Incidence of Sleep Disorders Reported by Patients at UTHSC College of Dentistry: A Two-Year Follow-Up and Proposed Educational Program

Chris S. Ivanoff, DDS; Frank Pancratz, BS

Abstract: A 2011 study at one U.S. dental school found that patients were not routinely screened by dental students for obstructive sleep apnea and/or other related sleep disorders, nor were students being trained to screen. Consequently, the medical history questionnaire used in the clinic was updated to include five specific screening questions. The aim of this two-year follow-up study was to determine whether screening had improved at the school. A retrospective chart review of all patients (age 14-70+) in the third- and fourth-year dental clinics in 2012 and 2013 searched for “YES” responses to the five questions. Of 5,931 patients, 38% reported they snore or were told they snore. By age 50-59, their reports of snoring increased to 50%. About 5% reported incidents waking up choking. By age 50, between one-fifth and one-quarter indicated they woke up frequently during the night. One in six frequently felt overly tired during the daytime, often falling asleep. This problem was evenly reported by all age groups between ages 30 and 69. About half the patients reporting sleep problems also had hypertension and cardiovascular problems with an equal distribution between males and females. The results showed that updating the medical history form had dramatically improved screening for sleep-disordered breathing by these dental students. Though screening is neither a definitive diagnosis nor an attempt to distinguish among sleep disorders, the results correlate with national statistics. Screening is an important step to increase student awareness of this serious health trend as it prepares students to engage more constructively in its management and referral.

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Keywords: dental education, clinical education, clinical curriculum, clinic management, sleep disorders, sleep medicine, obstructive sleep apnea

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Obstructive sleep apnea (OSA) is increasingly becoming a reason patients seek the services of a dentist. Underdiagnosis and undermanagement of OSA can result in many adverse effects. Untreated OSA commonly elicits pathophysiologic and neurological alterations that can evolve into a constellation of maladaptive physical, psychological, family, and social consequences.1-5

According to prevalence studies, 20% of the U.S. population (50-70 million) suffer from chronic, long-term sleep disorders and intermittent sleep problems each year, and about 4% of the population or 18 million people have significant OSA problems that require treatment.6-8 Approximately one in five adults has at least mild OSA (5-15 apneic and hypopneic events per hour), and one in 15 adults has at least moderate OSA (apnea-hypopnea index, 15-30).9 Since less than two million people with OSA seek treatment per year, the remaining 16 million go untreated.10,11 In addition, 80% to 90% of patients with OSA are undiagnosed, despite having clear signs and symptoms.12 When patients are finally diagnosed with OSA, they have had obvious symptoms of the disorder for an average of seven years, during which time they report having seen a family physician about 17 times and a subspecialist about nine times.13 The most likely reason for missed diagnosis is that physicians are not screening for sleep apnea. When physicians do routinely ask their patients about OSA symptoms,11 the number of patients diagnosed and treated in their practices increases by about eightfold.14 Even when people with OSA report their symptoms to their doctors, there are only about 250 qualified treatment centers nationwide, which are therefore able to deal with a small fraction of sufferers—only 5% of those estimated to have sleep apnea.3

Studies suggest further that these patients are not being treated adequately by general dentists or
In general, predoctoral dental students are not being adequately trained to recognize and treat this problem.\textsuperscript{17,18} A 2011 study at the University of Tennessee Health Science Center (UTHSC) College of Dentistry that tracked the incidence of sleep-disordered breathing reported by patients seen in the third- and fourth-year dental clinics found that patients were not routinely being screened for sleep apnea and/or other associated sleep disorders, nor were students being trained to screen for the disorders.\textsuperscript{17} In fact, the condition of OSA and/or habitual snoring was missing on the medical questionnaire. As a result, this questionnaire was updated in 2011 to include five questions intended to screen patients for the condition. There was general agreement that omitting a sleep history was neglected diagnostic information that may prove vital to the patient’s medical and dental well-being.\textsuperscript{11,13} The aim of this study was to conduct a follow-up to determine if adding the questions improved students’ ability to screen for sleep disorders, as well as to determine what percentage if any of the patients visiting the clinics presented with symptoms and whether sleep-disordered breathing truly constitutes as serious a problem at this clinic as reported in the general population.

