

## Research

# Obstructive Sleep Apnea Knowledge: Attitudes and screening practices of Minnesota dental hygienists

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### Abstract

**Purpose:** Reported cases of obstructive sleep apnea (OSA) range between 4% to 9%, however between 70% to 90% of adults in the United States remain undiagnosed. The purpose of this study was to determine the current knowledge and attitudes of OSA among Minnesota dental hygienists and inventory OSA screening protocols currently used in dental practices.

**Methods:** The cross sectional study used an adapted Obstructive Sleep Apnea Knowledge and Attitude (OSAKA) survey instrument. Survey items included demographic variables, and measured attitudes, knowledge and perceived knowledge about OSA, routine screening procedures, and use of validated OSA screening protocols. Paper surveys were mailed to a random sample of 750 licensed Minnesota dental hygienists. Analyses included descriptive statistics (counts and frequencies), and analytic tests (one-way ANOVA, Pearson's correlation, and t-tests, Cronbach's alpha), as appropriate.

**Results:** Twenty-six percent of the returned surveys met inclusion criteria (n=197) and were used in the final analyses. Respondent age ranged from 19 to 70 years and mean years in practice experience was 19.9. The majority (93.9%) were in general practice and had completed an associate degree (59.6%). The mean (SD) self-rated OSA knowledge was 3.5 (3.3) on a scale of 0-10, attitude score was 3.2 (0.8) on a 5-point Likert scale, and knowledge score was 9.5 (range 0-17). No significant differences were found by age, degree type, or years in practice and OSA knowledge or attitudes. Routine practices included head and neck exams (89.3%), taking blood pressure (41.6%). Using a validated OSA screening protocol was reported by 9.6% of the respondents.

**Conclusion:** Dental hygienists perceive that assessing patients for OSA is important, however they have moderate knowledge of the disease. Results support incorporating OSA into dental hygiene practice through additions to the dental hygiene education curriculum and ongoing professional development courses with the goal of improving the screening and referral of patients presenting with OSA symptoms.

**Keywords:** obstructive sleep apnea, OSA screening, sleep disorders, dental hygiene education, professional role

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### Introduction

Current estimates of obstructive sleep apnea (OSA) cases in the United States (U.S.) adult population range between 4% to 9%, however between 70% to 90% of adults remain undiagnosed.<sup>1-2</sup> Repetitive episodes of total or partial collapse of the upper airway during sleep characterizes OSA leading to sleep disruption and decreased oxygen levels or hypoxia.<sup>3</sup> Inflammation, oxidative stress and increased sympathetic activity precipitated by the sleep fragmentation and hypoxia are some of the mechanisms, that link OSA to several medical comorbidities affecting patients' oral and systemic health.<sup>4</sup> A strong association

exists between OSA and cardiovascular diseases including hypertension, heart failure, arrhythmias, and stroke.<sup>5,6</sup> Some studies also implicate a potential association between OSA and periodontal disease.<sup>5,7</sup> Inflammatory cytokines such as TNF- $\alpha$ , IL-1 $\beta$  and acute phase C-reactive protein are increased in OSA patients<sup>8,9</sup> and in patients with periodontitis.<sup>10,11</sup>

Several anatomical risk factors are associated with OSA including a large neck circumference, small size and a retruded position of the mandible (retrognathia), enlarged tongue, tonsillar hypertrophy, class II malocclusion and extension of

the soft palate behind the tongue.<sup>3</sup> Snoring, general fatigue, and excessive daytime sleepiness (EDS) are common symptoms of OSA. Because symptoms such as fatigue and EDS are also common to other chronic diseases, OSA is often not diagnosed as readily as its comorbidities such as diabetes or cardiovascular diseases.<sup>3</sup> Obesity is a major risk factor for OSA. It often leads to enlargement of the soft tissue in the upper airway and the tongue.<sup>12,13</sup> Ideal screening includes identifying the anatomical risk factors, clinical symptoms that patients experience and implementing validated screening tools followed by appropriate referral to a physician for further evaluation.<sup>4</sup>

