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RELATION BETWEEN ORAL BEHAVIORS AND DISTRESS IN FERNANDO PESSOA UNIVERSITY DENTAL STUDENTS

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"Trabalho apresentado à Universidade Fernando Pessoa como parte dos Requisitos para a obtenção do grau de Mestre em Medicina Dentaria"

(Clara Alix Alize Bartolome)

RESUMO

Objetivo: estudo epidemiológico transversal com vista à avaliação da associação entre comportamentos orais e sofrimento psicoemocional (ansiedade e depressão) nos estudantes do Mestrado Integrado em Medicina Dentária da Universidade Fernando Pessoa.

Métodos: 106 estudantes foram avaliados pelo autopreenchimento da versão portuguesa dos questionários: *Oral Behaviors Checklist*-21 e *Patient Health Questionnaire*-4. Os resultados da *Oral Behaviors Checklist* foram avaliados pela soma dos 21 itens (0 a 4 pontos cada item) que varia entre 0-84 pontos; o sofrimento psicoemocional foi avaliado pelo *Patient Health Questionnaire*-4, numa escala de 0 - 12 pontos (0 a 3 pontos cada item) e por categorias (3 pontos ≤ sofrimento suave < 6 pontos; 6 pontos ≤ sofrimento moderado < 9 pontos; sofrimento severo ≥ 9 pontos). Para todas as análises estatísticas, o nível de significância foi de 0,05 e utilizou-se o IBM® SPSS *Statistics*, versão 25.0.

Resultados: 100% dos estudantes tinha pelo menos um comportamento oral; 34,9% da população apresentava sofrimento psicológico suave, 11,3% sofrimento moderado e 3,7% sofrimento severo. A média da soma da *Oral Behaviors Checklist* foi significativamente diferente entre grupos de sofrimento psicológico (ANOVA, p = 0,010) mas mais elevada para o grupo do sofrimento moderado que para o grupo de sofrimento suave ou sem sofrimento psicológico (Scheffé Test $p \leq 0{,}040$), não se verificando o mesmo para o grupo de sofrimento psicológico severo.

Conclusões: Dentro das limitações deste estudo, não foi conclusiva a associação entre a soma da *Oral Behaviors Checklist* e as diferentes categorias de sofrimento psicológico.

Palavras-Chave: Estudantes universitários; Comportamentos orais; Sofrimento psicoemocional; Ansiedade; Depressão

ABSTRACT

Objective: Cross-sectional epidemiological study to evaluate the association between oral behavior and psychoemotional suffering (anxiety and depression) in the students of the Integrated Master of Dentistry at Fernando Pessoa University.

Methods: 106 students were evaluated by self-filling the Portuguese version of the questionnaires: Oral Behaviors Checklist-21 and Patient Health Questionnaire-4. The results of the Oral Behaviors Checklist were evaluated by the sum of 21 items (0 to 4 points each item) ranging from 0-84 points; psychoemotional suffering was evaluated by the Patient Health Questionnaire-4 on a scale of 0 - 12 points (0 to 3 points each item) and by categories (3 points ≤ mild suffering < 6 points; 6 points ≤ moderate suffering < 9 points; severe suffering ≥ 9 points). For all statistical analyses, the significance level was .05 and IBM® SPSS Statistics, version 25.0 was used.

Results: 100% of the students had at least one oral behavior; 34.9% of the population presented mild psychological suffering, 11.3% moderate suffering and 3.7% severe suffering. The mean sum of the Oral Behaviors Checklist was significantly different between groups of psychological distress (ANOVA, $p = .010$) but higher for the group of moderate distress than for the group of mild or no psychological distress (Scheffé Test $p \leq .040$), and not the same for the group of severe psychological distress.

Conclusions: Within the limitations of this study, the association between the sum of Oral Behaviors Checklist and the different categories of psychological suffering was not conclusive.

Keywords: University students; Oral behaviors; Psychoemotional suffering; Anxiety; Depression.

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ABREVIATIONS AND ACRONYMS LIST

ANOVA	ANalysis Of VAriance
DC/TMD	Diagnostic Criteria for Temporomandibular Disorders
DSM-5	Diagnostic and Statistical Manual of Mental Disorders - version 5
EMG	Electromyography
FPU	Fernando Pessoa University
GAD-2	Generalized Anxiety Disorder – 2
IMD	Integrated Master Dentistry
OBC-21	Oral Behaviors Checklist (21 questions)
OBCsc	Oral Behaviors Checklist Sum Score
OPB	Oral Parafunctional Behaviors
PHQ-4	Patient Health Questionnaire (4 questions)
STAI	State Trait Anxiety Index
TMD	Temporomandibular Disorders

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I. INTRODUCTION

Oral parafunctional behaviors are defined as activities involving the mouth, not associated with mastication, deglutition and speech. Examples of such behaviors are: bruxism, clenching and grinding, thumb sucking, nail biting (Mehta, et al., 2014). Oral behaviors are common in the general population. Some are more typical of children and adolescents and are generally abandoned gradually with growth, although they can persist over time. Others are acquired throughout life (Atsü, et al., 2019). Some oral behaviors are normal to a certain degree, but become parafunctional, when they reach a certain frequency or intensity (Lurie, et al., 2007). University students are a vulnerable group for oral behaviors and the prevalence of at least one behavior varies between 76.8% and 95.0% (Conti, et al., 1996; Miyake, et al., 2004; Panek, et al., 2012; Wieckiewicz, et al., 2014). This difference was probably because in this study it was used OBC-21, that is the most acceptable self-reporting tool available for the comprehensive assessment of a various classes of OPBs (Khawaja, et al., 2015), and have excellent measurement reliability (Kaplan & Ohrbach, 2016) for measuring OPBs that typically occur unconsciously (Ohrbach & Michelotti, 2018) while, the other studies rated a limited number of OPBs (only 4-9 OPBs) by unreliable questionnaires (author's questionnaires).

