Patient ES

SYNOPSIS:

INTRODUCTION:

This patient was a 38-year-old Caucasian male (02/11/1981) with chief complaint of loud and continuous snoring, but also felt sleep deprived. He initially consulted his general medical practitioner regarding his symptoms, who referred him to a sleep physician. After undergoing a sleep study Mr ES was diagnosed with severe obstructive sleep apnoea/hypopnea. His sleep physician recommended a trial of CPAP as the primary therapy however this was declined. The patient sought mandibular advancement splint (MAS) via referral elsewhere as it was not offered to the patient as an alternative therapy. He presented to me for consultation on 09/03/21. Epworth Sleepiness Score 3/24, STOPBANG 3/8.

CHIEF COMPLAINT:

The patient's chief complaint was snoring which also disturbed his partner's sleep and was rated 6/10 on as being moderately loud on a Numerical Rating Scale (NRS). There were no reports of witnessed apnoeic events. Secondary complaint was that of feeling sleep deprived. He reported feeling low in energy and unable to exercise and feeling somewhat agitated and exhausted at work most days. Mr ES experienced some lethargy and mild drowsiness with sedentary activities during the day with office work and early evening. As a result, he felt his general motivation levels were low. He also expressed a mild mood disturbance (depression) and was taking antidepressant for 10 years.

HISTORY OF PRESENT ILLNESS:

The patient has complaint of his snoring for a number of years and his wife reported its progressive worsening. However, he did not suspect obstructive sleep apnea as he felt he was physically in good shape. An Internet search and an intrigued curiosity lead to suspected obstructive sleep apnoea and confirmed by diagnosis. Sleeping in different positions did not diminish the complaint of noise or symptom of poor sleep and tiredness however it was worse in the supine position. Unfortunately, he did try a boil and bite appliance but was not able to tolerate for extended periods due to being dislodged and uncomfortable. An ambulatory study was completed on the 9th November, 2020 and this revealed an RDI of 40.6/hr and AHI of 38/hr and the lowest oxygen saturation concentration of 84%. CPAP was recommended but this was of no interest to the patient; it was not pursued or trialled but outright declined. Additionally, his wife was averse to the proposition and encouraged him to pursue MAS at another clinic as such patient ES sought referral elsewhere via his general practitioner. The over-the-counter device relieved the complaint of snoring; it did reduce the noise and proved to be a good test of MAS suitability and he presented wanting something more comfortable and permanent. ES had seen an ENT and had been referred elsewhere with suggestion of different device selection (Prosomnus).

PAST MEDICAL HISTORY:

Mr ES weighs 91.0kg and is 184cm tall and has a BMI of 26.9 He has mild depression (escitalopram) and allergic rhinitis which is well controlled pharmacologically. There is no history of motor vehicle accident; he reports being able to sleep in any position without restriction. Hypertension 136/90

CLINICAL AND RADIOGRAPHIC EXAMINATION:

The patient had no missing teeth and presented with sound oral hygiene. There were no periodontal pockets (CPITN 000 010). ES originally had a Class 2 dental occlusion that was orthodontically corrected in the upper arch. Midlines were not coincident and were out by 1mm; mandibular displacement/shift could not be detected. There was a flat curve of spee with an overjet 5mm and overbite 4mm with incisors proclined and fixed palatal bonded retainer. On lateral excursion, canine guidance was in group function; 48 was in posterior crossbite and all third molars were erupted into functional occlusion. His maximum mouth opening was 50mm, right lateral excursion 7mm left lateral excursion 7mm and he was able to protrude 6mm (total maximum mandibular protrusive range 10mm). There was no masticatory muscle or TMJ tenderness or pain upon palpation or function however clinical signs of bruxism (attrition) were evident. There was no clicking, deviation or deflection noted. He had a large tongue with a normal soft palate and medium sized uvula and had tonsils present (grade 2) Friedman grade 2 malampatti 2. There were no soft tissue lesions noted and oral mucosae appeared hydrated with salivary flow evident. Radiographs were not indicated. Some posterior teeth (15, 25 and 36) were heavily restored.

DIAGNOSIS: Home sleep test (ambulatory polysomnogram) on the 9th of November, 2020 revealed severe obstructive sleep apnoea/hypopnea and fragmented sleep and decreased REM proportion (5%). His RDI was 40.6/hr and oxygen nadir 84% (ODI 24.7/hr) His obstructive sleep apnoea had no positional element. Overall AHI was 38/hr and RERA 3.1/hr.

RATIONALE: a Somnomed Avant mandibular advancement appliance was chosen due to the preference of supine sleeping (device is attached and provides lip closure) and ease of use with mild lateral bruxism and relatively straight and upright teeth (flat curve of spee) the hybrid medial propulsion was suitable for this dental configuration. There was a slight concern on the patient's part regarding orthodontic stability. The patient was motivated and capable of understanding the titration mechanism although was concerned that the connecting band would stretch nonetheless was reassured that it was there to connect and attach upper and lower rims. It also allowed a small amount of mouth opening should that be required in the event of mild nasal obstruction.

The (acrylic) 3D printed appliance could easily be reprinted should there be any additional dentistry or modification with veneers or crowns. The starting treatment position was 5 mm out of a possible 10 mm (50%)

RESULTS: Patient reports subjective improvements in sleep parameters prior to objective sleep assessment. The success of the appliance was initially compounded by hesitation of device usage and it being a little firm to the teeth particularly in the maxillary incisor region although this did not interfere with daily life. However, after minor adjustment with warm water (20 minutes prior to usage in the evening) patient was able to cope with the appliance which led to large improvements in subjective symptoms.

Laboratory treatment polysomnogram (MAS in situ) was completed on 20th July, 2021. The treatment sleep study revealed an AHI of 1.9/hr and lowest oxygen saturation of 92%. Patient did not sleep supine in this study and therefore no REM sleep in supine position was recorded. However, REM proportion increased from 5% to 17%. ODI reduced to 1.1/hr.

He was recommended to continue wearing the appliance nightly at the current treatment position which was 9mm out of total 10mm (90%)

DISPOSITION:

A treatment sleep study was completed on the 20th July, 2021 which was analysed by a sleep physician. It confirmed the success of the appliance with the physician stating there was objective improvement in his AHI with a reduction of 46/hr to 1.9/hr apnoea/hypopneas per hour of sleep and no significant side effects. Sleep was generally consolidated and no significant respiratory events or desaturations were demonstrated. Given his improvements in his symptoms (snoring, decreased morning tiredness, daytime somnolence, sleep disturbances) and objective reduction of AHI, he was recommended to continue using his MAD to manage his obstructive sleep apnoea. The sleep physician scheduled no further reviews with him.

FOLLOW UP VISITS

Patient DOB: 02/11/1981
Initial Consult: 09/03/21
Appliance insert: 04/05/21

DOS: 22/06/21

Subjective: Patient has a history of severe obstructive sleep apnoea and presents for his one month follow up with the use of his Somnomed Avant mandibular advancement device. Medical history, family history and social remains unchanged. No significant weight change is reported. Patient reports that his snoring is 100% improved with the use of the device. Patient awakens feeling refreshed with more energy, consistently and can function well at

work. The main side effect reported is mild discomfort of maxillary anterior teeth in the morning which possibly half an hour. Patient reports this does not interfere with eating and does not find it bothers him. He continues to use the device all night every night without any issue and overall feels more energy and improved mood throughout the day.

Objective: General appearance remains unchanged there was no masseter tenderness and no TMJ pain. Maximum mouth opening remained unchanged at 50mm. Right and left lateral excursions remain the same at 7mm and protrusion occlusion remained the same and there was no bite change or teeth mobility. There was no clicking, deviation or deflection noted. Intraorally no abnormalities were noted in any of the soft tissues. Appliance was titrated to band 4, 9mm out of a possible 10mm and was mechanically sound and clean. Maxillary anterior teeth were not tended to percussion or sensitive upon testing.

Assessment: Snoring reportedly resolved and there were improvements in subjective scores as stated above obstructive sleep apnoea has subjectively improved with oral appliance therapy. Confirmation of oral appliance success will need to be objectively tested with a treatment sleep study.

Plan: Recommended patient to continue wearing the appliance nightly and continue to do jaw exercises in the morning as per video from the AADSM. I do not recommend any further band change and lateral elastic retention was not required. No adjustment was made to the device and as per the physician's request, diagnostic sleep study was requested at one month later. A follow up was scheduled in 2 months.

DOS 18/08/2021

Subjective: Patient has a history of severe obstructive sleep apnoea and presents for three month follow up using Somnomed Avant mandibular advancement device. Medical history, family history and social remains unchanged. No significant weight changes reported. Patient advised a sleep study was completed, which confirmed the success of the appliance. Patient continues with jaw positioning exercises as per AADSM and reports no symptoms of joint stiffness or jaw repositioning issues; favourable noise reduction via spouse is confirmed. Patient awakens feeling refreshed and experiences no midday lethargy and can function at work quite well. There are no issues reported with device comfort or usage; patient reports full time adherence of 7.5hours and 7 nights/week.

Objective: General appearance remains unchanged. There was no masseter muscle or TMJ pain. Maximum mouth opening remained unchanged at 50 mm. Right and left lateral excursion has remained unchanged at 7mm and 7mm, respectively. Protrusion remains the same at 10mm total range. There was no clicking, deviation or deflection noted and occlusion has remained the same; there were no bite changes or teeth mobility. Intraorally no abnormalities were noted in any of the soft tissues. Appliance was titrated at 9 mm out of 10mm (90%) and is mechanically sound and cleaned well.

Assessment: Obstructive sleep apnea has improved to an AHI of 1.9/hr as confirmed by objective testing, including increased REM proportion from 5% to 17% total sleep time (TST).

Plan: Recommended patient to continue wearing the appliance nightly as this treatment position. Follow up was scheduled for 6 months.

DOS 07/05/2022

Subjective: Patient has a history of severe obstructive sleep apnoea and presents for 12 month follow up using Somnomed Avant mandibular advancement device. Medical history, family history and social remains unchanged. No significant weight changes reported. Patient continues with jaw positioning exercises and reports no symptoms and reports favourable noise reduction via spouse. Patient awakens feeling refreshed and experiences no midday lethargy into can function at work quite well. There are no issues reported with maxillary arch rim as was in the past and device. Sleep with positional therapy (lego bricks in pyjama shirt).

Objective: General appearance remains unchanged. There was no masseter muscle or TMJ pain. Maximum mouth opening remained unchanged at 50 mm. Right and left lateral excursion has remained unchanged at 7mm and 7mm, respectively. Protrusion remains the same at 10mm total range. There was no clicking, deviation or deflection noted and occlusion has remained the same; there were no bite changes or teeth mobility. Intraorally no abnormalities were noted in any of the soft tissues. Appliance was titrated at 9 mm out of 10mm (90%) and had been been modified on the fitting surface by dentist and endodontist.

Assessment: Obstructive sleep apnoea is well controlled with AHI reduced from 38/hr to 1.9/hr as confirmed by objective testing, with improved REM proportion from 5% to 17% of total sleep time.

Plan: Recommended patient to continue wearing the appliance nightly at this treatment position. A follow up was scheduled for 3 months. In the interim period, endodontic treatment and full coverage restoration of teeth 15 and 47 will be undertaken and device will be replaced with a new digital scans and 3D printed device of the same configuration.

Summary: this case is an example of that commonly seen in the practice of dental sleep medicine. Although the case was indicated for a trial of CPAP, the patient's own trial of (non-customised) MAD led to the pursuit of preferred therapy. This is also demonstrates that severe apnoea cases can succeed with MAD and have good control of AHI. Further research is indicated in the area of case selection and suitability of MAD for reduction of AHI

ResMed

Home Polysomnography Sleep Study Report

Patient Name: ES	**1981**
Date of Birth:	**26.9 kg/m^2**
BMI:	**Prof Thomas Havas**
Referring Physician:	**9/11/2020**
Date of Study:	

Specialist Comments:

overnight diagnostic sleep study showed fragmented sleep architecture with normal sleep efficiency. Sleep latency was longer than average. Decreased quantities of REM were observed and sleep was predominantly observed in the left lateral position.

The sleep study shows severe obstructive sleep apnea. This consisted of a Respiratory Disturbance Index (RDI) of 40.6/hr [normal<5/hr]. The overall Apnea Hypopnea Index (AHI) was 38.0/hr. Obstructive apneas were not exclusively seen in REM sleep.

Respiratory events were associated with mild to moderate oxygen desaturation, an oxygen nadir of 84.0% and the desaturating event index was recorded at 24.7/hr.

Snoring was moderate.

The patient reports normal levels of sleepiness as noted on their **Epworth Sleepiness Score (3/24).**

The ECG showed sinus rhythm throughout the night, with an average heart rate of 62bpm.

Conclusion and Recommendations:
A trial of CPAP should be considered for this severe degree of OSA.

Thank you for referring this patient for testing.

Professor David Barnes MBBS (Syd), FRACP, FCCP
Consultant Respiratory and Sleep Disorders Physician
Provider No: 049006HW

This Sleep Report has been written by an independent Sleep Physician following analysis of data from a home polysomnogram, review of referral request and completion of pre-test clinical evaluation including medical and symptom history, performed by a Sleep Therapist under the guidance of the Sleep Physician. If the patient has discrepant symptoms from the study result, or fails to respond to therapy, then referral to a Sleep Specialist for consultation may be indicated.

Name:		**DOB:**		**Weight:**	91.0kg
Gender:	Male	**Age:**	39	**Height:**	184.0cm
Commercial License:	no	**ESS:**	3	**BMI:**	26.9 kg/m^2
		Stop Bang:	3		

SLEEP SUMMARY:

Study Date:	9/11/2020	Stage 1:	44.5mins	11 %	[Norm = 1 - 5%]
Start Time:	10:25 PM	Stage 2:	265mins	64 %	[Norm = 40-55%]
Recording Time:	10.0hrs	Stage 3:	82.5mins	20 %	[Norm = 20-35%]
Time in Bed (TIB):	511.5mins	REM:	19mins	5 %	[Norm = 15-30%]
Sleep Latency:	33.3mins			TOTAL	INDEX
REM Latency:	401.5mins	RERA:		21	3/hr
Total Sleep Time(TST):	411mins	Respiratory Arousals:		256	37/hr
Awake Time (WASO):	100.5mins	SpontaneousArousals:		48	7/hr
Sleep Efficiency:	75%	**TOTAL Arousals:**		325	**47.4/hr**

RDI:	**40.6 /hr**	Respiratory Disturbance Index
AHI:	**38.0 /hr**	Apnea Hypopnea Index
RERA:	**3.1 /hr**	Respiratory Effort Related Arousals

RESPIRATION STATISTICS:

	Number	Index	Mean [seconds]	Supine Index	Non-Supine Index	REM Index	NREM Index
Apnea	4	1	18.2	0	1	0	1
Obstructive	0	0		0	0	0	0
Central	2	0	16.2	0	0	0	0
Mixed	2	0	20.1	0	0	0	0
Hypopnoea	256	37	22.4	99	10	9	39
TOTAL	**260**	**38**	**22.3**	**99**	**10**	**9**	**39**

Position	Time/ %TST
Supine	31%
Prone	16%
Left	39%
Right	14%
Upright	0%
Unknown	0%

OXYGEN STATISTICS:

Baseline Awake SpO2:	96 %
Average NREM SpO2:	91 %
Average REM SpO2:	92 %
Average O2 desaturation Sleep:	4 %
Nadir Spo2:	84 %

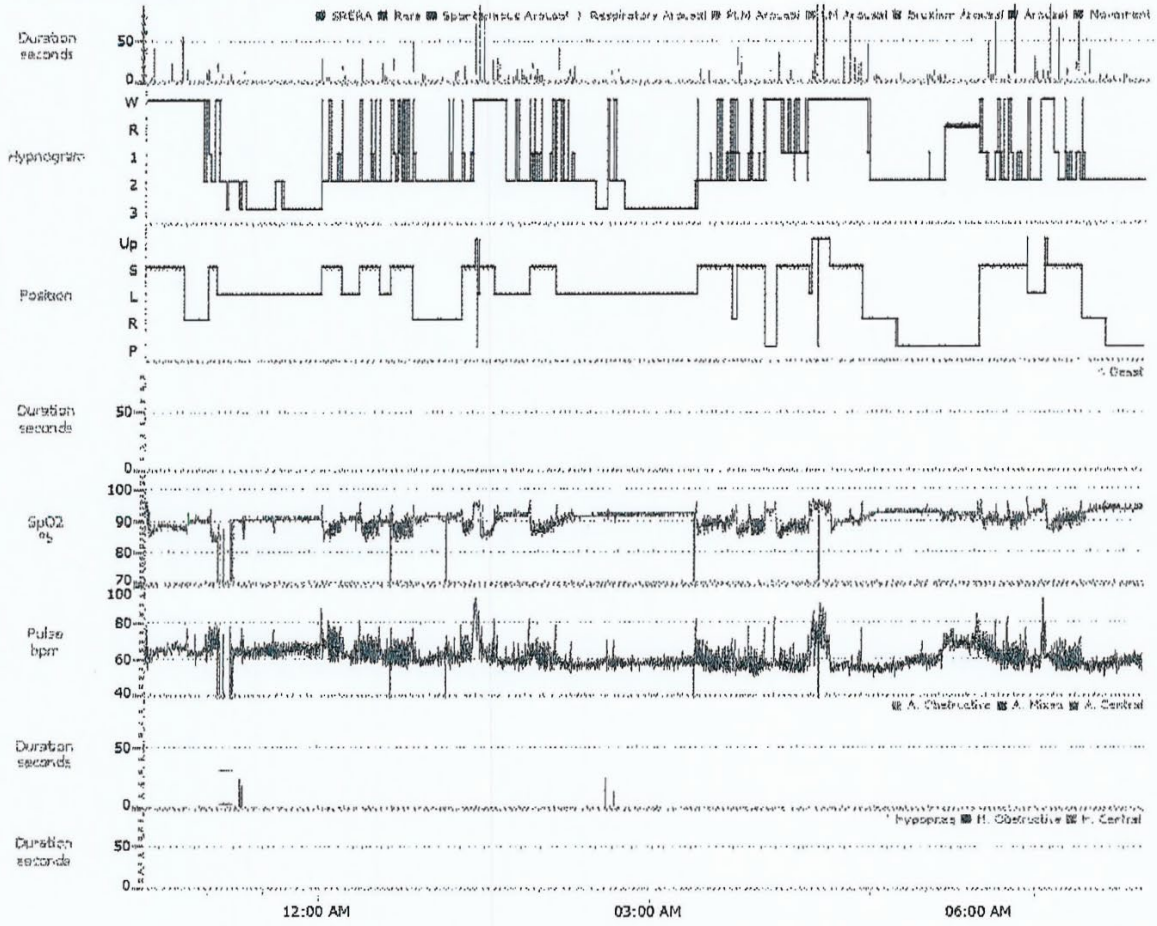
Saturation < 89%	46.3 mins	11 %
Saturation < 79%	0.1 mins	0 %
Saturation < 69%	0.1 mins	0 %
Oxygen Desaturation Index:		**25 /hr**

PULSE & SNORE STATISTICS:

Average HR:	62 bpm
Min HR:	51 bpm
Max HR:	89 bpm

Snoring Time:	139.7mins	34 %
Snoring Episodes:	135	
Average Duration:	1mins	

SUMMARY GRAPH:



Device: Nox A1
Signals Recorded: EEG, EOG, ECG, EMG, Thoracic & Abdominal Effort (RIP), Position, Audio (Snoring), Pulse Rate & Waveform, Nasal pressure, calRIP Flow, Ambient Light, Oxygen Saturation (+/- additional signals)
Scoring Criteria: Hypopneas: ≥ 10sec events with ≥ 30% reduction in airflow/effort associated with at least 3% desaturation or arousal. Apneas: ≥ 10sec events with complete cessation of airflow.
Epworth Sleepiness Scale (ESS): A short questionnaire which determines the likeliness of the patient to doze off or fall asleep in certain situations. Score is out of 24.

Patient ES MAS in situ study **Patient ID:** 20663

WOOLCOCK
LEADERS IN BREATHING & SLEEP RESEARCH

Study Date: 20/07/2021

Study Type: Diagnostic

Requesting Physician: Dr Yizhong Zheng
Referring Physician: Dr Amy Huynh

DOB (dd/mm/yyyy): 1981
Height (cm): 184
Weight (kg): 90
BMI (kg/m^2):26.6
Neck Circumference (cm): 37
Subjective Sleep Latency: 20 mins
Subjective Total Sleep Time: 6.5 hours
Subjective Sleep Quality: same as usual

Gender: Male
Evening BP (mmHg):133/89
Morning BP (mmHg):108/61
Snoring:
ESS: 03/24

Methodology

The patient underwent polysomnography study using the Compumedics Grael v2 PSG system with Profusion scoring software. The data was adequate for interpretation and the raw data was reviewed in its entirety. Scoring was based on the Recommended Standards and Specifications as outlined in the AASM Manual for the Scoring of Sleep and Associated Events, Version 2.2.

Summary

Sleep Architecture

Time available for sleep (min)	= 472.0	Sleep latency (min)	= 25.0
Total sleep time (min)	= 374.0	REM latency (min)	= 146.0
Wake after sleep onset (min)	= 73.0	NREM sleep (min)	= 310.5
Sleep efficiency (%)	= 79.2	REM sleep (min)	= 63.5

Respiratory, Movement and arousal events*

Total RDI (events/hr)	= 1.9	Minimum SpO_2 (%)	= 92
Total AHI (events/hr)	= 1.9	ODI (desat/hr)	= 1.1
RERA index	= 0.0		
RDI in NREM (events/hr)	= 1.5		
RDI in REM (events/hr)	= 3.8		

Limb Movement (Movement/hr)= 14.6

Total arousal index (arousals/hr)= 16.0 Limb arousal index (arousals/hr)= 5.0

WOOLCOCK
LEADERS IN BREATHING & SLEEP RESEARCH

Patient ID: 20663

Interpretation

***Scorer's Comments*:**
No abdominal effort trace all night, all other channels delivered optimal signals.

Sleep Physician's Report:
Technical comments noted. PSG performed with MAS in situ. Sleep is generally consolidated, and all stages of sleep are demonstrated. No supine sleep recorded. REM latency is prolonged. No significant respiratory events or desaturations. Intermittent limb movements during NREM sleep are not associated with significant arousals. ECG in sinus rhythm

Conclusion & Recommendations:
No significant sleep disordered breathing with MAS in situ.

