BJOS
Brazilian Journal of Oral Sciences

Original Article

Volume 22
2023
e237397

Temporomandibular disorders and associated comorbidities among brazilian dental students during COVID-19

Francyéllen Teixeira da Silva[1], Jessica Klöckner Knorst[1], Lucas Machado Maracci[1], Vilmar Antônio Ferrazzo[2], Gabriela Salatino Liedke[2], Tatiana Bernardon Silva[3], Mariana Marquezan[2*]

[1] Federal University of Santa Maria, School of Dentistry, Santa Maria, RS, Brazil.

[2] Federal University of Santa Maria, School of Dentistry, Department of Stomatology, Santa Maria, RS, Brazil.

[3] Federal University of Santa Maria, School of Dentistry, Department of Restorative Dentistry, Santa Maria, RS, Brazil.

Corresponding author:
Mariana Marquezan
Av. Roraima, 1000. Prédio 26F. Cidade Universitária. Camobi. 97105-900. Santa Maria, Rio Grande do Sul, Brazil.
mariana.marquezan@ufsm.br

Editor: Dr. Altair A. Del Bel Cury

Received: October 27, 2021
Accepted: October 9, 2022

Aim: This study aimed to assess the prevalence of temporomandibular disorders (TMD) and psychosocial comorbidities in undergraduate dental students in a southern Brazilian university, during the COVID-19 pandemic. Also, it aimed to verify the association between psychosocial factors and TMD. **Methods:** Fonseca Anamnestic Index, Depression Anxiety Stress Scale (DASS-21), a socioeconomic questionnaire, and questions about academic performance and social distancing were applied. Poisson regression analysis was used to assess the association of predictive variables with TMD. **Results:** The prevalence of TMD was found to be 82.4%, and more than half of the students had some degree of stress, anxiety, and depression. Students who had symptoms of stress (RR 1.11; 95% CI 1.04-1.19), anxiety (RR 1.19; 95% CI 1.12-1.27) and reported academic performance worsening (RR 1.12; 95% CI 1.07-1.19) had higher TMD scores. **Conclusion:** The findings suggest that TMD was highly prevalent among dental students at a federal university in southern Brazil during the pandemic, being associated with high levels of stress, anxiety, poor academic performance, and greater social distancing.

Keywords: COVID-19. Temporomandibular joint disorders. Depression. Anxiety.

Introduction

Temporomandibular disorders (TMD) encompass a group of multifactorial conditions that cause pain and/or loss of function of the masticatory muscles, temporomandibular joint (TMJ), and associated structures[1]. Scientific evidence indicate a relationship between TMD and psychosocial aspects, such as stress, anxiety and depression[2,3], being the last both highly associated with painful TMD[3].

Undergraduate students have high stress levels and feel greater distress than the general population, which leads to a high prevalence of mental health problems and greater risk for psychopathological problems[4]. Intense pace of life, increased hours of study, and geographical distance from family and friends might provoke feelings such as disappointment, irritability, concern, and impatience[5]. In addition, several studies have shown that stress levels among dental students are significantly higher when compared to students from other undergraduate programs[6]. This may be related to a complex curriculum that involves theoretical learning, clinical practice, and patient care[7], being a possible reason why most dental students report symptoms that are already identified as risk factors for TMD and pain conditions[8].

On March 11, 2020, the World Health Organization (WHO) declared the COVID-19 pandemic, caused by the SARS-CoV-2 virus[9]. Due to its high contagion, in the absence of mass vaccination the most effective means of controlling virus propagation was practicing social distancing[10]. Therefore, factors that generate stress may be increased during the COVID-19 pandemic. In this sense, the suspension of in-person activities, such as classes, for an indefinite period, as well as the excess of negative information may trigger important psychological disorders[11]. In addition, the adoption of a remote educational model can lead to several access difficulties that can also be considered stressful and generate anxiety in this period[12].

The stress present in a daily routine during a pandemic might cause damage to health, that is, it can contribute to the development of TMD, depression, anxiety, and stress. Thus, this study aimed to verify the prevalence of these pathologies in undergraduate dental students at Federal University of Santa Maria (UFSM), as well as to analyze the association between TMD and the presence of comorbidities, academic performance, and social distancing, during the COVID-19 pandemic. The conceptual hypotheses were: 1) the prevalence of TMD is high among dental students at UFSM; 2) the highest occurrence of TMD is associated with high levels of stress, anxiety, and depression; 3) the highest occurrence of TMD is associated with worse academic performance and greater social distancing.

