



Jaws of knowledge: an analysis of temporomandibular joint insights in dental training—a quasi-experiment study

Bhushan R. Bhagat^{1,3}, Mahesh R. Khairnar², Samanwita Maity¹, Muskaan M. Sachdev¹, Sonal Shah¹, Ravina Dharamsi¹

¹Department of Oral and Maxillofacial Surgery, Dr. D. Y. Patil Dental College & Hospital, Dr. D. Y. Patil Vidyapeeth, Pune,

²Unit of Public Health Dentistry, Faculty of Dental Sciences, Institute of Medical Sciences, Banaras Hindu University, Varanasi,

³Nair Hospital Dental College, Mumbai, India

Abstract (J Korean Assoc Oral Maxillofac Surg 2024;50:80-85)

Objectives: To access the knowledge of undergraduate and postgraduate students of the dental college on basic anatomy, physiology, clinical examination, and pathology of the temporomandibular joint (TMJ).

Materials and Methods: A total of 610 undergraduate and postgraduate students of dental college, were included in this study. The questionnaire was pretested for validation and distributed online through Google forms.

Results: A pairwise comparison showed that the percentage of correct answers for interns significantly differed from that of IV Bachelor of Dental Surgery ($P=0.050$) and postgraduate students ($P=0.048$) (below average: up to 6 correct answers, good: 7-11 correct answers, excellent: 12 or more correct answers).

Conclusion: TMJ diseases are common in daily life but frequently go undiagnosed and untreated due to a lack of clinical expertise. This demonstrates the necessity of providing instructions that give students in-depth knowledge and abilities for TMJ issues in clinical practice.

Key words: Temporomandibular joint anatomy, Temporomandibular joint clinical examination, Temporomandibular joint disorders, Temporomandibular joint knowledge, Dental students

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I. Introduction

Diverse anatomical components of the stomatognathic system enable the mouth to open, swallow, breathe, phonate, suck, and make diverse facial expressions¹. One of these structures is the fully mobile temporomandibular joint (TMJ). The TMJ controls the jaw's opening and shutting. Clinical issues involving the masticatory muscles, the TMJ, and related structures are caused by temporomandibular disorders (TMD). This results in significant socioeconomic costs because of frequently leaving work and needing medical care and surgical procedures^{2,3}. TMDs have been identified as the common

source of non-dental orofacial discomfort and are frequently treated by medical practitioners. In terms of diagnosis, prognosis, and therapy, it is the disease that modern society faces as the greatest challenge. To diagnose TMDs, a thorough history and physical examination are essential. TMJ dysfunction frequently manifests as pain and restricted ranges of motion. As additional diagnostic resources, radiographic examinations are used. A clinician must carefully include TMJ imaging in the patient's therapy plan together with the clinical presentation, signs, and symptoms^{3,4}.

A study conducted on dentists in Italy regarding their knowledge of the symptoms and treatment related to TMD showed that 41% of general practitioners had sufficient TMD knowledge, 12% were aware of TMD, and 47% had insufficient knowledge⁵.

A multidisciplinary approach involving general dentistry, oral medicine and radiography, orthodontics, oral surgery, physical therapy, and psychology may be necessary to fully address the patient's needs. The diagnoses and treatment are influenced by the dental professionals' training, outlook, and experience⁶.

Bhushan R. Bhagat

Department of Oral and Maxillofacial Surgery, Dr. D. Y. Patil Dental College & Hospital, Dr. D. Y. Patil Vidyapeeth, Pimpri, Pune 411018, India
TEL: +91-9975630997

E-mail: bhagatbhushan10@gmail.com

ORCID: <https://orcid.org/0000-0003-4413-3879>

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Dentistry plays a huge role in managing orofacial problems. Problems related to TMJ are among the most important in dentistry. Dentists must know about TMJ as part of their practice⁷. This study evaluates undergraduate and postgraduate students' knowledge of basic anatomy, physiology, clinical examination, and pathology of TMJ because these students will be TMD-experienced dental practitioners in areas of dentistry that are specialized for the diagnosis and treatment of TMDs. This study aims to assess the knowledge, attitude, and practice of undergraduate and postgraduate dental students.

