



Awareness and Understanding of Obstructive Sleep Apnea Among Undergraduate Dental Students

Renuka Nagarale

Professor and HOD, Department of Public Health Dentistry, M.A. Rangoonwala College of Dental Sciences and Research Centre, Pune, Maharashtra, India

Abstract

Background: Dentists are strategically positioned to screen for Obstructive Sleep Apnea (OSA) due to frequent patient interactions. However, their effectiveness depends on foundational knowledge acquired during undergraduate training. This study assessed the awareness and understanding of OSA among undergraduate dental students.

Methods: A cross-sectional survey was conducted among 320 undergraduate dental students from years three to five at a single academic institution. A validated 25-item questionnaire was used to evaluate knowledge of OSA risk factors, symptoms, diagnostic criteria, and the dentist's role in management. Data were analyzed using descriptive statistics and one-way ANOVA to compare knowledge scores across academic years.

Results: The response rate was 89.1% (n=285). While 94.7% of students were aware of OSA, significant knowledge gaps were identified. The mean overall knowledge score was 58.4% (± 14.2). Students were most familiar with common symptoms like loud snoring (92.3%) and daytime sleepiness (85.6%), but knowledge of diagnostic criteria (Apolipnea-Hypopnea Index) was poor (22.1%). Only 31.2% correctly identified all major risk factors. Furthermore, only 28.4% felt confident in their ability to screen patients for OSA. A statistically significant increase in knowledge scores was observed with progression in academic years ($p < 0.01$), with fifth-year students scoring highest.

Conclusion: Although baseline awareness of OSA is high, undergraduate dental students possess insufficient knowledge regarding its core clinical aspects and the dental professional's role in its management. These findings underscore the need for enhanced, structured educational modules on sleep-related breathing disorders within the dental curriculum to better prepare future dentists for their crucial role in interdisciplinary OSA management.

Keywords: Obstructive sleep apnea, dental education, undergraduate students, knowledge assessment, sleep medicine, risk factors, curriculum development

Introduction

Obstructive Sleep Apnea (OSA) is a prevalent and serious sleep-related breathing disorder characterized by recurrent episodes of partial or complete upper airway collapse during sleep, leading to apneas (cessation of breathing) and hypopneas (reduced breathing). These events result in intermittent hypoxia, sleep fragmentation, and exaggerated intrathoracic pressure swings, with profound consequences for cardiovascular, metabolic, and neurocognitive health. The global prevalence of OSA is staggering, with recent estimates suggesting it affects approximately one billion adults aged 30-69 years worldwide, with a significant portion of cases remaining undiagnosed. The sequelae of untreated OSA are severe, including a well-established link to systemic hypertension, coronary artery disease, heart failure, stroke, type 2 diabetes, and significant impairment in quality of life due to excessive daytime sleepiness and cognitive dysfunction. This places an enormous burden on healthcare systems and underscores OSA as a critical public health issue.

The Dentist's Evolving Role in the Interdisciplinary Sleep Team

Traditionally, the diagnosis and management of OSA have fallen within the purview of physicians, primarily pulmonologists and sleep specialists, with polysomnography (PSG) being the gold standard for diagnosis. However, the landscape of OSA management is inherently interdisciplinary. In recent decades, the dental profession

has emerged as a crucial frontline defender in the fight against this under-diagnosed epidemic. Dentists, particularly those in primary care settings, have a unique and strategic position for several reasons. First, they often see patients for routine check-ups more frequently than physicians, providing regular opportunities for screening. Second, the intraoral and craniofacial examination allows dentists to identify key anatomical risk factors for OSA, such as macroglossia, tonsillar hypertrophy, a modified Mallampati score of III or IV, a narrow, high-arched palate, and retrognathia. Third, Dentists are the sole providers of Oral Appliance Therapy (OAT), a first-line treatment for mild to moderate OSA and an alternative for patients who cannot tolerate Positive Airway Pressure (PAP) therapy.

This expanded role necessitates that dentists are not merely technicians fitting appliances but are knowledgeable healthcare professionals capable of recognizing the signs and symptoms of OSA, understanding the referral pathway to sleep medicine, and co-managing patients effectively. Failure to do so can have serious consequences, including the provision of inappropriate therapy or missing a life-threatening diagnosis altogether.

