Survey of Oral Appliance Practice Among Dentists Treating Obstructive Sleep Apnea Patients*

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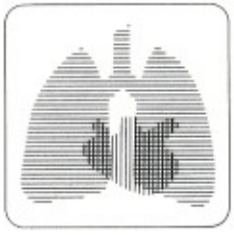

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Survey of Oral Appliance Practice Among Dentists Treating Obstructive Sleep Apnea Patients*

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Purpose: **Oral appliances (OAs) are used to treat obstructive sleep apnea (OSA). This study seeks to quantify the patterns of practice of OA use among dentists.**
Design: **Survey mailed to dentists.**
Participants: **Members of the Sleep Disorders Dental Society (SDDS).**
Measurements: **Dentists were asked questions regarding number of patients treated, types of OA used, average total OA cost to the patient excluding reimbursement, percentages of patients receiving pretreatment and posttreatment nocturnal polysomnography (NPSG), and whether they believe subjective patient reports alone or nocturnal pulse oximetry alone is an adequate substitute for NPSG to assess OSA treatment response. Summary statistics for the absolute value and percentage data are presented with the median, maximum, and minimum range.**
Results: **Three hundred fifty-five surveys were mailed, of which 124 (35%) were returned. These dentists treat a median of 27 OSA patients with OAs (range, 2 to 300) annually. Patients receive pretreatment NPSG in 95% of cases (range, 0 to 100%), and posttreatment NPSG in 18% of cases (range, 0 to 100%). Only 7% of dentists believe subjective patient reports alone are an adequate substitute for NPSG. Nocturnal pulse oximetry was perceived to be an adequate substitute for NPSG by 37%. Dentists who believe nocturnal pulse oximetry to be an adequate substitute for posttreatment NPSG are less likely to obtain pretreatment or posttreatment NPSG (Mann-Whitney *U* test, two-tailed; p=0.001, p=0.02).**
Conclusions: **Most SDDS dentists believe subjective reports and nocturnal pulse oximetry are inadequate to assess OA treatment response in OSA patients, yet posttreatment PSG is obtained infrequently.** ***(CHEST 1997; 111:382-86)***

Key words: dentists; obstructive sleep apnea; oral appliance; polysomnography

Abbreviations: ASDA=American Sleep Disorders Association; CPAP=continuous positive airway pressure; NPSG=nocturnal polysomnography; OA=oral appliance; OSA=obstructive sleep apnea; RDI=respiratory disturbance index; SDDS=Sleep Disorders Dental Society

The prevalence of obstructive sleep apnea (OSA), as defined by a respiratory disturbance index (RDI) of ≥15 events per hour on nocturnal polysomnography (NPSG), is approximately 3% for middle-aged adults in the United States.[1] Continuous positive airway pressure (CPAP) is a very effective treatment for OSA, but compliance is only 60 to 70% under optimized clinical conditions.[2] Thus, the use of alternatives to CPAP for the treatment of OSA, such as oral appliances (OAs), potentially involves large numbers of patients.

For editorial comment see page 266

Based on a review of OA outcome studies, the American Sleep Disorders Association (ASDA) published practice parameters in 1995 which state that OAs are a primary treatment for patients with mild OSA and a secondary treatment for patients with moderate and severe OSA who cannot tolerate treatment with CPAP.[3] Recent studies suggest that the role of OAs in the treatment of OSA may even be broader than that envisioned in the ASDA practice parameters. Randomized, crossover studies by Ferguson et al[4] and Clark et al[5] demonstrate that patients prefer treatment with OAs over CPAP, although OAs are less effective than CPAP for treating OSA. A study by Menn et al[6] suggests that a serially adjusted appliance increases treatment efficacy, resulting in an overall 70% success rate as

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defined by ≥50% decrease in RDI and posttreatment RDI <20 events per hour. This appliance was also effective in five of nine (56%) patients with severe OSA (pretreatment RDI >40 events per hour).

The lack of standardization in the use of OAs for the treatment of OSA is problematic. There have been at least 40 studies to date evaluating various OAs, with efficacies of individual OAs varying widely.[7] These studies also suggest that the patterns of practice among individual dentists are distributed among a broad spectrum with respect to the types of OAs used, the cost of these OAs, the intensity of patient follow-up, and the frequency of the use of NPSG both pretreatment and posttreatment. To our knowledge, no studies to date have evaluated this variability in the application of OAs for the treatment of OSA. Since dentists are currently the primary practitioners who manufacture, modify, and dispense OAs, we sought to determine these patterns of practice by surveying members of the Sleep Disorders Dental Society (SDDS). The SDDS is a special-interest group that consists primarily of dental clinicians and seeks to promote research and training for the application of OAs for the treatment of OSA and snoring.