II. Materials and Methods

1. Study design, study population, and study setting

The present cross-sectional study was conducted with a cohort of 610 undergraduate (UG) and postgraduate (PG) dental students in a dental institute in the Western Maharashtra Region of India. The study was conducted from September 2023 to November 2023. The undergraduate students included the students from the Bachelor of Dental Surgery course during their first, second, third, and fourth years of study and the internship. Ethical clearance was obtained from the Ethics Committee at Dr. D. Y. Patil Dental College & Hospital (No. DYPDCH/DPU/EC/920/28/2023). A written informed consent was obtained from all the study participants after explaining to them the objectives of the study.

1) Sample size

The sample size was calculated using an online calculator available at raosoft.com. A minimum of 599 survey responses were needed with a margin of error of $\pm 1\%$ and a confidence level of 95%, a population size of 638 (total number of UG and PG students), and a response distribution of 50%.

2) Sampling technique

A purposive sampling method was employed to select the study participants.

3) Inclusion criteria

Those undergraduate and postgraduate students who gave consent to participate were included in the study.

4) Study questionnaire

A questionnaire consisting of 18 items related to the knowledge of basic anatomy, clinical examination, and pathology

of the TMJ among dental UG and PG students was developed by the authors and subjected to a panel of five experts consisting of academicians from the field of oral medicine and radiology, oral surgery, and public health dentistry for review and content validation. Details of the content validity index (CVI) were the Scale-CVI/Ave (based on Item-CVI [Item-level CVI]): 0.90; Scale-CVI/Ave (based on proportion relevance): 0.91; Scale-CVI/UA (Scale-level CVI based on the universal agreement method): 0.86. Necessary modifications were made as per suggestions, and one item was removed from the questionnaire. A final questionnaire consisting of 17 items was subjected to assess internal consistency. The value of Cronbach's alpha coefficient (internal consistency reliability) was 0.80, which was considered good. The questionnaire was then administered to another group of five dentists on two different occasions to check test-retest reliability. The kappa coefficient value obtained was 0.84, which shows strong agreement between the responses.

An email with a link to the survey questionnaire was sent to all the student participants. One week later, they were again reminded through an email to complete the survey. Responses to the survey were collected through an online survey administration app (Google forms). The responses obtained were modified according to correct and incorrect answers to every question. Correct answers were identified as "score 1," and incorrect answers were identified as "score 0." Based on the responses obtained, the knowledge of each participant was categorized into excellent (12-17 correct responses), good (7-11 correct responses), and below average (6 or fewer correct responses).

2. Statistical analysis

The questionnaire was mailed to all the UG and PG students of the dental institute (total of 638), out of which 610 students responded with a completed questionnaire (response rate of around 95%). The data were compiled using Microsoft Excel 16 software (Microsoft) and analyzed using IBM SPSS Statistics software (ver. 26; IBM Corp.). The level of significance was kept at 5%. Demographic details and the distribution of correct answers were presented using descriptive statistics. A comparison of correct answers (in %) among different student categories was performed using a one-way ANOVA test followed by a post hoc Tukey test for pairwise comparisons. A comparison of knowledge among different student categories was done using the chi-square test.

III. Results

The mean age of the study participants was 20.95±1.45 years. In given datasets, 292 were males (45.8%) and 346 were females (54.2%).(Table 1)

The distribution of correct answers (in %) varies from 8.0 to 82.6.(Table 2)

In a statistical analysis, all undergraduate, postgraduate, and internship students were analyzed with the help of a one-way ANOVA test. A significant difference with a *P*-value of 0.003 was determined among the results of different groups. Subsequent post hoc Tukey tests were performed to further explore the differences, revealing that the mean scores in the intern group were significantly different from those in the other groups (*P*≤0.05), marked with an asterisk (*) in Table 3.

