

Correlation between Temporomandibular Joint Disorders, Sleep Quality and Stress among Dental Students: A Cross-sectional Study

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ABSTRACT

Introduction: Dental students are subjected to high levels of stress during their academic performance. The quality of sleep could also be affected in those with increased stress levels. Stress and sleep quality could be considered as risk factors in Temporomandibular Joint Disorders (TMD). Identification of the risk factors in TMD at the initial stages can lead to minimising the long term effects.

Aim: To investigate the relationship between TMD symptoms, sleep quality and stress among dental students.

Materials and Methods: A cross-sectional questionnaire-based survey was conducted in the Department of Oral Medicine and Radiology, Sinhgad Dental College and Hospital, Pune, Maharashtra, India, from November 2021 to December 2021 among 255 dental students. Fonseca Anamnestic Index (FAI) questionnaire was used for evaluation of TMD, while Perceived Stress Scale (PSS) and Pittsburgh Sleep Quality Index (PSQI) were used to assess stress scores and sleep quality, respectively. The students were surveyed to categorise them, if they were showing any symptoms of mild, moderate or severe TMD. Similarly the sleep quality and stress scores were assessed. The relationship between TMD with stress

and sleep quality was also evaluated. Data analysis was done using International Business Machines (IBM) Statistical Package for Social Sciences (SPSS) version 26.0. Comparison of frequencies of scores of PSS, PSQI and FAI within groups was done using Chi-square test. Bivariate correlation between PSS/PSQI, PSS/FAI and FAI/PSQI was assessed using correlation coefficient.

Results: Out of 255 participants, 182 were females and 73 were males. It was observed that 221 (86.7%) students reported moderate stress levels, 21 (8.2%) students showed mild and 13 (5.1%) subjects showed high stress levels. Temporomandibular symptoms were reported as mild, moderate and severe in 130 (51%), 21 (8.2%) and 9 (3.5%) students, respectively. A total of 229 (89.8%) students showed poor sleep quality and 26 (10.2%) students showed good sleep quality. Moderate stress was correlated with poor sleep quality and mild TMD.

Conclusion: The stress levels were significantly correlated with sleep quality and TMD symptoms. Thus, increased stress and poor sleep may be considered as risk factors of TMD. However, longitudinal studies in large samples are required to determine the cause and effect relationships between sleep quality, stress levels and TMD.

Keywords: Perceived stress scale, Psychological, Sleep disorder

INTRODUCTION

The term TMD refers to a variety of clinical conditions affecting the Temporomandibular Joint (TMJ), occlusion and soft tissues around [1,2]. They are the most frequent cause of incapacitating chronic orofacial discomfort, which is characterised by pain and/or dysfunction in the temporomandibular region and surrounding masticatory system, restriction of jaw mobility, and noises made by the TMJ [3,4]. The aetiology of TMD is multifactorial that include structural (occlusion), dysfunctions of the masticatory musculature and surrounding structures, repetitive microtrauma from parafunctional habits and external traumas [5,6]. Occlusal interferences, tooth loss, postural alterations, psychological (stress, anxiety, depression), and/or a combination of these could all be contributing factors. It was also discovered that sleep quality, posture, and ergonomics may all play a role in the aetiology of TMD [6-8]. Recent literature suggests the biopsychosocial theory, which covers various psychological aspects, plays a major part in the aetiology of TMD [9,10].

Patients with persistent TMD frequently experience living difficulties, including sleep disturbances [11,12]. The incidence of TMD can be attributed to sleep disorders which could further exacerbate the sleep disorder resulting in poor sleep, daytime dysfunction, and psychological distress [13,14]. It has also been demonstrated that sleep disorders could co-exist with psychological distress increase the risk for TMD. Sleep deprivation can be considered as a risk factor that can significantly impact one's general health and quality of life that includes multiple physiological, neurological and psychological processes [15-17]. Stress is concurrently a stimulus and a reaction

that includes both physiological and psychological components, which might affect normal functioning [18]. Students also face a lot of stress during education that can lead to mental distress which could negatively affect learning and cognitive performance [19,20].

It is well-known that dental school is a stressful atmosphere for students as it presents both theoretical and clinical difficulties for the students [21-23]. Persistent stress may have an adverse effect on the students' health, which may reduce their productivity at work or hinder their ability to learn. Students who experience chronic stress may also find it difficult to communicate with patients, lose the ability to work, become depersonalised, thus negatively impacting their academic performance [15,20,21].

Though there is lot of interest in this area, very few studies have evaluated the relationship between stress, sleep quality and TMD in dental students [6,12,13,24]. Thus, the aim of the present study was to investigate the stress level, sleep quality and severity of TMD symptoms in dental students and to find the relationship between them.

