

Combining Orthodontic and Sleep Apnea Treatment using Acceleration Techniques

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Abstract

Methods of treatment are now available for patients who need orthodontic clear aligner treatment and have also been diagnosed with Obstructive Sleep Apnea (OSA) and request sleep oral appliance therapy. This can be accomplished most efficiently by correcting malocclusions using clear aligners with the use of high-frequency vibration throughout active and retention phase treatment, while at the same time treating the patient's obstructive sleep apnea with an oral sleep appliance that fits over the clear aligners. Using this process, the patient avoids having to wait for orthodontic treatment to finish prior to treating OSA - a potentially life-threatening condition.

Keywords: Sleep; Sleep Appliance; Oral Appliance Therapy; Complications; Combination Therapy; Aligner Sleep Appliance; High Frequency Vibration; Aligner Seater; Accelerated Orthodontics; Vibration; Accelerated Aligner Exchange

Abbreviations

ASA: Aligner Sleep Appliance; OSA: Obstructive Sleep Apnea; MRD: Mandibular Repositioning Device; CBCT: Cone Beam Computed Tomography; HSAT: Home Sleep Apnea Testing; CPAP: Continuous Positive Airway Pressure; HFV: High Frequency Vibration; AAE: Accelerated Aligner Exchange; TMD: Temporomandibular Disorder; AHI: Apnea Hypopnea Index; MOPs: Micro-Osteoperforations

Introduction

Obstructive sleep apnea (OSA) is a serious sleep disorder that causes cessation of breathing during sleep. It is characterized by collapse of soft tissues in the back of the throat blocking the airway for periods lasting at least 10 seconds. The American Sleep Association reports that 25 million U.S. adults have obstructive sleep apnea [1].

Structural abnormalities predisposing individuals to OSA are reduced mandibular length and retrognathia of the jaw which can cause the tongue to occlude the airway [2]. Treatment options include; 1) constant positive air pressure, (CPAP) which is a loud cumbersome device that requires compliance with use every night to be effective, 2) mandibular repositioning device, which positions the jaw forward preventing airway blockage and surgical correction. Nonsurgical attempts precede surgical interventions typically, yet many patients refuse or cannot tolerate CPAP therapy [3]. For these patients a mandibular repositioning device is recommended. Patients diagnosed with a sleep breathing disorder may need, or already be in orthodontic treatment to correct malocclusions in their dentition. In some patients OSA is directly related to constricted arches and crowded anterior regions. Orthodontically correcting these conditions can allow more room for the tongue and thereby reduce or even alleviate OSA symptoms. However, orthodontic treatment takes significant time and can interfere with sleep appliances. Historically, this has presented a problem, as patients have had to complete their orthodontic treatment before starting sleep oral appliance therapy. This has been concerning to patients and clinicians since diagnoses of obstructive sleep

apnea, or other sleep breathing disorders, represent serious health and potentially life-threatening conditions. Many clinicians are now treating orthodontic malocclusions using clear aligner treatments, and in combination with auxiliary accelerators such as micro-osteoperforation (MOPS) and/or high-frequency vibration (HFV) the orthodontic treatment outcome can be more predictable with treatment time significantly reduced by approximately 60% [4-6]. This case study demonstrates a solution for treating orthodontic deficiencies in conjunction with sleep apnea. The method involves the use of clear aligners with high frequency vibration therapy to expedite treatment and ensure appliances are fully seated, with simultaneous use of an oral sleep appliance specifically designed for use during orthodontic treatment.

Diagnosis and Treatment Plan

Patient presented to the dental office with complaints of snoring, gasping/choking and excessive daytime sleepiness (Figure 1), along with grinding of teeth at times during sleep with lower crowding and unhappy with the disappearing upper smile line and gummy smile. Initial oral exam shows Class I malocclusion with constricted arches, mild vertical excess with excessive gingival display leading to a gummy smile, overjet of 2 mm, over bite of 4 mm, mild crowding at the lower cuspids and First bicuspid, aligned mid-lines, with moderate lingual tori (Figure 2). Overall, patient presented within normal limits of hygiene and oral health. Patient diagnosed with Class I occlusion with lingually inclined posterior upper and lower arches.