Materials and Methods

This is a cross-sectional observational study carried out on dental students in the city of Santa Maria, southern Brazil. Federal University of Santa Maria is a Higher Education Institution located in Santa Maria, in which 25,951 students are enrolled. It has a teaching staff composed of 2,020 teachers and offers 266 undergraduate programs. In March 2020, in-person classes were suspended due to the beginning of the COVID-19 pandemic in Brazil and were replaced by remote education until this

date. All 343 students enrolled at the Dentistry undergraduate program were invited to participate in this study. The volunteer participants filled out a digital questionnaire on Google Forms platform. Data collection was carried out in the period between August 11 and November 20, 2020, when the questionnaire was available on Google Forms. Students were invited to participate in the survey via social networks, email, and WhatsApp messaging application.

The sample size was calculated considering the following parameters: 5% sampling error, 95% confidence interval (CI), finite population of students enrolled in the UFSM Dentistry undergraduate program (estimated 350 students), and the expected prevalence of TMD (50%). Adding 20% for possible losses, the minimum sample size required was 221 individuals. Prevalence value of 50% was used when the prevalence of the phenomenon in question was unknown in some context, for example. The value of 50% gave the biggest possible size of the necessary sample[13].

The questionnaire was composed of the Fonseca Anamnestic Index (FAI)[14]; Depression, Anxiety and Stress Scale (DASS-21)[15]; questions regarding academic performance and social distancing during the COVID-19 pandemic; and a demographic and socioeconomic questionnaire.

The FAI[14] was used to assess the presence of TMD. This index consists of 10 questions: 1) "Do you have difficulty opening your mouth wide?"; 2) "Do you have difficulty moving your jaw to the sides?"; 3) "Do you feel fatigue or muscle pain when you chew?"; 4) "Do you have frequent headaches?"; 5) "Do you have neck pain or a stiff neck?"; 6) "Do you have ear aches or pain in that area (temporomandibular joint)?"; 7) "Have you ever noticed any noise in your temporomandibular joint while chewing or opening your mouth?"; 8) "Do you have any habits such as clenching or grinding your teeth?"; 9) "Do you feel that your teeth do not come together well?"; 10) "Do you consider yourself a tense (nervous) person?". Each question has three possible answers: "yes", "no", or "sometimes", which are assigned values of "10", "0", and "5", respectively. The total sum of these values classifies the severity of TMD: "absence of TMD" (0-15), "mild TMD" (20-40), "moderate TMD" (45-65), and "severe TMD" (70-100). This index is one of the few instruments available in the Portuguese language that is able to assess TMD severity. Despite being very sensitive to identifying TMD patients, it has low specificity in identifying non-TMD individuals, being recommended for screening of patients[16]. In the present study, the total scores of the TMD questionnaire were used. Thus, the higher the questionnaire score, the greater the severity of TMD.

Stress, anxiety, and depression levels were assessed using the reduced version of the Depression, Anxiety and Stress Scale (DASS-21), validated for the Brazilian population[15,17]. It consists of three subscales of seven items each, which aim to assess depression, anxiety, and stress experienced by the individual in the past seven days. The answers to each question are reported on a Likert scale, ranging from "strongly disagree" (0) to "strongly agree" (3). The overall scores for the three components are calculated by the sum of the scores of the 7 relevant items multiplied by two. The scoring ranges correspond to the levels of symptoms, ranging from "normal" to "extremely severe"[15]. In the analysis, the presence of stress, anxiety and depression

was dichotomized into "absent" (normal) or "present" (scores considered medium, moderate, severe, or extremely severe).

Regarding academic performance, a question about self-perceived performance was used: "During the pandemic, do you consider that your academic performance: 1) has improved, 2) has remained the same, 3) has worsened". In the analysis, the variable was dichotomized into "remained the same/improved" (scores 1 and 2) and "has worsened" (score 3). The attitude towards social distancing during the pandemic was also assessed: "Regarding the social distancing that is being guided by health authorities, that is, staying at home and avoiding contact with other people, how much do you think you are managing to do?", with the following possible answers: 1) Practically isolated; 2) Isolated enough; 3) More or less isolated; 4) Little isolated; 5) Very little isolated[18]. For the analysis, the variable was categorized as very isolated (scores 1 and 2) and more or less/little/very little isolated (scores 3, 4 and 5).

The demographic and socioeconomic variables assessed were gender (female and male), age, skin color (white and non-white), income, and family structure (living alone or with other people). The age was collected in years and later dichotomized according to the median into ≤21 years or >21 years. The monthly income was collected in Real (Brazilian currency; 1.00 US dollar corresponds to 5.13 reais) and later dichotomized by the median of ≤5000 or >5000 reais per month. The period (semester) in which the student was enrolled in was also considered for the analysis.

