

Psychological impact of COVID-19 pandemic on TMD subjects

P. DI GIACOMO, E. SERRITELLA, F. IMONDI, C. DI PAOLO

Department of Oral and Maxillo-facial Sciences, Gnathologic Division "Sapienza" University of Rome, Rome, Italy

Abstract. – **OBJECTIVE:** The aim of the study was to assess the psychological impact of COVID-19 pandemic on subjects with temporomandibular disorders (TMD), as for symptomatology and presence of parafunctions and sleep disorders.

PATIENTS AND METHODS: Two hundred fourteen subjects completed an online questionnaire, including Perceived Stress Scale (PSS), a temporomandibular screening and a specific item about the impact of such event on the psycho-physical side. Non-parametric tests – Mann-Whitney and Kruskal-Wallis – were performed to compare sex and age groups, as for PSS and "COVID-19 pandemic impact score (CpIS)", and the groups Improved/stationary and Worsened in symptomatology as for the "CpIS". Data of subjects undergoing gnathological therapy and not were compared, using Chi-squared test. Orofacial symptomatology values before and during pandemic were compared. The level of statistical significance was set at $p < 0.05$.

RESULTS: The most prevalent category of perceived stress was the one of "moderate stress". Participants on average attributed to the pandemic a medium-low impact. The reported symptomatology actually showed a significant negative trend only as for neck pain. The intensity of orofacial symptomatology during pandemic was lower than before. Differences between age groups were statistically significant, as for CpIS. Subjects belonging to the group Worsened in one or more fields examined – TMD symptoms, comorbidities, sleep disturbances and fatigue – reported a significantly higher CpIS ($p < 0.0001$). Awake and sleep bruxism, dental grinding, alteration in the quality and quantity of sleep and fatigue increased. Gnathological therapy was not a protective factor.

CONCLUSIONS: The most evident fact during pandemic was the increase of parafunctions and sleep disorders. The trend of symptoms was more variable and complex.

Key Words:

COVID-19, TMD, Psychological impact, Sleep disorders, Parafunctions.

Introduction

The coronavirus infection, after the outbreak in China in the last few months of 2019, has become a pandemic in 2020. Italy registered its first case in the second half of February, and, within a short time, it became the country in Europe with the greatest number of infected people and of deaths. Drastic measures were taken by the authorities and world population was forced to lockdown in order to contain the infection, and social aspects abruptly changed. As in the past, for example for people who faced wars, natural disasters or other health emergencies, the negative and sudden life change trigger and/or boost mental distress^{1,2}. As reported in the literature, the isolation could increase the incidence of neurologic and psychiatric symptoms³, such as post-traumatic stress disorder⁴, anxiety, depressive symptoms, insomnia, denial, anger, and fear, particularly in subjects with a previous psychiatric diagnosis⁵. There are some factors that may increase the risk of developing such conditions, such as female sex, lower socioeconomic status, interpersonal conflicts, frequent social media use and lower resilience and social support⁶.

It is well known the role of biopsychosocial factors, such as for example the ones related to environmental contingencies⁷⁻⁹, in pain perception and development and maintenance of Temporomandibular Disorders (TMDs)^{10,11}. Moreover, the high prevalence of psychological disorders, such as depression and anxiety, was found in TMD patients, mainly in those who suffer of masticatory muscle disorders¹²⁻¹⁷. People with chronic TMD pain show less psychological adaptability, on average, compared to healthy controls^{18,19}. In studies^{17,20-24} conducted in the US and Europe, it has been reported higher mean levels of affective distress, somatic awareness, psychosocial stress, and pain catastrophizing. Also, alexithymia was significantly associated with signs and symptoms

of TMD and was recognized as the main indicator of joint, facial, and head pain²⁵.

Furthermore, the association between bruxism and psychological aspects has been investigated. A recent systematic review²⁶ reported that some specific symptoms of the anxiety disorders spectrum might have association to probable sleep bruxism. Awake bruxism, in contrast, recognizes psychosocial factors, such as anxiety, stress and alexithymia, in its occurrence and maintenance²⁷. Patients with high levels of stress are almost 6 times more likely to refer awake bruxism^{28,29}. Enduring muscle contraction of head and neck is also related to a required body posture associated to fight-or-flight response. Therefore, muscle contraction in awake bruxism could be part of the defense behavior associated with anxiety and stress.