MATERIALS AND METHODS

It was a cross-sectional questionnaire-based survey conducted in the Department of Oral Medicine and Radiology, Sinhgad Dental College and Hospital, Pune, Maharashtra, India, from November to December 2021 among 255 dental students. Ethical clearance was obtained prior to survey from Institutional Ethical Committee (SDCH/IEC/2022/02). All the students that volunteered in the study were provided with a written consent. All dental students included were

informed about the nature of the study and received instructions on how to properly answer the questionnaire.

Inclusion criteria: Dental students who volunteered to participate in the survey and students who gave consent to participate in the study were included in the study.

Exclusion criteria: Students who did not give consent and the questionnaires answered incompletely were excluded from the study.

Study Procedure

The participants' stress scores, sleep quality scores and symptoms of TMD were measured using PSS [25], PSQI [26,27] and FAI [28], respectively. Total 37 questions were asked (10 in PSS, 17 in PSQI and 10 in FAI). All these questionnaires were standardised and internationally pre-validated. The participants submitted the self-administered questionnaire via Google form link as follows: (https://docs.google.com/forms/d/1A1ZpzTp_gw6L3jpFd4N4croECvxLMSCy6kN2H9bA7rE/edit?usp=drivesdk).

Assessment of parameters in the questionnaire:

- PSS score: The scale measures how an individual can perceive stress in daily situation. This scale includes 10 items with maximum score of 0-13 denotes mild stress, 14-26 moderately stressed and 27-40 is a highly stressed individual [25].
- PSQI score: This index measures the individuals' perception of sleep quality consisting of 17 items. The score for each subgroup ranges from 0 to 3 with a total score of 0 to 21. The sleep quality is poor when overall score is greater than 5 while good sleep quality is considered for scores lower than 5 [26,27].
- FAI score: This index consists of 10 items that helps in diagnosis of TMD. Based on points, individual are categorised as: 0-15 points suggest absence of TMD, 20-45 points: mild TMD, 50-65 points: moderate TMD and 70-100 points is diagnosed as severe TMD [28].

STATISTICAL ANALYSIS

All data were entered into a computer by giving coding system, proofed for entry errors. Data obtained was compiled on a Microsoft (MS) Office Excel Sheet (v 2019, Microsoft Redmond Campus, Redmond, Washington, United States). Data was subjected to statistical analysis using IBM SPSS software version 26.0. Descriptive statistics like frequencies and percentage for categorical data, Mean and Standard Deviation (SD) for numerical data has been depicted. Normality of numerical data was checked using Shapiro-Wilk test and was found that the data followed a normal curve; hence parametric tests have been used for comparisons. Bivariate correlation between two numerical variables will be checked using correlation coefficient. Comparison of frequencies of categories of variables with groups was done using chi-square test. For all the statistical tests, p-value <0.05 was considered to be statistically significant, keeping α error at 5% and β error at 20%, thus giving a power to the study as 80%. A product-moment correlation was run to determine the relationship between one variable (x) and the second variable (y).

RESULTS

A total of 255 students (182 females and 73 males) participated in the study. The mean value of PSS was 19.60 ± 5.0 [Table/Fig-1]. It was observed that 5.1% (13) of students have high level of stress while 8.2% (21) have low and 86.7% (221) students reported moderate stress levels [Table/Fig-2]. The mean value of PSQI was 5.78 ± 1.46 [Table/Fig-1] and it was found that 10.2% (26) of students experienced good quality of sleep while 89.8% (229) experienced poor quality of sleep [Table/Fig-2]. The mean value of FAI was 26.90 ± 20.0 [Table/Fig-1]. The prevalence of TMD was 62% in the present population. Temporomandibular symptoms were reported as severe in 3.5% (9) of students; moderate in 8.2% (21) and 51% (130) showed mild TMD symptoms [Table/Fig-2].

Index	N	Minimum	Maximum	Mean±Standard deviation
PSS score	255	1	40	19.60±5.008
PSQI score	255	4	8	5.78±1.468
FAI score	255	0	100	26.90±20.010

[Table/Fig-1]: The mean and standard deviation of Perceived Stress Scale (PSS), and Pittsburgh Sleep Quality Index (PSQI) Fonseca Anamnestic Index (FAI) scores. n: Number of participants

Index		n (%)
PSS	High	13 (5.1)
	Low	21 (8.2)
	Moderate	221 (86.7)
PSQI	Good	26 (10.2)
	Poor	229 (89.8)
FAI	Absence	95 (37.3)
	Mild	130 (51)
	Moderate	21 (8.2)
	Severe	9 (3.5)

[Table/Fig-2]: Frequency distribution of PSS, PSQI and FAI scores.

