The Oral Effects of Inhalation Corticosteroid Therapy: An Update
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Full of uncommon ambition, young Archie H. Hooker’s professional goals didn’t include joining his father’s San Diego printing business like his older brother. Archie’s family recorded his occupation as “apprentice-dentist” in the 1880 U.S. Census, when he was just 13 years old. Two years later, Hooker became the very first librarian of the San Diego Public Library, which opened in a bank building on the second floor right next to a dentist.

This dentist was Daniel Cave, who had emigrated from France a decade earlier in search of a better climate for his health. With only $20 to his name, Dr. Cave went on to establish a thriving dental practice and was elected to numerous civic leadership positions, including Chamber of Commerce president. He also provided apprentice opportunities to young men who would eventually become registered California dental practitioners — this in an era before dental school education and a board examination were prerequisites in order to practice dentistry. Without a doubt, Dr. Cave would have been an influential figure to any impressionable teen.

Hooker worked as San Diego’s librarian for two years, and he performed janitorial duties. Just imagine all the brief encounters and the casual conversations that may have occurred on that second floor between him and the accomplished Dr. Cave. While no records have been found to show that Hooker apprenticed with him (it’s possible, but I am still researching this), it could be surmised that Dr. Cave’s success as a dentist may have had some influence on Hooker’s future.

You and I have an opportunity to provide this same kind of inspiration. Just recently, I mentored a local high school student who balanced an excellent academic record with numerous extracurricular activities. This well-rounded student began as a patient of mine, volunteered at my clinic and is now a pre dental student in college. The student recently came back for a checkup and is still committed to becoming a dentist. If I had played just a small part in encouraging this promising student to pursue a career in dentistry, I would be satisfied. Dentistry needs these young exceptional individuals to elevate our profession in the future.

Of course, the right kind of mentor at the undergraduate level can strengthen the aspirations of any career-minded individual. I had two such advisors who made a significant impact on my journey: Terry T. Tanaka, DDS, of Chula Vista, Calif., whom I volunteered with for two years at the University of California, San Diego TMJ and Facial Pain clinic on Wednesday afternoons, and Lennon Goins, DDS, of La Jolla, Calif. Without their help, encouragement and counsel, I could have been sidetracked into taking the MCAT with my premed friends instead of the DAT and might have ended up becoming a different kind of doctor. That wasn’t for me.

But looking back, my decision to become a dentist was most influenced by the mentor I had when I was much younger, during my high school years. I spent many hours job shadowing William Quan, DDS, in my hometown of El Centro, Calif. I can still remember the visits to his dental office and all the welcoming sights and interesting smells. He talked to me about the many facets of dentistry, one time even chairside as he performed an anterior maxillary root canal on a patient. My experience at his office created the foundation for me to build upon for my goals. Of course, the fact that he’s my uncle helped, too.

Mentoring middle or high school students can be a game-changer. Look back on your formative years and you’ll probably remember that one great mentor, the one who made a difference in your career planning. Mentoring can be easy, too. In addition to just simply talking about your profession when that “right” student crosses your path, resources are available to help you make a strong impression.

Start with sharing the ADA webpage titled “Be a Dentist,” which is full of up-to-date facts and the latest material about choosing dentistry as a career. It is designed for both high school and college students. Access the webpage at ada.org, go to the “Education/Careers” tab, click on the selection “Careers in Dentistry,” then scroll down and click on “Be a Dentist.” A great document to download is the ADA fact sheet on dentistry careers.
sheet, “What can a career in dentistry offer you?” which highlights service to others, balanced lifestyle, self-employment, earning potential, status, prestige and a variety of career options. Those are similar to the reasons stated by the 2017 *U.S. News and World Report* when it chose “dentist” as the best profession in the United States.

The ADA offers other informative documents for the student, such as the detailed “Dentistry Careers” and the brochure that focuses on diversity, called “Something to Smile About: Careers in the Dental Profession or the New Dentistry,” to name a few. Another ADA webpage to recommend is “Mentoring Students (K–16)” Interested in Careers in Dentistry” found at ada.org/mentoring. The ADA states, “Mentors can help you understand dentistry from the other side of the chair and provide guidance about pursuing dentistry as a career.” Consider becoming a mentor.