The term Distress is defined as a composite measurement construct of anxiety and depression (Ohrbach & Knibbe, 2016). Anxiety is considered, by the Diagnostic and Statistical Manual of Mental Disorders, 5th Edition as excessive apprehensive expectation and worry, occurring more days than not for at least 6 months, about several events or activities (American Psychiatric Association, 2013). Anxiety disorders belong to the most common mental disturbances and have a similar prevalence in different populations and cultures. It is a normal adaptive response of the organism to danger or stressful events (Gdańska, et al., 2017). Depression is, according to the Diagnostic and Statistical Manual of Mental Disorders, 5th Edition, a common and serious mood disorder. To be diagnosed with depression, the individual must be experiencing five or more symptoms of a list of 9 (Appendix 1) during the same 2-week period and at least one of the symptoms should be either depressed mood or loss of interest or pleasure. The most common symptoms are lowered mood and activity, loss of interest and pleasure in otherwise joyful activities (American Psychiatric Association, 2013). Depressive disorders are common and constitute

a significant healthcare problem. They are currently the fourth leading cause of disability worldwide. Clinical depression happens in 5 – 10% of the population, yet even as much as a third of the population suffers from depressive symptoms of different intensity throughout their lives (Gdańska, et al., 2017). Anxiety and depression are the most common mental disorders in the general population, and that they frequently coexist (Kroenke, et al., 2009). Khubchandani, et al. (2016) showed that depression and anxiety are some of the most common causes of morbidity, social dysfunction, and reduced academic performances in college students. University students, especially ones in the medical field, are under considerable pressure and have higher perceived levels of stress and emotional distress, such as anxiety and depression, than non-students (Heinen, et al., 2017).

Depression symptoms are associated with self-reported oral parafunctional behaviors, according to (Khawaja, et al., 2015). And Chow and Cioffi stated (2018) that anxious people have frequent oral behaviors (Chow & Cioffi, 2018).

There are various evaluation systems of oral parafunctions. The Diagnostic Criteria for Temporomandibular Disorders (DC/TMD) (Schiffman, et al., 2014) recommended that routine assessment of oral parafunctions must be done as part of an overall biobehavioral assessment and recommended the use the Oral Behaviors Checklist (OBC). The OBC is a self-report questionnaire comprised of twenty-one items with semantic validity (Ohrbach, et al., 2008) for identifying and quantifying the frequency of jaw overuse behaviors (Markiewicz, et al., 2006).

There are different questionnaires to measure depression and/or anxiety such as the Patient Health Questionnaire -4 (that assess distress), Patient Health Questionnaire-9 (that assesses depression), the State Trait Anxiety Item (STAI), and the General Anxiety Disorder-7 (that assesses anxiety) (Kroenke, et al., 2009). The Patient Health Questionnaire-4 (PHQ-4) is recommended by the DC/TMD as an ultra-brief screener for distress (Ohrbach and Knibbe, 2016). It consists of 4 questions answerable by 4 choices that follow a gradient of frequency. It is composed of a 2-item depression scale (PHQ-2) and a 2-item anxiety scale Generalized Anxiety Disorder – 2 (GAD-2) (Löwe, et al., 2010) (Kroenke, et al., 2009).

This study aims to assess the prevalence of oral parafunctional behaviors and distress in university students. With this assessment, we wanted to see if there was, or not, an

association between oral parafunction and distress in dental students of the Fernando Pessoa University (FPU), using the OBC-21 and PHQ-4 questionnaires.

So, this study hypothesis H0 (null hypothesis) was “There is no association between oral behaviors (frequency/intensity) and distress categories (anxiety and depression)”.

II. MATERIALS AND METHODS

Cross-sectional epidemiological study integrated in a research project entitled "Study of the relationship of Temporomandibular Disorders (TMD) with altered sleep quality, functional limitation, oral behaviors and distress in university students from Integrated Master in Dentistry (IMD)-UFP.

1. Sample size, representativity and characterization

To calculate the minimum sample size to be selected/observed, and because this study was part of a global study to evaluate TMDs, it was considered that it was intended to describe the prevalence of TMDs, using a 95% confidence level in the inference of the population to be studied and that the sample universe was the 585 dentistry students who attended the IMD-UFP in the year of 2019 (UFP Report, A3Es). In the present study, DC / TMD were used. At the level of dentistry university students and until the date of the present sample calculation, only one study carried out in Sweden (Lövgren, et al., 2018) evaluated TMD by DC / TMD. In this study, the prevalence of TMDs was 30.0%. Based on these assumptions it would be necessary to select a sample of 209 students (Sergeant, 2018).

