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ORAL SURGERY UPDATE™

Jaw Surgery to Treat Severe Obstructive Sleep Apnea

Obstructive sleep apnea (OSA) syndrome has been associated with significant health issues, including hypertension, diabetes, cardiovascular events, stroke and even death. Daytime sleepiness, an increase in motor vehicle accidents, a decrease in neurocognitive functioning leading to poor memory, difficulty concentrating, moodiness and increased stress due to OSA can have a negative impact on a patient's quality of life.

WINTER 2017

FEATURED IN THIS ISSUE

OSA is the absence of breathing during sleep for ≥10 seconds despite an effort to breathe. Hypopnea is a 30% decrease in airflow lasting at least 10 seconds, with an oxygen desaturation of at least 4%. OSA severity is assessed with the apnea–hypopnea index (AHI), which measures the total number of hypopneas and apneas per hour of sleep. An AHI score of ≥5 plus patient-reported daytime sleepiness defines OSA syndrome. OSA severity is delineated by the following AHI scores:

- **Mild OSA:** 5 to 15
- **Moderate OSA:** 16 to 30
- **Severe OSA:** >30

Continuous positive airway pressure (CPAP) is the gold-standard nonsurgical sleep apnea treatment. However, patient compliance is an issue, with 29% to 83% of patients noncompliant when prescribed 4 hours of CPAP per night. Thus, many patients inquire about a surgical option.

Used to treat moderate to severe OSA, maxillomandibular advancement (MMA) surgery opens the airway and decreases the potential for airway collapse during sleep. As the mandible is surgically advanced with a bilateral sagittal split osteotomy (BSSO), the anterior belly of the digastric, mylohyoid, geniohyoid and genioglossus muscles also advance, pulling the tongue forward. The addition of a genioplasty, which also advances the suprahyoid muscles, is effective in patients with anterior mandibular deficiency.

A retrospective study by Goodday et al from Dalhousie University, Canada, used overnight polysomnograms taken preoperatively and ≥6 months postoperatively to evaluate and confirm OSA in 265 patients who failed a trial of CPAP and had MMA surgery. Their study focused on 13 patients, each with an AHI score of >100; these patients completed questionnaires concerning their daytime somnolence (using the Epworth Sleepiness Scale), snoring and overall satisfaction with the procedure.

Statistical analysis showed significant improvement in patients' AHI scores ($p < .001$) after surgery. From a preoperative mean AHI of 117.9, 8 patients had a postoperative AHI of <6, 2 patients had an AHI of 6 to 15, and 3 patients had an AHI of >15. The mean postoperative AHI score decreased by 101.8 events/hour, with 6 patients achieving a score <5, which defines a surgical cure. Two patients achieved a postoperative AHI score between 5 and 6, a level most physicians would not treat in the absence of daytime sleepiness.

The authors concluded that, by eliminating the use of CPAP, improving subjective outcomes and significantly decreasing a patient's AHI score, MMA surgery for extremely severe OSA can be a highly successful 1-stage treatment modality.

Goodday RH, Bourque SE, Edwards PB. Objective and subjective outcomes following maxillomandibular advancement surgery for treatment of patients with extremely severe obstructive sleep apnea (apnea-hypopnea index >100). J Oral Maxillofac Surg *2016; 74:583-589.*

Antiseptic Solutions and Bone Viability

Antiseptic solutions have been used extensively in dentistry for sterilization, including irrigation around implants, disinfection in advanced periodontal disease and antibacterial mouth rinses. Although these antiseptic solutions demonstrate cytotoxicity on bacterial cells, they may also negatively affect eukaryotic cells; chlorhexidine digluconate (CHX) and sodium hypochlorite (NaOCl) solutions are toxic to fibroblasts. These antiseptic solutions can alter the gene expression of cytokines and growth factors associated with cell growth, osteogenesis and inflammation.

