

Original Article

ASSOCIATION BETWEEN TEMPOROMANDIBULAR DISORDERS AND ACADEMIC PERFORMANCE AMONG DENTAL STUDENTS AT KMU INSTITUTE OF DENTAL SCIENCES, KOHAT

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ABSTRACT

Objectives: To find the association between temporomandibular disorders and academic performance among dental students at KMU Institute of Dental Sciences, Kohat.

Materials and Methods: An analytical cross-sectional study was conducted at KMU Institute of Dental Sciences, Kohat (Aug 2024 to Jan 2025) to assess the association between temporomandibular disorders and academic performance in dental students. A total of 163 dental students participated. Data were collected via a structured questionnaire including demographics, Fonseca Anamnestic Index and the Academic Performance Scale. Statistical analysis was performed using SPSS 27, with significance set at $p \leq 0.05$. Chi-square test of association was applied to find out the association between TMD and academic performance. Ordinal logistic regression analysis was used to find the strength of association between TMD severity and academic performance.

Results: Of 163 dental students (mean age 21.2 ± 1.4 years; 53.4% female), 98.8% reported symptoms of temporomandibular disorders, with moderate cases being most prevalent (63.8%). Academic performance was mainly moderate (51.5%) or poor (31.9%). No significant association was found between temporomandibular disorders and academic performance ($p = 0.75$), but increased TMD severity was significantly related to lower academic performance in chi-square analysis ($p = 0.01$). To check strength of this significant association, ordinal logistic regression analysis was done which showed all ORs < 1 , CI crossing 1 with non-significant p values.

Conclusion: Temporomandibular disorder symptoms were highly prevalent, but no significant association was found between TMD and academic performance.

Key words: Academic performance, Dental students, FAI (Fonseca amnestic Index), Temporomandibular disorder (TMD), TMD severity

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INTRODUCTION

Temporomandibular Disorder (TMD) are obscure to the world of dental literature and it is among the typical persistent pain after headache and back pain¹. The American Dental Association (ADA) has described TMD as a collective term for various

conditions that cause jaw pain, limited movement, or clicking sounds. It affects the joint connecting the jawbone to the skull, leading to discomfort, restricted mobility, and audible sounds when moving the jaw². It is the third most prevalent disease and in epidemiological studies, it has been found that 41% of general population is suffering from at least one symptom of TMD³. It is seen that women tend to suffer with more frequency and severity of TMD than men⁴. TMD can be caused by any condition that disrupts the synchronous functioning of the intricate system of bones, muscles and joints or problems similar to referring pain to the ear, head, and cervical area may result in multifactorial nature of TMD and exacerbating complication in TMD patients⁵. These can be the clinical factors that effects the jaw function including traumatic injuries, misaligned bites, and excessive strain on the joint⁶. Additionally, psychological and social factors such as stress, anxiety, and socioeconomic status can contribute to TMD development⁷. According to studies, students might undergo intense stress and develop a habit of clenching their teeth which leads to strain on joint due to the constant pressure of academic performance. As a result, students are more vulnerable to experiencing symptoms such as jaw pain, clicking and limited jaw function⁸. In Pakistan, a large number of dental students experience moderate to high intensity academic stress^{9,10}. Temporomandibular disorders (TMD) among students are closely linked to stress and psychological factor and have been shown to negatively impact overall health and quality of life. The presence of TMD symptoms such as pain, discomfort, and reduced jaw function can interfere with concentration, sleep, and daily functioning, ultimately leading to a decline in academic performance^{11,12}.

TMD in dental students in USA have shown a high prevalence of 90.1%¹³. In Italy, a TMD prevalence of 78% in dental students exists¹⁴. In dental colleges of Punjab in Pakistan, TMD prevalence and severity is high at 66.9% among undergraduate dental students¹⁵. TMD among dental students of Karachi^{16,17} Lahore¹⁸ and Faisalabad¹⁹ shows a prevalence of 52.1%, 42.6%, 63.6% and 23.6%, respectively. In Khyber Pakhtunkhwa (KpK), a prevalence of 72.3% has been seen among dental students²⁰.

During COVID-19 pandemic, dental students with TMD had a greater chance of deteriorated ac-

ademic performance²¹. Only a few studies have examined the association between TMD and academic performance^{12,22}. There is a dearth of research on the matter regarding the association between TMD and academic performance in dental students in South Asia including Pakistan.