Data analysis was performed using STATA 14.0 program (StataCorp. 2014. Stata Statistical Software: Release 14.0. College Station, TX: StataCorp LP). A descriptive analysis of the demographic, behavioral, and clinical characteristics of the sample was carried out. Unadjusted and adjusted Poisson regression analysis was used to assess the association between the predictor variables and the total TMD scores. The predictor variables that presented a p-value <0.20 in the unadjusted analysis were considered in the adjusted model. The results are presented as a Rate Ratio (RR) and a 95% confidence interval (95% CI). Poisson regression analysis was used in our study for modeling count data, as recommended by previous literature for this approach[19,20].

All procedures were in accordance with the ethical standards. The study protocol was approved by the Institutional Ethics Committee of Federal University of Santa Maria (date of approval: August 2020; approval number: 34721820.0.0000.5346). All participants signed an informed consent form.

Results

From 343 students enrolled in the Dentistry undergraduate program at UFSM in August 2020, 222 participated in this study (response rate of 64.72%). The sample included students from all semesters, with an average of 22 years of age (standard deviation [SD] 2.9). Among the assessed individuals, 74.3% were female and 82.4% were white. Regarding the socioeconomic level, 53.3% belonged to families whose monthly income was up to 5000 reais. The suggested prevalence of TMD was found to be 82.4%, and the mean score was 37.1 (SD 18.8). Most students had some degree of stress, anxiety, and depression (57.5%, 54.2%, and 58.6%, respectively) (Table 1).

Table 1. Distribution of demographic, socioeconomic, and clinical characteristics of students in the Dentistry undergraduate program at UFSM (n = 222).

Variables	N*	%
Demographic and Socioeconomic variables		
Gender		
Female	165	74.3
Male	57	25.7
Age		
≤ 21 years	116	52.3
> 21 years	106	47.7
Skin color		
White	183	82.4
Non-white	39	17.6
Monthly income (in Reais)[a]		
≤ 5000	116	52.3
> 5000	106	47.7
Dwelling situation		
Living alone	25	11.3
Living with other people	197	88.7
Semester of dental course		
1^{st} – 5^{th}	111	50.0
6^{th} – 10^{th}	111	50.0
Behavioral and psychosocial characteristics		
Social distancing during the COVID-19 pandemic		
Very isolated	141	63.5
More or less/little/very little isolated	81	36.5
How do you consider your academic performance before the COVID-19 pandemic?		
Same/Better	55	24.8
Worse	167	75.2
Stress		
Absent	95	42.8
Present	197	57.2
Anxiety		
Absent	101	45.5
Present	121	54.5
Depression		
Absent	92	41.4
Present	130	58.6

Continue

Continuation		
TMD classification		
Absent	39	17.6
Mild	92	41.4
Moderate	78	35.1
Severe	13	5.9
TMD score (mean [SD])	37.1 (18.8)	

*Values less than 222 are due to missing data; [a]1 USD corresponds to 5.60 reais. SD, standard deviation; TMD, temporomandibular disorder.

Table 2 shows the unadjusted and adjusted association between the predictor variables and the total TMD scores during the COVID-19 pandemic. In the unadjusted analysis, sex, age, social distancing, academic performance during the pandemic, stress, anxiety, and depression were associated with the total TMD scores ($p < 0.05$). In the adjusted analysis, only depression lost association with TMD. Male individuals had TMD scores 18% lower (RR 0.82; 95% CI 0.77-0.86) than females. In addition, individuals over the age of 21 presented about 10% higher degrees of TMD (RR 1.10; CI 95% 1.05-1.15) than their counterparts. Considering behavioral characteristics, students who performed low social distancing presented TMD scores 16% lower than individuals that performed high isolation (RR 0.84; 95% CI 0.80-0.88). Dental students who had a worse academic performance showed higher TMD scores (RR 1.12; 95% CI 1.07-1.19). Considering the psychosocial characteristics, the presence of stress (RR 1.11; 95% CI 1.04-1.19) and anxiety (RR 1.19; 95% CI 1.12-1.27) symptoms were responsible for 11% and 19% higher scores of TMD among students during the pandemic, respectively.

Table 2. Unadjusted and adjusted association between the predictor variables and the total TMD scores, determined by Poisson regression.

