BMC Oral Health

RESEARCH

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Knowledge, awareness and perception of dental students about the world workshop classification of periodontal and peri-implant diseases and conditions 2017 - a questionnaire-based survey

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Abstract

Background The latest classification for periodontal and peri-implant diseases and conditions was introduced in 2017 which marked a significant milestone in the field of periodontics. However, the extent of awareness, knowledge, and acceptance among dental students remains unclear. This study aimed to assess the knowledge, awareness, and perception (KAP) of University of Sharjah(UOS) dental students towards the latest classification.

Methods A cross-sectional, questionnaire-based survey was sent through email to a total of 372 participants including undergraduate dental students and interns. The questionnaire addressed participants' demographics, awareness, usage, knowledge, and perceptions of the latest 'Periodontal and Peri-implant Diseases and Conditions Classification'. The statistical analysis was performed using descriptive statistics and the Chi-square test of proportion.

Results Among the 372 students included in the study, a total of 329 students participated by completing the online survey, resulting in an 83.92% response rate. The awareness regarding the latest classification was high (91.1%) and 88.7% of them implemented it in their practice. Furthermore, most participants recognized the advantages of the 2017 classification, with 76.2% acknowledging the inclusion of clinical health definitions. The mean overall knowledge score was least in BDS 3 (1.37 ± 1.05) and highest in the interns (1.37 ± 1.05). The students had a positive perception of the latest 2017 classification being user-friendly (64%), applicable in the day-to-day dental clinic (55.3%), and satisfied with the classification scheme (62.6%). However, 69.5% of students suggested a need for a thorough educational program on the latest classification.

Conclusions The present survey reveals high awareness and usage of the 2017 periodontal classification among UOS dental students, with knowledge increasing across academic years. While students generally held positive perceptions

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of the classification's advantages and user-friendliness, further educational programs on the latest classification, diagnosis, and treatment planning in periodontics are needed.

Keywords Classification, Dental education, Diagnosis, Knowledge, periodontal disease classification, Treatment plan, 2017 World workshop classification, Students survey

Introduction

In the field of periodontics, the use of classification systems for periodontal diseases is highly crucial for accurate diagnosis and effective treatment planning. These systems help clinicians categorize periodontal conditions, based on scientific evidence, according to their severity and clinical features and therefore assist them in tailoring the intervention according to the patient's specific needs, thus delivering patient-centered care [1]. Furthermore, they facilitate better communication among healthcare providers and support ongoing research in periodontology by standardizing disease definitions and outcomes. Thus, reflecting on the historical evolution of these classification systems is essential for understanding the advancements made in this field and gaining insight into our current position.

In 1886, G.V. Black introduced a classification system based on the clinical characteristics of periodontal diseases [2]. Over the years, clinicians have proposed numerous classification systems [3, 4, 5]. A consensus on a specific classification system was only reached in 1989. This system, however, had significant shortcomings including unclear classification criteria, category overlap, insufficient consideration of gingival diseases, and undue emphasis on the age of onset and progression rates [3]. In 1999, a new classification system, incorporating additional categories such as abscess, endodontic-periodontal lesion, development, and acquired deformity, was introduced [3, 4]. Even though the 1999 classification system served as a practical reference for many years in both clinical practice and scientific investigation within the field of periodontology, it had a significant overlap between categories and lacked clear differentiation based on pathobiology [6, 7, 8, 9]. Additionally, certain conditions, such as peri-implant disease, were not adequately addressed in this system. Thus, for the first time in 2017, World Workshop introduced a pristine classification for 'Periodontal and Peri-implant Diseases and Conditions' to address some of the diagnostic concerns witnessed in the previous classifications, which was a collaborative effort between the American Academy of Periodontology (AAP) and the European Federation of Periodontology (EFP) [4].

The new classification system was designed to provide a more precise and standardized framework for diagnosing and managing periodontal and peri-implant diseases, reflecting the latest scientific evidence and clinical understanding. The primary aim of the "2017 Classification' was to introduce a reference that could be utilized for diagnosing and managing 95% of periodontal diseases [10]. In this classification, the staging and grading system permits clinicians to use the patient's medical and dental health records to evaluate the likelihood of future bone loss to identify high-risk patients and set individual recall schedules to evade worsening and optimize patient care [11].

However, the significant differences between the 2017 and previous classifications made the widespread adoption of the latest grading and staging system very challenging [12, 13]. After reviewing the literature related to the pathophysiology of periodontitis, the workshop concluded that there was no sufficient evidence to support that *chronic* and *aggressive* periodontitis are different diagnostic entities and are caused by different microbes; hence, they should not be considered two separate diseases. Therefore, the 2017 classification eliminated the terms *aggressive* and *chronic*, thus providing a broader periodontal disease category [10, 14, 15]. This classification has given rise to mixed opinions among professionals, clinicians, and students who are still learning how to implement it [11, 12]. For global implementation, it is therefore crucial for dental schools to incorporate this system into their curricula. Moreover, students must receive training to develop the necessary skills to effectively make sound clinical decisions upon using this classification system [10, 16].

