

Differences of psychological status of TMD patients, orthodontic patients and the general population during the COVID-19 epidemic: a cross-sectional study

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Abstract

Background Confronting with the outbreak of COVID-19, this cross-sectional study aimed to assess the differences of psychological status of temporomandibular disorders patients, orthodontic patients and the general population in China during the epidemic. **Methods** An online anonymous questionnaire was developed in Chinese, including the individual background information, the perception of the epidemic, and level of anxiety and depression through Kessler Psychological Distress Scale (K10). The respondents were divided into Control group, ORTHO group and TMD group. Descriptive analysis and multiple linear regression modelling were performed. **Results** 1241 valid questionnaires in total were collected, with 587 orthodontic patients and 220 TMD patients. The mean score of K10 was 18.65. When compared with the general population, TMD patients displayed statistically higher level of anxiety and depression ($P < 0.05$), whereas orthodontic patients not ($P > 0.05$). Multiple linear regression model also showed that age, gender, some concerns about the impact of epidemic were correlated with psychological status. **Conclusions** The overall mental health was severely worsened by the COVID-19 epidemic. TMD patients had higher level of psychological distress than orthodontic patients and the general population. Factors such as younger age, female, concerning about the isolation and psychological barriers and distrust were amongst the associations with a high level of psychological distress. Mental health care should be paid to patients when hospitals and clinics re-open after the COVID-19 epidemic, especially to patients with these relevant characteristics.

Introduction

The coronavirus disease 2019 (COVID-19) has nowadays gained intense attention worldwide. As the number of cases and affected countries continued to increase, the risk assessment of the novel coronavirus disease has already been upgraded to very high at a global level by the World Health Organization.

Besides the risk of infection and spread of the disease, the mental health of the public during the epidemic has been clearly of concern. Though guidelines for emergency psychological crisis intervention has been issued in China¹, the mental health care for the novel coronavirus outbreak has still been poorly handled².

During the epidemic, the official opening of enterprises and schools was postponed, and dental hospitals and clinics were no exception (the dental emergency department excluded). The department of dentistry is kind of special, as many dental operations would produce aerosols in the workplace^{3,4}, and aerosol transmission of COVID-19 is considered possible if one is exposed to a highly concentrated mixture in an enclosed area for an extended period⁵. Thus, dental patients should be particularly attached great importance. Temporomandibular disorders (TMD), as a collective term consisting of all the problems regarding the temporomandibular joint and related musculoskeletal structures, is associated with psychosocial factors⁶, while orthodontic treatment, as a long-term procedure with a 2–6 weeks routine

follow-up, has now been interrupted. Psychological status of these patients might be affected by the epidemic.

Therefore, this study aimed to assess the differences of psychological status of TMD patients, orthodontic patients and the general population during the COVID-19 epidemic. The null hypothesis was that there was no significant difference of psychological status among these groups, and other associated variables showed no value of prediction.

Methods

Data collection

The protocol of this cross-sectional study was approved by the Institutional Review Board of West China Hospital of Stomatology (Approval no. WCHSIRB-D-2020-218). It was conducted through online questionnaires comprising 3 parts (see Additional file 1) developed in Chinese via www.wjx.cn.

The first part focused on individual background information including gender, age, residence, occupation/major, companion, the history of pneumonia-like symptoms, and close contact with individuals from Hubei province. The second part was about the perception of the epidemic developed by the investigators, including knowledge and severity of COVID-19, the risk of infection of themselves and people around them, and the main concerns about the influence of the epidemic.

The last part was the Kessler Psychological Distress Scale (K10) which is a well-validated, highly useful clinical measure of psychological symptoms^{7,8}. The Chinese version of this scale was available at the inception of the study and its validity and reliability have been validated in previous study⁹. There are 10 items in this scale to measure the frequency of negative symptoms in the past month, including nervousness, hopelessness, sadness, worthlessness, and fatigue. Scores of each item are recorded on a 5-point Likert scale ranging from score 1 (none of the time) to score 5 (all of the time), with the total scores ranging from 10 to 50. Since there is no universally agreed category or groupings for K10 scores¹⁰, the score was regarded as a continuous variable in this study, with higher scores indicating increased psychological distress. However, the K10 score has been shown to be a sensitive screen for diagnosis of anxiety and depression, with 4 items indicating anxiety and 6 items indicating depression¹¹. Brooks RT identified the factor structure and interpretation of K10 and suggested two-factor structures instead of single dimensional measure¹².