Variables	Unadjusted RR (CI 95%)	p-value	Adjusted RR (CI 95%)	p-value
Demographic and socioeconomic variables				
Gender		<0.01		<0.01
Female	1.00		1.00	
Male	0.76 (0.72-0.80)		0.82 (0.77-0.86)	
Age		<0.01		<0.01
≤ 21 years	1,00		1.00	
> 21 years	1.06 (1.02-1.11)		1.10 (1.05-1.15)	
Skin color		0.787	-	
White	1,00			
Non-white	1.02 (0.85-1.22)			

Continue

Continuation				
Monthly income (in Reais)		0.325	-	
≤ 5000	1.00			
> 5000	1.06 (0.93-1.22)			
Dwelling situation		0.394	-	
Living alone	1.00			
Living with other people	1.09 (0.88-1.36)			
Semester of dental course		0.901	-	
1st – 5th	1.00			
6th – 10th	1.00 (0.88-1.15)			
Behavioral and psychosocial characteristics				
Social distancing		<0.05		<0.01
Very isolated	1.00		1.00	
More or less/little/very little isolated	0.83 (0.72-0.96)		0.84 (0.80-0.88)	
Academic performance		<0.01		<0.01
Same/Better	1.00		1.00	
Worse	1.15 (1.09-1.21)		1.12 (1.07-1.19)	
Stress		<0.01		<0.01
Absent	1.00		1.00	
Present	1.34 (1.28-1.40)		1.11 (1.04-1.19)	
Anxiety		<0.01		<0.01
Absent	1.00		1.00	
Present	1.35 (1.29-1.41)		1.19 (1.12-1.27)	
Depression		<0.01		0.098
Absent	1.00		1.00	
Present	1.28 (1.23-1.34)		1.05 (0.99-1.12)	

*TMD, temporomandibular disorder; RR = rate ratio; CI = confidence interval; a1 USD corresponds to 5.60 reais.

Discussion

During a pandemic, many studies on the biological risk of the disease or on the pathogen are developed, but it is also necessary to pay attention to psychosocial aspects. These generally tend to be neglected and can cause several disorders[21,22], such as stress, anxiety, and depression, which can lead to the development of TMD[11]. In addition, patients with TMD have a higher level of anxiety and depression than the general population[23]. Thus, the findings of this study partially suggest the confirmation of its conceptual hypothesis, because in the unadjusted analysis TMD was associated with stress, anxiety, depression, and low academic performance, whereas in the adjusted analysis, depression lost association with TMD.

The findings suggest that the prevalence of TMD in undergraduate dental students at UFSM during the COVID-19 pandemic was high (82.4%), higher than previous studies with undergraduate students that also used the FAI to assess prevalence

of TMD, ranging between 53.2% and 66.3%[24-26]. In a study carried out in Saudi Arabia that also used the FAI, the prevalence of TMD in dental students before the COVID-19 outbreak was 49.9% and a positive association was reported between the level of perceived stress and anxiety and tone of both masseters[27]. During the pandemic, a cross-sectional study[28] found the prevalence of TMD to be 77.5%, corroborating our findings. On the other hand, another recent study[29] found the prevalence of symptoms of TMD to be only 27.4%, which can be partially explained by the low percentage of individuals that were performing greater social isolation in the sample (21.2%).

Based on the findings of this study, this high prevalence of TMD might be an effect of stressors caused by the pandemic, which intensify the symptoms of bruxism and TMD[11,30], as well as the difficulty of access and consequent learning during remote education[31]. In addition, students who reported worse academic performance had higher TMD scores, which suggest the confirmation of the hypothesis raised. Moreover, it was observed that individuals who performed greater social distancing had higher levels of stress and, consequently, probable higher TMD scores. During the pandemic, social distancing is necessary to mitigate contamination[32], although it is associated with negative psychological effects, such as post-traumatic stress, confusion, and anger, mainly due to prolonged isolation, frustration, boredom, and fear of infection[33]. Social isolation also leads to a decrease in the practice of physical activity; those who exercised during the pandemic had 13% lower levels of stress[34]. Therefore, the stress levels during the pandemic influence the development of TMD (or its worsening in those individuals who already had the disorder)[28] and might also lead to greater depressive and painful symptoms[35].

