Snoring: What Works?

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Overview

Evaluation
Anatomical conceptual framework

Treatment options
Behavioral
“Medical”
Palate
Tongue
Oral appliances
Evaluation

Snoring: sound produced by vibration of upper airway structures during sleep
Underlying basis: turbulent airflow = airway narrowing

Goal of history and physical examination is determination of factors that:
create turbulent airflow
contribute to sound production

Not synonymous—examination of sound characteristics alone does not direct treatment adequately

Anatomical Conceptual Framework

Effective treatment directed at site(s) of airway narrowing as well as sound production

- Nose
- Palate
- Hypopharynx
Oral Cavity and Oropharynx—Physical Exam

Height, weight, neck circumference

Tonsil size (0-4+)

Palate and uvula thickness and length
--webbing

Surgical changes?

Lateral pharyngeal tissue character, redundancy
Tongue size
Modified Mallampati Position (tongue size relative to palate and “space” created by mandible and pharynx)
--Samsoon and Young’s (Anaesthesia 1987) modification of Mallampati position, with tongue protrusion
Evaluation Is Closely Connected to Treatment Options

Behavioral: Weight loss
  Avoidance of supine position
  Avoidance of alcohol or sedatives

PAP
Anatomical conceptual framework
  “Medical”—nasal medications and devices
  Surgery
  Oral appliances
Treatments and outcomes differ between snoring and OSA, but conceptual framework may not

Treatment Options

PALATE PROCEDURES
Palate Radiofrequency
Laser-assisted Palatoplasty
CAPSO (modified)
Injection Snoreplasty
Pillar Procedure
Others

TONGUE
Tongue Radiofrequency
Oral Appliances, e.g.
Mandibular Advancement Device
NASAL TREATMENT
will not discuss
Snoring Treatment—Does It Work?

Outcome Measures:
Snoring—self or bed partner rating
Snoring—objective
Bed partner satisfaction
AHI—any reduction
AHI—meaningful reduction
Sleepiness—Epworth Sleepiness Scale score (subjective)

Palate Radiofrequency

Many areas of the body
Heart, prostate, oncology
Turbinates, palate, tonsils, tongue

Multiple technologies
Monopolar (Gyrus, Ellman) vs.
Bipolar (Arthrocare, Celon)
Temp-controlled (Gyrus) vs. not

Energy creates injury, fibrosis
Minimally invasive and titratable (multiple sessions)
Palate Radiofrequency Outcomes

Too many studies to summarize; mostly subjective outcomes (with objective outcomes equivocal)
Technologies do differ, but little direct comparison
Effectiveness likely similar to other stiffening procedures
Patient selection likely critical

Complications (Kezirian et al. Laryngoscope 2005):
Major: significant airway compromise, infection requiring drainage 0.2% (1/669 patients)
Moderate: hemorrhage, palatal fistula, nerve paresis or paralysis, significant dysphagia 1% (7/669)

Laser Assisted Uvulopalatoplasty (LAUP)

Technique of serial reshaping and removal of tissue of the soft palate and oropharynx

Described by Yves-Victor Kamami (1986)
“French” (Kamami) or “British” (Kotecha) method
– “British” method involves ablation of mucosa of anterior soft palate

Lasers: CO2, KTP, Argon
Cautery-assisted
LAUP Stage I: French Technique

LAUP Stage II

Revise trenches if needed

Can add “British” central lesion
LAUP

Studies rarely describe selection criteria (one paper), technique (two papers), or timing of serial sessions (3-8 weeks)

LAUP is less painful than UPPP but more painful than Palate TCRF (Troell et al. 2000, Blumen et al. 2003)

Outcomes vary between papers
  - Snoring: bed partner ratings usually improve, but objective data limited (decrease of 3.8 dB in snoring)
  - Other outcomes show +/- change: QOL (incl bed partner), ESS

Cautery-Assisted Palatal Stiffening Operation (CAPSO)
Cautery-Assisted Palatal Stiffening Operation (CAPSO)

Mair and Day Oto-HNS 2000
92% resolution of snoring (subjective)

Wassmuth Oto-HNS 2000
25 pts; AHI ≥10; 0-1+ T; No craniofacial abnormalities
Results: AHI 25 to 16.6*
40% (10/25) meaningful AHI improvement

Modified CAPSO

Pang and Terris Oto-HNS 2007

13 pts: AHI <15; BMI <33; 0-2+T
Snoring improved over 90 days (8.3 to 3.3)
6/8 OSA meaningful AHI improvement
Injection Snoreplasty
Brietzke and Mair Oto-HNS 2001
2cc 1% or 3% Sotradecol (used for treatment of varicose veins)
AHI < 10; selection by awake palatal snoring
Snoring subjectively resolved 25/27 (92%)

Brietzke and Mair Oto-HNS 2003
25 patients with subjective resolution of snoring and 17 additional patients with AHI <10, 0-1+T
1-2 treatments with sotradecol
Objective improvements after injection snoreplasty, although no consistent finding
• Relapse 20% at 19 months

50% Ethanol—Brietzke and Mair Oto-HNS 2004
15% reduction in # palatal snores
Other objective improvements in loudness
Brietzke and Mair
Oto-HNS 2003

