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Knowledge and education level of dental sleep medicine among undergraduate dental students in Riyadh, Saudi Arabia: A cross-sectional study

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ABSTRACT

Objective: Knowledge assessment of Dental Sleep Medicine DSM between undergraduate dental students in Riyadh, Saudi Arabia. Moreover, to improve the student's recognition and treatment of sleep disorders. **Methods:** A cross-sectional conducting analytical studies to evaluate knowledge of DSM. The data was collected using a self-administered structured online questionnaire which consisted of demographic details, questions related to students' interest in DSM, and 9-items validated modified version of ASKME (Assessment of Sleep Knowledge in Medical Education) survey. **Results:** In a total of 485 responses among seven universities, (62.1%) were female and (37.9%) were male. The majority of the respondents (82.4%) have a decreased level of knowledge according to the Modified ASKME tool. **Conclusion:** Low level of education among students can lead to a community of dentists with poor knowledge of sleep disorders.

Keywords: Sleep Medicine Education; Dental Education; Obstructive Sleep Apnea; Modified ASKME Survey

1. INTRODUCTION

Dental sleep medicine (DSM) is a new discipline concerned with the management of the oral causes and consequences of sleep-related breathing disorders by using oral appliances and upper airway surgeries. Sleep-related breathing disorder is considered a serious problem that might affect the patient's quality of life in terms of morbidity and mortality (Talaat et al., 2016). According to the international classification of sleep disorders, there are more than 80 types of sleeping disorders, including Obstructive Sleep Apnea (OSA), Complex Sleep apnea, and Central Sleep Apnea (Almohaya et al., 2013). OSA is a common sleep disorder in Saudi Arabia according to a previously conducted study to assess the prevalence of OSA; the results revealed that 3



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out of 10 Saudi men and 4 out of 10 Saudi women are at risk of developing OSA (Ba Hammam, 2011). OSA occurs due to the collapsing of the soft tissue in the back throat, which will cause partial (hypopneas) or complete (apnea) upper airway closure resulting in disturbed breathing during sleep. Most of the episodes last between 10 to 30 seconds or some might persist for a longer time. This will cause a notable reduction in the blood oxygen saturation levels that might reach 40 % in severe cases. If OSA was not treated, it might be associated with various medical complications such as stroke, coronary heart disease, and hypertension (Swapna et al., 2019).

A study conducted in Saudi Arabia by Almohaya et al., (2013) to assess Sleep Medicine Education and knowledge among medical students reported that more than 80% (348) of the study sample had rated their knowledge in sleep medicine as below average. This study highlighted that the understanding of sleep medicine is poor among medical students which reflects a weak education in this field (Almohaya et al., 2013). Sleep-related breathing disorders have a high prevalence rate, yet many remain undiagnosed. According to studies, the reason behind the undiagnosed cases is the poor education of sleep medicine among health care workers (Talaat et al., 2016). Sleep medicine interacts with dentistry in terms of diagnosis and management. The dentist has a vital role in identifying the sleep-related breathing disorders during the routine examination and the risk factors (Reviewers, 2008). Studies demonstrated that between the associated sleep symptoms and disorders, OSA has a higher risk factor for tooth grinding during sleep, hypersalivation, xerostomia, gastrointestinal reflex, and orofacial pain (Quan and Schmidt-Nowara, 2017; Lavigne et al., 1999). Besides, the management of these disorders can be done by dentists as part of the sleep medicine team using oral appliances, which includes fabricating oral appliances by a qualified dentist to avoid any alteration of the dental occlusion and temporomandibular joints (Huynh et al., 2013; Padma et al., 2007).

A study conducted in the Middle East aimed to assess the knowledge of sleep medicine between dental students. A total of 70.8% of the respondents were found to have low awareness about the field (Talaat et al., 2016). As there is no data reported on the knowledge of sleep medicine for dental students in Riyadh, this study is designed to assess the prevalence of dental sleep medicine education and knowledge between undergraduate students in Riyadh, Saudi Arabia.