Currently, there are several validated OSA screening tools available for health professionals such as the Epworth Sleepiness Scale, Berlin Questionnaire, and STOP Questionnaire.<sup>14-16</sup> Each evaluates a different aspect or risk factor of OSA. Perhaps the most widely used tool is the STOP-BANG questionnaire, which takes into account the patient's medical conditions and symptoms.<sup>15</sup> Mallampati scoring of oropharynx (length of soft palate) is an important part of assessment of the potential for soft tissue obstruction during intra-oral examination which has been shown to predict both the presence and severity of OSA.<sup>17</sup> Patients at risk for OSA are usually referred by their primary care providers although some otolaryngologists, cardiologists and neurologists specialize in sleep medicine. A definitive diagnosis is obtained by conducting polysomnography (i.e., sleep study) in consultation with a sleep medicine physician.<sup>8</sup>

Continuous positive airway pressure (CPAP) is the most effective treatment for moderate to severe OSA. The CPAP machine provides a continuous stream of air under high pressure that prevents the upper airway from collapsing.<sup>3</sup> The American Academy of Sleep Medicine recommends oral appliances (OA) for patients who are intolerant of CPAP (25% to 58%) or for those who prefer an alternate treatment option.<sup>18</sup> The OA advances the tongue and the mandible forward, increasing the upper airway diameter and reducing the upper airway collapse.<sup>19-21</sup>

Dental professionals have the potential to recognize the signs and symptoms of sleep apnea and refer patients for a medical consultation.<sup>4</sup> Dental hygienists spend the most time with patients and have the potential to provide an appropriate setting to conduct OSA screenings. While the potential for this practice has been previously proposed,<sup>4</sup> no published studies have reported the level of knowledge and attitudes about the importance of identifying OSA among dental hygienists. Practice modifications adopted by busy clinicians require both a positive attitude toward the need, and adequate knowledge base in the subject matter to implement and sustain a change.<sup>22</sup> The primary aim of this study was to assess the

current OSA knowledge and attitudes of Minnesota dental hygienists and to identify the screening tools currently used to identify patients at high risk of OSA in dental practices. In addition, the study results can inform the need for continuing education on OSA, dental hygiene program curriculum changes, and implementing OSA screening protocols into dental hygiene clinical practice.

## Methods

The study population consisted of a simple random sample of the 5,625 licensed dental hygienists in the state of Minnesota; those who were no longer in clinical practice or who obtained licensure within the last year were excluded from the study. An initial sample size of 750 participants was based on an average of an approximate 50% response rate, a sample size used in recent survey studies with dental hygienists and budgetary restrictions.<sup>23-25</sup> However, since this was a descriptive study, no minimum sample was required to meet statistical test criteria.

### *Data collection instrument*

The Obstructive Sleep Apnea Knowledge and Attitude (OSAKA) questionnaire had been developed to measure OSA knowledge and attitudes among physicians; the instrument was modified for use in this study.<sup>26</sup> Following permission from the OSAKA designer, the items were adapted for administration to dental hygienists with minimal changes reflecting clinical practice settings (e.g., “cardiology” was changed to “dental hygiene”). The final version of the 40 item survey included 18 OSA knowledge items divided into four subcategories described as prevalence, diagnosis, risk factors, and treatment.<sup>26</sup> Response choices were true (scored as 1 point), and false or don't know (scored as 0 points) with a total possible score of 18 points. Five attitudinal items were subcategorized into two areas: importance of OSA as a disorder, and confidence in identifying and managing OSA patients.

Responses were selected from a 5-point Likert scale ranging from “not important or confident” to “extremely important or confident”. Self-assessed knowledge of OSA consisted of one question ranked on a scale of 0 (no knowledge) to 10 (very knowledgeable). Additional questions assessed OSA curricular content in dental hygiene undergraduate programs, and completion of post-graduate OSA continuing education courses. Routine clinical screening practices assessed were the inclusion of an OSA item on medical history forms, performing extra- and intraoral examinations, and checking blood pressures (BP). An inventory of one or more currently used OSA protocols included the Mallampati Classification<sup>27</sup>, Berlin questionnaire<sup>14</sup>, STOP questionnaire, STOP-

BANG questionnaire<sup>15</sup>, and the Epworth Sleepiness Scale.<sup>16</sup> Demographic variables included age, practice setting (general or specialty), and undergraduate degree type (bachelor or associate).

