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Assessing Patient Compliance and Long-Term Outcomes of Oral Appliances in Sleep Apnea Management

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ABSTRACT

Obstructive Sleep Apnea (OSA) was identified as a common chronic sleep disorder causing serious physiological, psychological, and functional impairments; and Oral Appliance Therapy had been developed as an effective alternative to traditional treatment due to its portability, comfort, and patient satisfaction. The objective of this study was to determine the patient compliance and long-term results (both subjective and objective) of oral appliance therapy in the management of sleep apnea by assessing comfort, ease of use, treatment effects, side effects, patient satisfaction, and their association with long term adherence. A quantitative cross-sectional research design was adopted and data were collected with a structured questionnaire from 422 diagnosed patients of sleep apnea. Sample size was calculated using Cochran's formula and Analysis & interpretation of the collected data were done by descriptive and inferential statistics using IBM SPSS Statistics. The findings demonstrated high levels of patient adherence, comfort, perceived treatment effectiveness and long-term health improvement among the individuals surveyed. It was also discovered that patient satisfaction levels were high and had a robust acceptance, coupled with an equally strong positive behavioral intention toward continued use of Oral Appliance Usage. Moderate side effects (gastrointestinal or related to the infusion), and difficulties in adjusting behavior confronted by both patients and staff were reported but had no significant impact on continuing treatment. Results indicated that stronger compliance and perceived effectiveness predicted better long-term health states and quality of life outcomes whilst manageable side effects did not influence sustained use. Oral appliance therapy is a successful and patient-centered treatment option for sleep apnea that has proven to make an important contribution to improved clinical outcomes and long-term compliance when administered under proper direction and continuing follow-up care.

INTRODUCTION

Obstructive Sleep Apnea (OSA) is the most prevalent and persistent form of sleep related breathing disorders, it is characterized by recurrent episodes of partial or total obstruction of the upper airway during sleeping which leads to intermittent hypoxaemia, disrupted sleep architecture and considerable physiological strain occurring in affected individuals (J.-S. Kim & Choi, 2024). It has become an important public health issue due to the high prevalence and association with many systemic complications, including cardiovascular disease, metabolic dysfunction, cognitive impairment, and decreased quality of life (Al-Khansaa Diab, 2023). As a result of the increasing obesity rates, aging populations, sedentary lifestyles and better understanding and testing techniques for OSA sleep apnea is rising to one of the highest challenged termed diseases with millions people affected globally (Ali *et al.*, 2022). It is very prevalent, but many people are undiagnosed or poorly treated, which can lead to increased long-term health problems and higher clinical costs. Depending on the severity and anatomical features of OSA, as well as patient preferences and treatment tolerance, several therapeutic options are available (Beri *et al.*, 2023). Of the interventions currently available, continuous positive airway pressure (CPAP) is

considered the first-line treatment for moderate to severe cases. As such, long-term compliance with CPAP therapy remains an intractable problem due to pain, discomfort, inconvenience (having a device attached to the face) mask failure, claustrophobia noise intolerance and limitations leading to lifestyle activity restriction (Aalaei *et al.*, 2020). Such barriers have led healthcare providers to pursue other treatment options that could provide better comfort and acceptance with the same efficacy. A rising alternative is oral appliance therapy such as mandibular advancement devices (Kang *et al.*, 2024). These are custom-made oral appliances designed to reposition the lower jaw and tongue forwards, with the aim of keeping upper airway open during sleep thus minimizing airway collapse episodes (J.-S. Kim & Choi, 2024). Oral appliances are quickly in the spotlight of sleep medicine due to their portability, simplicity, non-invasiveness, and relatively high patient compliance (Kang *et al.*, 2024). Oral appliances have emerged as a key element in the treatment of patients with OSA, especially those who are unable to undergo or have failed CPAP therapy, using this type of device for the long-term purpose (Agrosamdhya, 2021). Patient-reported outcomes in the context of oral appliance therapy provide important information about the real-world effectiveness and barriers to long term success with

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treatment (Asgary *et al.*, 2018). Though their use for sleep apnea treatment increases worldwide, understanding of the impact of compliance with oral appliance therapy on long term treatment outcomes is lacking (Hamza *et al.*, 2024). Older studies have generally examined clinical efficacy, not drug use behavior and patient-reported improvements in health over a longer time horizon. Thus, this gap in the literature warrants a quantitative study exploring the association between patient adherence and long term outcomes to provide objective information relevant for clinical decision making, treatment planning, and patient education.

From this perspective, the current study entitled aims to review patient compliance with OAT and investigate its impact on long-term health-related, functional, and quality-of-life outcomes in patients diagnosed with sleep apnea. This study will provide important empirical data advancing patient-centered sleep medicine and providing evidence needed to develop more effective OSA long term management strategies.