Materials and Methods

A survey instrument was designed containing the following questions: (1) What is your occupation? (2) What is the percentage of patients in your practice over the past year that you have evaluated or treated for sleep disorders (either snoring or sleep apnea)? (3) How many OAs have you made or dispensed over the past 12 months? (4) List the names or types of the OAs that you work with and the percentage of time you utilized each. (5) What is the percentage of patients who receive full sleep studies prior to receiving an OA in your practice? (6) What is the percentage of OSA patients who receive full sleep studies after receiving an OA in your practice? (7) Do you believe overnight pulse oximetry recording is an adequate substitute for a sleep study in assessing the effectiveness of an OA in an individual OSA patient? (8) Do you believe that taking a history or using a questionnaire is an adequate substitute for a sleep study in assessing the effectiveness of an OA in an individual OSA patient? (9) How many times do you adjust an OA, on average, after the initial fitting? (10) What is the percentage of patients who are successfully treated for snoring with OAs in your practice? (11) What is the percentage of patients who are successfully treated for OSA with OAs in your practice? (12) What is the percentage of your patients who are treated with an OA for OSA who cannot tolerate using it on a long-term basis (>6 months)? (13) What is the average total cost to the patient for an OA, excluding any reimbursement? (14) Do you belong to the SDDS?

Copies of this survey were mailed to the 355 current members of the SDDS along with the April 1996 *SDDS Newsletter*. One hundred twenty-four surveys were returned as of June 1996. Surveys were included in the results even if not all of the 14 items were completed.

Summary statistics for the absolute value and percentage data are presented with the median, maximum, and minimum range. Results were analyzed using the Wilcoxon signed rank test to compare paired data, and the Mann-Whitney *U* test for comparing independent samples. A p value <0.05 was interpreted to indicate statistical significance.

Results

Three-hundred fifty-five surveys were mailed, of which 124 (35%) were returned. One hundred ten of these respondents were dentists (87%), 10 were orthodontists (9%), and 4 were maxillofacial surgeons (3%). All respondents were SDDS members. Since most respondents were dentists, all practitioners are referred to as dentists for the purpose of this study. Over the preceding year, these dentists evaluated or treated 5% of their total patients (range, 1 to 90%) for either snoring or OSA. These dentists treated a median of 27 patients (range, 2 to 260) with snoring or OSA with OAs over the preceding year. A total number of 3,421 patients were treated with OAs during the study period. Twenty-five different OAs were used and are listed by the number of dentists using a specific device (from highest to lowest). A device is listed only if it is used by more than one dentist: Tongue-Retaining Device™, (Professional Positions, Inc; Racine, Wis), Klearway™ (Great Lakes Othodontics; Tonawanda, NY); Nocturnal Airway Patency Appliance™ (Great Lakes Orthodontics); Herbst™ Appliance (Great Lakes Orthodontics); PM Positioner™ (Dental Services Group; Minneapolis); Snore Guard™ (Hays and Meade, Inc; Albuquerque, NM); Tongue Anterior Positioner™ (Oral Appliance Therapeutics; Dallas); Therasnore™ (Distar, Inc; Albuquerque, NM); Elastometric™ (Great Lakes Orthodontics); Mandibular Repositioning Device™ (Todd Morgan, MD; Escondido, Calif); Silent Night (Lion's Bay, British Columbia, Canada); SNOAR Positioner™ (Micro Labs, Inc; Dublin, Calif); and Snor-no-mor.™ Of the 25 OAs used, only 11 (42%) have been evaluated with studies that include pretreatment and posttreatment NPSG data. The individual efficacy rates for these appliances are cited in a number of review articles.[7-9] These OAs are classified as one of the following four design types and the percentages for each type are weighted according to the number of patients seen annually by each dentist to provide a total for all four device types of 100% (Fig 1).