\section*{Methods}

The study was approved by the Institutional Review Board of the University of Tennessee Health Science Center (14-03366-XM). A blind and objective retrospective chart review by computer scan searched patient data in the electronic health record at the time of the project. The UTHSC College of Dentistry patient database was used for the study in a HIPAA-compliant manner; no identifiers were collected or retained through the data collection process.

The study was conducted by an IT administrator (FP) on existing electronic medical records collected from all patients 14 years of age and older, visiting the third- and fourth-year dental clinics during the years 2012 and 2013. The records query searched for “YES” responses to five questions on the medical history questionnaire used by third- and fourth-year dental students to screen for sleep-disordered breathing or OSA. The five questions were as follows: Do you snore or have you been told that you snore? Do you wake up choking? Do you wake frequently at night? Are you frequently overly tired during the daytime? Do you often fall asleep during the day?

All personal patient information was filtered out during the review, which strictly focused on responses to the five questions. The data were organized according to age and evaluated as percentage of the total number of charts queried. The axiUm database based on an Oracle platform served as a repository for data. It extracted and aggregated into a single data warehouse the elements needed for the study by filtering out data sets that could potentially become identifiers.

\section*{Results}

Of the 5,931 patient charts reviewed for 2012 (Table 1) and 2013 (Table 2), 38\% of the patients reported that they snore or had been told they snore (1,250/2,941, 34.1\%, year 2012; 1,004/2,990, 41.8\%, year 2013). The ratio of males to females between the ages of 14 and 49 was approximately 1:2 and was approximately equal from age 50 to 79.
Table 1. Self-reported sleep problems of patients at UTHSC dental clinic, 2012

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Note: Specific questions asked were (left to right): Do you snore or have you been told that you snore? Do you wake up choking? Do you wake frequently at night? Are you frequently overly tired during the daytime? Do you often fall asleep during the day?

Table 2. Self-reported sleep problems of patients at UTHSC dental clinic, 2013

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Note: Specific questions asked were (left to right): Do you snore or have you been told that you snore? Do you wake up choking? Do you wake frequently at night? Are you frequently overly tired during the daytime? Do you often fall asleep during the day?
Reports of snoring came from about a third of all patients between ages 20 and 49; by age 50-59, that level increased to as many as half. About 5% of the patients (4.7%) collectively reported incidents in which they woke up choking (149, year 2012; 94, year 2013). One-fifth of the patients (17.6%) (625, year 2012; 420, year 2013) and as many as a quarter of the patients by age 50 indicated that they woke up frequently during the night. Less than 16% of the patients (15.7%) (486, year 2012; 446, year 2013) reported frequently feeling overly tired during daytime hours, during which time half (8.76%) said they often fell asleep (254, year 2012; 266, year 2013). The problem seemed evenly reported by all age groups between 30 and 69 years. About half of the patients reporting sleep problems also had hypertension or cardiovascular problems with an equal distribution between males and females for 2012 (Figure 1) and 2013 (Figure 2).

Figure 1. Percentage of clinic patients with sleep problems reporting hypertension (HBP) or cardiovascular problems (CVD), 2012

Figure 2. Percentage of clinic patients with sleep problems reporting hypertension (HBP) or cardiovascular problems (CVD), 2013
Discussion

When we compared the results of this study with those from two years earlier, it was clear the addition of the five questions on the medical history form had dramatically improved screening for sleep disorders by these students. Prior to the introduction of the five questions in 2010, the entire dental school clinic’s database for sleep apnea and snoring indicated only 92 patients out of 5,247 who said they snored, while no patients at all were identified as potentially having sleep problems. In contrast, after students began screening for snoring, the number of self-reported snorers increased to 2,254 patients (38%; total n=5,931) in 2013; 1,292 patients (21.8%; total n=5,937) indicated waking up frequently at night; and 932 (15.9%; total n=5,869) reported being frequently tired during daytime.

Though screening is neither a definitive diagnosis nor an attempt to distinguish among various sleep disorders, the results of our study correlate with national statistics. Previous studies have reported that 2-4% of the adult working-age population has OSA with moderate sleepiness and an apnea-hypopnea index of greater than five events per hour. Men are at least twice as likely to have the problem, with a prevalence of 24% in men and 9% in women. Our review of our school’s clinical data found that at least one in five patients reported waking up frequently during the night, with about 5% indicating they woke up choking. Previous studies have found that overweight middle-aged males are particularly susceptible, and when those characteristics are combined with habitual and intermittent snoring, the prevalence is as high as 34%. In our study, 38% of the patients reported that they snore or have been told that they snore. Although twice as many patients who reported snoring were male, the review could not track data related to obesity as that information is not currently on the medical charts.