Some of the main side effects caused by the COVID-19 outbreak are high anxiety and depression levels, due to great exposure to negative news, fear of contagion, unemployment, and the loss of loved ones[36].More than half of the study sample self-reported stress, anxiety, and depression. Two metanalyses found divergent prevalences of anxiety[37] and depression[38] on dental students during the post-pandemic period, ranging from 26-45% and 26-49%, respectively. Regarding Brazilian dental students, a cross-sectional study found that 31.3%, 29.6%, and 24.2% of students had mild, moderate, and severe anxiety symptoms, respectively, totalizing 85.1% of the study sample[39]. Before the COVID-19 outbreak, the prevalence of anxiety and depression ranged from 24% to 50.5%[27,40] on dental students, similar to the findings after the pandemic, possibly explained by the extensive curriculum of this undergraduate program, involving theoretical learning, clinical practice, and patient care[7].

Considering the gender of the students, females presented higher TMD scores. Studies also point out that the occurrence of TMD is twice as common among women[41], and that psychological overload during the pandemic is greater in female individuals[42]. Also, individuals who were over 21 years of age presented higher TMD scores. This age group is closer to graduation, with additional stressors such as concerns about the future and the labor market[42]. The literature considers that the peak of development of TMD occurs between 20 and 40 years of age[43], which corroborates the findings of the present study.

This is the first study to assess the impact of the COVID-19 pandemic on the prevalence of TMD among undergraduate dental students in the south of Brazil. In addition, this study used validated instruments for the diagnosis of TMD and comorbidities. The Depression, Anxiety and Stress Scale questionnaire is a method of easy reproducibility and data collection without the examiner's influence. Another positive aspect is its representative sample of undergraduate dental students at UFSM, which allowed the analysis and extrapolation of findings.

Some limitations of this study must be recognized. The fact that it was a cross-sectional observational study did not allow any causal relations. Therefore, future studies are suggested to assess causality, following participants until a change in the pandemic scenario occurs. Besides, the study used a digital questionnaire, thus no clinical examinations were performed and therefore the origin of the TMD (myogenous or arthrogenous) could not be assessed. Lastly, even though more complete instruments for the diagnosis of TMD are available (e. g., the Diagnostic Criteria for Temporomandibular Disorders - DC/TMD)[44], the FAI is a very sensitive index in identifying TMD patients (despite its low specificity in identifying patients who do not have TMD), recommended for patient screening. Furthermore, this instrument has already been used in previous studies that evaluated TMD[45-47].

Sociodemographic variables should also be considered when interpreting the results. Even though all students were invited to participate, some biased answers toward those who were concerned with their oral health or who wanted to participate in research projects might be seen. Participants' age is another relevant issue. Since this study evaluated undergraduate students, other studies might observe a different impact of the pandemic in older subjects. In addition, questions about academic performance and social distancing were created for this study, and their results reflect the students' self-report. However, the findings are extremely relevant to the academic environment. This study can be taken as a warning to other educational institutions, in view of its findings. Mental health care should be emphasized by the University, based on activities that encourage self-care and dialogue strategies with students. This is essential because, as demonstrated in this study, students are stressed, anxious, and with a high prevalence of TMD. As a result of these problems, the performance and development of daily activities are affected.

In conclusion, the findings of this study suggest a high prevalence of TMD (82.4%) among dental students at UFSM during the COVID-19 pandemic. TMD was associated with high levels of stress, anxiety, poor academic performance, and greater social distancing. Furthermore, women and individuals over the age of 21 were more likely to have higher TMD scores.

Acknowledgements

The authors wish to thank the undergraduate students who helped with data collection.

Conflicts of interest

The authors report no conflict of interest.

Funding

None.

Data availability

The authors declare that data is unavailable to access.

Author contribution

FRANCYÉLLEN TEIXEIRA DA SILVA: Conception of the work, Original draft of the work, Final approval of the version to be published, Agreement to be accountable for all aspects of the work; **JESSICA KLÖCKNER KNORST**: Analysis of data for the work, Drafting the work, Final approval of the version to be published, Agreement to be accountable for all aspects of the work; **LUCAS MACHADO MARACCI:** Interpretation of data, Drafting the work, Final approval of the version to be published, Agreement to be accountable for all aspects of the work; **VILMAR ANTÔNIO FERRAZZO:** Interpretation of data, Critical review, Final approval of the version to be published, Agreement to be accountable for all aspects of the work; **GABRIELA SALATINO LIEDKE:** Design of the work, Critical Review, Final approval of the version to be published, Agreement to be accountable for all aspects of the work; **TATIANA BERNARDON SILVA:** Acquisition of data, Critical Review, Final approval of the version to be published, Agreement to be accountable for all aspects of the work **MARIANA MARQUEZAN:** Design of the work, Critical review, Final approval of the version to be published, Agreement to be accountable for all aspects of the work.