Dental practitioners were invited to distribute the questionnaires to their patients, and general residents as well. The respondents were divided into 3 groups as follows: 1) Control group: general residents without being diagnosed with TMD or in orthodontic treatment; 2) ORTHO group: dental patients who were in the process of orthodontic treatment; 3) TMD group: TMD patients who had been diagnosed by a specialist. The online questionnaires were available from February 19 to February 29, 2020. All participants were informed consent for the use of the data recorded.

After data collection, the contents of the questionnaires were screened, and the questionnaires with identical answers appeared in all K10 questions or similar questions with extreme variation in answers were excluded.

Statistical analysis

Descriptive statistics were performed to describe the characteristics of the data. The scores from K10 questions were summed separately to form an individual K10-Anxiety and K10-Depression score for each patient. Using the score as a continuous outcome variable respectively, multiple linear regression analysis was performed, adjusted for groups (Control group, ORTHO group, TMD group), as well as gender, age, residence (city or rural area), occupation/major (medical-related or not), companion (living alone or not), the history of pneumonia-like symptoms (with or without), close contact with individuals from Hubei province (with or without), knowledge and severity of COVID-19 (5-point scale ranging from score 1 (very little) to score 5 (Very much)), the risk of infection (5-point scale ranging from score 1 to 5), and the main concerns about the influence of the epidemic (isolation from family/society, impact on work/study, impact on daily life, psychological barriers and distrust). The coefficients, 95% confidence intervals (CI) for Beta, and P-values were calculated. All statistical analyses were performed by SPSS (IBM SPSS Statistics version 21.0, IBM Corp., Armonk, New York, USA) with a two-tailed α significance level of 0.05.

Results

1241 valid questionnaires were included in this study, and 434, 587, 220 of those were divided into Control group, ORTHO group, and TMD group, respectively. Descriptive statistics of the three groups were listed in Table 1. For categorical variables, each category and its percentage of each group are reported, while mean and standard deviations (SD) are reported for quantitative variables.

The proportion of females in ORTHO group and TMD group was higher than Control group, while the mean age of ORTHO group was the youngest among the three groups. The mean values of the 5-point Likert scale of the knowledge and severity of the COVID-19 were 4.05 and 4.61, respectively, whereas the mean values of the infection possibility using the same scale were 2.29 for the respondents themselves and 2.38 for the people around them. The main concern about the influence of the epidemic was the impact on work/study, accounting for 57.9%. And the mean value of the total score of K10 of all respondents was 18.65.

Cronbach's alpha value for the 4 items indicating anxiety in K10 was 0.896. The mean value (\pm SD) of the total score of anxiety in Control group, ORTHO group, TMD group were 7.59 (\pm 3.046), 7.52 (\pm 3.134), and 7.94 (\pm 3.184), respectively. Multiple linear regression analysis showed extent of anxiety in TMD group was higher than Control group (B 0.567, 95% CI 0.042-1.092), whereas the difference between ORTHO group and Control group was not statistically significant (B -0.013, 95% CI -0.043-0.408). Other predictors related to anxiety were younger age, female, close contact with individuals from Hubei province, higher score in infection possibility of people around you, concern about isolation from family/society, and

concern about psychological barriers and distrust. Table 2 reported the coefficients, 95% confidence intervals (CI), and P-values of every variable.

Other 6 items indicating depression in K10 reached 0.895 in internal consistency analysis. The mean value (\pm SD) of the total score of depression were 10.98 (\pm 4.532), 10.81 (\pm 4.369), 11.74 (\pm 4.890) in Control group, ORTHO group, and TMD group, respectively. Through multiple linear regression analysis, TMD group displayed higher odds of depression than Control group (B 0.954, 95% CI 0.191-1.717), whereas ORTHO group and Control group was not statistically different (B -0.227, 95% CI -0.842-0.388). In addition, younger age, female, close contact with individuals from Hubei province, lower score in knowledge of COVID-19, higher score in infection possibility of yourself, concern about isolation from family/society, and concern about psychological barriers and distrust among people, were also associated with depression. The coefficients, 95% confidence intervals (CI), and P-values of every variable were listed in Table 3.