LITERATURE REVIEW

Obstructive Sleep Apnea (OSA) is the most common type of sleep-related breathing disorder associated with recurrent upper airway collapse during sleep, resulting in intermittent hypoxia, fragmentation of sleep architecture and daytime dysfunction (Aini *et al.*, 2024). Obstructive sleep apnea (OSA) a chronic disease connected with a higher frequency of hypertension, cardiovascular disease, stroke, diabetes and cognitive dysfunction as well as depressive symptoms and work productivity reduction (Md. Halimuzzaman, 2023). The global burden of OSA continues to rise as obesity rates increase, population's age and diagnostic awareness improves. Some earlier epidemiological studies have shown an age- and gender-independent increase in the prevalence of OSA in both men and women, although most affected individuals appear to be overweight, especially middle-aged (Al Muktadir *et al.*, 2019). Despite its increasing burden, effective treatment strategies have been a long-standing goal in sleep medicine for patients with sleep apnea (S.-J. Kim & Park, 2020). Sleep apnea is treated by many therapeutic procedures, which vary in efficacy and success rates such as lifestyle changes, weight reduction, CPAP (continuous positive airway pressure) therapy, positional therapy, surgical intervention, and oral appliance therapy (Ajina *et al.*, 2024). For moderate to severe OSA, continuous positive airway pressure is still the most widely prescribed therapy due to extensive evidence of maintenance of airway patency leading to reductions in apnea-hypopnea events (Rahman *et al.*, 2025). But long-term CPAP adherence is poor due to discomfort, mask-related irritation and noise disturbance, claustrophobia or difficulty travelling with the apparatus or using it in daily life, as reported by many studies (Kamenova *et al.*, 2022). This has generated a demand for alternative treatment modalities that enhance patient comfort and promote long-term adherence. Out of the alternative

treatment modalities, oral appliance therapy has received wide clinical acceptance by practitioners (Ou *et al.*, 2024). Mandibular advancement devices are a type of oral appliance, and they work by keeping the lower jaw and tongue in a forward position to remain open during sleep. They are mainly recommended for patients with mild to moderate OSA and those who cannot tolerate CPAP therapy (Hamza *et al.*, 2024). Literature has shown that oral appliances could benefit the non-invasive treatment options due to their portability, simplicity of use and convenience for patients compared with continuous positive airway pressure (CPAP) (Maideen *et al.*, 2025). Behavioral studies indicate that patients who perceive clear symptomatic improvement are more likely to use these medications continuously. Similarly, educative counselling, frequent clinical follow-ups and individualized appliance adjustments were shown to improve compliance (Barron *et al.*, 2025). Still others show that compliance worsens with a prolonged treatment course, emphasizing the need for longer follow-up. Several determinants have been identified that influence adherence to oral appliance therapy in the literature (Gimenez *et al.*, 2020). The physical comfort still stays the one highly important factor. Other observers have also noted far higher compliance among patients having minimal discomfort and appropriate application, than with subjects complaining of other jaw pain or dental problems (Ojile *et al.*, 2024). Psychological factors are also very important. Compliant behavior may be affected by patient knowledge, anticipation of treatment benefits, and confidence in the therapy and disease severity (Kennedy *et al.*, 2022). Those who are aware of the health implications of untreated OSA tend to adhere better to long-term therapy. The continuity of treatment is also influenced by socioeconomic factors, such as education level, financial capacity to obtain specialized dental care, and healthcare support systems (Ramseier, 2024). Research has also verified that long-term adherence is greater in patients provided with continuing follow-up care and educational reinforcement (Liptak *et al.*, 2025). While oral appliances are often well tolerated, several studies have reported additional side effects which may affect patient acceptance and adherence. Jaw pain temporal mandibular joint peace tooth movement dental sensitivity hyper salivation dry mouth gum irritation bite change (Uematsu *et al.*, 2016).