**Pillar Procedure**

Insertion of three polyethylene terephthalate (PET, same as Dacron) implants into soft palate musculature at junction of hard/soft palate

Premise: implants and host response (fibrosis) create stiffening of tissue that decreases airway compromise and snoring

FDA Clearance (2003):
Primary snoring and mild-moderate OSA

Restore Medical/Medtronic: substantial research
Disclosure: Medtronic consultant
### Pillar Procedure—Snoring/Mild OSA (All)

<table>
<thead>
<tr>
<th>Study</th>
<th>Snoring—Subjective</th>
<th>Snoring—Objective</th>
<th>Bed partner satisfaction</th>
<th>Sleepiness</th>
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</thead>
<tbody>
<tr>
<td>Ho 2004</td>
<td>7.9 to 4.8</td>
<td></td>
<td></td>
<td>Decrease</td>
</tr>
<tr>
<td>Nordgard 2004</td>
<td>7.3 to 3.6</td>
<td></td>
<td>86%</td>
<td>Decrease</td>
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<tr>
<td>Maurer 2005</td>
<td>7.3 to 2.1</td>
<td></td>
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<tr>
<td>Maurer 2005</td>
<td>7.1 to 4.8 (1 year)</td>
<td>No changes at 90 days</td>
<td>90%</td>
<td>Decrease</td>
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<td>Kuhnel 2004</td>
<td>8.0 to 4.4</td>
<td></td>
<td></td>
<td>Decrease</td>
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<tr>
<td>Nordgard 2006</td>
<td>7.1 to 4.8 (1 year)</td>
<td></td>
<td>70%</td>
<td>Decrease</td>
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<tr>
<td>Romanow 2006</td>
<td>8.5 to 4.4</td>
<td></td>
<td>90%</td>
<td>No change</td>
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### Table 4

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Baseline</th>
<th>Day 90</th>
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<tbody>
<tr>
<td>Snoring index (snrH)*</td>
<td>273 ± 178</td>
<td>276 ± 172</td>
</tr>
<tr>
<td>Primary vibration frequency (Hz)</td>
<td>107 ± 99</td>
<td>110 ± 99</td>
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<tr>
<td>Palatal vibration frequency (Hz)</td>
<td>82 ± 10</td>
<td>80 ± 30</td>
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<tr>
<td>Type 1 and type 2 (%)</td>
<td>91 ± 25</td>
<td>89 ± 24</td>
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<tr>
<td>Resistance occurrence index (%)</td>
<td>25 ± 16</td>
<td>23 ± 14</td>
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<tr>
<td>Maximum relative loudness [dB]</td>
<td>15 ± 7</td>
<td>16 ± 6</td>
</tr>
</tbody>
</table>

*Snoring index: Number of snorers per hour.
Primary vibration frequency: Fundamental frequency of all snoring events.
Palatal vibration frequency: Frequency of all velum-like snoring events.
Type 1 and type 2: Percentage of velum-like snorers.
Resistance occurrence index: Percentage of all respiratory events whose spectral profile suggests increased resistance to airflow.
Maximum relative loudness: Loudness in dB of the loudest 10% of all snoring events.

### Placebo effect—for all stiffening procedures?

**Subjective improvement without objective improvement**
Pillar Procedure—Conclusions
(probably like other stiffening procedures)

Single modality
Primary snoring
Mild to moderate OSA
Patient selection is critical, similar to other procedures

Palate primary factor
(mild/mod OSA studies)
MMP 1-2; BMI ≤ 32
0-2+ Tonsils (0-1+ ?)
Palate normal length

Tongue Radiofrequency

Treatment of tongue base and ventral tongue

Gyrus (TCRF)
Multiple treatment sessions
OSA Target: 9,000-11,000 J

Arthrocare: bipolar
Celon (Europe, ?US): bipolar

No literature for primary snoring
Mandibular Advancement Devices

Objective improvement in snoring
--number of snores, intensity
Little discussion of patient selection

Maurer et al. Oto-HNS 2007
Vanderkeven Acta Otol 2004
Other studies

<table>
<thead>
<tr>
<th>Procedure</th>
<th>Cost</th>
<th>Pain</th>
<th>Effectiveness (? MMP 1-2, 0-1+T)</th>
<th>Other factors</th>
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<tr>
<td>Palate RF</td>
<td>***</td>
<td>**</td>
<td>Multiple tx</td>
<td></td>
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<tr>
<td>LAUP</td>
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<td>Multiple tx? Tissue removal</td>
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<td>CAPSO</td>
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<td>Tissue removal</td>
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<tr>
<td>IS</td>
<td>*</td>
<td>*</td>
<td>Multiple tx?</td>
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<tr>
<td>Pillar</td>
<td>***</td>
<td>*</td>
<td>Foreign body</td>
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<tr>
<td>Tongue RF</td>
<td>****</td>
<td>****</td>
<td>Multiple tx Differs (tongue)</td>
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<tr>
<td>MAD</td>
<td>* to ****</td>
<td>**</td>
<td>Compliance</td>
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</tbody>
</table>
Conclusions

Objective data comparing snoring treatment options are limited or non-existent

Best treatment options for snoring depend on the combination of thorough patient evaluation and integration of available evidence, clinical experience, and patient preferences

Save the Date!

February 2011
Presidents’ Day Weekend
Orlando, FL