Discussion

This study analyzed anxiety and depression of 1241 respondents, with 587 orthodontic patients and 220 TMD patients during the COVID-19 epidemic. The average K10 score of all respondents was 18.65 with a median of 17.0, which was noticeably higher compared with normative population^{13,14}, and even residents experienced environmental catastrophe¹⁵. Though there might be difference between races, it was quite evident that the epidemic had severe adverse effects on mental health.

Level of both anxiety and depression was shown to be higher in TMD patients. The null hypothesis that all variables have the same influence on psychological distress was rejected. TMD symptoms were related to pain frequency, psychological distress, jaw dysfunction and parafunctional behaviors¹⁶. Previous study has shown that orofacial pain was associated with poorer oral health-related quality of life and signs of psychological distress¹⁷, with which our study agreed.

Through multiple linear regression analysis, psychological status of orthodontic patients was not found statistically different from general population. There were many researchers using the Oral Health Impact Profile (OHIP-14) to assess oral health-related quality of life (OHRQoL) on patients in orthodontic treatment¹⁸⁻²⁰ and it was acknowledged that the orthodontic patients had higher negative impacts than the control group²⁰. Psychological distress correlated with quality of life²¹, but QoL is a quite different concept from psychological distress. As for adults in their 20 s, the rate of positive perception towards orthodontic treatment was up to 63.2%²². Also, aesthetics is a major concern in orthodontic treatment for individuals, other than symptoms like orofacial pain and jaw dysfunction in TMD patients. These reasons contributed to the difference of psychological status of TMD patients and orthodontic patients.

The proportion of females is more than that of males, both in orthodontic patients and TMD patients, which was in accordance with the trend that females were more likely to seek orthodontic treatment²³, and have higher risk of TMD as well²⁴. Agreed with our findings, a cross-sectional survey conducted in

1400 university students of China using the same scale showed females were more vulnerable to psychological distress²⁵. In the regression models, using either anxiety score or depression score as the dependent variable, years of age were negatively correlated with psychological status. Youngsters might have more access to the severity of the epidemic through smartphones and developed higher odds of distress, while some elder people were not much cared about the disease. Similarly, previous study has shown psychological distress decreased through the range of 20–64 years of age²⁶. Furthermore, respondents reporting close contact with individuals from Hubei province were associated with increased distress level. This sub-sample was relatively small, compared with respondents out of the epicenter, but the mental health of patients with confirmed COVID-19, patients with suspected infection, quarantined family members, and medical personnel was of the greatest concern².

In terms of the perception of COVID-19, both average knowledge score and severity score of the COVID-19 were up to 4-4.5. When asked about the possibility of infection, the degree of the answers distributed to a relatively lower level, with the mean value below 2.5. These data revealed that the Chinese government had achieved great success on the disease disclosure, as well as the disease prevention and control. As for the main concerns about the influence of COVID-19, objective choices like impact on work/study and on daily life accounted more, while more subjective ones were relatively less concerned, such as isolation from family/society and psychological barriers and distrust among people.

However, these latter two attitudinal items mentioned above were related to high anxiety and depression. This certainly highlights the need to carry out mental health care in addressing the issue of distress in dental patients and general residents. Another prominent finding is that higher score in infection possibility of people around you was related to higher anxiety, whereas higher score in infection possibility of yourself indicated increasing odds of depression. The diagnosis of anxiety and depression tends to co-occur, and their symptoms are highly correlated²⁷. However, they are not quite the same concept, which also supported the use of two-factor structures of K10 in accordance with Brooks's study¹².

One limitation of this study was that we didn't include the severity of the symptoms in TMD patients, types of appliances in orthodontic patients or other possible independent variables. It has been shown that compared to removable appliances, fixed appliances resulted in a significant negative effect on OHRQoL¹⁸, and this independent variable might also be related to psychological status.