Fonseca Anamnestic index index according to gender showed that females reported more symptoms of TMD than males, but the results were statistically non significant. There was no significant difference in stress scores and sleep quality scores according to gender [Table/Fig-3].

Index		Females		Males		Total	
		n	%	n	%	n	%
FAI	Absence	63	34.6	32	43.8	95	37.3
	Mild	96	52.7	34	46.6	130	51.0
	Moderate	16	8.8	5	6.8	21	8.2
	Severe	7	3.8	2	2.7	9	3.5
PSS	High	9	4.9	4	5.5	13	5.1
	Low	15	8.2	6	8.2	21	8.2
	Moderate	158	86.8	63	86.3	221	86.7
PSQI	Good	21	11.5	5	6.8	26	10.2
	Poor	161	88.5	68	93.2	229	89.8

[Table/Fig-3]: Frequency distribution of FAI, PSS and PSQI scores according to gender. n: Number of participants, %: Percentage

Perceived stress scale score scores showed statistically significant low and positive correlation with PSQI scores and FAI scores. However, there was no statistically significant (p-value <0.01) correlation between FAI and PSQI scores (p-value >0.05) [Table/Fig-4].

Index	Variables	PSS score	PSQI score
PSQI score	Correlation	0.272	-
	Sig. (2-tailed)	<0.0001	-
	N	255	-
FAI score	Correlation	0.335	0.096
	Sig. (2-tailed)	<0.0001	0.127
	N	255	255

[Table/Fig-4]: Bivariate correlations between PSS, PSQI and FAI scores. (Bivariate correlation checked using correlation coefficient) The p-value in bold font indicates statistically significant values

Comparison between the PSS and PSQI scores revealed that as the stress level increases the sleep quality decreases. There was a statistically significant difference seen for the frequencies between the scales (p-value <0.01) with higher frequency for moderate PSS with poor PSQI [Table/Fig-5]. Comparison between the PSS and FAI scores revealed that students having moderate level of stress showed mild symptoms of TMD. There was a statistically significant difference seen for the frequencies between the scales (p-value <0.01) with

higher frequency for moderate PSS with mild FAI [Table/Fig-6]. Association between the PSQI and FAI scores revealed no difference for the frequencies between the groups (p -value >0.05) [Table/Fig-6].

Index	PSQI			Chi-square test		
	Good	Poor	Total	Value	df	p-value
PSS	High	0	13	67.289	2	<0.0001
	Low	13	8			
	Moderate	13	208			
	Total	26	229			

[Table/Fig-5]: Comparison of frequencies of subjects/association between PSS and PSQI.

The p-value in bold font indicates statistically significant values

Index	FAI					Chi-square test		
	Absence	Mild	Mod-erate	Severe	Total	Value	df	p-value
PSS	High	0	10	2	1	19.249	6	0.004
	Low	15	6	0	0			
	Moderate	80	114	19	8			
	Total	95	130	21	9			
PSQI	Good	12	13	0	1	3.013	3	0.390
	Poor	83	117	21	8			
	Total	95	130	21	9			

[Table/Fig-6]: Comparison of frequencies of subjects/association between PSS, PSQI and FAI.

The p-value in bold font indicates statistically significant values

DISCUSSION

The TMD has a complex and multifactorial aetiology that includes anatomical, pathophysiological, trauma alone or together in addition to psychosocial factors [10]. An up-regulated Hypothalamo-pituitary-adrenocortica (HPA) axis with higher cortisol secretions in TMD patients suggests that emotional distress plays a key role to higher pain catastrophising scores [4,7]. The results of the current study offer an epidemiological support for the relationship between stress, sleep, and TMD. FAI is used as an alternative assessment for diagnosing TMD in a non patient population, as it allows collecting larger data in a relatively short period. It is easy to apply, reliable and cost-effective; and the index involves lesser investigator influence and also lesser variability in measurements [29-32]. So, the authors followed the FAI for TMD evaluation.

In the present study, TMD affected 62.7% of participants, the TMD symptoms were reported as 51% showing mild TMD, while the severity of the condition was only reported in 3.5% of students. This overall prevalence was in accordance to previous studies [5,30-33]. TMD was present in 77% of Turkish dental students, predominantly in females, according to Gaş S et al., Bimb K et al., found that TMD affected 50.3% of the study group, with mild TMD affecting the majority of medical and dental students [24,30]. Augusto VG et al., found that the sample showed a prevalence of TMD of 71.9%, with half of the patients exhibiting mild symptoms [31]. According to Nomura K et al., TMD was common (71%) among Brazilian dental students, with mild cases (35.78%), moderate cases (11.93%), and severe cases (5.5%) [32]. TMD was present in 60.50% of University students, with 41% showing mild TMD, according to Özdiñç S et al., [33]. In a study by Ahuja V et al., the most prevalent TMD among dental students was clicking (24.9%) followed by deviation (16.3%), muscle tenderness (14.3%) and TMJ pain (5.7%) [5]. Few studies suggest females have increased symptoms of TMD as compared to males [9,29,30,33], while few studies suggest no gender difference in TMD symptoms [2,6]. In the present study, FAI index according to gender showed that females reported more symptoms of TMD than males, but the results were statistically non significant.