In their study, Silverberg and Iaina found that about half of the patients who had essential hypertension had obstructive sleep apnea and that about half of those who had OSA had essential hypertension. A growing body of evidence suggests that OSA is a major contributing factor in the development of essential hypertension. This association was also found in our study: 40-67% of the patients between the ages of 50 and 70+ with sleep problems also had hypertension, while 12-27% suffered from other cardiovascular conditions.

Though updating the medical questionnaire was an important step to increase our students’ consciousness about this serious health problem, it still leaves unanswered how to prepare students to play a more constructive role in its management. Improving students’ ability to screen by no means makes them competent to diagnose or manage OSA. The barriers to dentists’ treating or managing OSA include defining an appropriate role for the dentist in diagnosis and management, as well as misconceptions about OSA appliances. Although OSA appliances can be very effective in managing the condition, clinicians may prescribe them incorrectly without a proper diagnosis. Failure to obtain a definitive diagnosis from a sleep study, which currently means acquiring a prescription from a medical specialist, may result in inadequate management and side effects. Poor prescribing practices include inadequate follow-up and appliance adjustment and failure to anticipate and treat potential side effects. Among other reasons for poor practices are outdated attitudes, a lack of knowledge about polysomnography, and concerns about follow-up. Insufficient training in OSA patient management is compounded by clinicians’ fear of litigation and poor cross-disciplinary communication with sleep medicine specialists. Dentists and dental educators have expressed the need for more effective ways to teach dental sleep medicine and engage dentists in the fabrication of oral appliances.

As potential providers of sleep apnea appliances, both dental students and practitioners have a responsibility for safe and efficient OSA management. Although most dental schools do not provide adequate education on this subject, a recent study by Simmons and Pullinger found that increased curriculum hours were being devoted to sleep medicine in dental school, although competencies have still not been defined. While 25% of the schools in their study spent no time on sleep medicine at all, the average time devoted to the subject for the schools with a predoctoral sleep medicine curriculum was 3.92 hours, and it was 2.96 hours across all 49 responding schools. Given the magnitude of sleep problems, three to four curriculum hours is still insufficient for students to achieve competence in screening for sleep-related breathing disorders or adequate foundation for future involvement in treatment.
Preparing Students to Manage Sleep Disorders

As previous studies have pointed out, there is not yet a systematic way to improve clinician practices and/or patient outcomes in dental sleep medicine. For this reason, a colleague and I have proposed a comprehensive educational program to educate students about dental sleep medicine management more effectively than episodic teaching when OSA problems are identified. This program is based on the premise that if sleep medicine education in dental school cultivates good clinical reasoning, better appliance-prescribing behavior, and improved management skills, it may help students to make optimal clinical decisions when managing OSA or referring their patients to specialists.

Our current predoctoral curriculum includes a four-hour course in dental sleep medicine. Under the current clinical screening paradigm, after students identify patients potentially suffering from sleep-related breathing disorders, they refer those patients to the head of the TMD and Sleep Dentistry Program for more advanced assessment and referral to a sleep clinic if necessary. Our proposed dental sleep medicine educational program is designed to provide advanced knowledge and skills beyond those developed in this four-hour course. Among the topics we propose is polysomnography, which is essential for proper diagnosis and treatment of OSA as well as the bridge language for effective communication with sleep medicine specialists after referral.

The program’s four-tier scaffold would combine traditional and problem-based learning (PBL) to improve students’ diagnostic and assessment skills to optimize decision making for OSA patients. Tier 1 provides underpinning knowledge of OSA mechanisms with traditional and contextualized instruction by integrating clinical correlations and studying worked cases that stimulate clinical thinking. Tier 2 develops critical decision making skills through self-directed learning and actively solving problem-based cases. Tier 3 exposes students to management approaches taken by allied health fields and cultivates interdisciplinary communication skills. Tier 4 provides a knowledge and experience synthesis by rotating students through community sleep clinics. The combined teaching approach aims to increase critical thinking and problem-solving skills to assist graduates to better manage OSA patients throughout their careers and, ultimately, increase student competence in dental sleep medicine.