Since academic stress and prevalence of TMD is high in dental students in Pakistan. Finding out the association between TMD and academic performance is integral for designing preventive strategies to decrease the incidence of TMD and enhance the academic performance of dental students.

This study seeks to determine the association of temporomandibular (TMD) and academic performance in dental students at Khyber Medical University Institute of Dental Sciences (KMU-IDS) Kohat.

Hypothesis of the study is that an association between TMD and academic performance among dental students exists.

MATERIALS AND METHODS

An analytical cross sectional study was conducted at Khyber Medical University Institute of Dental Sciences (KMU-IDS), Kohat from August 2024 to January 2025 following approval from Institute Ethical Committee (KIDS-IRBB/ECC/24-5/19). Sample size was decided using a published study³⁷ analyzing relationship of TMD and academic performance in dental students (sample size=195). Dental students from first to final professional year were included in the study. This study employed a convenience sampling method and those who provided informed consent were included in the study. Exclusion criteria comprised students with already diagnosed psychiatric conditions such as anxiety or depression, students currently on psychiatric medications, or students with pre-existing medical conditions affecting the TMJ. To handle the missing data, incomplete questionnaires had to be excluded from study if found.

Data collection was carried out using questionnaire in hard form. Students were approached in the classes by primary investigator and questionnaires were distributed among 178 students. Questionnaire had the exclusion criteria disclaimer at the top. Then, there was a demographics section. Section A was about Fonseca Anamnestic Index (FAI) to evaluate TMD. According to the scoring criteria of FAI, a total score of 0-15 indicated absence of TMD while

a score greater than 15 indicated presence of TMD. Section B was about Academic performance scale to assess student’s academic performance.

FAI is a widely used scale, with an internal consistency of 0.73% in similar dental context²³. The academic performance scale had been used in studies conducted by Vandana Esht²⁴ and Mina Azwar²⁵ on medical science students. The scale has solid internal consistency of 0.89 and is developed by Carson Birchmeier, Emily Grattan, Sarah Hornbacher, and Christopher Gregory of Saginaw Valley State University. In our pilot study, the Cronbach alpha was 0.8 showing high reliability of the scale.

Data was analyzed by the use of IBM SPSS Statistics version 27. No missing data was identified. The mean and standard deviation were computed for the scale variable (age), while categorical variables such as gender, professional year, presence of temporomandibular disorders and academic performance levels were calculated using frequencies and percentages. TMD (primary exposure) was evaluated both as a dichotomous variable (positive/negative) and an ordinal variable (TMD severity levels). Academic performance with categories was taken as dependent variable. The chi square test of independence was employed to evaluate associations between categorical variables. Ordinal Logistic Regression analysis was carried out to see the strength of any significant associations seen in chi-square analysis.

RESULT

Total 163 students participated in this study. Response rate was 91.5%. Of 163 students, 41(25.5%) were from 1st year whereas 43(26.4%), 40 (24.5%), 39 (23.9%) were from 2nd, 3rd and 4th Professional BDS year respectively. Out of this 76 (46.6%) were male and 87 (53.4%) were female with mean age of these students was 21.21±1.4 years.

161 (98.8%) of total dental students showed high TMD prevalence whereas only 2(1.2%) of stu-

dents showed no signs of TMD. Table 1 shows the frequency of TMD severity.

No association was found between TMD and academic performance (p value=0.75). However, a significant association was found between TMD severity and academic performance (p value=0.01).

Out of 76 male students, only 1 (1.3%) was TMD negative and 75 (98.7%) were TMD positive. Among 87 female students, 1 (1.1%) was TMD negative and 86 (98.9%) were TMD positive. The association between gender and presence of TMD was not statistically significant with p value of 0.923. The association between gender and TMD severity was also non-significant as p value was greater than 0.05.

Of the 76 males, most performed moderately (40), followed by poor (23), good (9), excellent (2), and failing (2). Among the 87 females, the majority also had moderate performance (44), with 29 poor and 14 good, while none failed or excelled. Overall (N=163), 84 showed moderate, 52 poor, 23 good, 2 excellent, and 2 failing performance. There is no association as p value was 0.26.