Like Daniel Cave, you too can have such a positive impact on a young mind. Dr. Cave moved on to Los Angeles and in 1911 became president of the Southern California State Dental Association, which was an early form of the California Dental Association when it existed as two constituent entities. He was even one of CDA’s first life members. Additionally, Dr. Cave served as the first president of the San Diego Country Dental Society, which he and six others founded in 1887. Their first meeting was held on the second floor of that same San Diego dental office across the hall from the library. By that time, however, the office was co-owned by two other founding SDCDS members: Dr. Edward S. Mathews and a young man named Dr. Archibald H. Hooker.

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Having read the article “Management of Infections and the Use of Antibiotic Prophylaxis by Dentists: A Review of the Evidence” in the March Journal, we wish to point out the ambiguity on antibiotics that exists in the literature, the most recent being a campaign to sway patients away from thinking that antibiotics are a cure-all.1

Third molars, for example, are at the confluence of multiple facial spaces that serve as a conduit for infection to spread. Extraction wounds inherently contain bacterial inhabitants. However, antibiotic prophylaxis seems to be unwarranted and currently no clear-cut consensus on the use of antibiotics in soft tissue or bony impactions. Depending on the nature of the surgical procedure, the degree of tissue trauma, clinical acumen of the surgeon and patient comorbidities, aseptic measures have a definite role in the incidence of surgical site infection, hence it is difficult to conclusively cement the need for antibiotics for all third molar surgeries.

Dentinal sensitivity and sharp-shooting pain often alert patients to the progression of caries from enamel to dentin to the pulp and periapical tissues. The virulence of the microbes and the host reparative mechanism strike a balance to limit the spread of infection in an immunocompetent individual by forming a periapical granuloma/cyst. Cellulitis and abscess further limit infection before they progress to primary and secondary spaces of the head and neck. A timely intervention by dentists and a preventive approach by patients would be handy in curtailing the progressive rise in antibiotic resistance.

Extraction of the pulp tissue remains a viable option, but is sometimes deferred for fear of local anesthesia failure in an inflamed pulp and lack of patient compliance.2 For a successful clinical outcome, combined with an agitated patient in pain, antibiotics remain perfect fodder and a rapid short-term solution. The acute nature of dental pain often makes patients mistakenly use any leftover antibiotics.

Patient demand and lack of prescribers’ updated knowledge have prejudiced the decision to prescribe antibiotics at least as much as the patients’ clinical diagnosis. A wide array of prescribing practices with regard to clinical conditions, antibiotic of choice and duration of therapy do exist. This necessitates the need for a more practical advice for dentists who can then value their clinical judgment at the same time beholding their patients’ interest and safety.3,4

Studies have claimed there is no difference in healing after routine extractions in well-controlled and uncontrolled diabetics,5 but it would be difficult to infer whether wound healing would remain satisfactory in minor surgical procedures in an uncontrolled diabetic. Evidence-based decision-making related to optimal antibiotic strategies in surgical practice is the need of the hour. This will minimize rising antibiotic resistance and curb the idea that antibiotics are magic bullets for treating life-threatening infection.

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REFERENCES

The Journal welcomes letters.

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The nub:
1. One’s own moral motives can be protected from scrutiny by claiming to be protecting others’ interests.
2. The best dodge against moral responsibility is to avoid becoming a data point in general statistics.
3. Moral decoys are available for rent.

I have a killer business plan, and I am looking for a few special people with the talent and vision to seize the opportunity. There is a crying and growing need for images demonstrating the damage that can be done by greedy, bureaucratic and misguided liberals and pseudo-scientists. My company would rent out victims to inform the public and embarrass the meddlers. The firm would be called Moral Decoys.

Of course, such firms already exist. They are a multibillion-dollar industry, mostly centered on public relations, lobbying and legal outfits. The correct technical name is a “front.” The strategy is straightforward: Scare the public to prevent rule-makers from imposing unfavorable restrictions.

In the 1970s, proposed regulation of chlorofluorocarbons used in refrigeration was delayed and weakened by the Alliance for Responsible CFC Policy. On the outside, this was small manufacturers of air conditioning units and a group of citizen scientists working for the public good. Actually, it was a coalition of a few large chemical companies and was managed by a public relations firm. Early recycling legislation was opposed because it would put mom-and-pop operations out of business and create toxic pest hazards.

Fluoride causes cancer. The Affordable Care Act was supposed to increase unemployment and tip the balance away from full-time to part-time work. The opposite has in fact been the case. The grandest of the moral decoys has been “shareholder interests.” First noticed in the 1980s, CEOs have made it an all-purpose justification for short-term profit above all other considerations.

