What is obstructive sleep apnea (OSA) and why do dentists care?
A whirlwind introduction to a new area of practice

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I have no conflict of interest.

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Course Objectives:

Get a basic understanding of obstructive sleep apnea (OSA)
What is it? Where is it? And Why is it?
Start to learn a new vocabulary needed to treat this disease and understand that we must partner with medical providers.
Gain a basic understanding of the overall disease and its medical consequences
Understand some of the device designs, choices and side-effects
Add simple procedures to your daily evaluation of new patients to screen for patients who may have obstructive sleep apnea

OSA is a medical disease that dentists can often treat.

It affects ~ 16% of the US population; this is more than the number of people who have asthma
T Young et al. Epidemiology of OSA. AJRCCM Vol. 165 1217-1239. 2002

Moderate-Severe ~ 11.3% of adults. P Prepagerd.
Increased incidence of Sleep-Disordered Breathing in Adults Am J of Epidemiol. 2012 175(5) 1006-1014

Treatment is covered by medical insurance

Who gets OSA?
What is obstructive sleep apnea and snoring?

Occurs only during sleep
Results in a narrowing of the upper airway and may prevent adequate air flow to the lungs. This may lead to multiple medical problems. Just the effort of breathing through a smaller airway causes side-effects.
May not cause any overt symptoms
Has multiple factors any of which may be a ‘tipping point’ that causes airway collapse
Primary snoring requires that the patient have normal empirical testing and no symptoms (EDS, HTN, etc.)

Simple description

➢ The upper airway is collapsible from the posterior aspect of the nasal spine to the base of the epiglottis; it can be small or unusually collapsible which then limits the amount of air getting to the lungs at night.

➢ So even though one is trying to breathe, the decrease in air flow may result in a drop in the amount of oxygen in the blood stream and allow build up of carbon dioxide. The body responds by slightly ‘waking up’ the patient and interfering with restful sleep.

Where is the collapsible airway?

Obstructive Sleep Apnea

The UA muscles are enclosed in a bony box:

Of the 20+ muscles that make up the upper airway, not one of them has the primary function of pharyngeal dilation!

A minor narrowing of the upper airway may result in snoring but frequent narrowing over the course of the night can result in significant sleep disordered breathing.

Severe sleep apnea can be life threatening.

Snoring

When air enters the narrow part of an airway it creates turbulence which causes loose tissue to vibrate, making the noise we call snoring.

- 50% of children who habitually snore have OSA
- 17% of women with sleep disordered breathing do not snore
- 3% of men with OSA do not snore

What tissue vibrates?

Snoring causes tissue damage

Meet the grandmother who snores at 111 decibels... louder than a JET plane

Why do we have to partner with MDs?

Legally, only a physician can diagnose obstructive sleep apnea; OSA must be ruled out before you treat a patient for “snoring”

- Most patients with OSA have concomitant medical disorders that require a physician’s care

Treatment of a patient for snoring without first determining the level of OSA could result in prevention of proper medical care and leave the dentist liable for negative legal outcomes.
Since MDs don’t speak “Dental speak” and OSA is a medical disease, dentists need to learn the medical vocabulary used by physicians.

Apnea

A total blockage of the upper airway regardless of continued effort to breathe.

Obstructive Apnea

When BOTH criteria are met:
- Drop in the peak signal excursion by > 90% of pre-event baseline using oronasal thermal sensor.
- The duration of the > 90% drop in sensor signal is at least 10 sec.

Note: The identification of an apnea does not require a minimum desaturation.

Hypopnea

A partial blockage of the upper airway that is severe enough to cause a shift in sleep level and or a drop in blood oxygen saturation.
Sleep Levels

Arousals
These are shifts in sleep level from deeper to lighter precipitated by increased diaphragmatic action, drop in oxygen level or physical movement.
Arousal fragment sleep and result in many negative outcomes.

Oxygen Desaturation
Below 90% is abnormal
Triggers sympathetic response
Can go below 50%!!!!
Leads to:
Cardiac Disease

Polysomnography
(In laboratory sleep testing)
- Considered the gold standard for diagnosis
- Patient supervised by trained personnel
- Multiple channels recorded including:
  - EEG
  - EOG
  - EMG (Chin and legs)
  - Oximetry
  - Airflow
  - Respiratory effort
  - Snoring
  - Body position

Polysomnography

Out of Center – Home Sleep Apnea Testing (HSAT)
Mandated by most Massachusetts medical insurance companies as a first level diagnostic test but large nationwides still allow PSGs.
The number of events recorded during a sleep study averaged over the hours of sleep time is the event index.

