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## THESIS APPROVAL PAGE FOR MASTER OF SCIENCE IN ORAL BIOLOGY

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**An assessment of Army dentists' knowledge and opinions of obstructive sleep  
apnea**

A manuscript

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## Abstract

**Objective:** To establish and compare Army dentists' with and without dental sleep medicine training and their current knowledge, comfort, and opinions towards screening, referring, and role in the OSA management.

**Methods:** A knowledge and opinion-based survey about OSA was emailed to 984 Army dentists.

**Results:** 223 dentists responded, including all experience levels and nine dental specialties. Nearly 25% of responders reported <5 hours of sleep medicine training. Untrained dentists were less knowledgeable, less likely to screen patients for OSA, and were more likely to report being uncomfortable screening or referring to a physician for evaluation of suspected OSA. All groups agreed dentists play a role in OSA management and increased sleep medicine training would benefit their practice.

**Conclusion:** Our results indicate sleep medicine training would increase Army dentists' knowledge and comfort in screening, referring, and managing OSA. Through these measures, access to care, readiness, and deployability of Soldiers would improve.

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## **Background**

The American Academy of Sleep Medicine (AASM) defines obstructive sleep apnea (OSA) as “a sleep-related breathing disorder that involves a decrease or complete halt in airflow despite an ongoing effort to breathe.”<sup>1</sup> Partial reductions (hypopneas) and complete halts (apneas) in breathing usually last between 10-30 seconds and cause a desaturation in blood oxygen levels.<sup>1</sup> This abrupt decrease in oxygen causes the brain to respond by arousing the person from sleep to reestablish normal breathing. These hypopneas and apneas are combined and averaged per an hour to determine a patient’s *apnea-hypopnea index* (AHI). This measurement determines severity of OSA as mild (AHI 5-15), moderate (AHI 15-30), and severe (AHI>30).

Obstructive sleep apnea is diagnosed by a physician after an interpretation of a positive polysomnography, or sleep study.<sup>2</sup> The preferred management of OSA is keeping the airway open via a continuous positive airway pressure (CPAP) device. The AASM also endorses oral appliance therapy for patients with mild-moderate OSA, primary snoring (without apnea), and any severity level OSA patients who cannot tolerate CPAP therapy.<sup>3</sup> Oral appliances also offer an acceptable interim therapy when CPAPs are not practical or possible, such as for people who travel frequently, or service members training or deployed to austere environments. Other less common treatment options include a BiPAP (bi-level positive airway pressure) machine, adaptive servo-ventilation machine (ASV), or surgery.<sup>2</sup> Recommended behavior modifications for the management of OSA include weight loss, reduced alcohol consumption, exercise, and changing sleep positions.

Obstructive sleep apnea diagnoses continue to rise in the United States, but current data suggests it is still highly underdiagnosed. The prevalence of OSA in the

U.S. is estimated between 22-28 million adults, of which only about 6 million are diagnosed.<sup>1</sup> Therefore, roughly 80-90% of OSA cases are undiagnosed.<sup>4</sup> Symptoms of OSA include daytime sleepiness, fatigue, and snoring which can lead to depression, anxiety, obesity, bed partner sleep disturbance, impaired concentration and reflexes, and an overall decrease in quality of life.<sup>4-7</sup> Untreated OSA can lead to cardiovascular issues (such as stroke and hypertension), type 2 diabetes, increased mortality, and increased fatigue accidents.<sup>4-6</sup> Despite these serious sequelae, studies indicate effective screening and identification remains low. This may be particularly true in military populations where studies have shown a higher incidence of OSA among service members compared to the civilian population, estimating a thirty-fold increase in OSA diagnoses among military service members since 2005.<sup>8,9</sup>

Military service members are often expected to remain attentive in hazardous environments and situations. Concentration is required during training and combat operations as service members are often operating heavy machinery, vehicles, and weapons that can impact the safety of many people. Therefore, the Army has long recognized the importance of quality, timely sleep and promotes optimizing health with a performance triad that includes sleep. OSA, however, negatively affects both the subject as well as those around him or her. Countless studies have demonstrated the deleterious effects of OSA patient snoring on the sleep quality of bed partners.<sup>7</sup> The applicability of this concept is particularly true for service members as during training and deployment they are often in very close sleeping quarters with one another. If service members are struggling with undiagnosed or untreated OSA, the sleep quality and potential side-effects thereof could disrupt entire units of Soldiers. The compounding consequence of OSA could potentially decrease unit morale, cohesion, and effectiveness.