The role of stress and change in living habits, as the ones faced during COVID-19 pandemic, in the etiology and persistence of TMDs remains unclear. However, dysregulation of the hypothalamic-pituitary-adrenal axis and serotonergic system has been correlated with TMD in several studies³⁰⁻³², even if further investigations are recommended. The autonomic impairment may also lead to increased sympathetic drive and sensation of hyperarousal which create and perpetuate any sleep disturbance. Furthermore, poor sleep is prevalent among individual with anxiety disorders and post-traumatic stress disorders^{33,34}. Tosato et al³⁵ proved that an increase in cortisol, which is a hormone released in stressful circumstances, was accompanied by greater muscle activity and TMD severity. Furthermore, there was a positive correlation between electromyographic activity, salivary cortisol, the degree of temporomandibular disorder severity, and muscle activity.

In this context, this study aimed at assessing the psychological impact of COVID-19 pandemic on subjects affected by temporomandibular disorders. Patients were evaluated in terms of pain symptoms, mandibular functionality, sleep disturbance and parafunctions, recorded during the isolation period and compared to the ones before the outbreak of the pandemic.

Patients and Methods

Study Design

This study was performed at Sapienza University of Rome in May 2020. An online questionnaire was created as data collection tool,

designed by the authors specifically for this research. It was administered to subjects affected by temporomandibular disorders, visited, and screened before lockdown at the Department of Oral and Maxillo-facial Sciences, Unit of Gnathology. Subjects were recruited through convenience sampling, because of the limited access to medical records, due to the pandemic. However, the authors reached as many e-mail contacts as possible, in order to limit the chance of sampling error occurring.

The elaboration of the questionnaire took its cue from the scientific literature^{36,37}. The first ten questions belonged to the Perceived Stress Scale³⁶, which is one of the most widely used scale for the evaluation of the psychological stress. Scores ranging from 0-13 indicated a low level of stress; the ones ranging 14-26 indicated a moderate level of stress; the ones ranging 27-40 indicated high level of stress. On the basis of the references of the Diagnostic Criteria for Temporomandibular Disorders (DC/TMD)³⁷ the questionnaire was supplemented by questions (No. 11, 13, 14, 16-20, 22-24, 26) taken from “TMD Pain Screener”, “Pain” section, “Headache” section, “Jaw Joint Noises” section, “Closed/Open Locking of The Jaw” section, Graded Chronic Pain Scale, Jaw Functional Limitation Scale, Oral Behavior Checklist, though in a modified form. To make the questionnaire complete and consistent with the current pandemic situation, the authors added questions regarding change in symptomatology during lockdown and about the presence and type of the ongoing gnathological treatment, if present. The authors also included a direct question about a self-evaluation of the impact of the pandemic on the psycho-physical sphere, called “COVID-19 pandemic impact score- CpIS”.

The questionnaire consisted of 31 close-ended questions. The questionnaire was uploaded online to the free survey platform GOOGLE SURVEY (surveys.google.com, Google LLC). Patients were informed about the study and asked to complete the questionnaire online. An informative text was inserted at the top of the questionnaire and informed consent was obtained in the form of patients stating their agreement to participate in the study. The data collected were anonymous, and tracing the identity of the subjects was not possible.

The study was approved by the Institutional Ethics Committee of the Department of Oral and Maxillo-Facial Sciences, Sapienza University of Rome, Italy, protocol No. 0001279.

Statistical Analysis

In this study, descriptive statistical analysis was carried out.

Non-parametric tests – Mann-Whitney and Kruskal-Wallis – were performed to compare sex and age groups, as for PSS and “COVID-19 pandemic impact score (CpIS)”.

Furthermore, Mann-Whitney U test was also performed, under the following hypotheses: a) subjects who worsened in pain symptomatology (TMD/headache/neck pain), compared to the ones who improved or were stationary, and b) subjects who had sleep disturbances and fatigue on awakening, compared to the ones who had not, reported a different “COVID-19 pandemic impact score” (CpIS).

The scores assigned to the orofacial symptomatology, relating to the period before and during Coronavirus pandemic were compared.

Chi-squared test was performed to assess differences between subjects undergoing gnathological therapy and not, in terms of symptomatology (TMD, headache, neck pain).

The level of statistical significance was set at $p < 0.05$. The software used is STATA 15.1 (StataCorp LLC, TX, USA).

Results

The questionnaire was sent to 463 subjects. The turnout was about of 46%. Two hundred fourteen subjects completed the online questionnaire (177 females -82.6% and 37 males -17.4%). The distribution among age groups was homogeneous, 35.8% (76) range 20 -35 years old, 36.7% (79) range 35-55 years old and 27.5% (59) > 55 years old.

The percentage obtained for each alternative of the 31 questions was reported in the Table I.

The overall level of perceived stress, according to PSS was moderate with a median = 17. The most prevalent category was the one of “moderate stress” with 130 subjects affected (61%). The other categories reported the following results: 8% for the category high stress level and 31% for the low stress level whose 60% with a score ≥ 10 .

The impact of Coronavirus was considered medium-low with a median = 2.

The differences between females and males and among age groups, in relation to the values of the PSS and of CpIS are reported in the following Table II.