SLEEP DISORDER ASSESSMENT

1. Has anyone told you that you stop breathing while asleep? Y (N) 4

2. Have you ever been involved in any type of accident because you nod/droff or fall asleep? Y (N) 3

3. Have you ever nodded off or fallen asleep while driving? Y (N) 3

4. Have you woken up suddenly gasping for air, heart racing or with a sense of breath? (Y) (N) 3

5. Do you grind your teeth? (Y) (N) 3

6. Do you snore or has someone ever told you that you snore? (Y) (N) 3

7. Does anyone in your family have a history of snoring or sleep apnea? (Y) (N) 3

8. Do you feel tired or sleepy throughout the day? (Y) (N) 2

9. Does it take you less than 10 minutes to fall asleep? (Y) (N) 2

10. Does it take you more than 20 minutes to fall asleep? (Y) (N) 2

11. Once you fall asleep, do you have trouble staying asleep? (Y) (N) 2

12. Do you find it difficult to manage your weight? (Y) (N) 1

13. Do you suffer from headaches during the morning or during the night? (Y) (N) 1

MEDICAL HISTORY

14. Have you been diagnosed with high blood pressure or take medication for it? (Y) (N) 3

15. Do you suffer from acid reflux? (Y) (N) 3

16. Do you suffer from heart disease or have you had a stroke? (Y) (N) 3

17. Have you been diagnosed with a sleep disorder? (Y) (N) 3

18. Have you stopped using your CPAP device? (Y) (N) 3

19. Are you wearing your CPAP less than 5 hrs per week? (Y) (N) 3

Please add all the questions you answered with YES and enter the total here → 24

RISK LEVEL	LOW RISK	MODERATE RISK	HIGH RISK	SEVERE RISK
RANGE TOTAL	3 TO 3	4 to 5	6 to 7	8+

Patient Signature: _____

SleepArchiTx FAX 888-388-8178 | diagnose@sleeparchitx.com


Figure 1: Patient's Sleep Disorder Assessment Form by SleepArchiTx.



Figure 2: Patient initial photos.

Initial Treatment

Patient was referred to patient’s medical doctor for sleep study with resulting diagnosis of moderate sleep apnea (Figure 3). Patient refused the use of CPAP and was given a prescription for a mandibular repositioning device. Clear aligners were fabricated and an Aligner Sleep Appliance (ASA) [7] was ordered. Clear aligner treatment was initiated by up-righting posterior teeth and resolving upper and lower arch disharmony. Patient was placed on an accelerated aligner exchange (AAE) protocol using a high-frequency vibration device for 5 minutes daily at bedtime and changing aligners every 5-days (Figure 4). Patient was instructed to wear the Aligner Sleep Appliance (ASA) on top of her clear aligners to improve her collapsed airway during sleep and assist the management of her OSA. A morning bite repositioner was used to help return the patient’s mandible back to centric position (Figure 5).



REST Diagnostics | 15423 Creek Bend Dr., Sugar Land, TX 77478
Independent Testing Facility | NPI: 1134587629

HOME SLEEP APNEA TEST REPORT

Patient Name: Suzanne	Ordering Provider: P. Ataii, DMD		
Date of Birth: 11/6/1966	Night 1 Date: 1/29/2018		
Ht: 5'7" Wt: 190	Device Type: ARES WATERMARK		
BMI: 30	Neck Circumference: 15 in.		
Epworth Score: 10			

	Overall AHI	% time < 90% SpO2	Minimum SpO2
Night 1:	7	0.6	81%

CLINICAL HISTORY: Ms. Suzanne is 51 years old with a history of snoring and gasping symptoms during sleep, Bruxism, acid reflux, and daytime hypersomnolence. Two nights of Home Sleep Apnea Tests (HSAT) were ordered to assess this patient’s respirations during sleep.

SLEEP STUDY FINDINGS (NIGHT 1): The total valid recording time of the study was 7 hours. Based upon 4% hypopnea desaturation criteria there was a mild degree of OSA recorded (AHI 7/hour). Loud snoring was recorded. Analysis of oxygen desaturation during the night revealed a mean SpO2 of 96%, with a SpO2 < 90% for 0.6% of the total recording time, and a minimum SpO2 of 81%.

