

Identification of Malocclusion by Dental Undergraduate Students: A Cross-sectional Study

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ABSTRACT

Introduction: Health is multifaceted and influenced by a variety of variables. Along with dental caries, periodontal and gingival disorders, malocclusion is one of the most prevalent dental issues. It can impair oral health by increasing the prevalence of dental caries, periodontal diseases, and temporomandibular disorders, as well as predispose to oral habits in the majority of cases. Hence, knowledge about the need for treatment and the correct time of commencement is essential for treating malocclusion.

Aim: To assess the level of understanding of dental undergraduate students in the identification of malocclusion.

Materials and Methods: A cross-sectional study was conducted on 150 final-year dental undergraduate students from private dental colleges who were randomly chosen. A pre-tested questionnaire with closed-ended questions was given to every participant, and their knowledge levels were evaluated on the same day after the collection of completed questionnaires. The

questionnaire contained intraoral and extraoral photographs of patients with malocclusions. Students were asked questions about the identification of various malocclusions, and the data was analysed as frequency (n) and percentages (%).

Results: Questionnaire responses by a total of 150 dental undergraduate students, (48 males and 102 females) with a mean age of 21±2 years were analysed. The majority of students were able to identify Angle's Class-I (n=139, 92.7%), Class-II (n=103, 68.7%), and Class-III (n=122, 81.3%) malocclusions, as well as canine relationships (n=136, 90.7%). The majority of students had no difficulty in recognising transverse malocclusions, such as posterior crossbite (n=103, 68.7%) and scissors bite (n=99, 66%), as well as common malocclusions like crowding, spacing, midline shift, and deep bite.

Conclusion: Most of the students were familiar with the diagnosis of malocclusion. However, knowledge regarding the type of appliance to be used and the age of starting treatment was lacking.

Keywords: Diagnosis, Knowledge, Orthodontic treatment, Questionnaire

INTRODUCTION

A comfortable and effective dentition that enables people to maintain their social roles is the definition of oral health [1]. Oral health education is considered a necessary prerequisite for health-related behaviour. Oral health can significantly impact human welfare and general health. Malocclusion, classified as a developmental condition rather than a disease, is included under the heading of handicapping dentofacial anomalies by the World Health Organisation (WHO) in year 1987. It is defined as an anomaly that causes disfigurement or impedes function and requires treatment if the disfigurement or functional defect is likely to be an obstacle to the patient's physical or emotional well-being [2].

According to the WHO, malocclusion is the third most important oral health condition. India is a large country with a diverse population of races and ethnicities, and the prevalence of malocclusion varies noticeably from the north to the south. Malocclusion can impair several oral functions such as chewing, swallowing, and speaking skills, as well as dentofacial aesthetics and psychosocial self-confidence, all of which have a negative impact on daily life [3,4]. It can also impair oral health by increasing the prevalence of dental caries, periodontal diseases, and temporomandibular disorders. Malocclusion may result from local causes, including thumb sucking, developmental tooth anomalies, and early primary tooth extraction, in addition to genetic, environmental, or a combination of factors. Although malocclusion can present challenges in practicing excellent oral hygiene, chewing, speaking, and breathing, and can predispose individuals to oral habits that may cause pain and discomfort, in the majority of cases, the primary motivator for orthodontic treatment is the cosmetic impairment caused by malocclusion. While it may not be possible to completely eliminate several causes of malocclusion,

early treatment at the appropriate time can help prevent and reduce the progression of certain malocclusions [5,6].

Proper tooth alignment and interdigitation between the arches can help prevent gum recession, trauma to the teeth, dental caries, gum diseases, and tooth loss in some individuals. Orthodontic appliances can be used to correct malocclusion and restore a stable occlusal relationship. It has been demonstrated that the desire to look attractive, self-esteem, and self-perception of dental appearance all influence orthodontic treatment [7]. Therefore, understanding the need for treatment and the appropriate time to begin is critical for addressing malocclusion.