Differences between age groups were statistically significant as for CpIS.

Differences between groups (Improved/stationary and Worsened) as for the impact of COVID-19 on TMD, comorbidities, sleep disturbances and fatigue were statistically significant, as shown in the Table III.

The orofacial symptomatology median before pandemic was 4 (on a scale of 0 to 10). The orofacial symptomatology median during pandemic was 3. The values attributed to orofacial pain before lockdown and the one during lockdown were statistically significant ($p = 0.005$; U Mean value = 22578; U standard deviation = 1254.4; $Z=2.75$).

No significant differences about the presence of a gnathological treatment between the groups Improved/stationary and Worsened in TMD symptomatology and headache were detected.

Instead, subjects undergoing gnathological therapy and who also reported a worsening of neck pain were significantly prevalent, if compared to subjects with neck pain who did not undergo a gnathological therapy (Table IV).

Discussion

The main goal of the authors of this study was to evaluate the psychological impact of the recent COVID-19 pandemic on TMD patients.

The starting hypotheses supposed negative variations both in the symptomatology and in the incidence of sleep disorders and parafunctions, due to a greater psychological involvement dictated by the current social change. Furthermore, one of the aims of the study was to verify if people undergoing gnathological therapy were more “protected” than people waiting for treatment.

From the analysis of the sample emerged a moderate stress level (no significant differences between females and males and among age groups), in line with the study of Wu et al³⁸ performed on a TMD population during COVID-19 pandemic. The authors decided to include in the questionnaire an explicit question about the impact of COVID-19 pandemic on the psycho-emotional sphere. In fact, it was not possible to have a comparison with a test of the pre- COVID-19 period, which could confirm if the stress level was actually lower/equal or greater than before. From the answers, participants on average attributed to the pandemic a medium-low impact on their psychological condition. Despite the presence of a significant psychological substrate in the sam-

Table I. COVID-19 and TMD questionnaire.

Questions & Answers	Percentage (%) for each alternative
PSS (Perceived stress scale)	
1. In the last month, how often have you been upset because of something that happened unexpectedly?	
0 = Never	20.2%
1 = Almost never	20.2%
2 = Sometimes	38.5%
3 = Fairly often	18.3%
4 = Very often	2.8%
2. In the last month, how often have you felt that you were unable to control the important things in your life?	
0 = Never	32.1%
1 = Almost never	20.2%
2 = Sometimes	27.5%
3 = Fairly often	18.3%
4 = Very often	1.8%
3. In the last month, how often have you felt nervous and stressed?	
0 = Never	7.3%
1 = Almost never	14.7%
2 = Sometimes	44%
3 = Fairly often	22%
4 = Very often	11.9%
4. In the last month, how often have you felt confident about your ability to handle your personal problems?	
0 = Never	4.6%
1 = Almost never	8.3%
2 = Sometime	31.1%
3 = Fairly often	42.2%
4 = Very often	12.8%
5. In the last month, how often have you felt that things were going your way?	
0 = Never	6.4%
1 = Almost never	18.3%
2 = Sometimes	45.9%
3 = Fairly often	26.6%
4 = Very often	2.8%
6. In the last month, how often have you found that you could not cope with all the things that you had to do?	
0 = Never	16.5%
1 = Almost never	29.4%
2 = Sometimes	38.5%
3 = Fairly often	12.8%
4 = Very often	2.8%
7. In the last month, how often have you been able to control irritations in your life?	
0 = Never	4.6%
1 = Almost never	7.3%
2 = Sometimes	33.9%
3 = Fairly often	43.1%
4 = Very often	11%
8. In the last month, how often have you felt that you were on top of things?	
0 = Never	2.8%
1 = Almost never	11.9%
2 = Sometimes	35.8%
3 = Fairly often	37.6%
4 = Very often	11.9%

Continued

Table 1 (Continued). COVID-19 and TMD questionnaire.