Short-term side effects are usually mild and can be managed by making changes to the device or adapting gradually. But long-term pain can cause patient drop-out from therapy (Meskill *et al.*, 2023). Longitudinal studies indicate that side effect-related treatment discontinuation can be substantially reduced by regular follow-up appointments and early intervention. Long-term outcomes are an important measure of success in the treatment of sleep apnea (Meskill *et al.*, 2024). Oral appliances can positively affect sleep quality (SQ) under conditions of consistent use, habitual use of your oral appliance has been shown in previous studies to have positive impacts on daytime functioning, cognitive

performance, mood stability and overall improved quality of life (Genovese *et al.*, 2024). Longer adherence has also been linked to reducing cardiovascular risk factors, lower blood pressure and sleepiness during the day, as well as higher work productivity (Curtis Tilves, 2022). Various studies have suggested that using the appliance regularly may lessen healthcare utilization and reduce treatment related stress. The literature also shows that the long-term outcomes can be heterogeneous with respect to patient demographics, disease severity and compliance behavior (N *et al.*, 2025). Patients who sense significant improvements in sleep quality, reduced snoring and daytime energy level are more inclined to refer others to oral appliance therapy and continue treatment over time. Comfort of the device, communication by provider, quality of customization and value of treatment all have large impacts on satisfaction. The objectives of the study are:

- To evaluate patient adherence with oral appliance therapy in patients with obstructive sleep apnea.
- To assess the comfort, convenience and efficacy of oral appliance therapy for the symptomatic treatment of sleep apnea.
- To determine side effects and practical difficulties of patients in using oral appliances.
- To investigate the long-term health effects and quality-of-life benefits of oral equipment use.
- To determine patient satisfaction and its correlation with compliance and success in long term treatment.

MATERIALS AND METHODS

A quantitative cross-sectional approach was used to investigate patient adherence and patient-reported long-term treatment outcomes measures relating to the management of Obstructive Sleep Apnea by Oral appliance therapy in adults accessing sleep clinic, dental hospital and specific respiratory care. The study included a patient population that consisted of all adult participants diagnosed with sleep apnea who had been treated with oral appliances for no less than six months. The main data collection tool was a structured questionnaire developed using five-point Likert scale that measured compliance behavior, effectiveness of treatment, side effects experienced by patients, patient satisfaction and longer-term health outcomes. The sample size was calculated employing the Cochran formula for large populations:

$$n = \frac{Z^2 \cdot p \cdot (1 - p)}{E^2}$$

Where n = sample size, Z = standard normal variate for 95% confidence level (1.96), p = estimated proportion of the population with the attribute being measured (p was presumed to be 0.5 since no prior information needed to be used) and E is margin of error (0.05) (Cochran, 1942). Therefore, the minimum sample size required for a single population proportion was 384 respondents, but to compensate for possible non-response and incomplete questionnaires, a larger number of participants were

approached. Another 10% was added to account for partial responses and non-response bias, resulting in a final target sample of 422 participants. In this study, purposive sampling technique was used to recruit eligible respondents who were meeting the inclusion criteria. Data were collected by self-report questionnaires after taking informed consent from the participants. The collected data were coded, entered and analyzed using IBM SPSS Statistics (version 28), where descriptive statistics, reliability analysis, correlation and multiple regression analysis was performed to find the relations between patient compliance and long-term treatment outcome. Ethical principles such as voluntary participation, confidentiality, anonymity and informed consent were upheld at all stages of this study.

RESULT AND DISCUSSIONS

In this section the quantitative analysis performed in order to evaluate patient adherence and long-term effects following oral appliance therapy (OAT) for treating Obstructive Sleep Apnea (OSA). Data were analyzed using IBM SPSS. Descriptive statistics, reliability analysis, correlation and regression analyses were performed to investigate the relations between variables of the present study. The results are systematically presented following the research objectives, which include demographic characteristics of respondents, adherence to oral appliance use, comfort and ease of use with oral appliances, treatment effectiveness and side effects including adverse events, patient satisfaction, and long-term health outcomes. The results are then discussed in light of past empirical evidence and current theoretical perspectives, offering insight into how compliance with oral appliances affects treatment success and the health-related quality of life in sleep apnea patients.

Demographic Information of the Respondents

The demographic characteristics of the respondents were examined to gain a background profile of this type of patients involved in this study on therapy with oral appliance for conservative treatment regarding Obstructive Sleep Apnea. The demographic characteristics were age, gender, marital status, educational level, occupation, time since diagnosis of sleep apnea and treatment with oral appliance. Final analysis included 422 valid responses. It is important to note that the demographic characteristics of this sample are relevant here, as age, sex (including female hormonal factors such as ovulation), level of education and duration under treatment might play a significant role in terms of tolerance to wearing an oral appliance and other long-term health-related consequences.

