Title

Passive orofacial myofunctional therapy (OMT) appliance for treating obstructive sleep apnea (OSA): A clinical case report

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Abstract

Current treatment options for patients with obstructive sleep apnea (OSA) include continuous positive airway pressure (CPAP), oral appliance therapy (OAT), behavioural management, and adjunctive therapies which include orofacial myofunctional therapy (OMT). Certain dental appliances used for OMT can be worn at night and include components to encourage proper tongue and lip placement, important components in OMT. This case report describes the use of a passive OMT appliance in the successful management of a patient's moderate OSA.

Keywords: orofacial myofunctional therapy, dental sleep medicine, obstructive sleep apnea

Abbreviations

Continuous positive airway pressure: CPAP

Home sleep apnea test: HSAT

Obstructive sleep apnea: OSA

Oral appliance therapy: OAT

Orofacial myofunctional disorders: OMDs

Orofacial myofunctional therapy: OMT

Sleep breathing disorders: SBDs

Upper airway resistance syndrome: UARS

Introduction

Sleep breathing disorders (SBDs), also known as sleep disordered breathing, are a group of medical conditions affecting more than 15% of the global population. While there are many different types of SBDs, upper airway resistance syndrome (UARS) and obstructive sleep apnea (OSA) may be of particular interest to dentists. OSA is characterized by repetitive partial or complete obstructions in the upper airway, usually along the pharyngeal segment, while maintaining the thoracic effort of breathing and with associated oxygen desaturations and/or neurological arousals. UARS is very similar to OSA but without the oxygen desaturations. For both UARS and OSA, the neuro-arousals have a cascading effect on health and function, with well-established correlations with other chronic conditions including diabetes, hypertension, myocardial infarction, cerebrovascular infarction, dementia, Alzheimer's, daytime sleepiness, etc.

For both UARS and OSA, diagnosis is done through a home sleep apnea test (HSAT). While OSA is defined by an apnea-hyponea index greater than five, UARS is traditionally diagnosed by an HSAT negative for OSA but with respiratory disturbance and a patient experiencing symptoms of daytime sleepiness and/or fatigue. Both UARS and OSA have the same treatment options; continuous positive airway pressure (CPAP), oral appliance therapy (OAT), surgery, weight loss, behavioural management, and adjunctive therapies such as orofacial myofunctional therapy (OMT).

Orofacial myofunctional disorders (OMDs) are correlated with SBDs, with worse OMDs correlating with increased severity of SBDs.[1] OMDs include low tongue posture, lip incompetence, tongue thrust swallow pattern, presence of noxious oral habits, and difficulty with appropriate dissociation of orofacial muscles. OMT used to correct OMDs can result in improvements of up to 50% in patients with OSA.[2-4] It is for this reason that OMT is not considered a primary stand-alone treatment for OSA.

Passive OMT appliances (appliances that sit passively in the mouth to aid in myofunctional therapy, usually to aid specifically in tongue and lip positioning, without components specifically designed for active tooth movement) are a relatively new creation and may provide an interesting treatment option for patients suffering from UARS and mild OSA. Passive OMT appliances encourage a myofunctionally appropriate tongue position and lip competence with minimal mandibular protrusion. While OAT for OSA has traditionally placed the mandible at 50% of maximum protrusion and titrated the jaw anteriorly, recent research indicates that minimal protrusion may be sufficient.[5-7] Minimizing protrusion is important as increased protrusion is correlated with increased risks of side effects such as temporomandibular joint dysfunction, long term changes to the craniofacial structure, dental occlusal changes, and other soft tissue side effects.[7-10] While passive OMT appliances are "stock made" and not designed to be titratable, recent research indicating minimal protrusion may be sufficient in OAT makes the use of passive OMT appliances a potentially appropriate treatment option for patients suffering from SBDs. This is especially so as the components aiding in appropriate tongue positioning may help manage one of the important anatomical points of collapse in the upper airway: the tongue. This means that passive OMT appliances may provide sufficient therapeutic benefit for some patients with SBDs without the costs associated with custom fit titratable appliances used in OAT. In addition, there are significantly decreased risks of side effects commonly associated with protrusive positioning traditionally used in OAT, and faster treatment delivery as the appliances may be held "in stock" rather than having to be custom made.

This case study describes the use of a passive OMT appliance in the treatment of mild/moderate OSA immediately after an initial sleep study, demonstrating the ability for passive OMT appliances to be used in OAT for quick delivery of care and complete index management.