OSA exhibits many intraoral signs and symptoms which can be noticed during routine dental appointments. These signs may include: large, scalloped tongue; anterior attrition; narrow, high arched palate; retrusive or class II jaw relationship; periodontal bones loss; redness of palate; elongated or enlarged uvula; and mandibular exostosis.<sup>10</sup> Additionally, patients may report symptoms such as dry mouth, bruxism, TMJ pain, morning headaches, or even classic symptoms such as daytime sleepiness, fatigue, or snoring during a routine medical history. While these signs and symptoms are not exclusive to OSA, the presentation of them should alert the dental professional to investigate more. There are several easy screening tools for OSA which could be completed during a medical history at a yearly dental exam, including the STOP-Bang (snoring, tiredness, observed apnea, hypertension, BMI, Age, Neck Circumference, and Gender) questionnaire, Epworth Sleepiness Scale, and Berlin questionnaire.

Previous studies have sought to establish how dentists fit into the OSA conundrum. The first published article regarding dentists' knowledge and perceptions of OSA was in 2004 by Bian.<sup>11</sup> He showed 58% of surveyed dentists could not identify common intraoral and reported signs of symptoms of OSA. He reported a general lack of knowledge and education of OSA and oral appliance therapy (OAT) and limited communication between dentists and physicians.<sup>11</sup> Approximately fifteen years later, a questionnaire-based study out of Riyadh once again demonstrated a significant lack of OSA knowledge among graduating dental students.<sup>12</sup> However, Kale et al. (2020) in a study out of India assessed the knowledge and attitude of dentists in various areas of OSA. They found that while dentists had a good general knowledge (definitions, risks, findings, etc.) of OSA, they had poor familiarity with screening, diagnosis, referring, and treatment of OSA.<sup>13</sup> In yet another study, a group from Helsinki (Vuorjoki-Ranta et. al.) compared general dentists and specialists and their knowledge and attitudes of OSA.

They found specialists had more knowledge of OSA and recommended increased OSA education in dental school and “better cooperation among medical professionals and development of adherent treatment chains.”<sup>14</sup> Finally, a survey was sent to a limited group of Army dentists at Fort Bragg in 2019 by Balkom.<sup>15</sup> His study concluded AOC, gender, and history of OSA training did not have significant effect on OSA knowledge, but nearly 50% of Army dentists did not feel confident in their OSA training.<sup>15</sup>

The variety of locations and groups around the world studying this topic speak to the breadth of obstructive sleep apnea’s ramifications worldwide. Approximations range as high as almost 1 billion people around the world have OSA.<sup>16</sup> In the United States a report from Frost & Sullivan (as commissioned by the AASM) estimated that “undiagnosed OSA cost the United States approximately \$149.6 billion in 2015.”<sup>1</sup> A study published by the U.S. Navy conveyed that the 1 in 20 service members with sleep-disordered breathing cost taxpayers nearly \$100 million in FY 2012 to FY 2013 and would continue to rise.<sup>7</sup> Health-care systems will be overrun as medical costs continue to climb from the many adverse health consequences of untreated OSA. Medical organizations globally will need to consider innovative, cost-effective, and practical approaches to regulating OSA.

As OSA continues to burden the medical system, dentists have the potential to play an important role in solving the screening, referral, and treatment of OSA. Several position papers have been published highlighting the need for a multi-disciplinary approach to OSA management and dentists’ role on that team.<sup>17-20</sup> In 2017 the American Dental Association policy “The Role of Dentistry in the Treatment of Sleep Related Breathing Disorders” emphasized dentists should be screening patients for SRBD as part of their comprehensive exams and if a risk of SRBD is suspected, patients should

be referred for evaluation and diagnosis by a physician.<sup>17</sup> As previously mentioned, oral appliances are a viable therapy option for mild-moderate OSA, primary snoring (without apnea), and CPAP-intolerant patients.<sup>3,17-20</sup> Qualified dentists with appropriate training and certification should be providing OAT [as prescribed by a physician] to include appliance delivery, adjustment, monitoring, and referral for a sleep-study follow-ups.<sup>17,18</sup>