The sample was selected using a non-probabilistic sampling method in which all the students from the IMD-UFP who wanted and had the time opportunity to do so participated in the study that took place between February 21st and March 9th, 2020, in the Pedagogical Dental Clinics of Fernando Pessoa University. However, due to the state of the COVID-19 pandemic, the study had to be stopped suddenly with only 106 students observed.

This sample consisted of 70 women (66.0%) and 36 men (34.0%), with a mean age (± standard deviation) of 26.0 ± 6.0 years. For better structuring of the sample and possibility of comparing results, two age groups were created, one of young adults (18 - 25 years) and another that included all others (> 25 years).

The mean age (± standard deviation) for females was 25.4 ± 6.1 and for males 27.1 ± 5.9. It was possible to verify statistically significant differences in the age of women and men in the total sample (Mann-Whitney U test, p= 0.048), however, by age groups, it was verified that there were no significant differences in the age of women and men (18 - 25 years, p=.269; > 25 years, p=.977). (Table 1; Appendix 3)

Of the observed IMD students, 10.4% (n=11) attended the second year, 3.8% (n=4) the third year, 24.5% (n=26) the fourth year and 61.3% (n=65) the fifth year.

2. Study participants

Recruitment: All participants were recruited from the IMD from the Fernando Pessoa University, based on willingness to participate and the inclusion and exclusion criteria.

Inclusion criteria: The participants had to be 18 years old or older, to participate in the study. They had to study dentistry at the Fernando Pessoa University.

Exclusion criteria: No ongoing orthodontic treatment; No orthognathic surgery in the past month; No oral surgery in the past month.

This study was approved by the Fernando Pessoa University's Ethics Committee, in Porto, Portugal, and informed consent was obtained from each participant (Appendix 4 and Appendix 5).

3. Epidemiological questionnaires

Self-assessments of oral parafunctional behaviors:

Oral parafunctional behaviors were assessed using the Portuguese version of the OBC (Barbosa, et al., 2018) (Appendix 6). The OBC was divided in 21 questions, referenced 1 to 21. The possible responses to each item on the questionnaire are: 'None of the time', 'A little of the time', 'Some of the time', 'Most of the time' and 'All of the time', which are equivalent to scores of 0, 1, 2, 3 and 4, respectively, yielding a maximum possible score of 84.

Self-assessment for presence of psychological distress:

The participants' distress (anxiety and depression) was evaluated with the PHQ-4, which is composed to 4 questions (Appendix 2). The PHQ-4 results can be divided into 4 categories: 'Without distress' (score 0-2); 'Mild distress' (score 3-5); 'Moderate distress' (score 6-8); 'Severe distress' (score 9 and above). The maximal possible score to this questionnaire is 12 points.

4. Data management and analysis

The comparison of central tendency measures in independent groups with symmetric distributions was performed using parametric tests (Student's t-test in the case of 2 groups).

When the observed distributions were asymmetric, the comparison was performed using non-parametric tests at the median of the observations (Kruskal-Wallis test for more than 2 groups, and / or Mann Whitney U Test for 2 independent groups). Normality of the data has always been verified. The categorical variables comparison was performed using contingency tables, with the presentation of counts and percentages, and Chi-squared test results. OBC sum score (OBCsc) was compared between groups (sex and age) using an unpaired t-test and an ANOVA was used to test for significant differences in at least one of the four distress groups (without distress, mild distress, moderate distress and severe distress) followed by post-hoc Scheffé test for pairwise comparisons. For all analysis reported, probability values are two-tailed, and the significance level was set at $\alpha = .05$. IBM® SPSS Statistics for Windows, Version 25.0 (IBM® Corporation, Armonk, New York, USA) was used.

III. RESULTS

1. Oral Parafunctional Behaviors: OBC-21

In the study sample, 100.0% of the students had one or more OPB. One participant had 1 to 3 OPBs, representing 0.9% of the sample and 31 participants (29.2%) had 4 to 8 OPBs. Most participants, 69.9% of them (74 people), had more than 8 OBs (Table 4; Appendix 7)

From the 21 OBs the most prevalent in the study population were “Sleep in a position that puts pressure on the jaw (for example, on stomach, on the side)” (89.6%); “Eating between meals (that is, food that requires chewing)” (84.9%); “Yawning” (84.0%); “Use chewing gum” (74.5%); and “Lean with your hand on the jaw, such as cupping or resting the chin in the hand” (73.6%) (Table 5; Appendix 8).

On the other end of the spectrum, the five least prevalent oral behaviors (OB) were “Play musical instrument that involves use of mouth or jaw (for example, woodwinds, brass, string instruments)” (6.6%); “Grind teeth together during waking hours” (23.6%); “Place tongue between teeth” (23.6%); “Hold or jut jaw forward or to the side” (25.5%); and “Press tongue forcibly against teeth” (29.2%) (Table 5; Appendix 8).

In the study population, “Hold or jut jaw forward or to the side”, “Hold, tighten, or tense muscles without clenching or bringing teeth together” and “Play musical instrument that involves use of mouth or jaw (for example, woodwinds, brass, string instruments)” were significantly more frequent in male gender than in female gender (Chi-Squared Test, $p \leq .030$) (Table 5; Appendix 8).