Respondents aged 41–50 years accounted for 31.8% of participants, followed by those between 31–40 years (28.0%). The fewest respondents were in the 18–30 year age group (17.1%). This result implies that adult age group in middle ages, afflicts to diagnose and treat sleep apnea more frequently supported by clinical literature showing increased prevalence by old age caused by changes in

Table 1: Demographic Information of the Respondents

Demographic Variable	Category	Frequency	Percentage (%)
Age	18–30 years	72	17.1
	31–40 years	118	28.0
	41–50 years	134	31.8
	Above 50 years	98	23.2
Gender	Male	247	58.5
	Female	167	39.6
	Other	8	1.9
Marital Status	Single	96	22.7
	Married	284	67.3
	Divorced/Widowed	42	10.0
Educational Qualification	Secondary	48	11.4
	Higher Secondary	76	18.0
	Undergraduate	172	40.8
	Postgraduate	102	24.2
	Others	24	5.7
Occupation	Service Holder	164	38.9
	Business	94	22.3
	Self-employed	68	16.1
	Retired	54	12.8
	Others	42	10.0
Duration of Diagnosis	Less than 1 year	64	15.2
	1–3 years	158	37.4
	4–6 years	126	29.9
	More than 6 years	74	17.5
Duration of Oral Appliance Use	Less than 6 months	52	12.3
	6–12 months	114	27.0
	1–3 years	176	41.7
	More than 3 years	80	19.0

airway muscle tone, weight gain and comorbid health conditions throughout life. The higher participation of patients older than 40 years only adds to the statistical significance that long-term management of sleep apnea either improves with age or more attention should be given to those suffering from this condition in this age category. In terms of gender all respondents most identified as being male (58.5%), followed by female (39.6%) and very few opted for other genders (1.9%). This is consistent with previous epidemiological studies that have also reported a substantially higher prevalence of sleep apnea in men, attributable to anatomical, hormonal and lifestyle-related risk factors. Nonetheless, the large number of female respondents indicates an improved awareness and diagnosis among women, which mirrors the growing recognition that gender differences exist in various aspects of sleep disorders. In terms of marital status, the majority among our responders were married (67.3%); followed by single respondents (22.7%); the divorced and widowed constituted about 10.0%. The low rate of unmarried subjects may provide more opportunities

for diagnosis of sleep apnea via behaviorally evident symptoms such as snoring or breathing interruptions, both of which often lead to attention from the partner and medical referral. In conclusion, family support may also promote adherence to treatment and long-term compliance with oral appliance therapy. The broadest level of educational qualification analysis showed that 40.8% of respondents had an undergraduate degree, and the next largest group (24.2%) held postgraduate qualifications. This indicates that well-educated individuals may be more likely to seek a professional diagnosis, comprehend the advantages of treatment, and comply with recommended therapeutic encounters. This suggests that education may be an important factor in health literacy and compliance behavior for those with sleep apnea. In terms of occupation, employees in services (38.9%), business and on-the-job professionals (22.3%) and self-employed workers (16.1%). This might suggest that working professionals who feel daytime fatigue, lose concentration or are unable to be productive because of their sleep apnea will seek ways to get through

the condition. Occupational requirements also may encourage patients to remain adherent with continuous use of oral appliances to enhance daytime productivity. Regarding the clinical history, most of the respondents (37.4%) had been diagnosed with sleep apnea in periods ranging from 1 to 3 years; additionally, 29.9% reported a longer duration period between 4 and 6 years. This demonstrates that participants were exposed to treatment for an adequate period of time to assess long-term outcomes. The periods of oral appliance usage showed a similar pattern with 41.7% and 19.0% of subjects having used the device for 1–3 years, and over three years respectively. Time spent in use is most beneficial for looking at persistent adherence and long-term therapeutic effects since longer durations of assessment increase the likelihood of observing patient adaptation, satisfaction, and health change.

The demographics suggested the sample represented an older, educated and employed group with substantial

treatment experience (Noori, 2022). These traits lay an intensive basis on studying the connection between molecular compliance with that of some terminus outcomes of oral appliance therapy over a protracted period of time.

Oral Appliance Compliance

Compliance of oral appliance was assessed as how much respondent adhered to treatment with prescribed oral appliance therapy in managing Obstructive Sleep Apnea. Compliance behavior was measured using six items: used every night, nightly duration of use during sleep, consistency through travel (travel conflict), and routine integration (established a routine) adherence with medical instructions and missed treatment sessions were avoided. Responses were collected on a scale of 1 to 5 (1 = Strongly Disagree, 5 = Strongly Agree). The mean score and standard deviation were computed to analyze the compliance levels of respondents.