Questions & Answers	Percentage (%) for each alternative
9. In the last month, how often have you been angered because of things that happened that were outside of your control?	
0 = Never	9.2%
1 = Almost never	30.3%
2 = Sometimes	42.2%
3 = Fairly often	15.6%
4 = Very often	2.8%
10. In the last month, how often have you felt difficulties were piling up so high that you could not overcome them?	
0 = Never	17.4%
1 = Almost never	43.1%
2 = Sometimes	25.7%
3 = Fairly often	11%
4 = Very often	2.8%
Screening of TMD and comorbidities (short and modified version)	
11. In the last 30 days, how long did any pain last in your jaw or masticatory muscles?	
a) Never	21.1%
b) Almost never	20.2%
c) Sometimes	29.4%
d) Often	29.4%
12. In the last 30 days, compared to the period before lockdown, pain in these sites is	
a) Stationary or improved	33%
b) Worsened	42.2%
c) I've never had pain in these sites in my life	24.8%
13. In the last 30 days, did the following activities change any pain in your jaw and/or masticatory muscles area on either side?	
a) Chewing hard or tough food	
a.1 Yes	44.95%
a.2 No	55.05%
b) Opening your mouth or moving your jaw forward to the other side	
b.1 Yes	49.5%
b.2 No	50.5%
c) Jaw habits such as clenching, grinding or chewing gum	
c.1 Yes	59.63%
c.2 No	40.37%
d) Other jaw activities such as talking, kissing, yawning	
d.1 Yes	33.94%
d.2 No	66.06%
14. In the last 30 days, have you had any headaches that included the temple areas of your head?	
a) Never	27.5%
b) Almost never	23.9%
c) Sometimes	32.1%
d) Often	16.5%
15. In the last 30 days, compared to the period before lockdown, pain in these sites is	
a) Stationary or improved	31.2%
b) Worsened	35.8%
c) I've never had pain in these sites in my life	33%

Continued

Table I (Continued). COVID-19 and TMD questionnaire.

Questions & Answers	Percentage (%) for each alternative
16. In the last 30 days, did the following activities change any pain in your jaw and/or masticatory muscles area on either side?	
a) Chewing hard or tough food	
a.1 Yes	26.6%
a.2 No	73.4%
b) Opening your mouth or moving your jaw forward to the other side	
b.1 Yes	28.44%
b.2 No	71.56%
c) Jaw habits such as clenching, grinding or chewing gum	
c.1 Yes	44.03%
c.2 no	55.97%
d) Other jaw activities such as talking, kissing, yawning	
d.1 yes	20.18%
d.2 no	79.82%
17. In the last 30 days, have you had any jaw joint noises when you moved or used your jaw?	
a) Yes	41.3%
b) No	58.7%
18. In the last 30 days, have you ever had your jaw lock or catch, even for a moment, so that it would not open all the way?	
a) Yes	41.3%
b) No	58.7%
19. In the last 30 days, when you opened your mouth wide, did your jaw lock or catch even for a moment such that you could not close it from this wide open position?	
a) Yes	5.5%
b) No	94.5%
20. In the last 30 days, how long did your neck pain last?	
a) Never	18.3%
b) Almost never	14.7%
c) Sometimes	22%
d) Often	45%
21. In the last 30 days, compared to the period before lockdown, pain in these sites is	
a) Stationary or improved	19.3%
b) Worsened	56%
c) I've never had pain in these sites in my life	24.8%
22. In the last 30 days, have you ever had...	
Tinnitus	
a) Yes	46.78%
b) No	53.22%
Vertigo or dizziness	
a) Yes	39.44%
b) No	60.56%
23. In the last 30 days, what was the average intensity of your orofacial pain? (scores ranging from 0 to 10 where 0 = no pain and 10 = severe pain)	
0	27.5%
1	11.9%
2	8.3%
3	7.3%
4	6.4%
5	11%
6	5.5%
7	11.9%
8	6.4%
9	3.7%
10	0%

Continued

Table 1 (Continued). COVID-19 and TMD questionnaire.

Questions & Answers	Percentage (%) for each alternative
24. What was the average intensity of your orofacial pain before COVID-19 pandemic? (scores ranging from 0 to 10 where 0 = no pain and 10 = severe pain)	
0	16.5%
1	6.4%
2	10.1%
3	11.9%
4	5.5%
5	15.6%
6	9.2%
7	13.8%
8	5.5%
9	3.7%
10	1.8%
Oral habits / Sleep/ Fatigue	
25. In the last 30 days, have you clenched or grinded your teeth...	
a. More than before	29.4%
b. Less than before	9.2%
c. Same as before	37.6%
d. I don't realize	23.9%
26. Your jaw tension is....	
a. Prevalent during the night	32.7%
b. Prevalent during the day	11.2%
c. Night and day	39.3%
d. I don't realize	16.8%
27. In the last 30 days, have you noticed more fatigue when you woke up?	
a. Yes	66.1%
b. No	33.9%
28. In the last 30 days, have you noticed a deterioration in the quality and quantity of sleep?	
a. Yes	61.5%
b. No	38.5%
Treatment	
29. Are you doing any gnathological therapy?	
a. Yes	75.3%
b. No	24.7%
30. What kind of therapy are you doing?	
a. With occlusal splint	63.6%
b. Orthodontics	1.9%
c. Drugs	1.9%
d. Physical therapy	1.9%
e. No treatment	30.8%
Covid-19 Impact as self-evaluation	
31. How much have the changes in this month had a negative impact on the level of mandibular dysfunction and/or facial pain? (Scores ranging from 0 to 5 where 0= no impact, 1=low impact, 2=medium-low impact; 3=moderate impact, 4 moderate/high impact and 5= high impact)	
0	29.9%
1	18.7%
2	21.5%
3	16.8%
4	9.3%
5	3.7%

Table II. The median Perceived Stress Scale (PSS) and “Coronavirus pandemic impact score” (CpIS), for each sex and age group. Mann-Whitney (U-value and Standard Deviation) and Kruskal-Wallis (H-value) tests.