In different professional years, most students showed moderate performance: first year (n=41) had 2 failing, 14 poor, 19 moderate, 6 good; second year (n=43) had 16 poor, 20 moderate, 7 good; third year (n=40) had 10 poor, 22 moderate, 7 good, 1 excellent; final year (n=39) had 12 poor, 23 moderate, 3 good, 1 excellent. Overall, 84 moderate, 52 poor, 23 good, 2 failing, 2 excellent, with no significant association (p=0.471).

In the first, second, and third years, all students (100%) were TMD positive. In the final year (n=41), 39 (95.1%) were positive and 2 (4.9%) were negative. TMD showed a significant association with professional year (p value =0.01), but TMD severity and professional year had no association with p value of 0.07.

Table 1: TMD severity Frequency

TMD Severity	Frequency (n)	Percentage (%)
No TMD	2	1.2%
Mild TMD	53	32.5%
Moderate TMD	104	63.8%
Severe TMD	4	2.5%
Total	163	100%

Table 2: Academic Performance Frequency

Academic performance	Frequency	Percent
Failing performance	2	1.2
Poor performance	52	31.9
Moderate performance	84	51.5
Good performance	23	14.1
Excellent performance	2	1.2
Total	163	100.0

Since the association between TMD and academic performance was non-significant, regression analysis was not used for this. To check the strength of significant association between TMD severity and academic performance, ordinal logistic regression analysis was done. TMD severity was the main predictor and academic performance was dependent variable. Unadjusted Ordinal logistic regression analysis model showed that academic performance cannot be predicted by increasing TMD severity. Mild TMD had same odds of high academic performance as No TMD category (reference category). Moderate and severe TMD had lower odds of high academic performance. However, no significant association was seen in this model. See the Table 3 below for unadjusted Regression analysis.

Even after adjustment for age, gender and professional year, the adjusted ordinal logistic regression model depicted that academic performance could not be predicted by increasing TMD severity. As compared to No TMD, Mild TMD had slightly lower odds of high academic performance. Moderate and

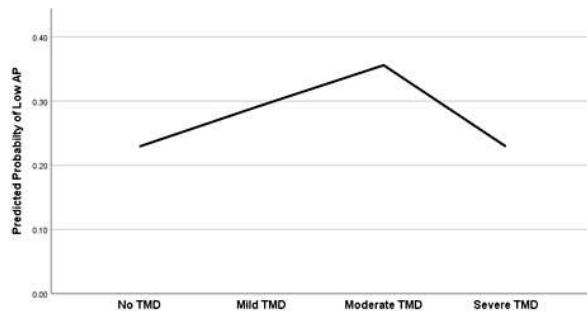


Fig 1: Plot of Predicted probability of low academic performance (AP) across TMD severity

Table 3: Unadjusted Ordinal Logistic Regression Analysis Results

Predictor	Estimate	OR	95% CI	p value
No TMD	0 ^a	1	-	-
Mild TMD	0.00	1	0.04-25.85	1.000
Moderate TMD	-0.334	0.716	0.10-5.02	0.737
Severe TMD	-0.619	0.538	0.07-3.65	0.526

OR=Odds Ratio, CI=Confidence Interval, No TMD (Reference Category)

Table 4: Adjusted Ordinal Regression Analysis Results (Adjusted Factors/Covariate=Gender, Professional year, Age)

Predictor	Estimate	OR	95% CI	p value
No TMD	0 ^a	1	-	-
Mild TMD	-0.109	0.897	0.032 - 24.74	0.949
Moderate TMD	-0.463	0.629	0.08 - 4.58	0.648
Severe TMD	-0.671	0.511	0.07 - 3.54	0.497

OR=Odds Ratio, CI=Confidence Interval, No TMD (Reference Category)

severe TMD showed reduced odds of being in high academic performance category. However, no association achieved statistical significance. See Table 4 below for adjusted Regression analysis.

Figure 1 (plot) represents the probability of low academic performance with TMD severity. As the TMD severity increases from no TMD to moderate TMD, probability of low AP increases. With the severe TMD, the probability drops down. Non-linear trend in this plot is consistent with non-significant association in ordinal logistic regression model.

DISCUSSION

This study addresses a key issue by assessing the association between academic performance and temporomandibular disorders among dental students. This study aimed to provide valuable and practical insights to improve student health and performance. A total of 163 dental students with an average age of 21.21 ± 1.4 years participated. Females were more prevalent 87 (53.4%) as compared to males 76 (46.6%), similar trend of female predominance was observed in studies conducted by Shalin²⁶ and Wishu⁸. Female predominance in this study can be credited to their increased preference for dentistry as a balance between career and personal life is easy to achieve. However, since dental students in this study were selected using convenience sampling, this may not represent the true picture as dental students who participated may be different from those who did not.