All authors have made substantial contributions to the conception or design of the work, actively participated in the manuscript's findings, and revised and approved the final version.

References

1. de Leeuw R, Klasser GD. Orofacial pain: Guidelines for Assessment, Diagnosis, and Management. 6th ed. Chicago: Quintessence Publishing; 2018.

2. Manfredini D, Lombardo L, Siciliani G. Temporomandibular disorders and dental occlusion. A systematic review of association studies: end of an era? J Oral Rehabil. 2017 Nov;44(11):908-23. doi: 10.1111/joor.12531.

3. De La Torre Canales G, Câmara-Souza MB, Muñoz Lora VR, Guarda-Nardini L, Conti PC, Rodrigues Garcia RM, et al. Prevalence of psychosocial impairment in temporomandibular disorder patients: a systematic review. J Oral Rehabil. 2018 Nov;45(11):881-9. doi: 10.1111/joor.12685.

4. Stallman, HM. Psychological distress in university students: A comparison with general population data. Aust Psychol Soc. 2010 March;45(4):249-57. doi: 10.1080/00050067.2010.482109.

5. Chatterjee S, Saha I, Mukhopadhyay S, Misra R, Chakraborty A, Bhattacharya A. Depression among nursing students in a Indian government college. Br J Nurs. 2014;23(6):316-20. doi: 10.12968/bjon.2014.23.6.316.

6. Owczarek JE, Lion KM, Malgorzata R. Manifestation of stress and anxiety in the stomatognathic system of undergraduate dentistry students. J Int Med Res. 2020 Feb;48(2):300060519889487. doi: 10.1177/0300060519889487.

7. Dyrbye LN, Thomas MR, Shanafelt TD. Systematic review of depression, anxiety, and other indicators of psychological distress among U.S. and Canadian medical students. Acad Med. 2006 Apr;81(4):354-73. doi: 10.1097/00001888-200604000-00009.

8. Lövgren A, Österlund C, Ilgunas A, Lampa E, Hellström F. A high prevalence of TMD is related to somatic awareness and pain intensity among healthy dental students. Acta Odontol Scand. 2018 Aug;76(6):387-93. doi: 10.1080/00016357.2018.1440322.

9. World Health Organization. WHO Director-General's opening remarks at the media briefing on COVID-19. 2020 Mar 11 [cited 2021 Mar 10]. Available from: https://www.who.int/director-general/speeches/detail/who-director-general-s-opening-remarks-at-the-media-briefing-on-covid-19---11-march-2020.

10. Vellingiri B, Jayaramayya K, Iyer M, Narayanasamy A, Govindasamy V, Giridharan B, et al. COVID-19: a promising cure for the global panic. Sci Total Environ. 2020 Jul 10;725:138277. doi: 10.1016/j.scitotenv.2020.138277.

11. Emodi-Perlman A, Eli I, Smardez J, Uziel N, Wieckiewicz G, Gilon E, et al. Temporomandibular disorders and bruxism outbreak as a possible factor of orofacial pain worsening during the COVID-19. J Clin Med. 2020 Oct;9(10):3250. doi: 10.3390/jcm9103250.

12. Appenzeller S, Menezes FH, Santos GG, Padilha RF, Graça HS, Bragança JF. New times, new challenges: strategies to ensure equal access to emergency remote education. Rev bras educ med. 2020;44(Suppl 01):155. doi: 10.1590/1981-5271v44.supl.1-20200420.

13. Antunes JLF, Peres MA. [Fundamentals of Dentistry: Oral Health Epidemiology]. São Paulo, Brazil: Santos; 2006. Portuguese.

14. Fonseca DM, Bonfante G, Valle AL, Freitas SFT. [Diagnosis of the craniomandibular disfunction through anamnesis]. RGO. 1994 Jan-Feb;42(1):23-8. Portuguese.

15. Vignola RC, Tucci AM. Adaptation and validation of the depression, anxiety and stress scale (DASS) to Brazilian Portuguese. J Affect Disord. 2014 Feb;155:104-9. doi: 10.1016/j.jad.2013.10.031.

16. Stasiak G, Maracci LM, Chami VO, Pereira DD, Tomazoni F, Silva TB. TMD diagnosis: Sensitivity and specificity of the Fonseca Anamnestic Index. Cranio. 2020 Oct 27;1-5. doi: 10.1080/08869634.2020.1839724.

17. Silva HA, Passos MH, Oliveira VM, Palmeira AC, Pitangui AC, Araújo RC. Short version of the Depression Anxiety Stress Scale-21: is it valid for Brazilian adolescents? Einstein (Sao Paulo). 2016 Oct-Dec;14(4):486-93. doi: 10.1590/S1679-45082016AO3732.

