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# Perceived Effectiveness, Self-Efficacy, and Social Support for Oral Appliance Therapy Among Older Veterans With Obstructive Sleep Apnea

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## ABSTRACT

**Purpose:** Obstructive sleep apnea is a prevalent sleep disorder among older adults. Oral appliances are increasingly prescribed as therapy for obstructive sleep apnea. Adherence to oral appliance therapy is highly variable. Based on value-expectancy theory and other social-psychological theories, adherence to oral appliance therapy may be influenced by patients' perceived effectiveness of the therapy, self-efficacy, and availability of social support. We examined these perceptions among older adults with obstructive sleep apnea who were prescribed oral appliance therapy.

**Methods:** We mailed surveys to all patients aged  $\geq 65$  years who had been prescribed oral appliance therapy for obstructive sleep apnea over the prior 36 months at a Veterans Affairs medical center. We examined frequencies of responses to items that assessed perceived effectiveness, self-efficacy, and social support for nightly use of oral appliances from friends, family, or health care staff.

**Findings:** Thirty-nine individuals responded (response rate, 30%; mean [SD] age 71.4 [SD 6.3] years; 97% male). Thirty-six percent of the respondents perceived regular use of oral appliance therapy to be effective in managing obstructive sleep apnea; 39% agreed that they felt confident about using oral appliances regularly; 41% felt supported by people

in their life in using oral appliance therapy; and 38% agreed that health care staff would help them to use their oral appliance regularly. These rates represented less than half of respondents despite the finding that 65% of patients believed that they would use their oral appliance regularly.

**Implications:** Although oral appliance therapy is increasingly prescribed for obstructive sleep apnea, only about one third of older adults prescribed it perceived it to be an effective treatment, were confident about oral appliance use, and/or believed that they would receive needed support. Future research is needed to better understand older adults' perceptions so that interventions can be designed to improve the effectiveness of oral appliances, their self-efficacy for using oral appliances, and their social support for this therapy, which may, in turn, improve oral appliance therapy adherence. (*Clin Ther.* 2016;■■■■-■■■) Published by Elsevier HS Journals, Inc.

**Key words:** attitude to health, oral appliance therapy, patient reported measures, sleep apnea syndromes.

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## INTRODUCTION

Obstructive sleep apnea is prevalent among older adults.<sup>1</sup> In a large, multicenter study, approximately one fifth of adults aged  $\geq 65$  years had sleep study findings consistent with obstructive sleep apnea.<sup>2</sup> Oral appliances are increasingly prescribed as therapy for obstructive sleep apnea. The most common types of appliances are mandibular advancement devices and tongue retaining devices.<sup>3</sup> Mandibular advancement devices treat sleep apnea by advancing the mandible forward to expand airway size.<sup>3</sup> Custom fabricated mandibular advancement devices are manufactured in a laboratory according to dental impressions and the dentist–prescriber’s requested advancement positions. These devices are titratable, allowing for small adjustments/advancements of the mandible. Prefabricated devices are made in large quantity without a specific patient in mind and subsequently may be molded or shaped for a specific patient in a dental clinic setting. These prefabricated devices may also be titratable. Tongue retaining devices fit over the tongue and advance the tongue forward.<sup>3</sup> Tongue advancement may be achieved through slight negative pressure in the lingual compartment of the device.<sup>4</sup> Oral appliances are commonly used in lieu of a positive airway pressure device in the treatment of obstructive sleep apnea, particularly in patients unable to tolerate positive airway pressure due to conditions such as claustrophobia or in patients who prefer a smaller medical device that does not require electricity.<sup>3</sup>

Although positive airway pressure therapy is considered first-line treatment for obstructive sleep apnea, oral appliance therapy may be considered in those unable to tolerate positive airway pressure therapy. A systematic review and meta-analysis of data on oral appliances for obstructive sleep apnea found that oral appliance therapy reduced the apnea–hypopnea index (AHI) by 7 events/h compared with control appliances.<sup>5</sup> Several studies have compared oral appliance and positive airway pressure therapies, and one meta-analysis of data from those studies found that although both therapies reduced the AHI significantly, positive airway pressure devices produced a larger reduction in AHI than did oral appliances (25 vs 9 events/h)<sup>6</sup> Another meta-analysis found that positive airway pressure devices decrease the AHI by 6 events/h and improved the oxygen nadir (lowest oxygen saturation value) by 2.9% compared with that in oral

appliances.<sup>5</sup> Oral appliance therapy may improve clinical outcomes such as blood pressure. A meta-analysis found that oral appliance therapy was associated with a 1.7-mm Hg decrease in diastolic blood pressure.<sup>7</sup> Moreover, studies suggest that many patients who use oral appliances are satisfied with their therapy.<sup>8</sup> These data support the use of oral appliances in those unable to tolerate positive airway pressure.