Despite published ADA guidelines regarding dentists and SRBD, it appears many private practice and military dentists are not conducting routine OSA screenings at yearly dental exams.<sup>4,15</sup> It is unclear, though, whether this is because dentists are not adequately educated and trained in sleep medicine, or if they do not believe it is within their scope of practice to screen, refer, and manage for OSA. Still, there are limited studies offering comprehensive analysis of dentists' management of OSA and, to our knowledge, there is no study comparing the effect of sleep medicine training on their knowledge and opinions regarding screening, referral, and OSA therapy.

The United States Army Dental Corps offers an excellent opportunity to study this topic because it includes a cohort of dentists trained from dental schools across the United States, a variety of experience levels and specialists, and provides the opportunity of a sleep medicine course to some Army dentists. Additionally, Army dentists are treating an at-risk population who are required to receive an annual dental exam and have access to free medical and dental care.

### Objective

It is our goal to establish Army dentists' current knowledge regarding signs and symptoms, screening methods, and OSA therapy. Additionally, this study sought to determine Army dentists' comfort level screening and referring OSA as well as their opinions of dentists' role in OSA management. Finally, we wanted to compare the effect

of sleep medicine training on Army dentists' knowledge and opinions of OSA. It is hypothesized that Army dentists without dental sleep medicine training have limited knowledge of OSA and are less confident in screening methods and referring possible OSA patients.

### Methods

A survey was developed for this research project and a link to a web-based survey was emailed through Outlook to a distribution list containing all Active-Duty Army Dentists. The email was sent via the Office of the Chief for the U.S. Army Dental Corps and contained 984 recipients. The email requested their voluntary participation in a survey for a postgraduate AEGD resident research project. The email also explained the purpose of the survey, how long it would take to complete, that no PII would be collected, and that by clicking the link they consented to participate in the survey but could withdraw consent at any point by exiting the browser.

Initial questions were about demographics and training. Then questions transitioned into knowledge-based questions regarding definitions, signs, symptoms, and screening for OSA. Finally, the survey concluded with Likert scale questions concerning comfort for screening, referring, and dentists' role in OSA identification and treatment. A final option to leave any additional comments or opinions about the survey or dental sleep medicine was afforded to survey participants. An example of the survey can be found in Appendix 1. The survey remained opened for two months before it was closed, and a statistical analysis was performed.

### Statistical Analysis:

Kruskal-Wallis tests were run to assess group differences with respect to training and beliefs regarding OSA. Pearson's chi-squared tests were used to assess pairwise

differences where appropriate. An analysis of variance (ANOVA) was performed to examine the potential relationship between time to complete the survey and respondent characteristics. Pooling of respondent data was conducted to facilitate group comparisons. Consequently, individuals identifying as a pediatric dentist (n = 5), orthodontist (n = 12), oral pathologist (n = 5), prosthodontist (n = 13), or failing to disclose their dental specialty (n = 1) were categorized as “Other” for some data. Additionally, those responding ‘Yes’ and reporting more than 5 hours of OSA and/or dental sleep medicine training were grouped together as *Trained* (n= 165) and those responding ‘No’ or less than 5 hours of training were grouped together as *Untrained* (n= 68). Data were analyzed using Statistical Package for the Social Sciences version 25 (IBM, Armonk, NY, USA). Statistical significance for all statistical tests was declared at  $P < 0.05$ .

## Results

Among the 984 dental providers contacted regarding the survey, 22.6% (n = 223) completed the survey. The majority of respondents identified as either a general dentist (n = 68; 30.5%) or a comprehensive dentist (n = 68; 30.5%). Oral and maxillofacial surgeons were the next most common respondent at 8.1% (n = 18). Periodontists comprised 7.2% (n = 16) of respondents and endodontists another 7.6% (n = 17). Other dental specialties constituted the remaining 16.1% (n = 36) and included: prosthodontists at 5.4% (n =13), orthodontists at 5.4% (n = 12), oral pathologists at 2.2% (n = 5), and pediatric dentists at 2.2% (n = 5). One respondent did not answer. The median time to complete the survey was 3.85 min (IQR 2.65 - 6.88). No difference in completion time was found between the dental specialties,  $P > 0.05$ . Dental experience by specialty is shown in Table 1. General dentists reported less experience overall compared to the other dental specialties,  $P < 0.001$ .