The Association for Dental Education in Europe (ADEE) states that dental graduates should be able to handle all forms of orthodontic emergencies, including referral when necessary [8]. Dental students should be exposed to orthodontic issues to develop their knowledge, skills, and confidence in dealing with orthodontic cases. Therefore, it is critical for dentists to develop the confidence necessary to effectively manage orthodontic patients. Understanding the causes of students' lack of confidence in identifying orthodontic problems would provide useful information to incorporate into teaching programs to address these issues [9]. There is limited published literature in this field, as the majority of earlier survey questions focused only on undergraduates' perceptions of orthodontic diagnosis and treatment for Class-II malocclusion [9-13].

Therefore, the main aim of this study was to assess the knowledge and understanding of dental undergraduate students in identifying all types of malocclusions, including both skeletal and dental aspects, which are required for basic diagnosis and planning of orthodontic treatment. Additionally, the study aimed to evaluate the students' level of confidence in selecting appropriate appliances.

MATERIALS AND METHODS

The current cross-sectional study was conducted on final-year BDS dental undergraduate students who were randomly chosen from a Private Dental College in Visakhapatnam, Andhra Pradesh, India, from July 2022 to August 2022. Approval for this study (Project #ANIDS/IEC/202206013) was granted by the Anil Neerukonda Institute of Dental Sciences' Institutional Review Committee (IRC) on June 16, 2022.

Inclusion criteria: Those BDS students who were present on the day of the study, completed their third year of BDS and were confirmed final year students were included in the study.

Exclusion criteria: First, second, and third-year BDS students of the chosen study institute were excluded from the study.





Sample size calculation: The sample size was determined using G-power Analysis software, considering a study power of 80% and a margin of error of 0.05%. An additional 2% was added to the sample to compensate for potential attrition. Seven samples were added to the initial sample size (143), resulting in a total sample size of 150.










Procedure




A questionnaire with closed-ended questions was initially constructed based on the BDS final year undergraduate orthodontic curriculum. To ensure face validity, feedback on clarity and writing style was obtained from five orthodontic educators and 10 final-year undergraduate students from the institute. Content validation was conducted by a

panel of 10 experts selected for their expertise in the field, including five orthodontists from academia, four orthodontic clinicians, and one public health dentist. The questionnaire pre-testers were chosen to ensure consistency in age, gender, clinical, and academic experience. Each panelist rated the usefulness of the questions on a 4-point scale (1-extremely useful, 2-useful, 3-may be useful, and 4-can be excluded). Scores of 1 and 2 were considered "yes" and included, while scores of 3 and 4 were considered "no" and excluded [14]. The total number of "yes" and "no" answers for each item was noted, and the Content Validity Index (CVI) was calculated as the total score divided by the number of experts. A score of 0.8 or above was considered acceptable. The test-retest reliability of questions was assessed using kappa values ranging from 0.8-0.87, indicating almost perfect agreement, which was considered adequate for inclusion in the questionnaire. After excluding five questions with poor content validity and reliability, the final questionnaire [Table/Fig-1] consisted of 20 items. The questionnaire was administered to every participant, and their knowledge levels were evaluated on the same day after collecting the completed questionnaires.

The first section of the questionnaire included demographic information such as study year and sex. The second section consisted of intraoral and extraoral photographs of patients with Angle's Class-I, II, and III malocclusions, which clearly depicted clinical features such as increased overjet and overbite, Class-I, II, and III canine and incisor relationships, transverse malocclusions, anterior diastema, crowding, crossbites in the anterior and posterior regions, scissors bite, and skeletal Class-I, II, and III. Students were

S. No.	Question	Options	(n)	(%)	
1.	Identify ideal Angle's Class-I molar relation	1	0	0	
		2	11	7.3	
		3	139	92.7	
		4	0	0	
2.		Which of the following is Angle's Class-II subdivision malocclusion?	1	8	5.3
		2	103	68.7	
		3	11	7.3	
		4	28	18.7	
3.		Which of the following is Angle's Class-III subdivision?	1	3	2
		2	126	84	
		3	12	8	
		4	9	6	
4.		Is this Class-I canine relation	Yes	14	9.3
		No	136	90.7	
5.		Class-III incisor relationship is also called as	Anterior crossbite	89	59.3
		Scissors bite	17	11.3	
	Anterior deep bite	31	20.7		
	Anterior closed bite	13	8.7		