Report of Case

A 32 year old female presented to a dental clinic having been previously diagnosed with OSA by a sleep physician through a home sleep test and with concerns of “tired all the time, yearly colds” and seeking to “feeling rested”. The patient had already declined standard CPAP therapy for OSA. The patient’s primary concerns, in ranked order, were 1) significant daytime sleepiness; 2) frequent heavy snoring; 3) feeling unrefreshed in the morning; 4) back pain; and 5) headaches. The patient reported no medical conditions significant for anemia, asthma, chronic fatigue, poor sleep, muscle aches, minor hearing impairment, gastroesophageal reflux, and previously having experienced a prolonged urinary tract infection resolved several years ago. The patient reported no current medications and/or supplements, though she did report taking acetaminophen or ibuprofen as needed for pain management. The patient reported having a metallic (nickel) allergy. The patient reported sleeping on her back and side, no difficulties with falling asleep, difficulties with staying asleep, waking not feeling rested, and chronic mouth breathing. The patient’s Epworth Sleepiness Scale score was 14, Nighttime Sleepiness Evaluation score was 9, STOPBANG score of 3, and Berlin Questionnaire rating of high risk. Clinical examination showed relatively average mandibular ranges of motion (50mm maximum opening with a 2mm left deflection, 8mm left and right lateral excursion, and 4mm protrusion). The patient had a current dentition status of left and right molar classification of Angle Class 3, an overjet of 1 mm and overbite of 0.5 mm. Based on the collected data, radiographic imaging was taken and sent for review with a medical radiologist who indicated no radiographic findings of significance contraindicating the use of dental appliances.

After discussions on the details pertaining to OAT, including its risks and benefits, the patient elected to proceed with OAT. However, the patient had some concern regarding the wait time related to manufacturing and appliance delivery which was approximated at four weeks and inquired about other treatment options during the wait period. Details pertaining to provisional OAT as well as passive OMT

appliances (Figure 1, their limitations, and American Academy of Sleep Medicine and American Academy of Dental Sleep Medicine practice guidelines) were discussed. Specifically reviewed and emphasized in relation to passive OMT appliances was that, unlike provisional OAT which can be titrated and are tooth borne, passive OMT appliances are not titratable and are tissue born though they do possess components that encourage appropriate tongue positioning and lip seal (components which are not a part of provisional OAT). Also reviewed and emphasized was that passive OMT appliances are not recommended as a replacement for custom fit titratable appliances for OAT. The patient elected to trial a passive OMT appliance during the wait period for her custom fit titratable dental sleep appliance due to the components related to tongue positioning and lip seal, which were in alignment with the patient's personal philosophies related to OMT. Review of the clinical records indicated that the patient would be a potential responder to OAT with minimal protrusion, a vertical range of 3-7 mm, and that the patient had no contraindications for OAT. Based on data collected during the clinical examination, an appropriately sized passive OMT appliance (Myobrace A1, Myofunctional Research Co., Rancho Cucamonga, CA) to hold the appropriate mandibular position was found and provided to the patient to trial. The patient was aware that this was not considered a standard treatment but desired to trial the passive OMT appliance. Due to the nature of this trial, the patient stated she understood the associated risks and agreed to follow up in the event of experiencing any adverse effects.

Results

A home sleep study unit of the same type as the one used for the original diagnosis of the patient's OSA (Figure 2a) by the sleep physician was dispensed on the same day that the passive OMT appliance was provided. Instructions for use included wear of the appliance at nighttime only, rinsing the appliance with water prior to insert and after removal from the mouth, and storing the appliance in a dry container or on a dry surface. Results showed the passive OMT appliance provided excellent

management of the patient's OSA (Figure 2b). Due to the unexpected results of the study and to verify that the results were not due to night to night variability, an additional two night sleep study using the same unit was conducted, with both additional nights confirming excellent management of the patient's OSA (Figure 2b). The patient also reported immediate improvements to her sleep quality (Nighttime Sleepiness Evaluation score of 0), decreased daytime sleepiness (Epworth Sleepiness Scale score of 3), improved vitality, and that her household reported no longer hearing her snoring. Over the following weeks, the patient also noted minimal difficulties with use of the passive OMT appliance, comfortable fit, and ability to maintain the appliance in the mouth through the entire night. The patient noted some limitations however, such as an inability to speak when wearing the appliance, increased salivation, and the need to hide the appliance from her pets. Overall, the patient reported satisfaction with the passive OMT appliance and elected not to proceed with more traditional OAT.

Discussion

The use of passive OMT appliances in OAT for the treatment of SDBs opens new possibilities for quick and immediate treatment for appropriately selected patients. Current American Academy of Sleep Medicine and American Academy of Dental Sleep Medicine practice guidelines indicate that only custom fit, titratable appliances should be used in the treatment of SDB. This is likely due to previous research indicating significant mandibular protrusion was indicated for OAT.[5,6] However, newer research has shown that minimal mandibular protrusion may be sufficient in OAT.[7] These techniques used for mandibular positioning may allow for appropriate selection of passive OMT appliances to be an acceptable alternative to more traditional appliances for OAT. The non-protrusive nature of passive OMT appliances may decrease the risks of side effects commonly associated with traditional protrusive techniques used in OAT, though are unlikely to eliminate the risks of these side effects entirely.[7-10] Furthermore, passive OMT appliances may also include components for appropriate tongue positioning,

which may aid in mitigating the tongue collapsing into the airway during sleep. Further research into the use of passive OMT appliances and specific and appropriate patient selection criteria for their use in OAT is necessary.

Aside from the inherent limitations in any case study, other limitations in this clinical case include the use of HSAT rather than overnight monitored polysomnography and not using multi-night studies to help account for night to night variability in sleep testing. Annual follow up sleep testing to confirm maintenance was also not yet available.

