Dental Management of Obstructive Sleep Apnea in a Maxillofacial Prosthodontic Practice

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Acknowledgements

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Sabin R. Bista, MD
Michael O. Summers, MD


Transfer of Information

Rationale for Providing this Service
Screening for OSA
   General Prosthodontic Patients
   Pre and Post - Head and Neck Cancer Treatment
Treatment of OSA with Oral Appliance

Transfer of Information

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Screening for OSA
   General Prosthodontic Patients
   Pre and Post - Head and Neck Cancer Treatment
Treatment of OSA with Oral Appliance
Significance

Impact of Chronic Sleep Disorder in the US

- 50-70 million people (National Center on Sleep Disorder Research, 2003)
- $16 billion annual health care expense
- $50 billion annual loss of productivity (National Center on Sleep Disorder Research, 2005)
- 82-98% of adults are undiagnosed (Young et al, 1993)

Impact of Obstructive Sleep Apnea in the USA

- 18 million people
- 9.1% middle-age males
- 4% middle-age females
Quality of Life

- Rested
- Alertness
- Cognitively aware
- No symptoms of pain
- Functioning at high level

Snoring...z z Z Z

I so sleepy
Health Consequences

- Hypertension
- Cardiovascular diseases
- Metabolic disorders, e.g., diabetes
- Gastric disorders, e.g., gastro-esophageal reflux disease
- Respiratory disorders, e.g., asthma
- Emotional and psychological disorders
- Increased mortality rates, e.g., driving accidents
- Decreased general quality of life

Actual Time Spent with Patient

- Medical Risk Factors
- Intra Oral Risk Factors
- Epworth Sleepiness Scale
- Berlin Questionnaire

- Polysomnography
- Dental Evaluation
- PAP Therapy
- Post Prosthesis Polysomnography
- Preauthorization Medical Insurance

- Mandibular Advancement Prosthesis
- One Week Evaluation
- Titrination

Actual Time Spent on Patients

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Sleep-Related Breathing Disorder

Obstructive Sleep Apnea

For Subjective Evaluation, at least one of the following:

- Patient complains of
  - Unintentional sleep episodes during wakefulness
  - Daytime sleepiness
  - Unrefreshing sleep
  - Fatigue
  - Insomnia
  - Patient wakes with breath holding, gasping or choking
  - Bed partner reports loud snoring, breathing interruptions

SRBD Screening and Treatment Protocol

Evaluate Medical Risk Factors

Medical Risk Factors

Intra Oral Risk Factors

Epworth Sleepiness Scale

Berlin Questionnaire
SRBD Screening and Treatment Protocol

Evaluate Intra Oral Risk Factors

<table>
<thead>
<tr>
<th>Intra Oral Risk Factors</th>
<th>Possible Indication</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lips</td>
<td>Incompetent lip seal Possible mouth breather and likely snorer</td>
</tr>
<tr>
<td>Tongue</td>
<td>Scalloped borders</td>
</tr>
<tr>
<td></td>
<td>Large tongue</td>
</tr>
<tr>
<td>Mallampati score</td>
<td>Score II &gt; increased odds of OSA *</td>
</tr>
</tbody>
</table>

Mallampati Score

<table>
<thead>
<tr>
<th>Score</th>
<th>Description</th>
<th>Odds OSA</th>
<th>Possible AHI</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>A clear view of oropharynx, uvula and soft palate</td>
<td>1</td>
<td>5</td>
</tr>
<tr>
<td>II</td>
<td>A limited view of the oropharynx with a view of most of the uvula and soft palate</td>
<td>2.5</td>
<td>≥ 10</td>
</tr>
<tr>
<td>III</td>
<td>Only view soft palate</td>
<td>5</td>
<td>≥ 15</td>
</tr>
<tr>
<td>IV</td>
<td>Only view hard palate</td>
<td>7.5</td>
<td>≥ 20</td>
</tr>
</tbody>
</table>

Nuckton TJ et al: Physical examination: Mallampati score as an independent predictor of obstructive sleep apnea. Sleep 2006; 9(7); 903-908.