18. Hallal PC, Horta BL, Barros AJD, Dellagostin OA, Hartwig FP, Pellanda LC, et al. Trends in the prevalence of COVID-19 infection in Rio Grande do Sul, Brazil: repeated serological surveys. Cien Saude Colet. 2020 Jun;25 (suppl 1):2395-401. doi: 10.1590/1413-81232020256.1.09632020.

19. Hutchinson MK, Holtman MC. Analysis of count data using poisson regression. Res Nurs Health. 2005 Oct;28(5):408-18. doi: 10.1002/nur.20093.

20. Coxe S, West SG, Aiken LS. The analysis of count data: a gentle introduction to poisson regression and its alternatives. J Pers Assess. 2009 Mar;91(2):121-36. doi: 10.1080/00223890802634175.

21. Ornell F, Schuch JB, Sordi AO, Kessler FHP. "Pandemic fear" and COVID-19: mental health burden and strategies. Braz J Psychiatry. 2020 Apr;42(3):232-5. doi: 10.1590/1516-4446-2020-0008.

22. Tucci V, Moukaddam N, Meadows J, Shah S, Galwankar SC, Kapur GB. The Forgotten Plague: Psychiatric Manifestations of Ebola, Zika, and Emerging Infectious Diseases. J Glob Infect Dis. Oct-Dec 2017;9(4):151-6. doi: 10.4103/jgid.jgid_66_17.

23. Wu Y, Xiong X, Fang X, Sun W, Yi Y, Liu J, et al. Psychological status of TMD patients, orthodontic patients and the general population during the COVID-19 pandemic. Psychol Health Med. 2021 Jan;26(1):62-74. doi: 10.1080/13548506.2020.1858489.

24. Nomura K, Vitti M, Oliveira AS, Chaves TC, Semprini M, Siéssere S, et al. Use of the Fonseca's Questionnaire to Assess the Prevalence and Severity of Temporomandibular Disorders in Brazilian Dental Undergraduates. Braz Dent J. 2007;18(2):163-7. doi: 10.1590/s0103-64402007000200015.

25. Bezerra PBN, Ribeiro AIAM, Farias ABLF, Farias ABL, Fontes LBC, Nascimento SR, et al. Prevalence of temporomandibular joint dysfunction and different levels of anxiety among college students. Rev Dor. 2012 Sept;13(3)235-42. doi: 10.1590/S1806-00132012000300008.

26. Pinto RGS, Leite WMA, Sampaio LS, Sanchez MO. Association between temporomandibular signs and symptoms and depression in undergraduate students: descriptive study. Rev Dor. 2017 Jul-Sep;18(3):217-24. doi: 10.5935/1806-0013.20170105.

27. Alahmary AW. Association of temporomandibular disorder symptoms with anxiety and depression in saudi dental students. Open Access Maced J Med Sci. 2019 Dec;7(23):4116-9. doi: 10.3889/oamjms.2019.746.

28. Gaş, Özsoy HE, Aydın KC. The association between sleep quality, depression, anxiety and stress levels, and temporomandibular joint disorders among Turkish dental students during the COVID-19 pandemic. Cranio. 2021 Feb 5;1-6. doi: 10.1080/08869634.2021.1883364.

29. De Medeiros RA, Vieira DL, Da Silva EVF, Rezende LVML, Dos Santos RW, Tabata LF. Prevalence of symptoms of temporomandibular disorders, oral behaviors, anxiety, and depression in Dentistry students during the period of social isolation due to COVID-19. J Appl Oral Sci. 2020 Nov;28:e20200445. doi: 10.1590/1678-7757-2020-0445.

30. Maia BR, Dias PC. [Anxiety, depression and stress in university students: the impact of COVID-19]. Estud psicol (Campinas). 2020;37:1-8. Portuguese. doi: 10.1590/1982-0275202037e200067.

31. Castioni R, Melo AAS, Nascimento PM, Ramos DL. [Brazilian federal universities in the Covid-19 pandemic: student internet access and emergency remote Teaching]. Ensaio: aval pol públ Educ; 2021 Apr-Jun;29:399-419. Portuguese. doi: 10.1590/s0104-40362021002903108.

32. Costa JA, Silveira JA, Santos SCM, Nogueira PP. [Cardiovascular Implications in Covid-19 Infected Patients and the Importance of Social Isolation to Reduce Disease Spread]. Arq Bras Cardiol. 2020 May;114(5):834-8. Portuguese. doi: 10.36660/abc.20200243.