- AI: Apnea Index
- AHI: Apnea Hypopnea Index
- REI: Respiratory Event Index

There is no way to tell the difference between primary snoring and obstructive sleep apnea without empirical testing.

Out of Center Sleep Testing underscores events because they do not score both airflow and EEG arousals.

A full health history and physical is required by a physician.

The following is a commonly used severity scale:

- AHI < 5 is normal
- AHI = 5 - 15 is mild OSA
- AHI = 15.1 - 30 is moderate OSA
- AHI > 30 is severe OSA

However this article also indicated that severity of OSA syndrome should be specified based on not only the AHI but also the severity of daytime sleepiness and oxygen levels.


Why does the upper airway to collapse?

It is really an accumulation of physiologic/anatomic and chemical alterations whose proportions are slightly different for each patient.
Predisposing factors for OSA:

- Obesity, especially upper body fat
- Male Gender
- Family history (genetics)
- Age
- Menopause
- Neurologic dysfunction
- Craniofacial abnormalities
- Alcohol or sedative use
- Smoking
- Racial background

ANATOMICAL ABNORMALITIES:
People with OSA, on general, have smaller upper airways than controls

FUNCTIONAL ABNORMALITIES:
e.g. Respiratory control mechanisms

DEVELOPMENTAL ABNORMALITIES
ACQUIRED ABNORMALITIES (Obesity)

GENETICS ACCOUNTS FOR > 35% of OSA

The size of the airway, in an awake healthy volunteer, decreases 29% just by going from an upright to a supine position.
Not so a sleep apneic!

People with seemingly normal anatomy can have significant OSA while others with obvious abnormal anatomy have no problem at all.

The response to breathing events depends on the individuals susceptibility to these events
The Tipping Point

Free nasal breathing is important to proper airway dynamics.
OSA can be created in the laboratory by forcing mouth breathing.

Healthy male subjects had their noses completely blocked with impervious plugs.

With normal nasal breathing the men had an AHI of $1.5 \pm 0.5$

With oral breathing these same subjects increased their AHI to $43 \pm 6$


Mouth breathing prevents proper tongue position

And alters muscle activity in the upper airway and compensatory mechanisms

Obesity

50% of American adults are overweight
25% of American adults are obese
10-20% of American children are obese

Fat deposition increases in both the muscles and the other soft tissues of the upper airway

OSA interferes with most major hormone pathways, and actually causes weight gain

Richard Schwab, MD Sleep 2004

Increased intraoral soft tissue

Increased intraoral hard tissue has *not* been shown to exacerbate OSA

Nor interfere with dental treatment of these patients

Palm E et al. Mandibular tori size is related to OSA and treatment success with CAT. Sleep Breath 2014 May; 18 (2):431-8
Obesity is NOT pathognomonic for OSA nor indicative of severity

What happens to patients with OSA?

When patients are tired:
- They have 7x number of MVAs
- Find it difficult to maintain healthy relationships
- They fall asleep at inappropriate times
- It is difficult to get out of bed in the morning
- Their major complaint may be ‘insomnia’.

Why are patients tired?
While dentists may *screen* for OSA
OSA is a medical disease and the diagnosis is made by a *physician*

As we screen for BP we can screen for OSA:
- **Health History**
- **Questionnaires**

A screening does not diagnose OSA
The patient needs a medical diagnosis by a physician because the oral devices are legal *medical* devices.
All the impact of OSA is medical.
Screening patients in the office with a home sleep apnea test may put you outside your scope of licensure.
Work with your local physicians

**Health History**
Add questions to your medical history:
- Do you or anyone in your family snore?
- Have you ever been told you stop breathing or gasp in your sleep?