2. MATERIAL AND METHODS

A cross-sectional analytical study was conducted to assess the prevalence of dental sleep medicine education and knowledge among undergraduate students in Riyadh, Saudi Arabia. The study was scheduled over three months (September 2020 to November 2020). Before the onset of the study, the Ethical Clearance was obtained from the Institutional Review Board (Ref. No.IRBC/2300/20). The Estimated sample size with a power of 80%, and 95% confidence interval, the sample size required for this study was 485 dental students from both genders. There are 7 dental colleges located in Riyadh (King Saud bin Abdulaziz University for Health Sciences, King Saud University, Princess Nourah Bint Abdul Rahman University, Prince Sattam Bin Abdulaziz University, Riyadh Elm University, Al-Farabi College, and Dar Al-Uloom University), and all the 7 dental colleges were included in this study. Convenience sampling technique was used for selecting the subjects for the study, considering the selection criteria to meet the sample size of 485. The dental students willing to participate were included in this study and those not willing were excluded. Written informed consent has been obtained from the willing participants. The students were assured that the data collected will remain confidential and anonymous.

The data was collected using a self-administered structured close-ended questionnaire (Appendix 1). The questionnaire was designed after referring to similar studies reported in the literature (Talaat et al., 2016). The questionnaire composed of 24 questions formatted into three main sections:

Demographics, including age, gender, and academic level; Study variables, which included a grade-point average (GPA), have more interest in sleep medicine and self-assessment of knowledge about sleep medicine; Knowledge assessment: The Assessment of Sleep Knowledge in Medical Education ASKME survey was used, which is a verified survey assessing five separate aspects of knowledge in sleep medicine. The modified ASKME questionnaire for the current study assessed basic knowledge for pathogenesis, diagnosis, treatment, and sequelae of sleep disorders. These elements were presented in a "true," "false," or "I don't know" format (Zozula et al., 2001).

The feasibility of the questionnaire was assessed by conducting a pilot study of 6 students. The questionnaire was distributed through email, social networking media, (Twitter)® and cell phones by using (WhatsApp)® application from Apple store®.

Statistical Analysis

The data was entered and analyzed using John's Macintosh Project JMP. Descriptive and inferential statistics were performed. Chi-square (χ^2) and Pearson's coefficient tests were used to compare categorical variables. A p-value of ≤ 0.05 was considered statistically significant.

3. RESULTS

All 7 universities respond to the questionnaire with 485 responses. Three hundred thirty-eight (69.7%) of the respondents were between 22 and 23 years of age, 301 were female (62.1%) and 184 (37.9%) were male. The distribution of responses among these universities was as followed: KSAU-HS 115 (23.7%), KSU 87 (17.9%), PNU 50 (10.3%), REU 75 (15.5%), Alfarabi 53 (10.9%), PSAU 52 (10.7%), and DU 53 (10.9%). Among participants, 208 (42.9%) had GPA >4.5 out of 5, 235 (48.5%) had a GPA from 4-4.49 and 40 (8.2%) had a GPA from 3.5 to 3.99. With regard to interest, 228 (47%) of the sample expresses more interest in sleep medicine, it is highly probable that this is attributed to other factors than the sleep medicine education itself (Table 1).