**Table 1. Demographics: Experience by Dental Specialty, n (%)**

Specialty	0 to <5 years	5 to <10 years	10-15 years	>15 years
General Dentist	52 (76.5)	12 (17.6)	1 (1.5)	3 (4.4)
Comprehensive Dentist	3 (4.4)	28 (41.2)	21 (30.9)	16 (23.5)
Periodontist	2 (12.5)	5 (31.3)	2 (12.5)	7 (43.8)
Endodontist	4 (23.5)	4 (23.5)	4 (23.5)	5 (29.4)
Oral & Maxillofacial Surgeon	1 (5.6)	8 (44.4)	4 (22.2)	5 (27.8)
Other	1 (2.8)	11 (30.6)	9 (25.0)	15 (41.7)

When asked about OSA training, 12.6% (n = 28) of respondents indicated they had received no training. About 26% (n = 58) of participants reported 0 to less than 5 hours of sleep medicine or OSA training. General dentists with no residency training were the most likely to report less than 5 hours of dental sleep medicine training. The amount of training received is reported in Table 2. Most [trained] respondents (63.7%, n = 142) reported having OSA training during a residency program. The next most common sources of OSA training were through an Army dental sleep medicine course (n = 93, 41.7%) or in dental school (n = 56, 25.1%). Twenty-three (10.3%) respondents indicated they had received training through continuing education courses. Only 9.9% (n = 22) reported training through the American Academy of Dental Sleep Medicine.

**Table 2. Reported Training Volume**

Training Hours	n	Percent
0 to <5	58	26
5 to <15	37	16.6
15 to <25	30	13.5
25 to 50	56	25.1
More than 50	42	18.8

Then respondents were asked questions to test their knowledge of OSA. Interestingly, 4.4% (n = 10) of respondents were unable to identify the correct definition. No association was found between correctly defining OSA and either dental specialty,

experience, or training ( $P>0.05$ ). While most respondents ( $n=214$ ; 96.0%) did identify polysomnography as the gold standard to diagnose OSA, trained dentists were more likely to respond correctly,  $P<.05$ . Trained dentists were also more likely to properly answer who could diagnose OSA and prescribe a sleep appliance ( $P<.001$ ) and that sleep appliances may be used to help manage more than just mild OSA cases ( $P<.001$ ). Two participants did not respond to these questions.

Questions continued by asking participants to select screening tools for OSA. Although the majority of dentists correctly selected the Epworth Sleepiness scale ( $n = 190$ ; 85.2%) and the STOP-Bang questionnaire ( $n = 171$ ; 76.7%), there was a significant difference ( $P<.001$ ) between trained and untrained dentists to correctly select those options. Only 14.8% ( $n = 33$ ) of surveyees correctly selected the Berlin questionnaire as a possible option. Moreover, 72.6% ( $n = 162$ ) and 50.6% ( $n = 113$ ) incorrectly chose the OSA screening survey and PSM (respectively) as screening tools.

When asked to identify possible symptoms of OSA, nearly all respondents selected daytime sleepiness ( $n = 221$ ; 99.1%), snoring ( $n = 216$ ; 96.9%), and daytime fatigue ( $n = 217$ ; 97.3%) and 82.1% ( $n = 183$ ) selected an inability to sleep on one's back. There was no difference between groups to identify these symptoms. However, more subtle symptoms including nocturnal bruxism ( $n = 171$ ; 76.7%) and depression ( $n = 172$ ; 77.1%), were more likely to be selected by trained dentists,  $P<0.001$  and  $P<0.05$ .

Intraoral signs of OSA correctly selected by respondents included a scalloped tongue ( $n = 200$ ; 89.7%), TMJ pain ( $n=141$ ; 63.2%), mandibular tori ( $n = 106$ ; 47.5%), periodontal bone loss ( $n = 49$ ; 22.0%), and anterior attrition ( $n = 140$ ; 62.8%). Nearly 40% incorrectly chose increased caries. Trained dentists were significantly more likely to select scalloped tongue, mandibular tori, and anterior attrition ( $P<.05$ ) than their untrained counterparts. Four participants skipped this question.

