1, 2021.
$^{\mu}$Chi-square test.

at T0, a total of 90 patients were excluded from the study, of whom 70 patients completed their treatment before T1, 6 patients missed more than 2 appointments, and 14 patients refused to fill out the questionnaire. Accordingly, the remaining 176 patients were included in the study. No significant difference was found between the two time points with regard to the demographic characteristics of the participants ($P > .05$).

Table 2 presents the comparison of STAI-S and STAI-T scores according to gender, age, and education. At T0, female subjects' STAI-S (38.82 ± 9.84) and STAI-T (43.16 ± 9.10) scores were significantly higher than those of male subjects (35.11 ± 9.93 and 39.15 ± 8.58, respectively) ($P < .05$), whereas no significant difference was found between male and female subjects' scores at T1 ($P > .05$). At both time points, the STAI-S (T0: 39.32 ± 10.88, T1: 38.10 ± 12.58) and STAI-T (T0: 43.80 ± 8.32, T1: 42.90 ± 10.17) scores of patients aged over 18 years were significantly higher than those of patients aged under 18 years (STAI-S; T0: 36.85 ± 9.26, T1: 34.26 ± 9.54 and STAI-T; T0: 40.97 ± 9.48, T1: 39.62 ± 9.27) ($P < .05$). Nevertheless, no significant difference was found between the educational levels of the patients and their anxiety scores at both time points ($P > .05$).

Table 3 shows the comparison of patients' STAI scores according to their demographic characteristics at both time points. The STAI-S score showed a significant decrease at T1 compared to T0 for total population (35.72 ± 10.92 vs. 37.83 ± 9.98), female patients (36.02 ± 11.32 vs. 38.82 ± 9.84), and patients aged under 18 years (34.26 ± 9.54 vs. 36.85 ± 9.26) ($P < .05$), whereas no significant difference was found for other subcategories ($P > .05$). By

Table 2. Comparison of anxiety scores according to demographic characteristics

	STAI-S				STAI-T			
	T0		T1		T0		T1	
Variables	Mean ± SD	*P*	Mean ± SD	*P*	Mean ± SD	*P*	Mean ± SD	*P*
Female	38.82 ± 9.84	.007$^{\alpha*}$	36.02 ± 11.32	.562$^{\alpha}$	43.16 ± 9.10	.001$^{\alpha*}$	41.26 ± 9.93	.387$^{\alpha}$
Male	35.11 ± 9.93		34.96 ± 9.89		39.15 ± 8.58		39.86 ± 9.19	
Age, 12-18	36.85 ± 9.26	.048$^{\alpha*}$	34.26 ± 9.54	.023$^{\alpha*}$	40.97 ± 9.48	.013$^{\alpha*}$	39.62 ± 9.27	.030$^{\alpha,*}$
Age, 18-30	39.32 ± 10.88		38.10 ± 12.58		43.80 ± 8.32		42.90 ± 10.17	
Secondary school	35.13 ± 9.01	.102$^{\beta}$	31.69 ± 6.23	.071$^{\beta}$	40.34± 9.04	.176$^{\beta}$	39.00 ± 8.77	.571$^{\beta}$
High school	38.20 ± 10.13		36.81 ± 11.45		42.15 ± 9.29		41.17 ± 9.59	
University	39.53 ± 10.05		34.13 ± 11.15		44.25 ± 7.92		41.27 ± 11.61	

STAI-S, State-Trait Anxiety Inventory-State anxiety; STAI-T, State-Trait Anxiety Inventory-Trait anxiety; T0, 2020; T1, 2021; SD, standard deviation.
$^{\alpha}$Independent-samples t-test, $^{\beta}$ANOVA test, $*P < .05$.