My business of renting out moral decoys will be based on two ethical pillars. First, actions are always undertaken for the benefit of others. One’s own advantage will be held in strictest confidence. Second, ethical focus will be on specific individual cases. Statistics and overall impact are out of bounds.

If I could remember the individual’s name, I would put him on the board of Moral Decoys. He was pretty famous back in the day when full-mouth cosmic reconstructions were going to bring dentistry to the stature it deserved. He was invited to give a talk on professional ethics to students at our dental school. He mostly showed his work, and there was no doubt that it was drop-dead gorgeous. He also made a point that insurance companies and uppity hygienists were literally bankrupting dentists, especially those losers who were trying to get by doing amalgams and prevention. A good 40 minutes into the presentation, he announced that he could summarize all of dental ethics on a single slide. It was a picture of two small children on wild animal skin rugs with large Harley-Davidsons in the background. He said, “I put my family first.”
OSA Causes Complications in Dental Implants

New data from research conducted by OSI Araba University Hospital, Spain, demonstrate a strong correlation between obstructive sleep apnea (OSA) and complications with previously implanted oral prosthetics, according to a study published in the Journal of Oral Implantology.

Obstructive sleep apnea (OSA), a disorder in which breathing repeatedly starts and stops during sleep, has frequently been linked to sleep bruxism, a condition in which the jaw is clenched and tightened during sleep creating excessive teeth grinding. Both conditions are linked to health issues; however, no previous studies linked OSA to prosthetic complications.

Researchers from OSI Araba investigated how OSA affects implant-borne prostheses. The frequency with which a complication occurred and the type of complication were studied in 67 patients. Of those 67 patients, the researchers found that 16 experienced complications, 13 of whom had OSA. Among these 16 patients with complications were 22 prostheses with a total of 30 issues. The researchers found these complications consisted of porcelain fracture, fracture of the screw/implant, loosening of the screw and decementation.

During the study, researchers also noted a strong relation between individuals who suffer from OSA and those who suffer from bruxism. Past studies revealed that those afflicted with bruxism had a higher instance of complications with implant prostheses than those without bruxism. This shows that people suffering from OSA or bruxism have a more difficult time with successful prosthetic implantation, according to the study.

The study noted that as awareness of the reciprocal relationship between OSA and dental diseases increases, one new aspect of interest could be the occurrence of technical complication in fixed prosthodontics. This study shows that 81 percent of patients with OSA experienced complications with their prostheses. The success rate of implants, which is reported to be between 92 and 97 percent, shows a strong correlation between OSA and prosthetic complications. The researchers believe that additional exploration is necessary to further understand the risk factors and frequencies of these occurrences.

For the full text of the study, “Frequency of Prosthetic Complications Related to Implant-Borne Prosthesis in a Sleep Disorder Unit,” see the Journal of Oral Implantology 43 (1), 19-23 (2017).

Study Finds Mutations Responsible for Cleft Palate

Researchers at the University of Exeter, United Kingdom, located a novel gene mutation causing cleft lip and cleft palate defects (CLP), which slows the turnover of hyaluronan, an important component of the hard palate, according to a study published recently in the journal PLOS Genetics.

The genetics underlying cleft lip and cleft palate are poorly understood. By studying individuals with syndromic CLP from Amish and Northern Saudi Arabian families, the researchers identified the responsible mutations. Syndromic CLP is accompanied by other congenital defects such as the heart anomaly cor triatriatum sinister, where the heart develops a third atrial chamber on the left side.

The collaborative team mapped the condition to mutations in the HYAL2 gene, which encodes an enzyme that breaks down hyaluronan, a carbohydrate polymer found widely in connective tissue and in the hard palate. Enzyme assays showed that the mutations reduced HYAL2 protein levels in the tissues, which likely inhibited hyaluronan turnover ultimately impacting development of the palate and other body parts. Further experiments using mice that lack HYAL2 showed that the mice develop defects similar to human syndromic CLP, including cor triatriatum sinister.

The findings also illustrate the fundamental importance of HYAL2 and hyaluronan turnover for normal human and mouse development. A better understanding of the factors contributing to these anomalies may contribute to the development of new treatments for these common birth defects, such as hycromone, a drug that blocks hyaluronan synthesis.

For more on this study, see the journal PLOS Genetics at dx.doi.org/10.1371/journal.pgen.1006470.
Friends, Family Play Crucial Roles in Oral Health Care

Social networks — not Facebook and Twitter, but the “in real life” networks of friends, family and acquaintances — may play an overlooked role in oral health care, according to research presented in February at the American Association for the Advancement of Science conference in Boston.