Similar to positive airway pressure therapy, patients who use oral appliances may experience side effects. The use of oral appliances may cause dry mouth, excessive salivation, discomfort, and malocclusion, which can be barriers to regular use of the oral appliances. Furthermore, because oral appliances for obstructive sleep apnea are removable, successful therapy requires that patients remember to reinsert the appliance nightly prior to sleep.<sup>3</sup> Unfortunately, adherence to oral appliance therapy for obstructive sleep apnea is highly variable.<sup>9,10</sup>

Consistent with value-expectancy theories of behavior (which posit that the importance and perceived outcomes of specific behaviors affect choice, persistence, and performance<sup>11</sup>), adherence to oral appliance therapy is hypothesized to be more likely if patients perceive therapy to be effective, have social support from others (eg, encouragement and assistance from friends, family, and health care providers with adhering), and are confident that they can adhere.<sup>12</sup> Although an increasing number of older patients are being diagnosed with obstructive sleep apnea and prescribed oral appliance therapy, studies examining older patients’ perceptions, self-efficacy, and social support for oral appliance therapy are lacking. These types of studies may be useful for informing the development of behavioral interventions that increase acceptance and adherence to oral appliance therapy. We examined the perceptions of effectiveness, self-efficacy, and social support among older adults prescribed oral appliance therapy.

## PATIENTS AND METHODS

### Study Design, Sample, and Data Collection

Between April and June 2014, we mailed a survey to adults in the Los Angeles area who were aged  $\geq 65$  years who had been prescribed oral appliance therapy for obstructive sleep apnea during the prior 36 months at a Veterans Affairs medical center and who had a

valid postal address (N = 122). This Veterans Affairs medical center has a large sleep center that offers comprehensive therapy for obstructive sleep apnea, including positive airway pressure, oral appliances, and surgical interventions. Although the majority of patients with obstructive sleep apnea are initially treated with positive airway pressure therapy, some may be prescribed an oral appliance as initial therapy after discussion with a sleep physician about the risks and benefits of treatment options. For this study, a review of durable medical equipment (Veterans Affairs Prosthetics) and dental clinic records were used for identifying eligible patients who were prescribed an oral appliance for sleep apnea. Postal address, date of birth, and sex were abstracted from Veterans Affairs electronic health records. To encourage participation in the survey, a \$2 bill was included with the survey instruments mailed to these patients. The full study methods were approved by local institutional review boards (protocols 2013-091198 (VA Greater Los Angeles Healthcare System) and 13-001132(University of California, Los Angeles)).

## Measures

### *Demographic characteristics*

Age was calculated based on date of birth obtained from each patient's electronic health record, which also provided the patient's sex. From the survey responses, we collected information about race, ethnicity, and years of formal education. A question about duration of oral appliance use (<1 year versus  $\geq 1$  year) was also included in the survey.

### *Health Status*

To characterize the overall health of the sample, we collected information on self-rated health,<sup>13</sup> which is predictive of utilization and mortality,<sup>14,15</sup> as well as the prevalences of depressive symptoms and falls<sup>16</sup> (Table I).

### *Measures Of Oral Appliance Therapy Perceived Effectiveness, Self-Efficacy, And Support*

We adapted a subset of measures of perceived effectiveness (graphs 1 and 2 in Figure 1), self-efficacy (graphs 3 and 4 in Figure 1), and support (graphs 5–7 in Figure 1) from a published questionnaire that was developed for individuals prescribed positive airway pressure therapy.<sup>17</sup> Adaptations included replacing the term CPAP in each item stem used in the published

questionnaire with the term *dental sleep appliance*. We also made several formatting changes to make the questions and responses clearer for older veterans. For example, we provided 5 labeled response options for items 1 and 2 (ie, *extremely*, *very*, *somewhat*, *a little*, and *not at all*) in place of the response options in the published questionnaire, which labeled only the extremes of the response scale (1 = not at all important [or effective] or 5 = extremely important [or effective]). Similarly, for items 3 to 7, we provided 5 labeled response options (*strongly agree*, *slightly agree*, *neither agree nor disagree*, *slightly disagree*, and *strongly disagree*) in place of the response options provided in the published questionnaire, which labeled only the 2 extreme categories (1 = disagree completely and 5 = agree completely). In the instructions, we substituted the words *30 days* for the term *month* from the published questionnaire. We opted to include only a subset of items from the published questionnaire due to concern about participant burden. We also provided participants the opportunity to make open-ended comments (Figure 2).