Table 1 Distribution of the study population based on the demographic details.		
Parameters	Distribution	Frequency (n) / Percentage (%)
Age (years)	19-23	422 (87)
	24-27	63 (13)
Gender	Male	184 (37.9)
	Female	301 (62.1)
University	KSAU-HS	115 (23.7)
	KSU	87 (17.9)
	PNU	50 (10.3)
	REU	75 (15.5)
	Alfarabi	53 (10.9)
	PSAU	52 (10.7)
	DU	53 (10.9)
GPA	>4.5 out of 5	208 (42.9)
	4-4.49	235 (48.5)
	3.5 to 3.99	40 (8.2)
	Below 3	2 (0.4)
Interest in sleep medicine	Yes	228 (47)
	No	257 (53)

In the responding dental school, the sum of the hour's average dedicated to teaching sleep medicine was 4.1 hours. Among the seven dental schools offering the DSM in their undergraduate program, DSM is taught in fourth years or D3 followed by third year D2. Regarding the department involved in teaching DSM, oral medicine 314 (66%) was most commonly involved followed by, orthodontics 198 (41.6%), prosthodontic-restorative-occlusion 182 (38.2%), and lastly oral surgery 106 (22.3%). The most frequent therapies taught within the DSM education were oral appliance 402 (82.9%), orthodontic treatment 182 (37.5%), mandibular advancement 114 (23.5%), and CPAP 111 (22.9%). Regarding the most discussed topic was sleep bruxism 425 (87.6%) followed by obstructive sleep apnea 293 (60.4%), insomnia 198 (40.8%), (Table 2).

Table 2 Distribution of the study population based on the dental sleep medicine education.		
Parameters	Distribution	Frequency (n) / Percentage (%)
Number of dedicated teaching hours of teaching sleep medicine	0	213 (43.9)
	1-3	272 (56)
	More than 3	66 (13.6)
The academic year dental sleep medicine was taught	First/Pre-dental	7 (1.4)
	Second/D1	36 (7.4)

	Third /D2	214 (44.1)
	Fourth/D3	348 (71.8)
	Fifth/D4	127 (26.2)
Department involved in teaching dental sleep medicine	Oral medicine	314 (66)
	Orthodontics	198 (41.6)
	Prosthetic-restorative-occlusion	182 (38.2)
	Oral surgery	106 (22.3)
Most frequent therapies taught within the DSM education	Oral appliance	402 (82.9)
	Orthodontic treatment	182 (37.5)
	Mandibular advancement	114 (23.5)
	CPAP	111 (22.9)
Most discussed topics within the DSM education	Sleep bruxism	425 (87.6)
	Obstructive Sleep Apnea	293 (60.4)
	Insomnia	198 (40.8)
	Sleep-Related Breathing Disorder	162 (33.4)
	Clinical Occlusion	138 (28.5)
	Sleep-Related Movement Disorder	31 (6.4)
	Circadian Rhythm Sleep Disorders	21 (4.3)

There was a significant negative correlation in the data concerning a board-certified trained faculty at the institutions ($p < 0.0001$) (Figure 1). However, there was a significant perfectly positive correlation between the presence of dental SM clinics and university ($p = 0.0298$) (Figure 2). The majority of the respondents (82.4%) have a reduced level of knowledge according to their answer to the Modified ASKME tool. Table 3 shows the number (%) of answers to the questions.

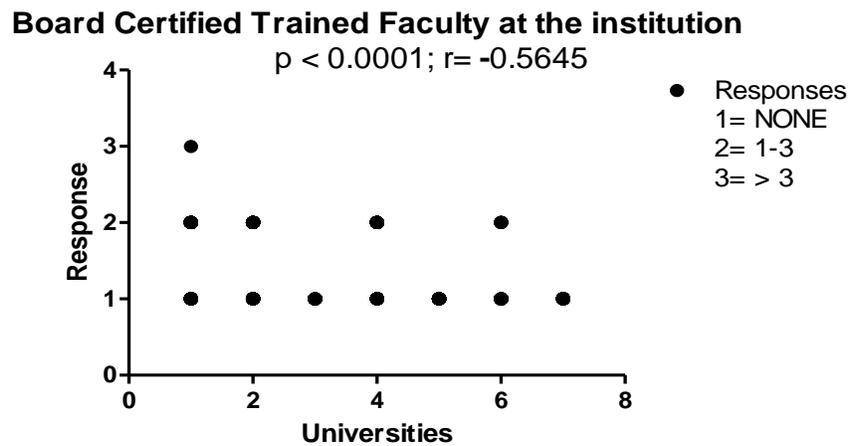


Figure 1 Universities: 1. KSAUHS 2. KSA 3. PNU 4. REU 5. FARABI 6. PSAU 7. DUU ($r = -0.5645$) indicates significant negative association between the presence of board-certified trained faculty and university.