Brenda Heaton, an assistant professor of health policy and health services research at Boston University’s Henry M. Goldman School of Dental Medicine, specializes in social epidemiology with a focus on oral health. In 2008, she and other members of BU’s Center for Research to Evaluate and Eliminate Dental Disparities began a new line of research focused on understanding oral health and disease among Boston public housing residents.

Some women Heaton interviewed had been born and raised in the unit that they were living in and were now raising their own child in that unit. “So we had grandmother, mother and child in one unit,” she said. Those close connections influenced how people behaved. To make significant progress against diseases like tooth decay, Heaton had to tap into those networks herself.

To understand the connections that already existed within the community, Heaton needed to draw a social map. Since 2008, her team has interviewed close to 200 women living in Boston public housing and identified nearly 1,000 individuals who were influential. Heaton is using those network maps to find similarities in how information flows through these communities. The ultimate goal, she says, is to use the maps to introduce health information and resources into a community in ways that change long-term behaviors.

“You can’t design those interventions until you actually have a really strong grasp of the network structure,” said Heaton. “The power of this approach is that it focuses on prevention rather than cures. It might take a village, but tooth decay is an entirely preventable health outcome.”

For more information about the Boston public housing research project, go to bu.edu/creedd/projects/project2.

New Prospect for More Effective Treatment of Nerve Pain

Thanks to a newly tested substance, the pain of trigeminal neuralgia can be reduced to a tolerable level without troublesome side effects, according to a study involving the Center of Dental Medicine at the University of Zurich and published in The Lancet. Trigeminal neuralgia is characterized by sharp, lancinating pain in the teeth or facial area usually caused by an irritation of the trigeminal nerve, the cranial nerve responsible for the sensory innervation of the facial area, parts of the scalp and the oral cavity.

Pain signals reach the brain via the activation of sodium channels located in the membranes of nerve cells. The sodium channel 1.7 is frequently expressed on pain-conducting nerves, and higher pain intensity is linked to higher channel activity. Blocking this sodium channel, usually by a local anesthetic, inhibits the pain.

In trigeminal neuralgia, the nerve damage is presumed to be at the base of the skull. However, this region is hard to reach by local injections and therefore requires drug treatment. The novel substance BIIB074 tested in this study inhibits the sodium channel 1.7 state-dependent, which means the more active this sodium channel gets, the stronger it is blocked by BIIB074. By contrast, currently available medications block the sodium channel 1.7 irrespective of the nerve activity and commonly result in burdening side effects. “Unlike conventional drugs, which often cause tiredness and concentration problems, BIIB074 was not only effective, but also very well tolerated,” explained Dominik Ettlin, a UZH dental specialist.

Read more about this study in The Lancet 16 (4), 291-300 (2017). Image: Center of Dental Medicine; UZH
Synthetic Tooth Enamel May Lead to More Resilient Structures

Unavoidable vibrations, such as those on airplanes, cause rigid structures to age and crack, but researchers at the University of Michigan may have an answer for that — design them more like tooth enamel, which could lead to more resilient flight computers, for instance. The results of their research were published in the March issue of the journal Nature.

Most materials that effectively absorb vibration are soft, so they don’t make good structural components. For inspiration on how to make hard materials that survive repeated shocks, the researchers looked to nature.

“Artificial enamel is better than solid commercial and experimental materials that are aimed at the same vibration damping,” said Nicholas Kotov, the Joseph B. and Florence V. Cejka professor of chemical engineering.

He and his team examined many structures in animals that had to withstand shocks and vibrations: bones, shells, carapaces and teeth. These living structures changed from species to species and over the eons. Tooth enamel told a different story. Under an electron microscope, it shared a similar structure whether it came from a Tyrannosaurus, a walrus, a sea urchin or Kotov himself (he contributed his own wisdom tooth to the effort).

Evolution had hit on a design that worked for pretty much everyone with teeth. And unlike bone, which can be repaired, enamel had to last the lifetime of the tooth, withstanding repeated stresses and general vibrations without cracking.

Bongjun Yeom, a postdoctoral researcher in Kotov’s lab, recreated the enamel structure by growing zinc oxide nanowires on a chip, layering two polymers over the nanowires, spinning the chip to spread out the liquid and baking it to cure the plastic between coats. It took 40 layers to build up a single micrometer of enamel-like structure. Then, they laid down another layer of zinc oxide nanowires and filled it in with 40 layers of polymer, repeating the whole process up to 20 times.

