

Relationship between Temporomandibular Disorder and Risk Factors in Health Science Students: A Cross-sectional Study

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ABSTRACT

Aim: Temporomandibular disorder (TMD) is a collective term involving masticatory muscles, temporomandibular joint (TMJ), and problems of associated structures. Several studies have demonstrated factors related to TMD signs and symptoms. However, these data are still limited in Thailand. This study aimed to (i) investigate the prevalence of TMD and (ii) to clarify the relationship between TMD and risk factors in Health Science students, Naresuan University, Phitsanulok, Thailand.

Materials and methods: Three hundred ninety-four subjects participated in the study. Temporomandibular disorder diagnosis was accomplished by a simplified tool for patient screening using a TMD questionnaire. Demographic data and parafunctional habits were collected by a self-assessed questionnaire. Suanprung Stress Test-20 (SPST-20) was used for stress level detection. The data were analyzed by independent *t*-test, Chi-square test, or Fisher's exact test at *p* value < 0.05.

Results: There were 133 males and 261 females. The mean age was 21.19 ± 1.39 years old. The prevalence of TMD was 32.7%. Trauma history, degree majors, clenching, chewing gum, cheek-biting, lip-biting, unilateral chewing, and stress were significantly correlated with TMD. In contrast, gender, age, academic year, history of orthodontic treatment, and some parafunctional habits indicated no relationship with TMD.

Conclusion: One-third of health science students at Naresuan University had TMD symptoms.

Clinical significance: The most common symptom was TMJ sound and several types of parafunctional habits were associated with TMD.

Keywords: Health science student, Parafunctional habit, Prevalence, Risk factors, Temporomandibular disorder.

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INTRODUCTION

According to the American Academy of Orofacial Pain (AAOP), temporomandibular disorder (TMD) is defined as the problems involving masticatory muscles, temporomandibular joint (TMJ), and/or associated structures. Temporomandibular disorder is a major cause of non-odontogenic pain in the orofacial region. Signs and symptoms of TMD are pain and dysfunction.¹ Pain is often associated with jaw movements, such as, yawning, chewing, or speaking. The dysfunction includes joint sound, jaw deviation, limit mouth opening, etc.

The prevalence of TMD symptoms in childhood is rare² while TMD in adolescents, adults, and the elderly ranges from 7 to 74.1%.²⁻⁹ Some researchers claimed that university students especially health science students had a higher prevalence of TMD than other college students.¹⁰ These data vary depending on population, diagnostic criteria, and research methodology.

Multifactorial etiology is the best explanation for TMD cause. Four main etiological factors are trauma (direct/indirect or microtrauma), anatomical factors, pathophysiological factors, and psychosocial factors.¹ For example, a higher prevalence of whiplash injury was found in TMD patients compared with non-TMD patients.¹¹ Kim et al. also reported that subjects with trauma history displayed significantly higher signs and symptoms of TMD than those without trauma history.¹² Several studies demonstrated that parafunctional habits, such as, clenching, bruxism, unilateral chewing, and/or lip-biting are related to TMD.¹³⁻¹⁸ Also, anatomical factors consisting of angle's class II/III, midline shift, large overjet, and deep overbite have been associated with signs and symptoms of TMD.^{19,20}

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Orthodontic treatment is one of the interesting factors to develop TMD signs and symptoms because the process of this treatment affects adaptation of the masticatory system. Although current evidence indicated that the orthodontic treatment is unable to prevent or promote the signs and symptoms of TMD, the relationship between these factors has been studied.²¹⁻²³ In addition to the aforementioned physical factors, the psychosocial factors cannot be neglected. Psychosocial factors, such as, stress, anxiety, and depression, alter the patient's perception and tolerance compared with healthy subjects.^{24,25} Bruxism and stress showed a significant relationship with TMD patients.¹⁷ A study in Thailand also confirmed significant relationships between

TMD symptoms and unilateral chewing, headache, and stressful lifestyle.¹³

Elimination of contributing factors has a great impact on the long-term success of TMD treatment. Although a lot of studies presented relevant factors and TMD, the study between risk factors and TMD in Thailand is limited. Therefore, this study aimed to investigate the prevalence of TMD in health science students, Naresuan University, using a screening tool questionnaire for TMD and to evaluate the relationship between TMD and its risk factors.