## Statistical Analysis

We examined frequency distributions of the survey responses and the types of sleep apnea therapy prescribed. Open-ended comments were reviewed and summarized. To assess for internal consistency reliability, we estimated Cronbach  $\alpha$  for the 7-item scale that assessed perceived effectiveness, self-efficacy, and nightly support.

We used the *t* test to examine differences in patients' characteristics between survey respondents and nonrespondents.

## RESULTS

A total of 39 individuals responded to the postal survey (response rate, 30%). The mean (SD) age was 71.4 (6.3) years. Slightly more than half of respondents (54%) reported having <4 years of college education. The majority (97%) of the sample was male, and most respondents (74%) were non-Hispanic white. Fifty-five percent indicated <1 year of duration of oral appliance therapy use.

More than half of participants (65%) agreed that they would be able to use their oral appliance therapy regularly. In the domain of perceived effectiveness, 36% believed in the effectiveness of oral appliance

Table I. Sample characteristics (N = 39). Data are given as number (%) of patients unless otherwise specified.

Characteristic	Value
Continuous variable	
Age, mean (SD), y	71.4 (6.3)
Categorical variables	
Education (n = 35)	
<4 y college	19 (54)
≥4 y college	16 (46)
Sex (n = 33)	
Male	32 (97)
Female	1 (3)
Race/ethnicity (n = 27)	
White, non-Hispanic	20 (74)
Black	3 (11)
Multiple	2 (7)
Asian	1 (4)
Other	1 (4)
Duration of dental sleep appliance use (n = 31)	
<1 y	17 (55)
≥1 y	14 (45)
Self-rated health (n = 32)	
Excellent	2 (6)
Very good	4 (13)
Good	13 (41)
Fair	12 (38)
Poor	1 (3)
Felt down, depressed, or hopeless in previous 3 mo (n = 34)	
Yes	15 (44)
No	19 (56)
Tripped or fell in previous 3 mo (n = 36)	
Yes	13 (64)
No	23 (36)

therapy in managing or controlling obstructive sleep apnea. In the domain of self-efficacy, 39% felt confident that they would regularly use their oral appliance therapy. In the domain of social support, 38% believed they would receive nightly support; 38%, healthcare staff support; and 41%, support from people in their lives for using oral appliance therapy (Figure 1).

The value of internal consistency reliability of the 7-item scale (items listed in Figure 1) was 0.85, indicative of adequate reliability.<sup>18</sup>

Three participants provided comments. One participant commented that the process of getting fitted for an

oral appliance was protracted because dental work was needed prior to fitting the oral appliance. This same participant noted a change in bite associated with the oral appliance and malfunctioning of the oral appliance due to a broken hinge. Another participant who had been prescribed a tongue retaining device commented that repeated testing showed that the device was ineffective. A third participant simply stated that he was unable to use the device.

The difference in age between survey nonrespondents and respondents was not significant ( $P = 0.437$ ). The nonrespondent and respondent groups each included 1 women per group.