**Table 3. Responses to Knowledge Questions (Trained versus Untrained)**

Questions and Answers Choices	Trained (n=165)	Untrained (n=58)	Total (n=223)
OSA is defined as: A. Loud snoring and restless sleep B. A sleep-related breathing disorder that involves a decreased or complete halt in airflow despite an ongoing effort to breathe. C. A sleep-related disorder in which the effort to breathe is diminished or absent. D. A sleep-related disorder that involves decreased airflow due to obesity and/or age.	0 157 8 0	0 56 1 1	0 213 (95.5%) 9 1
Which of the following are possible symptoms of OSA? Select all that apply. ○ Patient reported bruxism** ○ Daytime sleepiness ○ Daytime fatigue ○ Patient reported snoring ○ Depression* ○ Patient reports an inability to sleep on their back	<b>138 (83.6%)</b> 164 (99.4%) 162 (98.2%) 161 (97.6%) <b>134 (81.2%)</b> 137 (83%)	<b>33 (56.9%)</b> 57 (98.3%) 55 (94.8%) 55 (94.8%) <b>38 (65.5%)</b> 47 (81%)	<b>171 (76.7%)</b> 221 (99%) 217 (97.3) 216 (97%) <b>172 (77%)</b> 184 (82.5%)
Which of the following are possible intraoral signs of OSA? Select all that apply. ○ Scalloped tongue* ○ TMJ Pain ○ Mandibular Tori* ○ Periodontal bone loss ○ Anterior attrition* ○ Increased caries	<b>153 (9.7%)</b> 108 (65.5%) <b>86 (52.1%)</b> 38 (23%) <b>110 (66.7%)</b> 68 (41.2%)	<b>47 (81%)</b> 33 (56.9%) <b>20 (34.5%)</b> 11 (19%) <b>30 (51.7%)</b> 20 (34.5%)	<b>200 (89.7%)</b> 141 (63.2%) <b>106 (47.5%)</b> 49 (22%) <b>140 (62.8%)</b> 88 (39.5%)
Which of the following could be used as screening tools if you suspect a patient has OSA? Select all that apply. ○ Epworth Sleepiness Scale** ○ Polysomnography ○ STOP-Bang Questionnaire** ○ OSA Screening Survey ○ Berlin Questionnaire	<b>155 (93.9%)</b> 86 (52.1%) <b>141 (85.5%)</b> 120 (72.7%) 45 (27.3%)	<b>35 (60%)</b> 28 (48.3%) <b>30 (51.7%)</b> 42 (72.4%) 6 (10.3%)	<b>190 (85.2%)</b> 114 (51%) <b>171 (76.7%)</b> 162 (72.6%) 51 (14.8%)
What is the gold standard to diagnose obstructive sleep apnea? A. Sleep partner B. Sleep application on phone C. Polysomnography* D. Electromyography E. STOP-Bang Questionnaire	1 0 <b>162 (98.2%)</b> 1 1	1 0 <b>52 (89.7%)</b> 4 1	2 0 <b>214 (96%)</b> 5 2
Who can diagnose OSA and prescribe an oral sleep appliance? A. Dentist B. Sleep physician** C. Both A and B	2 <b>148 (89.7%)</b> 14	0 <b>34 (58.6%)</b> 23	2 <b>182 (81.6%)</b> 37 (16.6%)
Only mild sleep apnea can be treated with an oral sleep appliance? A. True B. False**	23 <b>141 (85.4%)</b>	21 <b>36 (62%)</b>	44 (19.7%) <b>177 (79.4%)</b>

\*Indicates statistical significance, p < 0.05

\*\*Indicates statistical significance, p < 0.001

Next, questions transitioned into Likert scale opinion-based questions regarding comfort and different aspects of OSA management. Roughly a 1/3 of Army dentists reported not being comfortable or only slightly comfortable (32.3%, n = 72) screening for OSA and the remaining 67.7% (n = 151) of respondents reported being moderately or very comfortable screening patients for OSA. When asked if they regularly screen patients for OSA, the majority (n = 157; 70.4%) reported screening some (n = 117; 52.5) or all (n = 40; 17.9) of their patients for OSA. However, 29.6% (n=66) of Army dentists indicated they did not screen any of their patients. Similarly, 28.7% (n=64) were not comfortably or only slightly comfortable referring patients for evaluation of suspected OSA whilst 70.1% (n=158) were moderately or very comfortable referring. One participant did not answer. There was a significant correlation ( $r = .62$ ,  $P < 0.001$ ) between those who reported screening for OSA and those who reported being comfortable screening for it. Additionally, individuals with OSA training were significantly more comfortable overall screening and referring for suspected OSA,  $P < .001$ .