In relation to age categories “Bite, chew, or play with your tongue, cheeks or lips”, “Clench teeth together during waking hours”, “Singing” and “Lean with your hand on the jaw, such as cupping or resting the chin in the hand” were significantly more frequent in younger students (Chi-Square test, $p \leq .023$). Only “Hold, tighten, or tense muscles without clenching or bringing teeth together” was significantly more frequent in the older students (Chi-Square test, $p = .009$) (Table 5; Appendix 8).

2. Distress: PHQ-4

In the study population the PHQ-4 sum score mean was 3.0 (±2.4). Of the 106 participants of the sample, 53 participants (50.0%) scored "Without distress", 37 participants (34.9%) scored "Mild distress", 12 participants (11.3%) scored "Moderate distress" and only 4 participants (3.8%) scored "Severe distress".

According to distress categories, no differences were observed between the gender ($p \geq .213$) or the age categories ($p \geq .547$)

Table 1. Prevalence of Distress levels in the Study Population (n=106) and distribution distress levels by gender and assessment of differences between genders (Chi-square Test). Prevalence= (number of cases/ population) x 100 (in %)

Distress level	**Total n %**	**Males**	**Females**	**p-value**	**<= 25 years**	**> 25 years**	**p-value**
Without distress	53 50.0%	15 41.7%	38 54.3%	*.218*	33 48.5%	20 52.6%	*.685*
Mild distress	37 34.9%	14 38.9%	23 32.9%	*.537*	25 36.8%	12 31.6%	*.591*
Moderate distress	12 11.3%	6 16.7%	6 8.6%	*.213*	8 11.8%	4 10.5%	*.847*
Severe distress	4 3.8%	1 2.8%	3 4.3%	*.700*	2 2.9%	2 5.3%	*.547*

3. Relation between Oral Behaviors (OBCsc) and gender, age group and distress category

The OBCsc mean was 20.6 (±8.1) in the study population and its mean value was not significantly different for female vs male gender ($p = .925$), but its mean value was found to be significantly higher for the younger group (21.3 (±8.8), $p < .029$) vs older one, and for distress categories ($p = .010$). In the later, the mean OBCsc for moderate distress was significantly higher (27.8 (±8.8), Scheffé Test $p \leq .040$) than for without distress and for mild distress (19.2 (±8.4) and 20.0 (±6.2), respectively). No differences were observed for the OBCsc between any other distress group comparisons (Scheffé Test, $p \geq .799$).

Table 2. The comparison of mean OBC sum score (±SD) among categories of relevant covariates (sex, age group and distress categories).

Variable	**Category**	**n**	**Mean OBC sum score (±SD)**	***p value***
Sex	Male	36	20.5 (±7.9)	.925
	Female	70	20.6 (±8.2)	
Age	18-25	68	21.3[a] (±8.7)	.029[*]
	> 25	38	19.2[b] (±6.5)	
Distress Categories (PHQ-4)	Without distress	53	19.3[b] (±8.4)	**.010**[†]
	Mild Distress	37	20.4[b] (±6.8)	
	Moderate distress	12	26.6[a] (±8.2)	
	Severe distress	4	23.4 (±7.8)	

[a,b] -different letters stand for significant mean value differences ([a] the highest mean value, [b] the lowest) according to the [*]Student t-test, and [†]ANOVA followed by Scheffé post-hoc test

IV. DISCUSSION

This study investigated the relation between oral parafunctional behaviors and distress in dental university students. It was performed on 106 students of the IMD-UFP from the University Fernando Pessoa. This study was part of a global study to describe the prevalence of temporomandibular disorders (TMDs) among the 585 IMD-FPU dentistry students. Based on these assumptions, it would have been necessary to select a sample of 209 students (Sergeant, 2018) to be representative with a 95% confidence interval. The investigation was cut short, due to the COVID-19 global pandemic this being a major limitation in the results to be presented and discussed.

For the results of the OBC-21 questionnaire, we can use both the scoring as the sum of the number of items with a non-zero response, or a weighted sum. We found that 100% of the participants to this study have answered positively to at least one question In other studies, such as the one conducted by (Barbosa, 2015), in Oporto University students, the result was quite similar (99.9%. However, other studies have shown a lower prevalence. Panek et al. (2012) observed a prevalence of 95% and Myiake et al. (2004) a prevalence of 77.6%. These differences may be due to the fact that in this work, and in Barbosa (2015) OBC-21 was used, however in the work of Myiake et al. (2004) and Panek et al. (2012) only 9 and 4 oral behaviors were evaluated by authors questionnaires. Another difference (between this study and the previous studies) can be explained by the type of sample selected (here, dental students), which can have an influence on their attentiveness to their oral behaviors, and the reduced sized of the sample (106 students versus 1381 students (Barbosa, 2015), 3557 students (Miyake, et al., 2004) and 303 students (Panek, et al., 2012).

Some items stood out in the 21 questions of the OBC-21 questionnaire. In the overall sample, the 5 items with higher prevalence were snacking, yawning, inadequate sleeping position, using chewing gum and inadequate mandibular position.