The group demonstrated that their synthetic tooth enamel approached the ability of real tooth enamel to defend itself from damage due to vibrations.


Dentist Designs Waterless Toothbrush

A Park City, Utah, dentist in collaboration with local high school students has designed a toothbrush and flossing tool that doesn’t require water or spitting. The brush is designed for children but can be used by anyone, according to a recent article in the Park Record newspaper.

Marielle Pariseau, DMD, was inspired to develop the toothbrush after a supervised toothbrushing and flossing program she started in Canada several years earlier was short lived. The program was modeled after Scotland’s Childsmile Core, a nationwide initiative to help improve the health of children’s teeth through the distribution of dental packs and supervised toothbrushing programs. Dr. Pariseau quickly discovered that putting dozens of children together and giving them toothbrushes and water was just asking for trouble, so the program didn’t last long.

Now a Utah resident, Dr. Pariseau began working with students in the Park City Center for Advanced Professional Studies program at Park City High School to design the waterless toothbrush. The bristles of the brush are prepped with xylitol, an FDA-approved compound that is safe to swallow and proven to reduce bacteria that cause cavities.

Pariseau intends to sell the toothbrushes through her company, TeethFirst, but she also started a Kickstarter campaign to raise funds to help establish supervised toothbrushing programs in local kindergarten classes.

“If we start putting a system like this in the schools, then all the kids get to brush at least once a day for the correct amount of time, under supervision, and they also floss,” she said. “And they learn to do that as a routine. That is what is going to change the dynamics of oral health.”

Marielle Pariseau, DDM. Image: Bubba Brown/Park Record
Study Links Changes in Oral Microbiome with Dental Disease

A team of scientists from The Forsyth Institute and the Dasman Diabetes Institute in Kuwait have found that metabolic diseases, which are characterized by high blood pressure, high blood sugar and obesity, lead to changes in oral bacteria and put people with metabolic diseases at greater risk for poor oral health.

A study of more than 8,000 10-year-olds in Kuwait showed that metabolic diseases led to increases in salivary glucose, alterations of the bacteria found in the mouth and increased risk of cavities and gum disease, reinforcing the need for preventive dental care and greater integration between medical and dental care. The study was published in the journal PLOS ONE in March.

While scientists know a great deal about which bacteria live in our mouth and throughout the body, it is still unclear whether differences in the human microbiome that are seen in many disease states are a symptom of the disease or part of the underlying cause.

“The mouth represents a rich microbiome that is easily accessible,” said Dr. Max Goodson, the study’s lead author.

Researchers measured the glucose concentration, bacterial counts and relative frequencies of 42 bacterial species in whole saliva samples from 8,173 Kuwaiti adolescents using DNA probe analysis. In addition, clinical data related to obesity, dental caries and gingivitis were collected. Data were compared between adolescents with high salivary glucose (HSG) and those with low salivary glucose.

Investigators found that HSG was associated with dental caries and gingivitis in the study population. The overall salivary bacterial load in saliva decreased with increasing salivary glucose concentration. Under HSG conditions, the bacterial count for 35 of 42 species was significantly reduced and relative bacterial frequencies in 27 species were altered, as compared with LSG conditions. These alterations were stronger predictors of high salivary glucose than measures of oral disease, obesity, sleep or fitness. These observations clearly indicate that metabolic diseases, such as diabetes, that produce elevated glucose in blood and saliva can significantly alter the oral microflora.

To learn more about this study, see PLOS ONE (2017);12(3): e0170437. doi:10.1371/journal.pone.0170437.

Intervention Improves Dental Health of Elderly

A tailored preventive oral health intervention significantly improved the cleanliness of teeth and dentures among elderly home care clients, and functional ability and cognitive function were found to be strongly associated with better oral hygiene, according to a University of Eastern Finland study published in the journal Age and Ageing.

The study is part of a larger intervention study, NutOrMed (optimizing nutrition, oral health and medication for older home care clients), comprising a six-month oral health and nutrition intervention among home care clients aged 75 years or older.

An interview and an oral clinical examination were carried out in the intervention group of 151 participants and in the control group of 118 participants. The mean age of the intervention group was 84 years and 85 years in the control group. The intervention group received a tailored intervention of oral and denture hygiene. They were advised to brush at least twice daily with fluoride toothpaste and to clean interdental spaces, dentures and oral mucosa daily. Both groups were reinterviewed and re-examined after six months. The intervention significantly reduced the number of plaque-covered teeth and improved denture hygiene, while the reduction in the number of plaque-covered teeth was associated with functional ability and cognitive function, according to the study.