Finally, when asked if dentists play a role in diagnosing and providing treatment for OSA, the majority of respondents (n = 217; 97.3%) indicated they do. Despite this, when asked if OSA and sleep medicine training would benefit their practice, 6.3% (n = 14) responded that it was not within the scope of practice. Another 16.6% (n = 37) stated that additional training was unnecessary as they were already well-trained to manage OSA patients. 159 (71.3%) respondents indicated they would benefit from additional training and 13 (5.8%) were unsure or skipped the question). There was no difference in the rate of response to this question with respect to a respondent's dental specialty ( $p = 0.21$ ), nor years of experience ( $p = 0.23$ ), or hours of sleep medicine training ( $p = .13$ ).

**Table 4. Responses to Opinion Questions (Trained versus Untrained)**

Questions and Answers Choices	Trained (n=165)	Untrained (n=58)	Total (n=223)
Do you regularly screen your patients for OSA? a. No b. Yes, some of them* c. Yes, all of them*	28 (17%) <b>101 (60.6%)</b> <b>36 (21.8%)</b>	38 (65.5%) <b>16 (27.6%)</b> <b>4 (6.9%)</b>	66 (29.6%) <b>117 (52.5%)</b> <b>40 (17.9%)</b>
How comfortable are you screening for OSA? a. Very comfortable** b. Moderately comfortable** c. Slightly comfortable** d. Not comfortable at all**	77 (46.1%) 56 (33.9%) 29 (17.6%) 3 (1.8%)	5 (8.6%) 13 (22.4%) 16 (27.6%) 24(41.4%)	82 (36.8%) 69 (30.9%) 45 (20.2%) 27 (12.1%)
How comfortable are you referring patients for evaluation of suspected OSA? a. Very comfortable** b. Moderately comfortable** c. Slightly comfortable** d. Not comfortable at all**	81 (48.5%) 52 (31.5%) 26 (15.8%) 5 (3%)	13 (22.4%) 12 (20.7%) 23 (39.7%) 10 (17.2%)	94 (42.2%) 64 (28.7%) 49 (22%) 15 (6.7%)
Dentists play a role in screening and providing treatment for OSA. a. Strongly agree b. Agree c. Neither agree or disagree d. Disagree e. Strongly disagree	112 49 1 0 3	27 29 2 0 0	139 (62.3%) 78 (35%) 3 0 3
Do you think more access to OSA and sleep medicine training would benefit your practice. a. Yes b. No, I don't think its within my scope of practice c. No, I am already well-trained to manage OSA patients d. Unsure	115 (69.7%) 5 (3%) 36 (21.8%) 8 (4.8%)	44 (75.9%) 9 (15.5%) 1 3	159 (71.3%) 14 (6.3%) 37 (16.6%) 11 (4.9%)

\*Indicates statistical significance,  $p < 0.05$

\*\*Indicates statistical significance,  $p < 0.001$

## Discussion

The results of this survey support the hypothesis that Army dentists without dental sleep medicine training have statistically significant less knowledge of OSA and are less confident in screening and referring possible OSA patients when compared to their trained counterparts. Furthermore, it established Army dentists' current knowledge about OSA as well as their attitude towards screening, referring, and managing OSA. Finally, it also offered an assessment of the effect of sleep medicine training on Army dentists' knowledge and opinions of OSA.

A strength of this study was the number of responses and the diverse experience level and dental specialty demographics of the group. Dental practice experience ranged from less than one year to more than fifteen years and dentists from all specialties responded except for Public Health.