Three of those oral behaviors, (“snacking”, “yawning” and “inadequate sleeping position”) can also be found as some of the most prevalent in the male/female groups, and the age groups. Most of those behaviors are among the five more prevalent for each group (males/females, under 25 years old/over 25 years old). Furthermore, when we do a cross-comparison between all groups, while there is a slight difference in certain behaviors and

categories, the majority of the most and least prevalent behaviors are shared in both genders and in both age categories. The use of chewing gum (item 13) is most prevalent in women and in the older population. This result can be surprising in the older population, since Martyn and Lau (2019) state that as the older the population, the least frequent the chewing-gum use (Martyn & Lau, 2019). The older participants tend to conform to socially accepted behaviors, and chewing gum is not one of them. However, the population of this study consisted of students and that could explain the use of chewing gum being accepted among older individuals.

However, only 3 of the 21 items had shown statistically differences between gender groups (Qui-square test, $p \leq .030$), (Item 6 "Hold tighten, or tense muscles without clenching or bringing teeth together"; item 7 "Hold or jut jaw forward or to the side"; item 14 "Play musical instruments") . For those items, males showed a higher frequency in those behaviors. Studies like Winocur (2006) and Barbosa (2015) shown that women tend to demonstrate a significative higher prevalence in a large spectrum of oral behaviors compared to men, however in this particular sample, only men shown a statistically significant difference in some oral behaviors. Relatively to item 6 and 7, it can be considered two possible explanations for this difference: 1) in a sexist society like the Portuguese, it will be more accepted that men can "tighten or tense the muscles" and "hold or jut jaw forward" than women (Costa, et al., 2015) as they are oral behaviors associated with aggressiveness, it is more associated with the psychosocial profile of the male gender (Courtenay, 2000). In relation to "play musical instruments" also in the study of (Barbosa, 2015) it was a more prevalent behavior in the male group supporting the fact that Portuguese male university students are more motivated to play musical instruments by the influence of the academic musical bands (Pereira & Gonçalves, 2018).

In relation to OBCsc the mean in this study was 20.6 (±8.1) that was much lower than in the study of Barbosa (2015) (24.2±8.6), however as in that study, no significant differences was verified on the OBCsc between genders (t-student test, p=.925), but the youngest students presented a significantly higher OBCsc then the oldest students (t-student test, p=.029). The difference in the OBCsc mean was probably related with mean age between studies. In Barbosa (2015) study the mean age was 21.7±3.9 years and in this study, it was

26.0±6.0 years. These differences are in accordance with the idea that the oral behaviors tend to reduce with age (Atsü, et al., 2019).

Heinen et al. (2017) stated that university students from the medical field have higher levels of distress, due to the high-pressure environment they are in. The fact that our study was based on students working in the medical field may also have influenced our results. As stated by Heinen, et al. (2017) medical students have higher levels of distress, which can have altered the PHQ-4 scores, compared to the general population. In this study the PHQ-4 sum score mean was 3.0 (±2.4) and was higher than in the study of Heinen et al. (2017) (2.7 ± 2.2), corroborating the idea that distress is high in the students of this area of studies. The difference to our study could be related to the fact that in the study of Heinen et al. (2017) the study populations was from the first year of a medical while in this study predominantly students from final clinical years of the IMD-UFP were observed (85.8%). According to Kroenke et al. (2009) persons scoring three points and higher should be further evaluated with a more accurate tool for anxiety and depression. These results indicate that in the future, the PHQ-9 and GAD-7 should be used when assessing anxiety and depression in dental students.

Over one third of the participants (34.9%) had "mild distress", twelve participants had "moderate distress" and four participants had "severe distress". In the evaluation of the distress categories by gender and age groups there were no significant differences (Qui-square test, $p > .05$) as verified in the study Heinen et al. (2017). However, a correlation between the PHQ-4 and the OBC-21 was partially observable through the simultaneous augmentation of the mean of the total OBC scores (OBC sum scores) and of the PHQ-4 categories. In the literature, Khawaja et al. (2015), Endo et al. (2011) and Manfredini & Lobbezoo (2009) have also shown a causal relationship between psychological factors and oral parafunctional behaviors. In this study it was verified that in the group with moderate distress the OBCs score was significantly higher than in the groups of "no distress" and "mild distress" (Scheffé Test $p \leq .040$). This difference indicated a relation between the mean OBCsc and the 4 PHQ-4 categories. In fact, when the level of distress of the participants increased, their average OBCsc also increased, except in the group of "severe distress" in which this trend was not verified, probably because of the size of the group, only 4 students. However, some factors could contribute for in the group of "severe distress" the OBCsc be

inferior to the one in the "moderate distress" group namely, the state of distress itself that can decrease the awareness of oral behaviors or the use of anxiolytic medications that can decrease the performance / awareness of oral behaviors (Ibáñez, et al., 2014).

In the study of Chow and Cioffi (2018), the authors realized a cross-sectional study with a similar goal and methodology than us. While they also used the OBC-21 questionnaire, they used a different questionnaire to assess the participants' emotional state: the STAI. They demonstrated that there was a statistical association between anxiety and a higher intensity/frequency of oral behaviors. Our results follow the same direction as Chow and Cioffi's, but the conclusion is weaker because, probably, the lower number of participants (Chow & Cioffi, 2018).

According to the results of this study the null hypothesis "There is no association between oral behaviors (frequency/intensity) and distress categories (anxiety and depression)" could not be rejected, however this could be probably explained by the sample size, because the association found was not true only for one of the distress category, which only include four students.