Consistency has been a key focus within the Periodontology discipline at the College of Dental Medicine, University of Sharjah. To ensure uniformity in teaching, consensus meetings were organized for periodontal faculty members to establish agreement on diagnosis and treatment planning using the latest 2017 classification of periodontal and peri-implant diseases. From the academic year 2021, the periodontal faculty members participated in consensus meetings as part of the department's calibration program in the periodontology discipline. Through several training sessions, faculty members achieved a uniform consensus on diagnosis and treatment planning based on the latest classification. As a result, calibrated periodontal faculty members demonstrated improved agreement in teaching diagnosis and treatment plans for dental students and interns. However, variations in knowledge about the most recent classification system were expected among dental students based on their academic year, consequently affecting their acceptance level. Such variations, along with technical

difficulties and the gap between theory and clinical applications, could pose challenges in implementing this new system. Getting insights from dental students regarding the challenges encountered during their clinical periodontal training can help identify areas for remedial interventions within the discipline.

To the best of our knowledge, a study assessing the knowledge, awareness and perception of dental students about the latest classification of periodontal and peri-implant diseases 2 in the United Arab Emirates (UAE) published in the literature is very scanty. Only three studies are closely related to knowledge, awareness, or perception of the 'World Workshop Classification of Periodontal and Peri-implant Diseases and Conditions 2017' [10, 17, 18], and only one study was done among undergraduate students [10]. Hence, the present survey was conducted to assess the knowledge, awareness and perception (KAP) of University of Sharjah dental students towards the 'World Workshop Classification of Periodontal and Peri-implant Diseases and Conditions 2017'.

Materials and methods

Study design and settings

The present study was a cross-sectional, questionnaire-based design that targeted the students at clinical levels (3rd, 4th, 5th year BDS and interns) at the College of Dental Medicine, University of Sharjah, UAE. The target population based on convenience sampling included a total of 392 participants (100 in 3rd BDS, 111 in 4th BDS, 110 in 5th BDS and 71 in Interns) present in the college during the study period. The study was conducted between August 2023 and February 2024. The Research Ethics Committee, University of Sharjah, UAE approved the study protocol (No: REC-23-06-10-01-S).

Questionnaire

The online-based survey was conducted using Google Forms, utilizing a questionnaire similar to those used by Mishra et al., 2020 [17] and Hegab and Abdelkawy, 2021 [18]. The self-administered questionnaire began with an opening paragraph to clarify the study's objective, ensure participants' anonymity and voluntary participation, and confirm that responses would remain confidential and accessible only to the authors. Students were advised that participation in the survey was voluntary and that non-participation or withdrawal from the survey would not impact their academic progress. The students' consent to participate in the survey allowed them to respond to the questionnaire further.

The questionnaire had four sections: a demographic data section (gender, age group, year of study), an awareness section (questions about awareness, usage, and advantages of the 2017 World Workshop classification), a knowledge section, and a perception section. All the questions included in this survey were mandatory, ensuring that participants could not proceed through the survey without answering each required question.

The present survey consisted of a total of 22 questions. Among them, three questions were regarding the demographic data (gender, age group, and year of study), and 19 questions focused on the awareness, usage, advantages, key knowledge, and perception regarding the latest 2017 World Workshop classification. Three survey questions were adopted from Mishra et al., 2021 [17], while eight were adopted from Hegab and Abdelkawy, 2020. The rest of the questions were developed through the focus group discussion (FGDi). The focus group consisted of six periodontists who were both academicians and clinicians with more than five years of experience in the specialty of periodontics. The FGDi were carried out among the six faculty members every 15 days for two months to finalize the questionnaire.

Initially, a questionnaire with a total of 25 questions was developed. These questions were sent through e-mail to six other periodontists (who were both academicians and clinicians with more than ten years of experience in the specialty of periodontics and who were not part of FGDi) for content validity. An online content validation form was sent through e-mail to the experts, and clear instructions were provided to facilitate the content validation process. The content validation (CV) and content validity index calculation was done according to Yusoff, 2019 [19].

According to the calculation and expert feedback, three questions were deleted, and the final questionnaire consisted of 22 validated questions along with demographic data. Subsequent adjustments were made to ensure the questionnaire was clear and comprehensive.

After finalizing the questionnaire, a link was created in the Google Form, and a pilot test was conducted on twenty dental students (5 from each year, 3rd, 4th, 5th, and Interns) to confirm the flow and ease of answering the questionnaire. There were no difficulties or hindrances in answering the questions by the volunteer participants of the pilot study.

Data collection

The validated questionnaire link for the Google Form was delivered to the targeted sample through their official University email addresses. Participation was voluntary, and no incentives were provided to those who participated in the study. Reminders were sent out three times at one-month intervals. The data was obtained, gathered, and inserted in Microsoft Excel Version 13.

The responses received from the pilot study participants were included in the final samples, as no changes were made to the questionnaire after their participation.