However, nearly half of the teeth in the intervention group had plaque even after the intervention. In the control group, oral health habits deteriorated during the six-month follow-up. Read more of this study at Age Ageing (2017); 1–6. doi: 10.1093/ageing/afx020.
The Oral Effects of Inhalation Corticosteroid Therapy: An Update

Darren P. Cox, DDS, MBA, and Leticia Ferreira, DDS, MS

ABSTRACT Inhaled corticosteroids (IC) are commonly used for the treatment of respiratory diseases. Although these medications are generally considered safer when compared to oral systemic corticosteroids, there is evidence for potential systemic and local adverse effects with their use. Therefore, dentists should be aware of these adverse effects, especially the commonest local effects that can involve the oral mucosa. This article reviews the literature on the complications of IC therapy with emphasis on its potential oral effects.

AUTHORS Darren P. Cox, DDS, MBA, is an associate professor of pathology and medicine at the University of the Pacific, Arthur A. Dugoni School of Dentistry. He is a 1990 graduate of the LSU School of Dentistry and completed his residency in oral, head and neck pathology at Emory University Hospital, Atlanta, in 2000.

Leticia Ferreira, DDS, MS, is an assistant professor of pathology and medicine at the University of the Pacific, Arthur A. Dugoni School of Dentistry. She obtained her dental degree from the Universidade Federal da Bahia in Bahia, Brazil, in 2006 and completed a residency in oral and maxillofacial pathology and a master’s in biomedical sciences at Texas A&M Health Science Center, Baylor College of Dentistry in Dallas in 2011.

Conflict of Interest Disclosure: None reported.

Glucocorticosteroids are a class of corticosteroids produced by the adrenal cortex and regulated by the hypothalamic-pituitary-adrenal (HPA) axis. The main human endogenous glucocorticoid is cortisol; however, numerous synthetic analogues of this hormone are available. Glucocorticosteroids have several important metabolic functions in the body. They are important mediators of the stress response and, as the name indicates, have important effects on the metabolism of glucose increasing glycogenolysis and gluconeogenesis, inhibiting peripheral utilization of glucose and increasing glucose release from the liver, overall leading to hyperglycemia. These components also affect the metabolism of fat, protein and bone and regulate growth and development, especially in fetal tissues. Nevertheless, the main reason these substances are widely used in medicine is due to their potent anti-inflammatory and immunosuppressant activities. Glucocorticosteroids inhibit the migration and accumulation of neutrophils and monocytes at sites of inflammation and suppress the phagocytic, bactericidal and antigen-processing activity of these cells. Glucocorticosteroids also appear to suppress T-cell helper function and inhibit the synthesis of pro-inflammatory mediators (i.e., interleukins, other cytokines, leukotrienes and prostaglandins). These hormones can also induce apoptosis of inflammatory cells, predominantly of eosinophils and lymphocytes of the T-cell lineage. Hence, these effects are highly desirable in the treatment of a variety of acute and chronic inflammatory conditions and autoimmune diseases.
All in all, exogenous glucocorticosteroids are therapeutically used for a variety of conditions such as replacement therapy in adrenal insufficiencies, for the control of acute and chronic inflammation, allergic reactions, autoimmune diseases, the prevention of graft rejection after organ transplantation and the treatment of myeloproliferative diseases such as certain leukemias.1,5,6 Unfortunately, the long-term use of glucocorticosteroids is associated with several potentially serious side effects. The most common side effect of prolonged use of these medications is suppression of the HPA axis, resulting in a reduction in endogenous cortisol production from the adrenal cortex and eventually causing adrenal cortical atrophy. This suppression might cause serious complications if the exogenous glucocorticosteroid therapy is suddenly stopped or if the patient’s demand of cortisol increases, such as during a stressful event.7 Moreover, due to their potent immunosuppressant effects, the chronic use of glucocorticosteroids may compromise the immune system and predispose the patient to several common and rare infections and even saprophytic sepsis.1 Long-term use of oral glucocorticosteroids is also associated with other serious side effects, including osteoporosis, metabolic disease and increased risk of cardiovascular disease.8–11