Yours sincerely

Prof. Brendon Yee MBCHB (Otago) FCCP FRACP PhD (Sydney)
Sleep and Respiratory Physician

Woolcock Interdisciplinary Clinic, NHMRC Centre for Excellence Sleep Health

Cc Dr Michelle Donergan, Sleep Dentist, WIMR

Cc Dr Amy Huynh, Shop 2, 199 Cox Road, North Ryde, NSW, 2133

Cc: Prof David Barnes, Suite 416, Lv 4, 100 carillon Ave, Newtown, NSW, 2042

Patient ID: 20663

Detailed data

Sleep Architecture					
Analysis Start- Light Off:	22:04:21	Analysis End-Lights On	05:56:21	Total Sleep Time (min)	374
Time available for sleep (min)	472	Sleep Period (min)	447	Sleep Efficiency (%)	79
Sleep Latency (min)	25	REM Latency (min)	146	Awakenings (number)	30

Stage Distribution	Duration (min)	TST (%)
WASO	73.0	-
Stage N1	41.5	11.1
Stage N2	200.5	53.6
Stage N3	68.5	18.3
REM	63.5	17.0

Limb movement data

Event	Total count	Index (hr^{-1})
Limb Movement	91	14.6
LM arousal	31	5.0

Respiratory data

AHI	Supine	Non-Supine
NREM/hr	0.0	1.5
REM/hr	0.0	3.8

Arousal Events	NREM		REM		TST	
	Count	Index (hr^{-1})	Count	Index (hr^{-1})	Count	Index (hr^{-1})
Total Arousals	95	18.4	5	4.7	100	16.0
Spontaneous	61	11.8	5	4.7	66	10.6
Respiratory-related	3	0.6	0	0.0	3	0.5
Limb-related	31	6.0	0	0.0	31	5.0

Patient ID: 20663

Respiratory Events (by type)	Hypopnea	Obstructive Apnea	Central Apnea	Mixed Apnea	TOTAL
Count:	11	1	0	0	12
Index (event/hr)	1.8	0.2	0.0	0.0	1.9
In REM (event/hr)	3.8	0.0	0.0	0.0	3.8
In NREM (event/hr)	1.4	0.2	0.0	0.0	1.5
Max length of Event (sec)	45	17			-
Mean length of Event (sec)	20	17	0	0	20

Respiratory Events (by body position)	Supine Sleep		Prone Sleep		Left-Side Sleep		Right-Side Sleep	
	Count	Index	Count	Index	Count	Index	Count	Index
Time (hhr:mm)	0:0.0		4:27.5		1:32.0		0:14.0	
Hypopnea	0	0.0	10	2.2	0	0.0	1	4.3
Obstructive Apnea	0	0.0	0	0.0	0	0.0	1	4.3
Central Apnea	0	0.0	0	0.0	0	0.0	0	0.0
Mixed Apnea	0	0.0	0	0.0	0	0.0	0	0.0
TOTAL	0	0.0	10	2.2	0	0.0	2	8.6

Oxygen saturation	Wake	NREM	REM	TST
Mean. SpO_2%:	96	96	96	96
Min. SpO_2%	-	94	92	92
ODI (desat/hr)	-	0.6	3.8	1.1
% Time in range				
90 - 100%:	93	99	100	99
80 - 89%:	0	0	0	0
70 – 79%	0	0	0	0

Pulse Rate	NREM	REM	TST
Mean. PR (bpm)	64	68	64
Min. PR (bpm)	55	57	55
Max. PR (bpm)	87	83	87

Definitions:

Apnea: Complete cessation of airflow for ≥10 sec, measured via pressure transducer and a reduction by ≥90% via a thermister.
Hypopnea: Reduction in airflow ≥30% for ≥10 sec, measured via pressure transducer, with either an arousal or ≥3% desaturation.
RERA: Increased respiratory effort OR flattening of airflow for ≥10 sec leading to an arousal. Included in total arousal index.

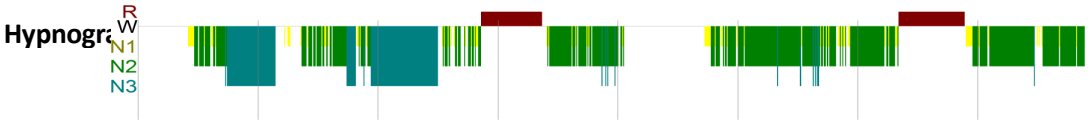
AHI = Apnea Hypopnea Index; The number of apneas and hypopneas per hour of sleep. Does not include RERA's.
RDI = Respiratory Disturbance Index; The number of apneas, hypopneas and RERAs per hour of sleep.

Oxygen desaturation = =>3% desaturation from baseline SpO2

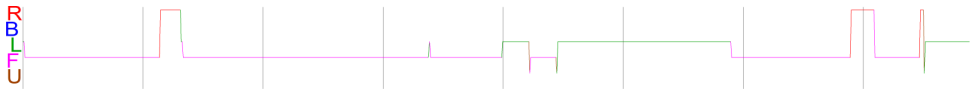
ODI = Oxygen desaturation index; the number of oxygen desaturations =>3% per hour of sleep.
PR = Pulse Rate
TST = Total sleep time
TIB = Time in bed
WASO = Wake after sleep onset

Patient ID: 20663

Graphic Summary



Body Position



Arousal

Respiratory event graphs with RERA and hypopnea

SpO2

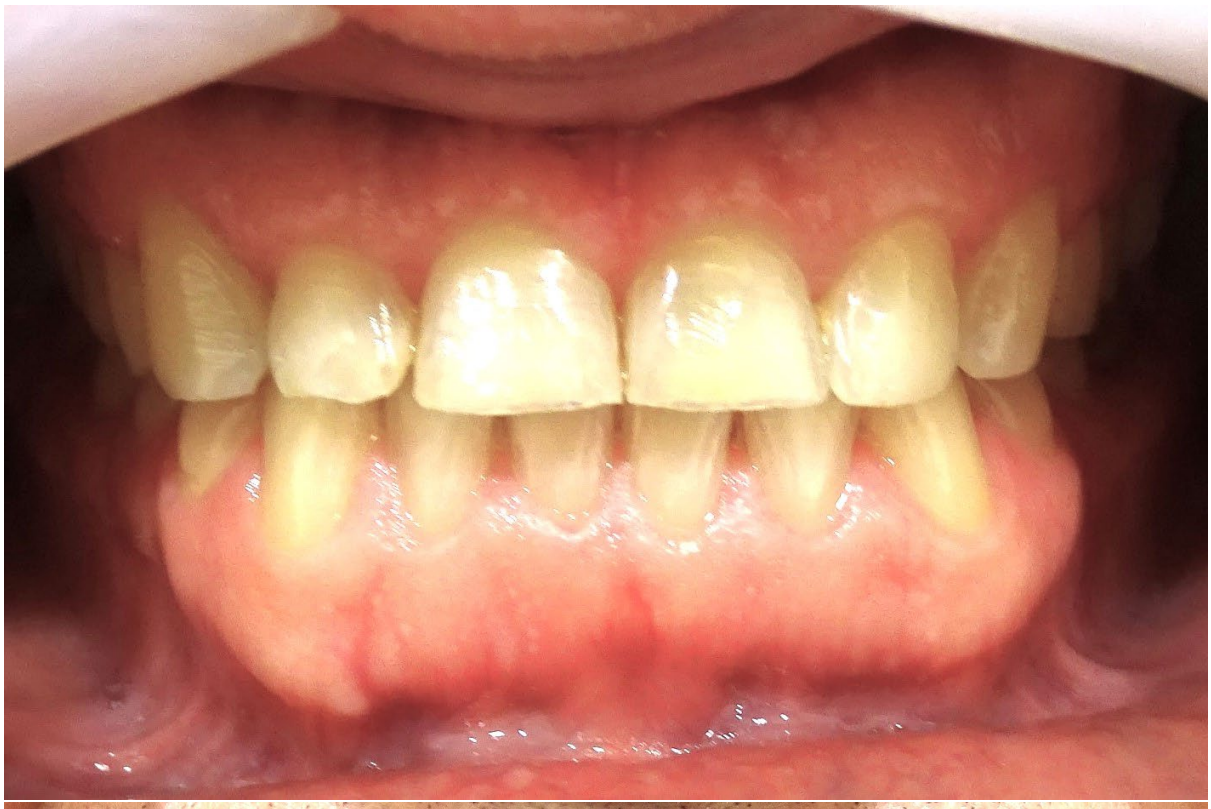
Pulse rate

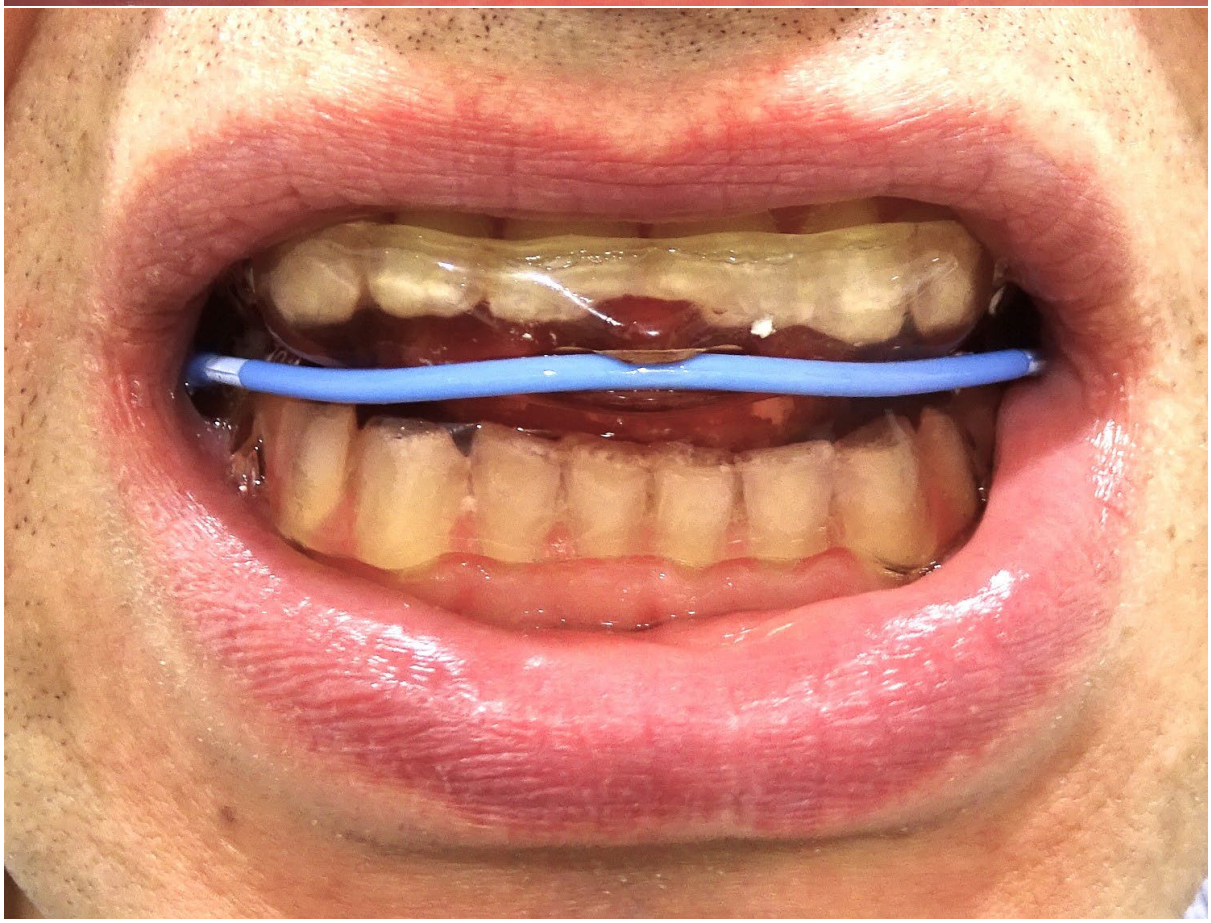
Leg movement

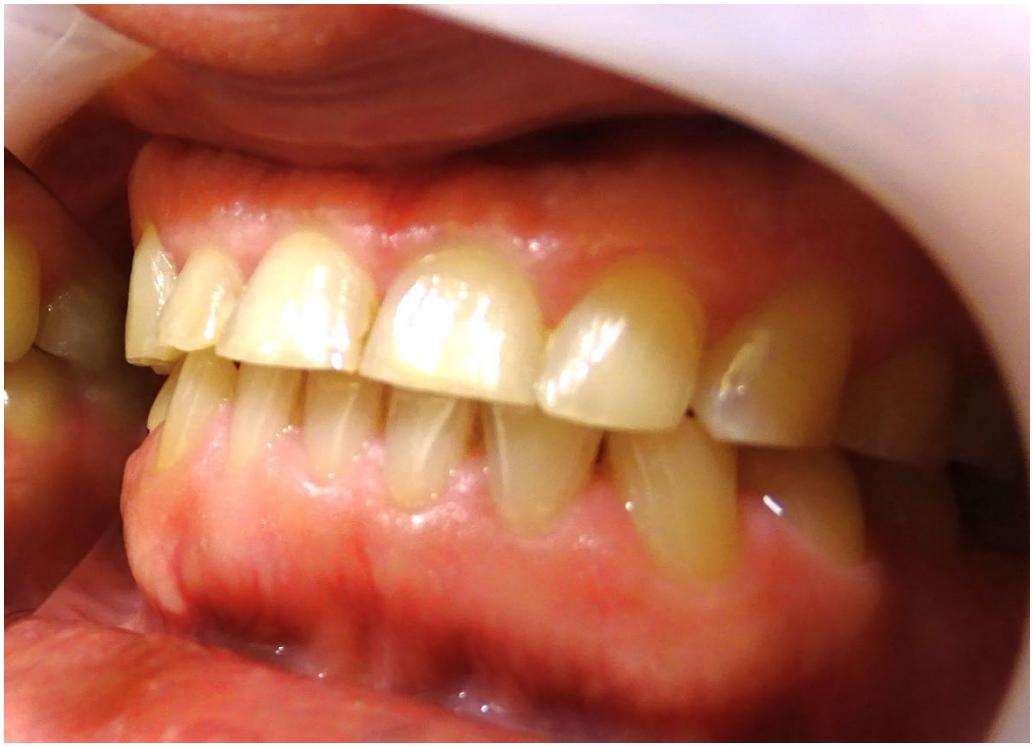
Time	11PM	12AM	1AM	2AM	3AM	4AM	5AM
Hrs	0	1	2	3	4	5	6	7
Epoch	96	216	336	456	576	696	816	936

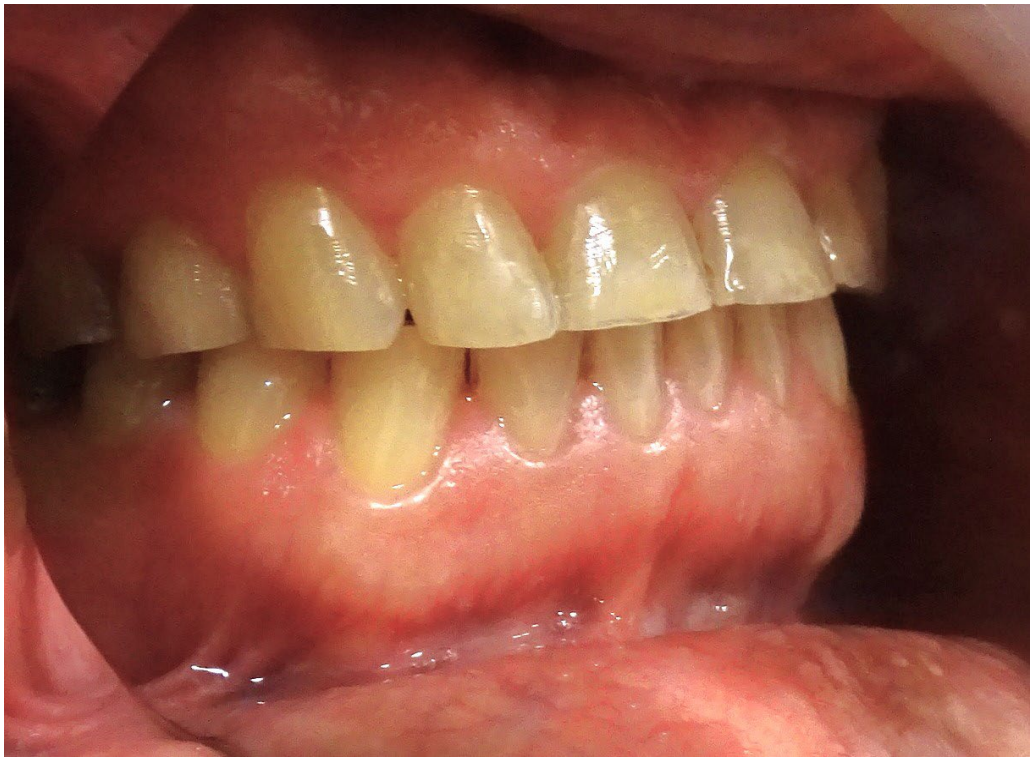
10:04:21 PM 5:08:50 AM

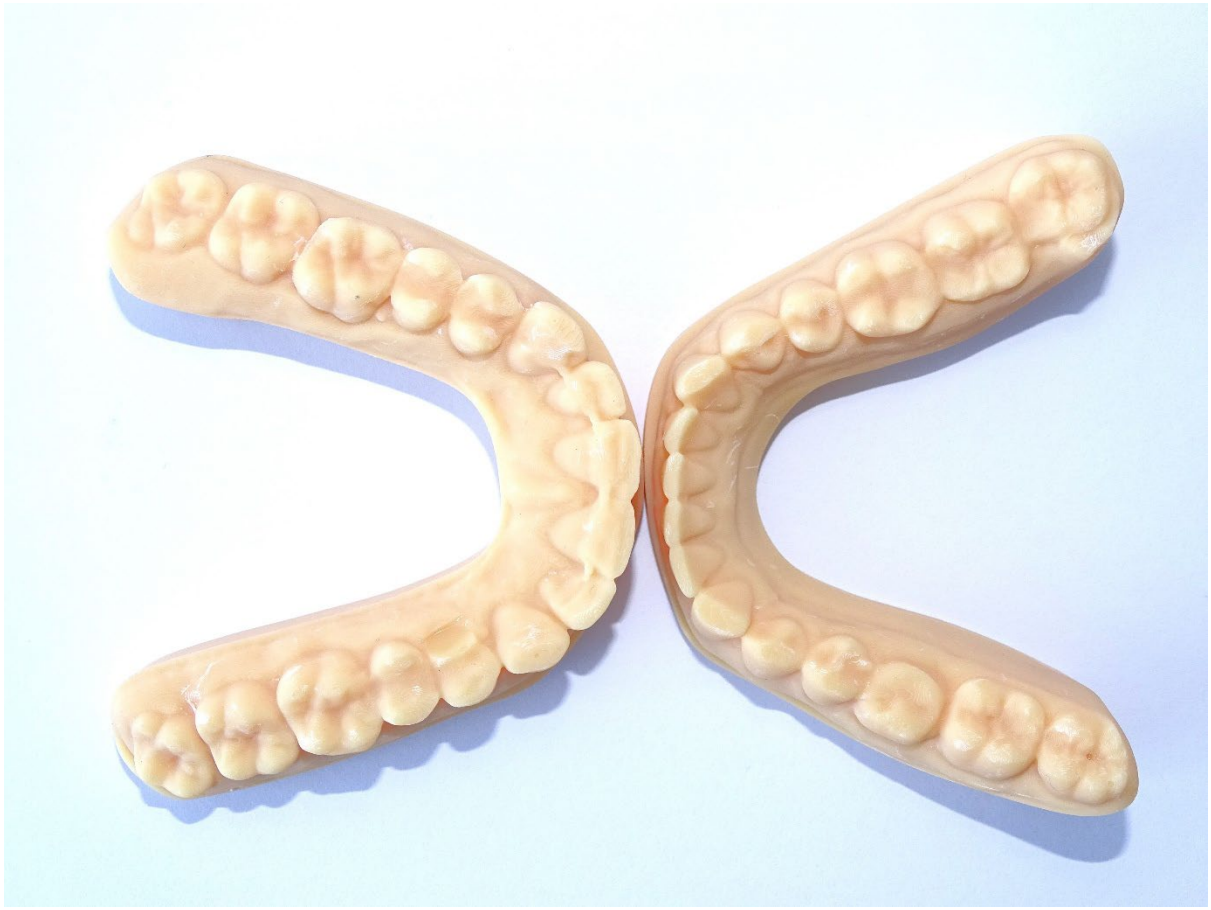
INTRA-ORAL PHOTOGRAPHS:

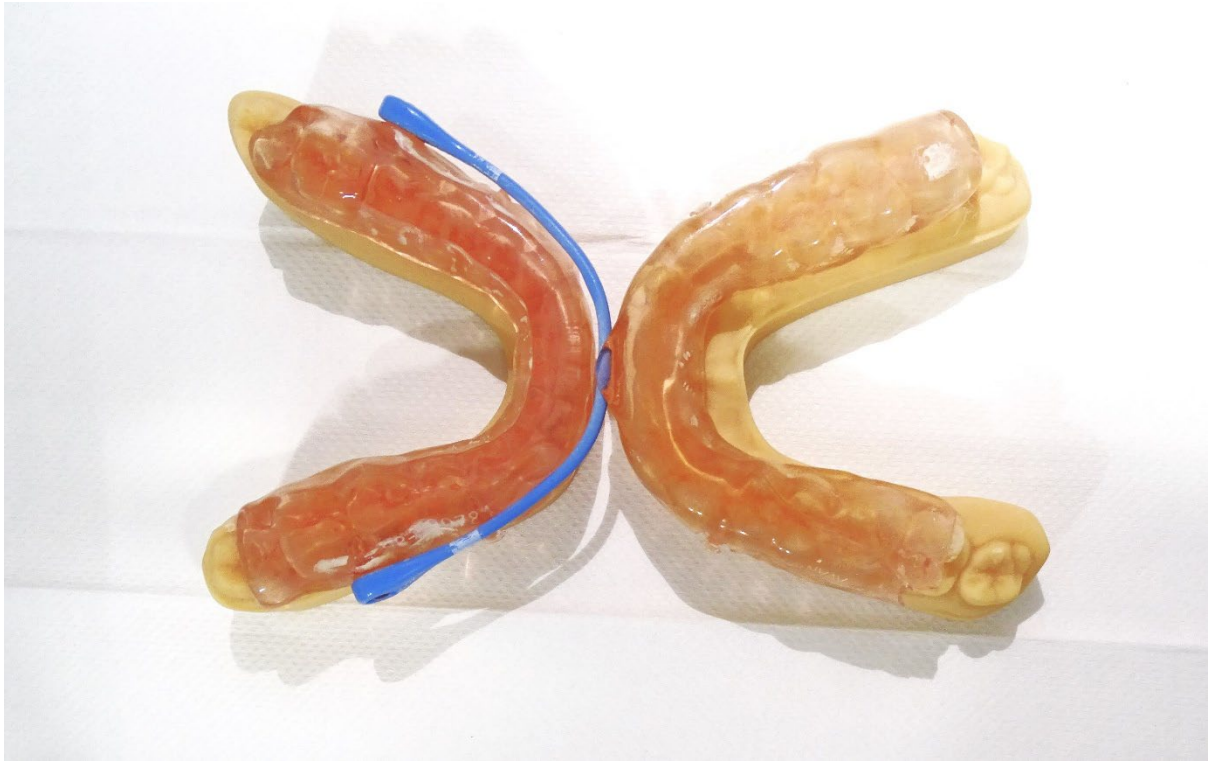


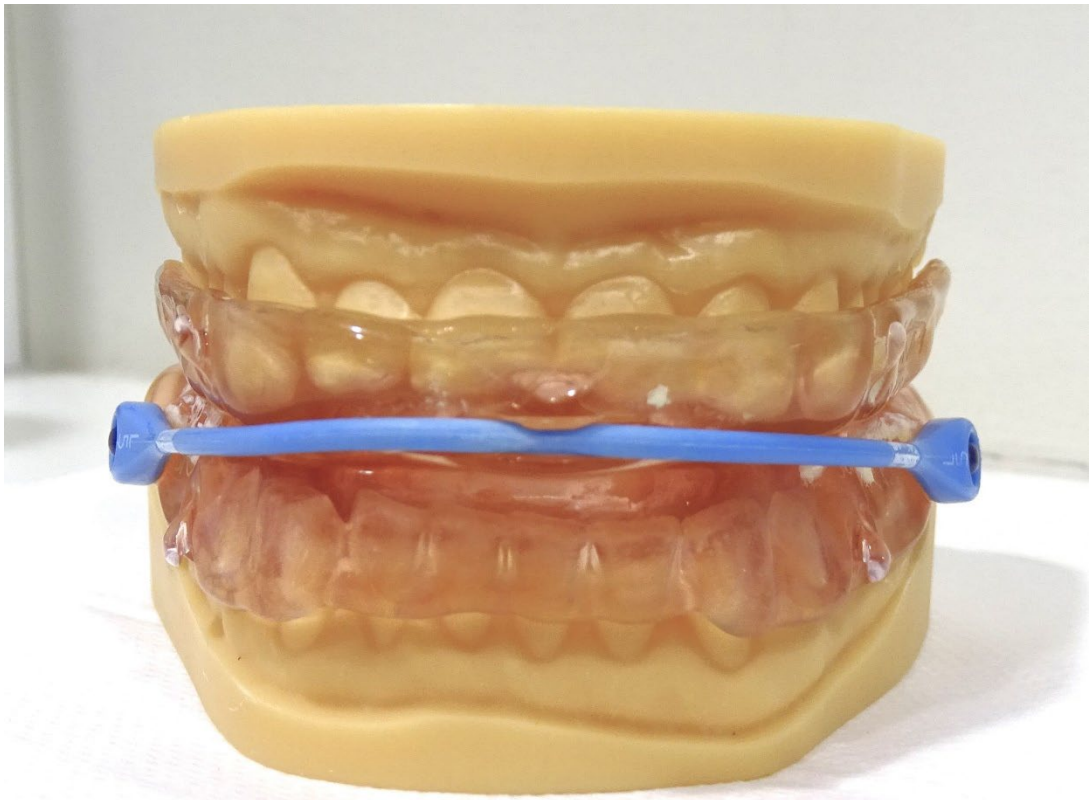


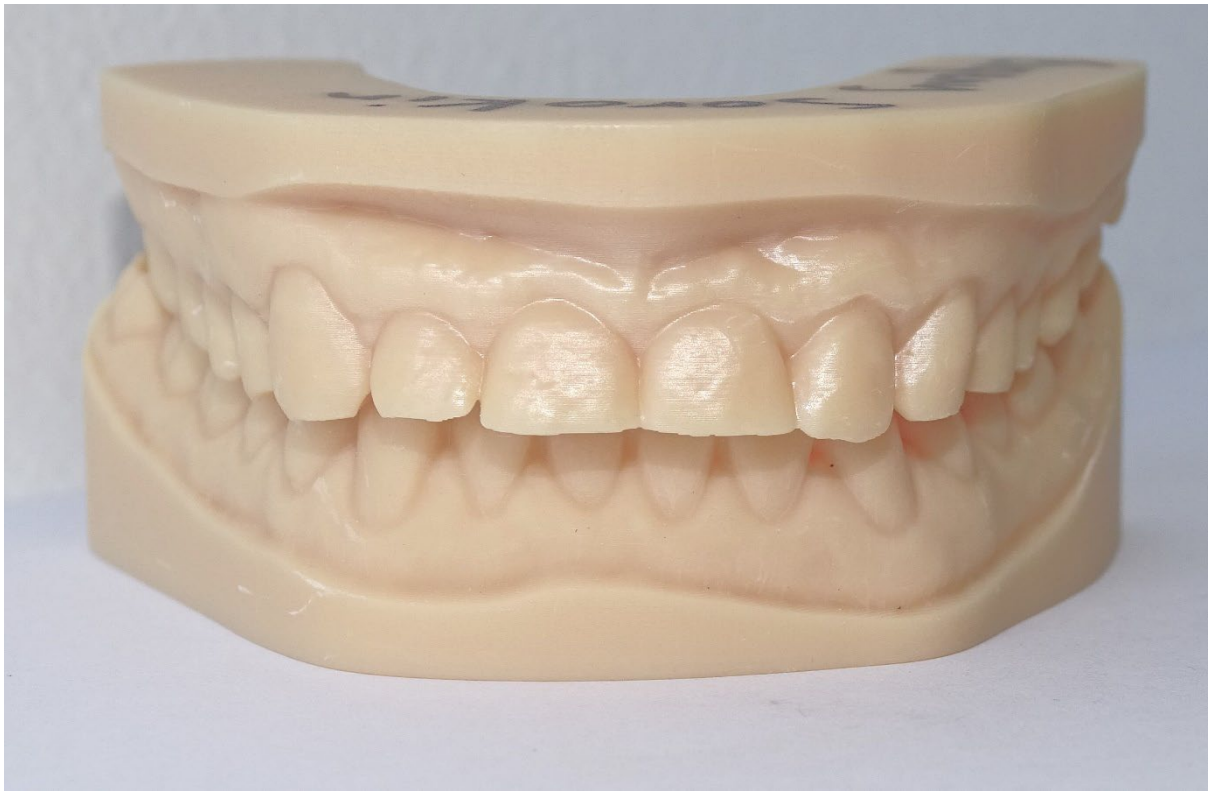


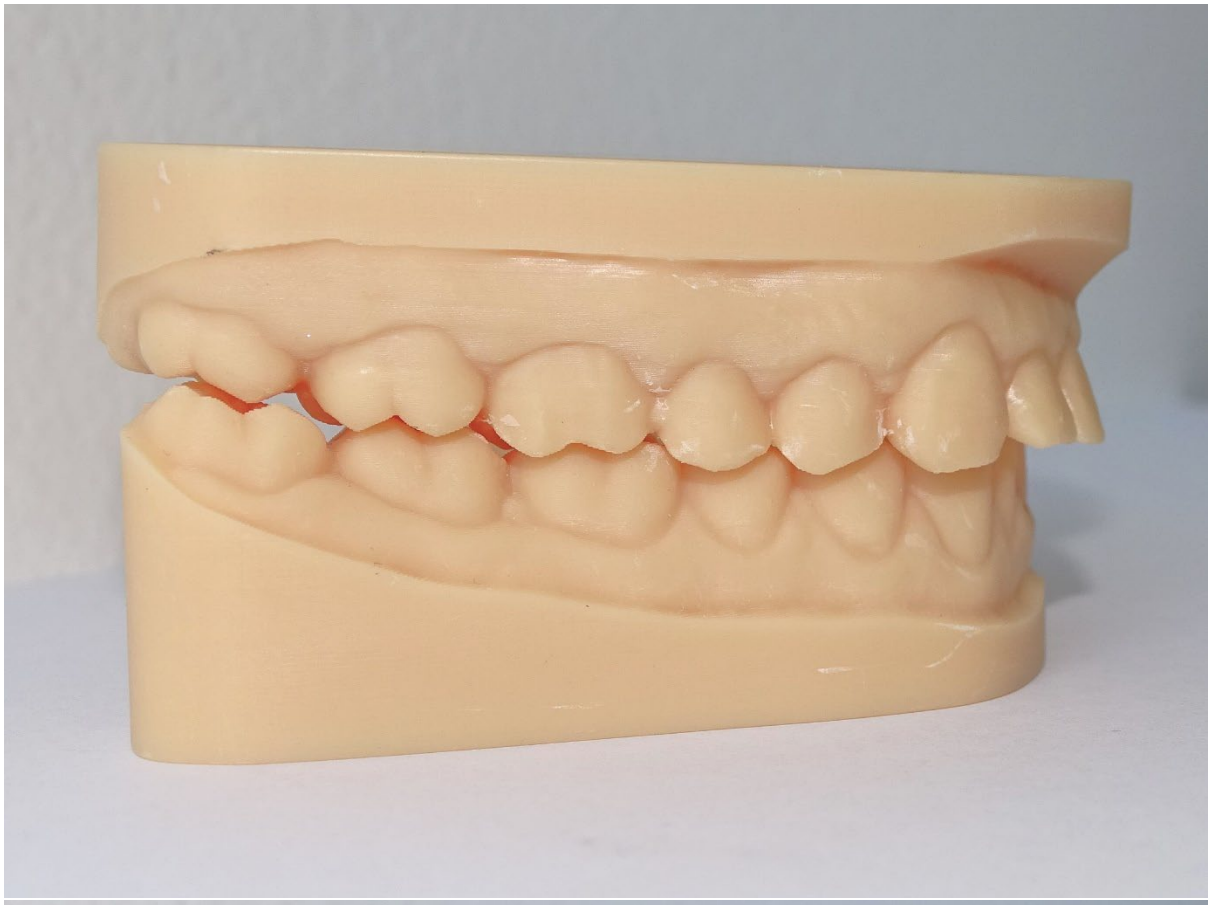


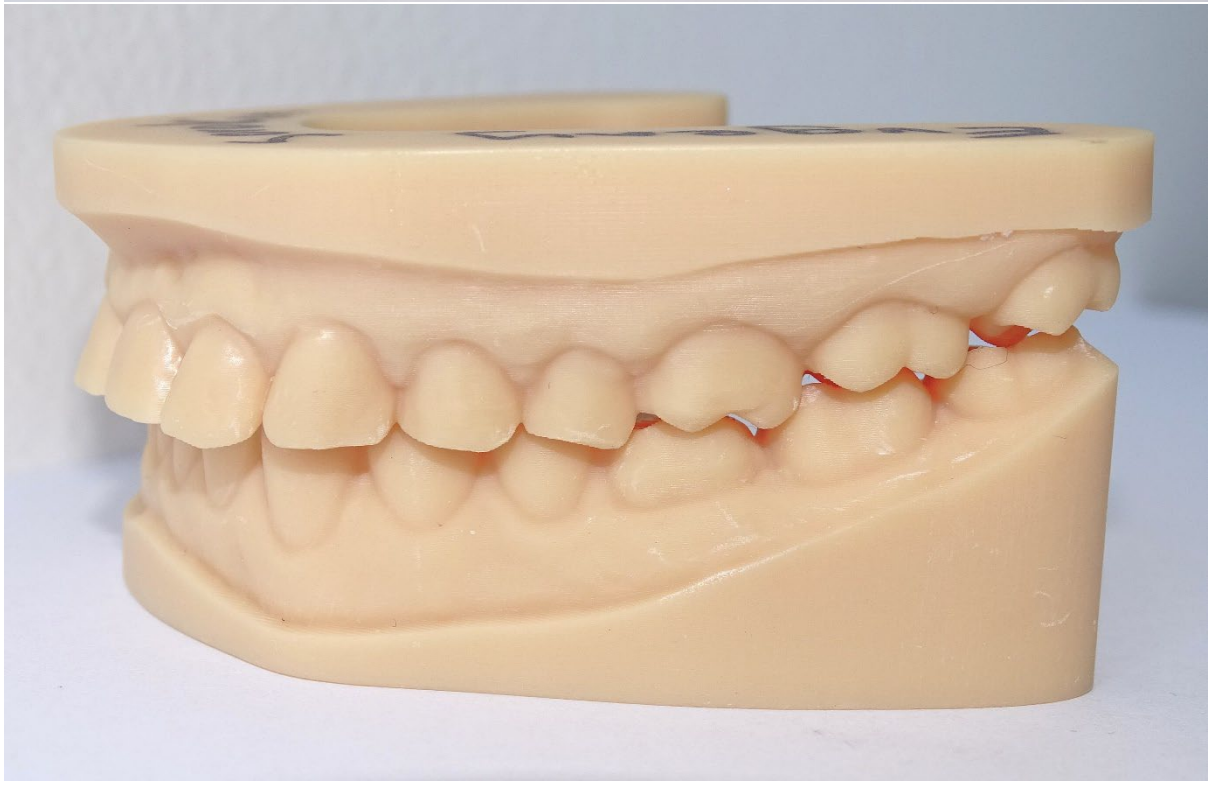


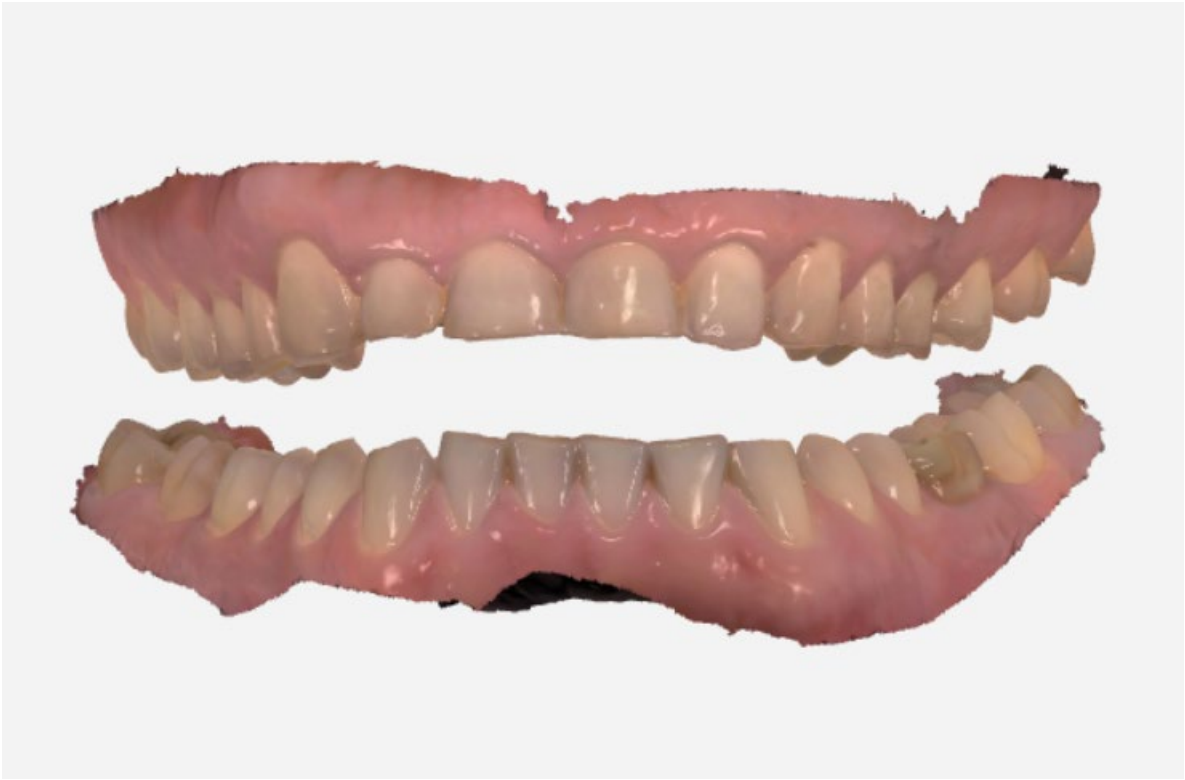


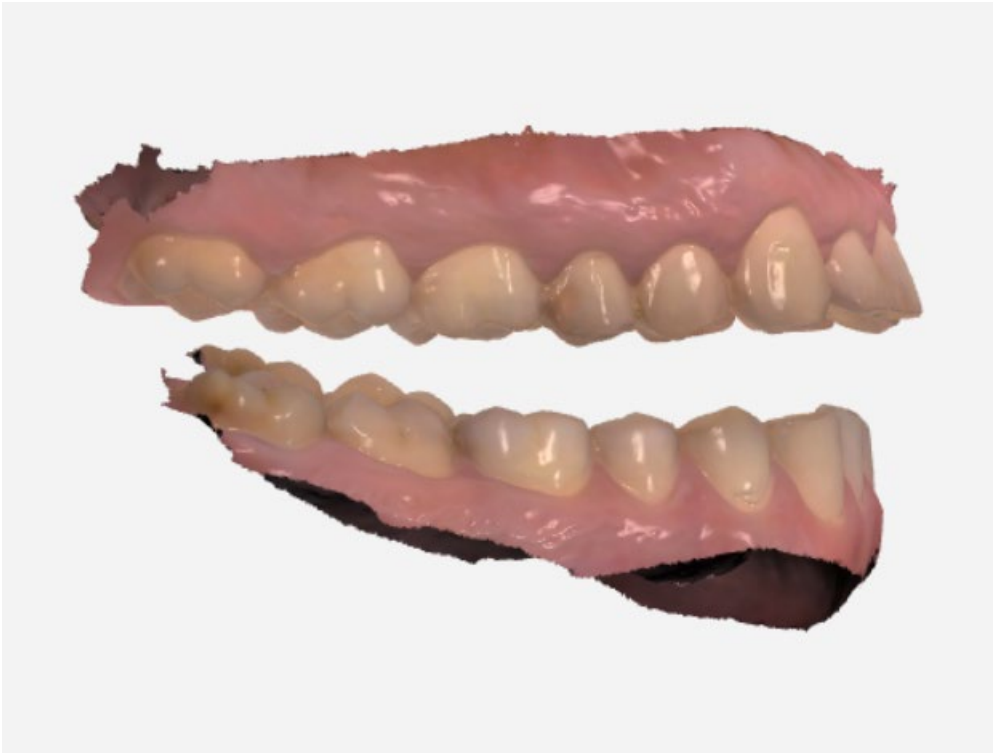


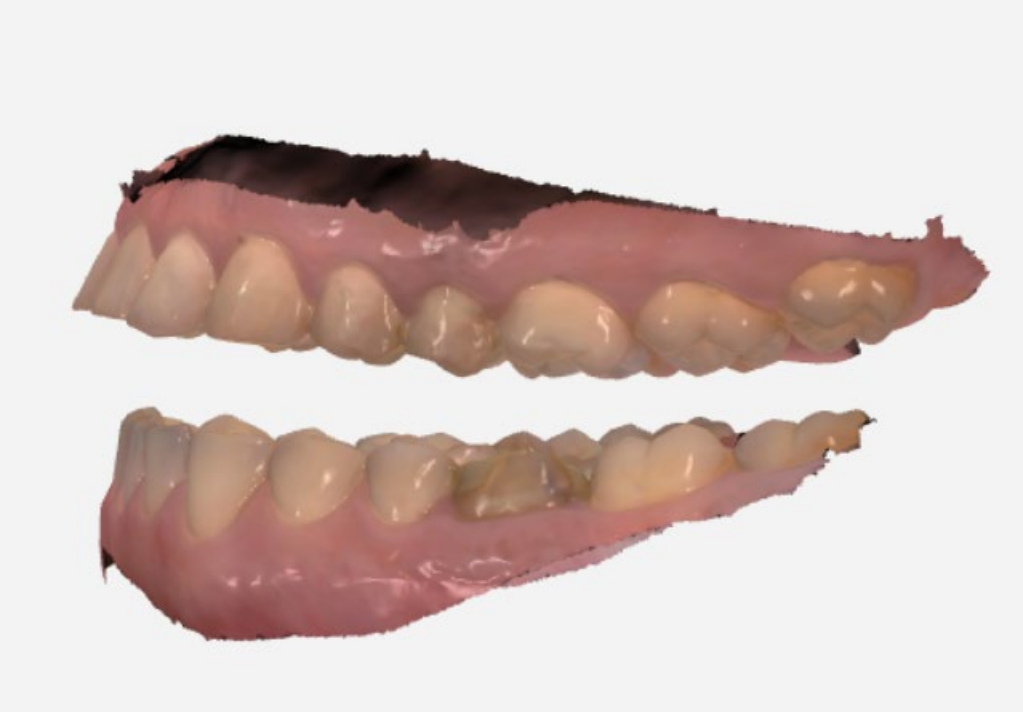












Thank you to the technicians from Somnomed Australia for the reproduction of 3D printed models and assistance with 3Shape Trios digital scans.

Patient LF57

SYNOPSIS:

INTRODUCTION:

This patient was a 57-year-old Caucasian female (17/03/1965) with the chief complaint of snoring and tiredness. Foremost, it was the complaint of frequent migraines that brought about this journey. Ten years ago, she initially consulted her general medical practitioner regarding her symptoms who referred her to a sleep physician. More recent sleep study results LF was diagnosed with severe obstructive sleep apnoea/hypopnea. Initially she was prescribed a trial of CPAP and despite ongoing reviews with a CPAP Therapist and several masks, was unable to yield satisfactory adherence. She presented to me for consultation on 08/02/2022. Epworth Sleepiness Score 11/24; sleeps 10pm to 7am with 30 minute onset.

CHIEF COMPLAINT:

The patient's chief complaint was poor sleep; although aware of a snoring complaint it was not the main concern as her partner was not so bothered and rated it 2/10 on Numerical Rating Scale (NRS). There were witnessed apnoeas and she reported waking 3 times a night and often unable to re-initiate sleep. LF is not feeling rested at all; she stated always feeling tired but never had any problems driving nor any issues with maintaining alertness. Also, she had complained of headaches and stated having anxiety and a heart condition and being fatigued during the daytime, struggling to exercise; each day was emotionally demanding.

HISTORY OF PRESENT ILLNESS:

Sleep related history: long term complaint of snoring, although there were no witnessed apnoeas. The usual bedtime was 10 pm with sleep latency short. She would wake disrupted with palpitations and headaches, buzzing noise, and she would wake unrefreshed at 7am and throughout the day experience memory loss, brain fog, morning headaches, mood changes, daytime somnolence, poor concentration and also a background of sinus problems.

During the CPAP trial, LF stated not coping well at all with a nasal mask and felt a suffocating sensation and changed masks from full face mask due to reported low compliance. A change of mask again with change of pressure setting yielded CPAP usage over a week of average 1-2 hours per night and slight improvement with new nasal mask, but no change in symptoms. LF struggled over the last year with walking up hill and exercise becoming a little difficult. In general, life didn't appear to be too happy, stating that she's gained quite a bit of weight and consulted and endocrinologist and felt that menopause was the cause of all symptoms.

PAST MEDICAL HISTORY:

LF weighs 79Kg and is 161cm tall (BMI 30.5cm. She has Diabetes Mellitus, Hashimoto's thyroiditis, laryngopharyngeal reflux, chronic sinusitis, septal deviation, PTSD and history of severe anxiety (has been hospitalised). Recent pneumonia, pleurisy, whooping cough. She stated that she had a sleep study at St Vincent's Hospital when her weight was 68 kg and was

dismissed as "nothing". Medications: semaglutide, levothyroxine, metformin, eletriptan, HRT. PTSD management she prefers a holistic approach (hypnotherapy, somatic healing, hypnotherapy and acupuncture). Has had 2 MRIs and seen 2 neurologists for opinion on headaches (2-3 week migraine) and prescribed medication was declined.

Social history: socialiser non-smoker, very little alcohol and no recreational drug usage.

CLINICAL AND RADIOGRAPHIC EXAMINATION:

Radiographic examination was not indicated as LF has a long-term dental practitioner. A heavily restored dentition and well maintained; LF had a history of periodontal issues and completed a course of periodontal therapy and attends a Periodontist every 6 months (CPITN 111, 121). Class 1 molar relationship with moderate curve of spee, overjet 3mm and overbite 5mm or 80%; midlines were not centred due to width of 11 and 21 crowns (out by 2mm to RHS)). Minor crowding of the lower incisor segment. Implant retained crowns at 21 and 22 while porcelain bonded crowns at 16, 11 (root filled), 23, 25, 26, 36, 46 are all in good condition. Intermaxillary width was 33mm. Lower third molars present and erupted into the line of occlusion. LF also had history of fixed orthodontic treatment third molars were present. TMJ examination showed a normal range of motion in pathway 45mm, without deviation, clicking or aberration in pathway; on lateral excursion, canine function was into protected occlusion. Palpation of muscles: there were slightly hypertrophic masseters.

DIAGNOSIS:

Overnight polysomnogram on the 12th of October 2021 revealed severe obstructive sleep apnoea/hypopnea and low baseline oxygen saturation (range 89-95%). Her AHI was 32.1/hr and lowest oxygen saturation of 79%. Her obstructive events were much more prevalent in the supine position (nREM 37.0/hr and REM 55.4/hr). ODI was 19.9/hr (desaturations >3%)

RATIONALE:

A Somnodent Flex mandibular advancement appliance was chosen due to its comfort and ease of use but also that the fitting surface is receptive to fixed restorative work present; the fit is relatively passive and not too retentive. Patient was motivated and capable of understanding its titration mechanism, which allowed her to titrate the appliance independently if necessary. It also allowed for freedom of mouth opening, if required. The acrylic material allowed for any adjustment if the patient was to undergo dental treatment. The starting treatment position was 7mm out of a possible 12mm (58%)

RESULTS:

Patient reports subjective improvements in sleep parameters prior to objective sleep assessment. The patient was able to cope with the appliance which led to a large improvement in subjective symptoms. Treatment polysomnogram was completed 11th May 2022 (MAS in situ). The treatment sleep study revealed an AHI of 3.5/hr and lowest oxygen desaturations of 89%. Patient slept an hour supine in this study and REM proportion was reduced (20 minutes, 6% total sleep time). There was no supine REM sleep and therefore

may underestimate result. RDI was 4.3/hr while ODI was 0.8/hr (previously 19.9/hr). She was recommended to continue wearing the appliance nightly at the current treatment position which was 10 mm out of total range 12mm (83%).

DISPOSITION: A treatment sleep study was completed on the 11th of May 2022 which was analysed by a sleep physician. It confirmed the success of the appliance with the physician stating there was objective improvement in her AHI with a reduction from 32 to 3.5 apnoeas/hypopneas per hour of sleep and no significant side effects. Given her improvements in her symptoms (snoring, decreased morning tiredness, daytime somnolence and sleep disturbances) and objective reduction of her AHI she was recommended to continue utilising her mandibular advancement appliance to manage her obstructive sleep apnoea. The sleep physician scheduled no further reviews with her.