Table 3. Changes in anxiety scores between two time points

	STAI-S						STAI-T					
	T0	T1		95% CI			T0	T1		95% CI		
	Mean ± SD	Mean ± SD	*d*	L	U	P^{α}	Mean ± SD	Mean ± SD	*d*	L	U	P^{α}
Total	37.83 ± 9.98	35.72 ± 10.92	0.33	0.13	4.09	0.037*	42.09 ± 9.12	40.86 ± 9.72	0.20	-0.56	3.01	.178
Female	38.82 ± 9.84	36.02 ± 11.32	0.48	0.45	5.15	.020*	43.16 ± 9.10	41.26 ± 9.93	0.32	-0.22	4.02	.079
Male	35.11 ± 9.93	34.96 ± 9.89	0.21	-3.47	3.78	.934	39.15 ± 8.58	39.86 ± 9.19	0.12	-3.93	2.52	.667
Age, 12-18	36.85 ± 9.26	34.26 ± 9.54	0.41	0.30	4.88	.026*	40.97 ± 9.48	39.62 ± 9.27	0.19	-0.95	3.64	.250
Age, 18-30	39.32 ± 10.88	38.10 ± 12.58	0.19	-2.34	4.77	.501	43.80 ± 8.32	42.90 ± 10.17	0.21	-1.88	3.70	.523
Secondary school	35.13 ± 9.01	31.69 ± 6.23	0.43	-0.53	7.41	.089	40.34± 9.04	39.00 ± 8.77	0.20	-3.03	5.72	.541
High school	38.20 ± 10.13	36.81 ± 11.45	0.22	-1.01	3.80	.256	42.15 ± 9.29	41.17 ± 9.59	0.15	-1.14	3.10	.364
University	39.53 ± 10.05	34.13 ± 11.15	0.86	-0.44	11.23	.070	44.25 ± 7.92	41.27 ± 11.61	1.49	-2.35	8.30	.267

STAI-S, State-Trait Anxiety Inventory-State anxiety; STAI-T, State-Trait Anxiety Inventory-Trait anxiety; T0, 2020; T1, 2021; SD, standard deviation, *d*, Cohen's effect size; L, lower; U, upper.
$^{\alpha}$Independent samples t-test. $*P < .05$.

contrast, no significant difference was found between the STAI-T scores at T0 and T1 ($P > .05$).

DISCUSSION

The present study evaluated the immediate clinical and long-term anxiety effects of COVID-19 on orthodontic patients over the 1-year follow-up period and the results indicated that although a significant reduction was observed in state anxiety, no significant change was found in trait anxiety. Accordingly, our null hypothesis was partially accepted.

Examining the pandemic conditions in the 2 time periods in 2020 and 2021, when the study was conducted, is of great importance for interpreting the long-term changes in patients. In early June 2020, when the first questionnaire was filled out by the patients, the nationwide measures, which had lasted for about 3 months and included lockdown, were relieved and gradual normalization measures were announced and then routine dental practices were resumed. On June 8, 2021, when the second questionnaire was filled out by patients, the decreasing trend in the number of confirmed COVID-19 cases and COVID-19-related deaths continued.[19,20] In one of our previous studies,[9] we shared the results of the questionnaire in detail for individuals aged 14 and over in a period when the pandemic remained uncertain in many respects. Subsequently, in 2021, a rapid vaccination program was initiated in many countries, leading to a glimmer of hope.[21]

The risk of COVID-19 transmission is relatively higher in closed areas such as in dental clinics and in situations where masks cannot be used such as dental procedures.[16,22] In the present study, we used STAI to investigate the feelings of orthodontic patients during the clinical visit, which is frequently visited, and to evaluate the long-term change in their feelings during the current unpredictable pandemic period.

In our study, STAI scores decreased significantly at T1 compared to T0. This finding could be explained by the decrease in the potential SARS-CoV-2 threat in the clinic among orthodontic patients in addition to the continuation of the precautions taken in the clinic, rapid vaccination of healthcare personnel beginning from early 2021, and rapid increase in the rate of mass vaccination in Turkey during the study period. On the other hand, mean STAI-S score was remarkably higher than the pre-pandemic STAI-S score reported by Yıldırım and Karacay (26.60 ± 4.47).[23] This finding indicates that patients have not yet returned to their immediate pre-pandemic psychological comfort. Additionally, continuing their orthodontic treatment during the pandemic period along with the high risk of infection and the risk of returning to strict measures that may hinder the treatment may also play a role in the immediate anxiety of the patients.