Males	PSS median	17	CpIS median	1
Females	PSS median	17	CpIS median	2
Differences between male/female as for PSS	U-value= 2880	U st.dev = 307	z=0.05	<i>p</i> = 0.96 (not significant)
Differences between male/female as for CpIS	U-value 2754	U st.dev = 293.1	z= 1.50	<i>p</i> = 0.1336 (not significant)
25-35 yrs	PSS median	18	CpIS median	2
35-55 yrs	PSS median	17	CpIS median	2
> 55 yrs	PSS median	15	CpIS mean CpIS median	1
Differences between age groups As for PSS	H-value = 2.28		<i>p</i> = 0.31921 (not significant)	
Differences between age groups As for CpIS	H-value= 6.21		<i>p</i> = 0.0464 (significant)	

p-value < 0.05. Z = zeta test.

ple examined – exacerbated or not by the current contingency – the reported symptomatology actually showed a significant negative trend only as for neck pain. In fact, from the questionnaire emerged that the intensity of pain symptomatology during lockdown seemed to be lower. However, in the categories “orofacial pain” and “headache” there was a prevalent percentage of patients which referred a worsening of symptomatology. The authors hypothesize that such discrepancy in data could be explained considering both the questionnaire bias and/or that in the subjects who reported any improvements, the extent of such improvement in quantitative terms exceeded the one of worsening for the subjects who reported it.

As for neck pain, 56% reported a worsening of symptomatology. The authors attributed the outcome not only to the stress condition but also to the reduction/suspension of physical rehabilitation sessions and of physical activities.

Because of the complexity of the analysis and the number of variables of data collected, it was not possible to confirm unreservedly the initial hypothesis that the psychological stress would lead to a negative variation of symptomatology, except for neck pain. This also in the view of the fact that the stress level of the sample was homogenous, regardless of the effective impact of COVID-19, but the percentage of Improved/stationary and Worsened were overlapping, except for the neck pain category. In fact, in this category, subjects who “worsened” were clearly prevalent. So, does the psychological impact play a role in the change of symptomatology? Why only for the category “neck pain”? Are there any “protective” factors, despite the psychological state? Are there any bias in the questionnaire? The analysis was complex and not easy to interpret. Bias was most likely present, considering the early formulation of the ques-

Table III. Mann-Whitney (U-value and Standard Deviation) and Z test for the assessment of the differences between groups Improved/ stationary and Worsened, as for the impact of Covid-19 on pain symptomatology, sleep disorders and fatigue.

	U mean value	U SD	Z test	<i>p</i> -value
Between groups (improved/worsened-TMD)	858	107.3	4.48	< 0.0001
Between groups (improved/worsened-Headache)	3182	285.9	5.04	< 0.0001
Between groups (improved/worsened-Neck Pain)	2226	229.9	4.61	< 0.0001
Between groups (presence/absence sleep disturbance)	4392	368.3	3.94	= 0.00081
Between groups (presence/absence tiredness upon waking)	4224	363.1	5.49	< 0.0001

Table IV. Chi-squared test for the effect of gnathological therapy on painful symptomatology.

	Chi-squared value	p-value
TMD pain and presence of any gnathological therapy	0.04	0.841481
Headache and presence of any gnathological therapy	0.136	0.71229
Neck pain and presence of any gnathological therapy	6.7	0.009641

tionnaire and early administration. In other recent studies on this topic^{39,40}, the authors found a stronger association between the deterioration of the psychological state induced by the pandemic and the worsening of previous symptomatology and the onset of new cases of TMD pain.

In order to deepen the level of the investigation, the authors performed further statistical analysis and took over this interesting result. For equal psychological distress as emerged from PSS, those who reported a worsening of pain symptomatology also referred a higher level of COVID-19 impact. Such additional data renewed the debate. In fact, by trying to combine all the results together, painful symptomatology was not so much influenced by the level of stress itself as by the change of the psychological state dictated by such contingency, which everyone has perceived in a personal way. When the pandemic situation kept changing rapidly from day to day, uncertainty and worries about the present and future were common and unavoidable, mainly for the age group 35-55 years⁴¹.