FOLLOW UP VISITS:

Patient DOB 17/03/1965
Initial Consultation: 8/2/22
Appliance Insert: 29/3/22

ENT Consultation 28/2/22

Given a background history of nasal symptoms, it was prudent to see the nose and throat specialist who diagnosed chronic rhinosinusitis or non-sinogenic headaches.

DOS: 27/4/22

Subjective: patient has a history of severe obstructive sleep apnea and presents for her one month follow up with the use of her Somnodent flex mandibular advancement appliance. Medical history, family and social history remains unchanged. No significant weight change is reported. Patient reports her snoring is 1000% improved with the use of the appliance. Patient awakens feeling refreshed on most days and experiences no lethargy but more energy and occasional anxiety but can modify this with natural therapies and remaining active with walking. The main side effect reported is mild tenderness of the jaw muscles which is relieved by stretching exercises and massage. This does not interfere with any eating or mastication or sleep and has not required analgesic and continues with recommended exercises as per American Academy of Dental Sleep Medicine.

Objective: LF's general appearance remains unchanged there was mild bilateral method a tenderness and no TMJ pain. Maximum mouth opening as before 45mm right left and protrusive excursions remain the same, 8 and 9mm respectively. Occlusion remained the same and there was no bite change or teeth mobility. There was no clicking deviation or deflection noted intraorally and no abnormalities were noted in any of the soft tissues. Appliance was titrated as per prescription 20 turns over 4 weeks 2 millimetres up to 75% and

was mechanically sound. Maxillary and mandibular incisor teeth we're not tender to percussion or sensitive during mastication.

Assessment: LF's snoring had reportedly resolved and there were improvements in subjective scores as stated above. Obstructive sleep apnea has subjectively approved with oral appliance therapy and confirmation of oral appliance success will need to be objectively tested with a treatment sleep study, MAD in situ and this was understood from the outset.

Plan: recommended patient to continue wearing the appliance nightly and titrate the appliance bilaterally by five turns on a weekly basis for the next two weeks, due to severe sleep apnoea, the device required optimisation to 83% (10 mm out of 12 mm total). An interim telephone call was scheduled to check on LF prior to further diagnostic study, MAS in situ. A follow up was scheduled in two months to review results.

Physician Review (conjoint dental review) Sleep study, MAS in situ 11/05/2022

DOS 9/6/22

Subjective: Patient has a history of severe obstructive sleep apnea and presents for her three month follow up with the use of her Somnodent flex mandibular advancement appliance. Medical history has changed and LF is now taking semaglutide; family history and social remains unchanged. No significant weight change is reported. Patient reports full time adherence all night approximately 7 hours with only 1 waking throughout the night; The main side effect reported is mild tenderness of the jaw muscles which is relieved by stretching exercises and massage. This does not interfere with any eating or mastication or sleep and has not required analgesic and continues with recommended exercises as per American Academy of Dental Sleep Medicine. Periodontal condition has not exacerbated.

Objective: LF's general appearance remains unchanged there was mild bilateral method a tenderness and no TMJ pain. Maximum mouth opening as before 45mm right left and protrusive excursions remain the same, 8 and 9mm respectively. Occlusion remained the same and there was no bite change or teeth mobility. There was no clicking deviation or deflection noted intraorally and no abnormalities were noted in any of the soft tissues. Appliance remained titrated as per prescription 30 turns / 83% and was mechanically sound. Maxillary and mandibular incisor teeth we're not tender to percussion or sensitive during mastication. There was no gingival or periodontal inflammation from device usage.

Assessment: Obstructive sleep apnoea has improved to an AHI of 3.5/hr as confirmed by objective testing including improvement in minimum oxygen saturation to 89%.

Plan: recommended patient to continue wearing the appliance nightly. The device required no adjustment or removal of acrylic. A follow up was scheduled for 6 months post-insertion.

DOS 4/9/22

Subjective: patient has a history of severe obstructive sleep apnea and presents for her six month follow up with the use of her Somnodent flex mandibular advancement appliance. Medical history, family history and social remains unchanged. No significant weight change is reported. Patient awakens feeling refreshed on most days and experiences no lethargy but

more energy and occasional anxiety but can modify this with natural therapies and remaining active with walking. The main side effect reported is mild tenderness of the jaw muscles which is relieved by stretching exercises and massage. This does not interfere with any eating or mastication or sleep and has not required analgesic and continues with recommended exercises as per American Academy of Dental Sleep Medicine.

Objective: LF's general appearance remains unchanged there was mild bilateral method a tenderness and no TMJ pain. Maximum mouth opening as before 45mm right left and protrusive excursions remain the same, 8 and 9mm respectively. Occlusion remained the same and there was no bite change or teeth mobility. There was no clicking deviation or deflection noted intraorally and no abnormalities were noted in any of the soft tissues. Appliance remained titrated as per prescription 30 turns / 83% and was mechanically sound. Maxillary and mandibular incisor teeth we're not tender to percussion or sensitive during mastication.

Assessment: LF's snoring remains resolved and there were improvements in subjective scores as stated above however some elements of tiredness remain and it was concluded that due to reduced sleep efficiency (68.6%) and REM duration, the result may underestimate the severity of obstructive sleep apnoea. However, ODI reduced from 19.9/hr to 0.8/hr.

Plan: recommended patient to continue wearing the appliance nightly at this treatment position and to continue exercises of jaw repositioning as per AADSM. The device required no adjustment or removal of acrylic. A follow up was scheduled in 12 months.

12 month follow up 16/8/23

LF was reviewed recently and control of symptoms related to obstructive sleep apnoea are in place; LF continues to adhere nightly with a high degree of satisfaction and is comfortable; Headaches (migraines) are ongoing and all endocrinology (pharmacotherapy) and review has been abandoned in favour of sleep and natural therapies, meditation and exercise. LF has ceased all medications in favour of healthy lifestyle, hydration, sleep hygiene and reduction of stress. There has been no weight gain and LF appeared to be with happy disposition and accepting of therapy in the long term.

Summary: this case illustrates a common scenario of the post menopausal woman who experiences protracted issues of sleep later in life superimposed on the struggle of weight gain. This case yielded improved sleep and reported well being and was able to cope better with life despite a continued back ground of headaches. LF was dubious as to the potential of MAD therapy but overall was relieved of some progress in her health.

Thank you to the technicians at Somnomed Australia for the reproduction of 3D models and assistance with the digital scan acculiner in reducing the vertical dimension of the device.

WOOLCOCK
LEADERS IN BREATHING & SLEEP RESEARCH

Patient ID: 21154

Patient name: LF56F

Study Date: 12/10/2021

Study Type: Diagnostic

Requesting Physician:

Physician:

Gender: Female
Evening BP (mmHg): 149/89
Morning BP (mmHg): 115/75

DOB (dd/mm/yyyy): 17/03/1965
Height (cm): 161
Weight (kg): 79

ESS: 5/24

BMI (kg/m^2): 30.5
Neck Circumference (cm): 37
Subjective Sleep Latency: Same as usual
Subjective Total Sleep Time: N/A

Methodology

The patient underwent polysomnography study using the Compumedics Grael v2 PSG system with Profusion scoring software. The data was adequate for interpretation and the raw data was reviewed in its entirety. Scoring was based on the Recommended Standards and Specifications as outlined in the AASM Manual for the Scoring of Sleep and Associated Events, Version 2.2.

Summary

Sleep Architecture

Time available for sleep (min)	= 416.0	Sleep latency (min)	= 9.0
Total sleep time (min)	= 292.0	REM latency (min)	= 262.5
Wake after sleep onset (min)	= 115.0	NREM sleep (min)	= 266.0
Sleep efficiency (%)	= 70.2	REM sleep (min)	= 26.0

Respiratory, Movement and arousal events*

Total RDI (events/hr)	= 32.1	Minimum SpO_2 (%)	= 79
Total AHI (events/hr)	= 32.1	ODI (desat/hr)	= 19.9
RERA index	= 0.0		
RDI in NREM (events/hr)	= 29.8		
RDI in REM (events/hr)	= 55.4		

Limb Movement (Movement/hr)= 0.0

Total arousal index (arousals/hr)= 43.4 Limb arousal index (arousals/hr)= 0.0

(*Respiratory events = see page 5 for definition of apneas, hypopneas and RERA)

WOOLCOCK
LEADERS IN BREATHING & SLEEP RESEARCH

Interpretation

Sleep Physician's Report:

The patient reported sleeping the same as usual. Sleep latency was normal. Sleep efficiency was reduced, as was REM duration. The baseline oxygen saturation was low at times, ranging from 89 to 95%. Bursts of repetitive obstructive hypopnoeas occurred especially during REM sleep with maximal oxygen desaturation to 79%. Obstructive respiratory events were much more prevalent in the supine position. The patient was in sinus rhythm. Evening hypertension was noted.

SUMMARY: Severe OSA. Recommend clinical review with regard to treatment options. The low baseline oxygen saturation may require further investigation.

Yours sincerely,

Associate Professor Andrew Chan MB BS PGCertClinLds MBA PhD FRACP

Respiratory and Sleep Medicine Physician

cc: NSW, 2065

Detailed data

Sleep data

Sleep Architecture					
Analysis Start- Light Off:	22:45:46	Analysis End-Lights On	05:41:46	Total Sleep Time (min)	292
Time available for sleep (min)	416	Sleep Period (min)	407	Sleep Efficiency (%)	70
Sleep Latency (min)	9	REM Latency (min)	262	Awakenings (number)	30

Stage Distribution	**Duration (min)**	**TST (%)**
WASO	115.0	-
Stage N1	54.0	18.5
Stage N2	152.0	52.1
Stage N3	60.0	20.5
REM	26.0	8.9

Limb movement data

Event	**Total count**	**Index (hr^{-1})**
Limb Movement	0	0.0
LM arousal	0	0.0

Respiratory data

AHI	**Supine**	**Non-Supine**
NREM/hr	37.0	24.4
REM/hr	55.4	0.0

Arousal Events	**NREM**		**REM**		**TST**	
	Count	**Index** (hr^{-1})	**Count**	**Index (hr^{-1})**	**Count**	**Index (hr^{-1})**
Total Arousals	210	47.4	1	2.3	211	43.4
Spontaneous	95	21.4	0	0.0	95	19.5
Respiratory-related	115	25.9	1	2.3	116	23.8
Limb-related	0	0.0	0	0.0	0	0.0

Respiratory Events (by type)	Hypopnea	Obstructive Apnea	Central Apnea	Mixed Apnea	TOTAL
Count:	156	0	0	0	156
Index (event/hr)	32.1	0.0	0.0	0.0	32.1
In REM (event/hr)	55.4	0.0	0.0	0.0	55.4
In NREM (event/hr)	29.8	0.0	0.0	0.0	29.8
Max length of Event (sec)	43	-			-
Mean length of Event (sec)	16	0	0	0	16

Respiratory Events (by body position)	Supine Sleep		Prone Sleep		Left-Side Sleep		Right-Side Sleep	
	Count	Index	Count	Index	Count	Index	Count	Index
Time (hhr:mm)	2:19.5		0:0.0		0:15.0		2:17.5	
Hypopnea	94	40.4	0	0.0	6	24.0	56	24.4
Obstructive Apnea	0	0.0	0	0.0	0	0.0	0	0.0
Central Apnea	0	0.0	0	0.0	0	0.0	0	0.0
Mixed Apnea	0	0.0	0	0.0	0	0.0	0	0.0
TOTAL	94	40.4	0	0.0	6	24.0	56	24.4

Oxygen saturation	Wake	NREM	REM	TST
Mean. SpO_2%:	92	91	89	91
Min. SpO_2%	-	86	79	79
ODI (desat/hr)	-	17.1	48.5	19.9
% Time in range				
90 - 100%:	91	78	32	74
80 - 89%:	2	7	44	10
70 – 79%	0	0	0	0

Pulse Rate	NREM	REM	TST
Mean. PR (bpm)	85	89	85
Min. PR (bpm)	72	82	72
Max. PR (bpm)	102	98	102

Definitions:

Apnea: Complete cessation of airflow for ≥10 sec, measured via pressure transducer and a reduction by ≥90% via a thermister.
Hypopnea: Reduction in airflow ≥30% for ≥10 sec, measured via pressure transducer, with either an arousal or ≥3% desaturation.
RERA: Increased respiratory effort OR flattening of airflow for ≥10 sec leading to an arousal. Included in total arousal index.

AHI = Apnea Hypopnea Index; The number of apneas and hypopneas per hour of sleep. Does not include RERA's.
RDI = Respiratory Disturbance Index; The number of apneas, hypopneas and RERAs per hour of sleep.

Oxygen desaturation = =>3% desaturation from baseline SpO2

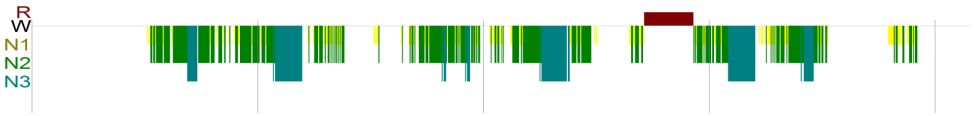
ODI = Oxygen desaturation index; the number of oxygen desaturations =>3% per hour of sleep.
PR = Pulse Rate

TST = Total sleep time TIB = Time in bed

WASO = Wake after sleep onset

Graphic Summary

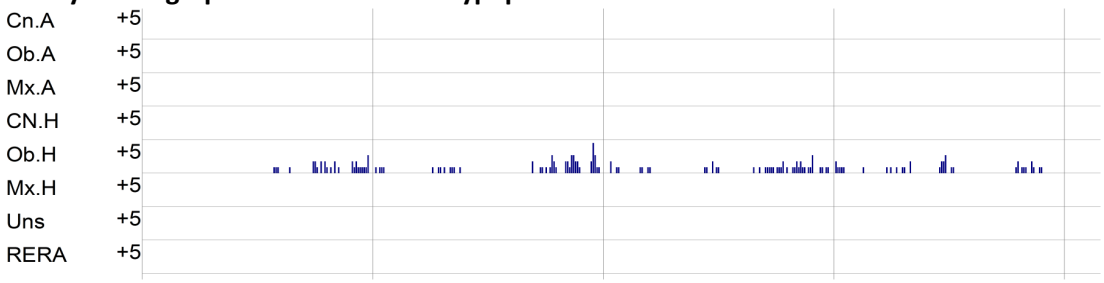
Hypnogram



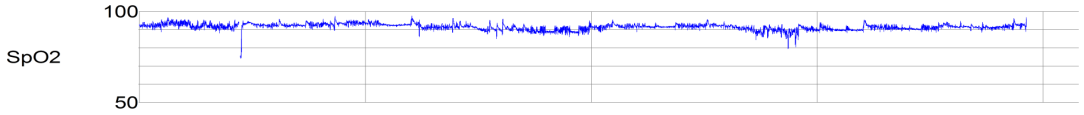
Body Position

Arousal

Respiratory event graphs with RERA and hypopnea

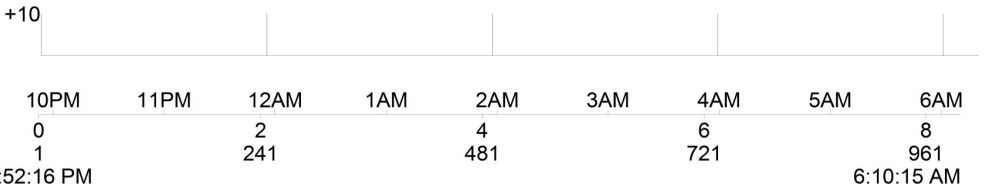


SpO2



Pulse rate

Leg movement



WOOLCOCK
LEADERS IN BREATHING & SLEEP RESEARCH

Patient details

Patient name:

Patient ID: 21154

Study Type: Diagnostic

Study Date: 11/05/2022

Requesting Physician: Dr. Yizhong Zheng

Referring Physician: Dr Yvonne Bloomfield

Gender: Female

DOB (dd/mm/yyyy): 17/03/1965
Height (cm): 161
Weight (kg): 79
BMI (kg/m^2): 30.5
Neck Circumference (cm): 37
Subjective Sleep Latency: 45 minutes
Subjective Total Sleep Time: 4 hours

Evening BP (mmHg): 137/84
Morning BP (mmHg): 120/63

ESS: 11/24

Methodology

The patient underwent polysomnography study using the Compumedics Grael v2 PSG system with Profusion scoring software. The data was adequate for interpretation and the raw data was reviewed in its entirety. Scoring was based on the Recommended Standards and Specifications as outlined in the AASM Manual for the Scoring of Sleep and Associated Events, Version 2.2.

Summary

Sleep Architecture

Time available for sleep (min)	= 450.0	Sleep latency (min)	= 29.5
Total sleep time (min)	= 308.5	REM latency (min)	= 304.5
Wake after sleep onset (min)	= 112.0	NREM sleep (min)	= 288.0
Sleep efficiency (%)	= 68.6	REM sleep (min)	= 20.5

Respiratory, Movement and arousal events*

Total RDI (events/hr)	= 4.3	Minimum SpO_2 (%)	= 89
Total AHI (events/hr)	= 3.5	ODI (desat/hr)	= 0.8
RERA index	= 0.8		
RDI in NREM (events/hr)	= 3.1		
RDI in REM (events/hr)	= 20.5		

Limb Movement (Movement/hr)= 0.0

Total arousal index (arousals/hr)= 20.2

Limb arousal index (arousals/hr)= 0.0

Name:
Patient ID: 21154

Study Date: 11/05/2022

(*Respiratory events = see page 5 for definition of apneas, hypopneas and RERA)

Interpretation

Sleep Physician's Report:

The study was performed with the patient using a mandibular advancement splint. The patient reported sleeping worse than usual. Sleep latency was long. Sleep efficiency was reduced, as was REM duration. No supine REM sleep was achieved. Little snoring was heard. The baseline oxygen saturation was low at times, ranging from 90 to 95%. Occasional obstructive hypopnoeas occurred almost exclusively during REM sleep with minor oxygen desaturation to 89%. This may be an underestimate of the severity due to the reduced sleep efficiency and REM duration, and the lack of supine REM sleep. The patient was in sinus rhythm.

SUMMARY: Mild residual OSA in REM sleep on this study with use of a mandibular advancement splint. However, the reduced sleep efficiency and REM duration, and the lack of supine REM sleep may have underestimated the severity. Recommend clinical review. The low baseline oxygen saturation may require further investigation.

Your Sincerely

Associate Professor Andrew Chan MB BS PGCertClinLds MBA PhD FRACP

Respiratory and Sleep Medicine Physician

cc: Dr Yvonne Bloomfield, Nature Care Wholistic \T\ Medical Centre 114 Alexander Street CROWS NEST NSW 2065,Fax:0299668699

Name: Patient ID: 21154

Detailed data

Sleep data

Study Date: 11/05/2022

Sleep Architecture					
Analysis Start- Light Off:	22:07:20	Analysis End-Lights On	05:37:20	Total Sleep Time (min)	308
Time available for sleep (min)	450	Sleep Period (min)	358	Sleep Efficiency (%)	69
Sleep Latency (min)	29	REM Latency (min)	304	Awakenings (number)	19

Stage Distribution	Duration (min)	TST (%)
WASO	112.0	-
Stage N1	21.0	6.8
Stage N2	175.5	56.9
Stage N3	91.5	29.7

REM	20.5	6.6

Limb movement data

Event	Total count	Index (hr^{-1})
Limb Movement	0	0.0
LM arousal	0	0.0

Respiratory data

AHI	Supine	Non-Supine
NREM/hr	2.9	2.1
REM/hr	0.0	22.1

Arousal Events	NREM		REM		TST	
	Count	Index (hr^{-1})	Count	Index (hr^{-1})	Count	Index (hr^{-1})
Total Arousals	93	19.4	11	32.2	104	20.2
Spontaneous	80	16.7	4	11.7	84	16.3
Respiratory-related	13	2.7	7	20.5	20	3.9
Limb-related	0	0.0	0	0.0	0	0.0

Respiratory Events (by type)	Hypopnea	Obstructive Apnea	Central Apnea	Mixed Apnea	TOTAL
Count:	18	0	0	0	18
Index (event/hr)	3.5	0.0	0.0	0.0	3.5
In REM (event/hr)	20.5	0.0	0.0	0.0	20.5
In NREM (event/hr)	2.3	0.0	0.0	0.0	2.3
Max length of Event (sec)	35	-			-
Mean length of Event (sec)	24	0	0	0	24

Respiratory Events (by body position)	Supine Sleep		Prone Sleep		Left-Side Sleep		Right-Side Sleep	
	Count	Index	Count	Index	Count	Index	Count	Index
Time (hhr:mm)	1:3.5		0:0.0		2:7.5		1:57.5	
Hypopnea	3	2.8	0	0.0	13	6.1	2	1.0
Obstructive Apnea	0	0.0	0	0.0	0	0.0	0	0.0
Central Apnea	0	0.0	0	0.0	0	0.0	0	0.0
Mixed Apnea	0	0.0	0	0.0	0	0.0	0	0.0
TOTAL	3	2.8	0	0.0	13	6.1	2	1.0

Oxygen saturation	Wake	NREM	REM	TST
Mean. SpO_2%:	94	93	93	93
Min. SpO_2%	-	89	90	89
ODI (desat/hr)	-	0.6	2.9	0.8
% Time in range				

90 - 100%:	98	98	100	98
80 - 89%:	0	0	0	0
70 – 79%	0	0	0	0

Pulse Rate	NREM	REM	TST
Mean. PR (bpm)	63	66	63
Min. PR (bpm)	54	58	54
Max. PR (bpm)	94	82	94

Definitions:

Apnea: Complete cessation of airflow for ≥10 sec, measured via pressure transducer and a reduction by ≥90% via a thermister.
Hypopnea: Reduction in airflow ≥30% for ≥10 sec, measured via pressure transducer, with either an arousal or ≥3% desaturation.
RERA: Increased respiratory effort OR flattening of airflow for ≥10 sec leading to an arousal. Included in total arousal index.