Table 1 The distribution of participants according to gender and age groups

Study participants		Frequency (*n*)	Percentage (%)	Significance	
				x^2	*p*-value
Gender	Males	88	29.1	**52.57**	0.001*
	Females	214	70.9		
	Total	**302**	100.0		
Age Groups (years)	19–20	10	3.3	**207.74**	0.001*
	21–22	156	51.7		
	23–24	117	38.7		
	25–26	19	6.3		
	Total	**302**	100.0		

*X^2: Chi-Square * Significant*

Statistical analysis

The data was statistically analyzed using IBM Statistical Package for Social Science (SPSS) version 21. For categorical data, the frequency and percentage were obtained. The Chi-Square test of Proportion was applied to evaluate the difference in proportion. Descriptive statistics, including mean and standard deviation, were calculated to summarize the knowledge scores for each group (BDS 3, BDS 4, BDS 5, and Internship). A One-way Analysis of Variance (ANOVA) was conducted to determine whether significant differences existed among the groups, following a significant ANOVA result, Tukey's Honest Significant Difference (HSD) post hoc test was applied to identify pairwise differences between the groups. All the statistical tests were conducted with a 95% confidence interval, and a $p < 0.05$ was considered statistically significant.

Results

Among the 392 students included in the study, 329 students completed the online survey, resulting in an 83.92% response rate. Of the 329 responses, 27 participants were not aware of the latest 2017 World Workshop classification system for periodontal and peri-implant disease and conditions. Hence, excluding these 27 responses, the remaining 302 responses were used to analyze the results.

The online survey employed closed-ended questions with mandatory responses, ensuring that participants could not proceed through the survey without answering each required question. As a result, all 302 responses included in the study had no incomplete, partial, or ambiguous responses.

Participants' distribution according to gender

Among the 302 responses included in the study,214 (70.9%) were females, and 88 (29.1%) were males. Of the 302 participants, 10 (3.3%) were aged 18–20, 156 (51.7%) were aged 21–22, 117 (38.7%) were aged 23–24, and 19 (6.3%) were aged 25–26. The distribution of participants by gender and age group is provided in Table 1.

Participants' distribution according to the year of study

A total of 70 (23.2%) participants were in their 3rd year of BDS program, 93 (30.8%) were in their 4th year, 73 (24.2%) were in their 5th year and 66 (21.9%) were in their internship (Fig. 1). The difference in proportion was not found to be statistically significant ($\mathbf{X^2} = 5.735$; $p > 0.05$).

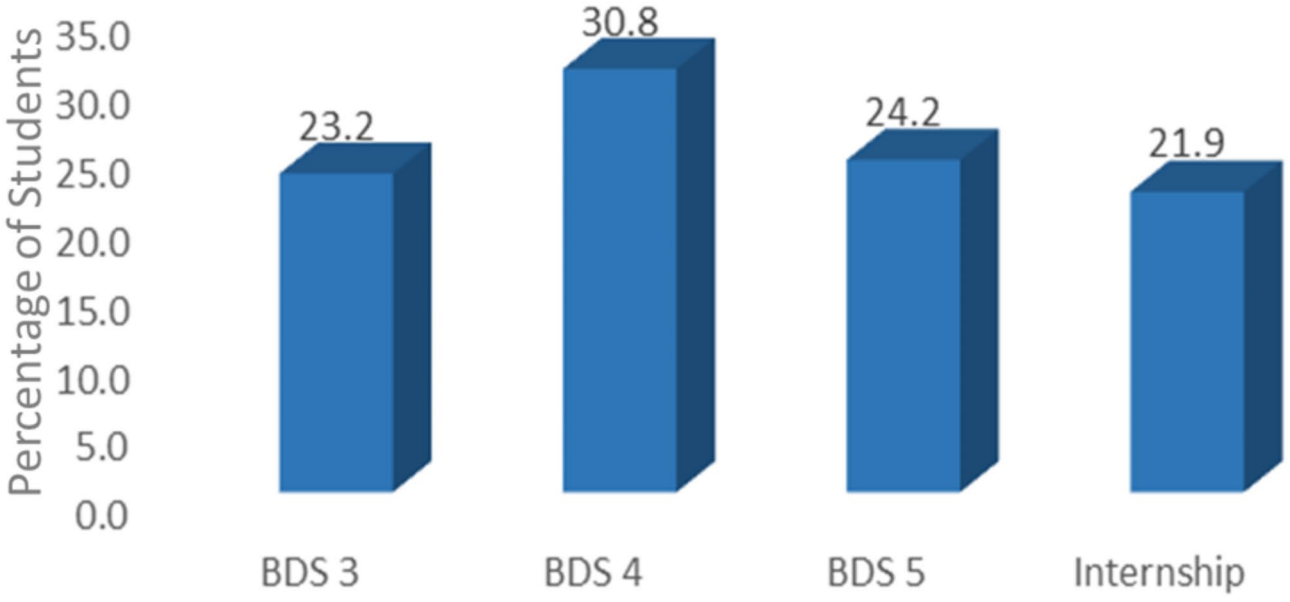

Fig. 1 Distribution of study participants according to year of study

Awareness, usage, and advantages of the latest 2017 world workshop classification

When participants were asked if they were aware of the latest 2017 World Workshop classification system for periodontal and peri-implant disease and conditions, 302 (91.7%) responded with "Yes"; among the aware students, 88.7% of participants used this classification system. 230 (76.2%) participants knew about the clinical health that was defined for the first time in the latest classification. Among the participants, 242 (80.1%) believed that the new classification system captures the severity and extent of periodontitis, while 194 (64.2%) thought that it gives clear definitions of periodontal health and gingivitis. A total of 167 (55.3%) felt that the new classification system throws light upon the current periodontal status of the patient. However, among 302 participants, 43 (14.2%) were not aware of the advantages of the latest 2017 classification. 95% (95%) of the participants agreed that the latest 2017 classification gives clear definitions of periodontal health and gingivitis compared to the old 1999 classification (Table 2).