From the analysis emerged that gnathological therapy was not a protective factor. No differences were found between groups presence/absence of gnathological therapy as for TMD symptomatology and headache. As for neck pain, subjects undergoing gnathological therapy that were even worse were significantly prevalent. This could be a confounding factor because the reader is led to think that not only the gnathological therapy is not a protective factor but also that it may be a negative factor. The authors of the study believe instead that, having regard to the high number of subjects affected by a worsening of neck pain and the high number of subjects undergoing gnathological therapy, there is likely to be an overlap of the two subsamples, without any relationship of dependence between the two variables. In fact, according to the authors of the study, neck pain may be less significantly interested by the effects of a gnathological therapy than the other categories of pain. The authors can only highlight the variability of factors which may have influenced the response to a therapy and among them the reduction/suspension of the access to treatment facilities.

As for parasomnia, such as awake and sleep bruxism, dental grinding, alteration of the quality and quantity of sleep, as well as awakening fatigue, the authors report a significant increase. This result can be considered a direct epiphenomenon of patients' unconscious psychological involvement in the pandemic situation. Sleep disorders were found also in the study of Fu et al⁴², who highlighted that among the psychological reactions to the COVID-19 pandemic, there were sleep disturbances. Data which confirmed the bruxism outbreak are included in the study of Emodi-Perlman et al⁴³. The outcome is in line with the literature results^{44,45}, that anxiety, stress, depression, coping strategies, and catastrophizing may precipitate or prolong both forms of bruxism.

Limitations of the study:

- Possible confounders that could have influenced the results and that were not under control;
- Questionnaire's bias;
- The lack of the analysis of the socio-demographic aspects.

Conclusions

The study provided interesting outcome but also some questions, also considering the intrinsic limitations of the study. The most evident fact during pandemic was the increase of parafunctions and sleep disorders. The trend of symptoms was more variable and complex.

Analysis and interpretation of data was certainly complex, characterized by many variables. Further investigations are required.

The external validity of the study is difficult to define, because of the limitations of the study, such as bias and sampling strategies, the latter limited by pandemic restrictions. However, the most interesting results obtained are in line with the ones of other recent studies on this topic. Such consideration would lead authors and readers to think that the examined sample may effectively reflect the TMD population.

Conflict of Interest

The Authors declare that they have no conflict of interests.