By providing basic knowledge and skills during the early science courses and TMD/SDB course (Phase I), students are enabled by traditional didactics (six hours) to screen for OSA more effectively when taking patients’ medical history. Lessons include basic concepts, terminology, pathophysiology of sleep medicine as it relates to dentistry, and supplementing diagnostic screening with the Epworth questionnaire. The Epworth Sleepiness Scale (ESS) measures daytime sleepiness with a short questionnaire that is helpful in diagnosing sleep disorders and more advanced screening. The questionnaire asks patients to rate their probability of falling asleep on a scale of increasing probability from 0 to 3 for eight situations in which people engage during their daily lives, though not necessarily every day. The eight scores are added to obtain a single number. A score in the 0-9 range is considered to be normal, while the 10-24 range indicates expert medical advice should be sought. Scores of 11-15 indicate the possibility of mild to moderate sleep apnea, and 16 and above indicate the possibility of severe sleep apnea or narcolepsy. Certain questions have been shown to be better predictors of specific sleep disorders, although tests (polysomnography) are required to provide an accurate diagnosis.

Phase II would prepare dental students to respond more effectively after OSA patients have been screened. The goal is to prepare students with better multidisciplinary communication skills to effectively conduct a professional consultation with medical reviewers and polysomnograph technicians for referral. The addition of a three-hour shadowing rotation in a sleep clinic, a three-hour lab exercise in which pairs of students take protrusive records and fabricate a sleep appliance on each other, and a three-hour PBL session led by a multidisciplinary group to review sample cases or summary reports by a medical reviewer would reinforce all the principles learned in the TMD/sleep medicine course. Phase III would then aim to engage students after referral by shadowing accredited faculty members in the Craniofacial Pain/Sleep-Disordered Breathing Clinic, adding depth to students’ understanding of the clinical features and diagnosis of OSA and current dental and medical therapies.

The goal of this educational program is to enable students to screen for OSA better and participate as functional members of a multidisciplinary team.
that can jointly diagnose and treatment plan OSA patients with sleep medicine specialists. The model integrates both worked and unsolved PBL case scenarios and includes multidisciplinary participation to increase critical thinking and problem-solving skills. With small-group discussions led by instructors in each of the relevant basic science courses, the students first study worked cases that correlate information to clinical scenarios. This includes the neurological and pharmacological basis of sleep and modulation, how obstructive breathing systems are developed, discussions about ethical standards in OSA management, and current clinical research that provides basic knowledge about experimental methodology and contemporary evidence-based OSA management strategies. A PBL sleep medicine workshop would then be offered during summer orientation before students enter the clinic in the third year (Phase II). This PBL experience would be student-centered learning in which small groups of students are guided by facilitators to resolve problems in OSA management that form the basis for organized focus and stimulus for learning. (See sample cases in Table 3.)

The problems require the integration of knowledge about polysomnography and diagnostic tools, including the Epworth questionnaire. Case scenarios would guide students to understand the differences among sleep studies, CPAP therapies, and OAs, as well as how and when they are used. The emphasis is on effective screening and diagnosis. Since the real-world referral process for complex cases often requires multidisciplinary treatment efforts, teaching dental students to interact with other health professionals adds further value to the students’ learning experience. Therefore, three dental students would be paired with three medical students to expose them to the management approaches taken in other health fields. A knowledge and experience synthesis during the second semester of the senior year (Phase III) would then engage the students in community sleep centers as part of a three-hour clinical rotation and transition from cases to actual experience.

During clinical encounters with OSA patients, the students could use assessment tools to supplement Epworth scoring for accurate and comprehensive assessment of OSA management. Since patients are credible judges of their sleep experience, patient self-reports would serve as the basis for planned intervention by assessing sleep-related interference with activity. On a sleep rating scale from 0 (no problem sleeping) to 10 (no sleep at all), ratings of 4 to 7 are

Table 3. Sample cases in the proposed educational program
Case 1: Example of Summary Report

| Mr. X, age 45, 5’9” tall, 275 lbs., presents to the sleep lab to rule out OSA. He complains of some snoring and daytime sleepiness. His score on the Epworth sleepiness scale is elevated at 15 (out of possible 24 points), affirming excessive daytime sleepiness (normal is <10/24). |

This single-night diagnostic sleep study shows evidence of OSA. For the full night, his apnea-hypopnea index (AHI) was elevated at 18.1 events/hr. (normal <5 events/hr; this is moderate OSA). While sleeping supine, his AHI was twice that: 37.1 events/hr. He also had some oxygen desaturation; for 11% of sleep time, his SaO2 was between 80% and 90%.

