Sleep Prosthodontics and Temporomandibular Disorders

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Heterogeneous group of pathologies affecting the temporomandibular joint, the jaw muscles, or both

Triad of clinical signs: muscle/TMJ pain, TMJ sounds; and restriction, deviation, or deflection of the mouth opening path
Typical TMD patient

- 21-50 year old
- 77.5% female
- 79.3% headaches, 82.4% ear pain, 42.4% throat symptoms

Manfredini D, et al. OOOO 2011:112;453-462
Cooper BC, Klainberg I. Cranio 2007;25:114-126
1-75% population TMD signs

5-33% report symptoms

Variation due to definition of TMD

Manfredini D, et al. OOOO 2011:112;453-462
Research Diagnostic Criteria for TMD

Group I Myofacial pain - 45.3%
Group II Disc Displacement - 41.1%
Group III Arthralgia - 30.1%
Combinations
Research Diagnostic Criteria for TMD

- Group I Myofacial pain - 45.3%
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- Combinations
MFP Theories

- Occlusal
- Malocclusion
- Bruxism
- Structural
Occlusion

Theory

Treatment- occlusal adjustments, orthodontics and orthognathic surgery

Presence or absence of interferences little relationship to TMD
Malocclusions

Lateral open bites, increased overjet, deep bites

Class II, div 2 no more or less than others

Bruxism loads teeth and joints

Force?

Many bruxers do not have TMD, especially wear patients
Structural

Cervical spine
Forward head posture
Cause or effect?
New Lens on Old Literature
Bruxism, TMD and >3mm difference between MIP-CR are associated with headaches

More frequent in women (1.71:1)
Headaches

Bruxism, TMD and >3mm difference between MIP-CR are associated with headaches

More frequent in women (1.71:1)

SB improves airway patency during sleep

Obstruction of the airway stimulates the subject to clench the teeth as an unconscious attempt to relieve the airway

Winocur E. et al. J Oral Rehabil 2011;38:3-11
Strong statistical significance between the RDI severity and the presence and severity of the bruxism

Pediatric sleep-related tooth wear can be utilized as a clinical marker for pediatric SDB
Bruxism, TMD and >3mm difference between MIP-CR are associated with headaches

More frequent in women (1.71:1)
Patients with TMD pain report poor quality sleep, while patients that do not sleep well are more susceptible to TMD.

Bruxism, TMD and >3mm difference between MIP-CR are associated with headaches

More frequent in women (1.71:1)
Retrognathic Mandible creates smaller airway

A smaller airway may be caused by increased size of the soft tissues or normally sized soft tissue within a more restricted craniofacial structure

Could Airway Explain...

TMD-UARS Link
Upper Airway Resistance Syndrome


- Increase inspiratory effort and increase sleep micro-arousals
- Narrowing of pharynx without oxygen desaturation below 4%
Diagnosis of UARS was established by demonstrating a RERA index of >5/h with an AHI < 5/h in patients with ESS>10.

Loube DI, Andrade T, Howard RS Chest 1999;115:1333-1337

Younger and more often female
Lower BMI
Greater headaches, GERD, depression, anxiety, bruxism
Symptoms of rhinitis, hypothyroidism and asthma

Gold A et al. Chest 2003;123:87-95
More sleep-onset insomnia, nocturnal awakenings with difficult return to sleep

Fatigue rather than sleepiness
Upper airway opening triggered by:

- Compensatory neuromuscular response - females
- Arousal response (hypoxia and hypercapnia) - males

UARS Misdiagnosed

Gold A et al. Chest 2003;123:87-95

Functional Somatic Syndromes- chronic fatigue syndrome, fibromyalgia, irritable bowel syndrome (IBS), migraine/tension headaches, and temporomandibular syndrome
Linking TMD and UARS
25 consecutive TMD/headache patients -
100% UARS via PSG

Metz, J personal communication 2009
Myofacial Pain Link

90% Associated with Airway*

- UARS Bruxism- Diurnal
Experienced Stress may be Related to Daytime Clenching and, in turn, to Evening and Morning Jaw Muscle Pain
Tooth Contact Creates MPD

50% to 60% of Patients with Masticatory Myalgia Habitually Keep the Teeth in Contact During Wake Time

Only 20% Admit to Clenching when Awake

Greater Risk than Nocturnal Bruxism


Wake-time Parafunction is a more Relevant Risk Factor for Myogenous Masticatory Pain than Sleep Bruxism

Long-lasting Muscle Contractions may Elicit Muscle Pain even if Preformed at Low Intensity
90% Associated with Airway*

- UARS Bruxism- Diurnal
- Catecholamine Release
Increased effort during NREM sleep (particularly in stages 3 and 4) and increased respiratory rate in REM sleep avert significant SaO$_2$ drops.