Using bone chips from the lateral aspect of a porcine mandible, Sawada et al from the University of Bern, Switzerland, assessed changes after rinsing them with 4 different antiseptic solutions:

- 0.5% povidone iodine (PI)
- 0.2% CHX
- 1% hydrogen peroxide (H_2O_2)
- 0.25% NaOCl

A cell assay evaluated the samples for cell viability. At 15 minutes and 4 hours after rinsing, an enzyme-linked immunosorbent assay determined the protein release of transforming growth factor-β1, bone morphogenetic protein 2, vascular endothelial growth factor, interleukin-1β and receptor activated nuclear factor–κB ligand.

After rinsing, scanning electron microscopy (SEM) showed a loss of the surface protein layer. Control samples visualized under SEM showed various rough surfaces with many macro- and microtopographies; control surfaces also showed a marked protein-fibrin network. In varying degrees, both the surface roughness and fibrin layer of the samples were lost after being rinsed with the 4 antiseptic solutions. An abundant protein layer remained on the CHX-rinsed bone samples, with the amount of surface protein content gradually decreasing in the following order: CHX, H_2O_2, PI, NaOCl; the cell viability on the bone sample surfaces decreased in the same order.

The authors noted that their study was limited because the samples were rinsed for 10 minutes, far longer than the rinsing time used clinically. In contrast to the other antiseptic solutions tested, rinsing with CHX resulted in the maintenance of increased cellular viability and the release of growth factors associated with the induction of bone remodeling and angiogenesis.

Sawada K, Fujioka-Kobayashi M, Kobayashi E, et al. Effects of antiseptic solutions commonly used in dentistry on bone viability, bone morphology, and release of growth factors. J Oral Maxillofac Surg *2016;74:247-254.*

Table 1 Effect and relative effect of risk factors on AO incidence

Risk factor	Risk ratio[a]	|Effect|, %[b]	Relative effect, %[c]	p value[d]
OC use	1.9	7.6	50.2	.001
Smoking	1.5	9.8	68.2	≤.001
Sex (total population)	1.5	4.6	42.9	≤.001
Sex (no OC use)	1.2	3.6	34.6	.01
Menstruation	0.8	4.9	36.6	.30

[a] *Risk ratio* = $risk_{treatment} / risk_{control}$ *between paired comparisons.*
[b] $|Effect| = |risk_{treatment} - risk_{control}|$ *between paired comparisons.*
[c] *Relative effect* = $|effect| /$ *mean risk.*
[d] *p value for* $|effect|$.

Dry Socket Risk in Oral Contraceptive Users

The most common complication after tooth extraction, alveolar osteitis (AO), also known as dry socket, results from either partial or complete loss of a blood clot and causes localized pain, halitosis and parageusia. One possible risk factor for AO may be the use of an oral contraceptive (OC). A meta-analysis showed that women using estrogen-based hormonal therapy in the form of OCs had up to a 1.8× increase in the incidence of dry socket after extraction of impacted third molars.

Bienek from the ADA Foundation, and Filliben from the National Institute of Standards and Technology, both in Maryland, performed a study of the literature using MEDLINE and Cochrane Library databases. In the population using OC, smoking and timing of exodontia in the menstrual cycle were considered. For each factor, the data were dichotomized and used for pairwise comparison between men and women. Comparing men with women not using OC eliminated the possibility of misinterpreting data and conclusions.

Of the 43 articles identified, 29 eligible for meta-analysis found that women not using OC had a 1.2× greater risk of developing AO than did men; women using OC had a nearly 2-fold greater risk (13.9% vs 7.5%). The effect and relative risk factors on the incidence of AO are summarized in Table 1.

The first OCs contained 10 mg of norethynodrel (progestin) and 150 μg of mestranol (estrogen). Over time, the estrogen dose was decreased to 50 μg and then to between 20 μg and 35 μg. However, newer generations of OC contain as little as 15 μg of estrogen.