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References

- 1) Torales J, O'Higgins M, Castaldelli-Maia JM, Ventriglio A. The outbreak of COVID-19 coronavirus and its impact on global mental health. *Int J Soc Psychiatry* 2020; 66: 317-320.
- 2) Fagan J, Galea S, Ahern J, Bonner S, Vlahov D. Relationship of self-reported asthma severity and urgent health care utilization to psychological sequelae of the September 11, 2001 terrorist attacks on the World Trade Center among New York City area residents. *Psychosom Med* 2003; 65: 993-996.
- 3) Guerriero RM, Pier DB, de Gusmão CM, Bernson-Leung ME, Maski KP, Urion DK, Waugh JL. Increased pediatric functional neurological symptom disorders after the Boston marathon bombings: a case series. *Pediatr Neurol* 2014; 51: 619-623.
- 4) Lee SM, Kang WS, Cho AR, Kim T, Park JK. Psychological impact of the 2015 MERS outbreak on hospital workers and quarantined hemodialysis patients. *Compr Psychiatry* 2018; 87: 123-127.
- 5) Jeong H, Yim HW, Song YJ, Ki M, Min JA, Cho J, Chae JH. Mental health status of people isolated due to Middle East Respiratory Syndrome. *Epidemiol Health* 2016; 38: e2016048.
- 6) Mowbray H. In Beijing, coronavirus 2019-nCoV has created a siege mentality. *BMJ* 2020; 368: m516.
- 7) Blyth FM, Macfarlane GJ, Nicholas MK. The contribution of psychosocial factors to the development of chronic pain: the key to better outcomes for patients? *Pain* 2007; 129: 8-11.
- 8) Crofford LJ. Chronic pain: where the body meets the brain. *Trans Am Clin Climatol Assoc* 2015; 126: 167-183.
- 9) Reiter S, Eli I, Mahameed M, Emodi-Perlman A, Friedman-Rubin P, Reiter MA, Winocur E. Pain catastrophizing and pain persistence in temporomandibular disorders patients. *Oral Facial Pain Headache* 2018; 32: 309-320.
- 10) Osiewicz M, Lobbezoo F, Ciapała B, Pytko-Polończyk J, Manfredini D. Pain predictors in a population of temporomandibular disorders patients. *J Clin Med* 2020; 9: 452.
- 11) Jivnani HM, Tripathi S, Shanker R, Singh BP, Agrawal KK, Singhal R. A study to determine the prevalence of temporomandibular disorders in a young adult population and its association with psychological and functional occlusal parameters. *J Prosthodont* 2019; 28: e445-e449.
- 12) Almeida-Leite CM, Stuginski-Barbosa J, Conti PCR. How psychosocial and economic impacts of COVID-19 pandemic can interfere on bruxism and temporomandibular disorders? *J Appl Oral Sci* 2020; 28: e20200263.
- 13) Manfredini D, Marini M, Pavan C, Pavan L, Guarda-Nardini L. Psychosocial profiles of painful TMD patients. *J Oral Rehabil* 2009; 36: 193-198.
- 14) De La Torre Canales G, Câmara-Souza MB, Muñoz Lora VR, Guarda-Nardini L, Conti PC, Rodrigues Garcia RM, Del Bel Cury AA, Manfredini D. Prevalence of psychosocial impairment in temporomandibular disorder patients: a systematic review. *J Oral Rehabil* 2018; 45: 881-889.
- 15) Kindler S, Samietz S, Houshmand M, Grabe HJ, Bernhardt O, Biffar R, Kocher T, Meyer G, Völzke H, Metelmann HR, Schwahn C. Depressive and anxiety symptoms as risk factors for temporomandibular joint pain: a prospective cohort study in the general population. *J Pain* 2012; 13: 1188-1197.
- 16) Boscato N, Almeida RC, Koller CD, Presta AA, Goettems ML. Influence of anxiety on temporomandibular disorders: an epidemiological survey with elders and adults in Southern Brazil. *J Oral Rehabil* 2013; 40: 643-649.
- 17) Fillingim RB, Ohrbach R, Greenspan JD, Knott C, Diatchenko L, Dubner R, Bair E, Baraian C, Mack N, Slade GD, Maixner W. Psychological factors associated with development of TMD: the OP-ERA prospective cohort study. *J Pain* 2013; 14: T75-T90.
- 18) Eli I. Psychosocial factors in the etiology, diagnosis and management of temporomandibular disorders. *Alpha Omegan* 2003; 96: 20-23.
- 19) Rollman GB, Gillespie JM. The role of psychosocial factors in temporomandibular disorders. *Curr Rev Pain* 2000; 4: 71-81.
- 20) Carlson CR, Okeson JP, Falace DA, Nitz AJ, Curran SL, Anderson D. Comparison of psychologic and physiologic functioning between patients with masticatory muscle pain and matched controls. *J Orofacial Pain* 1993; 7: 15-22.
- 21) Quartana PJ, Buenaver LF, Edwards RR, Klick B, Haythornthwaite JA, Smith MT. Pain catastrophizing and salivary cortisol responses to laboratory pain testing in temporomandibular disorder and healthy participants. *J Pain* 2010; 11: 186-194.
- 22) Manfredini D, Winocur E, Ahlberg J, Guarda-Nardini L, Lobbezoo F. Psychosocial impairment in temporomandibular disorders patients. RDC/TMD axis II findings from a multicentre study. *J Dent* 2010; 38: 765-772.
- 23) Ferrando M, Andreu Y, Galdon MJ, Dura E, Poveda R, Bagan JV. Psychological variables and temporomandibular disorders: distress, coping, and personality. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod* 2004; 98: 153-160.
- 24) Pallegama RW, Ranasinghe AW, Weerasinghe VS, Sitheequ MA. Anxiety and personality traits in patients with muscle related temporomandibular disorders. *J Oral Rehabil* 2005; 32: 701-707.