33. Brooks SK, Webster RK, Smith LE, Woodland L, Wessely S, Greenberg N, et al. The psychological impact of quarantine and how to reduce it: rapid review of the evidence. Lancet. 2020 Feb;395(10227):912-20. doi: 10.1016/S0140-6736(20)30460-8.

34. Bezerra ACV, da Silva CEM, Soares FRG, da Silva JAM. Factors associated with people's behavior in social isolation during the COVID-19 pandemic. Cienc Saude Colet. 2020 Jun;25(Supl.1):2411-21. doi: 10.1590/1413-81232020256.1.10792020.

35. Saccomano 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 Nov;17(23):8907. doi: 10.3390/ijerph17238907.

36. Wieckiewicz M, Danel D, Pondel M, Smardz J, Martynowicz H, Wieczorek T, et al. Identification of risk groups for mental disorders, headache and oral behaviors in adults during the COVID-19 pandemic. Sci Rep. 2021 May;11(1):10964. doi: 10.1038/s41598-021-90566-z.

37. Santabarbara J, Idoiaga N, Ozamiz-Etxebarria N, Bueno-Notivol J. Prevalence of Anxiety in Dental Students during the COVID-19 Outbreak: A Meta-Analysis. Int J Environ Res Public Health. 2021 Oct 19;18(20):10978. doi: 10.3390/ijerph182010978.

38. Santabárbara J, Ozamiz-Etxebarria N, Idoiaga N, Olaya B, Bueno-Novitol J. Meta-Analysis of Prevalence of Depression in Dental Students during COVID-19 Pandemic. Medicina (Kaunas). 2021 Nov;57(11):1278. doi: 10.3390/medicina57111278.

39. Fernandez MS, Vieira IS, da Silva NRJ, Cardoso TA, Bielavski CH, Rakovski C, et al. Anxiety symptoms and alcohol abuse during the COVID-19 pandemic: A cross-sectional study with Brazilian dental undergraduate students. J Dent Educ. 2021 Nov;85(11):1739-48. doi: 10.1002/jdd.12742.

40. Stormon N, Ford PJ, Kisely S, Bartle E, Eley DS. Depression, anxiety and stress in a cohort of Australian dentistry students. Eur J Dent Educ. 2019 Nov;23(4):507-14. doi: 10.1111/eje.12459.

41. Bueno CH, Pereira DD, Pattussi MP, Grossi PK, Grossi ML. Gender differences in temporomandibular disorders in adult populational studies: A systematic review and meta-analysis. J Oral Rehabil. 2018 Sep;45(9):720-9. doi: 10.1111/joor.12661.

42. Barros MBA, Lima MG, Malta DC, Szwarcwald CL, Azevedo RCS, Romero D, et al. [Report of sadness/depression, nervousness/anxiety and sleep problems in the Brazilian adult population during the COVID-19 pandemic]. Epidemiol Serv Saude. 2020;29(4). Portuquese. doi: 10.1590/S1679-49742020000400018.

43. Manfredini D, Guarda-Nardini L, Winocur E, Piccotti F, Ahlberg J, Lobbezoo F. Research diagnostic criteria for temporomandibular disorders: a systematic review of axis I epidemiologic findings. Oral Surg Oral Med Oral Pathol Oral Radiol Endod. 2011 Oct;112(4):453-62. doi: 10.1016/j.tripleo.2011.04.021.

44. Schiffman E, Ohrbach R, Truelove E, Look J, Anderson G, Goulet JP, et al. 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(1):6-27. doi: 10.11607/jop.1151.

45. Czernaik CM, Muniz FWMG, Colussi PRG, Rösing CK, Colussi EL. Association between temporomandibular disorder symptoms and demographic, dental and behavioral factors in the elderly: a population-based cross-sectional study. Br J Pain. 2018 Jul-Sep;1(3):223-30. doi 10.5935/2595-0118.20180044.

46. Yap AU, Chen C, Wong HC, Yow M, Tan E. Temporomandibular disorders in prospective orthodontic patients. Angle Orthod. 2021 May;91(3):377-83. doi: 10.2319/010720-863.1.

47. Zatt FP, Muniz FWMG, Trevizan TC, Scalco NR, Calcia TBB, Colussi PRG. Prevalence of temporomandibular disorder and possible associated factors in a sample of older adults: population-based cross-sectional study. BrJP. 2021 Jul-Sep;4(3):232-8. doi: 10.5935/2595-0118.20210050.