Content validity of the modified survey was evaluated by OSA experts associated with the University of Minnesota School of Dentistry and recommended changes were incorporated into a second version. The survey was then piloted among ten dental hygienists who met the inclusion criteria for study participation. Further changes were reviewed by the study team and incorporated into the final survey.

### **Procedures**

The paper survey was mailed to 750 randomly selected dental hygienists and included a cover letter and stamped addressed return envelope. Subjects were asked to return the survey within two weeks of receipt. Each mailing list name and address was numbered with a corresponding code indicated on the survey allowing for a targeted second mailing to non-respondents two weeks after the initial mailing. The study was submitted to the University of Minnesota Institutional Review Board and deemed exempt.

### **Data analysis**

Descriptive statistics including means and standard deviations for continuous measures; counts and percentages for categorical measures, were used to summarize item responses (SAS V9.3; SAS Institute Inc., Cary, NC). Internal consistency of the modified survey instrument attitude items was calculated to determine Cronbach's alpha. Pearson's correlation was used to test the correlation between self-assessed knowledge and total knowledge scores. Total knowledge scores and attitude scores were treated as dependent variables with one-way ANOVA for age categories, t-tests for degree type, and Pearson's correlation coefficient to determine an association with years in practice. The alpha level for all statistical tests was established at 0.05.

## **Results**

Surveys were completed and returned by 230 respondents (n=230) included in the initial mailing of 750 (n=750) dental hygienists. Thirty-three surveys were excluded from analysis because respondents did not meet study inclusion criteria (i.e., they were no longer in clinical practice). The final sample consisted of 197 surveys (n=197) or 26% of the sample.

Respondents ranged in age from 19 to 70 years. Mean (SD) years in practice was 19.9 (12.0) and 93.9% practiced primarily in a general dentistry setting. The mean (SD) weekly hours practiced was 29.7 (8.3), and the majority of subjects (59.6%) earned an associate level degree upon

completion of their dental hygiene program. Because a substantial number of respondents did not indicate their degree type (8.3%), results were reported with an additional category titled "non-specified." This variable was not included in additional analyses. Respondents' mean (SD) self-rated level of OSA knowledge was 3.5 (3.3) out of 5. Respondents' total knowledge mean score was 9.5 out of 18; itemized results are reported in Table I. Applying Pearson's product-moment coefficient of correlation, a moderate and statistically significant correlation ( $r=0.46$ ,  $p<0.001$ ) was found between the respondents' perceived self-assessed knowledge and their total knowledge scores.

Response frequencies to the five OSA attitudinal questions are shown in Table II. Subcategory mean scores (SD) for the "importance of OSA" was 3.7 (0.8) out of 5 and "confidence of identifying OSA risk factors" was slightly lower at 2.8 (1.0) out of 5. The mean (SD) for all items was 3.2 (0.8).

Because the instrument used to collect data was altered for use in this study, both the internal validity and correlation between items was tested replicating the same procedures conducted by Schotland, et al.<sup>26</sup> as part of initial survey development. Cronbach's alpha was established at 0.81 indicating a good level of internal consistency. Correlations between each item ranged from none to high, with several results yielding statistically significant associations (Table III).

Results of the inferential statistical analyses comparing the dependent variables of total knowledge scores and attitude to age, degree type and years in practice are displayed in Table IV. No statistically significant differences were found.

The majority of respondents reported that they routinely conducted extra- and intraoral examinations (89.3%), but fewer than half (41.6%) regularly checked patients' blood pressure. Less than half reported inclusion of an OSA item on their practice's medical history form (39.6%). Only ten (9.6%) of the respondents used an established OSA screening tool with half reporting use of the STOP-BANG tool, either exclusively or in addition to, another method.