In addition, the COVID-19 pandemic was also growing during the study, which may have influenced the anxiety state of some participants however this particularly effect was not evaluated during the study (Cao, et al., 2020).

The questionnaires used (OBC-21 and PHQ-4) themselves have their own limitations. They can be understood and graded quite subjectively, seeing as they are both self-evaluating questionnaires. Other methods of assessment for oral behaviors and distress could have been used, such as EMG (electromyography) or individual psychiatric consults, to obtain more reliable results. However, the constraints they bring would have shortened the sample even further (Markiewicz, et al., 2006). The answers to the questions can vary depending on the participants' tolerance and sensibility. Many participants were confused when answering the twentieth question of the OBC-21and did not know what was considered "normal" or "excessive". The length of the OBC-21 can bring the participants to not be as thorough or attentive as they would have been with a shorter questionnaire.

The PHQ-4 is an ultra-brief screening tool, and this briefness can be a limitation, as it can overlook cases of anxiety and/or depression in the assessed participants (Eack, et al.,

2014). The fact that those questionnaires are self-answering is an additional limitation to reliability of the results, as a bored participant could fake answers in order to finish the questionnaire more quickly, or overzealous participants can alter their answers in order to "please" the researcher (McCambridge, et al., 2012).

Finally, the population studied had the bias of being dental students. They were therefore more likely to be more attentive to the semi-conscious or unconscious attitudes that the questionnaires assessed. They could also guess what results were expected and influence their answers with these assumptions (Gove & Geerken, 1977). This participant's bias could be one of the explanations to the high prevalence of oral parafunctional behaviors.

V. CONCLUSION

This study showed that there was an inconclusive relation between oral behavior and distress level among the dentistry students of Fernando Pessoa University. The sample size, cut short because of COVID-19, prevented this study from being fully representative of the IMD-UFP population, limiting the conclusions that could be drawn. If possible, the ideal for this study would be to continue, if the COVID-19 situation allows, to verify whether the null hypothesis posed for this study can be effectively rejected.

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VII. APPENDIX

1. Appendix 1: list of 9 symptoms of depression according to DSM – 5

The DSM-5 outlines the following criterion to make a diagnosis of depression. The individual must be experiencing five (or more) of the following symptoms have been present during the same 2-week period and represent a change from previous functioning; at least one of the symptoms is either (1) depressed mood or (2) loss of interest or pleasure.

Note: Do not include symptoms that are clearly attributable to another medical condition.

1. Depressed mood most of the day, nearly every day.
2. Markedly diminished interest or pleasure in all, or almost all, activities most of the day, nearly every day.
3. Significant weight loss when not dieting or weight gain or decrease or increase in appetite nearly every day.
4. Insomnia or hypersomnia nearly every day.
5. Psychomotor agitation or retardation nearly every day.
6. Fatigue or loss of energy nearly every day.
7. Feelings of worthlessness or excessive or inappropriate guilt nearly every day.
8. Diminished ability to think or concentrate, or indecisiveness, nearly every day.
9. Recurrent thoughts of death, recurrent suicidal ideation without a specific plan, or a suicide attempt or a specific plan for committing suicide.

(American Psychiatric Association, 2013) pp. 161 – 162.

2. Appendix 2: PHQ – 4 Questionnaire in Portuguese

Critérios de diagnóstico de Disfunção Temporomandibular Eixo II - RA

Questionário de Saúde do Paciente - 4

Nas últimas 2 semanas, com que frequência foi incomodado pelos seguintes problemas? Por favor coloque um visto na caixa para indicar a sua resposta.

		Nenhum 0	Vários dias 1	Mais de metade dos dias 2	Quase todos os dias 3
1.	Sinto-me nervoso, ansioso e inquieto	☐	☐	☐	☐
2.	Não consigo parar ou controlar a preocupação	☐	☐	☐	☐
3.	Pouco interesse ou prazer em fazer coisas	☐	☐	☐	☐
4.	Sentir-se em baixo, deprimido ou sem esperança	☐	☐	☐	☐

RESULTADO TOTAL =____

Se assinalou qualquer um destes problemas, quão difícil é que estes problemas tornaram para si trabalhar, realizar as tarefas em casa, ou relacionar- se com outras pessoas?

Nada difícil	Algo difícil	Muito difícil	Extremamente difícil
☐	☐	☐	☐

3. Appendix 3: sample characterization.

Table 3. Distribution of the students in the sample by age (all and according to gender) and indication of the most relevant statistics (count, mean, standard deviation, minimum and maximum)

Age		**N**	%	**Mean ±dp**	**Median**	**Min-Max**	**p[1]**
18-25		68	64.2	22.5±1.7	23.0		
Gender	**Fem**	49		22.4±1.7	23.0		.269
	Masc	19		22.9±1,6	23.0		
> 25		38	35.8	32.1 ±6.1	30.5		
Gender	**Fem**	21		32.4 ±6.8	30.0		.977
	Masc	17		31.7 ±5.4	32.0		
Total		106	100.0	26.0 ±6.0	24.0	18 – 50	
Gender	**Fem**	70	66.0	25.4 ±6.1	23.0	18 – 50	**.048**
	Masc	36	34.0	27.1 ±5.9	25.0	20 – 46	