MATERIALS AND METHODS

This cross-sectional study was approved by the Naresuan University Ethical Committee, Phitsanulok, Thailand (IRB Number 0225). The data were collected from July to December 2019.

Population and Sample Size

Officially registered health science, undergraduate students, at Naresuan University, Phitsanulok, Thailand were recruited in the study. The health science undergraduate program consisted of 7-degree majors: Dentistry, Nursing, Medicine, Pharmaceutical Sciences, Medical Sciences, Allied Health Sciences, and Public Health. Sample size calculation was done using Taro Yamane's formula,²⁶ by using a total of 3,845 health science students to calculate a required sample size of 363 students. To avoid incomplete data, 400 students were invited to this study. The proportional stratified random sampling technique was used to establish a sample size for each degree majors to avoid bias (Table 1).

Data Collection

All participants received the self-assessed questionnaire from the researcher. They have received a completed explanation of the study objectives and how to complete the required questionnaire.

The self-assessed questionnaire consisted of four main sections. The first one was demographic data including gender, age, degree majors, academic year, history of orthodontic treatment, and trauma. The second one was the TMD screening questionnaire;²⁷ a simplified questionnaire for Thai people used to correctly classify individuals with and without TMD in the past 30 days. The sensitivity

and specificity of the questionnaire were 73 and 70%, respectively.²⁷ The third one created by the researcher was parafunctional habits data consisting of 13 questions, such as, sleep bruxism, tooth clenching, nail-biting, pen-biting, cheek-biting, lip-biting, chewing gum, chewing hardness food, unilateral chewing, lateral sleep position, sucking a finger, and resting your chin on your hand. All subjects were asked to indicate the most performed habits on a Yes or No answer. The last one was stress detection. Suanprung Stress Test-20 (SPST-20) from the Department of Mental Health, Thailand which has a Cronbach's alpha coefficient of 0.82 was used. It comprises 20 questions and 5 level scores for each one. A lower score means no stress and a higher score indicates the higher stress in the past 6 months. The total score was used to classify subjects into four severity of the stress as follows: mild (0–23), moderate (24–41), severe (42–61), and extreme (≥ 62).

Statistical Analyses of the Data

All data were analyzed by using a Statistical Program for Social Sciences (SPSS) 23.0. The prevalence of TMD was reported in mean and standard deviation (SD). The independent samples' *t*-test was used to compare the means of two independent groups. Chi-square or Fisher's exact test was used to analyze the correlation between factors and TMD. The significant level was set at $p < 0.05$.

RESULTS

There were 394 completed questionnaires, 261 females (66.24%) and 133 males (33.76%) with the age ranged from 20 to 25 years. Several responded questionnaires according to degree majors (Table 2) were 24 (Dentistry), 36 (Nursing), 58 (Medicine), 60 (Pharmaceutical Sciences), 56 (Medical Sciences), 88 (Allied Health Sciences), and 72 (Public Health).

Temporomandibular disorder screening questionnaire revealed that 32.74% ($N = 129$) of subjects had TMD and 67.28% ($N = 265$) were TMD free. The association between demographic information and TMD symptoms are shown in Table 2. The TMD group was statistically correlated with degree majors ($p = 0.045$). There was no statistically significant association between TMD/non-TMD subject and gender, age, academic year, or history of orthodontic treatment.

Table 1: Distribution of student's sample according to degree majors using a proportional stratified random sampling method

Degree majors	Total number of students	% of subject from population	Number of subjects
Medicine	599	$\frac{599 \times 100}{3,845} = 16\%$	$\frac{16\% \times 400}{100} = 64$
Public health	679	$\frac{697 \times 100}{3,845} = 18\%$	$\frac{18\% \times 400}{100} = 72$
Pharmaceutical sciences	571	$\frac{571 \times 100}{3,845} = 15\%$	$\frac{15\% \times 400}{100} = 60$
Medical sciences	555	$\frac{520 \times 100}{3,845} = 14\%$	$\frac{14\% \times 400}{100} = 56$
Nursing	356	$\frac{356 \times 100}{3,845} = 9\%$	$\frac{9\% \times 400}{100} = 36$
Dentistry	252	$\frac{252 \times 100}{3,845} = 6\%$	$\frac{6\% \times 400}{100} = 24$
Allied health sciences	833	$\frac{833 \times 100}{3,845} = 22\%$	$\frac{22\% \times 400}{100} = 88$
Total population	3,845		
Total sample size			400