**Questionnaires**

You *CAN NOT* diagnose OSA from:
- Radiographs (Cephalometric, CbCT)
- Questionnaires
- Oral and oropharyngeal examination
- Patient history
Dental Patients at High Risk for OSA

- Pacemakers (88%)
- Women with CAD (30% have AHI > 10)
- Late Pregnancy (opposing results)
- Morbidly Obese Males
- Post menopausal Women
- 36% of patients with OSA have a first degree relative with OSA

Referrals / Communication

- Physician order for OAT / MAD to the dentist
- Documentation needed
- Who calls whom
- Paperwork
- Keep in mind the mandates and documentation required by insurance (letter of medical necessity, Rx, tried PAP, etc)
- Work in a collaborative fashion, do not make assumptions
- HIPAA / Release of info

If you are sending the patient to see the sleep physician:

- Explain oral device therapy to the patient before he goes to see the MD
- Send a note to the physician explaining what made you suspect a sleep disorder in the patient
- The physician will always want the patient to try PAP but very few insurance companies insist on a trial of PAP except for patients with severe OSA

If you treat a patient diagnosed with primary snoring:

- You are responsible for referring that patient back to the sleep physician if:
  - Symptoms return
  - Weight gain
  - Aging
  - Menopause
  - Change in medical status (HTN, arrhythmia)

Treatment Options

- Positive Airway Pressure (CPAP, BPAP, APAP)
- Surgical Intervention (MMA and soft tissue)
- Oral Appliance
- Behavioral changes (weight loss, positional changes)

Positive Airway Pressure

- CPAP, APAP, BiLevel PAP, etc

Mask with headgear
PAP machine
Tubing

Courtesy of Kelly Carden, MD
Positive Airway Pressure

PAP Therapy

Advantages
Quickly and demonstrably effective
Reverses symptoms
Improves CV dysfunction
Cost Effective, reduces health care costs
Reduces MVAs

Disadvantages
Chronic therapy
Poor adherence to therapy

PAP was FDA accepted for adults only, but now it is accepted for children as young as 8. Premaxillary changes will occur in both groups.
86% of patients using CPAP complain of side-effects

- Air leaks
- Interrupted sleep
- Pressure sores
- Mask dislodgement
- Claustrophobia
- Eye discomfort
- Aerophagia
- Maxillary tooth movement
- Sinus infection / Rhinorrhea
- Mucosal Drying (15-50%)

CPAP moves teeth

Adherence to Therapy?

Surgical Intervention

Maxillomandibular / Telegnathic surgery

Soft Tissue Throat Surgery / Tracheotomy

MMA Surgical Considerations

Insurance may cover only for severe OSA unless there is an underlying skeletal abnormality

Can leave the patient with permanent numbness, esthetic changes

Requires orthodontics that is not covered by medical insurance

Soft Tissue Surgery

Fallen out of favor except in selected patients

Over 14 soft tissue surgeries have been developed

Originally done as part of multilevel surgery; this Stanford staging is out-of-date

It is considered a salvage treatment

It is NOT considered curative

Nasal surgery is more common and effective
Behavioral Changes

Weight Loss
Avoid alcohol and sedative / narcotics
Smoking cessation
Avoid exogenous androgens
Avoid supine sleep position

Oral Appliance Therapy for OSA

The most common Oral Appliances for the treatment of OSA are dual arch adjustable dental devices that limit mandibular movements.

Acronyms abound: MRD MAS

Medical insurance companies demand FDA accepted oral devices

While there are > 120 oral devices cleared by the FDA for the treatment of OSA

Medicare limits the field to only 3 different types of devices.

FDA 510 Market Approval

Efficacy of treatment

CPAP returns 90 -95 % to normal breathing
MMA returns 46 – 75% to normal breathing
Oral devices return 37-56 % to normal breathing
Soft tissue surgery in adults returns 13 % to normal breathing

Normal Breathing is fewer than 5 breathing events per hour.
Is AHI the most important outcome?

Pearls:
- OSA is a common disease
- OSA is a potentially fatal disease
- OSA is an insidious disease
- It affects all ages from infants to the elderly
- It cannot be diagnosed without a sleep study
- Oral devices are very effective in treatment of OSA

Oral Appliances

- Decrease blood pressure
- Improve daytime sleepiness
- Decrease snoring
- Improve quality of life
- Decrease inflammatory markers
- Have high adherence
- Decrease cardiac fatalities

Pearls
- Dentist can treat >50% of sleep apneics as well as physicians.
- Patients are more than twice as compliant with oral devices as they are with CPAP
- Dentists and their staffs can screen for sleep apnea in the dental office
- Medical insurance will often cover treatment


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Biomechanics of Mandibular Advancement
All MRDs:

- Are tooth retained on at least one arch
- Alter VDO and interincisal distance
- Advance the mandible with some sort of mechanism
- Impact the TMJ
- Cause side effects

So what do they do?