Knowledge-based questions to diagnose according to the latest 2017 world workshop classification

When participants were asked about the periodontal diagnosis for an interdental clinical attachment level at the site of greatest loss of 1–2 mm and the probing depth of less than 4 mm, most of them 226 (74.8%) correctly identified it as Stage I Initial Periodontitis. Similarly, when the participants were asked about the grade of periodontitis suggesting less than 0.25% radiographic evidence of bone loss over 5 years, most participants (74.5%) correctly identified it as a Grade A: slow rate of progression with a statistically significant difference between the correct and incorrect responses ($p < 0.05$). However, there was no statistical difference between the correct and incorrect response regarding the diagnosis of periodontitis with interdental Clinical Attachment Level (CAL) at the site of the greatest loss of > 5 mm and loss of 6 teeth due to periodontitis (Table 3).

Comparison between knowledge-based questions and year of study

Looking at the correct responses ($n = 226$, 74.8%), related to the periodontal diagnosis for the interdental clinical attachment level at the site of the most significant loss of 1–2 mm and the probing depth of less than 4 mm, 28 (40%) of these responses were from BDS 3, 82 (88.2%) were from BDS 4, 60 (82.2%) were from BDS 5 and 56 (84.8%) were from interns. This difference in the percentage was found to be statistically significant ($p < 0.05$). Similarly, significant differences were observed among different years of study for the remaining questions (Table 4).

Overall knowledge scores among the participants according to the year of study

The mean scores increased across the years, with BDS 3 having the lowest mean score ± standard deviation (1.37 ± 1.05) and interns showing the highest (2.53 ± 0.80) (Table 5a). A pairwise comparison of mean scores using statistical tests reveals significant differences in

Table 2 Participants' responses regarding the awareness, usage, and advantages of the 2017 world workshop classification

Questions	Responses	Frequency (*n*)	Percentage (%)	Significance	
				x^2	*p*-value
Are you aware of the latest 2017 World Workshop classification system for periodontal and peri-implant disease and conditions? (*n* = 329)	Yes	302	91.7	203.7	0.001*
	No	27	8.3		
Are you currently using the 2017 classification in your practice? (*n* = 302)	Yes	268	88.7	181.3	0.001*
	No	34	11.3		
Are you aware that in the latest 2017 classification, clinical health is defined for the first time? (*n* = 302)	Yes	230	76.2	82.7	0.001*
	No	72	23.8		
What are the advantages of the latest 2017 classification?					
This system captures the severity and extent of periodontitis.(*n* = 302)		242	80.1	87.79	0.001*
It throws light upon the current periodontal status of the patient.(*n* = 302)		167	55.3		
It gives clear definitions of periodontal health and gingivitis.(*n* = 302)		194	64.2		
Unaware (*n* = 302)		43	14.2		
Compared to the 1999 classification, the latest 2017 classification clearly defines periodontal health and gingivitis. (*n* = 302)					
Strongly agree		122	40.4	257.6	0.001*
Agree		165	54.6		
Disagree.		11	3.6		
Strongly disagree.		4	1.3		

*X^2: Chi-Square * Significant*

Table 3 Knowledge-based questions to diagnose according to the latest 2017 world workshop classification

Questions & Options (*n* = 302)	Frequency (*n*)	Percentage (%)	Significance	
			X^2	*p*-value
Which of the following is the periodontal diagnosis if the interdental clinical attachment level (CAL) at the site of greatest loss is 1–2 mm and the probing depth is less than 4 mm?[a]				
Stage I: Initial periodontitis. #	226	74.8	414.2	0.001*
Stage II: Moderate periodontitis.	52	17.2		
Stage III: Severe periodontitis with potential for additional tooth loss.	10	3.3		
Unaware	14	4.6		
Which stage of periodontitis shows interdental CAL at the site of greatest loss is > 5 mm and tooth loss is 6 teeth due to periodontitis?				
Stage II: Moderate periodontitis.	23	7.6	217.7	0.001*
Stage III: Severe periodontitis.	102	33.8		
Stage IV: Very severe periodontitis. #	168	55.6		
Unaware	9	3.0		
Which grade of periodontitis suggests less than 0.25% radiographic evidence of bone loss over 5 years?[a]				
Grade A: Slow rate of progression. #	225	74.5	410	0.001*
Grade B: Moderate rate of progression.	53	17.5		
Grade C: Rapid rate of progression.	16	5.3		
Unaware	8	2.6		

