

Harry Legan, D.D.S.

An Orthodontist's Evidence-Based Approach to Treating Obstructive Sleep Apnea (OSA)

Background

- OSA manifests as an upper airway problem, localized to the pharyngeal area
- OSA affects the quality of life (daytime sleepiness) and can be a significant life risk
- 4% of middle-aged males and 2% of middle-aged females have OSA
- Contributing factors are obesity, supine sleep posture, decreased oral/pharyngeal muscle tone secondary to alcohol-related CNS depression
- Males with > 17-inch neck size and females with > 16-inch neck size are OSA candidates
- Other contributing factors are nose/mouth abnormalities and nasal obstructions
- Anatomic factors associated with OSA are:
 - Maxillary and mandibular retrognathia
 - Increased lower face height
 - Large tongue
 - Long uvula/large soft palate
 - Inferior positioning of the hyoid bone
- OSA symptoms include snoring, insomnia, daytime fatigue, and impaired intellect
- Medical complications include pulmonary effects, congestive heart failure, stroke, and fatal accident (due to fatigue)
- Polysomnography allows a definitive diagnosis of OSA by monitoring respiratory airflow and effort. The resulting respiratory distress index (RDI) classifies the severity of the OSA:
 - RDI < 5 = normal
 - RDI 5 – 15 = mild OSA
 - RDI 15 – 30 = moderate OSA
 - RDI > 30 = severe OSA
 - An RDI > 20 is usually associated with increased health risk and mortality

Treatment Protocols

- For mild OSA: Encourage increased sleep time, weight loss, change sleep posture, avoid CNS depressants, use of oral appliances
 - For moderate to severe OSA:
 - Continuous Positive Air Pressure (CPAP) apparatus (1st line treatment)
 - Soft tissue surgery (show limited improvement long-term)
 - Radiofrequency ablation
 - Plasty of the uvula, soft palate, pharynx (scalpel or laser assisted)
 - Plasty of the tongue
 - Removal of tonsils/adenoids
 - Oral appliances
 - Tongue retaining devices
 - Anterior mandibular positioning appliances (AMPA)
 - 58 appliance styles currently available
 - Act to change the position of the upper airway structures

- Decrease the potential for upper airway collapse
- Indicated for snoring and mild-moderate OSA
- Indicated for those intolerant to CPAP
- Indicated when surgery not a good option
- Not indicated for severe OSA
- Hard tissue surgery
 - Genioglossus advancement with hyoid myotomy (GAHM)
 - Maxillary and mandibular advancement
 - Standard LeFort I and BSSO
 - Maxilla is advanced 7 – 10 mm. without bone grafting
 - Mandible is advanced 10 – 12 mm.
 - Maxillary and mandibular skeletal expansion
 - Standard SARME (upper) and Transverse distraction osteogenesis (lower)
 - Protocol for SARME is to wait 1 week post-surgery to expand 0.5mm per day
 - Combination of surgical expansion and advancement of both jaws

Evidence supporting treatment protocols

- AMPA treatment at Vanderbilt has provided evidence of treatment outcomes
 - Patient protocol:
 - Initial survey given
 - Polysomnography and RDI obtained for definitive diagnosis of OSA
 - Acrylic appliance to advance the mandible 2/3 of maximum protrusion (usually 5-7 mm. anterior and 3 mm. vertical). Ramp design allows freedom of mandibular movement
 - Post-appliance insertion survey indicates 74-88% improvement in following factors:
 - Ease of use
 - Quality of life
 - Snoring
 - Gasping/apneic events
 - Symptoms improve as good or better than with use of CPAP
 - AMPA easier to adjust to than CPAP
 - RDI improves, on average, from 11.2 to 2.9 with AMPA treatment
- Cochrane *systematic review* comparing effectiveness of AMPA with other treatments
 - 13 randomized clinical trials, 533 patients total
 - 5 trials showed AMPA reduced patient RDI by 13.17
 - 7 trials showed AMPA not as effective as CPAP in reducing RDI, but was equal to CPAP in post-treatment symptom scores, and was preferred over CPAP by patients
 - 1 trial showed soft tissue surgery was no more effective than AMPA in RDI improvement and post-treatment symptom scores. Patients treated with AMPA had a better RDI after 12 months

- Conclusions: CPAP is better than AMPA on improving sleep disordered breathing. Should restrict the use of AMPA to patients who cannot tolerate CPAP
Cooke, V, Schooff, M. Oral appliances for obstructive sleep apnea? Amer Family Phys 2006;73:801-05.
Lim J, Lasserson TJ, Fleetham J, Wright J. Oral appliances for obstructive sleep apnea. Cochrane Database Syst Rev 2004;(4):CD004435.
- Dr. Legan's views:
 - Evidence-based data for this subject is limited by the lack of quality studies
 - Some important data is not published
 - Feels the best treatment for mild to moderate OSA is AMPA
 - Feels the best treatment for severe OSA is hard tissue surgery
- Uvulopalatopharyngealplasty (termed UPPP, operating room under general anesthesia)
 - Short-term effectiveness in reducing OSA symptoms good
 - Long-term effectiveness in reducing OSA symptoms not supported
Pepin JL, Veale D, Mayer P, Bettega G, Wuyam B, Levy P. Critical analysis of the results of surgery in the treatment of snoring, upper airway resistance syndrome (UARS), and obstructive sleep apnea (OSA). Sleep. 1996 Nov;19(9 Suppl):S90-100.
- Laser assisted UPPP (office procedure under local anesthesia)
 - Long-term effectiveness in reducing OSA symptoms not supported
 - Multiple surgeries needed
 - Cochrane *systematic review* comparing surgery to AMPA found:
 - Long-term, RDI for AMPA lower than that for laser assisted UPPP
 - Improvement by surgery not supported long term
- Radiofrequency ablation
 - Needed yearly
 - Complications from tissue shrinkage and wound healing
- Nasal treatments – generally ineffective for OSA
- Skeletal surgery by maxillary and mandibular advancement (MMA)
 - Produces increase in airway space on cephalogram of 6-7 mm.
 - Improves RDI from 50-70 initial to 7-10 post-surgery (same change as CPAP)
 - RDI improvement is maintained 4 years post-surgery
 - Only 4% relapse of skeleton at 4 years post-surgery
Prinsell, JR. Maxillomandibular advancement surgery for obstructive sleep apnea syndrome. J Am Dent Assoc. 2002 Nov;133(11):1489-97; quiz 1539-40.

Conclusions

- The first line of treatment for mild OSA is behavior modification
- Oral appliances (AMPA) are first line of treatment for mild-moderate OSA
- CPAP treatment for mild-moderate OSA where AMPA fails or is not tolerated
- Soft tissue surgery has high risk/benefit ratio and shows no long-term improvement
- Hard tissue surgery (MMA) is an effective surgical treatment for moderate-severe OSA