- 25) Kindler S, Schwahn C, Terock J, Mksoud M, Bernhardt O, Biffar R, Völzke H, Metelmann HR, Grabe HJ. Alexithymia and temporomandibular joint and facial pain in the general population. *J Oral Rehabil* 2019; 46: 310-320.
- 26) Miglis MG. Autonomic dysfunction in primary sleep disorders. *Sleep Med* 2016; 19: 40-49.
- 27) Polmann H, Domingos FL, Melo G, Stuginski-Barbosa J, Guerra EN, Porporatti AL, Dick BD, Flores-Mir C, De Luca Canto G. Association between sleep bruxism and anxiety symptoms in adults: a systematic review. *J Oral Rehabil* 2019; 46: 482-491.
- 28) Przysłańska A, Jasielska A, Ziarko M, Pobudek-Radzikowska M, Maciejewska-Szaniec Z, Prylińska-Czyżewska A, Wierzbik-Strońska M, Gorajska M, Czajka-Jakubowska A. Psychosocial predictors of bruxism. *Biomed Res Int* 2019; 2019: 2069716.
- 29) Quadri MF, Mahnashi A, Al Almutahhir A, Tubayqi H, Hakami A, Arishi M, Alamir A. Association of awake bruxism with khat, coffee, tobacco, and stress among Jazan University Students. *Int J Dent* 2015; 2015: 842096.
- 30) Lambert CA, Sanders A, Wilder RS, Slade GD, Van Uum S, Russell E, Koren G, Maixner W. Chronic HPA axis response to stress in temporomandibular disorder. *J Dent Hyg* 2013; 87: 73-81.
- 31) Gameiro GH, Andrade AS, Nouer DF, Veiga MC-FA. How may stressful experiences contribute to the development of temporomandibular disorders. *Clin Oral Investig* 2006; 10: 261-268.
- 32) Staniszewski K, Lygre H, Bifulco E, Kvinnsland S, Willassen L, Helgeland E, Berge T, Rosén A. Temporomandibular Disorders related to stress and HPA-axis regulation. *Pain Res Manag* 2018; 2018: 7020751.
- 33) Zhang Y, Ren R, Sanford LD, Yang L, Zhou J, Zhang J, Wing YK, Shi J, Lu L, Tang X. Sleep in posttraumatic stress disorder: A systematic review and meta-analysis of polysomnographic findings. *Sleep Med Rev* 2019; 48: 101210.
- 34) Horenstein A, Morrison AS, Goldin P, Ten Brink M, Gross JJ, Heimberg RG. Sleep quality and treatment of social anxiety disorder. *Anxiety Stress Coping* 2019; 32: 387-398.
- 35) Tosato JDP, Caria PHF, Gomes CAFDP, Berzin F, Politti F, Gonzalez TDO, Biasotto-Gonzalez DA. Correlation of stress and muscle activity of patients with different degrees of temporomandibular disorder. *J Phys Ther Sci* 2015; 27: 1227-1231.
- 36) Lee EH. Review of the psychometric evidence of the perceived stress scale. *Asian Nursing Research* 2012; 6: 121-7.
- 37) Schiffman E, Ohrbach R, Truelove E, Look J, Anderson G, Goulet JP, List T, Svensson P, Gonzalez Y, Lobbezoo F, Michelotti A, Brooks SL, Ceusters W, Drangsholt M, Ettl D, Gaul C, Goldberg LJ, Haythornthwaite JA, Hollender L, Jensen R, John MT, De Laat A, de Leeuw R, Maixner W, van der Meulen M, Murray GM, Nixdorf DR, Palla S, Petersson A, Pionchon P, Smith B, Visscher CM, Zakrzewska J, Dworkin SF. Diagnostic Criteria for Temporomandibular Disorders (DC/TMD) for Clinical and Research Applications: Recommendations of the International RDC/TMD Consortium Network* and Orofacial Pain Special Interest Group. *J Oral Facial Pain Headache* 2014; 28: 6-27.
- 38) Wu Y, Xiong X, Fang X, Sun W, Yi Y, Liu J, Wang J. Psychological status of TMD patients, orthodontic patients and the general population during the COVID-19 pandemic. *Psychol Health Med* 2021; 26: 62-74.
- 39) Saccomanno S, Bernabei M, Scoppa F, Pirino A, Mastrapasqua R, Visco MA. Coronavirus lockdown as a major life stressor: does it affect TMD symptoms? *Int J Environ Res Public Health* 2020; 17: 8907.
- 40) Asquini G, Bianchi AE, Borromeo G, Locatelli M, Falla D. The impact of Covid-19-related distress on general health, oral behaviour, psychosocial features, disability and pain intensity in a cohort of Italian patients with temporomandibular disorders. *PLoS One* 2021; 16: e0245999.
- 41) Wang C, Pan R, Wan X, Tan Y, Xu L, McIntyre RS, Choo FN, Tran B, Ho RC, Sharma VK, Ho C. A longitudinal study on the mental health of general population during the COVID-19 epidemic in China. *Brain Behav Immun* 2020; 87: 40-48.
- 42) Fu W, Wang C, Zou L, Guo Y, Lu Z, Yan S, Mao J. Psychological health, sleep quality, and coping styles to stress facing the COVID-19 in Wuhan, China. *Transl Psychiatry* 2020; 10: 225.
- 43) Emodi-Perlman A, Eli I, Smardz J, Uziel N, Wieckiewicz G, Gilon E, Grychowska N, Wieckiewicz M. Temporomandibular disorders and bruxism outbreak as a possible factor of orofacial pain worsening during the COVID-19 Pandemic--concomitant research in two countries. *J Clin Med* 2020; 9: 3250.
- 44) Winocur E, Messer T, Eli I, Emodi-Perlman A, Kedem R, Reiter S, Friedman-Rubin P. Awake and sleep bruxism among israeli adolescents. *Front Neurol* 2019; 10: 443.
- 45) Manfredini D, Colonna A, Bracci A, Lobbezoo F. Bruxism: a summary of current knowledge on aetiology, assessment and management. *Oral Surg* 2019; 13: 358-370.