Questions	Responses				Significance	
	Correct		Incorrect		X^2	p-value
	n	%	n	%		
Which of the following is the periodontal diagnosis if the interdental clinical attachment level at the site of greatest loss is 1–2 mm and the probing depth is less than 4 mm?	226	74.8	76	25.2	74.5	0.001*
Which stage of periodontitis shows interdental clinical attachment loss at the site of greatest loss is > 5 mm and tooth loss is 6 teeth due to periodontitis?	168	55.6	134	44.4	3.8	0.051
Which grade of periodontitis suggests less than 0.25% radiographic evidence of bone loss over 5 years?	225	74.5	77	25.5	72.5	0.001*

*# Correct answer; X^2: Chi-Square; * Significant;[a]Questions adopted and modified from Mishra et al., 2021[17]*

Table 4 Comparison between knowledge-based question responses among the participants according to the year of study

Responses	Year of Study (*n* = 302)				Total	*p*-value
	BDS 3 *n* (%)	BDS 4 *n* (%)	BDS 5 *n* (%)	Internship *n* (%)		
Which of the following is the periodontal diagnosis if the interdental clinical attachment level at the site of greatest loss is 1–2 mm and the probing depth is less than 4 mm?						
Incorrect	42 (60.0%)	11 (11.8%)	13 (17.8%)	10 (15.2%)	76 (25.2%)	0.001*
Correct	28 (40.0%)	82 (88.2%)	60 (82.2%)	56 (84.8%)	226 (74.8%)	
Total	70 (100%)	93 (100%)	73 (100%)	66 (100%)	302 (100%)	
Which stage of periodontitis shows interdental CAL at the site of greatest loss is > 5 mm and tooth loss is 6 teeth due to periodontitis?						
Incorrect	36 (51.4%)	44 (47.3%)	40 (54.8%)	14 (21.2%)	134 (44.4%)	0.001*
Correct	34 (48.6%)	49 (52.7%0	33 (45.2%)	52 (78.8%)	168 (55.6%)	
Total	70 (100%)	93 (100%)	73 (100%)	66 (100%)	302 (100%)	
Which grade of periodontitis suggests less than 0.25% radiographic evidence of bone loss over 5 years?						
Incorrect	36 (51.4%)	44 (47.3%)	40 (54.8%)	14 (21.2%)	134 (44.4%)	0.001*
Correct	34 (48.6%)	49 (52.7%)	33 (45.2%)	52 (78.8%)	168 (55.6%)	
Total	70 (100%)	93 (100%)	73 (100%)	66 (100%)	302 (100%)	

Table 5 a Overall knowledge scores in different years of study of the participants

Year of Study	Mean	Std. Deviation	Significance	
			F-value	*p*-value
BDS 3	1.37	1.056	19.54	0.000*
BDS 4	2.20	0.854		
BDS 5	2.06	0.962		
Internship	2.53	0.808		
Total	2.04	1.002		

**Significant*

knowledge scores between several groups. BDS 3 students scored significantly lower than all other groups, as indicated by p-values < 0.05 in comparisons with BDS 4, BDS 5, and interns. Similarly, interns outperformed BDS 5 students significantly (mean difference = 0.46181, $p = 0.018$) and BDS 4 students, though the latter was not statistically significant ($p = 0.126$). No significant difference was found between BDS 4 and BDS 5 scores ($p = 0.781$) (Table 5b).

Perceptions of the participants regarding the latest 2017 world workshop classification

When asked whether the 2017 classification gave clearer definitions of periodontal health and gingivitis than the 1999 classification, most participants (54.6%) agreed with this statement. Similarly, Table 6 provides various perceptions regarding the latest classifications. When participants were asked about the need for a thorough educational program on the latest classification, diagnosis, and treatment planning in periodontics, 210 (69.5%) participants agreed with this statement (Table 6).

Discussion

Researchers have consistently worked on advancing technologies to enhance the diagnostic capabilities of periodontal diagnosis and classification, using both clinical and radiographic data [9, 19, 20, 21]. However, a clinician's proficiency in interpreting and integrating this data, coupled with critical thinking skills, is crucial for accurate periodontal decision-making and delivering patient-centered care [6]. The latest classification system for periodontal disease emphasizes a thorough multidimensional staging and grading approach [4, 16]. This updated system is notably different from the 1999 classification, which could result in differences in diagnosing, treatment planning, and managing periodontal diseases. Even with the introduction of consensus training programs for dental students in periodontics, there remains a need for further enhancement to ensure consistent clinical decision-making among the students [23].

Hence, the present survey was designed to explore the knowledge, awareness and perceptions of undergraduate dental students and interns at the College of Dental Medicine, University of Sharjah, regarding the latest 2017 world workshop classification system for periodontal and peri-implant diseases and conditions. The study aimed to gather information from students at different stages of their dental education, including BDS 3, BDS 4, BDS 5, and interns to gauge whether this new system is being effectively communicated and adopted in the clinical setting and to identify gaps or misconceptions in education that might require curricular and/or teaching methods' modifications.