Inhalation Corticosteroid Therapy
Glucocorticosteroids is commonly referred to in the medical and pharmaceutical literatures as just corticosteroids. One of the most common uses of corticosteroids today is in the treatment of asthma, where inhaled corticosteroids (ICS) are considered the most potent anti-inflammatory medication available and the most consistently effective long-term control medication for mild, moderate or severe persistent asthma.14

These substances are especially effective in asthmatic patients because they regulate gene expression of inflammatory mediators, help control edema, production of mucus and the eosinophil infiltration typically seen in asthma.1 Indeed, several studies have confirmed that corticosteroids are effective in diminishing asthma symptoms, improving airway hyperresponsiveness,13 controlling airway inflammation,14 reducing frequency of exacerbations13 and decreasing the number of hospitalizations and fatalities due to the disease.15,16

ICs are not only important in the maintenance treatment of asthma, but they can also be used in the management of patients with chronic obstructive pulmonary disease (COPD). COPD is a general term for pulmonary diseases characterized by persistent airflow limitation from the lungs that is not fully reversible. COPD encompasses two main diseases: chronic bronchitis and emphysema. COPD affects more than 10 percent of the U.S. population and is the fourth leading cause of death in this

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### Orally Inhaled Corticosteroid Medications

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<th>Adult dosing</th>
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<tbody>
<tr>
<td>Fluticasone furoate</td>
<td>Dry powder inhaler</td>
<td>100 or 200 mcg</td>
<td>Arnuity Ellipta</td>
<td>1 puff inhaled qd</td>
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<tr>
<td></td>
<td>Metered dose inhaler</td>
<td>100 or 200 mcg</td>
<td>Brea Ellipta *</td>
<td>1 puff inhaled qd</td>
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<tr>
<td>Mometasone furoate</td>
<td>Dry powder inhaler</td>
<td>220 mcg</td>
<td>Asmanex Twinhaler</td>
<td>1–2 puffs/day inhaled divided qd-bid</td>
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<tr>
<td></td>
<td>Metered dose inhaler</td>
<td>100 or 200 mcg</td>
<td>Asmanex HFA</td>
<td>2 puffs inhaled q12h</td>
</tr>
<tr>
<td>Fluticasone propionate</td>
<td>Dry powder inhaler</td>
<td>50, 100 or 250 mcg</td>
<td>Flovent Diskus</td>
<td>1–2 puffs inhaled bid</td>
</tr>
<tr>
<td></td>
<td>Metered dose inhaler</td>
<td>44, 110 or 220 mcg</td>
<td>Flovent HFA</td>
<td>2 puffs inhaled bid</td>
</tr>
<tr>
<td>Beclomethasone dipropionate</td>
<td>Metered dose inhaler</td>
<td>40 or 80 mcg</td>
<td>Qvar</td>
<td>1–4 puffs inhaled bid</td>
</tr>
<tr>
<td>Ciclesonide</td>
<td>Metered dose inhaler</td>
<td>80 or 160 mcg</td>
<td>Alvesco</td>
<td>1–2 puffs inhaled bid</td>
</tr>
<tr>
<td>Budesonide</td>
<td>Dry powder inhaler</td>
<td>90 or 180 mcg</td>
<td>Pulmicort Flexhaler</td>
<td>2 puffs inhaled bid</td>
</tr>
<tr>
<td></td>
<td>Nebulized</td>
<td>0.25 mg/2ml, 0.5 mg/2 ml, 1 mg/2 ml</td>
<td>Pulmicort Respules</td>
<td>0.25–1 mg/day NEB divided qd-bid **</td>
</tr>
<tr>
<td></td>
<td>Metered dose inhaler</td>
<td>80 or 160 mcg</td>
<td>Symbicort***</td>
<td>2 puffs inhaled bid</td>
</tr>
<tr>
<td>Triamcinolone acetonide</td>
<td>Metered dose inhaler</td>
<td>2–4 puff s inhaled bid</td>
<td>Azmacort****</td>
<td>2–4 puffs inhaled bid</td>
</tr>
<tr>
<td>Flunisolide</td>
<td>Metered dose inhaler</td>
<td>80 mcg</td>
<td>Aerospan</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Aerobid****</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Aerobid-M****</td>
<td></td>
</tr>
</tbody>
</table>

*Combination of fluticasone furoate and vilanterol, which is a long-acting beta2-adrenergic agonist (LABA).
**Pediatric dosing, 1 to 8 years of age.
***Combination of budesonide and formoterol fumarate dehydrate, which is a long-acting beta2-adrenergic agonist (LABA).
****Discontinued in the U.S. due to the FDA’s mandated phaseout of inhalers that contain chlorofluorocarbons (CFCs).
The purpose of inhaled corticosteroid therapy is for the drug to be deposited directly at the site of airway inflammation.