Another unique feature of this survey was its specific examination of whether dentists had received any training about OSA or sleep medicine, where they had received it, and how much training they had. About 26% reported none or less than 5 hours of sleep medicine training. Of those trained, most reported their training was during residency or the Army sleep medicine course. Surprisingly, only 25% of Army dentists reported OSA training during dental school. Additionally, general dentists with no residency training were the most likely to report less than 5 hours of dental sleep medicine training. Therefore, if general dentists are not being trained in dental school, in residency, or the Army sleep medicine course, they are likely not properly trained to identify and screen for OSA during dental exams. This was evident in the survey as untrained dentists were less likely to identify intraoral signs of OSA. This is particularly problematic for the Army because general dentists perform most patient screenings, examinations, and treatment. Additionally, they see the most patients and serve as the conduit for treatment elevation within the dental system. If they are not proficient in identifying and screening patients for OSA, there is a high likelihood many potential OSA patients are remaining undiagnosed.

Overall, our study demonstrated Army dentists had a good baseline knowledge of OSA. Most dentists could correctly define OSA and understood it had to be diagnosed via polysomnography and a physician. Additionally, well-known symptoms of OSA (daytime sleepiness and fatigue, reported snoring, etc.) were easily identified by more than 97% of dentists. The more subtle symptoms, though, such as patient reported

bruxism and depression were statistically more likely to be identified by trained dentists. Therefore, the potential sequelae of bruxism, including TMD, myofascial pain, headaches, and tooth damage, are less likely to be attributed to OSA by untrained dentists. This could prove frustrating to both providers and patients as chief complaints and sick call visits are never truly solved because the correlation between OSA and these symptoms is never made.

Indubitably, dentists should be able to routinely identify signs and symptoms of OSA and subsequently screen and refer for suspected OSA evaluation. Even though 97% of respondents agreed that dentists play a role in screening and managing OSA, only 18% screen all patients for OSA. More worrisome is that nearly 30% of Army dentists are not regularly screening their patients for OSA. Careful consideration of several of the survey questions may offer valuable insight as to other reasons why this number remains so high. The first is most dentists receive no OSA or sleep medicine training during dental school. Therefore, if post-graduate training is not provided, there is a high probability dentists lack proper skills to screen and manage OSA. It is also possible dentists do not realize it is not only within their scope of practice to screen, refer, and manage OSA, but that there is an ADA policy recommending dentists provide regular OSA screenings during their dental exam. Likewise, there is no official military policy or regulation standardizing OSA screenings as part of dental or medical yearly exams. In fact, despite ADA recommendations, there is likely more regulations denying Army dentists (trained or untrained) from managing OSA

Secondly, one of the more enlightening and different aspects of the survey was the effect of training on dentists' reported comfort about OSA management. Trained providers were significantly more comfortable screening and referring for suspected OSA with 77-79% reporting being moderately or very comfortable. Inversely, 57-67% of

untrained dentists reported being not comfortable or only slightly comfortable. There was a significant correlation between those who reported screening for OSA and those who reported being comfortable screening for OSA. Consequently, lack of confidence in their training or not knowing how to apply their knowledge in a clinical setting to confidently screen and refer patients may also explain why some dentists are not screening for OSA.

Thirdly, the final question of the survey allowed space for any comments or questions about the survey or sleep medicine. Similar to previous studies, several commented their biggest difficulty was communicating with physicians.<sup>11,14</sup> On the flip side, medical providers may not be aware Army dentists provide oral appliance therapy and are underutilizing Army dentists. This is a huge disservice to patients and can lead to delayed care, denied insurance claims, and patient dissatisfaction. Without clear, established communication chains, it can become cumbersome, impractical, and discouraging for dentists to refer suspected OSA cases for evaluation.

Finally, several also reported they did not feel they had support of their Command. Some stated their Command do not push out sleep medicine course training information and do not support training opportunities for their dentists, especially the general dentists. Others reported Commands denying credentialing to trained providers. This presents an interesting military perspective as Army dentists are not only subject to state licensure laws and ADA guidelines, but also local military policies, adding an additional barrier for dentists to navigate. It is the hope that by demonstrating the significant impact of sleep medicine training on Army dentists' knowledge and confidence managing OSA that it will help promote awareness to Army Dental Leadership to the importance of properly training Army dentists about OSA, increasing

training opportunities (especially to general dentists), and creating policies to incorporate regular OSA screenings into yearly military dental exams.