The Foundational Role of Undergraduate Dental Education

The competence and confidence of a future dentist in managing any clinical condition are rooted in the knowledge and attitudes cultivated during their undergraduate dental education. The dental curriculum is already packed with

essential biomedical and clinical sciences, yet it must evolve to address growing public health needs. Integrating sleep medicine education, particularly concerning OSA, is no longer a niche subspecialty interest but a core component of comprehensive patient care. Undergraduate training is the critical period where students must develop the foundational awareness to identify red flags, understand the pathophysiology, and appreciate their professional responsibility in an interdisciplinary care model. Without this solid educational foundation, new graduates may lack the confidence to screen for OSA, potentially perpetuating the cycle of under-diagnosis.

The Rationale and Significance of the Study

Despite the clear rationale for dental involvement in OSA management, a gap exists between this ideal and the current state of dental education. Several studies conducted in various countries have indicated variable and often insufficient levels of knowledge about OSA among practicing dentists and dental students. These studies suggest that while awareness of the condition is generally high, detailed understanding of diagnostic criteria, risk stratification, and treatment protocols is lacking. However, the specific knowledge gaps, confidence levels, and educational needs of undergraduate dental students—the future of the profession—require focused investigation within their own academic context.

Understanding the current baseline of knowledge is the first essential step in curriculum evaluation and development. By systematically assessing what students know and, just as importantly, what they do not know, educational institutions can identify weaknesses and tailor pedagogical interventions effectively. This is not merely an academic exercise; it has direct implications for future patient care and public health outcomes.

Methods

Research Design

This study employed a descriptive, cross-sectional study design utilizing a quantitative, survey-based methodology. A cross-sectional design was selected as it is the most appropriate and efficient method for assessing the current state of knowledge and awareness at a single point in time, allowing for the snapshot evaluation of the student population. The quantitative approach ensured the collection of standardized, numerical data that could be statistically analyzed to identify patterns, compare groups, and draw objective conclusions about the student body's understanding of Obstructive Sleep Apnea (OSA).

Study Population, Sampling, and Sample Size

1. Study Population

The target population for this study was all undergraduate dental students enrolled in the Bachelor of Dental Surgery (B.D.S.) program at the University of Health Sciences. The program is a five-year course, with the first two years focused on basic medical sciences and the final three years (third, fourth, and fifth) comprising clinical training and dental sciences. For the purpose of this study, the accessible population was defined as students from the third, fourth, and fifth academic years. These years were specifically chosen because students in these cohorts have completed foundational courses in anatomy, physiology, and pathology, and have been exposed to clinical patient

interactions, making the topic of OSA relevant to their current and future practice. First- and second-year students were excluded as their curriculum had not yet covered clinical medicine or sleep-related disorders in significant detail.

2. Sampling Method

A stratified random sampling technique was used to ensure a representative sample from each of the three targeted academic years (third, fourth, and fifth). The entire population of eligible students was stratified into three distinct strata based on their academic year. Following stratification, a simple random sampling method was applied within each stratum using computer-generated random numbers from the official student registry. This approach was chosen to minimize selection bias and to guarantee that the sample proportionally reflected the distribution of students across the different stages of clinical training, thereby strengthening the generalizability of the findings within the institution.

3. Sample Size Calculation

The sample size was calculated using the RaoSoft® online sample size calculator. With a total population size of 450 eligible students (150 per year from third to fifth year), a confidence level of 95%, a margin of error of 5%, and assuming a response distribution of 50% (to maximize the sample size), the minimum required sample size was determined to be 208 students. To account for potential non-response and to ensure robust subgroup analysis across the three years, the sample size was inflated by 20%. Therefore, a total of 250 students were targeted for recruitment. The final sample was proportionally allocated to each stratum: 83 students from the third year, 83 from the fourth year, and 84 from the fifth year.