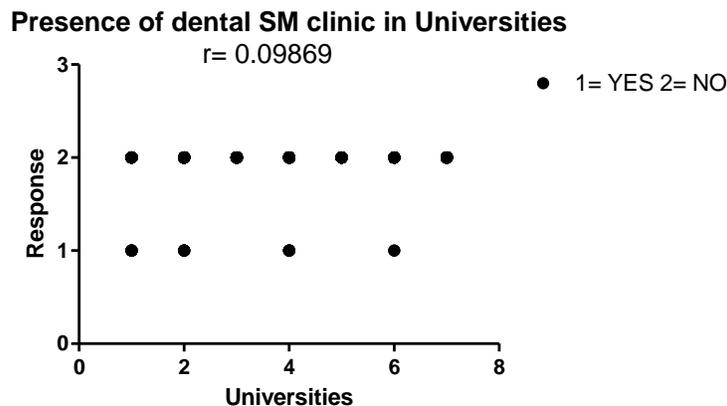


Figure 2 Universities: 1. KSAUHS 2. KSA 3. PNU 4. REU 5. FARABI 6. PSAU 7. DUU($r=0.9869$) ($p= 0.0298$) indicate significant perfectly positive correlation between the presence of dental SM clinics and university.

Table 3 The number and percentages of study population’s answers to the modified ASKME tool.

Modified ASKME tool	Yes n (%)	No n (%)	I don’t Know n (%)
1. Uvulopalatopharyngoplasty is curative for most obstructive sleep apnea (OSA)patients	58 (12%)	44 (9.1%)	383 (79%)
2. Most patients with OSA snore	116 (23.9%)	58 (12%)	311 (64%)
3. OSA is associated with hypertension	49 (10.1%)	65 (13.4%)	371 (76.5%)
4. An overnight sleep study is the gold standard for diagnosing OSA	141 (29.1%)	17 (3.5%)	327 (67.4%)
5. The most common cause of OSA in children is the presence of large tonsils and adenoids	135 (27.8%)	19 (3.9%)	331 (68.2%)
6. Association of untreated OSA with higher incidence of automobile crashes	70 (14.4%)	56 (11.5%)	359 (74%)
7. OSA is more common in women than men	43 (8.9%)	57 (11.8%)	385 (79.4%)
8. CPAP is the first-line therapy for severe OSA	74 (15.3%)	14 (2.9%)	397 (81.9%)
9. Cardiac arrhythmias may be associated with untreated OSA	84 (17.3%)	14 (2.9%)	387 (79.8%)

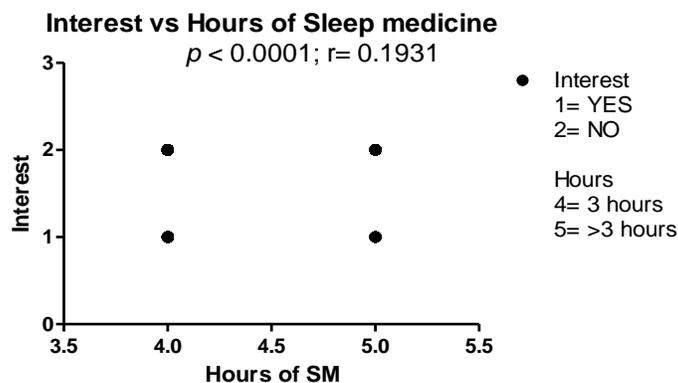


Figure 3 $r=0.1931$ $p<0.0001$ indicate significant weekly positive correlation between interest and hours of sleep medicine.