Table 2: Descriptive Statistics of Oral Appliance Compliance Behavior

Statement	Mean	Standard Deviation
I use my oral appliance every night as prescribed.	4.28	0.71
I wear the oral appliance for the entire sleeping period.	4.17	0.78
I rarely skip using the appliance.	4.11	0.82
Using the appliance has become part of my daily routine.	4.34	0.66
I continue using the appliance even while traveling or away from home.	3.96	0.89
I follow my healthcare provider's instructions regarding appliance use.	4.39	0.63
Overall Compliance Score	4.21	0.75

Table 2 shows that there was a good overall level of adherence to oral appliance therapy among respondents with an overall mean score of 4.21 (SD=0.75). Most participants had adequate compliance with prescribed treatment, indicating that OA-T is accepted as a long-term treatment modality for sleep apneic patients. In terms of compliance indicators, the statement with the highest mean score was “I follow my health provider directions about appliance use” (Mean = 4.39, SD = 0.63). This is consistent with earlier findings that show clinician-patient communication and follow-up consultation can improve treatment adherence (Saint-Fleur *et al.*, 2021). Next, the statement “Using the appliance has become routine for me” received the second highest mean score (Mean=4.34; SD =0.66). The result implies that most respondents have achieved integration of oral appliance therapy in their daytime and night-time routines. The assertion “I use my oral appliance every night as prescribed” also produced a high mean score (Mean = 4.28, SD = 0.71), suggesting that respondents tended consistently to habitual nightly compliance. Correspondingly, “I use the oral appliance during the whole sleep time” scored high (Mean = 4.17, SD = 0.78). This implies that the appliance was not only utilized but also continued in use throughout the full sleep cycle, thereby maximizing therapeutic efficacy among respondents. A mean score of 4.11 (SD = 0.82) for the item, “I only rarely do not use the appliance,”

also suggested an acceptance point in line with positive compliance pattern. The lowest mean score observed was for the statement: “I use the appliance while travelling or away from home” (Mean = 3.96, SD = 0.89). While still above the neutral threshold, this suggests potential difficulties in maintaining consistency in treatment when traveling or changing environments. Overall, these findings suggest that participants exhibited a high level of oral appliance compliance; therefore, oral appliance therapy is typically well accepted and implemented into patients’ lives. This finding has been supported by previous literature which suggests that the portability, comfort and ease of use of oral appliances may improve long-term patient adherence as well compared with other forms of SA treatment (Al-Khansaa Diab, 2023).

Comfort and Ease of Use

Comfort and ease of use were assessed based on respondent’s perceptions about the physical comfort, usability and adaptability for oral appliance therapy in managing Obstructive Sleep Apnea. Comfort is one of the key factors for long-term adherence as a patient is most likely to stick with treatment maintaining a proper fit, inflicting little discomfort and weaving into daily life with ease. Comfort and ease of use on five measurement items: appliance fit, sleep comfort, maintenance simplicity, routine compatibility and adaptation to using the device.

Table 3: Descriptive Analysis of Comfort and Ease of Use

Statement	Mean	Standard Deviation
The oral appliance fits comfortably.	4.26	0.69
I can easily sleep while wearing the appliance.	4.18	0.77
The appliance is easy to maintain and clean.	4.31	0.64
The appliance does not interfere with my bedtime routine.	4.22	0.72
I adapted quickly to using the appliance.	4.09	0.81
Overall Comfort and Ease of Use Score	4.21	0.73

Data summarized in table 3 indicate that respondents found the oral appliance therapy to be comfortable and easy to use with a mean of 4.21 and standard deviation of .73. This result indicates that the majority of the subjects reported a positive usability and comfort, which corresponds well with the high compliance written above. The highest mean value (4.31, SD = 0.64) was given to “the appliance is easy to maintain and clean” from all statements contained in the measurement items. This finding is in line with the previous studies which recognized device simplicity and low maintenance as key benefits of oral appliance therapy against more complex treatment alternatives. The oral appliance fits comfortably also produced a high mean score (Mean = 4.26, SD = 0.69) and so the vast majority of respondents reported being satisfied with the physical fit of their devices. In addition, the statement the appliance is not disruptive to my night-time routine scored a mean of 4.22 (SD =0.72) suggesting that participants found it relatively easy to integrate the use of the device into their nightly routine. This indicates that oral appliance therapy introduces minimal change to familiar patterns of sleep. Correspondingly, the following statement “I can sleep very well with the appliance in place” received high mean

values (Mean = 4.18, SD = 0.77). This finding reflects the fact that respondents were not highly disrupted in their sleep with the device. The item with the lowest mean score was “I adapted to using the appliance quickly” (Mean = 4.09, SD = 0.81). While this score remains in above the agreement threshold, it indicates that some respondents would have preferred more time before they felt fully comfortable using the device.

In summary, the results showed that respondents rated oral appliance therapy very high as conferring comfort and convenience, with overall ease of use in everyday life (Paz & Castriotta, 2022). These results parallel the existing data supporting comfort, ease of use, and lifestyle convenience as principal predictors of successful adherence and maintenance therapeutic efficacy in sleep disorders.