Dentists adjust an individual appliance 2.5 (range, 0 to 6) times, which is consistent with the frequent use of custom-fit and serially adjustable devices, although the survey did not distinguish the adjustment rates for individual OAs. Dentists observe that 10% (range, 0 to 37%) of patients are unable to tolerate long-term (>6 months) use of an OA. The

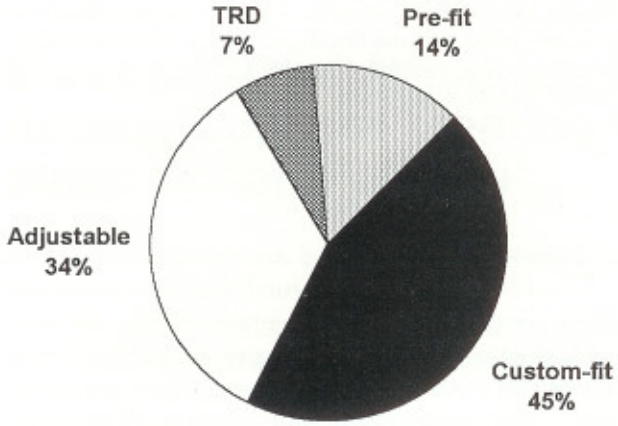

FIGURE 1. Oral appliance types used by dentists to treat patients who have OSA. TRD=Tongue Retaining Device.™

total cost to the patient for treatment with an appliance excluding any reimbursement is $933 (range, $400 to $2,450).

Only 7% of dentists believed that subjective patient reports alone are an adequate substitute for NPSG. Nocturnal pulse oximetry was perceived to be an adequate substitute for NPSG by 37%. Dentists who believe nocturnal pulse oximetry to be an adequate substitute for posttreatment polysomnography are less likely to obtain pretreatment or posttreatment NPSG (Mann-Whitney *U* test, two-tailed; $p=0.001$, $p=0.02$). Pretreatment NPSG was performed in 95% (range, 0 to 100%) of patients referred for snoring or OSA and posttreatment NPSG was performed in 18% (range, 0 to 100%) of known OSA patients. Dentists believe that 70% (range, 12 to 100%) of patients are successfully treated for OSA with OAs, despite the low percentage of posttreatment studies performed. Dentists also believe that 95% (range, 45 to 100%) of patients are successfully treated for snoring with OAs.

DISCUSSION

To our knowledge, this is the first study to evaluate systematically the patterns of practice among dentists using OAs to treat OSA. It is important to evaluate these patterns of practice because dentists are being asked to provide treatment for a medical syndrome, OSA, which if treated inadequately may lead to decreased daytime wakefulness,[10] increased cardiovascular morbidity,[11] and possibly increased overall mortality.[12] Treating OSA patients with OAs requires close cooperation between dentists and sleep disorders physicians; otherwise patients may be unavailable for follow-up or treated inadequately. This study seeks to facilitate closer cooperation between physicians and dentists by identifying potential areas for improvement in this joint approach for treating OSA patients.

It is an encouraging finding that most SDDS dentists do not believe subjective patient reports or nocturnal pulse oximetry alone is adequate to assess treatment response for OAs in OSA patients. Previous studies support the validity of these beliefs.[13,14] The need for objective testing is especially important in nonsnoring OSA patients such as those who have received uvulopalatopharyngoplasty or laser-assisted uvuloplasty prior to being fitted with an OA. Unfortunately, these dentists are unable to "practice what they preach" on this issue since most OSA patients treated with OAs do not receive posttreatment studies. Possible reasons for the lack of posttreatment NPSG were not determined in our study but could include the following: posttreatment NPSG completed but dentist unaware of results; patient does not follow up with sleep disorders medicine physician after receiving OA; sleep disorders medicine physician does not order posttreatment PSG; insurance company or managed-care system denies authorization for posttreatment PSG; patient refuses posttreatment polysomnography.

The ASDA practice parameters for the treatment of snoring and OAs state that posttreatment NPSG is not indicated for mild OSA unless symptoms worsen or do not resolve.[3] However, the definition of mild OSA is not specified in these practice parameters, nor are there widely accepted criteria among sleep disorders physicians for classifying OSA severity. A study by Miljeteig et al[15] of OSA patients who received uvulopalatopharyngoplasty demonstrated that although there was no objective postoperative change in OSA and snoring severity, most patients reported subjective improvement in snoring and sleep quality. A similar disparity between subjective and objective response to treatment may occur in OSA patients treated with OAs. This potential lack of objective treatment response to OAs is made more concerning by the fact that some of the OAs used have not been validated by clinical studies and that individual patient response to a particular appliance is highly variable and often difficult to predict.[16,17] Indeed, a preliminary study by Jamieson et al[18] of a serially adjustable OA suggests that some OSA patients have worsened conditions as jaw protrusion is increased, although these data must be interpreted with considerable caution since this study involved small numbers of OSA patients with severe disease. These findings suggest that objective treatment response as measured by NPSG may be important to measure in individual OSA patients treated with OAs, if the purpose of treatment is to adequately treat possible associated health hazards. The utiliza-

tion of posttreatment NPSG could be enhanced by the application of ambulatory studies with limited montages. These limited montage studies may be cheaper and easier to perform than full NPSG.[19]