Activates SNS
Short sleep duration and poor sleep quality were associated with increased 24-hour urinary catecholamines, even in normal subjects with no complaints of insomnia.

Sympathetic Activation

Reduced Vagal Tone
Increased Catecholamines
Reduced Heart Rate Variability
Increased Systemic Vascular Resistance
Sensitized mechano-insensitive nociceptors can be activated by endogenously released catecholamines. Contribute to sympathetically maintained pain. Complex Regional Pain Syndrome.
Myofacial Pain Link

90% Associated with Airway*

- UARS Bruxism- Diurnal
- Catecholamine Release
- Trigeminal Airway Control
Trigeminal firing linked to RERA and RMMA activity

Masticatory muscles manage airway
MYOFACIAL PAIN LINK

90% Associated with Airway
- UARS Bruxism - Diurnal
- Catecholamine Release
- Trigeminal Airway Control
- Hyperalgesia
Hyperalgesia


- Sleep continuity disturbances, not simple sleep restriction
- Impairs endogenous pain-inhibitory function
- Increases spontaneous pain
Sleep deprivation especially REM sleep loss induces hyperalgesia and spontaneous pain.

TMD History

- Left joint click, right side pain
- Daily discomfort, pain levels cyclical
- Tension and migraine headaches
- Facial asymmetry, Hx Trauma soccer
TMD History

Wakes herself grinding teeth
Wakes herself grinding teeth
Removes orthosis during night because increases grinding and makes her uncomfortable
Could not sleep with anterior deprogrammer
Sleep History

- Sleep-onset insomnia, awake multiple times with difficulty returning to sleep
- Fatigue
- Sleep terrors
- Aware of bruxism since 4 y.o.
Tonsillitis 5x in 2 years, MD recommend removing
Saturation Event: drop in SpO2 by at least 4% for a minimum duration of 10 seconds.
Pulse Event: Change in rate by at least 6 bpm for a minimum duration of 8 seconds.

Graphic Summary
SpO2 (10 % per division)

Events

Pulse Rate (10 BPM per division)
Why Does An Orthosis Work or Not Work?
What do all splints do?
Why do splints work?
- Idealize occlusion and disocclusion?
- Reduces muscle activity?
- Eliminates bruxing?
Why do splints work? Improved Airway

- Increasing Vertical
- Advancing Mandible
Impact of Opening Vertical Dimension and Protrusion on Airway
Mouth opening increases upper airway collapsibility.

Mouth opening should be kept at a minimum for better treatment success with oral appliances.
Subjects with an increased anterior facial height and very retrognathic jaws begin further down and back on the opening path.

Any increase in the vertical dimension would quickly occlude the oropharynx.

Increased OVD Improves Airway

- More Space for “BA” Tongue
- Increases Intraoral Volume for Constricted Arches
Always felt tongue too big for mouth

Worn splint for 10yrs, recently cut off posteriors to make it into anterior splint—shifted bite, popping left joint, muscle pain

3-4 nights per week grind, wake up 1-2x nightly, Gags, tongue thrust
The TV/OCV ratio of the OSAS patient group was significantly higher than that of the normal controls.

Tongue volume of OSAS patients tended to be smaller but not significantly.*
Extraction Orthodontics and TMD

- Oral Volume Reduced
- Airway Reduction
Open Posterior Air Space

Constricted Posterior Air Space
Class I malocclusion

Significant decrease in mandibular intermolar width for the extraction group

Significant increase in maxillary intermolar width for the nonextraction group
Class II, div 1

Maxillary arch- extraction group decrease intermolar width, nonextraction increase

Mandibular arch- extraction group decrease width and continued to decrease at 2 year follow-up. Nonextraction increased
Pretreatment mean oropharyngeal volume for extraction group larger.

Post treatment OP airway volume for non-extraction group larger.
Mandibular advancement to “incisor aligned” position decreased both upper airway collapsibility and resistance during sedation.

Larger increments of hyoid movement are associated with an improved airway response.

Some patients are prone to develop a worsening of their OSA in response to a bite rise, while others are insensitive...it remains unclear which patient characteristics can be held responsible for aggravating the OSA condition.
Increased vertical creates room for tongue
--Desaturations associated with Early Motion are Excluded in these calculations.
--Physician should review the waveform and consider reviewing the report without the above exclusions.
2-4% Desat RERA  >4% Desat

--Desaturations associated with Early Motion are Excluded in these calculations.
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PATTERN BASED REPORT

OXYGEN SATURATION BASELINE ANALYSIS

SPO2 CYCLING
% Time in Cycling (Duration)  13%  (00:57:01)

Orthosis
---Desaturations associated with Early Motion are Excluded in these calculations.
---Physician should review the waveform and consider reviewing the report without the above exclusions.