Results of this study indicate Mr. X would benefit from CPAP. To this end, a sleep medicine specialist might recommend a CPAP titration study.

Case 2: Summary Report from a Split Night Study

| Mr. Z, age 42, 6’ tall, 325 lbs., came to Sleep Lab to diagnose or rule out OSA. This polysomnogram consisted of overnight recording of left and right EOG, submental EMG, left and right anterior EMG, central and occipital EEG, EKG, airflow measurement, respiratory effort, and pulse oximetry. The test was done without supplemental oxygen. His latency to sleep onset was slightly prolonged at 28.5 minutes. Sleep efficiency was normal at 89.3% (413.5 minutes sleep time out of 463 minutes in bed). |

During the first 71 minutes of sleep, Mr. X manifested 83 obstructive apneas, 3 central apneas, 1 mixed apnea, and 28 hypopneas, for an elevated apnea-hypopnea index (AHI) of 97 events/hr (severe OSA). His lowest SaO2 during the pre-CPAP period was 72%. CPAP was then applied at 5 cm H2O and sequentially titrated to a final pressure of 17 cm H2O. At this pressure, his AHI was 4 events/hr and the low SaO2 had increased to 89%. This final titration level occurred while he was in REM sleep. Mask used was a Respiration Classic nasal (medium-size).

This split night study shows severe OSA in the pre-CPAP period, with definite improvement on high levels of CPAP. At 17 cm H2O, his AHI was normal at 4 events/hr and low SaO2 was 89%. Based on this split night study, a medical sleep specialist might recommend that he start on nasal CPAP 17 cm H2O along with heated humidity.
regarded as interfering with comfort and daily function, and ratings of 8 or higher adversely affecting quality of life. In theory, report cards developed for pain management could easily be adapted to further measure overall performance in OSA management by using indicators to compare the desired target set by clinicians to actual findings reported by the patients. The tool would help students to quickly identify where goals are not being met and allow planning for immediate course correction, closer monitoring, and earlier intervention. The tool could also improve the students’ assessment skills.

When encountering complaints of insomnia in dental practice, early intervention is important, and dental education must bridge the gap in students’ understanding to ensure a basic level of care. Integrating biomedical science and clinical teaching with contextualized learning presents opportunities for deeper levels of learning. Teaching the diagnosis and management of OSA alongside the underpinning oral physiology may help students understand the topic better than teaching them sleep medicine as a separate topic. By giving students information that is both clinically useful and relevant, the knowledge they acquired early in their studies is then further amplified with useful PBL correlations.

Since OSA appliance therapy alone is not always appropriate management and can even be hazardous to patients, management requires a multidisciplinary approach with a strong focus on psychological factors. Teaching behavioral sciences, including interpersonal and communication skills, is therefore integrated with the teaching of diagnostic methods to improve referral and prescribing behavior, patient safety, and control of OSA. If adopted, the curriculum is sure to raise questions, including the specific components of the curriculum that are most useful for improved practice and whether improved practice patterns actually translate into better patient outcomes.

Conclusion

This study reflects a commitment to transform present standards of comprehensive dental care and address OSA as a serious contemporary dental health issue in dental education. The commitment begins by aggressively screening patients for OSA in predoctoral clinics, updating medical histories to include OSA, and exposing students to earlier training that is compulsory. This is only the beginning of expanding the abilities of our students regarding sleep medicine. Without diminishing the importance of proper diagnosis and treatment skills based on sound and thorough training, the changes to the curriculum, the medical history form, and the expansion of our clinical services are all designed to work within the framework of guidelines pertinent to the treatment of OSA. Not only will these changes give our students the opportunity to become engaged in the treatment of OSA; they will do so in a manner that does not violate the standard levels of care.

REFERENCES