Conclusions:

Our results indicate Army dentists without sleep medicine training were statistically less knowledgeable and confident screening and referring suspected OSA patients compared to their trained counterparts. This suggests increased sleep medicine training would increase Army dentists' knowledge and confidence in screening and referring OSA. Furthermore, local Command support for increased sleep medicine training and credentialing and improving communication with physicians would empower more Army dentists to screen and manage OSA. Army dentistry has the potential to make a significant impact on the rising health concern surrounding obstructive sleep apnea. By training more providers and implementing routine OSA screenings into yearly dental exams, access to care, screening, referral, and diagnosis of OSA would increase. Ultimately this would improve readiness and deployability of Soldiers!

## Appendices

### Appendix 1: Survey

#### **An assessment of Army dentists' knowledge of screening methods and treatment options for obstructive sleep apnea**

1. How long have you been a dentist?
  - a. 0-5 years
  - b. 5-10 years
  - c. 10-15 years
  - d. More than 15 years
  
2. What is your MOS?

a. 63A	e. 63F	h. 63M
b. 63B	f. 63H	i. 63N
c. 63D	g. 63K	j. 63P
d. 63E		
  
3. Have you received any training about obstructive sleep apnea and/or dental sleep medicine? If so, please select all that apply.
  - a. No
  - b. Dental School
  - c. During a residency program
  - d. Army Dental Sleep Medicine course
  - e. CE through the American Academy of Dental Sleep Medicine
  - f. Other CE courses
  
4. Roughly how many hours of OSA and sleep medicine education and training do you think you have received?
  - a. None
  - b. Less than 10 hours
  - c. 10-25 hours
  - d. 25 or more hours
  
5. Do you regularly screen patients for OSA?
  - a. No
  - b. Yes, I screen some of my patients
  - c. Yes, I screen all my patients

6. Obstructive Sleep Apnea is defined as:
- Loud snoring and restless sleep
  - A sleep-related breathing disorder that involves a decreased or complete halt in airflow despite an ongoing effort to breathe.
  - A sleep-related disorder in which the effort to breath is diminished or absent.
  - A sleep-related disorder that involves decreased airflow due to obesity and/or age.
7. Which of the following are possible symptoms of OSA? Select all that apply.
- Patient reported nocturnal bruxism
  - Daytime sleepiness
  - Daytime fatigue
  - Patient reported snoring
  - Depression
  - Patient reports inability to sleep on their back
8. Which of the following are possible intraoral signs OSA? Select all that apply.
- Scalloped tongue
  - TMJ Pain
  - Mandibular Tori
  - Periodontal Bone Loss
  - Anterior Attrition
  - Increased Caries
9. Which of the following could be used as screening tools if you suspect a patient has OSA? Select all that apply.
- Epworth Sleepiness Scale
  - Polysomnography
  - STOP-Bang Questionnaire
  - OSA Screening Survey
  - Berlin Questionnaire
10. What is the gold standard to diagnose sleep apnea?
- Sleep partner
  - Sleep application on phone
  - Polysomnography
  - Electromyography
  - STOP-Bang Questionnaire.
11. Who can diagnose OSA and prescribe an oral sleep appliance?
- Dentist
  - Sleep physician
  - Both A and B

12. T/F: Only mild sleep apnea can be treated with an oral sleep appliance.
- True
  - False
13. How comfortable are you for screening for OSA?
- Not comfortable at all
  - Slightly comfortable
  - Moderately Comfortable
  - Very comfortable
14. How comfortable are you referring patients for evaluation of suspected OSA?
- Not comfortable at all
  - Slightly comfortable
  - Moderately Comfortable
  - Very comfortable
15. Dentists play a role in diagnosing and providing treatment for OSA.
- Strongly Disagree
  - Disagree
  - Unsure
  - Agree
  - Strongly Agree
16. Do you think more access to OSA and Sleep Medicine training would benefit your practice?
- Yes
  - No, I don't think its within my scope of practice
  - No, I am already well-trained to manage OSA patients
  - Unsure
17. Do you have any additional comments regarding any of the previous questions or about Dental Sleep Medicine?

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