In the present study, both undergraduate students and interns in the College of Dental Medicine, University of Sharjah, UAE, were included, and in addition to the knowledge, awareness and perception, the attitude towards the latest Classification of Periodontal and Peri-implant Diseases and Conditions 2017 was also assessed. In our study, postgraduate students, general practitioners, and those in the preclinical years were excluded to avoid bias, as postgraduate students and general practitioners typically possess a more advanced understanding

Table 5 b Pairwise comparison of overall knowledge scores between the years of study of the participants

Year of Study	Year of Study	Mean Difference	Std. Error	*P* value	95% Confidence Interval	
					Lower Bound	Upper Bound
BDS 3	**BDS 4**	-0.832*	0.145	0.000	-1.209	-0.456
	BDS 5	-0.697*	0.154	0.000	-1.094	-0.299
	Internship	-1.158*	0.157	0.000	-1.567	-0.750
BDS 4	**BDS 3**	0.832*	0.145	0.000	0.456	1.209
	BDS 5	0.135	0.143	0.781	-0.236	0.507
	Internship	-0.326	0.14817	0.126	-0.708	0.056
BDS 5	**BDS 3**	0.697*	0.15400	0.000	0.299	1.094
	BDS 4	-0.135	0.14395	0.781	-0.507	0.236
	Internship	-0.461*	0.15637	0.018	-0.865	-0.057
Internship	**BDS 3**	1.158*	0.15795	0.000	0.750	1.567
	BDS 4	0.326	0.14817	0.126	-0.056	0.708
	BDS 5	0.461*	0.15637	0.018	0.057	0.865

*. The mean difference is significant at the 0.05 level.

Table 6 Perceptions of the participants regarding the latest 2017 world workshop classification

Questions & Responses	Frequency (*n*)	Percentage (%)	Significance	
			X^2	*p*-value
When compared to the 1999 classification, the 2017 classification gives clear definitions of periodontal health and gingivitis.				
Strongly agree	122	40.4	257.55	0.001*
Agree	165	54.6		
Disagree.	11	3.6		
Strongly disagree.	4	1.3		
Is your patient comfortable while periodontal charting using the 2017 classification?				
Yes	165	54.6	2.59	0.120
No	137	45.4		
What do you think about adding the item "clinical health on reduced periodontium to the latest classification?[b]				
Strongly disagree.	17	5.6	138.6	0.001*
Slightly disagree	18	6.0		
Neutral	126	41.7		
Slightly agree	61	20.2		
Strongly agree	80	26.5		
How would you rate the staging and grading process in periodontitis?[b]				
Very poor	9	3.0	149.5	0.001*
Poor	11	3.6		
Fair	91	30.1		
Very good	112	37.1		
Excellent	79	26.2		
What is your opinion of replacing "aggressive periodontitis" with a higher stage and grade on a periodontitis scale?[b]				
Strongly disagree	13	4.3	114.3	0.001*
Slightly disagree	21	7.0		
Neutral	109	36.1		
Slightly agree	77	25.5		
Strongly agree	82	27.2		
Is the staging and grading system of periodontitis applicable in the day-to-day dental clinic?[b]				
Strongly disagree	14	4.6	97.4	0.001*
Slightly disagree	24	7.9		
Neutral	97	32.1		
Slightly agree	83	27.5		
Strongly agree	84	27.8		
Are systemic diseases affecting the periodontium clearly covered in the latest classification?[b]				
Strongly disagree	9	3.0	106.7	0.001*
Slightly disagree	25	8.3		
Neutral	89	29.5		
Slightly agree	94	31.1		
Strongly agree	85	28.1		
Do you think the prognosis and treatment planning of periodontal cases will differ according to the latest classification?[b]				
Strongly disagree	9	3.0	102.5	0.001*
Slightly disagree	27	8.9		
Neutral	92	30.5		
Slightly agree	90	29.8		
Strongly agree	84	27.8		
Is the latest classification user-friendly for management of the patients in dental clinics?[b]				
Strongly disagree	12	4.0	113.6	0.001*
Slightly disagree	20	6.6		
Neutral	77	25.5		
Slightly agree	98	32.5		
Strongly agree	95	31.5		
Overall, how do you feel about the latest 2017 classification scheme?[b]				

Table 6 (continued)

Questions & Responses	Frequency (*n*)	Percentage (%)	Significance	
			X^2	*p*-value
When compared to the 1999 classification, the 2017 classification gives clear definitions of periodontal health and gingivitis.				
Very dissatisfied	7	2.3	153.7	0.001*
Dissatisfied	17	5.6		
Neutral	89	29.5		
Satisfied	121	40.1		
Very satisfied	68	22.5		
Do you need a more thorough educational program on the latest classification, diagnosis and treatment planning in periodontics?[a]				
Yes	210	69.5	46.1	0.001*
No	92	30.5		

*# Correct answer; X^2: Chi-Square * Significant;[a]Questions adopted from Mishra et al., 2021[17];[b]Questions adopted from Hegab and Abdelkawy, 2020 [18];*

of the periodontal classification system while students in the preclinical and clinical years have limited exposure to it in clinical contexts and our aim was to assess the KAP in the undergraduate students to know whether there is a need to change or modify the teaching method of the latest classification.

To ensure consistency, fairness, and reliability in teaching and assessment across courses or programs, faculty calibration is crucial in this respect. Furthermore, for a cohesive learning environment, faculty members must align their understanding of standards with their expectations and evaluation criteria. This alignment is necessary for enhancing the quality of instruction as providing students with equitable learning experiences, clear expectations, and constructive feedback, ultimately improving their academic performance and professional preparedness, which is important in the periodontal discipline. Additionally, conducting calibration helps to maintain standardization [24].