## **Discussion**

Previous studies have established the potential for dental hygienists to screen patients for OSA risk factors in clinical practice settings. However, there is a gap in the literature regarding the actual OSA knowledge, attitudes and screening practices of dental hygienists. As no dental hygiene comparatives were available, results of physicians completing the OSAKA knowledge and attitudes items were reviewed. Comparisons of studies assessing the OSA knowledge of cardiologists, internists and family practitioners showed that

**Table I. Dental hygienists' responses to OSA knowledge items**

	Correct responses are shaded		
	True n (%)	False n/(%)	Don't know n/(%)
<b>Prevalence:</b>			
The estimated prevalence of obstructive sleep apnea among adults is between 2-10%.	29 (15)	67 (35)	101(50)
<b>Diagnosis:</b>			
An overnight sleep study is the gold standard for diagnosing obstructive sleep apnea.	165 (84)	10 (5)	21 (11)
Less than 5 apneas (cessation of breathing during sleep) or hypopneas (limited breathing during sleep) per hour is normal in adults.	38 (20)	45 (23)	112 (57)
The majority of patients with obstructive sleep apnea snore.	142 (74)	19 (9)	36 (17)
A craniofacial and oropharyngeal examination is useful in the assessment of patients with suspected obstructive sleep apnea.	132 (68)	6 (3)	57 (29)
<b>Risk Factors:</b>			
Women with obstructive sleep apnea may present with fatigue alone.	95 (48)	29 (14)	73 (37)
Obstructive sleep apnea is more common in women than men.	10 (5)	98 (51)	88 (44)
Obstructive sleep apnea is associated with hypertension.	98 (51)	18 (9)	80 (40)
The loss of upper airway muscle tone during sleep contributes to obstructive sleep apnea.	117 (61)	8 (4)	71 (36)
The most common cause of obstructive sleep apnea in children is the presence of large tonsils and adenoids.	149 (77)	3 (2)	43 (22)
Alcohol at bedtime improves obstructive sleep apnea.	5 (3)	162 (83)	29 (14)
Untreated obstructive sleep apnea is associated with a higher incidence of automobile crashes.	117 (60)	10 (5)	68 (34)
In men, a collar size 17 inches or greater is associated with obstructive sleep apnea.	92 (47)	15 (8)	88 (45)
Cardiac arrhythmias may be associated with untreated obstructive sleep apnea.	139 (71)	1 (1)	56 (28)
<b>Treatment:</b>			
Uvulopalatopharyngoplasty (a surgical procedure to remove and/or remodel tissues of the throat) is curative for the majority of patients with obstructive sleep apnea.	20 (9)	83 (43)	94 (47)
CPAP (continuous positive airway pressure) therapy may cause nasal congestions.	52 (36)	38 (19)	106 (54)
Laser-assisted uvuloplasty is an appropriate treatment for severe obstructive sleep apnea	41 (21)	20 (11)	134 (68)
CPAP is the first line therapy for severe obstructive sleep apnea.	124 (64)	11 (6)	61 (31)

these health care providers consistently scored higher than dental hygienists (76%, 79% and 78%, respectively, vs. 54%).<sup>26, 28</sup> Mixed comparisons were found between this study and others when comparing OSA knowledge with clinician age, practice type or specialty, and years in practice. This study, similar to a report of cardiologists, found no differences in OSA knowledge or attitudes by age, years in practice or practice type. However, Schotland et al.<sup>26</sup> found a statistically significant inverse relationship among internists and family practitioners by age; lower knowledge scores and less confidence in diagnosing OSA were associated with increased age. These differences may be due to practice specialization with cardiologists and dental hygienists being less likely to routinely screen for OSA as compared to primary care family practitioners and internists.

Attitudinal comparisons found that fewer dental hygienists than cardiologists reported OSA as either a “very important” or “extremely important” clinical disorder (59% vs. 78%, respectively).<sup>28</sup> Fewer than one-fourth, (24%, of dental hygienists) compared to over two-thirds, (68% of physicians), were confident in their ability to identify patients with OSA.<sup>28</sup> Twenty-four percent of dental hygienists compared to 18% of cardiologists were “very confident” or “extremely confident” in their ability to manage (dental or general) concerns of OSA patients. Twenty-seven percent of dental hygienists were “very confident” or “extremely confident” in their ability to manage dental concerns related to OSA on CPAP therapy compared to 10% of cardiologists’ general ability to manage these patients.