By analysis, 161(98.8%) of total dental students showed high TMD prevalence whereas only 2(1.2%) of students showed no signs of TMD. In contrast, Nazir¹⁵ reported 66.9% prevalence of TMD among

364 dental students. This difference may be due to our smaller, more homogenous sample with higher stress exposure which can inflate prevalence compared to larger, more diverse groups. Also in our study, only self-reporting by questionnaire was done without any clinical examination, which may explain the relatively high TMD prevalence.

Furthermore about 53(32.5%) of students who were TMD positive had mild symptoms, 104 (63.8%) had moderate and only 4(2.5%) had severe TMD symptoms whereas study by Amna Rehman²⁷ showed contradictory results with 36.3% mild, 4.8% moderate and 0.5% severe TMD symptoms. The variation may be due to differences in sample characteristics, stress levels, sampling methods, and institutional or environmental factors influencing symptom severity. Moreover, due to the self-reporting based on FAI only, students may over or under report the symptoms, leading to misclassification of TMD severity.

Our study found no association between the presence of TMD and academic performance. Regression analysis model for TMD severity and academic performance also turned out to be non-significant for predicting academic performance based on TMD severity. These findings are similar to results by Takamiya²² which also shows no association between TMD and academic outcomes. Possibly, because academic outcomes are influenced by multiple factors beyond TMD status alone. Factors such as learning opportunities, previous academic ability and stress coping strategies, can play a role.

Additionally, our study shows prevalence of TMD is somehow more in females similar to Shalin²⁶ and Chinthalapalli²⁸ however, it is not statistically significant with the p value more than 0.05. Similarly, Bonjardim²⁹ also reported a non-significant gender difference in TMD prevalence. The relatively higher prevalence of TMD in females may be linked to enduring more stress and hormonal changes as reported by Grave³⁰ and Gao³¹.

A significant association was observed between TMD presence and academic year ($p = 0.01$) in our study, although severity did not vary significantly, with moderate TMD being the most common across groups (p value=0.07). By contrast, Chinthalapalli²⁸ reported a lower prevalence, ranging from 19.4% in first-year students to 40.9% in final-year students, with a non-significant association between TMD

prevalence and year of study (p value=0.075). The difference in findings may be due to variations in sample size, and population characteristics such as stress levels, lifestyle habits, and academic workload. As sleep, anxiety and stress were not measured in this study, this might explain the observed differences.

A comparison with the study by Xiao Jiao Lin³² reveals similar findings regarding the relationship between academic performance and professional year. Our study and study by Lin³² found no statistically significant association between professional year and academic performance. These findings suggest that the academic year alone may not play a decisive role in determining academic performance among dental students.

Our study found no statistically significant association between gender and academic performance ($p > 0.05$), though female students exhibited slightly higher academic outcomes. These findings are consistent with those of Lin³², showing no gender difference in performance and indicating that impact on academic achievements may not be inherently gender driven across all educational framework. Supporting this, Gao³¹ and Bedewy³³ identified higher levels of psychological stress among female students but did not demonstrate a direct impact on academic achievement. Collectively, these studies suggest that while female students may experience greater academic stress, it does not necessarily compromise their performance potentially reflecting more effective coping strategies, greater academic engagement or resilience.

LIMITATIONS

The relatively small sample size and its confinement to a single dental college may restrict the generalizability of the findings. Moreover, no clinical examination of the temporomandibular joint (TMJ) was performed; the diagnosis of TMD relied solely on self-reported questionnaires, which may compromise diagnostic accuracy and may over report prevalence and severity. Potential confounders such stress and sleep were not measured in this study.

CONCLUSION

TMD symptoms were highly prevalent in our study, affecting 98.8% of participants. Although no statistically significant association was found between TMD and academic performance. TMD

severity could not independently predict academic outcomes.

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CONFLICT OF INTEREST
Authors declare no conflict of interest.
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AUTHORS' CONTRIBUTION

The following authors have made substantial contributions to the manuscript as under:

Conception or Design: MS, SS, AM, MM
Acquisition, Analysis or Interpretation of Data: MS, SS, AM, MM
Manuscript Writing & Approval: MS, SS, AM, MM

All the authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.



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