Treatment Effectiveness

Treatment effectiveness evaluated respondents’ perspectives on perceived treatment benefit and clinical improvement in symptoms associated with the use of an oral appliance for management of Obstructive Sleep Apnea.

Table 4: Descriptive Statistics of Treatment Effectiveness

Statement	Mean	Standard Deviation
My snoring has decreased since using the oral appliance.	4.42	0.61
I experience fewer breathing interruptions during sleep.	4.29	0.68
My sleep quality has improved.	4.35	0.65
I wake up feeling more refreshed.	4.18	0.77
My daytime fatigue has decreased.	4.24	0.72
The oral appliance effectively manages my sleep apnea symptoms.	4.38	0.63
Overall Treatment Effectiveness Score	4.31	0.68

The results in Table 4 show the list of responses where respondents were asked to indicate how effective oral appliance therapy was in treating their sleep apnea symptoms and the mean± standard deviation of the multiple-choice responses of sufferers rating this treatment highly was a score of 4.31 ±0.68 (table of scores). These findings indicate that participants generally agreed that oral appliance therapy had achieved clinically meaningful changes and that it was helpful for the management of their symptoms. The mean score was highest for the statement “My snoring decreased

since I have had the oral appliance” (Mean = 4.42, SD = 0.61) among all measures taken into account. This finding suggests that the reduction of snoring was one of respondents’ most observable and persistent benefits. The second highest mean score was for the statement, “the oral appliance effectively alleviates my symptoms of sleep apnea” (Mean = 4.38, SD = 0.63). This outcome indicates that respondents tend to take a favorable view of the therapy’s success in controlling key sleep apnea-related symptoms. The high level of agreement reflects great confidence in treatment efficacy and may play an

important role leading to long term adherence.

Patients who feel that their treatment is clinically useful are more adherent and compliant with the recommendations made by practitioners. Likewise for the statement, “My sleep quality has improved,” which received a high mean score ($M = 4.35$; $SD = 0.65$) meaning most respondents found improvement in their sleep continuity and reduction in nocturnal disturbances. The statement: “I have less interruptions in my sleep to breathe” also showed a high mean score (Mean = 4.29, $SD = 0.68$). This result suggests that, while using the appliance, respondents felt they experienced a significant decrease in apnea or hypopnea events. Similarly, the item “My daytime fatigue was low” had a mean score of 4.24 ($SD = 0.72$), as respondents felt they attained healthier energy and less sleepiness during waking hours. The perceived mean score was lowest for “I feel more refreshed when I wake up” (Mean = 4.18, $SD = 0.77$). While this still indicates strong agreement, the slightly lower score suggests not all respondents felt an immediate or sustainable improvement in morning freshness. Oral appliance therapy was considered to be a successful intervention for obtaining relief from sleep apnea symptoms, enhancing sleep quality, reducing daytime fatigue, and improving overall treatment

outcomes. The high performance ratios indicate that physiologic and functional improvements were reported, further confirming the clinical significance of oral devices as a potential long-term treatment alternative.

These results are in line with what has previously been demonstrated in the empirical literature whereby oral appliance therapy can provide significant symptomatic relief even where patients utilize their appliances consistently and receive appropriate clinical support (Wadhawan *et al.*, 2024). The results are consistent with the notion that sleep apnea treatment compliance and long-term therapy outcome is potentially related to (perceived) effectiveness of the intervention.

Side Effects and Challenges

To identify the physical discomforts (from side effects), adjustment problems with OSA and challenges due to treatment, an analysis was performed. Five measurement items were to assess common side effects and treatment-related challenges, including jaw discomfort, tooth discomfort, excessive salivation or dry mouth, impact of side effects on treatment use (e.g. motivation to continue the appliance after adjusted), and difficulties with appliance fitting or adjustment.

Table 5: Descriptive Analysis of Side Effects and Challenges of Oral Appliance

Statement	Mean	Standard Deviation
I experience jaw discomfort while using the appliance.	2.84	1.02
I experience tooth discomfort due to appliance use.	2.67	0.96
The appliance causes excessive salivation or dry mouth.	3.11	0.91
Side effects affect my willingness to continue treatment.	2.43	0.88
I have experienced fitting or adjustment problems.	2.76	0.94
Overall Side Effects and Challenges Score	2.76	0.94