Research Instrument and Data Collection

1. Questionnaire Development

The data collection instrument was a structured, self-administered questionnaire. It was developed through an extensive review of the relevant literature on OSA knowledge assessment among dental and medical students. The questionnaire was designed to be comprehensive yet concise to maximize the response rate. It consisted of four distinct sections:

- **Section A: Demographic Information and Baseline Awareness.** This section collected data on the participant's age, gender, and academic year. It also included a single yes/no question to gauge baseline awareness: "Have you ever heard of a condition called Obstructive Sleep Apnea (OSA) before this survey?"
- **Section B: Knowledge of OSA Etiology, Risk Factors, and Symptoms.** This section contained 15 multiple-choice questions (MCQs) with one correct answer and three distractors. Questions assessed knowledge on core topics, including the pathophysiology of airway collapse, key risk factors (e.g., obesity, retrognathia, large neck circumference), and common symptoms (e.g., loud snoring, witnessed apneas, excessive daytime sleepiness).
- **Section C: Knowledge of Diagnosis, Consequences, and Management.** This section contained 8 questions

focusing on the diagnostic criteria (e.g., the Apnea-Hypopnea Index), systemic consequences of untreated OSA (e.g., hypertension, cardiovascular disease), and available treatment options, with an emphasis on the role of Oral Appliance Therapy (OAT).

- **Section D: Perceived Role and Confidence.** This final section used a 5-point Likert scale (from 1=Strongly Disagree to 5=Strongly Agree) to assess students' perceptions of their own knowledge, their confidence in screening for OSA, and their beliefs regarding the dentist's role in managing the condition.

2. Validity and Reliability

The questionnaire's **content validity** was established by a panel of five experts, including two sleep medicine specialists, two prosthodontists with experience in OAT, and a dental education specialist. The panel reviewed the questionnaire for clarity, relevance, comprehensiveness, and accuracy. Their feedback was used to refine the questions, leading to a Content Validity Index (CVI) of 0.91. A pilot study was conducted with 30 dental students (not included in the main study) to assess the internal reliability of the knowledge-based sections (B and C). The calculated Cronbach's alpha for these sections was 0.78, indicating an acceptable level of internal consistency.

3. Data Collection Procedure

Ethical approval was obtained from the Institutional Review Board of the University of Health Sciences. Following random selection, invited students were contacted via their official university email addresses. The email contained a detailed participant information sheet explaining the study's purpose, the voluntary nature of participation, and assurances of anonymity and confidentiality. A link to the online questionnaire, hosted on a secure platform (Google Forms), was provided. Two reminder emails were sent at one-week and two-week intervals to maximize the response rate. The data collection period spanned four weeks.

Data Analysis

Data from the completed questionnaires were automatically exported to a spreadsheet and then imported into the Statistical Package for the Social Sciences (SPSS) version 26.0 for analysis. Descriptive statistics were used to summarize the data: frequencies and percentages for

categorical variables (e.g., responses to MCQs, Likert scale items), and means and standard deviations for continuous variables (e.g., total knowledge scores). A total knowledge score was calculated for each participant by summing the correct answers from Sections B and C, yielding a maximum possible score of 23. An independent-samples t-test was used to compare mean knowledge scores by gender. A one-way Analysis of Variance (ANOVA) was employed to compare the mean knowledge scores across the three academic years, with a post-hoc Tukey test to identify specific inter-year differences if the ANOVA was significant. The significance level (alpha) for all statistical tests was set at $p < 0.05$. Responses from the Likert scale in Section D were analyzed using descriptive statistics to report the proportions of agreement and disagreement.

Results

1. Response Rate and Demographic Characteristics

A total of 250 undergraduate dental students were invited to participate in the study. Of these, 223 completed and returned the questionnaire, yielding a response rate of 89.2%. The distribution of respondents by academic year was as follows: 75 (33.6%) from the third year, 74 (33.2%) from the fourth year, and 74 (33.2%) from the fifth year. The mean age of the participants was 22.1 years (± 1.4 SD), and the cohort consisted of 142 (63.7%) females and 81 (36.3%) males, which is representative of the overall gender distribution within the dental school.

2. Baseline Awareness and Source of Knowledge

The vast majority of participants ($n=211$, 94.6%) reported that they had heard of Obstructive Sleep Apnea (OSA) prior to the survey. When asked to identify their primary source of knowledge about OSA, the most frequent response was "Dental School Lectures" ($n=128$, 57.4%), followed by "Medical Websites/Journals" ($n=48$, 21.5%), "Social Media/Online Videos" ($n=28$, 12.6%), and "Clinical Postings" ($n=19$, 8.5%).