The results revealed that 228 dental students are interested in DSM with a significant weekly positive correlation between the interest and teaching hours ($p<0.0001$) (Figure 3). One hundred seventy-seven (36.5%) of dental students from different universities

reported that they have 1-3 board-certified trained dental sleep medicine faculty members in their institution. There was no significant correlation between the interest toward DSM and the number of board-certified trained faculty members ($p=0.1577$) (Figure 4).

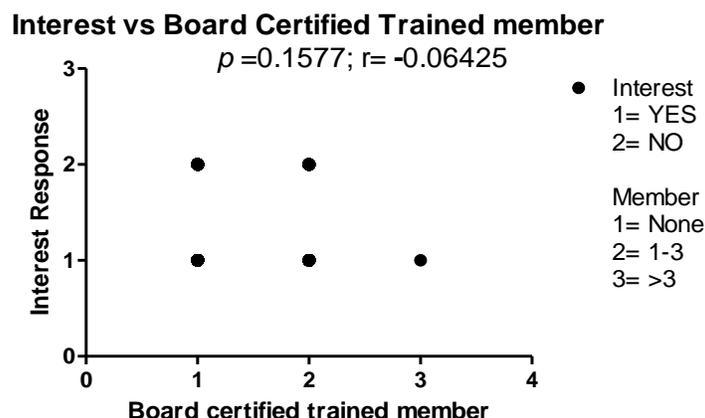


Figure 4 $r=-0.6425$; $p= 0.1577$ indicate insignificant weekly negative correlation between interest and board-certified trained member.

4. DISCUSSION

Dental Sleep Medicine is considered now as a valuable specialty in dental practice. Although Saudi Arabia has a low standard level of sleep medicine services compared to developed countries, there were remarkable improvements noticed in the last eight years (Bahammam et al., 2014). A survey conducted in Saudi Arabia among Primary Health Care (PHC) physicians to evaluate the knowledge and attitude toward sleep medicine reported that 43% of PHC physicians were unaware of the of sleep medicine existence as a sub-specialty, 40% of the participants thought sleep disorders are not common (Simmons and Pullinger, 2012). The involvement of Dental Sleep Medicine in undergraduate student's curriculum is not satisfactory. Several studies were done to assess the knowledge of medical and dental students in the field of sleep medicine, but there were no studies reported in Riyadh.

A study was done in Saudi Arabia among selected medical schools to evaluate the education of sleep medicine knowledge, which revealed that medical students from the surveyed institutions lack knowledge of sleep medicine, which reflects the weak level of education in this field of medicine (Almohaya et al., 2013). Another study from Middle East universities reported that dental students at Middle Eastern universities have a low level of education in sleep medicine, resulting in a decreased level of knowledge (Talaat et al., 2016). Hence, this study intended to assess the knowledge and awareness of DSM among undergraduate dental students in Riyadh, Saudi Arabia. In addition, the study aim is to improve the student's recognition of sleep disorders and management. The mean age of undergraduate students in this study is 23, which is similar to studies conducted in Saudi Arabia and the Middle East, where the average age was 23.1. The reason for the similar age could be attributed to the fact that most of the participants are seniors.

In the current study, the number of female participants was 301 (62.1%) which could be attributed to the female population dominating more in the Saudi dental school compared to males (Talaat et al., 2016). The present study survey included a question about the type of university, which was not discussed in any other study, to assess any correlation between the knowledge and type of university, and according to the results, there was no correlation between them. Moreover, most of the participants were from KSAU-HS and the reason behind that is there was easy access to undergraduate dental students from this university. In contrast, a study conducted on medical students has a lower number of KSAUHS participants (Almohaya et al., 2013). Usually, dental sleep medicine topics are discussed in the fourth and fifth year; as a result, there were no participants from the first three years. In the current study, most of the participants have a GPA >4 out of 5, in study conducted by Almohaya et al., (2013) most of the participants 167 (48.1%) have a GPA between 3.99 to 3, this could be due to different curriculum difficulty between dental and medical schools. A total of 228 (47%) of the participants are interested in dental sleep medicine. While in a study conducted among medical students 96 (27.7%) of the sample expressed interest in DSM. This difference in number could be due to those dental students had more exposure to DSM compared to medical students (Almohaya et al., 2013).