For I Bachelor of Dental Surgery (BDS) mean value is 66.56. II BDS mean value is 71.25. III BDS mean value is 72.95. IV BDS mean value is 64.80. Interns' BDS mean value is 78.87. Postgraduate students' mean value is 65.14. (Table 3)

A pairwise comparison showed that the percentage of cor-

Table 1. Demographic details of study participants

Variable	Value
Age (yr)	20.95±1.45
Sex	
Male	292 (45.8)
Female	346 (54.2)

Values are presented as mean±standard deviation or number (%).

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Table 2. Distribution of correct answers

Question	Correct answer	Distribution of correct answers (%)
1. TMJ is a	Diarthroidal joint	82.6
2. Which ligament is not associated with TMJ?	Stylohyoid ligament	70.9
3. Which part of mandible forms the TMJ?	Condylar process	73.4
4. Mandibular fossa is a part of	Temporal part	81.4
5. In rest position, relation of articular eminence to the head of the condyle is	Antero-superior	77.7
6. Which part of the mandible is attached to the medial pterygoid muscle?	Medial surface of mandible	68.5
7. Which part of the mandible is attached to the lateral pterygoid muscle?	Condylar process	66.9
8. Which part of the mandible is attached to the temporalis muscle?	Coronoid process	70.7
9. When you protrude your jaw, which muscles of mastication are acting?	Masseter, medial pterygoid & lateral pterygoid	74.1
10. When you move your jaw side to side, which muscles of mastication are not acting?	Masseter	73.7
11. Which muscle is not responsible for closing the mouth?	Lateral pterygoid	11.3
12. In TMJ examination, how many areas you palpate for examination of muscle of mastication in TMJ pain?	Three	79.0
13. On which side should the examiner stand during TMJ examination?	Front	87.2
14. How many methods do you know about TMJ examination?	Three	82.9
15. Do you know about crepitus?	Yes	93.7
16. What is lock jaw?	Hypermobility of TMJ	8.0
17. In TMJ deviation mandible moves towards	Affected side	83.7

(TMJ: temporomandibular joint)

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rect answers for interns significantly differed from that of IV BDS (*P*=0.050) and PG students (*P*=0.048).

A chi-square test was conducted to assess the distribution of knowledge levels (below average, good, excellent) among different groups (UG students, interns, PG students). A significant variation was seen among the groups with the *P*-value of <0.001. Specifically, in the interns group, the majority of participants demonstrated excellent knowledge (88.9%), whereas in the other groups, a more balanced distribution was observed. Knowledge levels were categorized as below average (0-6 correct answers), good (7-11 correct answers), and excellent (12 or more correct answers), with an asterisk (*) indicating statistical significance *P*-value.(Table 4)

A chi-square test was conducted to assess the associations between different groups (UG students, interns, PG students), and the results indicated significant differences in knowledge

Table 3. Comparison of correct answers (in %) among different student strata

Group	No. of students	Mean±SD	<i>P</i> -value
I BDS	108	66.56±24.43	0.003*
II BDS	223	71.25±19.56	
III BDS	137	72.95±18.55	
IV BDS	62	64.80±24.85	
Interns	27	78.87±14.15	
PG students	81	65.14±26.87	

(BDS: Bachelor of Dental Surgery, PG Students: postgraduate students, SD: standard deviation)

**P*≤0.05.

Statistical analyses by one-way ANOVA test; post hoc Tukey test.