Evaluate Intra Oral Risk Factors

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<td>Mallampati score</td>
<td>Score II &gt; increased odds of OSA *</td>
</tr>
<tr>
<td>Uvula</td>
<td>Large, swollen or elongated</td>
</tr>
<tr>
<td>Oropharynx</td>
<td>Narrow airway</td>
</tr>
<tr>
<td></td>
<td>Tonsil grading</td>
</tr>
</tbody>
</table>
**Tonsils Assessment**

- 0: Surgically removed
- I: Hidden within the pillars
- II: Extended to the pillars
- III: Beyond the pillars but not to the midline
- IV: Extended to the midline “kissing tonsils”

**SRBD Screening and Treatment Protocol**

- Medical Risk Factors
- Intra Oral Risk Factors
- Epworth Sleepiness Scale
- Berlin Questionnaire

**Epworth Sleepiness Scales**

- 8 questions
- Each: 0 to 3 score
- Range of sum: 0 to 24
- Below 10 is normal
- Scores approach 9: ↑ risk for OSA
- Psychometric properties
Berlin Questionnaire

- Identify patients at risk for OSA
- 3 Categories
  - 5 questions on snoring and apnea
  - 4 questions on fatigue
  - 1 question on high blood pressure / or BMI > 30 kg/m²
- High risk (vs low risk)
  - 2 or > categories where scores are positive
- Psychometrics
  - High risk categories predicted a RDI > 5 (OSA)
  - Sensitivity of 0.86
  - Specificity of 0.77
  - Positive predictive value of 0.89

SRBD Screening and Treatment Protocol

Medical Risk Factors
Intra Oral Risk Factors
Epworth Sleepiness Scale
Berlin Questionnaire

Obstructive Sleep Apnea

- Objective Evaluation: Polysomnography
- Repeated episodes of upper airway obstruction occurring during sleep
  - Apnea ➔ Complete
  - Hypopnea ➔ Partial
    - < 50% reduction of airflow for > 10 seconds
- AHI: Apneas-Hypopneas Index
  - Incidences of apnea / hypopnea per hour
    - Mild: 5 to 15
    - Moderate: 15 to 30
    - Severe: > 30
- RDI: Respiratory Disturbance Index


PAP Therapy

- Primary therapy is positive airway pressure (PAP)
- Four types of PAP
  - Continuous positive airway pressure (CPAP)
  - Bilevel positive airway pressure (BiPAP)
  - Auto-adjusting positive airway pressure (APAP)
  - Expiratory pressure relief mode (Flexible CPAP)

CPAP with CPAP Pillow
Alternatives to PAP Therapy

Many patients cannot tolerate PAP Therapy: 5 to 50% within a year - 12 to 25% stop using PAP in 3 years.

Screening for OSA

Rationale for Providing this Service

Screening for OSA

General Prosthodontic Patients

Pre- and Post- Head and Neck Cancer Treatment

Treatment of OSA with Oral Appliance

Transfer of Information

Pre - Head and Neck Cancer Treatment

Payne RJ, 2005: Prospective study to determine the prevalence of OSA among consecutive patients with Oral or Oropharyngeal Ca prior to surgical resection

17 patients recruited

Polysonomography 2 to 14 days prior to surgery

OSA: AHI ≥ 20 per hour

N= 13 /17 (76%)

Tendency for postoperative complications more common among patients with OSA

Prolonged ICU stay, cardiopulmonary morbidities, need for mechanical ventilation

Limitations:

High AHI limit, Small N

Post - Head and Neck Cancer Treatment

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Symptoms</th>
<th>Comments</th>
<th>Treatment</th>
<th>N</th>
<th>Citation</th>
<th>Evidence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Radiation Therapy to Neck</td>
<td>Snoring &amp; Excessive Daytime Sleepiness</td>
<td>Edema and Erythema</td>
<td>CPAP</td>
<td>2</td>
<td>a</td>
<td>Case Series</td>
</tr>
<tr>
<td>Reconstructive Laryngectomy</td>
<td>Laryngeal Edema</td>
<td>CPAP &amp; Co2-Laser Treatment</td>
<td>3</td>
<td>c</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Post - Head and Neck Cancer Treatment

- Friedman M et al, 2001: Cross-sectional study to assess the incidence of OSA in patients who have been treated for H&N Ca resection.
  - N=24 patients had cancer surgery
    - Soft palate (N=2), Larynx (N=7), Supraglottic larynx (N=4), Tongue base (N=7), Pharynx (N=4)
  - Sleep Questionnaire and Polysomnography
    - Mild OSA: RDI of > 15 OR <90% O₂ saturation
  - All 10 of 24 patients who had radiation therapy → OSA
  - 11 of 14 without radiation therapy → OSA
  - Limitations:
    - Small N, Non-validated instrumentation, high RDI cut off.