Early study:

Suggested that MAS increased the space between bony structures and provided increased room for soft tissue, but recent studies show action is more complex with substantial inter-subject variation.


Advance the Mandible
Advancing the Mandible

“Passive mandibular advancement during general anesthesia stabilizes the upper airway by increasing airway size in both the retropalatal and retroglossal area and by reducing closing pressure”

Isono et al, Advancement of the Mandible Improves Velopharyngeal Patency J Applied Physiol 79, 2132-2138 1995

Airway Changes with MRD

The airway opens more behind the soft palate than the tongue
It opens laterally more than antero-posteriorly

Ryan et al. Mandibular advancement oral appliance therapy for obstructive sleep apnea: effect on awake caliber of the velopharynx. Thorax 1995; 54: 972-977

Increase is most significant in the velopharynx, and least in the hypopharyngeal space
Zhao et al. Three-dimensional upper-airway changes associated with various amounts of mandibular advancement in awake apneic patients. AJODO May 2008;661-668

Alterations in Upper Airway dimensions

Neutral position Mandibular advancement Neck extension Mouth opening

In successful cases, the hyoid moves up and forward


Movement of the hyoid showed great interindividual variation


Lateral Cephs show an increase in the A/P dimensions of the oropharynx but show variable effects on nasopharyngeal airway

Johal, et al Use of videofluoroscopy in the assessment of the pharyngeal airway in OSA. Eur J Orth 53 (2011);212-219

Hyoid moves closer to mandibular plane in successful pts (Isono)

Airway shape changes can increase airway stability in some patients (Ng AT et al. Effect of oral appliance therapy on upper airway collapsibility in OSA. Am J Respir Crit Care Med. Jul 15 2003;168(2): 238-241

In successful cases, the hyoid moves up and forward

Ng AT et al. Effect of mandibular advancement splint treatment on tongue shape in obstructive sleep apnea. Sleep and Breathing. Jan 2015

The length of the tongue shortens and the height increases in responders

The base of the tongue moves less than the anterior aspect of the tongue

Soft palate area and width decreased

Alter: VERTICAL OPENING

The Mandible Naturally Rotates Down and Backwards

Opening the mouth to an interincisal distance of 1.5 cm. correlates to a 1 cm backwards movement of the attachment of the genioglossus muscle.*

Effectively, the more you open the VDO the worse you can make some patients.

*Sher, AG Otolaryng Clinic North America, 1990; 23:593

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In successful patients oral appliances:
- Increase the size of the velopharynx more than the oropharynx or hypopharynx
- Increase the size of the airway laterally
- Alter muscle tone
- Decrease collapsibility
- Bodily move the tongue forward
- The tongue shortens and moves higher
- Move the hyoid up and forward
- Decrease oral breathing

But why?
Tongue displacement could decrease external pressure to the soft palate produced by posterior movement of the tongue base or stiffen the VP through the palatoglossus arch.

Brown EC et al. Tongue and lateral upper airway movement with mandibular advancement. Sleep Vol. 36, No 3, 2013 397-404
Awake supine MRI at end expiration

Muscle tone

Genioglossus EMG decreases with mandibular advancement

Submental and masseter EMG increases with mandibular advancement

Lateral Opening

Appears related to fibers connected to the internal aspect of the ramus which project medially and attach to the lateral walls of the upper airway in the area of the pterygomandibular raphe. As the mandible moves forward these fibers are under tension and widen the UA.

Minimization of the open posture of the mandible augments nasal nocturnal breathing.

Meurice JC et al., Effects of mouth opening on UA collapsibility in normal subjects. AJRCCM 1996;153:255-9
Fitzpatrick ML et al., Effect of nasal or oral breathing route on upper airway resistance during sleep. Eur Resp J 2003; 22:827-832
Movement of tissues with mandibular advancement is influenced by anatomical and physiologic differences between subjects and possible altered local mechanics related to fat deposition and mouth opening.


(Zeng Influence of nasal resistance on oral appliance treatment outcomes in OSA. Sleep 1008(31) 543-547)

There is substantial inter-individual difference in response to oral appliance therapy.

Why are we not really sure how mandibular advancement works?