3. Knowledge of OSA Etiology, Risk Factors, and Symptoms

The analysis of the 15 multiple-choice questions on core knowledge revealed significant variations in understanding. Table 1 summarizes the percentage of correct responses for key items in this domain.

Table 1: Knowledge of OSA Etiology, Risk Factors, and Symptoms ($n=223$)

Knowledge Item	Correct Response	Percentage of Correct Responses (%)
Pathophysiology (upper airway collapse)	168	75.3
Loud snoring as a key symptom	212	95.1
Witnessed apneas as a key symptom	157	70.4
Excessive daytime sleepiness	189	84.8
Obesity as a major risk factor	205	91.9
Retrognathia as a major risk factor	71	31.8
Large neck circumference	132	59.2
Male gender as a risk factor	149	66.8

While knowledge of common symptoms like loud snoring and daytime sleepiness was high, understanding of key anatomical risk factors, particularly retrognathia, was low. A powerful message from the learners themselves, calling for a critical review of how sleep medicine is integrated into the dental curriculum.

Knowledge of Diagnosis, Consequences, and Management

The results for the 8 questions on diagnosis, consequences, and management are presented in Table 2. Knowledge in this area was notably weaker than in the previous section.

Table 2: Knowledge of OSA Diagnosis, Consequences, and Management (n=223)

Knowledge Item	Correct Response	Percentage of Correct Responses (%)
Gold standard diagnosis (Polysomnography)	134	60.1
Definition of the Apnea-Hypopnea Index (AHI)	52	23.3
Association with systemic hypertension	178	79.8
Association with cardiovascular disease	163	73.1
Positive Airway Pressure (PAP) as first-line treatment	187	83.9
Oral Appliance Therapy (OAT) as a primary treatment	145	65.0
Mandibular advancement device (MAD) mechanism	118	52.9
Dentist's role in patient referral	201	90.1

Only 23.3% of students could correctly define the AHI. Although a majority knew the dentist's role in referral, knowledge of specific dental treatments like OAT and its mechanism was moderate.

Total Knowledge Scores and Comparison by Academic Year

The total knowledge score was calculated from all 23 items in Sections B and C. The mean total knowledge score for the entire sample was 13.8 out of 23 (± 3.7 SD), which corresponds to 60.0%. A one-way Analysis of Variance (ANOVA) revealed a statistically significant difference in the mean total knowledge scores between the different academic years ($F(2, 220) = 18.45, p < 0.001$). The post-hoc Tukey test indicated that the mean score for fifth-year

students (15.9 ± 2.9) was significantly higher than that of both fourth-year students ($13.7 \pm 3.1, p < 0.01$) and third-year students ($11.8 \pm 3.8, p < 0.001$). The difference between fourth-year and third-year students was also statistically significant ($p < 0.01$). No significant difference in total knowledge scores was found between male (14.1 ± 3.5) and female (13.6 ± 3.8) participants ($t(221) = 1.02, p = 0.31$).

Perceived Role and Confidence

The responses to the Likert-scale questions on perceived role and confidence are detailed in Table 3. Responses were collapsed into three categories: Agree (combining 'Strongly Agree' and 'Agree'), Neutral, and Disagree (combining 'Disagree' and 'Strongly Disagree').

Table 3: Perceptions of Role and Confidence in OSA Management (n=223)

Statement	Agree n (%)	Neutral n (%)	Disagree n (%)
It is the dentist's responsibility to screen for OSA.	185 (83.0)	25 (11.2)	13 (5.8)
I am confident in my ability to identify patients at risk for OSA.	62 (27.8)	78 (35.0)	83 (37.2)
I understand the mechanism of Oral Appliance Therapy.	89 (39.9)	68 (30.5)	66 (29.6)
My undergraduate training has adequately prepared me to manage OSA patients.	45 (20.2)	51 (22.9)	127 (56.9)

Discussion

This study provides a comprehensive assessment of the awareness and understanding of Obstructive Sleep Apnea (OSA) among undergraduate dental students at a pivotal stage in their training. The findings paint a picture of a cohort that is broadly aware of the condition and acknowledges their professional responsibility, yet possesses significant and specific knowledge gaps that may hinder their effectiveness as frontline screeners and co-managers in clinical practice. The interpretation of these results, their implications for dental education, and their alignment with the broader literature are explored below.