6.	Which of the following is the transverse malocclusion?	Anterior crossbite	32	21.3
		Anterior openbite	12	8.0
		Anterior deep bite	3	2.0
		Posterior crossbite	103	68.7
7.	Identify the ideal Angle's Class-III molar relation 	1	3	2.0
		2	20	13.3
		3	122	81.3
		4	5	3.3
8.	Which of the following is ideal Class-II canine relation? 	1	19	12.7
		2	102	68.0
		3	3	2.0
		4	26	17.3
9.	The following is Angle's Class-II Division 2 malocclusion 	Yes	115	76.7
		No	35	23.3
10.	Identify the following malocclusion 	Scissors bite	99	66.0
		Posterior crossbite	28	18.7
		Crossbite	8	5.3
		None of the above	15	10.0
11.	Identify the following malocclusion 	Scissors bite	26	17.3
		Posterior crossbite	111	74.0
		Anterior crossbite	6	4.0
		None of the above	7	4.7
12.	Ideal age to start correction of skeletal Class-III	Primary dentition	24	16.0
		Mixed dentition	72	48.0
		Permanent dentition	16	10.7
		As early as noticed	38	25.3
13.	Ideal age to start correction of skeletal Class-II	Primary dentition	26	17.3
		Mixed dentition	72	48.0
		Permanent dentition	28	18.7
		As early as noticed	24	16.0
14.	Do you think malocclusion requires orthodontic treatment? 	Yes	127	84.7
		No	23	15.3
15.	Do you think this malocclusion requires orthodontic treatment? 	Yes	142	94.7
		No	8	5.3
16.	Appliance selection to treatment of underlying malocclusion 	Removable appliance	39	26.0
		Fixed appliance	87	58.0
		Orthopedic appliance	15	10.0
		Myofunctional	9	6.0
17.	Appliance selection to treat underlying malocclusion 	Hawley's appliance	8	5.3
		Fixed orthodontic appliance	30	20.0
		Headgear	92	61.3
		Facemask	20	13.3

18.	Do you notice any discrepancy in the following picture?	Deep bite	11	7.3
		Midline shift	129	86.0
		Crowding	4	2.7
		None	6	4.0
19.	Appliance selection to treat underlying malocclusion	Fixed orthodontic appliance	9	6.0
		Headgear	45	30.0
		Facemask	95	63.3
		Hawley's appliance	1	0.7
20.	Treatment sequence for this case?	Orthodontic treatment	3	2.0
		Orthodontic treatment followed by orthognathic surgery	45	30.0
		Orthognathic surgery followed by orthodontic treatment	101	67.3
		Orthognathic surgery only	1	0.7

[Table/Fig-1]: The frequency distribution of the level of understanding among the undergraduate students in malocclusion identification.
Total N=150 responses

asked questions about the identification of Angle's malocclusions, the presence of dental problems, the optimal stage for initiating treatment, and so on.

STATISTICAL ANALYSIS

The collected data were entered into a Microsoft excel spreadsheet, and all descriptive analyses, including frequency calculations, were performed using IBM Statistical Package for Social Sciences (SPSS) software version 25.0 (IBM Corp., Armonk, NY).

RESULTS

The study involved a total of 150 dental undergraduate students, consisting of 48 males and 102 females, with a mean age of 21 ± 2 years. Approximately 92.7% ($n=139$) of participants correctly recognised Angle's Class-I molar relation. More than half of the students ($n=103$, 68.9%) were able to identify Angle's Class-II subdivision malocclusion. The majority of the sample ($n=126$, 84%) answered correctly regarding the identification of Angle's Class-III subdivision. A total of 90.7% ($n=136$) of the students were able to recognise the canine relationship in Class-I, while 9.3% ($n=14$) were unable to do so. Approximately half of the students ($n=72$, 48%) chose mixed dentition as the ideal age to start correction of skeletal Class-II and III. Furthermore, 84.7% of the students ($n=127$) responded positively to the need for orthodontic treatment for a deep bite, while 15.3% ($n=23$) disagreed [Table/Fig-1]. Nearly half of the students (41%) were unaware of alternative names for the Class-III incisor relationship. Furthermore, most students had no difficulty in identifying transverse malocclusions, including posterior crossbite (68.7%), scissors bite (66%), and common malocclusions such as crowding, spacing, midline shift, and deep bite, in the present findings [Table/Fig-1].