- Awake patients / Anesthetized patients / Asleep
- Upright vs. supine
- 2-dimensional evaluation vs 3-dimensional evaluation
- DISE / MRI / CT / Cephalometric radiographs
- Variability of protrusion and vertical opening
- Interindividual differences

Questions?

Who?

What constitutes a proper patient evaluation?

AADSM Guidelines

- Medical-Dental Evaluation
- Examination of teeth and restorations
- Intraoral habit assessment
- Radiographs (Pano or FMX)
- TMJ-occlusion examination
- Soft tissue-intraoral assessment
- Periodontal evaluation

Why the in-depth evaluation?:

Is the dentition healthy enough to withstand the forces of an MRD

Does the patient have adequate mandibular range of movement (without significant TMJ problems) to allow for proper advancement?

Baseline the occlusion, position of teeth, interdental contacts, soft tissue, in fact everything that will help you identify unwanted side effects ASAP

Help you determine which device may be a better choice
Hard Tissue Evaluation

DMF
Jaw relationship
Exostoses / Tori
Bony defects

DMF
Rampant Caries
Well Restored
Needs new bridge
Missing / overclosed

Tooth Position / Mobility

Missing teeth? Open spaces?
Cuspid spaces?
Implants ?
Path of withdrawal?

Dentition vs. Retention

Generally 7 healthy teeth per arch with 4 of the teeth being posterior multirooted teeth

Overjet

Class 2 and Class 3 patients do better than Class 1. AA Lowe

Overbite

Impacts vertical opening with the device
With an appliance, the overbite helps determine interocclusal distance and, hence, forces on the dentition.

Watch the VO!

The magnitude of forces increases with the distance of advancement and the magnitude of vertical opening.


Patients with a steep overbite of > 75% are much less successful with OA therapy.

A. Fransson, Swedish Dental Journal Supplement 163, 2003

Wear facets vs. Normal function

Are the wear facets consistent with normal mandibular excursive movements and consistent with the patient’s age?

BRUXISM CANNOT BE DIAGNOSED BY TOOTH WEAR !!!!!!!!!!!!!!!!

Posterior Intercuspation

Pre treatment photographs help quantify side-effects

Range of Mandibular Motion

Lateral
Opening
Deviation on Opening
Protrusive

Limited mandibular movement may indicate TMJ concerns

Protrusive Range: George Gauge
Mandibular range of movement: Protrusion...Why?

Older literature agrees that a patient must advance his mandible at least 8 mm to develop a statistical difference in airway cross section but statistics cannot be applied to any one individual.

G. Aarab, showed that some patients were treated with only 25% protrusion.

Maximally effective protrusion can be anywhere from 25% to >100% of the patient's natural jaw range. Aarab G et al. Effects of OAT at Different protrusion Clin Oral Invest 2011; 14:339-345.

The patient's range of protrusive movement will change with time.

YOU DO NOT NEED CbCT

The patient has already been diagnosed. Airway CANNOT be evaluated by scans. It does not differentiate between patients who will be successful with OAT and those who will fail. It is an unnecessary exposure to ionizing radiation.

Neck Circumference

Is more important than BMI in determining candidacy for OAT.
Intraoral Evaluation

Soft Tissue

Buccal Mucosa

Will you choose a device that interferes with soft tissue?

Periodontal Condition

Minor localized problems
Mouth breathing
OAT puts significant pressure on the dentition…They are orthodontic devices

Tongue Scalloping

This is an indication of a tongue crowded within the dentition

Tongue Size

There are many ways of classifying tongue and soft palate size

Mallampati / Friedman

Gives an idea of the size of the tongue body and tongue base
Opening to the oropharynx

This gives you a better idea of how much “real estate” sits between the oral device and an open airway.

Oropharyngeal opening

1. Palatoglossal arch
2. Glossopharyngeal arch
3. Uvula
4. Tonsil
5. Soft palate
6. Posterior pharyngeal wall

The anatomy is different from person to person

Crowded Opening to the Oropharynx

What we can’t see:

- Lingual Tonsils
- Lateral expanse of Upper Airway (UA)
- A/P expanse of UA
- Adenoids (Normally vestigial in adults)
- Shape of upper airway
- Location of narrowing of UA

Patients who have a low probability of success with OAT

- BMI > 35
- Inadequate dentition
- Retention
- Severe obstructive sleep apnea
- Macroglossia / Mallampati 4
- High CPAP pressures
- Psychological considerations
But the clinical exam should help you choose which device will be most easily tolerated.