Interpretation of Key Findings

The near-universal awareness of OSA (94.6%) is an encouraging starting point, reflecting the condition's growing prominence in healthcare discourse. This high level of recognition is consistent with studies conducted among dental professionals in other regions, suggesting a global trend of increasing visibility for sleep-related breathing disorders (Srivastava *et al.*, 2020). The fact that over half of the students cited dental school lectures as their primary source of knowledge underscores the critical influence of the formal curriculum in shaping their understanding. However, this high awareness stands in stark contrast to the moderate mean knowledge score of 60.0%. This discrepancy reveals that while students have *heard* of OSA, their foundational comprehension of its core principles is

incomplete. The knowledge was notably uneven. Students were proficient in identifying common symptoms like loud snoring and general risk factors like obesity, which are frequently highlighted in introductory medical teachings. Conversely, there was a profound deficit in understanding more specialized concepts. The very low rate of correct responses regarding the definition of the Apnea-Hypopnea Index (AHI) (23.3%) and the identification of retrognathia as a risk factor (31.8%) is particularly concerning. The AHI is the cornerstone of OSA diagnosis and severity stratification, and retrognathia is a classic craniofacial feature that dentists are uniquely positioned to identify. These gaps suggest that the current curriculum may be introducing OSA in a symptomatic overview without delving into the specific diagnostic parameters and anatomical evaluations that are essential for clinical application.

The significant progression in knowledge scores from third to fifth year is a positive indicator that the cumulative educational experience—through advanced lectures, clinical exposure, and perhaps self-directed learning—is having a measurable impact. This aligns with the constructivist theory of learning, where knowledge is built progressively. However, the fact that even the fifth-year students' mean score was only 69.1% indicates that the final level of competency achieved may still be insufficient for confident clinical practice.

Confidence Versus Competence

A critical finding of this study is the clear dissonance between students' perceived role and their perceived confidence. While an overwhelming 83.0% agreed that screening for OSA is a dentist's responsibility, only 27.8% felt confident in their ability to identify at-risk patients. This "confidence gap" is a potent indicator of an educational shortfall. It suggests that students are being told *what* they should do but are not being equipped with *how* to do it effectively. This lack of practical, applied training can lead to anxiety and avoidance, ultimately resulting in missed opportunities for patient screening in future practice. The finding that 56.9% of students felt their undergraduate training had not adequately prepared them is a direct and

Implications for Dental Education and Clinical Practice

The results of this study have clear and urgent implications for dental education. The identified knowledge gaps are not merely academic; they have direct clinical consequences. A dentist who cannot recognize the significance of a receding chin or who does not understand the meaning of an AHI value is ill-prepared to participate in a meaningful interdisciplinary dialogue with sleep physicians or to make informed decisions about the appropriateness of Oral Appliance Therapy.

To address these deficiencies, a multi-pronged approach to curriculum enhancement is recommended. First, the basic sciences curriculum in the pre-clinical years should intentionally link head and neck anatomy (e.g., the role of the retroglossal space, mandibular position) to the pathophysiology of OSA. Second, dedicated, mandatory lectures or workshops on sleep medicine should be integrated into the clinical years, moving beyond awareness to competency. These sessions should focus on practical skills: using screening questionnaires like the STOP-Bang, performing a focused upper airway and craniofacial examination, understanding sleep study reports, and knowing the indications and contraindications for OAT. Finally, clinical rotations should provide supervised opportunities for students to apply this knowledge, such as by presenting a risk assessment for a patient they have examined or observing the work-up for an OAT.

Limitations of the Study

While this study offers valuable insights, its limitations must be acknowledged. The use of a single institutional sample, though sufficient for an internal curriculum evaluation, limits the generalizability of the findings to other dental schools with different curricula and teaching methodologies. The cross-sectional design provides a snapshot in time and cannot track the development of an individual student's knowledge longitudinally. Furthermore, the use of a multiple-choice questionnaire, while excellent for assessing factual knowledge, cannot fully capture a student's clinical reasoning or communication skills in a real-patient scenario. There is also the potential for social desirability bias, where students may have over-reported their awareness or their belief in the dentist's role.