In the present study, DSM is mostly discussed in the oral medicine department 314 (66%), while in another study conducted by Talaat et al., (2016), it is usually discussed in the orthodontic department (56%), and this could be due to different curriculum

between these universities. The Middle East study found that dental students rarely have an opportunity to learn sleep medicine in dental schools. In the current study, the average teaching time (4.1h) of DSM in undergraduate dental students in Saudi Arabia, this is higher than the average hours for the medical student (2.6h) (Almohaya et al., 2013). Although many of the responses showed more teaching hours in DSM (3 hours), a decreased level of knowledge is observed among the undergraduate dental students according to modified ASKME tool responses. The most common topic discussed in the current study was sleep bruxism (SB) 425 (87.6%). Similarly, in a study conducted in the middle east the most common topic discussed was SB (60%) along with insomnia (60%) this could be because of the fact that SB is the most common sleep disorder faced in the dental clinic (Talaat et al., 2016).

The most common therapy discussed within DSM was not discussed in previous studies. However, in the current study, oral appliances were the most selected topic 402 (83%). Moreover, DSM was more taught in the fourth year (71.8 %) which is similar to a study conducted by Talaat et al., (2016) among dental students in the Middle East 153 (44%). This may be because these topics have become more advanced in recent years compared to the first basic years (Talaat et al., 2016). Most of the institutions (90%) have no sleep medicine clinic because DMS is considered a new discipline. The presence of board-certified trained DSM faculty was not discussed in other articles, however 177 (36.5%) dental students from different universities reported that they have 1-3 board-certified trained dental sleep medicine faculty members in their institution. This study shows that the sleep medicine knowledge between dental students in Riyadh is poor. In this study, only 65 (13.4 %) of the responders correctly answered more than 55.6% of the questions (5 questions out of 9), while 86.6% of the responders belong to the low group. This supports the data from another study assessing the dental students' knowledge in Middle East universities using the modified ASKME questionnaire, where the authors reported that only 29.2% responders scored above 60%, where the other 70.8% reported below 60% (Talaat et al., 2016).

Suggestions

Alternative strategies were recommended by many researchers to include sleep topics into the existing medical curriculum. The recommended approaches are to include sleep medicine science into the preclinical year's curriculum, sleep history, and physical signs into the basic clinical medicine years, and into problem-solving sessions, which applies to the dental curriculum (Bandla et al., 2007; Harding and Berner, 2002). One of the major challenges is to encourage the educational system to acknowledge more prevalence and major consequences of sleep disorders, where establishing and including the sleep medicine curriculum is the next goal. Ivanoff et al., (2012) also suggested that dental schools should add a question about sleep disorders in medical history questionnaires and to screen patients for sleep disorders.

Moreover, adding oral devices to every undergraduate curriculum and having mandatory early training in this field was suggested and in dental schools. Having the basic knowledge of DSM in preclinical dental education could be achieved by including basic sleep disorders in problem-based curricula. In clinical years, students should screen patients for sleeping disorders and recognize the anatomical and mechanical factors that might lead to upper airway obstruction. They should also acknowledge and discuss the need for medical treatment, and know-how and when to refer the patients for more investigations.

Limitation

Bias may arise as a result of survey respondents' attempts to overstate their performance, resulting in their lack of knowledge being under-reported in this study. Nevertheless, this study provides important information on DSM knowledge and emphasizes the need to improve undergraduate dental students' sleep medicine knowledge and education.