The majority of students ($n=142$, 94.7%) expressed the need for orthodontic treatment for crowding, while the remaining 5.3% ($n=8$) disagreed. Among the appliance choices for treating skeletal Class-II malocclusion in growing patients, 61.3% ($n=92$) of students selected "headgear". The facemask was selected by only 63.3% ($n=95$) of students as the device to treat skeletal Class-III malocclusion. For the sequence of treatment for skeletal Class-II malocclusion in non-growing patients, the majority of participants ($n=101$, 67.3%) chose orthognathic surgery followed by orthodontic treatment.

DISCUSSION

As described by Alex and Jacobson, malocclusion refers to an irregularity in teeth alignment and/or their relationship during dental occlusion that falls outside the range of what is considered normal [2]. With the increasing demand for orthodontic treatment, it is crucial to have a proper understanding of diagnosing these malocclusions, their causes, and the appropriate timing for intervention before educating the patient [2]. The purpose of the questionnaire given to undergraduate students who had already completed the orthodontics course was to assess their understanding of fundamental diagnostic principles.

In 1980, the American Association of Dental Schools developed a curricular guide for orthodontics with the aim of establishing the content of orthodontic education programs and providing enough information for students to be able to identify and take action in the presence of malocclusions. This includes distinguishing cases that may require interceptive orthodontics from those that need to be referred to orthodontists [9]. Dental students should be exposed to orthodontic cases to develop their knowledge, skills, and confidence in managing orthodontic emergencies or appropriately referring these patients to orthodontists at the right age. However, the limited published literature in this field suggests that students have low confidence in dealing with orthodontic diagnosis.

Ultimately, the data from this study can help universities evaluate the learning outcomes and competence of their graduates in identifying various malocclusions, providing them with the necessary knowledge and skills to carry out simple interventions. The findings of this study indicate that most students lack the knowledge necessary to determine the optimal timing for initiating treatment, and there is also a significant deficit in understanding the relationship between malocclusion diagnosis, patient age, and treatment planning.

In this study, the majority of students selected orthognathic surgery followed by orthodontic treatment as the approach for treating skeletal Class-II malocclusion in non-growing patients. Only 61% of students chose headgear for treating skeletal Class-II malocclusion in growing patients, and 63.3% selected the facemask for treating skeletal Class-III patients. These findings are consistent with those of a study conducted by Miguel JA et al., in which approximately half of the undergraduate students were able to classify unilateral Class-III malocclusion and 89% were able to identify anterior crossbite, but they lacked awareness of a basic treatment protocol for this abnormality [15].

S. No.	Author's name and year	Place of study	Number of subjects	Objective	Conclusion
1.	Miguel JA et al., [15] (2008)	State of Rio de Janeiro/ Brazil	138 senior students of 10 dental schools	Ability of undergraduate students to identify Class-III malocclusion and also to recognise the correct timing for referring them for orthodontic treatment, taking into consideration the patient's dental and skeletal ages.	Most of the students have difficulties in the correct diagnosis of Class-III cases and were not fully aware of a basic protocol for the treatment of this.
2.	Canavaro C et al., [10] (2012)	State of Rio de Janeiro/Brazil	138 students attending the last semester of 10 dental schools	Ability of undergraduate students in diagnosing Angle Class-II malocclusion and evaluation the clinical approach of these students toward this condition.	On completion of their undergraduate courses, students encounter difficulties in diagnosing Class-II and even found it hard to articulate ideas about a basic treatment protocol to correct this malocclusion.
3.	Fatani EJ et al., [9] (2019)	Riyadh Elm University	786 dental students	Ability of undergraduate senior dental students in diagnosing orthodontic problems and to evaluate the clinical approach of these students toward a patient displaying such problems.	On completion of their undergraduate courses, students encountered difficulties in diagnosing various orthodontic problems and even find it hard to articulate ideas about a basic treatment protocol.
4.	Almutairi SD and Alshawy ES, [16] (2021)	Qassim region, Saudi Arabia	250 undergraduate dental students	To assess the perception and knowledge levels of undergraduate dental students toward orthodontic treatment.	Most of the respondents had an acceptable level of knowledge regarding orthodontic treatment.
5.	Kapoor D [11] (2018)	Bharatpur, Nepal	138 fourth and final year BDS students	To assess the knowledge of dental undergraduate students about Class-II Division 1 malocclusion and their opinion about the treatment or clinical approach to such patients.	Students had a fair knowledge of common parameters used to determine Class-II Division 1 malocclusion; however they found difficulties in compiling and applying this knowledge to the clinical concept, and also were uncertain about the timing of the commencement of treatment.
6.	Al Shahrani I[13] (2014)	King Khalid University College of Dentistry, in the Kingdom of Saudi Arabia.	80 general dentists who had recently completed the BDS program	To assess the preparedness of fresh dental graduates in diagnosis and referral of orthodontic patients in general dental practice.	The study found that the fresh graduates showed moderate to good clinical proficiency in diagnosing various simple to moderate malocclusions.
7.	Zohra S and Amin Malik MH, [17] (2020)	Shadman, Lahore	33 recently graduated dental students	To find out whether the fresh dental graduates that are being produced by the dental colleges of Pakistan are knowledgeable and skilful in the field of orthodontics or not.	The majority of graduates felt underconfident and felt they were not well versed theoretically and clinically. Also, most of them were not interested in taking orthodontic as their subject of postgraduation since they did not feel very confident about it.
8.	Present study	Visakhapatnam Andhra Pradesh India	150 final-year dental undergraduate students	To Assess the level of understanding of dental undergraduate students in identification of malocclusion.	Most of the students were familiar with the diagnosis of malocclusion. However, knowledge regarding the kind of appliance to be used and the age of starting treatment was lacking.