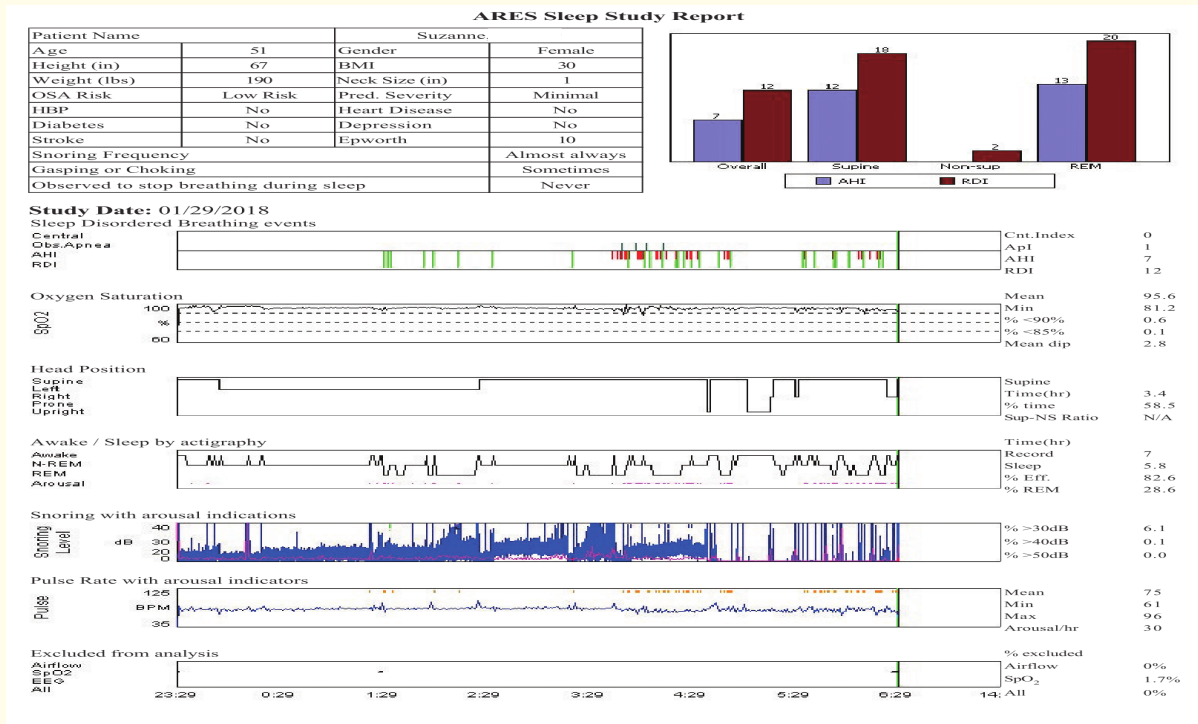


Figure 3: Sleep study baseline.



Figure 4: Vibration during clear aligner orthodontic treatment.



Figure 5: Bite reprogrammer and positioner.



Figure 6: Patient with clear aligner retention and Vibration.

Follow-up

In keeping with practice parameters, a follow-up sleep study was conducted to confirm the efficacy of the sleep appliance during the OSA treatment stages [8]. Subsequent sleep testing confirmed a reduction of the apnea-hypopnea Index (AHI) and improvement of the OSA within the first few weeks of wearing the sleep appliance while continuing the accelerated aligner exchange protocol using the high-frequency vibration device. After approximately 6 months of combination therapy, the crowding and inward angulation of teeth in the patient's lower posterior arches was resolved and patient continued to wear the ASA nightly while sleeping (Figure 7). A follow-up CBCT with the aligner Sleep Appliance in the patient's mouth to evaluate TMD and airway comparison demonstrates improved airway (Figure 8A and 8B).



Figure 7a: Aligner Sleep appliance with Clear Aligner Retention.



Figure 7b: ASA

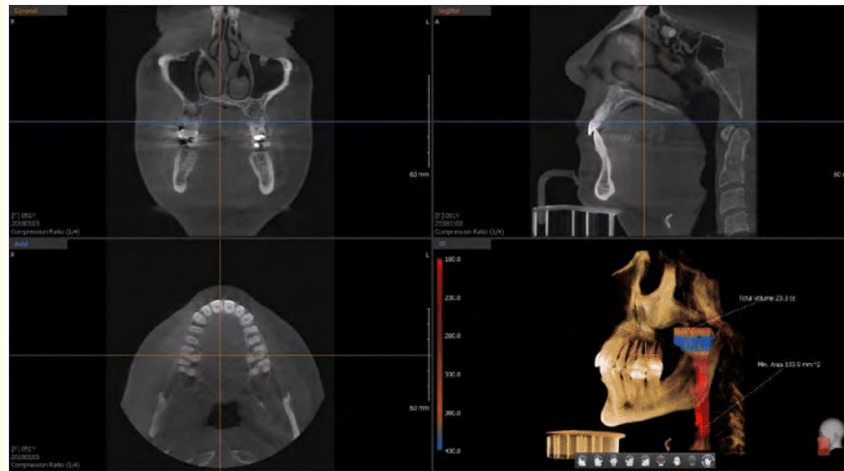


Figure 8A: Patient CBCT without ASA.