Post - Head and Neck Cancer Treatment

- Nesse W et al, 2006: Cross-sectional study to determine the prevalence of OSA within a Dutch population treated for H&N Ca at a particular center.
  - Primary: Oral / Oropharynx Ca > T₂N₀M₀
  - 49 eligible
    - N=33 → participated
      - 23 men & 10 women, age range 38 to 87 years old
    - N=10 → Epworth sleepiness test > 10
    - N=7 → Polysomnography
      - 2 refused
      - 1 Ca recurrence
    - N=4 → OSA, AHI > 5 (prevalence 12%)
  - Suggested: all patients with Oropharynx Ca T2 be screened

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Mandibular Advancement Prosthesis

- Mild to moderate OSA
  - 19 to 70% success rate
- Majority of patients
  - Reduced snoring
- Reduced daytime sleepiness
- Reduced apnea

<table>
<thead>
<tr>
<th>N</th>
<th>AH1 Before</th>
<th>AH1 After</th>
<th>% AH1 &lt; 5</th>
<th>% AH1 &lt; 10</th>
<th>Citation</th>
</tr>
</thead>
<tbody>
<tr>
<td>20</td>
<td>23 (15)</td>
<td>14 (15)</td>
<td>-</td>
<td>70%</td>
<td>Ferguson et al, 1997</td>
</tr>
<tr>
<td>48</td>
<td>31 (26)</td>
<td>15 (16)</td>
<td>19%</td>
<td>47%</td>
<td>Engelman et al, 2002</td>
</tr>
<tr>
<td>73</td>
<td>27 (2)</td>
<td>12 (2)</td>
<td>36%</td>
<td>-</td>
<td>Gotsopoulos et al, 2002</td>
</tr>
<tr>
<td>80</td>
<td>21 (1.3)</td>
<td>14 (1.1)</td>
<td>-</td>
<td>-</td>
<td>Barnes et al, 2004</td>
</tr>
<tr>
<td>101</td>
<td>21 (1.7)</td>
<td>13 (1.7)</td>
<td>-</td>
<td>-</td>
<td>Lam et al, 2007</td>
</tr>
</tbody>
</table>
SRBD Screening and Treatment Protocol

Medical Risk Factors
Intra Oral Risk Factors
Epworth Sleepiness Scale
Berlin Questionnaire

Polysomnography
Dental Evaluation
PAP Therapy

Extra and Intra Oral Evaluation

OBJECTIVE:
- Extra Oral Evaluation
  - TMD symptoms
  - Palpation of muscles
  - Neck size
- Intra Oral Evaluation
  - Relationship of dentition
  - Range of motion
  - Soft tissue & airway
  - Size: tongue, soft palate, uvula, palatopharyngeal area, Mallampati score, Tonsils assessment
  - Detailed dental evaluation
  - Radiographic evaluation

Extra- and Intra-oral Evaluation

ASSESSMENT:
- Therapeutic Effect
  - Where is the obstruction?
  - Clinical parameters predicting success
    - BMI, AHI
    - Positional dependent OSA
    - Small oral pharynx and/or neck size
    - Younger patients
  - Tolerance
  - Minimum of 5mm of protrusive capacity
  - TMD → less tolerance
  - Retention and Stability
    - Crown root ratio and good restorations
    - Good long term prognosis of dentition

Extra and Intra Oral Evaluation

SUBJECTIVE:
- Chief Complaint: sleep problems
- Family and Social History
- Medical History
- Dental History
- Current Medication
- History of Sleep-Related Disorder
  - Sleep pattern
  - Bed partner questionnaire
  - Epworth sleepiness scale
  - Referral sequence
  - Sleep Study Results
  - PAP Device Used
**Appliance Titration**

- **Patient’s Jaw Movement with Oral Appliance**
- **Mandibular Advancement**

- **Therapeutic Effective Positions**
  - **(A)** Most Retruded Position
  - **(B)** 60% of Maximum Protrusion
  - **(C)** Maximum Discomfort Free Position
  - **(D)** Maximum Protruded Position

**Medical Insurance in USA**

- Pre-authorization
  - DDS notes, Polysomnography results, research articles, PAP
- Majority of the time insurance will pay if diagnosis of OSA
  - ICD-9 code: 780.53
- DME codes: Oral device / appliance used to reduce upper airway collapsibility, adjustable or non-adjustable
  - E0485: Prefabricated
  - E0486: Custom fabricated
- CDT code: 5899 unspecified removable prosthodontic procedure by report
- Medicare: DDS has to be an accredited DME supplier