To have a pretreatment baseline so that side-effects can easily be identified before they become permanent.

Treatment:
- Appliance design, fabrication, placement
- Evaluation of OA over 3 + months
- Refer back to MD for F/U PSG
- Recall

Look Before you Leap
- Oral device therapy for OSA is like a restoration, they are not all single surface fillings.
- Various device materials and designs will cause more problems than they are worth.
- Oral device therapy is not successful for every patient, don’t ever promise them it will work.
- Treating OSA is MEDICAL therapy and we work in tandem with a physician.

Review the polysomnogram and physician’s notes
- Oral devices are only effective in the treatment of obstructive sleep apnea…not the >90 other sleep disorders
- Only 40% of patients with severe OSA are returned to normal breathing but 80% of mild sleep apneics respond positively.

Now that you have examined the patient, evaluated his medication list and asked questions about snoring / EDS / family history of OSA and reviewed the PSG results: it is time to pick an appliance.

Ferguson et al, Sleep 2006
Remember all of these findings when choosing an oral appliance

- Mandibular Plane Angle
- Lip competence
- Overjet
- Overbite
- Range of motion

Try to understand positive and negative indicators

Devices vary in many ways

- Type of hardware
- Location of hardware
- Vectors of force exerted
- Base material
- Bulk of device
- Ease of adjustment
- Life span

Some of the > 100 appliances accepted by the FDA for the treatment of OSA

- EMA
- SomnoDent MAS
- Equalizer
- Herbst (modified)
- Klearway
- NAPA
- DynaFlex - Dorsal
- OPAP
- SUAD
- PM Positioner
- MOSES
- Silencer
- SNOAR
- Hilsen
- TAP (1-3)
- TAP-PAP

Out of these devices ~ 16 have published in a peer reviewed journal

- Klearway
- Herbst / IST
- SomnoDent MAS
- TAP 1, 2, 3
- EMA
- Narval
- Silencer
- Elastomeric
- Twin Block
- SnoreGuard
- Tongue stabilizer
- SnoreBan
- SomnoGuard
- Silencor
- Blue


HERBST

SomnoDent MAS
Appliance Selection

This matters, Why?
- Patient comfort
- Raised Stenson’s Ducts
- Forces on the dentition
- Alteration in vector of mandibular movement
- Wisdom teeth
- Steep Curve of Spee

Sleep position
Poor eye hand coordination
Weak teeth
Hardware location and style
Interincisal distance
Ability to alter / increase interincisal distance

Would you choose:

Ability to alter after significant dental care

Can you work around problem teeth?
Narrow arches / Thin base

Ease of adjustment

Life span of device

Base materials

Chrome Cobalt
Laminates
Nylon
Polymethylmethacrylate
Polyethylenmethacrylate
Polycarbonate
Triad Material
Thermacryl
Thermoplastic acrylcs

Most highly marketed appliances

Laboratory Fees

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Fabrication of an oral device

Very accurate impressions are required

Capture the distal aspect of the molars

Look closely at the impressions

Can we identify the optimal mandibular position pretreatment?

- Protrusion
- Vertical
- Lip competence
- Proper midline alignment

What are we trying to accomplish?

Gauge choice for interincisal

Interincisal Registration

- 2 mm
- 5 mm
- 6 mm
- 10 mm
- 12 mm

T.O.M.: Tongue size, Overbite, Mandibular plane angle
Alteration in mandibular plane angle when changing the interincisal distance

Midline Alignment

To avoid TMJ discomfort, it is wise to start mandibular advancement at 50% forward of the most retruded position.

If you fabricate the device at a starting point of 50% protrusive range and do very slow advancement, it may take 1-2 months for the patient to notice improvement in symptoms.

Remember: ~20% of patients will be corrected at the initial position.

Bite Registration

Maximally effective protrusion can be anywhere from 25-125% of the patient’s natural jaw range.

The patient’s range of protrusive movement will change with time secondary to tooth and mandibular movement.

Informed Consent

Alternative treatments
Establish that the patient is ‘free will’
How the device works
Tell them that ≤ 57% are completely treated
Side-effects
Fee
Send the patient records and prescription to the laboratory.

FDA accepted devices can be made only in dental laboratories registered with the FDA.

**HIPAA Concerns**

**Placement**

Using skills you already have.