The dentists of the SDDS may not be representative of all dentists using OAs to treat OSA. Members of the SDDS receive educational materials, monthly newsletters, and approximately 25% of the members attend an annual national conference that keeps members appraised of new developments and the evolving standard of care for the use of OAs. The patterns of practice for non-SDDS dentists treating OSA patients in the United States is unknown, but may not be up to the standards of the SDDS, in which close cooperation between dentists and sleep disorders physicians is strongly emphasized. It will be important to determine patterns of practice in other groups of dentists, since OSA patients may be treated only by dentists, without the involvement of the sleep disorders physicians. Lack of physician involvement can lead to the failure to recognize and treat medical sequelae of OSA such as hypertension or to the failure to recognize other underlying pulmonary or cardiovascular diseases, which might be mistakenly treated as OSA.

The SDDS dentists use custom-fit mandibular advancement appliances most frequently, although both prefitted and serially adjusted mandibular advancement appliances are also commonly used. There are few peer-reviewed studies directly comparing specific appliances to each other. Thus, it is unclear from studies to date whether custom-fit or serially adjusted appliances are more effective than prefitted appliances. Tongue-retaining devices are used by many dentists, but are used much less frequently than mandibular advancement appliances. Adjustments of an individual appliance are made an average of 2.5 times; however, our study did not determine whether these were made for patient comfort or to maximize OSA treatment. Unfortunately, our study did not distinguish which types of OAs were adjusted, which is an important consideration since individual OAs require different amounts of chair time and subsequent follow-up. Further studies are needed to characterize the methods dentists use to choose and adjust specific devices for individual patients.

A potential flaw of any questionnaire study is that respondents may be biased to answer questions in a manner that is most beneficial to their own interests. This behavior likely occurred with our study, as these dentists believe that most of their OSA patients were successfully treated with OAs. Since posttreatment NPSG is performed infrequently, this belief contradicts the perception of the majority of dentists that subjective reports are inadequate to assess treatment response. A similar bias may exist with these dentists' response that only 10% of OSA patients fail to tolerate OAs after 6 months of treatment. A recent study shows an OA noncompliance rate of 24% for a custom-fit, preformed, preset, single jaw position, "boil and bite" mandibular advancement appliance (Snoreguard™).[4] Preliminary data from a study evaluating the tongue-retaining device found a noncompliance rate of 39% at a mean of 4.5 years after the appliance was dispensed.[20] Compliance rates may be higher with fully custom-made and serially adjustable OAs, although this has not been well demonstrated in the literature to date. Compliance rates are dependent on many factors, including patient comfort and treatment efficacy of OSA and snoring. Reasons for patient noncompliance are not evaluated in our study, but they warrant investigation in future studies.

The cost of OAs in the United States may be more expensive than previously thought. Schmidt-Nowara et al[8] specified a fee range of $400 to $900 for various OAs, although this estimate was made before serially adjustable OAs were available and this may explain the cost differences observed. For SDDS dentists, the median fee approximated the upper range of that estimate. Other cost factors include whether the OA was preformed or custom made, the specific design and material used in manufacturing the OA, and whether patented or nonpatented components are included in the OA. In addition, whether a general dentist or a specialist fits, adjusts, and oversees OAs has direct bearing on the overall cost. However, the median price for OAs is still lower than for most CPAP units. Comparisons of long-term costs for OA and CPAP are difficult, in view of the paucity of data on the long-term durability of OAs.

In conclusion, SDDS dentists' treatment of OSA patients with OAs encompasses a wide spectrum of clinical patterns of practice. Most of these dentists appear to consider NPSG as the preferred technique for diagnosing and treating OSA, although posttreatment NPSG is infrequently obtained. Future efforts at enhancing cooperation between dentists and sleep disorders physicians in the treatment of OSA with OAs should be promoted as a means of standardizing treatment.

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