**SRBD Screening and Treatment Protocol**

- **Polysomnography**
- **Dental Evaluation**
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- **Preauthorization**
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**PAP Therapy**

**Preauthorization**

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- **Preauthorization**
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- 780.53
Dental Procedures

- Upper and lower alginates
- George Gauge Record
- Position at 60 to 70% maximum protrusion
  - Assess discomfort
  - Experience an improvement in nasal breathing
  - Reduction in the ability to snore or "snort"
  - Severity of OSA
  - Occlusal diagnosis
  - Type of appliance

Non Titration Prostheses

Titration Prostheses

Klearway Appliance
Thornton Adjustable Positioners (TAP 3)

Silent Nite

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<table>
<thead>
<tr>
<th>Categories</th>
<th>Parameters</th>
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<td>Epworth Sleepiness Scale</td>
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<td>Dental Evaluation</td>
<td>Preamplification Medical Insurance</td>
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<tr>
<td>Metahydraulic Adenome Prothesis</td>
<td>One Week Evaluation</td>
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Recall Visits for Appliance Use

<table>
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<tr>
<th>Categories</th>
<th>Parameters</th>
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<tbody>
<tr>
<td>Nighttime Signs</td>
<td>Bed Partner Questionnaire</td>
</tr>
<tr>
<td>Daytime Symptoms</td>
<td>Epworth Sleepiness Scale</td>
</tr>
<tr>
<td>Adherence of Appliance Use</td>
<td>How many nights a week</td>
</tr>
<tr>
<td>Fit of Appliance</td>
<td>Retention</td>
</tr>
<tr>
<td>Stability</td>
<td></td>
</tr>
<tr>
<td>Appliance</td>
<td>Structure integrity</td>
</tr>
<tr>
<td>Symptoms of Appliance Use</td>
<td>Sensitivity of teeth</td>
</tr>
<tr>
<td>Discomfort: craniofacial muscles &amp; TMJ</td>
<td></td>
</tr>
<tr>
<td>Intra Oral Evaluation</td>
<td>Pathology due to appliance</td>
</tr>
<tr>
<td>Occlusion from baseline</td>
<td></td>
</tr>
<tr>
<td>Weight Comparison to Initial</td>
<td>Estimate of weight on scale</td>
</tr>
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- Dental Evaluation
- PAP Therapy
- Pre-authorization Medical Insurance
- Mandibular Advancement Prosthesis
- One Week Evaluation
- Titration

Titration Approaches

- Therapeutic Effective Positions
- Patient's Jaw Movement with Oral Appliance

Titration Schedule

- Therapeutic Effective Position
- Most Retruded Position
- 60% of Maximum Protrusion
- Maximum Discomfort Position
- Maximum Protruded Position
- Jaw Movement with Oral Appliance
- Snoring
- Sleepiness

Wee AG in 2010
Mandibular Advancement

Maximum Protruded Position

60% of Maximum Protrusion

Maximum Discomfort Free Position

Maximum Protruded Position

60% of Maximum Protrusion

Most Retruded Position

Jaw Movement with Oral Appliance

Mandibular Advancement

Therapeutic Effective Position

Titration Schedule

(A)

Wee AG in 2010

Possible Complications

- One year adherence of use is 77% (Marklund et al, 2004)

- Short term:
  - Excessive salivation
  - Teeth: sensitivity & looseness
  - Difficulty in swallowing with appliance in place

- Long term:
  - Dislodgement of ill fitting fillings
  - 44.3% unfavorable occlusal changes at 7.4 years
  - Deep overbite: smallest occlusal change (Nuckton TJ et al, 2006)

aveoTSD

- Tongue Stabilizing Device
  - Dr. Chris Robertson in NZ
  - After studying the onset of side effects of oral appliances

- Used internationally for OSA & Snoring (US)

- 3 sizes: M 95% of patients, 5% L & S

- Life expectancy of 12 to 24 months

- Indications:
  - Edentulous, Braces, Less than 8 teeth

- Titration Accessory
  - 5mm or 9mm
Summary

- Increases patient’s & bed partner’s QoL
- Brings in finances to offset maxillofacial prosthetics service care
- Easy to provide this service
- Little clinical time required

Questions: awee@unmc.edu