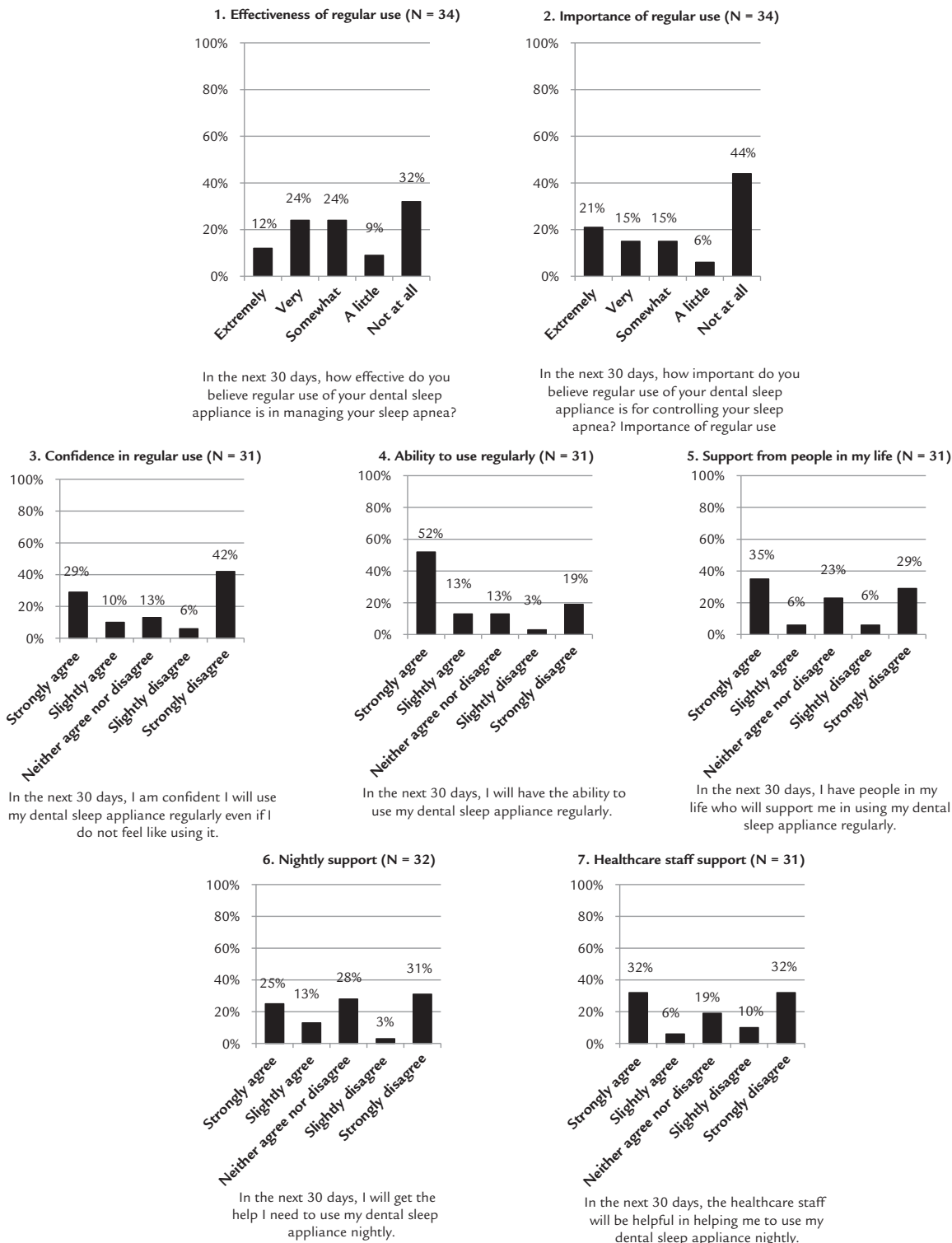


Figure 1. Descriptive results for the oral appliance survey items.

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Variable	Frequency (%)
1. Effectiveness of regular use (In the next 30 days, how effective do you believe regular use of your dental sleep appliance is in managing your sleep apnea?) (n = 34)	
Extremely	4 (12)
Very	8 (24)
Somewhat	8 (24)
A little	3 (9)
Not at all	11 (32)
2. Importance of regular use (In the next 30 days, how important do you believe regular use of your dental sleep appliance is for controlling your sleep apnea?) (n = 34)	
Extremely	7 (21)
Very	5 (15)
Somewhat	5 (15)
A little	2 (6)
Not at all	15 (44)
3. Confidence in regular use (In the next 30 days, I am confident I will use my dental sleep appliance regularly even if I do not feel like using it.) (n = 31)	
Strongly agree	9 (29)
Slightly agree	3 (10)
Neither agree nor disagree	4 (13)
Slightly disagree	2 (6)
Strongly disagree	13 (42)
4. Ability to use regularly (In the next 30 days, I will have the ability to use my dental sleep appliance regularly.) (n = 31)	
Strongly agree	16 (52)
Slightly agree	4 (13)
Neither agree nor disagree	4 (13)
Slightly disagree	1 (3)
Strongly disagree	6 (19)
5. Support from people in my life (In the next 30 days, I have people in my life who will support me in using my dental sleep appliance regularly.) (n = 31)	
Strongly agree	11 (35)
Slightly agree	2 (6)
Neither agree nor disagree	7 (23)
Slightly disagree	2 (6)
Strongly disagree	9 (29)
6. Nightly support (In the next 30 days, I will get the help I need to use my dental sleep appliance nightly.) (n = 32)	
Strongly agree	8 (25)
Slightly agree	4 (13)
Neither agree nor disagree	9 (28)
Slightly disagree	1 (3)
Strongly disagree	10 (31)
7. Healthcare staff support (In the next 30 days, the healthcare staff will be helpful in helping me to use my dental sleep appliance nightly.) (n = 31)	
Strongly agree	10 (32)
Slightly agree	2 (6)
Neither agree nor disagree	6 (19)
Slightly disagree	3 (10)
Strongly disagree	10 (32)

Figure 2. Perceived effectiveness, self-efficacy, and social support for oral appliance therapy (N = 39).