The authors concluded that, to mitigate women's risk for developing AO, dentists should know if their patients are using OC and whether they are smoking. Further study is needed to characterize participants for the route, type and dose of OC (or hormonal therapy) used at the time of tooth extraction.

Bienek DR, Filliben JJ. Risk assessment and sensitivity meta-analysis of alveolar osteitis occurrence in oral contraceptive users. J Am Dent Assoc *2016;147:394-404.*

Incidence of Oral Lesions by Population And Anatomy

Oral lesions are often identified based on anatomic location, size, color and other similar clinical features. Patient demographic data (e.g., age, sex, tobacco use) are also used to identify oral lesions. Dovigi et al, private practitioners from California, performed a large retrospective study of a broad group of dental practices to compare patient and anatomic characteristics in oral and maxillofacial lesions.

Three licensed oral pathologists reviewed and categorized the results of 51,781 biopsies taken from patients ≥17 years of age at practices located in the southwest United States between December 2001 and January 2015. Patient demographic data were limited to age, sex and anatomic site; no data were available for ethnicity, how long the lesions had been present, and patient tobacco and alcohol use.

Table 2 Percentage of lesions across disease types within each age group (excluding healthy tissue and other)

Age, years	Malignant, %	Benign, %	Infectious, %	Reactive, %	Potentially malignant, %	Developmental, %	Immune dysfunction, %	Physical trauma, %
17–25	0.37	1.44	3.97	70.47	0.72	21.37	0.29	0.69
26–35	0.55	1.38	4.82	77.08	1.18	12.38	0.81	0.89
36–45	0.85	1.39	5.34	78.49	2.24	7.26	2.18	1.46
46–55	1.41	1.19	6.02	78.36	3.06	4.76	2.89	1.52
56–65	2.00	0.97	6.42	75.82	4.40	4.11	3.69	1.78
66–75	2.84	1.37	6.84	73.94	4.81	3.42	4.15	1.99
≥76	6.28	1.55	7.26	69.45	6.64	2.80	3.46	1.87

Biopsies were taken from the lip, tongue, gingiva, floor of mouth, tonsil, pharynx, mandible, maxilla, palate, mucosa and apical area. Diagnoses were coded based on *Robbins and Cotran Pathologic Basis of Disease* as 1 of 10 disease types: benign neoplasm, malignant neoplasm, infectious, reactive, potentially malignant, developmental, healthy tissue, immune dysfunction, physical trauma and other. Relative prevalence of disease types, grouped by patient age (17 to 25, 26 to 35, 36 to 45, 46 to 55, 56 to 65, 66 to 75, and ≥76 years) are shown in Table 2.

Biopsies revealed the following:

- Reactive lesions were most common in the apical region; the gingiva and palate exhibited a broader spectrum of disease processes.
- The largest number of malignant lesions were found on the tongue.
- The floor of the mouth had the highest proportion of potentially malignant lesions; the floor of the mouth and the tonsil exhibited an approximate 4-fold higher proportion of malignancy than found at other sites.
- Among mucosal lesions, most common immune dysfunction diagnoses were from the buccal mucosa; the most common malignant diagnoses were from the mandibular vestibular mucosa.

The authors suggested that the oral mucosa be considered a heterogeneous tissue. Overall, reactive lesions were the most prevalent (74.93%), while malignant diagnoses comprised 1.97%. The 3 most prevalent diagnoses were

- benign keratosis
- chronic apical periodontitis
- radicular cyst

This information may assist clinicians in narrowing their diagnostic focus when patients present with oral lesions.

Dovigi EA, Kwok EYL, Eversole LR, Dovigi AJ. A retrospective study of 51,781 adult oral and maxillofacial biopsies. J Am Dent Assoc *2016;147:170-176.*

In the next issue of
Oral Surgery Update

Diets for temporomandibular disorders; an analysis of mandibular angle fractures; multiple opioid prescriptions; antibiotic use

Do you or your staff have any questions about **Oral Surgery Update**? Please call or write our office. We would be happy to hear from you.