Conclusion

This case report shows the successful use of a passive OMT appliance for OAT in the management of a patient with moderate OSA, reducing the patient's AHI from 16.5 to 3.7 and resolving the patient's chief concerns related to sleep quality and daytime sleepiness. Further research and testing in the possible use of passive OMT appliances for other patients with OSA should be explored, including developing appropriate patient selection criteria and exploring the long term side effects associated with their use.

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Passive OMT appliances may be purchased from distributors of or directly from the following companies: Myofunctional Research Corporation (Myobrace appliances), Orthotain Inc. (Healthy Start appliances), and Vivos Therapeutics (Vivos Growth Guide appliances). The specific appliance in this case

report was purchased from *Vector Diagnostics (https://www.vectordiagnostics.com/) in Ontario, Canada.*

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Figure Legend

Figure 1: Passive oromyofunctional therapy appliance, brand name Myobrace A1 (Myobrace, Myofunctional Research Co.)

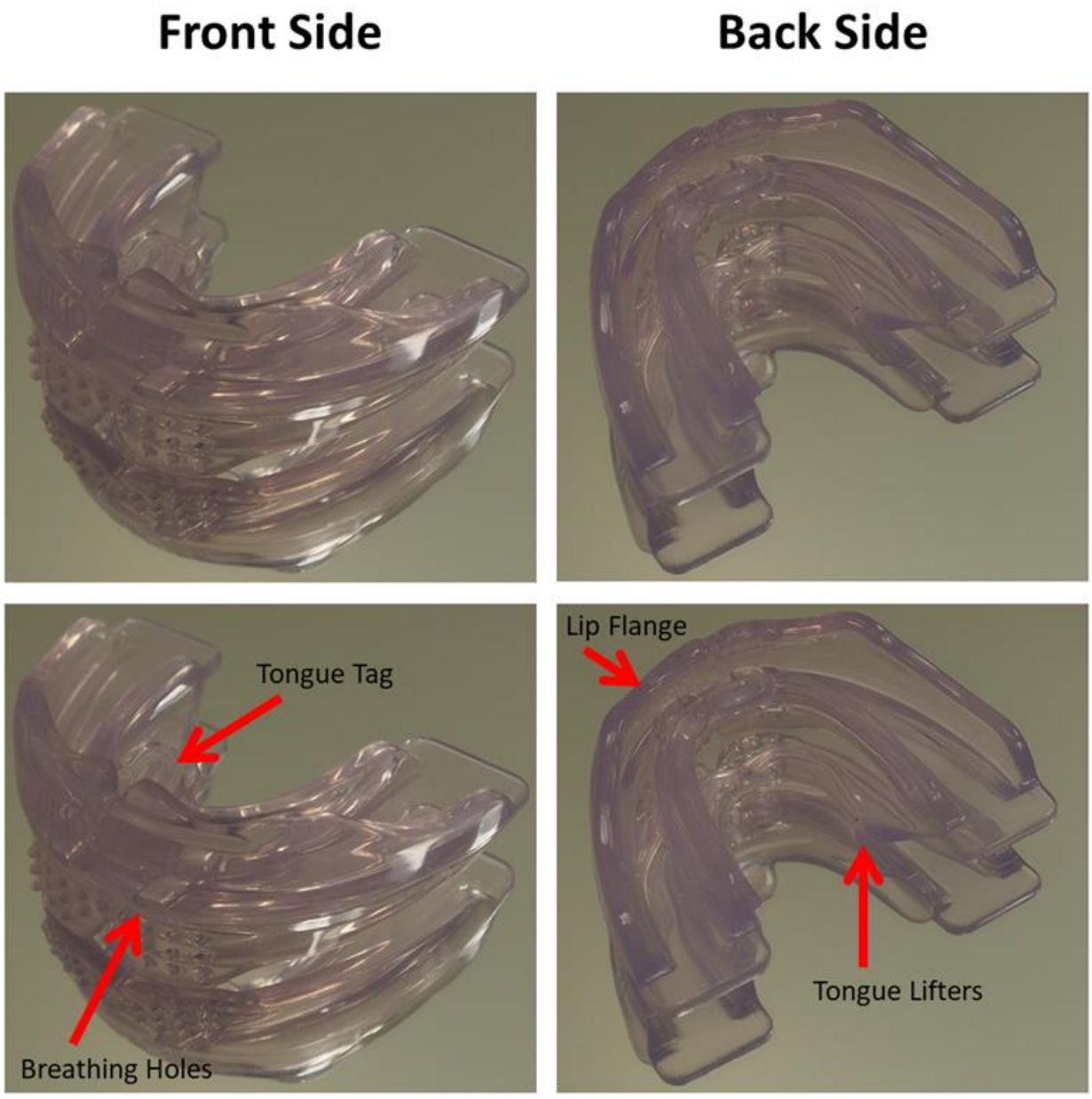

Figure 2: Home sleep apnea testing results indicating a) the patient likely has moderate obstructive sleep apnea, b) excellent management of the patient's obstructive sleep apnea with use of a passive OMT appliance over 3 nights to confirm results were not from night to night variability