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levels among the groups. Specifically, significant differences were observed between I BDS and II BDS (P -value of 0.001*), I BDS and III BDS (P -value of 0.002*), II BDS and IV BDS (P -value of less than 0.001*), I BDS and interns (P -value of 0.014*), II BDS and PG students (P -value of 0.001*), III BDS and IV BDS (P -value of 0.003*), and interns and PG students (P -value of 0.009*). The P -value was significant (≤ 0.05). (Table 5)

IV. Discussion

A comparable study was previously carried out with general dental practitioners (GDPs) and specialists in temporomandibular joint disorders (TMDs; i.e., prosthodontists, oral and maxillofacial surgeons, oral medicine specialists, and radiologists)⁸. It was shown that whereas GDPs had low/fair levels of understanding of TMDs, the majority of specialists had good levels of knowledge. Additionally, according to Al-Huraishi et al.⁸, GDPs had lower levels of etiology, diagnosis, and treatment understanding than did TMD specialists. Fur-

ther proof that general practitioners, subject matter experts, and academic experts agreed that undergraduate dental education on TMDs and orofacial discomfort was inadequate comes from a survey that Celakil and Saruhanoğlu⁹ did in Iran. This strongly shows that the undergraduate curriculum needs to be enhanced to include information on TMD diagnosis and management that is both theoretical and practical^{8,9}.

A few studies have examined relief from joint and muscle pain, but not from joint noise. Orthodontic therapies are thought to be able to remodel the TMJ by correcting malocclusion, which obviates the need for new functional requirements and maintains normal function. According to Singh et al.¹⁰, participants with symptoms like painless clicking and deviation could begin orthodontic therapy. The authors concluded that orthodontic therapy should come after pain and dysfunction have been addressed. According to Conti et al.¹¹, the majority of study participants believed that individuals with TMDs should not begin orthodontic treatment. The management of TMDs appears to be most successful when occlusal interferences are found and removed, according to the literature¹².

The available therapeutic options for TMDs are numerous, contradictory, and inconclusive. Occlusal interference correction was shown to have better outcomes. Other management modalities include like parafunctional habit therapy, physical therapy, medication management, heat application, surgical management, transcutaneous electrical nerve stimulation, prolotherapy, behavioral modification, trigger point therapy, and laser therapy, in that order¹³⁻¹⁶.

Because occlusal adjustment has the problem of being permanent, several systematic reviews and meta-analyses assert that there is no evidence to support its therapeutic use¹³. However, adjusting the occlusion is warranted if it is a contributing issue, such as the location of restorations causing TMD. The determination of possible clinical features of TMDs is key to the early diagnosis of TMJ dysfunction and adequate treatment^{17,18}. The correct diagnosis and clinical ex-

Table 4. Comparison of knowledge among different student strata

Group	Knowledge			Total	P -value
	Below average	Good	Excellent		
I BDS	21 (19.4)	19 (17.6)	64 (59.3)	108	<0.001*
II BDS	19 (8.5)	60 (26.9)	144 (64.6)	223	
III BDS	10 (7.3)	25 (18.2)	102 (74.5)	137	
IV BDS	15 (24.2)	11 (17.7)	36 (58.1)	62	
Interns	1 (3.7)	2 (7.4)	24 (88.9)	27	
PG students	20 (24.7)	15 (18.5)	46 (56.8)	81	

(BDS: Bachelor of Dental Surgery, PG students: postgraduate students)

* $P \leq 0.05$.

Statistical analysis by chi-square test.

Values are presented as number (%).

Below average: 0-6 correct answers, Good: 7-11 correct answers, Excellent: 12 or more correct answers.

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Table 5. Pairwise comparison of knowledge

Group	I BDS	II BDS	III BDS	IV BDS	Interns	PG students
I BDS	-	0.001*	0.002*	0.986	0.014*	0.943
II BDS	-	-	0.131	<0.001*	0.039*	0.001*
III BDS	-	-	-	0.003*	0.265	0.001*
IV BDS	-	-	-	-	0.015*	0.988
Interns	-	-	-	-	-	0.009*
PG students	-	-	-	-	-	-

(BDS: Bachelor of Dental Surgery, PG students: postgraduate students)

* $P \leq 0.05$.