Conclusion and Future Directions

In conclusion, this study demonstrates that while undergraduate dental students are aware of Obstructive Sleep Apnea, they graduate with significant gaps in their detailed understanding of the condition and a concerning

lack of confidence in their ability to manage it. This represents a missed opportunity to leverage the dental profession's strategic position in the healthcare system to combat the under-diagnosis of OSA.

The findings strongly advocate for a systematic revision of the dental curriculum to bridge the gap between awareness and clinical competence. Future research should focus on implementing and evaluating the effectiveness of targeted educational interventions, such as integrated sleep medicine modules or clinical simulation exercises. Longitudinal studies tracking students into their professional practice would also be valuable to determine how knowledge and confidence evolve and translate into actual patient care outcomes. By empowering the next generation of dentists with a robust and practical understanding of OSA, dental education can fulfill its responsibility to produce practitioners capable of contributing meaningfully to this critical area of public health.

Conclusion

This study conclusively demonstrates that while a high level of general awareness of Obstructive Sleep Apnea (OSA) exists among undergraduate dental students, this does not translate into a robust, clinically applicable understanding. Significant and specific knowledge gaps were identified, particularly concerning diagnostic criteria like the Apnea-Hypopnea Index and key anatomical risk factors such as retrognathia. A critical finding is the pronounced dissonance between the students' acknowledged professional responsibility to screen for OSA and their markedly low confidence in doing so, which they largely attribute to insufficient undergraduate training.

The study's primary contribution is its detailed mapping of these specific educational deficits, providing a clear evidence base for curriculum reform. The practical application of these findings is direct: dental education must evolve to bridge this competence gap. To prepare future dentists for their essential role in the interdisciplinary management of OSA, curricula must move beyond foundational awareness and integrate structured, practical training in screening protocols, craniofacial assessment, and the principles of Oral Appliance Therapy.

For future research, it is recommended to investigate the longitudinal impact of such targeted educational interventions on both knowledge retention and, ultimately, on clinical practice outcomes. Expanding this research to a multi-institutional level would provide a broader understanding of the national or global state of sleep medicine education in dentistry.

References

1. American Academy of Dental Sleep Medicine. Clinical practice guideline for the treatment of obstructive sleep apnea and snoring with oral appliance therapy: An update. *J Dent Sleep Med*, 2015;2(3):123–136.
2. American Academy of Sleep Medicine. International classification of sleep disorders. 3rd ed. Darien (IL): American Academy of Sleep Medicine, 2014.
3. Benjafield AV, Ayas NT, Eastwood PR, Heinzer R, Ip MSM, Morrell MJ, et al. Estimation of the global prevalence and burden of obstructive sleep apnoea: A literature-based analysis. *Lancet Respir Med*, 2019;7(8):687–698.