[1] Mann-Whitney U test

4. Appendix 4: study approval by the ethics committee

Universidade Fernando Pessoa
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Exma. Senhora
Prof. Doutora Sandra Gavinha
Directora da FCS

Porto, 10 de Dezembro de 2019

Exma. Senhora Prof. Doutora,

A Comissão de Ética, depois de receber, no dia 2 de Dezembro de 2019, o formulário de submissão de projectos à CE devidamente assinado (com data de 29 de Novembro de 2019), como solicitado na comunicação emitida por esta mesma Comissão no dia 28 de Novembro, e relativa à primeira submissão, do dia 4 de Novembro, apreciou o projeto de investigação em Medicina Dentária das Professoras Cláudia Barbosa (CB), Joana Sardinha (JS), Tânia Soares (TS), Sandra Gavinha, Ana Rita Nobrega (AN), Liliana Costa e Maria Conceição Manso, intitulado, "Estudo da relação das disfunções temporomandibulares com alteração da qualidade do sono, limitação funcional maxilar, comportamentos orais e stress/ansiedade em estudantes universitários da UFP". A Comissão de Ética não tem nada a opor à realização do projecto.

Com os melhores cumprimentos.

A Presidente da
Comissão de Ética da UFP
Teresa Toldy

Fundação Ensino e Cultura "Fernando Pessoa"
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5. Appendix 5: form of consent

No

DECLARAÇÃO DE CONSENTIMENTO INFORMADO

Estudo de avaliação das Distfunções Temporomandibulares e das suas relações com as alterações da qualidade do sono, limitação funcional maxilar, comportamentos orais e ansiedade em Estudantes Universitários do MIMD-UFP

Objectivo: Pretende-se avaliar a relação entre as disfunções temporomandibulares e a presença de limitações funcionais maxilares, bem como, verificar-se as alterações na qualidade do sono, comportamentos orais frequentes e ansiedade são factores de risco para as disfunções temporomandibulares, em estudantes do Mestrado Integrado em Medicina Dentária da Universidade Fernando Pessoa.

Eu, abaixo-assinado, ----------, compreendi a explicação que me foi fornecida acerca da participação na investigação que se tenciona realizar. Foi-me dada oportunidade de fazer as perguntas que julguei necessárias, e de todas obtive resposta satisfatória.

Tomei conhecimento de que a informação ou explicação que me foi prestada versou os objectivos e os métodos previstos no projecto. Além disso, foi-me afirmado que tenho o direito de recusar a todo o tempo a minha participação no estudo, sem que isso possa ter, como efeito, qualquer prejuízo pessoal.

Foi-me ainda assegurado que os registos em suporte papel serão confidenciais e utilizados única e exclusivamente para o estudo em causa, sendo guardados em local seguro durante a pesquisa e destruídos após a sua conclusão. Neste projeto apenas haverá a recolha de dados para fins de investigação científica.

Por isso, consinto em participar no estudo em causa. Data:__/__/2020

Assinatura do participante no projecto*:* O Investigador responsável:

Nome: Cláudia Barbosa **Assinatura:**
Joana Sardinha
Tânia Soares

Comissão de Ética da Universidade Fernando Pessoa

6. Appendix 6: Oral Behavior Checklist in Portuguese

Critérios de diagnóstico de Disfunção Temporomandibular Eixo II - C7/R3

Lista de Controlo de Comportamentos Orais

Com que frequência faz cada uma das seguintes atividades, tendo como base o último mês? Se a frequência da atividade varia, escolha a opção mais elevada. Por favor, coloque um (√) em cada item de resposta e não avance nenhum item.

	Atividades durante o sono	Nenhuma vez	<1 Noites/ mês	1-3 Noites/ mês	1-3 Noites/ semana	4-7 Noites/ semana
1.	Aperta ou range os dentes **durante o sono**, baseado em qualquer informação que possa ter	☐	☐	☐	☐	☐
2.	Dorme numa posição em que coloca pressão na mandíbula (por exemplo, de barriga para baixo, de lado)	☐	☐	☐	☐	☐
	Atividades durante o dia	Nenhuma vez	Um pouco do tempo	Algum do tempo	A maior parte do tempo	Todo o tempo
3.	Range os dentes **durante as horas em que está acordado**	☐	☐	☐	☐	☐
4.	Aperta os dentes **durante as horas em que está acordado**	☐	☐	☐	☐	☐
5.	Pressiona, toca ou mantém os dentes juntos sem que seja para comer (isto é, contato entre os dentes de cima e os de baixo)	☐	☐	☐	☐	☐
6.	Segura, aperta ou cria tensão muscular sem apertar ou juntar os dentes	☐	☐	☐	☐	☐
7.	Mantém ou projeta a mandíbula para a frente ou para o lado	☐	☐	☐	☐	☐
8.	Pressiona com força a língua contra os dentes	☐	☐	☐	☐	☐
9.	Coloca a língua entre os dentes	☐	☐	☐	☐	☐
10.	Morde, mastiga ou brinca com a sua língua, bochechas ou lábios	☐	☐	☐	☐	☐
11.	Mantém a mandíbula numa posição rígida ou tensa, como se fosse preparar para um impacto ou proteger a mandíbula	☐	☐	☐	☐	☐
12.	Mantém entre os dentes ou morde objetos, tais como, cabelo, cachimbo, lápis, canetas, dedos, unhas, etc.	☐	☐	☐	☐	☐
13.	Utiliza pastilha elástica	☐	☐	☐	☐	☐
14.	Toca instrumento musical que envolva o uso da boca ou mandíbula (por exemplo, instrumentos de sopro, metal ou madeira, ou instrumentos de corda)	☐	☐	☐	☐	☐
15.	Inclina-se com a mandíbula sobre a sua mão, por exemplo, em concha ou a descansar o queixo na mão	☐	☐	☐	☐	☐
16.	Mastiga a comida só de um lado	☐	☐	☐	☐	☐
17.	Come entre refeições (isto é, comida que requeira mastigação)	☐	☐	☐	☐	☐
18.	Fala durante períodos prolongados (por exemplo, ensina, vende, apoio ao consumidor)	☐	☐	☐	☐	☐
19.	Canta	☐	☐	☐	☐	☐
20.	Boceja	☐	☐	☐	☐	☐
21.	Segura o telefone entre a sua cabeça e os ombros	☐	☐	☐	☐	☐