Numerous studies have indicated that natural, environmental, or traumatic disasters are associated with a wide range of mental and behavioral disorders and that mental health problems may persist for a long time.[24] In the present study, no significant improvement was observed in the STAI-T scores in the total population. However, longitudinal studies conducted on COVID-19 have reported conflicting results. Pieh et al.[15] reported that the mental health problems that emerged in the first month of lockdown in Austria remained mostly unchanged 6 months later, when there were no serious restrictions. In contrast, Daly and Robinson[25] showed a relatively rapid psychological adaptation to the COVID-19 pandemic in the United States. In our study, unlike in other studies, the primary factor that could affect long-term anxiety was the initiation and continuation of mass vaccination. However, it has been reported that the consequences of pandemics on mental health are related not only to the disease itself but also to economic losses or the problems caused by lockdown restrictions.[13] This relationship could be explained by rapid spread of the delta variant in the community and the high daily number of new reported COVID-19 cases as well as the fear of being infected and of inability to return to pre-pandemic daily life or the job loss and financial losses caused by the pandemic.[19]

In our study, STAI scores were significantly higher in women than in men at T0 and this difference disappeared at T1. This finding could be associated with the significant decrease in the STAI-S scores of women along with the absence of a significant change in men during the 1-year follow-up period. In a similar way to our study, studies that evaluated orthodontic patients in the first months of the pandemic emphasized that women had higher anxiety levels compared to men.[10,12] This finding could be explained by the nature of women's responses to stressors and risk factors or their lower quality of life during orthodontic treatment.[26,27] On the other hand, the response of women to the reduction of risk factors may have played a role in the significant decrease in their STAI-S scores during this period.

Our findings also showed that adult individuals (>18 years) had significantly higher STAI-S scores at both T0 and T1 than individuals under the age of 18. Moreover, although there was a significant decrease in the STAI-S scores of individuals aged under 18 years, there was no significant change in individuals aged over 18 years. In contrast, some of the studies conducted on individuals who received orthodontic treatment at the beginning of the pandemic reported no significant relationship between age and anxiety levels,[12] while some others reported a negative correlation between age and anxiety.[10,28] In a longitudinal study, Kwong et al.[29] showed that the sudden increase in anxiety in children in the early stages of lockdown was caused by mitigation measures such as lockdown and social distancing rather than the COVID-19 infection.[29] This finding could be explained by the fact that the nationwide lockdown measures had not been lifted in Turkey at T0 and they had been lifted at T1. It is also known that adult orthodontic patients have different psychological characteristics compared to children and adolescents.[30] On the other hand, the long-term anxiety scores in our study showed that the difference between age groups persisted at T1. This difference could be attributed to the economic hardships and uncertainties experienced by adults working full time and to the children's and adolescents' having less responsibility.

At both time points, no significant relationship was found between educational status and anxiety scores and also no significant change was observed in the anxiety scores at T0 and T1 with regard to educational status. This finding implicates that the educational status of individuals does not affect their anxiety scores during the COVID-19 pandemic, which is consistent with the findings of Hawryluck et al.[31] who evaluated the patients during the SARS-CoV-2 pandemic.

Our study was limited in several ways. First, there was no untreated control group in the same age group. The inclusion of such a group would be beneficial to determine the role of oral braces in the changes in long-term anxiety; however, to our knowledge, there has been no study measuring the anxiety of a population not receiving fixed orthodontic treatment in a similar population since the beginning of the pandemic. The second limitation, the included participants were not screened for background anxiety disorders.[32-35] The third limitation, as in other cross-sectional studies, was the evaluation of a particular population at specific time periods. The course of the COVID-19 pandemic varies considerably among countries, regions, and even cities and thus countries have developed different strategies to prevent the spread of the pandemic.[36] Access to vaccines, which are the beacons of hope for ending the pandemic, and the vaccination rates in countries and even in different regions of the same country can vary considerably.[37] Therefore, the changes observed in the anxiety levels of our orthodontic patients over the 1-year follow-up period may not be generalized to orthodontic patients in other countries or even in other regions and cities of Turkey. Accordingly, further studies are needed to investigate the long-term changes in larger sample sizes at different time intervals using different mental health scales.

CONCLUSION

It was observed that the state anxiety levels of orthodontic patients decreased during the 1-year period of the pandemic, while there was no significant change in their trait anxiety levels. It was also revealed that both state and trait anxiety scores of adults were higher than those of adolescents.

Ethics Committee Approval: Ethical committee approval was received from the Non-Interventional Clinical Research Ethics Committee of Adıyaman University (Approval No: 2021/06-13).

Informed Consent: Informed consent was obtained from each participant and/or parent/guardian.

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