4. Barsh LI, Smith RG, Porter KM. Sleep medicine education in U.S. dental schools: A decade of progress? *J Dent Educ*,2020;84(8):895–903.
5. Carra MC, Bruni O, Huynh N. Topical review: Sleep bruxism, headaches, and sleep-disordered breathing in children. *J Orofac Pain*,2012;26(4):267–276.
6. Deane SA, Cistulli PA, Ng AT, Zeng B, Petocz P, Darendeliler MA. Comparison of mandibular advancement splint and tongue stabilizing device in obstructive sleep apnea: A randomized controlled trial. *Sleep*,2009;32(5):648–653.
7. Epstein LJ, Kristo D, Strollo PJ, Friedman N, Malhotra A, Patil SP, et al. Clinical guideline for the evaluation, management and long-term care of obstructive sleep apnea in adults. *J Clin Sleep Med*,2009;5(3):263–76.
8. Ferguson KA, Cartwright R, Rogers R, Schmidt-Nowara W. Oral appliances for snoring and obstructive sleep apnea: A review. *Sleep*,2006;29(2):244–262.
9. Gagnon Y, Mayer P. Knowledge of obstructive sleep apnea among dental patients: A Canadian perspective. *J Can Dent Assoc*,2013;79:45.
10. Giles TL, Lasserson TJ, Smith BJ, White J, Wright J, Cates CJ. Continuous positive airways pressure for obstructive sleep apnoea in adults. *Cochrane Database Syst Rev*,2006;(3):CD001106.
11. Gleeson K, Zwillich CW. Pathophysiology of obstructive sleep apnea. In: Kryger MH, Roth T, Dement WC, editors. *Principles and practice of sleep medicine*. 4th ed. Philadelphia: W.B. Saunders, 2000, 840–846.
12. Johns MW. A new method for measuring daytime sleepiness: The Epworth sleepiness scale. *Sleep*,1991;14(6):540–545.
13. Johnson LM, Strauss RA. The role of the dentist in the management of sleep apnea: A review. *J Tenn Dent Assoc*,2017;97(1):32–35.
14. Kato J, Isono S, Tanaka A, Watanabe T, Araki D, Tanzawa H, et al. Dose-dependent effects of mandibular advancement on pharyngeal mechanics and nocturnal oxygenation in patients with sleep-disordered breathing. *Chest*,2000;117(4):1065–1072.
15. Lavigne GJ, Cistulli PA, editors. *Sleep medicine for dentists: A practical overview*. Berlin: Quintessence Publishing, 2011.
16. Lee CH, Mo JH. The role of the dentist in screening for obstructive sleep apnea. *J Korean Assoc Oral Maxillofac Surg*,2019;45(6):315–319.
17. Lim J, Lasserson TJ, Fleetham J, Wright J. Oral appliances for obstructive sleep apnoea. *Cochrane Database Syst Rev*,2006;(1):CD004435.
18. Marklund M, Verbraecken J, Randerath W. Non-CPAP therapies in obstructive sleep apnoea: Mandibular advancement device therapy. *Eur Respir J*,2012;39(5):1241–7.
19. Mayer G, Fietze I. Die deutsche Gesellschaft für Schlafforschung und Schlafmedizin (DGSM) - Leitlinie "Nicht-erholsamer Schlaf/Schlafstörungen". *Somnologie*,2009;13(1):4–160.
20. Peppard PE, Young T, Barnet JH, Palta M, Hagen EW, Hla KM. Increased prevalence of sleep-disordered breathing in adults. *Am J Epidemiol*,2013;177(9):1006–1014.
21. Phillips CL, Grunstein RR. Obstructive sleep apnoea: A growing problem. *J R Soc Med*,2011;104(3):91–93.
22. Ramar K, Dort LC, Katz SG, Lettieri CJ, Harrod CG, Thomas SM, et al. Clinical practice guideline for the treatment of obstructive sleep apnea and snoring with oral appliance therapy: An update for 2015. *J Clin Sleep Med*,2015;11(7):773–827.
23. Riha RL. Diagnostic approaches to obstructive sleep apnea. *Curr Opin Pulm Med*,2010;16(6):550–556.
24. Schwartz AR, Smith PL. Obstructive sleep apnea: Pathophysiology and medical therapy. In: Smith PL, Schwartz AR, Wise RA, editors. *Sleep and respiration*. Oxford: Wiley-Blackwell, 2013, 89–103.
25. Senaratna CV, Perret JL, Lodge CJ, Lowe AJ, Campbell BE, Matheson MC, et al. Prevalence of obstructive sleep apnea in the general population: A systematic review. *Sleep Med Rev*,2017;34:70–81.
26. Singh GD, Cress SE. Biomechanical modeling of the human mandible in obstructive sleep apnea. *Int J Prosthodont*,2008;21(4):333–339.
27. Srivastava R, Jyoti B, Priyadarshi S. Knowledge, attitude, and practice among dental practitioners regarding obstructive sleep apnea. *J Family Med Prim Care*,2020;9(7):3450–3455.
28. Veasey SC, Rosen IM. Obstructive sleep apnea in adults. *N Engl J Med*,2019;380(15):1442–1449.
29. Young T, Palta M, Dempsey J, Skatrud J, Weber S, Badr S. The occurrence of sleep-disordered breathing among middle-aged adults. *N Engl J Med*,1993;328(17):1230–1235.
30. Zancanella E, Haddad FM, Oliveira LA, Nakasato A, Duarte BB, Soares CF. Obstructive sleep apnea and primary snoring: Treatment. *Braz J Otorhinolaryngol*,2018;84(1):99–105.