Though the sample size was substantial, another limitation was that based on the number of people who had access to the online questionnaire, we estimated overall response rate was approximately between 60–70%, but the specific number was not quite clear, which might to some extent impair the representativeness of the study sample.

Conclusions

In summary, this study showed that the overall mental health was severely worsened by the COVID-19 epidemic. TMD patients displayed higher level of anxiety and depression than orthodontic patients and the general population. Factors such as younger age, female, concerning about the isolation and psychological barriers and distrust were amongst the associations with a high level of psychological distress. Mental health care should be paid to patients when hospitals and clinics re-open after the COVID-19 epidemic, especially to patients with these relevant characteristics.

Abbreviations

COVID-19

the coronavirus disease 2019

TMD

temporomandibular disorders

Declarations

Ethics approval and consent to participate

The cross-sectional study was conducted after ethical clearance has been approved by the Institutional Review Board of West China Hospital of Stomatology (Approval no. WCHSIRB-D-2020-218). All participants were in a position to understand and consent to the study requirements, and provided informed verbal consent. Since participants were isolated due to the outbreak, written consent was not available, and this was approved by the ethics committee.

Consent for publication

Not applicable

Availability of data and materials

The data analyzed during the current study are not publicly available. They are available from the corresponding author on reasonable request.

Competing interests

The authors declare that they have no competing interests.

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Authors' contributions

YW and XX planned the study and participated in the study design. YW, XX, XF and WS analyzed the data. YW, XX, YY and JL interpreted the data. YW and XX drafted the manuscript and JW contributed substantially to its revision. All authors read and approved the final version of the manuscript.

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Tables

Table 1. Descriptive statistics of the total population (N=1241) and the Control group (N=434), ORTHO group (N=587), and TMD group (N=220).

Variable	Control (N=434)	ORTHO (N=587)	TMD (N=220)	Total (N=1241)
Gender [N (%)]¹				
Male	183(42.2%)	133(22.7%)	41(18.6%)	357(28.8%)
Female	251(57.8%)	454(77.3%)	179(81.4%)	884(71.2%)
Age [mean (SD)]²				
	28.41(9.768)	24.68(6.841)	27.05(7.269)	26.41(8.225)
Residence [N (%)]¹				
City	314(72.4%)	483(82.3%)	191(86.8%)	988(79.6%)
Rural area	120(27.6%)	104(17.7%)	29(13.2%)	253(20.4%)
Occupation/Major [N (%)]¹				
Non-medical related	377(86.9%)	472(80.4%)	200(90.9%)	1049(84.5%)
Medical related	57(13.1%)	115(19.6%)	20(9.1%)	192(15.5%)
Live alone [N (%)]¹				
No	349(80.4%)	490(83.5%)	187(85.0%)	1026(82.7%)
Yes	85(19.6%)	97(16.5%)	33(15.0%)	215(17.3%)
History of pneumonia-like symptoms [N (%)]¹				
No	428(98.6%)	583(99.3%)	218(99.1%)	1229(99.0%)
Yes	6(1.4%)	4(0.7%)	2(0.9%)	12(1.0%)
Close contact with individuals from Hubei province [N (%)]¹				
No	295(68.0%)	559(95.2%)	212(96.4%)	1066(85.9%)
Yes	139(32.0%)	28(4.8%)	8(3.6%)	175(14.1%)
Knowledge [mean (SD)]²				
	4.01(0.746)	4.11(0.649)	3.99(0.752)	4.05(0.705)
Severity [mean (SD)]²				
	4.60(0.611)	4.64(0.536)	4.54(0.599)	4.61(0.576)
Infection possibility [mean (SD)]²				
Yourself	2.30(1.095)	2.30(1.085)	2.23(1.044)	2.29(1.081)
People around you	2.45(1.076)	2.34(0.988)	2.32(1.047)	2.38(1.031)
Concern about isolation from family/society [N (%)]¹				
No	262(60.4%)	327(55.7%)	154(70.0%)	743(59.9%)
Yes	172(39.6%)	260(44.3%)	66(30.0%)	498(40.1%)
Concern about impact on work/study [N (%)]¹				
No	182(41.9%)	227(38.7%)	113(51.4%)	522(42.1%)
Yes	252(58.1%)	360(61.3%)	107(48.6%)	719(57.9%)
Concern about impact on daily life [N (%)]¹				
No	214(49.3%)	288(49.1%)	140(63.6%)	642(51.7%)
Yes	220(50.7%)	299(50.9%)	80(36.4%)	599(48.3%)
Concern about psychological barriers and distrust among people [N (%)]¹				
No	290(66.8%)	400(68.1%)	171(77.7%)	861(69.4%)
Yes	144(33.2%)	187(31.9%)	49(22.3%)	380(30.6%)
Total score of K10 [mean (SD)]²				
	18.56(7.271)	18.33(7.262)	19.68(7.816)	18.65(7.377)
Anxiety [mean (SD)]²				
	7.59(3.046)	7.52(3.134)	7.94(3.184)	7.62(3.114)
Depression [mean (SD)]²				
	10.98(4.532)	10.81(4.369)	11.74(4.890)	11.03(4.531)