[Table/Fig-2]: Malocclusion identification levels of undergraduates in various regions [9-11,13,15-17].

A study conducted by Canavaro C et al., showed that 32% of the students had difficulty in identifying Angle's Class-II division 1 malocclusion and its subdivisions. Additionally, 41.7% of the students preferred Class-II treatment to be done in the deciduous dentition stage, indicating a lack of understanding of the concept of growth modulation, similar to the results of the present study [10]. Another study by Fatani EJ et al., which involved undergraduate students who had completed their course and were presented with photographs of various malocclusions, observed that they encountered difficulties in diagnosing dental problems and implementing the basic protocols to correct malocclusions [9]. These findings align with the present study.

In contrast, a study conducted by Almutairi SD and Alshawy ES, on the perception and knowledge of undergraduate students towards orthodontic treatment upon completing their courses found that the students had an appropriate level of knowledge about orthodontic treatment, which was not the case in the current study [16]. Similarly, Kapoor and Al Shahrani found that when undergraduate final year students were shown dental casts and photographs as part of a study, most of them were able to recognise basic malocclusions but were unaware of the timing for the start of orthodontic treatment

[11,13]. These findings are consistent with the present ones [Table/Fig-2] [9-11,13,15-17].

In a study on undergraduates conducted by Zohra S and Amin Malik MH, to assess their knowledge and skills, it was found that most students were not interested in pursuing orthodontics as their postgraduation due to a lack of confidence in their abilities [17]. This lack of confidence was likely caused by the students' limited exposure to patients in their final year. Considering that this inability to diagnose problems might affect their clinical practice, it is suggested that thorough comprehensive studies be conducted to revise the undergraduate curriculum and place more emphasis on educating students about diagnosis, development, growth, and their impact on formulating treatment plans. This approach aims to boost their confidence and increase their interest in this specialty. Therefore, instead of using standard lectures, a case-based and student-centered learning format might improve students' abilities in clinical problem-solving and decision-making skills [18].

Limitation(s)

The study was conducted for a short duration and included a small number of students from one place, which limits the generalizability of the study findings. There is a possibility that participants may

have completed the questionnaire with assistance either from their colleagues or other sources, such as the internet. Therefore, long-term research involving students studying in institutions located in diverse geographical areas is necessary to determine the impact of teaching methods.

CONCLUSION(S)

According to the survey, the majority of undergraduate students were familiar with the fundamentals of orthodontics and the diagnosis of malocclusion. However, the students lacked knowledge regarding the type of appliance to be used for correction of malocclusion.

To increase their knowledge and confidence in dealing with orthodontic patients, it may be possible to conduct ongoing education programs and provide training to enhance their diagnostic abilities. This will also help inform and motivate patients for orthodontic treatment in their general clinical practice.

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