It should be noted that the last two attitudinal survey questions for dental hygienists specific to patient management and CPAP therapy, were modified to indicate dental concerns as opposed to general patient management in the original OSAKA survey for physicians. Results of correlation analyses between attitudes toward OSA and

**Table II. Dental hygienists' attitudes about the importance of and confidence in treating dental concerns of patients with OSA**

	Not important or confident	Somewhat important or confident	Important or confident	Very important or confident	Extremely important or confident	
	n (%)					Mean(SD)
<b>Importance of OSA</b>						<b>3.7 (0.8)</b>
As a clinical Disorder, OSA is:	1 (0.5)	15 (7.7)	62 (32.7)	75 (38.3)	41 (20.9)	
Identifying patients with possible OSA is:	0 (0.0)	15 (7.7)	71 (36.4)	64 (32.8)	45 (23.1)	
<b>Confidence with OSA</b>						<b>2.8 (1.0)</b>
Identifying patients at risk of OSA	33 (17.3)	40 (20.9)	73 (38.2)	32 (16.8)	13 (6.8)	
Ability to manage patients with dental concerns related to OSA	29 (15.1)	37 (19.3)	81 (42.2)	32 (16.7)	13 (6.8)	
Ability to manage dental concerns of patients on CPAP therapy	36 (18.9)	36 (18.9)	68 (35.6)	41 (21.5)	10 (5.2)	
<b>Total of all items</b>						<b>3.2 (0.8)</b>

**Table III. Results of Pearson's correlation tests between attitude items and total knowledge scores.**

	1	2	3	4	5
<b>OSA clinical (1)</b>	1	-	-	-	-
<b>ID pts (2)</b>	0.75**	1	-	-	-
<b>ID at risk (3)</b>	0.38**	0.43**	1	-	-
<b>Manage OSA (4)</b>	0.23*	0.30**	0.78**	1	-
<b>Manage therapy (5)</b>	0.28**	0.31**	0.68**	0.82**	1
<b>Knowledge score</b>	0.11	0.14	0.17*	0.25**	0.26**

\*  $p < 0.05$ , \*\*  $p < 0.001$

knowledge scores were similar for both dental hygienists ( $r=0.23$ ;  $p=0.001$ ) and cardiologists ( $r=0.29$ ;  $p=0.004$ ).<sup>28</sup> It is of interest that both clinician groups with attitudes identifying OSA as important, also had higher OSA knowledge scores.

Fewer than half of all respondents routinely collect clinical information critical to diagnosing OSA. Approximately one-third of dental hygienists reported that the medical history forms used in their practices include questions specific to OSA or its symptoms. Furthermore, only 41.6% responded that blood pressure screenings were performed during routine dental hygiene care appointments. This result was surprising as clinical practice guidelines recommend blood pressure screenings at all dental hygiene care appointments.<sup>29</sup> It is well established that many OSA patients also exhibit high blood pressure,<sup>30-34</sup> and current evidence suggests improved blood pressures with OSA treatment.<sup>34</sup>

A majority of respondents (89.3%) indicated that they completed or assisted in examinations that evaluate extra- and intra-oral structures during routine dental hygiene appointments. While the current emphasis of this procedure is on oropharyngeal cancer detection, educating dental hygienists on anatomical variations indicative of OSA could seamlessly include a practical addition to this routine assessment.

The use of established OSA screening protocols or other tools used in dental practices was very low in this study population (9.6%). The small number of respondents ( $n=10$ ) makes it difficult to determine the utility of available instruments, and further inquiry is needed to determine an appropriate tool for use in the dental setting.

