3D Airway Analysis in OSA and TMD Therapy
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- Faculty USF
- Co-Founder of Dental Sleep Solutions®
- Co-Founder DS3 Dental Sleep Software
Airway: Role of imaging

Airway Imaging Can Not Confirm or Exclude OSA
Imaging Can Help Understand Airway Anatomy (Phenotype)

- Identify Potential Obstruction Sites
- Evaluate Airway Support Structures
How I got involved in CBCT
The Dose Story – in perspective
RADIATION EXPOSURE IN DAILY LIFE

- Average annual effective dose in the US is 3,000 µSv*
- This is approximately 8 µSv/day

Estimated air travel for a 8 hour flight results in 80 to 100 μSv exposure

https://www.sievert-system.org/?locale=en#Calcul
ORTHOPANTOMOGRAPH®
OP300 Maxio
• AUTOMATIC DOSE CONTROL™
• (ADC)
## OP300 Maxio LDT Effective Dose Compared to 2D Effective Dose

<table>
<thead>
<tr>
<th>2D imaging</th>
<th>[µSv]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Full mouth series (18 exposures)</td>
<td>35-388</td>
</tr>
<tr>
<td>Bitewing</td>
<td>5</td>
</tr>
<tr>
<td>panoramic</td>
<td>20</td>
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</table>

<table>
<thead>
<tr>
<th>OP300 Maxio LDT</th>
<th>[µSv]</th>
</tr>
</thead>
<tbody>
<tr>
<td>5x5 Maxilla</td>
<td>4</td>
</tr>
<tr>
<td>5x5 Mandibular</td>
<td>5</td>
</tr>
<tr>
<td>6x8 Maxilla</td>
<td>8</td>
</tr>
<tr>
<td>6x8 Mandibular</td>
<td>14</td>
</tr>
<tr>
<td>8x8 Complete dentition</td>
<td>16</td>
</tr>
<tr>
<td>8x15 arches</td>
<td>24</td>
</tr>
<tr>
<td>13x15 Jaws &amp; sinus</td>
<td>32</td>
</tr>
</tbody>
</table>

(* Patient doses from Dental X-Ray Exams (Ludlow et al. 2008)

(** OP300 Maxio Dose Study (Ludlow 2014)
OP300 MAXIO LDT EFFECTIVE DOSE COMPARED TO 2D EFFECTIVE DOSE

13x15 Jaws & sinus | 32

(* Patient doses from Dental X-Ray Exams (Ludlow et al. 2008)
(** OP300 Maxio Dose Study (Ludlow 2014)
Why 3D?
3D imaging adds value to your treatment
Practice building and differentiation
How do patients perceive a practice?
Using 3D in the Dental office

- Treatment planning and diagnosis
- Office efficiency
- Endo
- 3rd molar evaluation
- Ortho
CBCT – Game Changer

• Screening & Patient Education
• Patient Candidacy & predicting factors - Anatomy, other treatment options, etc.
  • TMJ Baseline and Diagnostics
  • Nasal Airway
• MAD Jaw position?
13x15 CM FOV

Fields of View

- Orthognathics
- Airway
- TMJ
- Nasal Airway
- Trauma
OP300 Maxio
Confident diagnostics for entire maxillofacial region

The perfect FOV for all of today’s and any future needs
CBCT – Game Changer

• Screening & Patient Education
Airway Evaluation
Airway Evaluation

Total Volume: 17.6cc
Min Area: 25.16mm²
Minimal Cross-Sectional Area

Probability of OSA

<table>
<thead>
<tr>
<th>Level</th>
<th>Area Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>High</td>
<td>&lt;52 mm²</td>
</tr>
<tr>
<td>Moderate</td>
<td>52 mm² to 110 mm²</td>
</tr>
<tr>
<td>Low</td>
<td>&gt;110 mm²</td>
</tr>
</tbody>
</table>

Airway Evaluation

Total Volume: 44cc
Min Area: 37.1mm²
Airway Evaluation

Total Volume: 4.4cc
Min Area: 27.1mm²
Airway Evaluation

Total Volume: 4.4 cc

Min Area: 27.1 mm²
Airway Evaluation
Airway Evaluation
CBCT – Game Changer

✓ Screening & Patient Education

➢ Patient Candidacy & predicting factors - Anatomy, other treatment options, etc.