The psychosocial impairment such as somatisation and depression in TMD patients is linked with pain-associated disability as well as the

chronicity of pain. The natures of stress, the psychiatric response of an individual, as well as, controllability of stressful stimuli are the key variables that determine the HPA-axis response to chronic stress. Yet, the exact influence of stress in the aetiology and persistence of TMD remains inconclusive [4,7,34]. Perceived stress scale has been commonly used to quantify how an individual responds to different life situation [22,30,31]. Accumulating evidence suggests that stress and psychological factors contribute to initiation and progression of TMD [5,10,15,29]. The emotional response of students could change from each phase in their education, since the curriculum demands the students to demonstrate and adopt specific set of skills from time to time [18]. The various factors that lead to stress in university students include academic work pressure, economic situations, personal problems, and environment and time constraints [22,24]. The severity of TMD was closely related to quality of life, psychologic stress, self-performance distrust, psychosomatic and sleep disorders especially in students [6,31,35]. Few studies found that dental students show moderate level of stress [19,22]. Similarly, it is reported that dental students studying in higher classes i.e., those who are supposed to follow the deadlines of clinical work related pressure show higher levels of stress as compared to students in preclinical years [19,23]. In the present study, majority of students showed mild stress scores. Sleep is a behaviourally-regulated drive that involves a state of decreased responsiveness to external stimulus. Sleep has multiple physiological functions that include maintenance of homeostasis, memory consolidation, regulation of behaviour, emotions and hormones, recovery of immune function, regeneration of brain and muscles as well as energy balance [3,4,13]. PSQI is a reliable method to evaluate the nature and severity of sleep disturbance [17,36].

Stress influences the sleep disorder resulting in painful TMD condition [14]. The quality of sleep could be drastically affected in dental students as they are subjected to increased stress due to longer hours of theoretical and clinical practice [20,21]. But very few studies have been reported in dental students for assessment of sleep quality and TMD [12,24]. TMD's have been associated with psychological, somatic, and sleep disorders. It is evident in the literature that patients with TMD suffer from poor quality of sleep [30,36,37].

Few authors have reported that dental students have poor sleep quality [12,17,20,21]. Also, sleep affects the academic performance in students of higher academic semesters due to anxiety and reduced attention levels [15,35,37,38]. In contrast, Angelin TJ et al., reported that dental students in initial academic semesters show poor sleep quality due to lifestyle changes leading to irregular sleep patterns [17]. Few authors report increased stress leads to poor sleep quality in dental students [19,24]. In the present study, authors reported that moderate stress was correlated with poor sleep quality and mild TMD.

Among the important risk factors of TMD, sleep quality and perceived stress are commonly mentioned in literature [33]. Similarly, higher PSQI was positively associated with symptoms of TMD, parafunctional habits, co-morbid pain conditions, increased pain scores as well as compromised oral health related quality of life [4,7,10]. Also, association between poor sleep quality and TMD is well documented [11,37]. The higher the level of TMD disease severity, the higher the mean PSQI scores [24,36]. A bidirectional relation was observed between TMD and sleep disorders [36]. In the present study, there were non significant correlation seen between sleep quality and TMD. Exploring only TMD patients, psychoemotional issues were reported to be higher in those with poor sleep quality [10]. Lei J et al., confirmed the complex multidirectional relationships between depression, anxiety, stress and sleep in TMD [3].

Limitation(s)

The primary limitation in the present study is that it was conducted in a particular institution and so the sample size was limited. Secondly, clinical examination for the TMD symptoms was not carried out. Also, since the PSQI questionnaire involves self-reporting of sleep/wake

habits; this could evoke a possibility of bias as the scores rely on the students' subjective responses. Therefore, further studies with a larger sample or multi-institutional survey could help find the exact relationship between sleep quality, stress levels and TMD symptoms.

CONCLUSION(S)

The majority of dental students reported moderate levels of stress, poor quality of sleep and mild TMD symptoms. Sleep quality and TMD symptoms were both significantly correlated with stress levels. To ascertain the cause-and-effect connections between TMD, stress levels, and sleep quality longitudinal studies with large samples are necessary.

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PLAGIARISM CHECKING METHODS: [Jain H et al.]

- Plagiarism X-checker: Jan 19, 2023
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- iThenticate Software: Feb 27, 2023 (8%)

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