**Midline relationship verified**

**Simultaneous bilateral contact**

**Verify VDO is as requested**

Published studies, with data pooled from many patients, shows that vertical opening plays no role in OAT except in patient acceptance. However, Vroegop showed that an increase in interincisal negatively impacted UA opening in 80% of patients and was positive in only 2.5%.

Now if this were a real patient who opened on a hinge, how far open would the incisors be?
Retention must take into account patient strength and sleep bruxism

The patient must place this device every night and remove it every morning.

Sleep bruxism will impact any device fabricated to limit free jaw movement.

Placement of the device varies from that of other removable prostheses in many aspects but:

- Bilateral simultaneous contact is required
- Problems can occur in the retromolar pad area, internal to the coronoid process
- Soft tissue can be irritated by the hardware and base
- Over retention on weak teeth can cause problems

After you have placed the device – Contact the patient’s sleep physician

You are expected to keep records as if you were a physician.
You need to contact the physician to let him know the patient has received an oral device and will require medical follow-up in 3-4 months.

Calibration of the device

- Each individual has a different mandibular position that maximizes upper airway dimensions.
- Adjustable devices can be titrated over a prolonged period to maximize effectiveness and minimize side effects.
- Some patients can get worse if they advance the mandible too far; some never get to a therapeutic position.

Calibration of an oral device

- By the patient
- Using Out-of-center sleep testing (often referred to as home sleep apnea testing – HSAT)
- During Polysomnography

How far? In what increments?

- From 5-13 mm
- In .2 mm to 2 mm increments
- Adjustable by the patient
- Adjustable by the provider
After titration of the mandible to a point where the patient feels improvement in his sleep:

Another note to the MD is required that says the patient is ready to come back for follow-up evaluation and testing if the physician feels it is merited.

Side Effects with MRD use

Side-effects are caused by how the devices work and how they are designed. Some of them are related to how individual patients respond to the device chosen. If one device is ineffective then a different device will be ineffective.

To help control side-effects:

Devices must capture the distal aspect of the last tooth in the arch. Original casts cannot not be used to fabricate a second device but should be retained to establish a baseline. Frequent follow-up is necessary, 90 days is mandated. Fabrication of a bite retainer is standard.

Short term side-effects

Occlusal changes
Excessive salivation
Dry mouth
Pain in teeth or muscles
Tooth mobility
Dislodgement of crowns
Pain in TMJ
Unilateral or Bilateral
Soft tissue irritation

Short term side-effects are due to:

TMJ edema
Retention of the device
Thickness of the device base
Materials used in the device
Location of hardware
With a silly little 2 mm opening:

Then we advance the mandible

3D data shows the condylar movement more clearly

AM Edema in the TMJ is a common occurrence (it happens with night guards too)

One MRI study of the joint space of 1 year MRD users showed edema in the joint space and proliferation of the posterior fibers, but no bony changes:


Patients need to address joint edema every day
Mobility of Anterior Teeth

Adjust the device if the material allows

Joint Pain?


Device dislodges at night

Not retentive enough
No dental retention
Path of withdrawal
Strong elastics /Straps
Bruxism
Removes in sleep

Where is the dislodging force?

Over retentive on weak teeth?
Defective restorations?

Posterior pain may be interference with soft tissue anterior to the ascending ramus
How thick are the contours of the device you chose?

This impacts tongue space as well as buccal mucosa

This is why you check impressions- the lab will trim the casts and loose definition

Teeth can move secondary to forces from the muscles of mastication

Mandibular teeth walk forward away from the last fully covered tooth.

Research Evidence on Occlusal Changes:
Anterior shifting of mandibular first molars relative to maxillary first molars
Retroclination of max incisors and proclination of mandibular incisors

Robertson; Sleep 24(5): 531-537, 2001

Occlusal Changes Over Time

Slide courtesy of Alan A. Lowe, BDS, PhD
Patients who had orthodontic treatment as adults (> age 21) correlate with tooth movement from OA use ~ 100%

Personal communication with Alan Lowe, DMD, PhD

Jaw repositioning and tooth movement can become permanent side-effects.

There are no permanent side-effects within the first 6 months of treatment

Chris Robertson Sleep 2001

Pain is never a permanent side-effect

Adjust the device
Go to a different device
Remove the device and go back to PAP

Patients are not always aware of early occlusal changes.