In this study, the calibration was carried out for all faculty in Periodontology before they started teaching the Classification of Periodontal and Peri-implant Diseases and Conditions 2017. This was done to ensure that all students received consistent and equitable learning experiences, regardless of the faculty member teaching the classification, before responding to the survey questions. The calibration was not carried out for dental students as the main aim of this study was to evaluate whether this new system is being effectively communicated by calibrated faculty and adopted by students in the clinical setting and to identify gaps or misconceptions in education that might require curricular and/or teaching methods' modifications.

The distribution of the participants according to gender was found to be statistically significant, which corroborates with the male and female student ratio in the College of Dental Medicine, Sharjah. Regarding the distribution of participants according to the year of study, the difference in proportion was not found to be statistically significant, and this could explain the equal distribution of the samples in the selected year of study from BDS 3 to interns, even though convenience sampling was used. Most of the participants (91.7%) showed a high level of awareness (91.7%), utilization (88.7%), and implementation (76.2%) of the term clinical health definition in the new classification. However, Hegab and Abdelkawy reported that 55% of participants agreed on the awareness of the implementation of the term clinical health definition [18].

Though very few (14.2%) were not aware of the advantages of the latest 2017 classification, many participants were aware of the advantages of the latest classification, such as capturing the severity and extent of periodontitis (80.1%), giving clear definitions of periodontal health and gingivitis (64.2%) and throwing light upon the current periodontal status of the patient (55.3%), This finding could be related to the comprehensive didactic as well as practical/clinical activities offered by the Periodontics discipline at the College of Dental Medicine, University of Sharjah to dental students since the implementation of the latest classification in the curriculum from year 1 to year 5.

When participants were asked to diagnose the stage of the periodontal disease in a patient with interdental CAL of 1–2 mm at the site of greatest loss and probing depth of >4 mm, 74.8% of students responded with the correct answer. A similar finding was also observed when the participants were asked to diagnose the grade of the periodontal disease in a patient with >0.25% radiographic evidence of bone loss over 5 years. However, there was a 55.6% correct response regarding the diagnosis of periodontitis with interdental clinical attachment loss at the site of greatest loss is >5 mm, and tooth loss is 6 teeth due to periodontitis. There was an overall 68.2% correct responses in relation to the terms of knowledge-based questions to diagnose according to the latest classification. In contrast, only 25.2% of responses matched the diagnosis according to the latest classification according to Gandhi et al. (2022) among 263 students from three dental schools [10]. However, the findings unveil the need

for extended education regarding the 2017 classification system for periodontal and peri-implant diseases. While most students (54.6%) acknowledged the improved clarity of the new definitions compared to the 1999 system, this recognition wasn't universally translated into a deep understanding. This finding aligns with a study conducted by Gandhi et al., who also reported a variation in the accuracy of disease assessment, resulting in either underestimation or overestimation [10]. This finding was also confirmed by the presence of varying perceptions on the specifics of the classification, suggesting a potential gap between students' awareness of the general improvement and their ability to grasp the details of the new classification system fully. This disconnect underscores the importance of more comprehensive and in-depth training on the 2017 classification of periodontal and peri-implant diseases. Furthermore, the overwhelming request for a thorough educational program by 70% of the participants strongly reinforces this notion. These findings suggest that dental schools may need to evaluate their current curriculum critically. Incorporating a more robust clinical educational program on the 2017 classification system on periodontal and peri-implant diseases would ensure students are aware of the improvements and develop a strong foundation in their application. This deeper understanding would be instrumental in equipping future dentists with the necessary tools for accurate diagnosis and effective treatment planning in the field of periodontics.

In terms of knowledge acquisition based on the year of study, our results indicate that knowledge scores generally improve with progression in the program, with significant jumps from BDS 3 to later years and a marked increase during the internship year. The statistical analysis underscores the importance of advanced academic exposure and practical training in enhancing knowledge levels.

At the College of Dental Medicine, UOS, periodontal training begins in Year 1, where students learn the fundamentals of classification through lectures. In Years 3 and 4, the training becomes more hands-on. Year 3 students engage in peer-assisted learning (PAL), where they diagnose and develop treatment plans for a limited number of periodontally involved cases. In contrast, Year 4 students gain extensive clinical experience, diagnosing and treating a broader range of cases. This culminates in a comprehensive periodontal competency assessment, which includes diagnosis, treatment planning, utilizing the latest periodontal classification, instrumentation, and a viva voce. Lower scores on diagnostic knowledge-based questions among Year 5 students may be attributable to a combination of factors: the lack of a formal periodontal competency requirement and the disruption of in-person lab sessions and clinics due to the COVID-19 pandemic resulting in limited patient exposure. The observed increase in knowledge scores among interns may be attributed to their greater exposure to patients in the clinical setting compared to other students. The present study suggests that the current curriculum effectively equips students with the knowledge required for accurate periodontal diagnosis as they progress through their dental education. Knowledge variations in the diagnosis and treatment planning according to the year of study were also reported in previous studies [7, 10]. However, it is important to acknowledge the limitations of these few scenarios regarding the knowledge-based questions. Therefore, a more comprehensive analysis of all questions should be included in further studies. Despite some areas of neutrality, such as opinions on the addition of "clinical health on a reduced periodontium" and the applicability of the classification in day-to-day dental clinics, the overall responses indicated a favorable attitude toward the 2017 classification scheme. Furthermore, significant differences were observed in satisfaction levels among participants across different academic years, suggesting that perceptions of the classification may vary based on educational background and experience in the dental field. Additionally, a majority expressed awareness of key aspects of the 2017 classification, including the definition of clinical health, advantages, and specific diagnostic criteria.