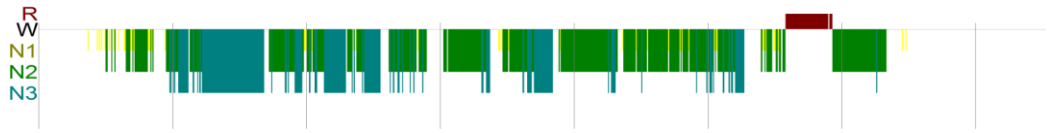
AHI = Apnea Hypopnea Index; The number of apneas and hypopneas per hour of sleep. Does not include RERA's.
RDI = Respiratory Disturbance Index; The number of apneas, hypopneas and RERAs per hour of sleep.
Oxygen desaturation = =>3% desaturation from baseline SpO2
ODI = Oxygen desaturation index; the number of oxygen desaturations =>3% per hour of sleep.
PR = Pulse Rate
TST = Total sleep time
TIB = Time in bed
WASO = Wake after sleep onset

Name: Patient ID: 21154

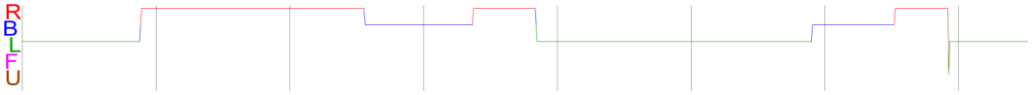
Study Date: 11/05/2022

Graphic Summary

Hypnogram



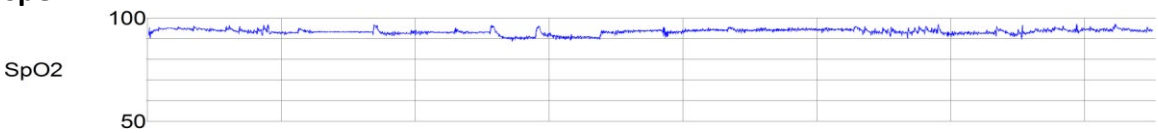
Body Position



Arousal

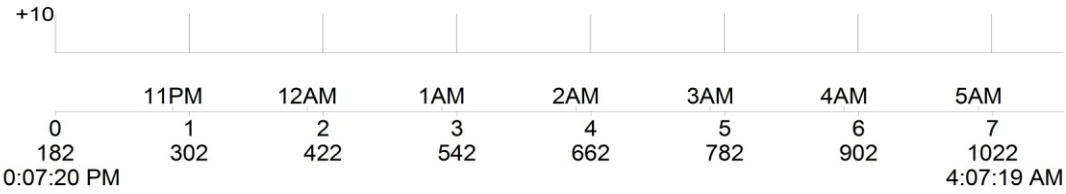
Respiratory event graphs with RERA and hypopnea