Table 2: Association between the presence of temporomandibular disorder (TMD) and the variables gender, age, degree majors, and academic year

	Total	Non-TMD N = 265	TMD N = 129	p value
Gender				
• Male	133	86 (32.5%)	47 (36.4%)	0.496 ^c
• Female	261	179 (67.5%)	82 (63.6%)	
Age (mean ± SD)	394	21.21 ± 1.39	21.13 ± 1.40	0.595 ^b
Degree majors				
• Medicine	58	42 (72.4%)	16 (27.6%)	0.045 ^{a,c}
• Public health	72	54 (75.0%)	18 (25.0%)	
• Pharmaceutical sciences	60	41 (68.3%)	19 (31.7%)	
• Medical sciences	56	37 (66.1%)	19 (33.9%)	
• Nursing	36	29 (80.6%)	7 (19.4%)	
• Dentistry	24	13 (54.2%)	11 (45.8%)	
Allied health sciences	88	49 (55.7%)	39 (44.3%)	
Academic year				
• 2	125	88 (33.2%)	37 (28.7%)	
• 3	109	75 (28.3%)	34 (26.4%)	
• 4	105	67 (25.3%)	38 (29.5%)	
• 5	30	22 (8.3%)	8 (6.2%)	
• 6	25	13 (4.9%)	12 (9.3%)	0.358 ^c

SD, standard deviation

^aSignificant correlation is at 0.05 level

^bIndependent t-test

^cChi-square test

Figure 1 showed the prevalence of TMD symptoms according to a TMD questionnaire. The most frequent TMD symptoms were TMJ sound (N = 94; 46.8%) followed by TMJ and/or temple pain (N = 41; 20.4%). Limit jaw movement was the least reported symptoms (N = 10; 5%).

The relationship between the TMD and history of orthodontic treatment, trauma history, parafunctional habits, and stress are shown in Table 3. Temporomandibular disorder was significantly associated with trauma history (p = 0.015), clenching (p = <0.001), pen biting (p = 0.038), cheek biting (p < 0.001), lip biting (p = 0.002), and unilateral chewing (p = 0.041). Multiple types of trauma were reported from the subjects. Chin crash was the most common trauma in TMD subjects, followed by a motorcycle accident. Furthermore, those who experienced stress were statistically correlated with TMD (p < 0.001). Most of the health science students in this study had moderate to severe stress (38.1–42.4%).

If the stress levels were re-classified into two rating scores as low and high-stress levels, the low-stress level was a group of the originally classified mild and moderate level (N = 164) and the high stress was a group of the originally classified severe and extreme level (N = 230). The relationship between stress level and degree majors based on the re-classification was displayed in Figure 2. The data revealed that the level of stress was associated with degree majors (Chi-square test; p = 0.012). In health science students, a high-stress level was found 1.4-fold higher than the lower-stress level.

DISCUSSION

The objective of this study was to investigate the prevalence of TMD and to examine the relationship between risk factors and the occurrence of TMD in health science undergraduate students, Naresuan University. By collecting data, the sampling groups were

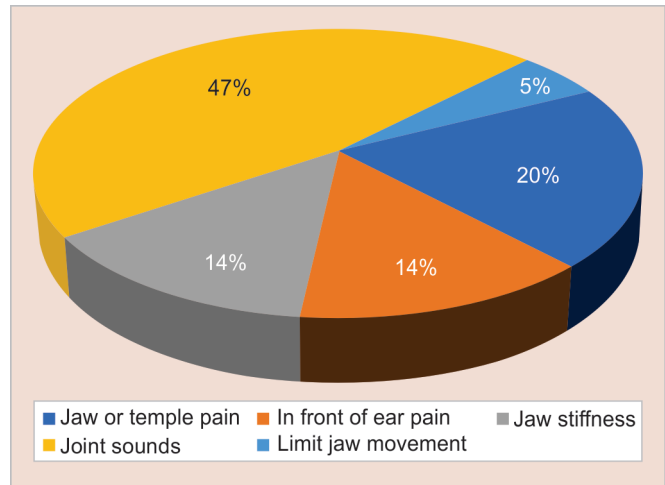


Fig. 1: Prevalence of temporomandibular disorder (TMD) symptoms according to a questionnaire for TMD screening

stratified randomly, both degree majors and academic year to gather truly represent population. A total of 400 questionnaires were distributed, and finally, 394 questionnaires (98.5%) were returned and analyzed.