## DISCUSSION

Although oral appliance therapy is increasingly prescribed for obstructive sleep apnea, two thirds of older adults prescribed an oral appliance for obstructive sleep apnea did not perceive oral appliance therapy as effective, were not confident about oral appliance use, and/or did not believe they would receive needed support for its use. These results were found despite our finding that more than half (65%) of patients believed they would use the oral appliance regularly.

The rates of perceived effectiveness, self-efficacy, and social support for oral appliance therapy were low, indicating that the older patients in this sample have low expectations for positive outcomes, have poor self-efficacy for overcoming barriers to use, and feel unsupported. These results are concerning because factors such as self-efficacy and social support are determinants of adherence to other types of sleep apnea therapies, such as positive airway pressure therapy.<sup>19,20</sup> Our results suggest that although oral appliance therapy may be an attractive alternative to positive airway pressure therapy because it is transportable and easy to use, many older patients prescribed oral appliance therapy may have unfavorable expectations and perspectives toward oral appliance therapy, which could negatively impact adherence. Whether younger, female, and nonveteran patients would have similar beliefs and expectations is unclear. Our sample, which comprised older, male veterans, had overall worse health, with nearly twice the percentage of survey participants reporting fair or poor health compared with only 17% of National Health and Nutrition Examination Survey respondents reporting fair or poor health.<sup>21</sup> Other populations may not have the same low expectations for positive outcomes and may have more perceived support from their health care providers and family.

Our results indicate that perceptions of low effectiveness, poor self-efficacy, and lack of social support regarding oral appliance therapy are issues that should be addressed in the clinical setting, particularly when treating older, male veterans. Social cognitive theory suggests that behavioral and cognitive therapies provided in the clinical management of patients can lead to an appreciable improvement in adherence to prescribed therapies.<sup>17,22</sup> A systematic review of data on interventions used for improving positive airway pressure adherence found improvement in outcomes when adherence was addressed through multiple approaches,

including educational and psychosocial interventions.<sup>20</sup> One study in positive airway pressure users found that a cognitive-behavioral therapy intervention increased self-efficacy and social support as well as adherence to positive airway pressure therapy.<sup>23</sup> Our findings suggest that patients with sleep apnea prescribed oral appliance therapy could also benefit from cognitive-behavioral therapy for improved adherence. Education about sleep apnea and the role of oral appliance therapy could improve outcome expectations and help patients to identify ways to overcome barriers.<sup>12</sup> Considering behavior change theory and identifying the stage of change at which a patient may be when therapy is recommended could also help clinicians to tailor more specific strategies, which may ultimately translate into higher levels of adherence.<sup>12</sup>

Our study has several limitations. First, the sample size was small, and the response rate was suboptimal. One of the possible reasons for the low response rate is that we mailed the survey instrument to patients instead of offering other modes, such as online or telephone, and we contacted each patient only once. Multiple contacts with the patients may have improved the response rate. The individuals sampled were predominantly male, and all are veterans. We did not have information on many factors that may influence beliefs about oral appliance therapy, such as whether patients had previously received educational information about oral appliance therapy.<sup>15</sup> We did not have objective measurements of sleep apnea severity, AHI on oral appliance therapy, or adherence to oral appliance therapy in this sample. Although sensors that remotely and objectively monitor adherence to oral appliance therapy have recently been approved for use in the United States, this technology was not available at our facility during the survey period. Documentation of subjective number of hours of oral appliance use per night was very sparse, which prevented us from examining relationships between oral appliance therapy adherence and perceived effectiveness, self-efficacy, and social support. Finally, we had limited feedback from participants on ways in which we could improve the questionnaire for use in future studies.

## CONCLUSIONS

Our study found unfavorable perceptions of the effectiveness of oral appliance therapy for sleep apnea,



low levels of self-efficacy for oral appliance therapy, and poor social support for oral appliance therapy among older, predominantly male veterans. Future research involving larger samples that include both men and women of all ages and that incorporate methods of increasing response rates (eg, sending the survey multiple times and using online and telephone modes of administering the survey) is needed for better understanding patients' perceptions of oral appliance therapy. This understanding then can be applied to the development of interventions for improving perceptions of, and increasing social support for, oral appliance therapy.

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### CONFLICTS OF INTEREST

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