The dentist must maintain strict follow-up to help the patient try to avoid serious side effects.

No side effects appear permanent within the first 6 months of oral device use.

The patients who have severe side effects are well aware of what is happening and have decided that the improvement in their quality of life is worth the price they are paying.

What actually changes long-term is also unknown

There is, at present, no literature on long term joint changes or if there are bony changes occurring
All devices have allergenic potential

- Acrylics
- Dye
- Latex
- Nickel
- Nylon

Side effects happen, they are not to be feared!

- All medical therapies have side-effects. Normally these are listed merely as > 10%.
- Published data says that side effects (in long term oral device users) can be as high as 84%.
- Not all changes are negative.
- Published data says 86% of CPAP users report adverse reactions (Waldhorn et al. Long-term compliance with nasal continuous positive airway pressure therapy and obstructive sleep apnea, CHEST 1990;97:33-38)

A well written ‘Informed Consent’ is very important.

Pearls

Dentist can treat 50% of sleep apneics as well as physicians.

Patients are more than twice as compliant with oral devices as they are with CPAP. This means that the clinical effectiveness is almost the same.

Dentists and their staffs can screen for sleep apnea in the dental office.

Referrals / Communication

- Physician order for OAT / MAD to the dentist
- Documentation needed
- Who calls whom
- Paperwork
- Keep in mind the mandates and documentation required by insurance (letter of medical necessity, Rx, tried PAP, etc.)
- Work in a collaborative fashion, do not make assumptions
- HIPAA / Release of info
Major Legal Concerns

Scope of Licensure
Compliance with local licensing requirements
(State Dental Law)

Standard of Care
Issues of professional liability

ADA scope of practice

ADA definition of “dentistry” (1997): The evaluation, diagnosis, prevention and/or treatment (nonsurgical, surgical or related procedures) of diseases, disorders and/or conditions of the oral cavity, maxillofacial area and/or the adjacent and associated structures and their impact on the human body; provided by a dentist, within the scope of his/her education, training and experience, in accordance with the ethics of the profession and applicable law.

Standard of care

Negligence, in general, is legally defined as “the standard of conduct to which one must conform… [and] is that of a reasonable man under like circumstances.”

In law, medical malpractice is considered a specific area within the general domain of negligence. It requires four conditions (elements) be met for the plaintiff to recover damages. These conditions are: duty; breach of duty; harm; and causation.

It is the ‘breach of duty’ that is considered the standard of care.

(http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3088386/)

American Academy of Sleep Medicine (AASM) Protocol


Sleep. 2006 Feb 1;29(2):240-3.


Sleep. 2006 Feb 1;29(2):244-6
It is the policy of the AASM and AADSM that patients presenting with symptoms of OSA require a face-to-face evaluation conducted by a qualified physician trained in sleep medicine.

The AASM defines a qualified physician trained in sleep medicine as one who is licensed by a state to practice medicine and maintains certification from the American Board of Sleep Medicine or one of the sponsoring sleep medicine boards of the American Board of Medical Specialties.

It is the opinion of the AADSM that oral appliances should be fit by a qualified dentist with training and experience in the temporomandibular joint, dental occlusion, and associated oral structures, and dentists who provide OAT as a treatment for OSA must practice within their scope of practice according to the dental practice law in the state in which they are licensed. Dentists are encouraged to follow current AASM Practice Parameters and Clinical Guidelines and current AADSM Treatment Protocols for OAT.

Furthermore, the AADSM encourages dentists providing OAT to complete at least 30 hours of relevant continuing education every three years, of which up to 10 credits may be AMA PRA Category 1 Credits™ in sleep medicine and the remaining credits should be in dental sleep medicine from ADA CERP recognized or AGD PACE approved providers. The AADSM encourages all licensed dentists currently treating OSA with OAT to pursue dental sleep medicine facility accreditation from the AADSM and certification from the American Board of Dental Sleep Medicine (ABDSM) by Jan. 1, 2018.

Summary of legal liability

Any healthcare provider who exceeds the scope of a professional license risks civil and criminal liability.

Those who practice within the scope of licensure but do not satisfy the standard of care also risk liability.

Presently, diagnosis appears to fall into the realm of medicine while management of oral appliance therapy dwells within that of dentistry.

For more information

www.AADSM.org
www.AASMnet.org

Partnership.
Dual ownership.