The prevalence of TMD in this study was 32.7%. This finding was consistent with previous studies that surveyed college students in Taiwan and Saudi Arabia.^{10,28} In Thailand, Itthikul et al.¹³ revealed that the prevalent rate of TMD in new dental patients was 65% when the interview was conducted by a dentist. Likewise, Vanichanon et al.³ found that the prevalence of TMD in scuba divers was 46.8% before diving and increased to 58.9% after driving. Population characteristics, research methodology, diagnostic criteria as well

Risk Factors of TMD

Table 3: The relationship between the presence of TMD and history of orthodontic treatment, trauma history, presence of parafunctional habits, and stress report

Variables	Non-TMD		TMD		p value
	N	%	N	%	
History					
Orthodontic treatment					
Pending	43	48.9	23	45.1	0.499 ^c
w/o orthognathic surgery	45	51.1	27	52.9	
w orthognathic surgery	0	0	1	2	
Trauma					
No	251	94.7	113	87.6	0.015 ^a
Yes	14	5.3	16	12.4	
Types of parafunctional habits					
Sleep bruxism					
No	200	75.5	86	66.7	0.072
Yes	65	24.5	43	33.3	
Clenching					
No	237	89.4	95	73.6	<0.001 ^b
Yes	28	10.6	34	26.4	
Nail-biting					
No	225	84.9	108	83.7	0.768
Yes	40	15.1	21	16.3	
Pen-biting					
No	237	89.4	105	81.4	0.038 ^a
Yes	28	10.6	24	18.6	
Cheek-biting					
No	225	84.9	89	69.0	<0.001 ^b
Yes	40	15.1	40	31.0	
Lip-biting					
No	206	77.7	81	62.8	0.002 ^b
Yes	59	22.3	48	37.2	
Tongue-biting					
No	250	94.3	118	91.5	0.387
Yes	15	5.7	11	8.5	
Chewing gum					
No	182	68.7	92	71.3	0.642
Yes	83	31.3	37	28.7	
Chewing hardness food					
No	101	38.1	54	41.9	0.510
Yes	164	61.9	75	58.1	
Unilateral chewing					
No	155	58.5	61	47.3	0.041 ^a
Yes	110	41.5	68	52.7	
Lateral sleep position					
No	79	29.8	28	21.7	0.093
Yes	186	70.2	101	78.3	
Sucking a finger					
No	263	99.2	126	97.7	0.336 ^c
Yes	2	0.8	3	2.3	
Resting your chin on your hand					
No	73	27.5	26	20.2	0.137
Yes	192	72.5	103	79.8	
Stress level					
Mild	13	4.9	1	14	<0.001 ^b
Moderate	111	41.9	39	150	
Severe	112	42.3	55	167	
Extreme	29	10.9	34	63	

TMD, temporomandibular disorder; W, with; W/O, without
 A significant correlation is at ^a0.05 level and ^b0.01 level. Chi-square test. ^cFisher's exact test