Study limitations include a low response rate despite two mailings including prepaid envelopes. Contributing factors may include lack of an incentive to complete the survey, limited familiarity or interest in the subject matter, or lack of time. Therefore, results may not be representative of dental hygienists as a whole. However, the significance of this study is that the dental hygienist respondents consider OSA to be an important disorder; although their confidence in identifying and managing dental concerns of OSA patients is lower than attitudes regarding its importance. Further, dental hygienists' perception of their OSA knowledge coincides with their actual OSA knowledge. As it is well established that attitudes preclude the acquisition of knowledge and subsequent behavioral change,<sup>22</sup> results from this study support increasing educational opportunities on OSA for dental hygiene students and practicing clinicians.

**Table IV. Inferential test results comparing OSA knowledge scores and attitudes to age, degree type and years in practice.**

		Total Knowledge	p-value	Attitude: Importance diagnosing	p-value	Attitude: Confidence identifying	p-value	Total Attitude Score	p-value
Age*	n (%)	Mean (SD)		Mean (SD)		Mean (SD)		Mean (SD)	
19-35	50 (25.5)	8.7 (4.2)		3.7 (0.8)		2.8 (1.0)		3.2 (0.8)	
36-45	43 (21.9)	9.8 (4.0)		3.7 (0.8)		2.8 (1.0)		3.2 (0.7)	
46-55	50 (25.5)	9.0 (3.9)		3.7 (0.9)		2.6 (1.2)		3.0 (0.9)	
56-70	53 (27.0)	10.5 (3.6)		3.7 (0.8)		2.8 (1.0)		3.2 (0.8)	
			0.1		0.99		0.61		0.77
Degree**									
AA	115 (59.6)	9.1 (4.0)		3.6 (0.9)		2.8 (1.1)		3.1 (0.8)	
BS	62 (32.1)	9.7 (4.0)		3.9 (0.8)		2.7 (1.0)		3.2 (0.8)	
Other	16 (8.3)	11.5 (2.8)		3.5 (0.5)		2.7 (0.8)		3.0 (0.6)	
			0.32		0.07		0.93		0.41
Years in Practice***									
1-10	53 (27.0)	9.0 (3.9)		3.8 (0.8)		2.7 (1.1)		3.2 (0.8)	
11-20	61 (31.1)	9.1 (4.3)		3.6 (0.9)		2.9 (1.1)		3.2 (0.9)	
21-30	36 (18.4)	9.7 (4.1)		3.7 (0.8)		2.6 (1.1)		3.2 (0.8)	
31-40	38 (19.4)	10.5 (3.0)		3.8 (0.8)		2.8 (1.1)		2.9 (0.7)	
41+	8 (4.1)	9.0 (4.0)		3.3 (0.6)		2.6 (0.9)			
			r= 0.12, p=0.99		r= -0.001, p=0.86		r= -0.006, p=0.42		r= -0.004, p=0.59

\* One-way ANOVA

\*\*t-test (associate and bachelor categories only)

\*\*\*Pearson's correlation coefficient

A majority of the 70 to 90% of Americans with OSA remain undiagnosed indicating the need for new screening and referral strategies.<sup>4</sup> As the health care paradigm shifts towards interprofessional practice, the potential role of dental hygienists to screen for OSA is timely. Standardized OSA screening can be integrated seamlessly into clinical practice as dental hygienists often conduct routine medical history reviews, head and neck examinations, intraoral examinations and blood pressure screenings. The time spent to administer a brief questionnaire, elicit a conversation regarding OSA symptoms, and provide a dentist's referral for assessment by a physician is reasonable, especially when considering the potential benefits to patients. Dental hygienists are likely to have more time for the initial screening of patients with the dentist confirming positive responses. Preparing clinicians will require incorporating OSA into dental hygiene curricula, and offering continuing education courses for practicing professionals. The long-term

goal of this line of research is to improve the recognition of OSA signs and symptoms along with referrals to physicians for further evaluation and management.

## Conclusion

The attitudes of Minnesota dental hygienists regarding the importance of OSA as a chronic disorder are higher than their knowledge of OSA. Currently, dental hygienists are underutilized for performing OSA screening in the dental practice setting. Results from this study support the practical aspects of incorporating OSA into the knowledge-base of dental hygiene practice to improve the screening and referral of patients presenting with OSA symptoms.

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