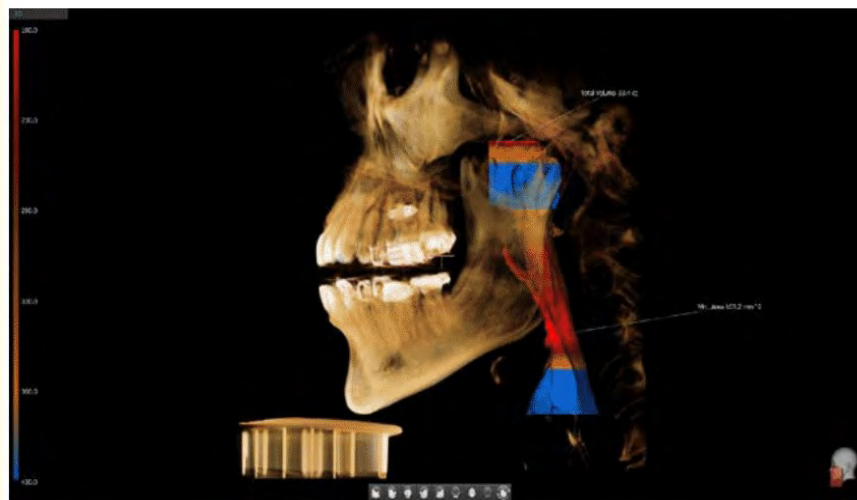


Figure 8B: Patient CBCT with ASA.

Retention Phase and Long-term follow-up

Normal follow-up and standard titrations were performed for 12 months following delivery of final retention. Patient was advised to continue using the high-frequency device in retention for 2 months at 5 minutes per day directly on the removable acrylic retainer prior to the placement of the ASA to help with bite stabilization and post-orthodontic retention bone density (Figure 9). This recommendation is based on the demonstrated increases in bone volume and bone density high-frequency vibration delivers in the absence of orthodontic force [9-11]. Patient reported that her symptoms related to obstructive sleep apnea had resolved with consistent use of the sleep appliance and corrected malocclusion. Patient intra oral and extra oral exam presented with stable occlusion and no skeletal changes.



Figure 9: High-Frequency Vibration 30 sec daily post retention.

Discussion

The patient's condition required both orthodontic movement as well as continuous treatment of obstructive sleep apnea. Due to patient's sleep apnea and lack of tolerance for CPAP, an oral mandibular repositioning device (MRD) was needed. However, wire and brackets can interfere with MRD sleep apnea treatment, therefore the combination therapy of clear aligners and the Aligner Sleep Appliance was chosen (Figure 10 and Figure 7). Given the difficult tooth movements, and desire to complete treatment as quickly as possible, high-frequency vibration was recommended. The high frequency device maximizes aligner seating and stimulates increased bone remodeling to expedite treatment [5]. Additionally, I recommend use of the high-frequency device to ensure compliance with therapy based on patients reports of reduced discomfort associated with accelerated aligner exchange protocols.



Figure 10: Patient with Aligner Sleep Appliance (ASA).

This case demonstrates a technique of accelerated correction of malocclusions using clear aligners and high-frequency vibration therapy while using the Aligner Sleep Appliance to simultaneously manage the patient's sleep disorder. Optimal and efficient treatment outcome(s) were delivered through concurrent treatment using combination therapies.

Conclusion

Treatment methods are now available to resolve minor tooth movements and manage sleep disorders simultaneously with the use of Aligner Sleep Appliance (ASA). Usage of high-frequency vibration and aligner seating tools and can be helpful in driving successful outcomes, especially when complicated tooth movements and expedited treatment is necessary.

Acknowledgements

Aligner Sleep Appliance (ASA) discussed herein is commercially available device exclusively distributed by SleepArchiTx USA.

The high frequency device discussed herein is the commercially available device manufactured by Propel Orthodontics LLC USA.

Conflict of Interest

Dr. Ataii is a co-inventor of the Aligner Sleep Appliance and a consultant to Propel.

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