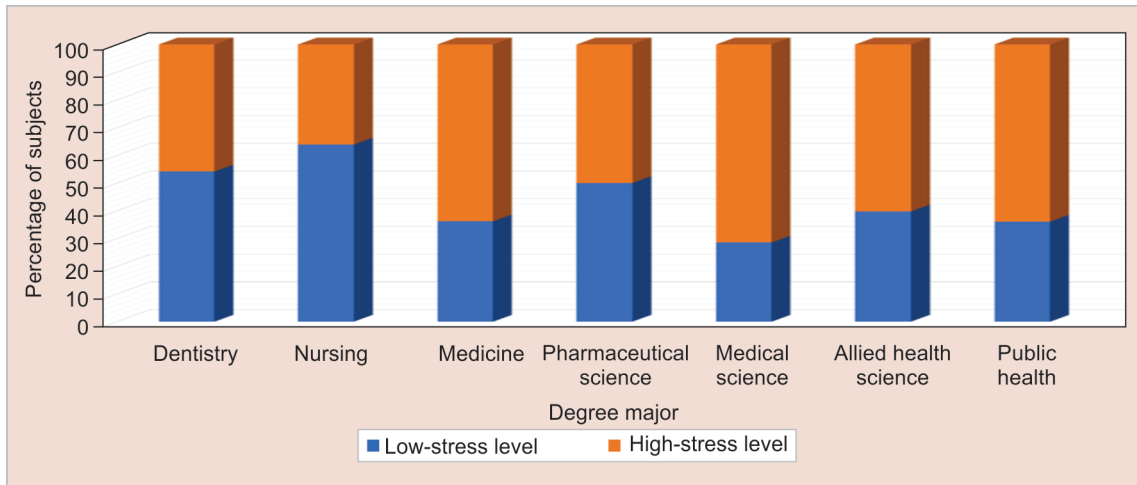


Fig. 2: Relationship between stress level and degree majors

as a lifestyle may be the main reason why TMD prevalence differs among studies.

Although statistical analysis indicated that gender was not significantly associated with TMD, our results showed a 1.75 times higher prevalence of TMD in females than males which was supported by previous studies.^{8,10,29,30} This finding may be explained by the fact that female has health awareness than male and the sex hormone level might be implicated in the physiopathology of TMD, resulting in lower pain thresholds, joint laxity, and hypermobility of TMJ.^{31,32}

The present study found that the most common symptoms of TMD were TMJ sounds (46.8%), which were consistent with the previous findings.^{3,10,28,33} Temporomandibular joint and/or temple pain (20.4%) is the second most symptoms. However, a recent study in college undergraduates in Australia revealed both pain (48.5%) and joint noises (48.5%) as the most equally common TMD symptoms.³⁰

Accordingly, previous studies tried to prove the association between TMD and orthodontic treatment. This study presented no statistically significant association between TMD and orthodontic treatment. The literature reviews reported orthodontic treatment did not provide a risk to TMD development, regardless of the mechanic type of orthodontic treatment, the non-extraction or extraction case, and the type of malocclusion of the patient before treatment.^{23,34}

While analyzing the relationship between TMD and direct and/or indirect trauma, our data demonstrated that injury history was significantly associated with TMD. The study on pain and disability in the head/neck region following trauma showed that subjects with trauma reported more jaw pain and disability compared with the controls.^{10,12,35} Thus, the trauma history especially in the orofacial region is one of the key factors in TMD development.

The roles of parafunctional habits on TMD were also investigated in this study. On the one hand, clenching, pen biting, cheek biting, lip biting, and unilateral chewing were associated with TMD. On the other hand, sleep bruxism, nail-biting, tongue biting, chewing gum, chewing hardness food, lateral sleep position, sucking a finger, and resting chin on hand showed no association to TMD. Similarly, several studies have shown a positive association between parafunctional habits and the presence of TMD^{13,29,36,37} and some evidence verified that sleep bruxism was

strongly associated with TMD symptoms.^{36,37} Anywise, our data were self-reported by students, and sleep bruxism which occurred under unconsciousness may not be recognized by subjects. Therefore, some data may be lost due to the unawareness of their presence.

Psychological factors, such as, stress, are the crucial factor in TMD development. Our data demonstrated that stress was strongly related to TMD in health science students and most subjects had a high-stress level. Gameiro et al.³⁸ proved that stress can affect biological processes related to the hypothalamic-pituitary-adrenal axis, the serotonergic, and opioid systems. For instance, recent studies verified that psychological stress can affect the biological processes of pain transmission and perception.³⁹⁻⁴¹

The limitation of this study is a cross-sectional design. The prospective cohort study is more appropriate to demonstrate the relationship between causal factors and TMD. Therefore, the translation of the association between risk factors and TMD should be done with caution. Furthermore, all participants are health science students which are unable to compare these results to other populations. Nevertheless, our results support previous studies in terms of prevalence and risk factors of TMD.

CONCLUSION

Temporomandibular disorder presented in 32.7% of the health science undergraduate students, Naresuan University. No demographic factors, such as, gender, age, academic year, and history of orthodontic treatment, were significant associated with TMD. However, TMD was more common in females. Trauma history, clenching, pen biting, cheek biting, lip biting, and unilateral chewing were significantly related to TMD and the strongest behavioral factor for TMD was psychological stress.

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