7. Appendix 7: statistical data about the study population

Table 4. Absolute and relative frequency of the number of OPBs in the sample (n=106)

Number OPBs	**N**	**%**
1 to 3	1	0.9%
4 to 8	31	29.2%
> 8	74	69.9%
Total	**106**	**100%**

8. Appendix 8: prevalence of OPBs in the study population

Table 5. Prevalence of Oral Parafunctional Behaviors (OPBs) in the Study Population (n=106) and distribution OPBs by gender, age group and assessment of differences between genders and age groups (Chi-square Test).

Oral behavior	**Total n OPB%**	**Male**	**Female**	***P****	**Age <= 25**	**Age > 25**	***P****
1.Clench or grind teeth when asleep, based on any information you may have	55 51.9%	17 47.2%	38 54.3%	*.491*	39 57.4%	16 42.1%	*.132*
2.Sleep in a position that puts pressure on the jaw (for example, on stomach, on the side)	95 89.6%	30 83.3%	65 92.9%	*.128*	62 91.2%	33 86.8%	*.483*
3.Grind teeth together during waking hours	25 23.6%	12 33.3%	13 18.6%	***.090***	17 25.0%	8 21.1%	*.646*
4.Clench teeth together during waking hours	68 64.2%	21 58.3%	47 67.1%	*.370*	50 73.5%	18 47.4%	***.007***
5.Press, touch, or hold teeth together other than while eating (that is, contact between upper and lower teeth)	69 65.1%	24 66.7%	45 64.3%	*.808*	47 69.1%	22 57.9%	*.245*
6.Hold, tighten, or tense muscles without clenching or bringing teeth together	41 38.7%	20 55.6%	21 30.0%	***.011***	20 29.4%	21 55.3%	***.009***
7.Hold or jut jaw forward or to the side	27 25.5%	16 44.4%	11 15.7%	***.001***	16 23.5%	11 28.9%	*.539*
8.Press tongue forcibly against teeth	31 29.2%	11 30.6%	20 28.6%	*.832*	21 30.9%	10 26.3%	*.620*
9.Place tongue between teeth	25 23.6%	12 33.3%	13 18.6%	*.090*	18 26.5%	7 18.4%	*.349*
10.Bite, chew, or play with your tongue, cheeks or lips	58 54.7%	19 52.8%	39 55.7%	*.774*	44 64.7%	14 36.8%	***.006***
11.Hold jaw in rigid or tense position, such as to brace or protect the jaw	27 25.5%	9 25.0%	18 25.7%	*.936*	18 26.5%	9 23.7%	*.752*
12.Hold between the teeth or bite objects such as hair, pipe, pencil, pens, fingers, fingernails, etc.	59 55.7%	20 55.6%	39 55.7%	*.988*	39 57.4%	20 52.6%	*.639*
13.Use chewing gum	79 74.5%	23 63.9%	56 80.0%	*.071*	49 72.1%	30 78.9%	*.435*
14.Play musical instrument that involves use of mouth or jaw (for example, woodwinds, brass, string instruments)	7 6.6%	5 13.9%	2 2.9%	***.030***	4 5.9%	3 7.9%	*.689*
15.Lean with your hand on the jaw, such as cupping or resting the chin in the hand	78 73.6%	23 63.9%	55 78.6%	*.104*	55 80.9%	23 60.5%	***.023***
16.Chew food on one side only	60 56.6%	17 47.2%	43 61.4%	*.162*	40 58.8%	20 52.6%	*.537*
17.Eating between meals (that is, food that requires chewing)	90 84.9%	31 86.1%	59 84.3%	*.804*	57 83.8%	33 86.8%	*.689*
18.Sustained talking (for example, teaching, sales, customer service)	51 48.1%	20 55.6%	31 44.3%	*.271*	32 47.1%	19 50.0%	*.771*
19.Singing	43 40.6%	15 41.7%	28 40.0%	*.689*	34 50.0%	9 23.7%	***.008***
20.Yawning	89 84.0%	28 77.8%	61 87.1%	*.213*	59 86.8%	30 78.9%	*.293*
21.Hold telephone between your head and shoulders	54 50.9%	19 52.8%	35 50.0%	*.786*	63 52.9%	18 47.4%	*.582*