As shown in Table 5, overall mean ($\pm$ SD) about side effects and treatment-related challenges among the respondents was moderate (mean: 2.76 ± 0.94). These results indicate that although some respondents experienced discomfort or adaptation problems during oral appliance therapy, they were typically not severe enough to significantly affect treatment acceptability. The statement Obtaining the appliance causes me to drool or my mouth feels dry scored the highest mean (Mean = 3.31, $SD = 0.91$) on all items measured. Oral moisture imbalance was the most common reported adverse outcome to which respondents exposed. Consistent with this, previous clinical studies have identified changes in salivation as one of the most common yet manageable side effects associated with oral appliance therapy. The statement “I have discomfort in my jaw while using the appliance” had the second highest mean score (Mean = 2.84, $SD = 1.02$). This finding demonstrates mild and moderate mandibular discomfort of some respondents, especially in the time after discharge. Jaw pain in relation to the mandibular advancement position, muscle compensation joint pain sensitivity. Likewise, the mean value of “I have also had difficulty in terms of fitting or adjustment

problems” (mean: 2.76, $SD = 0.94$). A percentage of respondents experienced issues involving appliance fitting, retention, or reactivation. The item of “I have tooth pain when wearing appliance” scored 2.67 ($SD = 0.96$), suggesting that only a few respondents experienced dental sensitivity or pressure-related discomfort, albeit quite low overall Prolonged pressure on teeth by an appliance usually causes tooth discomfort, especially during the adaptation period. The statement Side effects discourage me from continuing the treatment received the lowest mean score (Mean = 2.43, $SD = 0.88$). This is especially important since they noted some (tomatolike) physical side effects but these challenges overall did not lessen their motivation to continue therapy efforts. This result mirrors earlier studies which indicated that patients are willing to accept some relatively small side effects when therapeutic benefits become obvious.

In summary, the results indicate that oral appliance therapy was tolerated without serious side effects mostly and moderate adherence difficulty (Aalaei *et al.*, 2020). Decreased salivation, dry mouth jaw pain and fitting problems were reported by some of the respondents but it was equivalent to less than 20% responses, which didn't

considerably affect treatment continuity and adherence.

Long-Term Health Outcomes

Long-term health outcomes were evaluated to assess any long-lasting benefits in the physical, psychological, cognitive and functional well-being of respondents with Obstructive Sleep Apnea using oral appliance therapy as a

prolonged treatment. Six measurement items were applied to gauge the long-term health improvement reported by respondents regarding their overall health, concentration level about daytime wakefulness, energy level, emotional state, severity of sleep-related morbidity, and long-term health benefits perception.

Table 6: Descriptive Statistics of Long-Term Health Outcomes

Statement	Mean	Standard Deviation
My overall health has improved since using the appliance.	4.29	0.66
My daytime concentration has improved.	4.34	0.63
My energy level has improved over time.	4.27	0.69
My mood and emotional well-being have improved.	4.18	0.75
My sleep-related health complications have decreased.	4.23	0.71
I believe long-term use of the appliance benefits my health.	4.41	0.59
Overall Long-Term Health Outcomes Score	4.29	0.67

Results on long-term health impact of oral appliance therapy The results in Table 4.6 show that respondents had experienced substantially positive long-term health impact from the use of an oral appliance ($M = 4.29$, $SD = 0.67$). Most importantly, this result indicates that the patients themselves felt that adherence to oral appliance therapy has made a significant contribution to their physical health, cognitive proper functioning, emotional well-being and overall quality of life. The highest mean score in the measured items was related to the statement “I think using the appliance for a long time helps my health” ($Mean = 4.41$, $SD = 0.59$). This result suggested that respondents were very confident about the long-term clinical benefit of oral appliance therapy. Next, the only statement that received a higher mean score was “I am better able to concentrate during the day” ($Mean = 4.34$, $SD = 0.63$). Ultimately, this means extended therapy can also lead respondents to experience substantive benefits on the cognition level. Sleep benefits including continuous sleep, higher oxygen saturation at night and fewer awakenings likely improve attention. The high level of agreement among the respondents implies that oral appliance therapy improved actual cognitive performance in their daily lives. In the same way, the statement my general health has improved with the appliance received a very high mean ($Mean = 4.29$, $SD = 0.66$) corresponded to a perception from part of respondents that There were broad improvements in their general health condition. The autobiographical statement “My energy level has improved over time” scored a mean of 4.27 ($SD = 0.69$), reinforcing that people who had more excessive daytime vitality and physical exertion from the beginning have sustained their robust quality of life. Results showed treatment significantly lowered fatigue related limitations and allowed patients to live a more active everyday lifestyle. Similarly, the statement “I have less health problems” related to sleep showed a high mean score ($Mean = 4.23$, $SD = 0.71$). The lowest mean score was on the statement “My mood and emotional well-being are better” ($Mean =$

4.18, $SD = 0.75$). While still showing high agreement, the lower score suggests that improvements in emotional and psychological well-being had a greater individual variance than physical or cognitive outcomes.