Statistical analysis by chi-square test.

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amination of TMJ are necessary for dental students¹⁷. There are very few studies suggesting a direct relationship between knowledge about TMJ, TMD, and cognizance¹⁸. An adequate cognition is required among the students to investigate, diagnose, and treat TMDs at early stages¹⁸.

It is evident from the current study that most individuals have a good theoretical knowledge of basic anatomy, clinical examination, and pathology of the TMJ. These study results show that second-year students have the best knowledge of the TMJ. The reason for this could be a lack of awareness about the signs and symptoms of TMDs among the first-year students because the second-year students gave evidence of their knowledge of TMJ. The pairwise comparison showed that the percentage of correct answers for interns significantly differed from that of IV BDS and PG students. The reason for this could be the addition of awareness about signs and symptoms of TMDs among the interns due to their PG preparations. The authors recommend that more focus should be given on this topic with a more practically based approach of teaching through case-based and role-play learning will help students better understand the subject. Preclinical and clinical workshops should be conducted in the institute on TMJ to increase students' knowledge.

V. Conclusion

TMJ conditions are widespread in everyday life, yet they usually go undetected and untreated due to a lack of clinical knowledge. The need for teaching that equips students with in-depth knowledge and skills for TMJ disorders in clinical practice is illustrated by this study.

ORCID

Bhushan R. Bhagat, <https://orcid.org/0000-0003-4413-3879>

Mahesh R. Khairnar, <https://orcid.org/0000-0003-4274-9565>

Samanwita Maity, <https://orcid.org/0000-0002-3182-6708>

Muskaan M. Sachdev, <https://orcid.org/0000-0002-5189-2235>

Sonal Shah, <https://orcid.org/0000-0001-8424-0105>

Ravina Dharamsi, <https://orcid.org/0000-0003-1440-8907>

Authors' Contributions

B.R.B., S.M., M.M.S., and S.S. participated in study de-

sign and data collection and wrote the manuscript. M.R.K. participated in the study design and performed the statistical analysis. R.D. participated in the study design and coordination and helped to draft the manuscript. All authors read and approved the final manuscript.

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Ethics Approval and Consent to Participate

Ethical clearance was obtained from the Ethics Committee at Dr. D. Y. Patil Dental College & Hospital (No. DYPDCH/DPU/EC/920/28/2023). A written informed consent was obtained from all the study participants after explaining to them the objectives of the study.

Conflict of Interest

No potential conflict of interest relevant to this article was reported.

References

1. Bordoni B, Varacallo M. Anatomy, head and neck, temporomandibular joint. In: Aboubakr S, Abu-Ghosh A, Adibi Sedeh P, Aeby TC, Aeddula NR, Agadi S, et al., eds. StatPearls. StatPearls Publishing; 2023.
2. Sharma S, Gupta DS, Pal US, Jurel SK. Etiological factors of temporomandibular joint disorders. *Natl J Maxillofac Surg* 2011;2:116-9. <https://doi.org/10.4103/0975-5950.94463>
3. Bhagat B, Bhagat S, Sachdev M, Pandey ND. Desideratum of corroboration-based management for temporomandibular joint disorders: pressing priority in oral surgery. *J Korean Assoc Oral Maxillofac Surg* 2023;49:53-4. <https://doi.org/10.5125/jkaoms.2023.49.1.53>
4. Taneja P, Nagpal R, Marya CM, Kataria S, Sahay V, Goyal D. Temporomandibular disorders among adolescents of Haryana, India: a cross-sectional study. *Int J Clin Pediatr Dent* 2019;12:500-6. <https://doi.org/10.5005/jp-journals-10005-1689>
5. Mozhdeh M, Caroccia F, Moscagiuri F, Festa F, D'Attilio M. Evaluation of knowledge among dentists on symptoms and treatments of temporomandibular disorders in Italy. *Int J Environ Res Public Health* 2020;17:8760. <https://doi.org/10.3390/ijerph17238760>
6. Bergendal B, Bergendal T, Hallonsten AL, Koch G, Kurol J, Kvint S. A multidisciplinary approach to oral rehabilitation with osseointegrated implants in children and adolescents with multiple aplasia. *Eur J Orthod* 1996;18:119-29. <https://doi.org/10.1093/ejo/18.2.119>
7. López-Frías FJ, Gil-Flores J, Bonilla-Represa V, Ábalos-Labruzzi C, Herrera-Martinez M. Knowledge and management of temporomandibular joint disorders by general dentists in Spain. *J Clin Exp Dent* 2019;11:e680-5. <https://doi.org/10.4317/jced.55634>
8. Al-Huraishi HA, Meisha DE, Algheriri WA, Alasmari WF, Alshaim AS, Al-Khotani AA. Newly graduated dentists' knowledge of temporomandibular disorders compared to specialists in Saudi