¹Total number [percentage (%)] for categorical variables

²Mean [standard deviation (SD)] for quantitative variables

Table 2. Results of the multiple linear regression model (N = 1241): using summed score of 4 items indicating anxiety in K10 as the dependent variables

Variable	B	Std. Error	Beta (Standardized)	95% Confidence Interval for B	P
(Constant)	6.220	0.424		5.389 - 7.052	0.000
Groups					
Control group	Reference				
ORTHO group	-0.013	0.214	-0.002	-0.043 - 0.408	0.953
TMD group	0.567	0.268	0.070	0.042 - 1.092	0.034
Age	-0.022	0.011	-0.059	-0.044 - -0.001	0.037
Gender					
Male	Reference				
Female	0.672	0.195	0.098	0.290 - 1.054	0.001
Close contact with individuals from Hubei province					
No	Reference				
Yes	0.863	0.270	0.096	0.333 - 1.392	0.001
Infection possibility of people around you	0.400	0.084	0.133	0.235 - 0.566	0.000
Concern about isolation from family/society	0.372	0.187	0.059	0.006 - 0.738	0.046
Concern about psychological barriers and distrust	0.636	0.197	0.094	0.250 - 1.022	0.001
Observations				1241	
R Square / Adjusted R Square				0.063 / 0.057	

Table 3. Results of the multiple linear regression model (N = 1241): using summed score of 6 items indicating depression in K10 as the dependent variables

Variable	B	Std. Error	Beta (Standardized)	95% Confidence Interval for B	P
(Constant)	12.432	0.916		10.636 - 14.229	0.000
Groups					
Control group	Reference				
ORTHO group	-0.227	0.313	-0.025	-0.842 - 0.388	0.469
TMD group	0.954	0.389	0.080	0.191 - 1.717	0.014
Age	-0.050	0.016	-0.091	-0.081 - -0.019	0.001
Gender					
Male	Reference				
Female	0.765	0.284	0.076	0.207 - 1.322	0.007
Close contact with individuals from Hubei province					
No	Reference				
Yes	0.864	0.394	0.066	0.091 - 1.637	0.028
Knowledge	-0.566	0.179	-0.088	-0.918 - -0.214	0.002
Infection possibility of yourself	0.406	0.117	0.097	0.176 - 0.636	0.001
Concern about isolation from family/society	0.627	0.270	0.068	0.097 - 1.158	0.020
Concern about psychological barriers and distrust	1.030	0.286	0.105	0.469 - 1.592	0.000
Observations				1241	
R Square / Adjusted R Square				0.067 / 0.060	

Supplemental Information Note

Additional file 1

Evaluation of Psychological Status During COVID-19 Epidemic Questionnaire.docx

The online questionnaire conducted in this study was developed in Chinese and was translated into English as an additional file.

Additional file 2

STROBE Statement—Checklist of cross-sectional studies.docx

Supplementary Files

This is a list of supplementary files associated with this preprint. Click to download.

- [Additionalfile1Questionnaire.docx](#)
- [Additionalfile2Checklist.doc](#)