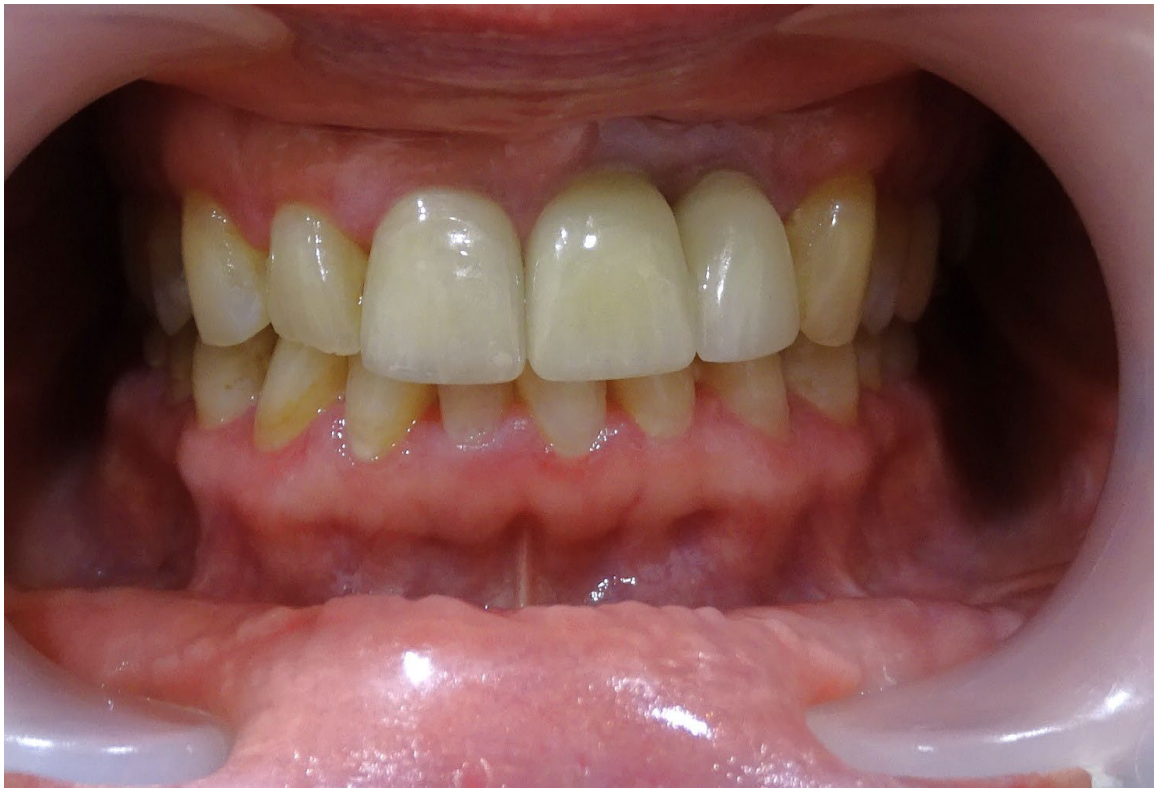
SpO2

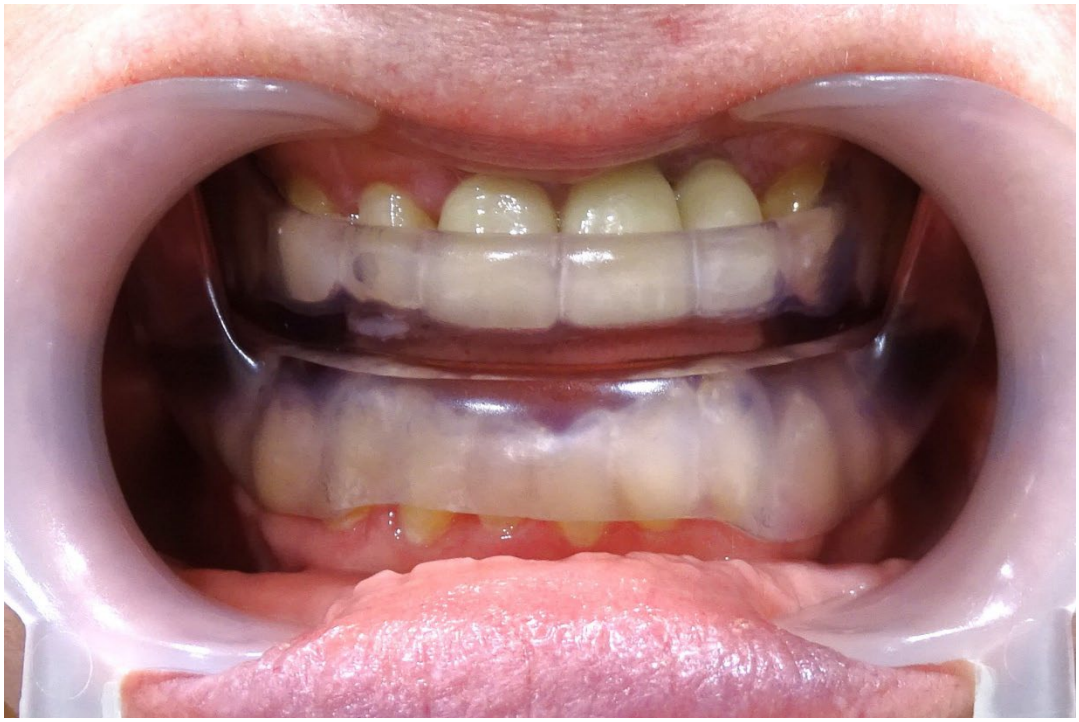


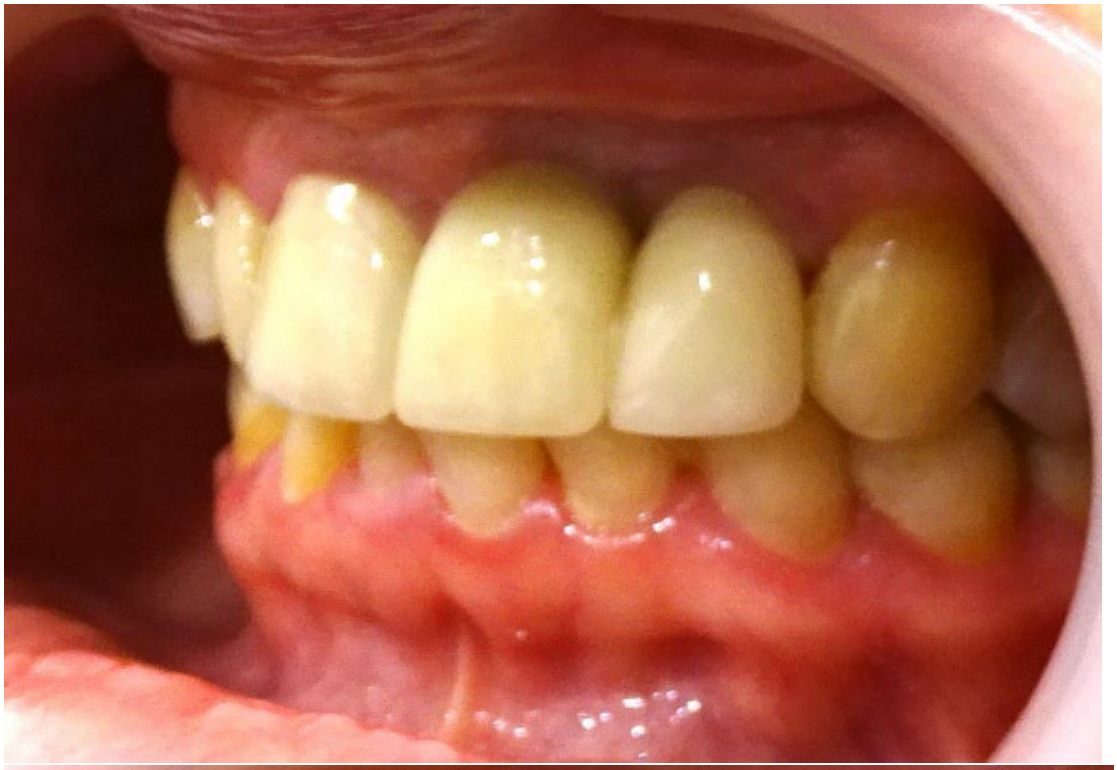
Pulse rate

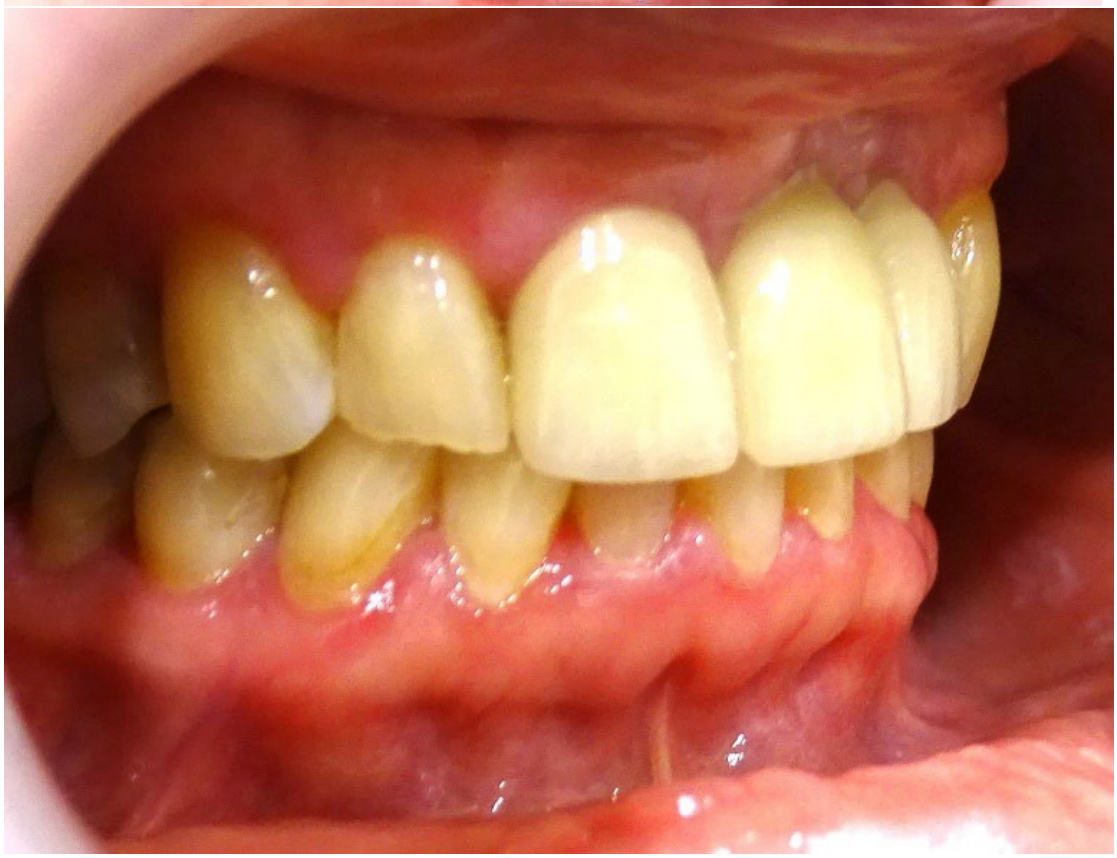
Leg movement

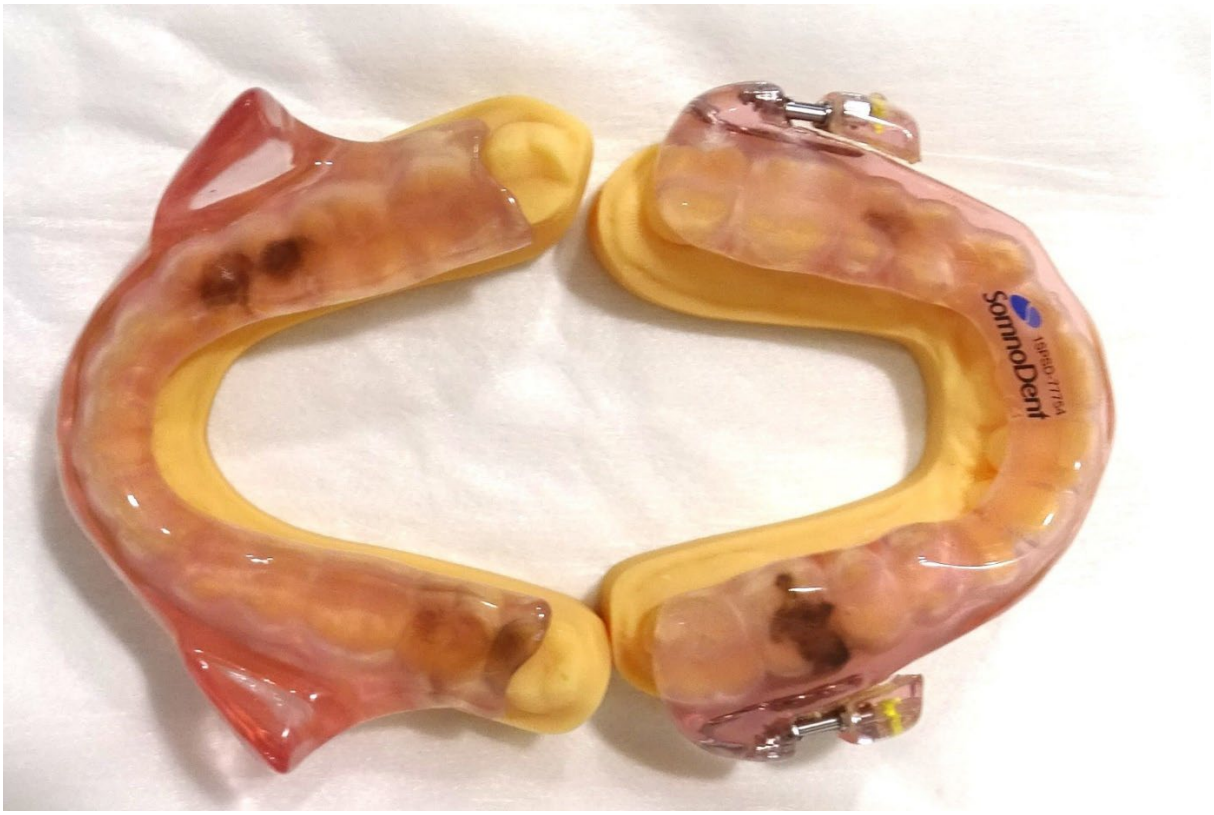


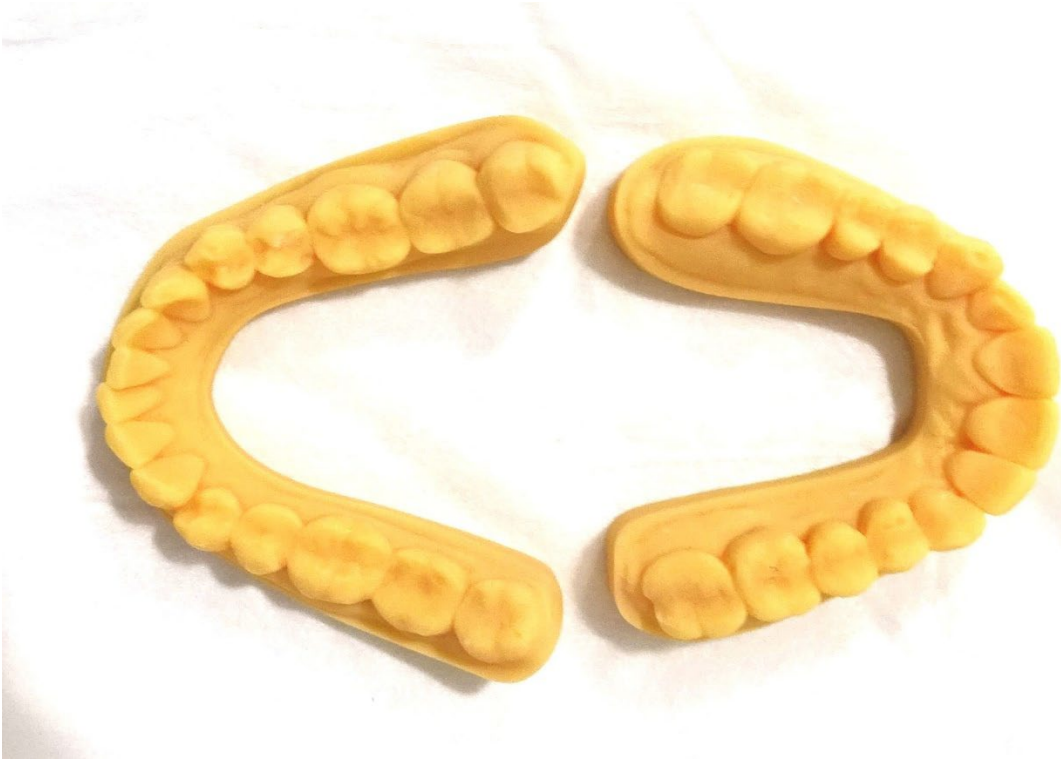


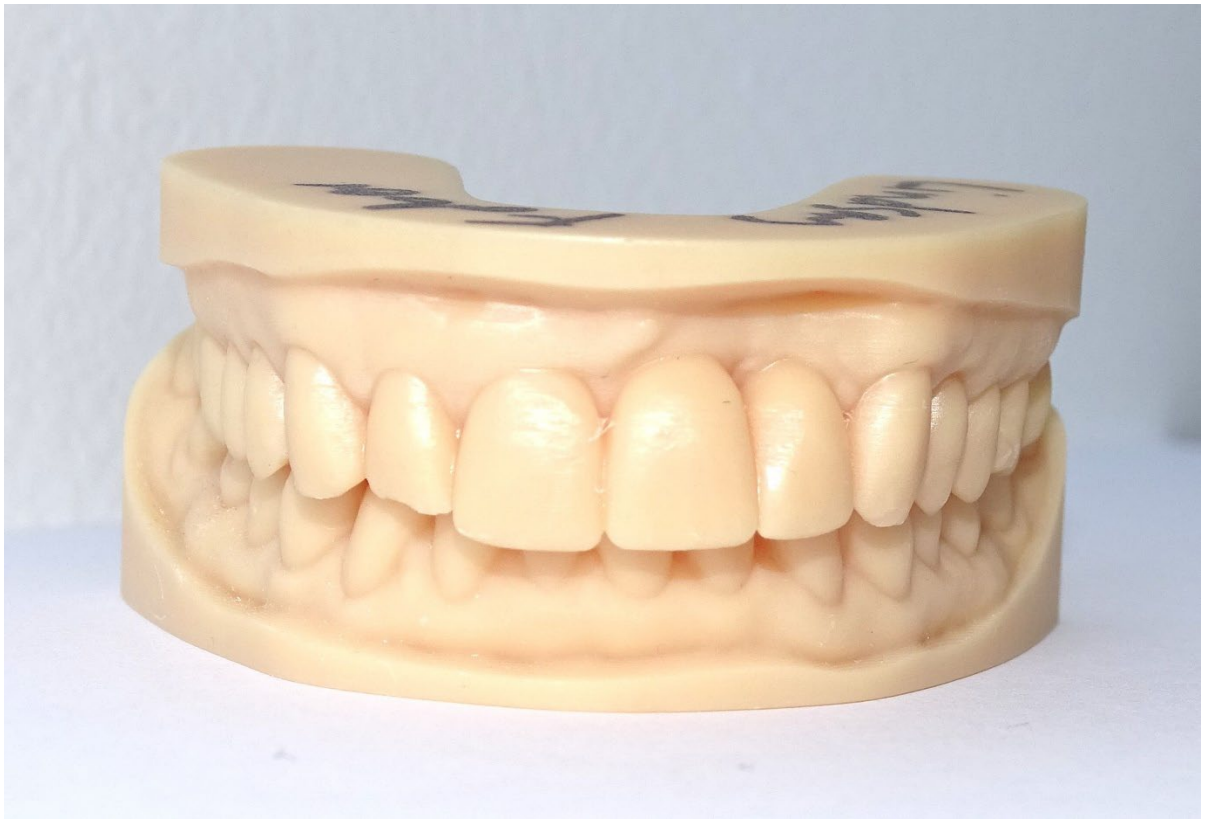


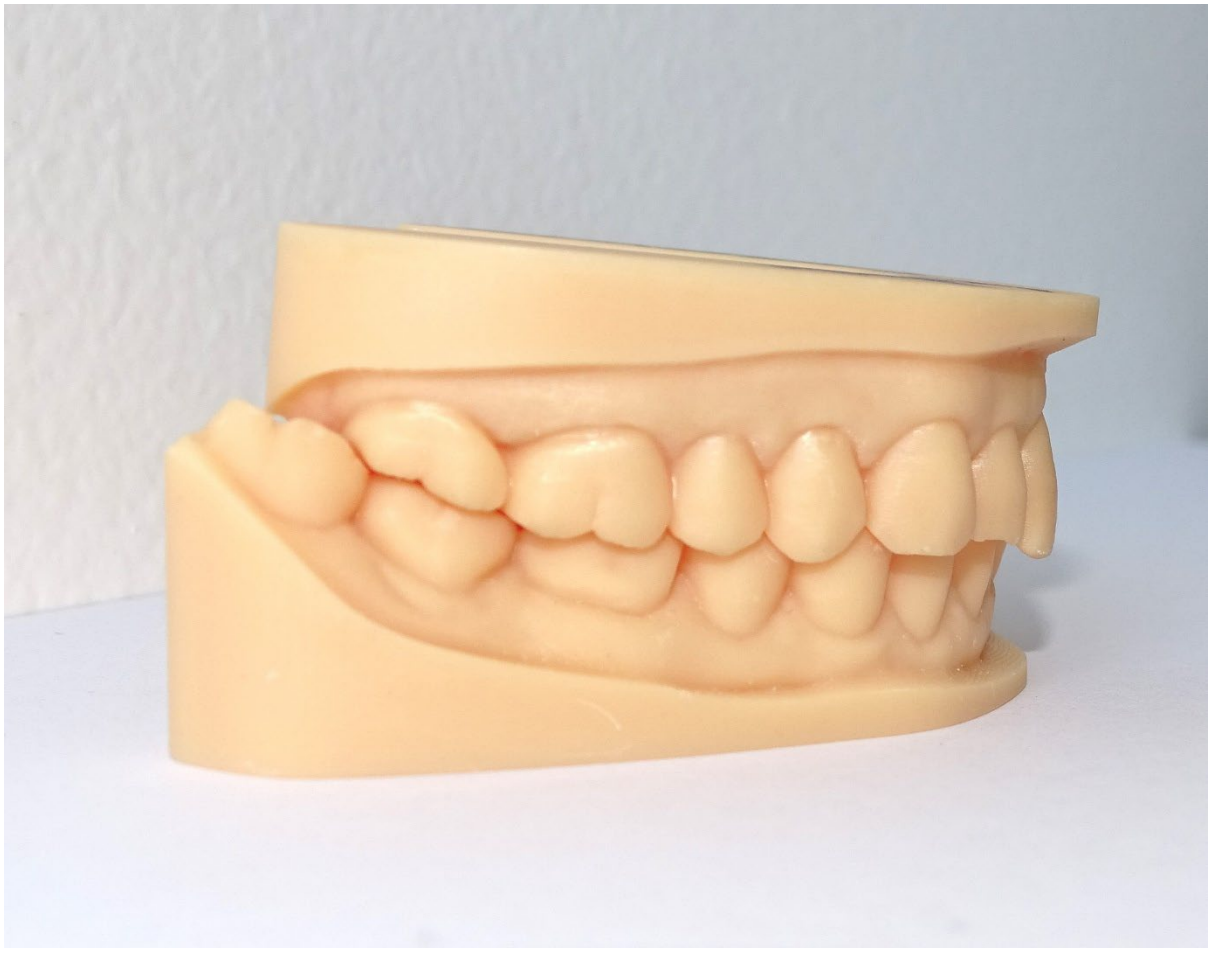


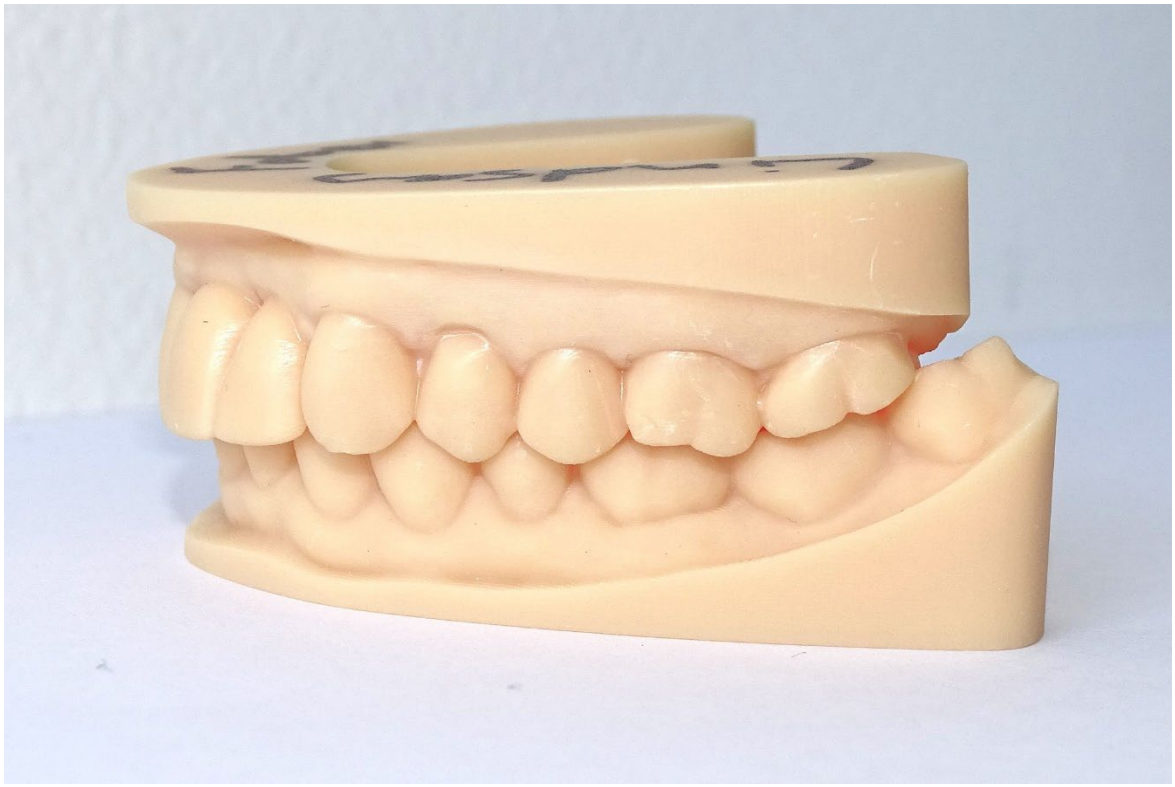


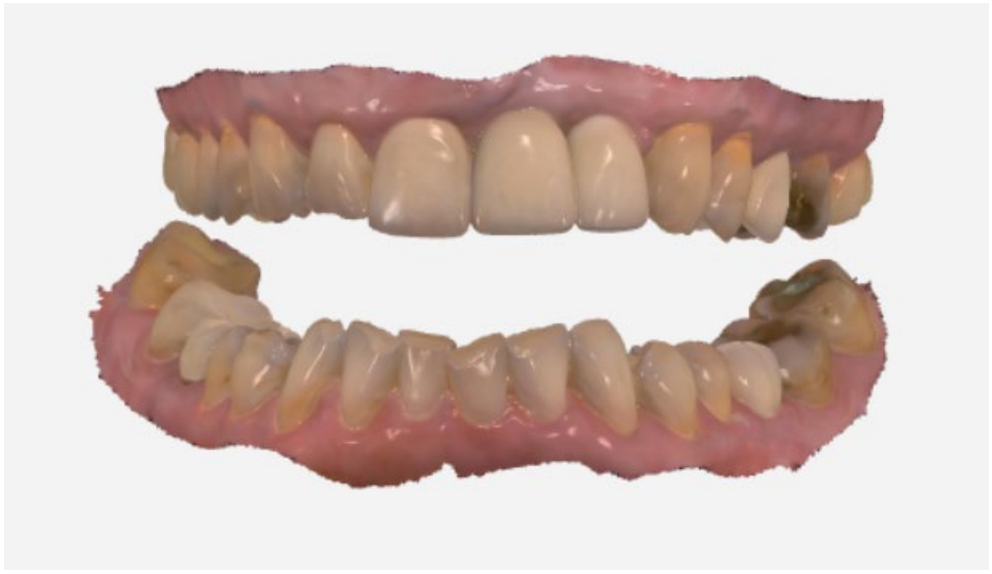

SomnoDent

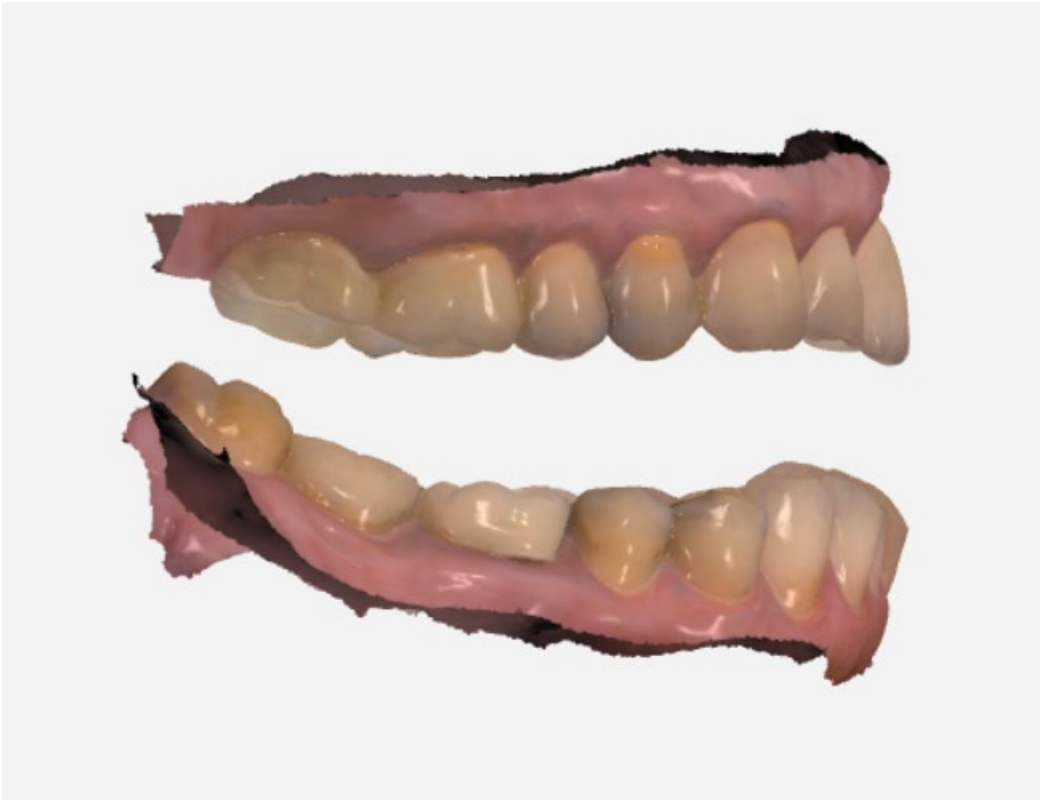


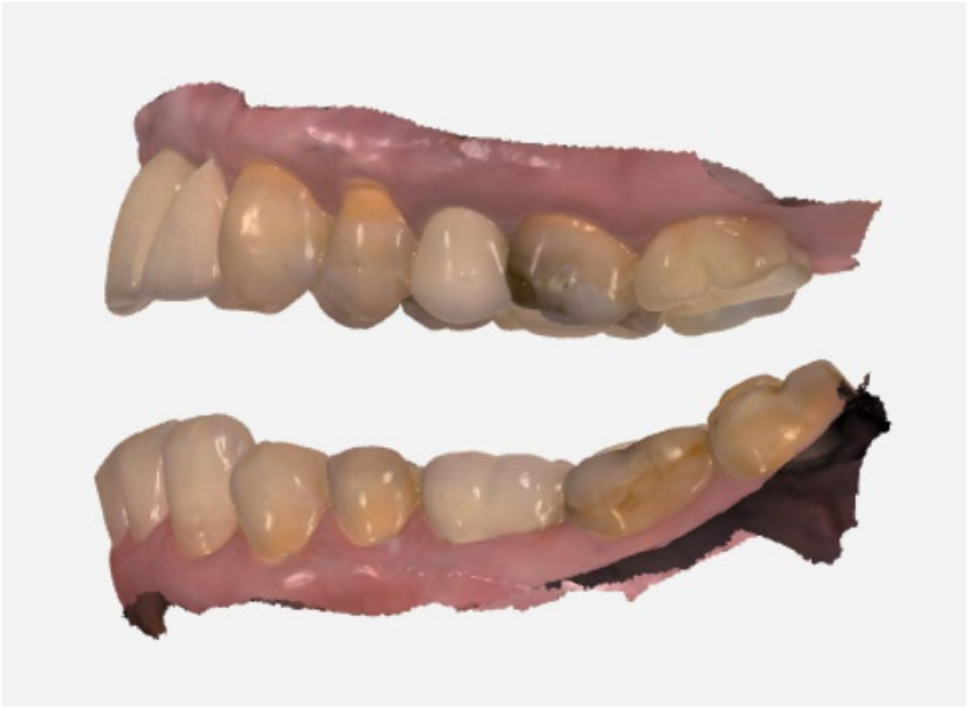












SYNOPSIS:

INTRODUCTION:

This patient was (in 2016) a 45 year old Asian male (DOB 21/05/1971) with the chief complaint of tiredness. Foremost, it was the complaint of excessive daytime somnolence over a 12 year period that brought about this journey. He initially consulted his general medical practitioner regarding his symptoms who referred him to a sleep physician (that was ten years prior). After undergoing a sleep study, WL was diagnosed with mild obstructive sleep apnoea/hypopnea and CPAP was implemented with average adherence 5-6 hours per night. CPAP compliance had waned, and his sleep physician referred him to trial a Mandibular Advancement Device/Splint (MAD/S). He presented to me for a consultation on 31/03/2016 and it was not until 2019 that MAS was commenced. Epworth Sleepiness Score 12/24

CHIEF COMPLAINT:

The patient's chief complaint was waking unrefreshed and tiredness throughout the day; although aware of a snoring complaint it was not the main concern as he lived alone. There were no witnessed apnoeic events. He reported waking with tiredness but also sleeping difficulties and wanted to find out if this in part, caused his depression. WL experiences difficulty staying awake during the day and would frequently nap; his sleep was poorly maintained and he would often wake at 3am and eat. He reported a protracted mental health history and being under the care of a Psychiatrist and Counsellor for ten years.

HISTORY OF PRESENT ILLNESS:

The patient has been aware of his sleep issues for 20 years and felt more so a worsening of his depression and daytime symptoms. The diagnosis of obstructive sleep apnoea was anticipated as his Father also had similar issues. WL used CPAP empirically for 5 years (2009-2014) as symptoms worsened; this yielded an improved mood and alertness however with decreased CPAP adherence at physician review in 2013, lifestyle intervention (weight loss) was suggested. WL returned to the clinic in 2016 with continued poor sleep and symptoms of excessive daytime somnolence and sought advice. A further lab/hospital based study was completed on the 4th of February 2016. This revealed and Apnoea-Hypopnea Index (AHI) of 9.7/hr and RDI 11.3/hr and the lowest oxygen concentration of 85.0%. Sleep efficiency on this study was only 50.5% and WASO (wake after sleep onset) almost 2 hours and only 8 minutes of REM sleep. Mandibular advancement splint was recommended.

PAST MEDICAL HISTORY:

Mr WL weighs 83Kg and is 164cm tall, with a BMI of 30.6. WL has ischaemic heart disease and in 2018 had coronary artery bypass and graft (CABG*2). He has hyperlipidaemia and hypertension which are well controlled pharmacologically. He is a diabetic (type 2 diabetes mellitus/NIDDM) and taking metformin, vitamin D Ostelin 5000mg; both kidney and liver are being monitored. WL is no longer taking antipsychotics for anxiety and depression (severe with previous ECT and TMS and currently awaiting trial of ketamine and psilocybin). He has no history of MVA. WL is committed to positive outlook/CBT and wellbeing but despite that has suicidal ideation and periods of rumination (months). WL is no longer taking antidepressant for depression (reduced from 300mg venlafaxine to 75mg to nil) and recently completed 4 week course of electroconvulsive therapy (ECT) as an outpatient and 12 sessions of transcranial magnetic stimulation (TMS) and is currently awaiting trial of ketamine and psilocybin. Ischaemic Heart Disease stable, managed with asprin and atorvastatin.

CLINICAL AND RADIOGRAPHIC EXAMINATION:

The patient had only the third molars missing: 18, 28, 38 and 48 removed. There was a porcelain fused to metal (PFM) crown on teeth 26, 36 and 46. There is no history of root canal therapy or traumatic injury to any teeth. The remaining teeth are in good condition however there is generalised loss of attachment on most buccal surfaces. There were minor amounts of plaque on most teeth and periodontal pockets (CPITN 1,1,1 1,2,1). Mr WL has a history of fixed orthodontic therapy with an original class 1 occlusion with midlines coincident. NB due to previous MAS (Somnodent dorsal fin MAD) there is bilateral posterior open bite and an edge to edge occlusion; midline is no longer coincident but with mandibular shift 2mm to the left hand side; His maximum mouth opening was 47mm, right lateral excursion 9mm and left lateral excursion 9mm and he was able to protrude a total of 12mm. There were no masticatory muscles or tenderness or pain upon palpation or function. There was no clicking, deviation or deflection noted. He had a normal tongue, long palate and elongated and erythematous uvula and had his tonsils present. There were no soft tissue lesions noted but mucosae was xerostomic. There is no reported issue with mastication.

DIAGNOSIS:

Overnight polysomnogram on the 4th of February 2016 revealed mild obstructive sleep apnoea/hypopnoea and mild periodic limb movements. His AHI was 11.3/hr and lowest oxygen desaturation of 85%. His obstructive sleep apnoea was considered to mild in all positions although one brief period of supine REM was recorded and there was poor sleep efficiency of 50.5% and extended period wake after sleep onset and delayed sleep onset of 99 minutes.

RATIONALE:

A Somnodent Flex mandibular advancement appliance was initially chosen due to its comfort and ease of use. Patient was motivated and capable of understanding its titration mechanism, which allowed him to titrate the appliance independently if necessary and able. It also allowed for vertical movement so patient can breathe through his mouth if required. The acrylic material allowed for any adjustment if the patient was to undergo dental treatment. His starting treatment position was 7mm out of a possible 12mm (58%). WL reported to be going very well with this device once acclimatisation had passed. During his hospital surgical stay, nurses misplaced the device during bed relocation. A Somnomed Avant MAS device was constructed and this worked well in view of the lateral bruxism habit and occasional mouth breathing.

RESULTS:

Patient reports subjective improvements in sleep parameters prior to objective sleep assessment. The success of the appliance was initially compounded by a reduction in compliance due to jaw stiffness and muscular tenderness. Patient was able to cope with the appliance which led to an improvement in subjective symptoms. Treatment polysomnogram was completed on 7th September 2022 (MAS in situ). The treatment sleep study revealed an AHI of 3.7/hr and lowest oxygen desaturations of 80%. Patient did sleep supine in this study but only 12 minutes and no REM sleep in supine was recorded. REM proportion overall had increased to 21% and sleep efficiency to 73%. ODI was not elevated at 4.6/hr. He was recommended to continue wearing the appliance nightly at the current treatment position which was 10 millimetres out of total range 12mm (83%).

DISPOSITION:

A treatment sleep study (ambulatory home sleep test level 2) was completed on the 7th September 2022, which was analysed by a sleep physician. It confirmed the success of the appliance, with the physician stating there was objective improvement in his sleep efficiency (73%) and AHI, with a reduction from 11.3 to 3.7 Apnoeas/hypopneas per hour of sleep and no significant side effects. REM proportion was now 21%. Given his mild improvements in his symptoms (decreased morning tiredness, daytime somnolence and sleep disturbances) and objective reduction of his AHI he was recommended to continue utilising his mandibular advancement appliance to manage his obstructive sleep apnoea. The sleep physician scheduled no further reviews with him. ODI reduced from 14.4/hr to 4.6/hr.

FOLLOW UP VISITS:

Patient DOB 21/05/1971
Initial Consultation:
Appliance Insert: 29/3/22

DOS: 27/4/22

Subjective: Patient has a history of mild obstructive sleep apnoea and presents for his one month follow up with the use of his Somnodent Avant mandibular advancement appliance. Medical history has changed and is no longer taking any antidepressant (has ceased Effexor). No significant weight change is reported. Patient reports his mood is stable and sleep routine maintained with the use of the appliance. Patient awakens feeling rested on most days and experiences minor lethargy and average energy and occasional mood disturbance and anxiety but is able to modify this with natural therapies and remaining engaged with a disability support worker, personal trainer and counselling sessions. The main (dental) side effect reported is mild tenderness of the jaw muscles which is relieved by stretching exercises and massage. There is no tooth discomfort. This does not interfere with any eating or mastication or sleep and has not required analgesic; subjective compliance reported as full time 6.5 hours per night.

Objective: General appearance remains unchanged. There was mild bilateral masseter tenderness and no TMJ pain. Maximum mouth opening as before 47 millimetres. Right and left and protrusive excursions remain the same (9mm, 9mm and 12mm respectively). Occlusion remained the same and the pre-existing bite change had not exacerbated; there was no tooth mobility. There was no clicking deviation or deflection noted intraorally, no abnormalities were noted in any of the soft tissues. Appliance was titrated at 9mm out of a possible 12mm 3 millimetres up to 83% and was mechanically sound. Maxillary anterior teeth we're not tender to percussion or sensitive upon testing.

Assessment: snoring reportedly resolved and there were improvements in subjective scores as stated above. Obstructive sleep apnea has subjectively approved with oral appliance therapy confirmation of oral appliance success will need to be objectively tested with a treatment sleep study.

Plan: Recommended patient to continue wearing the appliance nightly and continue with jaw repositioning exercises as per AADSM protocol. Elastic retention on placed for stability and comfort. No acrylic was removed from the device and retention remained without lifting. A follow up was scheduled in two months (3 months post issue of MAS)

Physician Review 9/6/22 (conjoint dental review)

Subjective: Patient has a history of mild obstructive apnoea and presents for his 3 month follow up with the use of his Somnomed Avant mandibular advancement appliance. Medical history and social history remain unchanged. Patient advises she has maintained a reasonable sleep routine and waking with improved well being with device usage; WL is still

managing his day-to-day mood with cognitive behaviour therapy, meditation and engagement with a disability support worker/personal trainer. He does at times experience lethargy and rumination. Patient experiences drowsiness and frequent low mood however feels that management of his sleep and routine is preferrable to any antipsychotic or antidepressant medication. The device is comfortable without any dental symptoms.

Objective: General appearance remains unchanged. There was mild bilateral masseter tenderness and no TMJ pain. Maximum mouth opening remained unchanged at 47mm. Right and left lateral excursions remain the same at 9mm. Protrusion remains the same at total range 12mm. Occlusion remained the same and the pre-existing bite change had not exacerbated; there was no tooth mobility. On the right-hand side, there was poor occlusal contact and the incisor relationship remained as edge to edge. The use of a morning repositioner had been abandoned some time ago. There was no clicking deviation or deflection noted. Intraorally, dryness was noted of the soft tissues, to include upper and lower lips. Appliance was titrated at 9mm out of a possible (83%) and is mechanically sound.

Assessment: Snoring as reduced (via feedback from a friend) and subjective symptoms are reduced but not resolved due to ongoing background of severe depression. Nonetheless adherence with oral appliance continues to yield favourable sleep and sense of rest. Confirmation of oral appliance success will need t be objectively tested with a treatment sleep study.

Plan: Recommended patient to continue wearing the appliance nightly at this treatment position and to continue jaw repositioning exercises as per AADSM. Patient was instructed on the management of dry mouth and advised to use high strength Fluoride toothpaste (5000ppm) without rinsing and to hydrate with 2 litres of water each day. Patient was referred for a treatment sleep study and a follow up was scheduled in 5 months.

DOS 14/12/2022

Subjective: Patient has a history of mild obstructive sleep apnoea and presents for his 9 month follow up with the use of his Somnomed Avant mandibular advancement appliance. Medical history has changed and WL now is enrolled in a trial of psyillocybin and is considering ketamine nasal spray. A weight loss of 5kg was reported. Patient advised a sleep study was completed and confirmed with the success of the appliance. Patient advises he has been doing well with this current device and the symptoms of well being remain the same; there was a regression in mental health at the start of the year, 6 months ago. Sleep hygiene and daily routines remain managed with improved outcome but are “continual work” and disciplined. He experiences some mild lethargy and minor drowsiness through out the day but longer sleep, remains active and engaged to combat symptoms of depression; no dental side effects are experienced and reports full time adherence with MAD/S

Objective: General appearance remains unchanged. There was no masticatory muscle or TMJ pain. Maximum mouth opening remain unchanged at 47mm. Right and left lateral excursions both remain at 9mm. Protrusion remains the same at 12mm total range. There

was no clicking, deviation or deflection noted. Occlusion has not exacerbated beyond the original bite change of decreased occlusal contact with minor posterior open bite on the right hand side; edge to edge incisor relationship exists with slight mandibular shift, 2mm to the left hand side. There was no tooth mobility and intra-orally dryness of the mucosae and lips remained unchanged. Appliance was titrated at 9mm out of a possible 12mm (83%) and is mechanically sound and well cleaned.

Assessment: Obstructive sleep apnoea has improved to an AHI/RDI of 3.7/hr as confirmed by objective testing, including an improvement of REM sleep proportion from 3.7% to 21.4% total sleep time (TST).

Plan: Recommended patient to continue wearing the appliance nightly at this treatment position and to continue with jaw repositioning exercises as per AADSM; patient will continue with oral hygiene regime and report back with his primary dental practitioner. Although oral hygiene, diet and hydration have improved, caries risk remains high with demineralisation at distal 46 full coverage restoration. A follow up was scheduled in 12 months.

Summary: this case report illustrates the complexities of symptoms related to mental health and the impact on sleep but also the importance of sleep hygiene and management of OSA in improved sleep efficiency. Despite having symptoms related to depression, improved sleep and apnoea reduction are beneficial to (subjective) everyday well being.

sleep@WOOLCOCK

Polysomnography Report

Patient name: WL baseline
DOB: 1971
Study Type: Diagnostic
Requesting Physician: Dr Brendon Yee
Referring Physician:
Height (cm): 164.0
Weight (kg): 77.0
BMI: 28.6

Neck Circumference: 39cm

Study Date: 4/02/2016
Gender: Male
Evening BP: 142/93
Morning BP: 140/97
Snoring: Soft to Moderate
ESS: 12/24

Subjective Sleep Quality: Worse

Sleep Architecture:

Total time in bed (min)	=	429.6	Sleep latency (min)	=	99.9
Total sleep time (min)	=	217.0	REM latency (min)	=	317.5
Wake after sleep onset (min)	=	112.7	NREM sleep (min)	=	209.0
Sleep efficiency	=	50.5%	REM sleep (min)	=	8.0

Total RDI*	**= 11.3/hr**	**Minimum oxygen saturations**	**= 85.0%**
Total AHI	**= 9.7/hr**	**Total arousal index**	**= 32.6/hr**
RDI Non-REM sleep	**= 11.2/hr**	**RERA index**	**= 1.7/hr**
RDI REM sleep	**= 15.0/hr**	**PLM arousal index**	**= 7.5/hr**

(*RDI= all apneas, hypopnoeas and RERAs-see page 3 for definitions.)