- Arabia. *BMC Oral Health* 2020;20:272. <https://doi.org/10.1186/s12903-020-01259-4>
9. Celakil T, Saruhanoğlu A. Knowledge and attitude toward temporomandibular disorders: a survey in İstanbul. *Turk J Orthod* 2022;35:39-45. <https://doi.org/10.5152/turkjorthod.2022.21170>
 10. Singh BP, Jayaraman S, Kirubakaran R, Joseph S, Muthu MS, Jivnani H, et al. Occlusal interventions for managing temporomandibular disorders. *Cochrane Database Syst Rev* 2017;2017:CD012850. <https://doi.org/10.1002/2F14651858.CD012850>
 11. Conti AC, Oltramari PV, Navarro Rde L, de Almeida MR. Examination of temporomandibular disorders in the orthodontic patient: a clinical guide. *J Appl Oral Sci* 2007;15:77-82. <https://doi.org/10.1590/s1678-77572007000100016>
 12. Lima AF, Cavalcanti AN, Martins LR, Marchi GM. Occlusal interferences: how can this concept influence the clinical practice? *Eur J Dent* 2010;4:487-91.
 13. Tsukiyama Y, Baba K, Clark GT. An evidence-based assessment of occlusal adjustment as a treatment for temporomandibular disorders. *J Prosthet Dent* 2001;86:57-66. <https://doi.org/10.1067/mpr.2001.115399>
 14. Wright EF, North SL. Management and treatment of temporomandibular disorders: a clinical perspective. *J Man Manip Ther* 2009;17:247-54. <https://doi.org/10.1179/106698109791352184>
 15. Dharamsi R, Nilesh K, Mouneshkumar CD, Patil P. Use of sodium hyaluronate and triamcinolone acetonide following arthrocentesis in treatment of internal derangement of temporomandibular joint: a prospective randomized comparative study. *J Maxillofac Oral Surg* 2024;23:204-9. <https://doi.org/10.1007/s12663-022-01804-4>
 16. Singh RK, Pal US, Goyal P, Nischal A, Gurung TR, Daga D. TMJ arthrocentesis alone and in combination with duloxetine in temporomandibular joint pain. *J Maxillofac Oral Surg* 2018;17:270-5. <https://doi.org/10.1007/s12663-017-1037-4>
 17. Kang HJ, Hwang DS, Kim YD, Shin SH, Kim UK, Kim JR, et al. Clinical study on the etiology, differential diagnosis and treatment of trismus. *J Korean Oral Maxillofac Surg* 2006;32:544-58.
 18. Choudhary SH, Kale LM, Mishra SS, Sodhi S, Muley PB, Pandey ND. An institutional survey for knowledge-based and self-awareness assessment in temporomandibular joint disorders among dental students. *Indian J Dent Res* 2016;27:262-7. <https://doi.org/10.4103/0970-9290.186238>

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