➢ TMJ Baseline and Diagnostics

➢ Nasal Airway

➢ Jaw Position?
Pharyngeal Tonsil (Adenoids)
Normal Nasal Anatomy
Nasal Deviation
Nasal Deviation – Guess Who?
Nasal Deviation
CBCT – TMJ Considerations
TMJ Evaluation
Condylar Head & Fossa Changes
Patient Case 1

Contact

Name: [redacted]

Complaints

Reason for seeking tx: snoring

Other Complaints
- Frequent snoring
- Difficulty falling asleep
- Difficulty in maintaining sleep
- Feeling unrested in the morning
- Irritability or mood swings

Bed Partner: No

Sleep Tests

Baseline Sleep Test? Yes
Type: PSG Baseline - View Study
Most Recent: 31 months ago - 12/20/2013
Diagnosis: 047.33 - OBSTRUCTIVE SLEEP APNEA
AHI/D: 41.6/45.0 Low O2: 65.8% T < 90%: -1%

Recent Titration
Type: PSG Titration - View Study
Most Recent: 31 months ago - 12/20/2013
Diagnosis: 047.33 - OBSTRUCTIVE SLEEP APNEA
AHI/D: 41.6/45.0 Low O2: 65.8% T < 90%: -1%

CPAP

Problems with CPAP
Have you had a sleep study? Yes
CPAP Intolerance
Have you tried CPAP? Yes
What are your initial complaints about CPAP?
An inability to get the mask to fit properly
Discomfort from the straps or headgear
Decrease sleep quality or interrupted sleep from the CPAP device
CPAP restricted movements during sleep
CPAP does not solve my sleep problems (ineffective)
Patient Case
Patient Case

Total Volume: 8.3cc

Min Area: 70.9mm²

Position

RL & AP Distance

Cross Section Area
Patient Case
**AIRWAY:** - The soft palate was approximately 48 mm long.
- Nasal septum deviation and small concha bullosa of the right and left middle nasal turbinates was noted.
- The most constricted area of the airways corresponded to the area posterior to the tongue and soft palate and it is reduced (approximately 70 mm²). This space is small and should be considered an **intermediate risk factor for obstructive sleep apnea (OSA).**
Sinus Evaluation
Signs of **increase in the mucosal thickening** were noted from the floor of the maxillary sinuses and from selected ethmoidal air cells. This is consistent with allergies or another condition of inflammatory origin (**sinusitis**). The antromeatal complexes were patent/clear.
- Dome-shaped soft tissue densities were noted from the floor of the maxillary sinuses and sphenoid sinus. They are consistent with **mucous retention cysts/sinus polyposis**.
- A soft tissue density was noted from the superior-anterior wall of the left maxillary sinus. This is consistent with a **sinus polyp**.
TMJ Evaluation
TMJ Evaluation
TMJ Evaluation
Evidence of **mild sclerosis and flattening** for the superior/posterior surface of the left condyle and sclerosis for the posterior slope of the left eminence was noted.
The right condyle was **small**. The reduction in size occurred along the posterior and superior surface of the right condyle (anterior-posterior and vertical dimension). **Evidence of sclerosis, flattening and small osteophyte formation** for the superior/anterior surface of the right condyle and **mild sclerosis** for the posterior slope of the right eminence was noted.
**Position:** When the mandible was in “closed” position the right condyle was positioned posterior to the center and the left condyle close to the center of their respective fossa. The right posterior articular spaces were reduced.

**OTHERS:** Bilateral elongation/partial calcification was noted for the styloid-hyoid ligament/process.
The findings described above should be considered risk factors for obstructive sleep apnea (OSA).
The findings described above are most consistent with **NON-ACTIVE degenerative joint disease (DJD)** for the **right** TMJ and **osseous remodeling** for the **left** TMJ. DJD involves the destruction of the articular tissues and may occur when the remodeling capacity of those tissues has been exceeded by the functional demands. The presence of these changes increases the probability of a displaced disc in the right TMJs. Reduction of condylar size maybe associated with **changes in occlusion**, asymmetries and mandibular posture which **may predispose to TMJ dysfunction**. The posterior positioned condyles within their fossa may predispose to anterior displaced discs and compression of the posterior surface of the condyles and the adjacent retrodiscal tissues.
Most of the other findings and their correspondent diagnosis were noted above. Please correlate the sections with the axial and panoramic views for additional diagnosis and treatment planning purposes. Reviewing the remaining available volume, there was no evidence of any other anomaly/pathology in the maxillofacial and surrounding structures available in this study.
Case 1

Contact

Name: [Redacted]

Complaints

Reason for seeking tx: snoring

Other Complaints
- Frequent snoring
- Difficulty falling asleep
- Difficulty in maintaining sleep
- Feeling unrested in the morning
- Irritability or mood swings

Bed Partner: No

Same room:

Sleep Tests

Baseline Sleep Test? Yes
Type: PSQ Baseline - View Study
Most Recent: 31 months ago - 12/20/2013
Diagnosis: 047.33 - OBSTRUCTIVE SLEEP APNEA
AHI/RE: 41.8/45.8 Low O2: 0% T < 90%: -1%

Recent Titration
Type: PSQ Titration - View Study
Most Recent: 31 months ago - 12/20/2013
Diagnosis: 047.33 - OBSTRUCTIVE SLEEP APNEA
AHI/RE: 1.4 / 2.7 Low O2: 95% T < 90% not given on report

CPAP

Problems w/ CPAP
Have you had a sleep study Yes
CPAP Intolerance
Have you tried CPAP? Yes
What are your chief complaints about CPAP?
An inability to get the mask to fit properly
Discomfort from the straps or headgear
Decrease sleep quality or interrupted sleep from the CPAP device
CPAP restricted movements during sleep
CPAP does not solve my sleep problems (ineffective)
So what did we learn?