Sleep Physician's Report: Diagnostic sleep study. Study recorded in supine and lateral positions and included 1 brief period only of supine REM sleep. Sleep onset was delayed and there were periods of wake after sleep onset 1st half of study. REM sleep proportion was much reduced. Soft-moderate snoring was documented. Mostly brief bursts of hypopneas occurred in supine sleep, with associated mild desaturations. Total RDI of 11 events/hr, minimal O2 saturation of 85%.

Conclusion & Recommendations: Mild obstructive sleep apnoea. Clinical review.

Yours sincerely

Dr Peter Buchanan **MB BS, MD, FRACP**
Sleep Disorder Specialist
Provider Number 0815127L
Woolcock Interdisciplinary Clinic, NHMRC Centre for Excellence Sleep Health

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Patient Name: LEE Walter • Study Date: 4/02/2016

SUMMARY

Sleep Architecture:	Hours of sleep recorded:	3:37:00 hrs
	Sleep Efficiency:	50.5%
	Arousal Index:	32.6/hr
Respiratory Events:	Respiratory Disturbance Index (TOTAL):	11.3/hr
	Respiratory Disturbance Index (NREM):	11.2/hr
	Respiratory Disturbance Index (REM):	15.0/hr
	Apnea Hypopnoea Index (TOTAL):	9.7/hr
Oxygen Saturation:	Awake average:	95.0%
	Minimum SaO2:	85.0%
	Oxygen Desaturation (≥3%) Index:	14.4/hr
Periodic Limb Movement:	Leg Movement index:	23.8/hr
	PLM arousal index:	7.5/hr

DETAILED RESPIRATORY DATA:

Respiratory events	Obstructive apnoea	Hypopnea	Central apnoea	Mixed Apnea	TOTAL
Count:	0	35	0	0	41
Index (events/hr):	0.0	9.7	0.0	0.0	**11.3**
REM Index:	0.0	15.0	0.0	0.0	15.0
NREM Index:	0.0	9.5	0.0	0.0	11.2
Max Length of Event:	N/A	50.4	N/A	N/A	
Mean Length of Event:	N/A	26.3	N/A	N/A	

Respiratory Events (by Body-Position)	Supine Sleep		Prone Sleep		Left-Side Sleep		Right-Side Sleep	
	Count	Index	Count	Index	Count	Index	Count	Index
Duration (hrs:min:sec):	1:44:28		0:00:00		0:31:00		1:21:32	
Obstructive Apneas:	0	0.0	N/A	N/A	0	0.0	0	0.0
Central Apneas:	0	0.0	N/A	N/A	0	0.0	0	0.0
Mixed Apneas:	0	0.0	N/A	N/A	0	0.0	0	0.0
Hypopneas:	26	14.9	N/A	N/A	5	9.7	4	2.9
Total:	27	15.5	N/A	N/A	9	17.4	5	3.7

AHI	Supine	Non-supine
NREM /hr	14.9	4.8
REM /hr	15.0	N/A

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Patient Name: LEE Walter • Study Date: 4/02/2016

DETAILED SLEEP, AROUSAL, LIMB and OXIMETRY DATA:

Sleep Architecture					
Analysis Start – Lights Off:	11:00:13 PM	Analysis End – Lights On:	6:09:47 AM	Total Sleep Time:	3:37:00
Time in Bed:	7:09:34	Sleep Period Time:	5:29:40	Sleep Efficiency:	50.5%
Sleep Onset:	1:39:54	REM Latency:	5:17:30	Awakenings:	28

Stage Distribution	Duration	% TST
WASO	1:52:40	
N1:	0:27:00	12.4%
N2:	1:58:00	54.4%
N3:	1:04:00	29.5%
REM:	0:08:00	3.7%

Arousal Events	Non-REM		REM		Total Sleep Time	
	Count	Index	Count	Index	Count	Index
TOTAL Arousals:	113	32.4	5	37.5	118	32.6
PLM-related:	27	7.8	0	0.0	27	7.5
Respiratory-related:	15	4.3	0	0.0	15	4.1
Spontaneous EEG*:	71	20.4	5	37.5	76	21.0

Limb Movements	LM Arousal Index	Total LM Index	LM Arousal Count	Total LM Count
Total Sleep Time:	7.5	23.8	27	86

OXYGEN SATURATION	Wake	Non-REM	REM	TST	TIB
Max. SpO2%:	100.0	98.0	98.0	98.0	100.0
Mean SpO2%:	95.0	93.8	94.1	93.8	94.4
Min. SpO2%:	81.0	85.0	89.0	85.0	81.0
% Time in range					
90 – 100%:	91.6%	97.6%	83.8%	97.1%	94.3%
80 – 89%:	1.8%	2.4%	2.1%	2.4%	2.1%

Definitions used in scoring:

Apnoea: Complete cessation of airflow for ≥10 sec, measured via pressure transducer and a reduction by ≥90% via a thermister.
Hypopnoea: Reduction in airflow ≥30% for ≥10 sec, measured via pressure transducer, with either an arousal or ≥3% desaturation.
RERA: Increased respiratory effort OR flattening of airflow for ≥10 sec leading to an arousal. Included in total arousal index.

Apnoea Hypopnoea Index: Includes: Apnoeas and hypopnoeas. Does not include RERA's.
Respiratory Disturbance Index: Apnoeas, hypopnoeas and RERA's.

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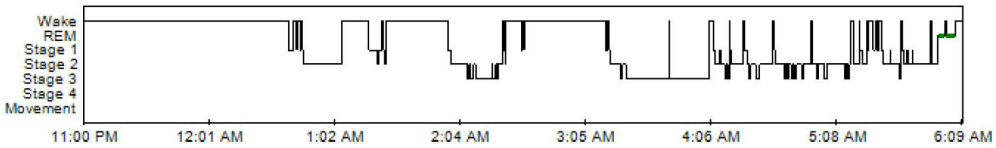
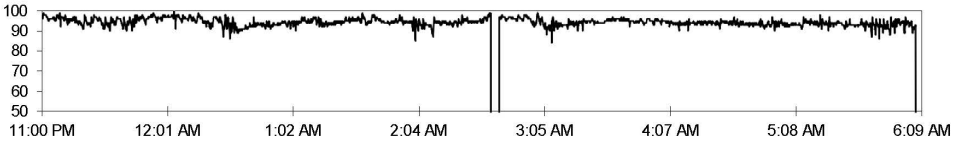
Patient Name: LEE Walter • Study Date: 4/02/2016

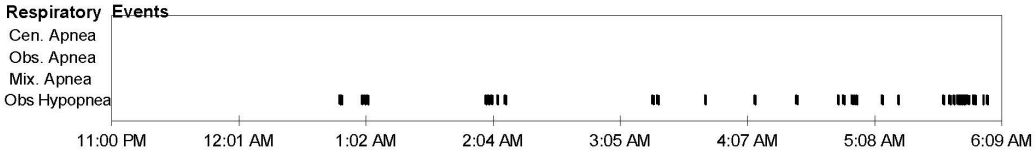
Hypnogram



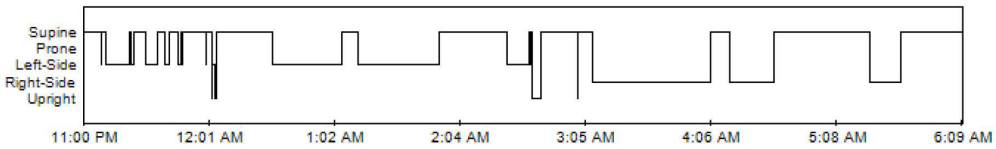
SpO2%



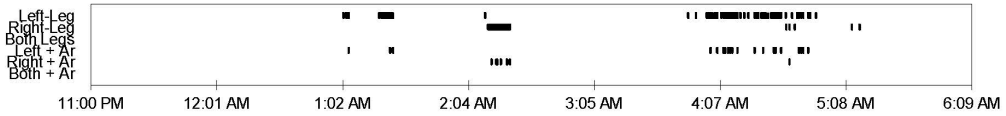
Respiratory Events



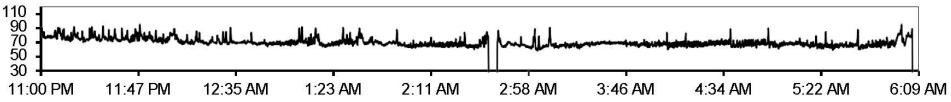
Body Position



Limb Movement Events



Pulse (bpm)



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Polysomnography Report

WL
DOB: 1971
Study Type: Diagnostic Ambulatory
Requesting Physician: Prof Brendon Yee
Referring Physician: Dr
Weight (kg): 82.2 kg
Height (m): 164.0 cm
BMI: 30.6 kg/m^2
Snore: Intermittent, mild-mod

Study Date: 7/09/2022
Gender: Male
Evening BP: 121/98
Morning BP: NA
Neck circumference: 41cm
Epworth Sleepiness Score: 7/24
Subjective Sleep Latency: Shorter
Subjective Total Sleep Time: 8hrs
Subjective Sleep Quality: Same

Sleep Architecture:

Total time in bed (min)	=	615.7	Sleep latency (min)	=	155.0
Total sleep time (min)	=	450.0	REM latency (min)	=	116.5
Wake after sleep onset (min)	=	10.7	NREM sleep (min)	=	353.5
Sleep efficiency	=	73.1%	REM sleep (min)	=	96.5

Total RDI*	**=**	**3.7 /hr**	**Minimum oxygen saturations**	**=**	**80%**
Total AHI	**=**	**3.7 /hr**	**Total arousal index**	**=**	**22.7 /hr**
RDI Non-REM sleep	**=**	**1.9 /hr**	**RERA index**	**=**	**0.0 /hr**
RDI REM sleep	**=**	**10.6 /hr**	**LM arousal index**	**=**	**14.0/hr**

(*RDI= all apneas, hypopnoeas, and RERA's -see page 3 for definitions.)

Sleep Physician's Report:
Technical issues as noted above. Reasonably consolidated sleep architecture despite frequent arousals. Sleep latency was significantly prolonged resulting in reduced sleep efficiency. All sleep stages were reached. Minimal supine sleep recorded. Infrequent respiratory events (mainly hypopneas) were observed in association with arousals and/or desaturations a nadir of 80%, occurring predominantly in REM sleep. ODI was not elevated at 4.6 desats/hr. Snoring recorded. Frequent PLMS were observed with occasional associated arousals. ECG showed sinus rhythm.

Conclusion & Recommendations:
1. No significant sleep disordered breathing on the present study
2. PLMS

Yours sincerely

Prof. Brendon Yee MBCHB (Otago) FCCP FRACP PhD (Sydney)
Sleep and Respiratory Physician
Woolcock Interdisciplinary Clinic, NHMRC Centre for Excellence Sleep Health

CC:

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SUMMARY

Sleep Architecture:	Total Hours Sleep Time:	450.0 min
	Sleep Efficiency:	73.1%
	Arousal Index:	22.7 /hr
Respiratory Events:	Respiratory Disturbance Index (TOTAL):	3.7 /hr
	Respiratory Disturbance Index (NREM):	1.9 /hr
	Respiratory Disturbance Index (REM):	10.6 /hr
	Apnea Hypopnea Index (TOTAL):	3.7 /hr
Oxygen Saturation:	Awake average:	93 %
	Minimum SaO2:	80 %
	Oxygenation Disturbance (≥3%) Index	4.6 /hr

Limb Movement Information:

	Count	Index
Limb Movement:	219	29.2
LM Arousals:	105	14.0

DETAILED RESPIRATORY DATA:

Respiratory events	Obstructive apneas	Hypopnea	Central Apnea	Mixed Apnea	TOTAL
Count:	0	28	0	0	28
Index (event/hr):	0.0	3.7	0.0	0.0	3.7
REM Index:	0.0	10.6	0.0	0.0	10.6
NREM Index:	0.0	1.9	0.0	0.0	1.9
Max length of Event (secs):	0.0	40.0	0.0	0.0	40.0
Mean length of Event (secs):	0.0	20.8	0.0	0.0	20.8

RESPIRATORY EVENTS	Supine Sleep		Prone Sleep		Left-Side Sleep		Right-Side Sleep	
(by position)	Count	Index	Count	Index	Count	Index	Count	Index
Duration (mins):	12.7		36.5		308.0		92.8	
Obstructive Apneas:	0	0.0	0	0.0	0	0.0	0	0.0
Central Apneas:	0	0.0	0	0.0	0	0.0	0	0.0
Hypopneas:	0	0.0	0	0.0	27	5.3	1	0.6
Mixed Apneas:	0	0.0	0	0.0	0	0.0	0	0.0
TOTAL:	0	0.0	0	0.0	27	5.3	1	0.6

AHI	Supine	Non-Supine
NREM/hr	0.0	1.94
REM/hr	0.0	10.57

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DETAILED SLEEP, AROUSAL, LIMB and OXIMETRY DATA:

Sleep Architecture					
Analysis Start- Light Off:	9:59:25 PM	Analysis End-Lights On:	8:15:07 AM	Total Sleep Time:	450.0 mins
Time in Bed (minutes):	615.7	Sleep Period (minutes):	459.0	Sleep Efficiency:	73.1%
Sleep Onset (minutes):	155.0	REM Latency (minutes):	116.5	Awakenings:	9

Stage Distribution	Duration (minutes)	%TST
WASO:	10.7	
Stage N1:	15.0	3.3
Stage N2:	245.5	54.6
Stage N3:	93.0	20.7
REM:	96.5	21.4

AROUSAL EVENTS	Non-REM		REM		Total Sleep Time	
	Count	Index	Count	Index	Count	Index
TOTAL Arousals:	138	22.7	26	16.2	170	22.7
PLM/LM-related:	104	17.7	0	0.0	105	14.0
Respiratory-related:	5	0.8	5	3.1	10	1.3
Spontaneous EEG:	14	2.4	8	5.0	23	3.1

OXYGEN SATURATION	Wake	Non-REM	REM	TIB
Mean. SpO2%:	94	93	92	93
Min. SpO2%		-		80
% Time in range				
90-100%:	64.33	99.04	89.12	88.14
80-89%:	0.18	0.48	9.43	1.80

Definitions used in scoring:

Apnoea:	Complete cessation of airflow for ≥10 sec, measured via pressure transducer and a reduction by ≥90% via a thermister.
Hypopnoea:	Reduction in airflow ≥30% for ≥10 sec, measured via pressure transducer, with either an arousal or ≥3% desaturation.
RERA:	Increased respiratory effort OR flattening of airflow for ≥10 sec leading to an arousal. Included in total arousal index.
Apnoea Hypopnoea Index:	Includes: Apnoeas and hypopnoeas. Does not include RERA's.
Respiratory Disturbance Index:	Apnoeas, hypopnoeas and RERA's.

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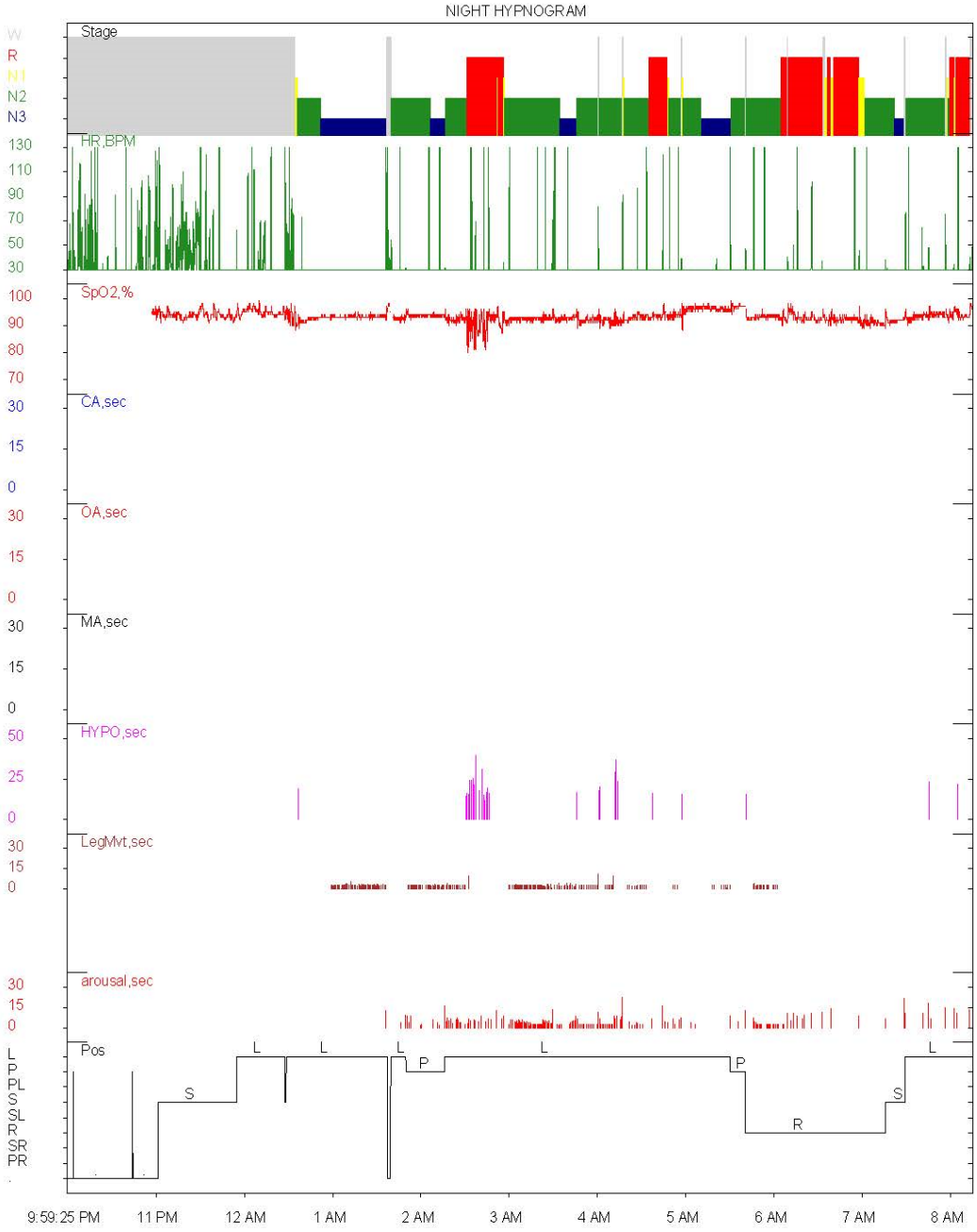

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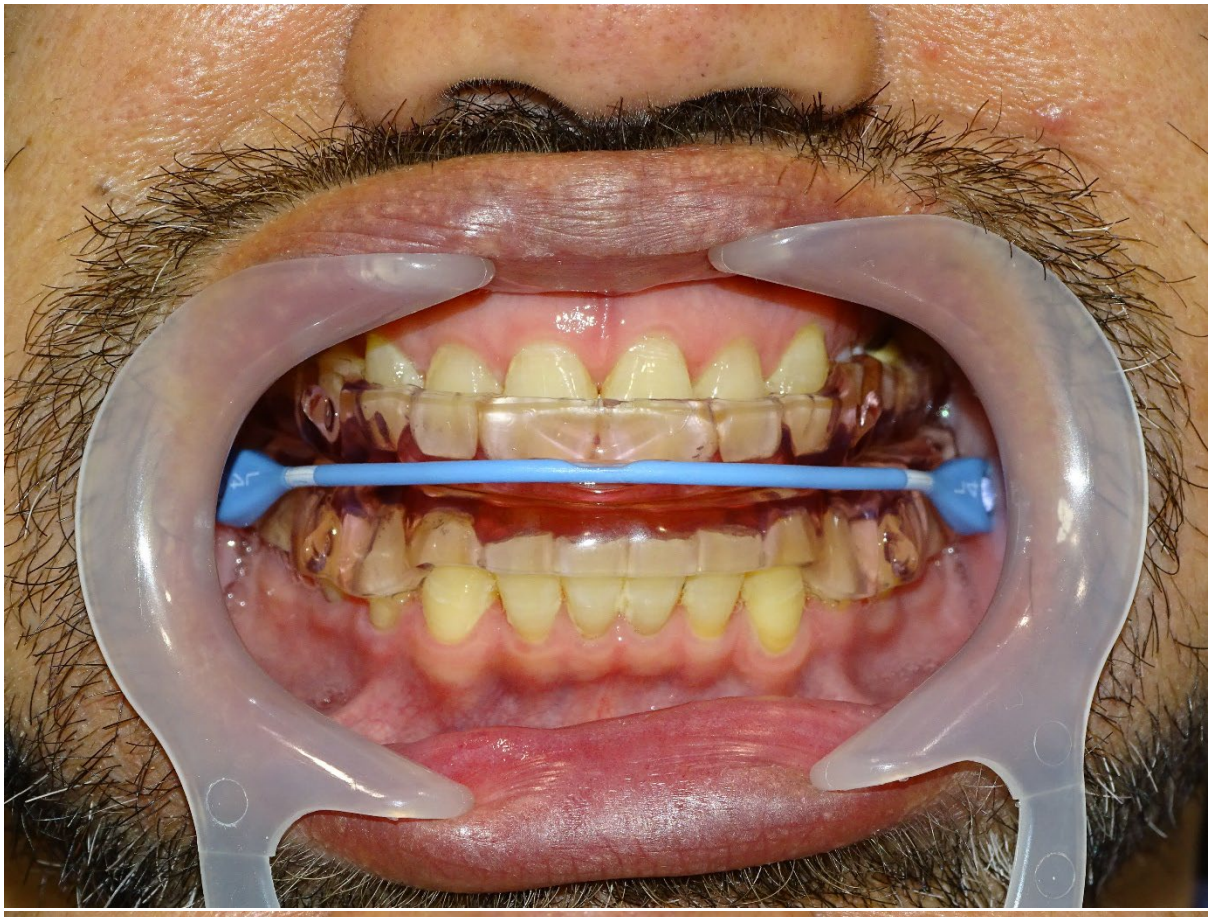