**OXYGEN SATURATION BASELINE ANALYSIS**

**SPO2 CYCLING**

<table>
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<tr>
<th>% Time in Cycling (Duration)</th>
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Increased Vertical May Improve Airway


15 patients (13 men, 2 women), AHI>10

- Advanced oral appliance (75% maximum protrusion)
- Nonadvanced, 5 mm anterior vertical opening
- PSG after adjustment
Increased Vertical May Improve Airway


- Advancement decrease mean AHI
  33.8 to 9.6

- Non-advancement 24.0 to 11.7 (no change in snoring, arousals or EES)
Stabilizing Splint May Worsen Airway

10 (7 men and 3 women) mild to moderate OSA patients, PSG recordings with and without splint

6 subjects increased AHI and RDI with splint, one better

Case Provided by
Dr Brian Vence

START: 3/29/2011 11:18:00 PM
END: 3/30/2011 7:08:58 AM
DURATION: 07:50:58

--Desaturations associated with Early Motion are Excluded in these calculations.
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2-4% Desat RERA
>4% Desat

PATTERN BASED REPORT

OXYGEN SATURATION BASELINE ANALYSIS

SPO2 CYCLING

No Splint, TMD
PATTERN BASED REPORT

OXYGEN SATURATION BASELINE

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Resolve Airway to Resolve TMD
Female, primary morning headaches history, 90% eliminated with CPAP

Goksan B et al Cephalalgia 2009;29:635-641
The intensity of TMD symptoms decreased significantly during MAA therapy.

Tinnitus decreased in intensity with the use of MAA.
313 TMD patients (70 males, 243 females), mean age 40 years, 276 report headaches

Neuromuscular overlays with interdigitation 1-2 mm above and anterior to the EMG monitored mandibular rest position; 24/7 wear for 3 months
Opens Airway and Improves Symptoms

Headaches decreased 85.9% at one month and 91.7% at three months

TMJ, ear, facial, cervical and back pain symptoms improved - 80.5% reduction of symptoms

Cooper BC, Klainberg I. Cranio 2008;26:104-117
Long-term multi-site study of 2104 treated, 250 untreated and 44 long-term treated TMD patients

Use of anterior repositioning appliance therapy produced better results than flat plane splint therapy

Brown DT, Gaudet EL Jr. Cranio 2002;20:244-253
Resolve Airway to Resolve UARS
Treatment with CPAP for 1 to 3 months lead to improvement in daytime sleepiness in all cases.
We do not recommend nasal CPAP as a long-term treatment for UARS because only 2% were compliant with CPAP 3 months after initiation.
MAA and UARS

Yoshida K. J Prosthet Dent 2002;87:427-430

MAA significantly improves sleep structure and excessive daytime sleepiness and reduces arousals in UARS subjects.
Improved Airway Reduces SB

Moderate SB and no apnea

MPD (<40%) minimum protrusion 77% SB reduction

MPD (>75%) maximum protrusion 83% SB reduction

Landry ML et al Int J Prosthodont 2006;6:549-556
Could Airway Explain...

- Anterior open bites and relapse
- Cervical structural TMD issues
Case provided by Dr Chris Mack

8y 1m
Obstructions and Posture-OSA Adult


- Average angle 10 degrees larger in OSA patients
- Forward posture increases diameter of airway and reduces airway resistance
Head posture of children requiring adenoidectomy extended 6.4 degrees greater than nose breathing controls.
Continuous interaction between mouth breathing, tongue position and tonsillar enlargement

Enlarged tonsils displace the position of the tongue, promoting tongue thrust, and mouth breathing
Phasic genioglossal EMG activity occurs more frequently during sleep in patients with OSA than in controls, suggesting that it is a compensatory mechanism that occurs when patency of the pharyngeal airway is precarious.
Mean Pulse 76
- Lowest pulse 54
- Highest pulse 122

Mean SpO2 95.6%
- Highest SpO2 99%
- Lowest SpO2 78%
- 7.8% time between 80-90%
Mean Pulse 68
  Lowest pulse 60
  Highest pulse 77
Mean SpO2 97.2%
  Highest SpO2 98%
  Lowest SpO2 94%
TOP 10 AIRWAY ARTICLES

www.Coredentistry.com