- Patient has small airway and is at risk for OSA
- Nasal airway is compromised. Pt. may have allergies and has sinus abnormalities.
- TMJ’s have existing abnormalities.
- Teeth are adequate support for Dental Sleep Therapy (DST).
Advise patient they are at risk for OSA.

Advise patient they have increased risks of problems with CPAP and/or Dental Sleep Therapy (DST) due to nasal problems.

Advise patient should consider ENT and/or allergist referral.

Advise patient they have existing TMJ concerns and they are at higher risks of complications with DST.

RB&A of Treatment and informed consent!
Tongue Compensated Airway

Tongue Contracts toward Genial Tubercle to increase Airway dimension
Note Tongue Position and Posture
### Case 2 Subjective Tests:

<table>
<thead>
<tr>
<th>Subjective Test</th>
<th>Post-Treatment</th>
<th>Pre-Treatment</th>
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</thead>
<tbody>
<tr>
<td>ESS - Epworth Sleepiness Scale</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>TSS - Thornton Snoring Scale</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>S - Snoring Level (1-10)</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>E - Energy Level</td>
<td>6</td>
<td>5</td>
</tr>
<tr>
<td>SQ - Sleep Quality</td>
<td>7</td>
<td>3</td>
</tr>
<tr>
<td>H/W - How often do you wake up</td>
<td>Occasionally</td>
<td>Occasionally</td>
</tr>
<tr>
<td>with morning headaches?</td>
<td></td>
<td>Several times per</td>
</tr>
<tr>
<td>A/W - Awakenings per Night</td>
<td>7</td>
<td>3</td>
</tr>
<tr>
<td>WA - Witnessed Apnea per Night</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>H/N - Hours of Sleep per Night</td>
<td>8-10</td>
<td>7-8</td>
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</tbody>
</table>

**Dev - Device**
- Dynaflex Dorsal

**Set - Device Setting**
- 18t

**N/W - Nights Worn per Week**
- 7

**Date**
- 06/20/2016
- 05/16/2016
- 04/04/2016
- 01/21/2016

**Baseline**
- None
### Case 2 Objective

#### Sleep Tests:

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<tr>
<th>Date</th>
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<th>Place</th>
<th>Diagnosis</th>
<th>Diagnosing Phys.</th>
<th>Diagnosing NPI#</th>
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<td>Home</td>
<td>SELECT</td>
<td>Michael Burke</td>
<td>1043236557</td>
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<td>08/13/2016</td>
<td>PSG Titration</td>
<td>Blake Medical Cent</td>
<td>G47.33 OBSTRUCT</td>
<td>Michael Burke</td>
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<td>08/04/2010</td>
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<td>G47.33 OBSTRUCT</td>
<td>Sanjay Yathiraj</td>
<td>1508851718</td>
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<table>
<thead>
<tr>
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<td></td>
<td>View</td>
<td>Edit</td>
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<table>
<thead>
<tr>
<th>AHI</th>
<th>9.7</th>
<th>9.1</th>
<th>86.2</th>
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<tbody>
<tr>
<td>AHI Supine</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>RDI</td>
<td>9.7</td>
<td></td>
<td>88.1</td>
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<tr>
<td>RDI Supine</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>O₂ Nadir</td>
<td>85%</td>
<td>80.0%</td>
<td>86%</td>
</tr>
<tr>
<td>T ≤ 80% O₂</td>
<td>18.3%</td>
<td>10.6%</td>
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<tr>
<td>Dental Device</td>
<td>Dynaflex Dorsal</td>
<td>Dynaflex Dorsal</td>
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**Post-Treatment**

**Pre-Treatment**
Case 2 Pre-Treatment
Case 2 Post-Treatment
CBCT Sleep Medical Insurance billing
CBCT Billing Key Points

- Documentation
- Preauthorization
- Accreditation
Documenting Medical Necessity is KEY!!
CBCT Documentation

You need to know what questions to ask to gather information specific to the necessity for a CBCT to bill to insurance.

- History of head or neck trauma
- Recurrent sinus infections or history of sinus problems
- History of head or neck surgery
- Nasal obstruction
- Problems swallowing
- TMD signs/symptoms or history of TMD
CBCT Preauthorization

• All Pre-Authorization
  • Include a medical necessity statement as to why a CBCT is standard of care for the treatment we provide as well as specific clinical information related to the patient that would support the need for the CBCT.

• CPT: 70486 Maxillofacial sinus CT without contrast

• Modifier: TC (technical component)
  • We are not billing for interpretation.

• Must have ICD-10 diagnosis code (OSA G47.33)
CBCT Accreditation

Intersocietal Accreditation Commission

Dental Website

• [http://www.intersocietal.org/dental](http://www.intersocietal.org/dental)

Requirement of being accredited to receive payment from Medicare as well as many private insurance companies when billing CT scans.
Questions?

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