The participants generally demonstrated positive perceptions of the latest classification, with a significant number expressing satisfaction, acknowledging its clarity, and expressing a desire for further educational programs on the subject. A similar study in Egypt in 2020 to evaluate the knowledge and perception of the periodontists and post-graduate students observed certain inadequacies in the new classification and a gap between theory and practice. The authors correlated this gap to the lack of clarity of certain aspects of the classification as perceived by the participants [18]. In our study, 52.7% of the participants agreed on replacing "aggressive periodontitis" with a higher stage and grade on a periodontitis scale, whereas 30.8% agreed with the participants in the Hegab and Abdelkawy study [18]. The interesting finding was that 64% of the student participants agreed that the latest classification is user-friendly for the management of patients in dental clinics. The significantly higher agreement (64%) among Sharjah University student participants regarding the user-friendliness of the latest classification for patient management, compared to the lower agreement (17.6%) in a previous study involving post-graduate students and practitioners [18], likely reflects the specific training and implementation approach at the university. Sharjah University introduces this new classification early in the student's academic journey, starting in BDS 1 through didactic coursework. This early

and consistent exposure likely familiarizes students with the classification system from the outset, making it more intuitive and user-friendly.

Mishra et al. [17] reported that 94.6% of participants needed a more thorough educational program on the latest classification, diagnosis, and treatment planning in periodontics, whereas 69.5% of the participants in the present study felt the same need.

Strengths, limitations, future scope and recommendations

The present pioneer study comprehensively examines knowledge, awareness, and perception in dental students related to the 2017 classification, which is a significant strength. It fills a gap in the literature, as previous studies may have focused only on knowledge or perceptions separately or focused on general practitioners or specialists rather than students [10, 17, 18]. This comprehensive approach provides a more holistic understanding of student perspectives. One of the key strengths of this study is its larger sample size ($n = 302$) compared to the study by Gandhi et al. ($n = 60$) [10]. This larger sample size increases the statistical power of the study and enhances the generalizability of the findings to the broader student population. This study is limited by the exclusion of scenarios or questions related to treatment planning, a crucial aspect of clinical practice.

This study has two key limitations: First, it did not include questions or scenarios related to treatment planning according to the latest classification. Second, the study's scope was restricted to a single dental institution in the UAE. Given that educational curricula and institutional practices can vary significantly, these factors could influence periodontal knowledge and clinical practices among dental students in different regions and globally. Multi-centric studies involving multiple dental colleges, both within the UAE and internationally, are needed to provide a more comprehensive understanding of KAP among dental students regarding the latest classification globally. This understanding will enable the development of a more uniform and effective curriculum for global use.

To further support students in clinics, bi-annual orientation and calibration sessions, including workshops with case scenarios/exercises and questionnaires, should be provided to all faculty, clinical tutors, and mentors regarding the latest classification.

Conclusions

The present survey reveals high awareness and usage of the 2017 periodontal classification among University of Sharjah dental students, with knowledge increasing across academic years. While students generally held positive perceptions of the classification's advantages and user-friendliness, further educational programs on the latest classification, diagnosis, and treatment planning in periodontics are needed. Multi-centric studies are recommended that can help restructure future periodontal courses for a better understanding of periodontal diagnosis and treatment planning to develop a globally uniform periodontology curriculum.

Acknowledgements

The authors would like to express their gratitude to all individuals, who agreed to participate in the study.The Deanship of Research and Graduate Studies (DRG), Ajman University, Ajman, United Arab Emirates supportedthe publication fees partially if accepted.

Author contributions

SSY and RMS conceived the study. AT, FS, SA, and SR collected the data. EAA, SSY, RMS, and MMM analyzed the results. AT, FS, SA, and SR wrote the first draft. RMS, SSY, EAA, and MMM reviewed the draft. EAA and MMM edited the draft. SSY and RMS wrote the final draft. All authors read and approved the final manuscript draft.

Funding

Not applicable.

Data availability

The data supporting the findings of this study are available within the article.

Declarations

Ethics approval and consent to participate

All methods in this cross-sectional, questionnaire-based study were carried out by the Declaration of Helsinki. The Research Ethics Committee, University of Sharjah, UAE has approved the study protocol (No: REC-23-06-10-01-S). Participation was voluntary, and all data were processed anonymously. The consent was obtained from all the participants who participated in the study through an online questionnaire. The students' consent to participate in the survey allowed them to respond to the questionnaire further.

Consent for publication

Not applicable.

Competing interests

The authors declare no competing interests.

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Received: 7 October 2024 / Accepted: 14 April 2025
Published online: 24 April 2025

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