The results overall indicate that long-term oral appliance therapy (OAT) is associated with significant and multifaceted health-related benefits in physical function, cognition, vitality, depression, and reduction of sleep-related complications (Bouloukaki *et al.*, 2020). Overall, the findings suggest that positive health outcomes at 5 years may serve to reengage patients in treatment motivation and increased adherence to oral appliance therapy as an effective long-term treatment for sleep apnea.

Patient Satisfaction

Satisfaction is one of the main outcome variables in treatment studies conducted over prolonged periods, as satisfaction reflects patients’ perception of how valuable therapy is, and thus can predict if they will continue receiving treatment or recommend it to others. Increased satisfaction tends to accompany higher rates of compliance, treatment adherence and better long-term health outcomes. Patient satisfaction was assessed with four measurement items (overall satisfaction with treatment, fulfillment of expectations, whether the participant would recommend the therapy to a friend/relative in need of similar help, and long-term use intention).

As shown in Table 7, high patient satisfaction was found with oral appliance therapy, mean score: 4.38 ± 0.62 . This finding indicates that the respondents were very best with treatment results, usability, and total experience of oral appliance therapy in controlling Obstructive Sleep Apnea. For the items that were measured, “I plan to use the appliance long term” received the highest mean score ($Mean = 4.45$, $SD = 0.58$). The very high intention of participants to remain in oral appliance usage after the study protocol often indicates strong endorsement of this result. Respondents scored the statement “I would

Table 7: Descriptive analysis of Patient Satisfaction

Statement	Mean	Standard Deviation
I am satisfied with my oral appliance treatment.	4.36	0.64
I would recommend this treatment to others.	4.41	0.60
The treatment has met my expectations.	4.28	0.68
I intend to continue using the appliance long term.	4.45	0.58
Overall Patient Satisfaction Score	4.38	0.62

recommend this treatment to others” second highest (Mean = 4.41, SD = 0.60). The item “I am happy with my oral appliance treatment” also had a very high mean score (Mean = 4.36, SD = 0.64), reflecting that the patients were relatively satisfied with the overall treatment experience. Likewise, the statement “The treatment has met my expectations” scored a mean of 4.28 (SD = 0.68), suggesting that most respondents were satisfied with treatments that oral appliance therapy had delivered as their initial outcomes. The results indicate a high degree of patient satisfaction with oral appliance therapy, suggesting desirable acceptance, treatment experience and behavioral intention.

The consistency of these results with previous literature suggesting that perceived effectiveness, comfort and ease of use are some basic determinants for patient-reported outcomes with regard to satisfaction, recommendation behavior and continuation intention (Ok, 2023). In addition, the high satisfaction levels that we observed support the premise of oral appliance therapy being an effective long-term management option for patients with sleep apnea.

Findings

- Patients were highly adherent to OA therapy for the treatment of Obstructive Sleep Apnea.
- According to the result, the oral appliances were considered comfortable and easy to use and effective at reducing sleep apnea symptoms.
- The study found moderate levels of side effects and challenges but were not major obstacles in continuing the treatment.
- The study concluded with these key results - the oral appliance therapy was found to make a significant contribution on long-lasting health outcomes and quality of life.
- The study indicated high patient satisfaction rates and positive correlations with treatment compliance and patients’ perception of treatment effectiveness.

Recommendations

- Healthcare providers should promote the use of oral appliance therapy as a safe and effective long-term treatment option for patients with Obstructive Sleep Apnea.
- Adjustments, routine follow-up and patient education can improve comfort, ease of use, and treatment success.
- Clinicians ought to proactively monitor for and manage side effects so as to minimize discomfort and

improve long-term adherence.

- Public awareness programs should be launched to demonstrate the importance of oral appliance therapy in improving the quality of sleep and health outcomes.
- Future clinical practice should aim for enhancing patient-centered care strategies to reinforce long-term satisfaction, compliance and treatment sustainability.

CONCLUSION

Oral appliance therapy is a feasible and an effective clinical treatment for Obstructive Sleep Apnea when not treated with CPAP, exhibiting high compliance rates as well as comfort from patient-reported outcomes. Results showed the majority of patients were adhered to use oral appliance for sleep in addition to marked improvements in sleep quality, daytime functioning, and health outcomes over time. While some mild to moderate side effects did occur, as well as challenges adjusting, these were not severe enough to prevent continuation of use or long-term adherence. Moreover, high levels of patient satisfaction characterized an acceptance of the therapy and favorable behavioral intentions toward continued use. In summary, the study found long-term health and quality-of-life benefits from oral appliance therapy (OAT), given appropriate clinical guidance along with follow-up and education.

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