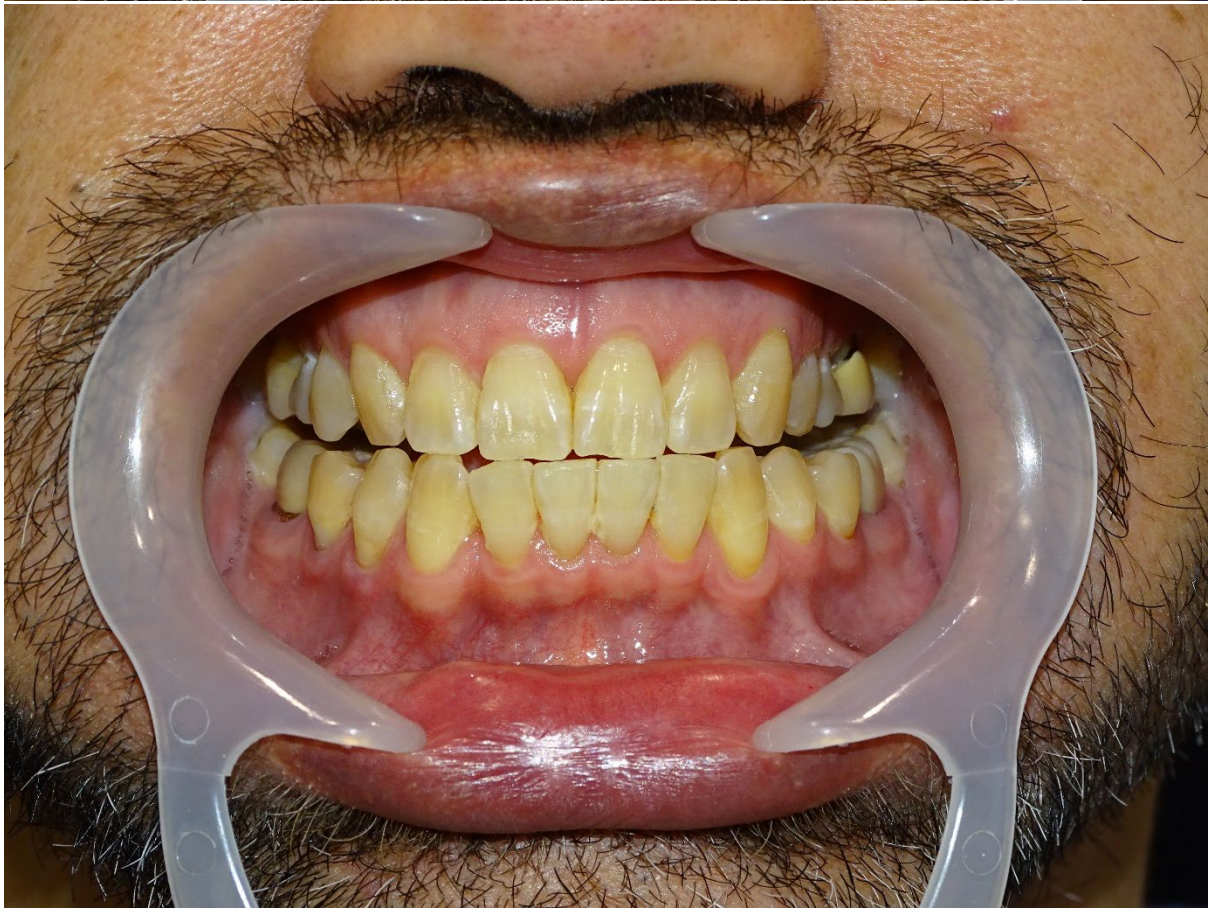

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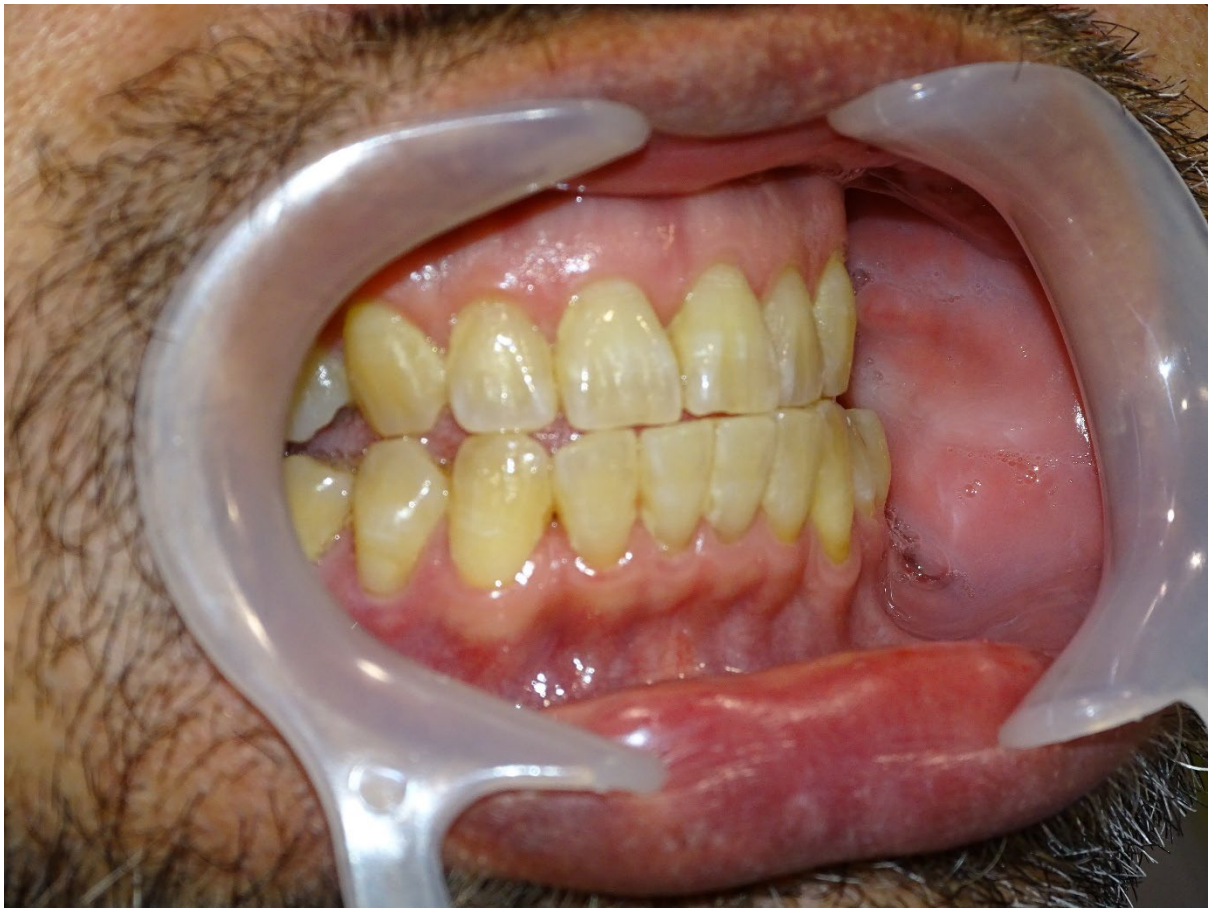

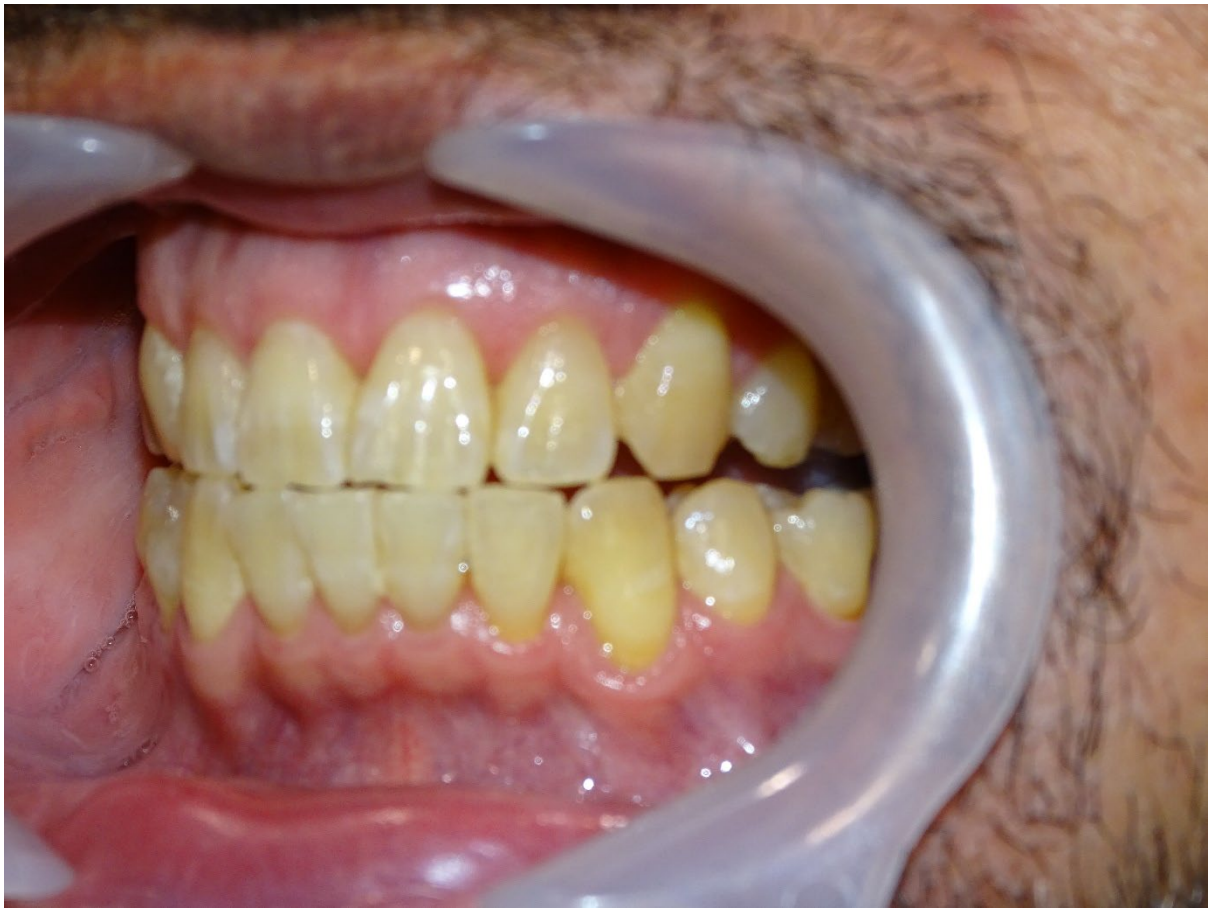

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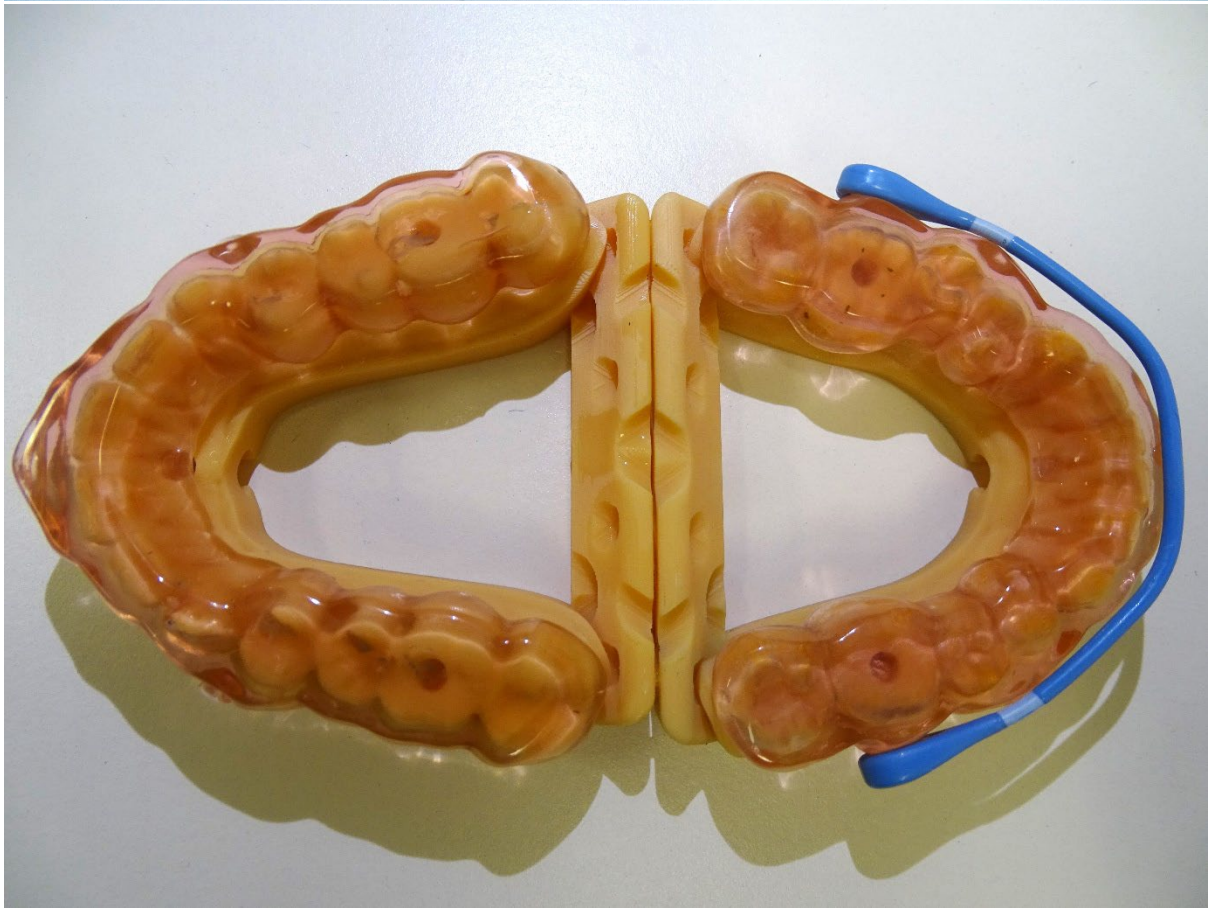

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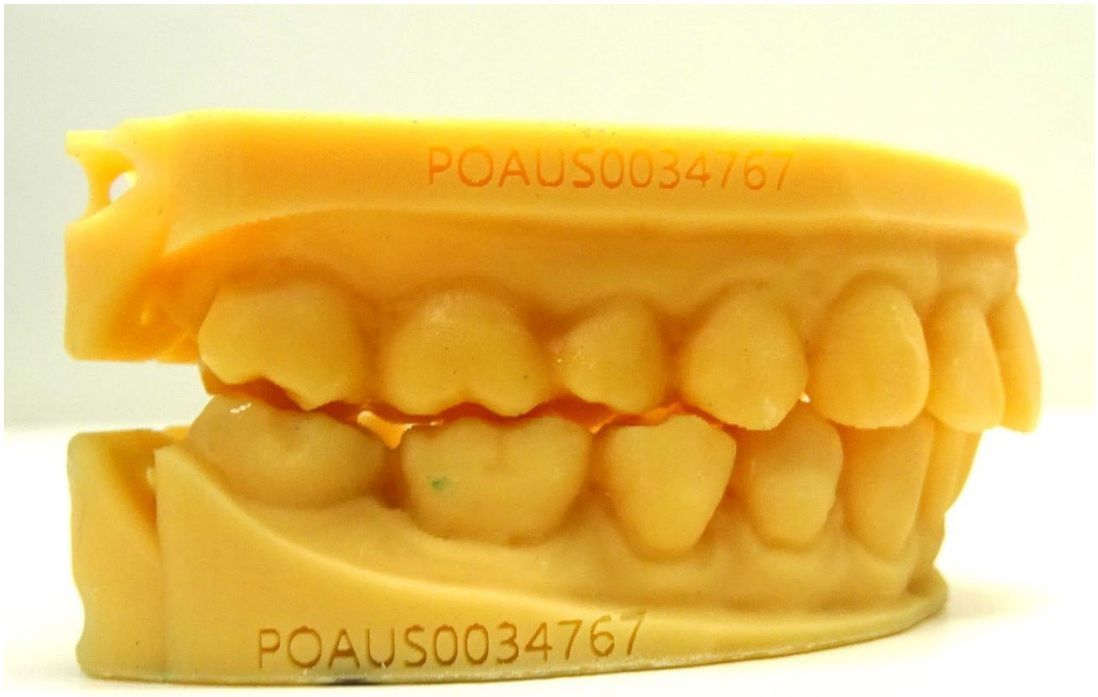

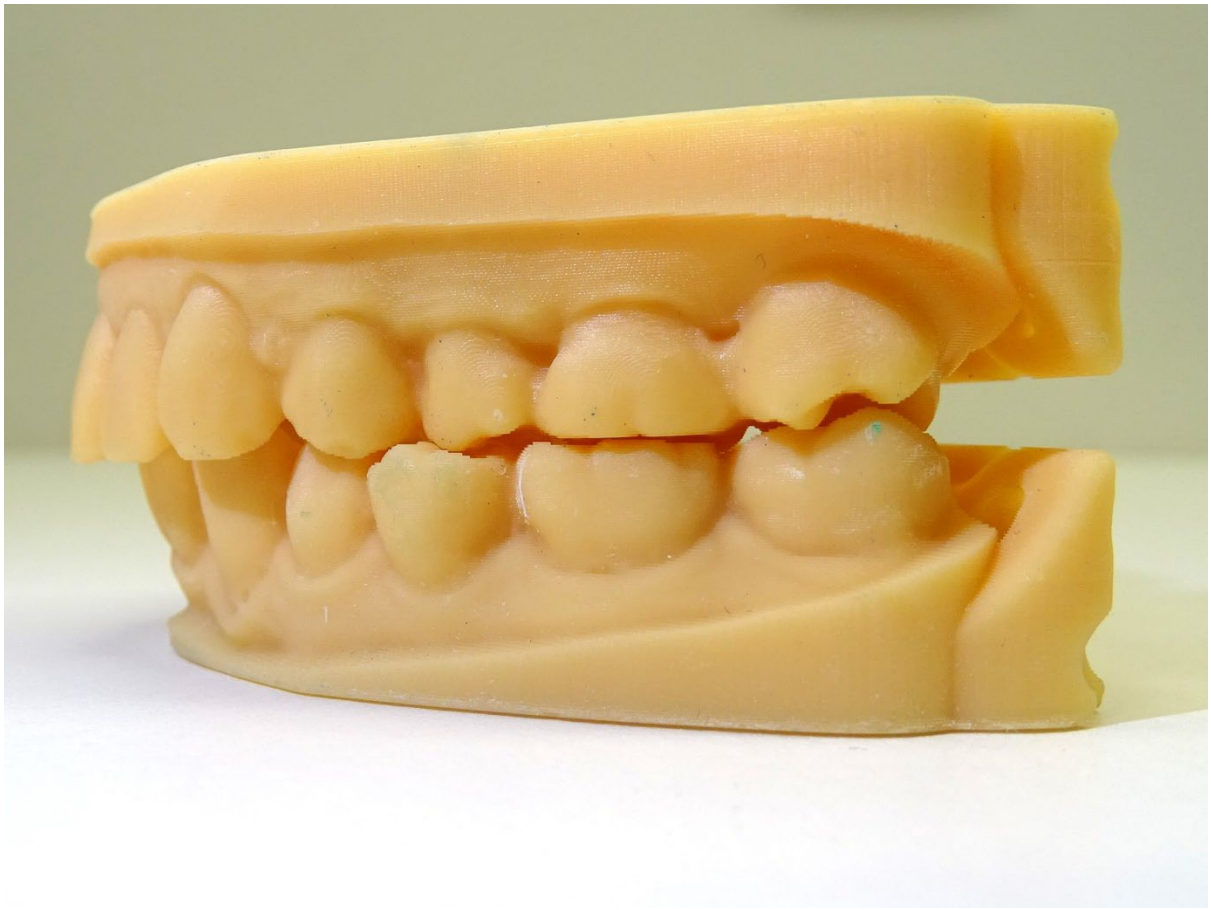

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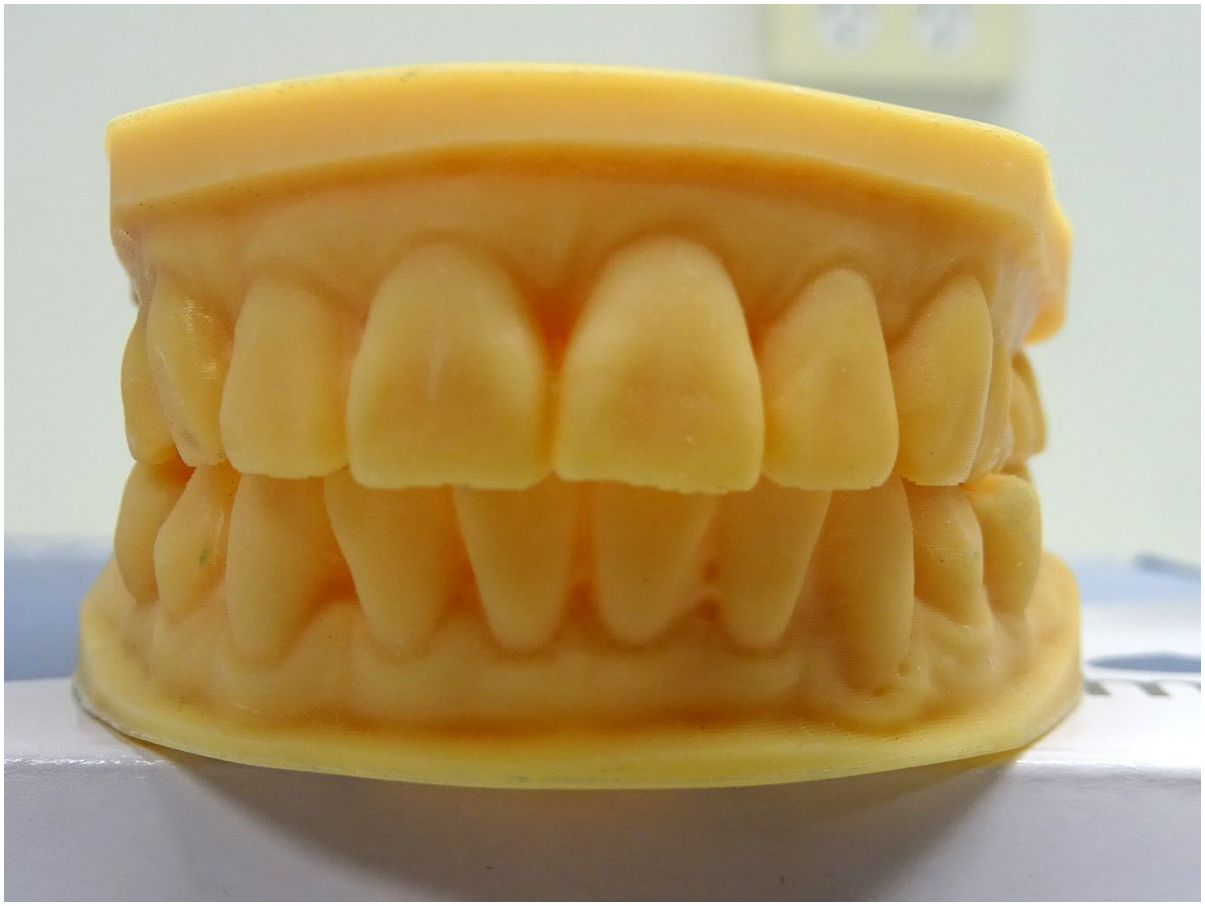

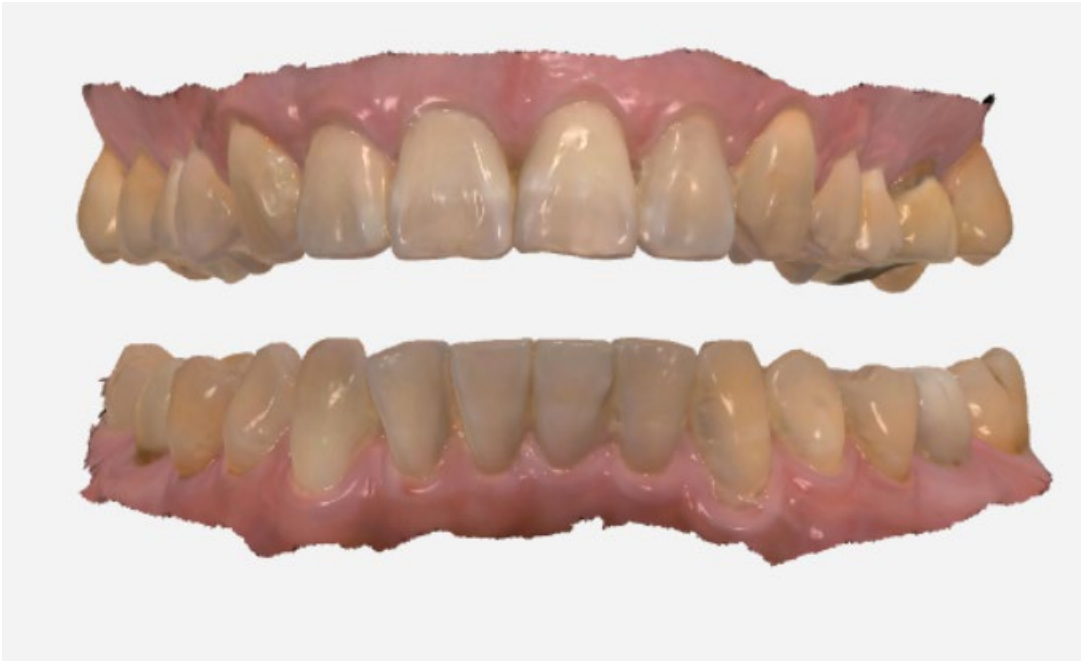

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