5. CONCLUSION

In conclusion, dental students in Riyadh have a weak knowledge of dental sleep medicine. The poor level of knowledge could be due to many reasons such as lack of interest in DSM and time for teaching the subject in some dental universities, different curriculum references, and insufficiently discussed topics. Low education and knowledge among dental students can lead to a community of dental graduates with poor knowledge of DSM, which can negatively affect the sleep disorders patients' early recognition and treatment.

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Contributors

Sanjeev Khanagar: Study design, Reviewer; Abdul Salam Thekkiniyakath Ali: Study design, Reviewer; Linah Yassin Alali: Study design, data collection, statistical analysis, and drafted the manuscript; Rahaf Alahmadi: Study design, data collection, statistical analysis, and drafted the manuscript; Maram Alqahtani: Study design, data collection, statistical analysis, and drafted the manuscript; Reem Bin Zaid: Study design, data collection, statistical analysis, and drafted the manuscript; Arwa Alhassoun: Study design, data collection, statistical analysis, and drafted the manuscript.

Ethics Approval

The study was approved by the Medical Ethics Committee of King Saud bin Abdulaziz University for health and sciences (Ref. No. IRBC/2300/20).

Conflicts of interest

The authors declare that they have no conflict of interest.

Funding

This study has not received any external funding.

Data and materials availability

All data associated with this study are present in the paper.

Appendix I

Demographic data:

1. Age:

Gender

Male

Female

2. What is the type of your university?

Private

Public

3. What university are you in?

King Saud bin Abdulaziz University for Health Sciences

King Saud University

Princess NourahBint Abdul Rahman University

Riyadh Elm University

Al-Farabi College

Prince Sattam Bin Abdulaziz University

Dar Al Uloom University

4. Study variables:

Academic level?

First year/ Pre-Dental

Second year/ D1

Third year/ D2

Fourth year/ D3

Fifth year/ D4

5. Grade-point average (GPA)?

4.50-5

4.00-4.49

3.50-3.99

Below 3

6. Do you have specific interest in sleep medicine?

Yes

No

7. Sleep medicine education:

Which department in your school teaches sleep medicine? (Circle all that apply)

Oral medicine

Oral surgery

Orthodontics

Prosthodontics/occlusion/restorative

How many class or clinic hours (if any) are spent on teaching topics of Sleep Medicine in each academic year?

0

1

2

3

More than 3

Which topics are discussed? (Circle all that apply)

Insomnia

Sleep bruxism

Obstructive sleep apnea

Clinical occlusion

Sleeping related breathing disorders (SRBD)

Circulation rhythm sleep disorder

Sleep related movement disorders

8. Which therapies for SRBDs are discussed? (Circle all that apply)

Oral appliance

Mandibular advancement

CPAP

Orthodontics treatment

9. In which academic year are the above topics being taught?

First year/ Pre-Dental

Second year/ D1

Third year/ D2

Fourth year/ D3

Fifth year/ D4

10. Do you have a Dental Sleep Medicine Clinic at your institution?

Yes

No

11. How many board certified trained dental sleep medicine faculty members are at your institution?

None

1-3

More than 3

12. Modified (ASKME) tool:

Uvulopalatopharyngoplasty is curative for the majority of patients with obstructive sleep apnea (OSA)?

True

False

I don't know

The majority of patients with OSA snore?

True

False

I don't know

OSA is associated with hypertension?

True

False

I don't know

An overnight sleep study is the gold standard for diagnosing OSA?

True

False

I don't know

The most common cause of OSA in children is the presence of large tonsils and adenoids?

True

False

I don't know

Untreated OSA is associated with a higher incidence of automobile crashes?

True

False

I don't know

OSA is more common in women than men?

True

False

I don't know

13. CPAP is the first-line therapy for severe OSA?

True

False

I don't know

14. Cardiac arrhythmias may be associated with untreated OSA?

True

False

I don't know

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