Children who have mild or moderate persistent asthma, low- to medium-dose IC therapy may have the potential of reducing growth velocity, although these effects appear to be small, transient and noncumulative. Moreover, currently there is not sufficient evidence to determine whether continuous IC administration during childhood affects final adult height. An increase in risk for dermal thinning, cataracts and glaucoma have also been reported with IC use. These potential systemic side effects of IC therapy are less significant than with a comparable dose of oral corticosteroids, and the National Asthma Education and Prevention Program Expert Panel Report 3 states that the efficacy of low- to medium-dose IC therapy outweighs any small risks of adverse effects and that these medications are well tolerated and safe if used at the recommended dosages. The expert panel recommends that in order to reduce the potential for adverse effects with IC therapy, only the lowest dose of IC that maintains asthma control should be used, and clinicians should consider adding a long-acting beta2-adrenergic agonist (LABA) to a low or medium dose of IC rather than using a higher-dose IC.

Local adverse effects are the commonest side effects encountered with the long-term use of IC. Although these effects do not cause significant morbidity to the patients, they might hinder compliance with treatment. Oral candidiasis is one of the most common of these effects and will be discussed in more detail later in this review. Dysphonia is also one of the most common side effects and has been reported in 5 to 50 percent of patients using ICs. Asthmatic patients presenting with dysphonia while using ICs showed a bilateral adductor vocal cord deformity with bowing of the cords on phonation. This side effect appears to be related to the dose and potency of the IC and may represent a reversible local steroid myopathy affecting the vocal cord muscles. In some patients, the dysphonia is not associated with vocal cord deformity and has been attributed to laryngeal candidiasis. Dubus et al. found perioral dermatitis in asthmatic children using IC. This finding depended on whether the children used a spacer device equipped with a face mask (5.2 percent), a nebulizer with a face mask or a nebulizer without a mouthpiece (14.3 percent). This side effect is believed to be due to a direct local action of the IC on the facial skin, and treatment with oral erythromycin or topical metronidazole has been recommended for severe cases. Cough during inhalation, dry throat, sensation of thirst and throat clearing have also been reported in patients using ICs. The frequency of all these adverse effects varies widely, depending on study design and length of the observation period.

In an attempt to reduce the potential for local adverse effects with the use of ICs, the National Asthma Education and Prevention Program Expert Panel Report recommends the use of spacers or valved holding chambers (VHCs) with a nonbreath-activated, metered-dose inhaler and for patients to be advised to rinse their mouths (rinse and spit) after inhalation.
Oral Effects of Inhalation Corticosteroid Therapy

Oral Candidiasis

Oral candidiasis is the most common human fungal infection with symptom-free carriage rates in the general population ranging from 20 to 75 percent. *Candida albicans* is considered a normal commensal resident of the oral flora that causes no problems in healthy populations. While overgrowth is well-known in the chronically immunosuppressed, as seen in advanced HIV or in patients immunosuppressed to prevent transplant rejection, local factors such as denture wearing and impaired salivary function and systemic factors such as extremes of age, smoking, diabetes mellitus, nutritional deficiencies and antibiotics are also known risk factors for the development of oral and oropharyngeal candidiasis. With denture wearers, it has been demonstrated that residual IC was significantly higher in full denture wearers than in partial denture wearers, as well as the occurrence of candidiasis, which can compound the effects of the altered conducive microenvironment produced by dentures.

First reported in 1964, 20 percent of asthmatic patients treated with dexamethasone inhalers developed oral candidiasis and subsequently in 1986 and 1988 as a consequence of other oral ICs. A literature review of trials done in 2001 of more than 100 patients using ICs for more than six months found a 6 to 14 percent prevalence of oral candidiasis. The consensus of the studies reviewed was that ICs promote clinical infection by *Candida* and typically presented as the erythematous or pseudomembranous variants. Lesions were generally localized to areas where the spray was deposited and varied according to the dosage and frequency of use. Lesions were typically amenable to topical antifungal therapy such as nystatin oral rinses.

Purported mechanisms of pathogenicity involved with ICs as related to oral candidiasis are varied. Generalized immunosuppression and anti-inflammatory effects of corticosteroids are well-known to play a major role in the development of candidiasis. Localized corticosteroid-induced immunosuppression is a feature of IC use, so it is logical that this would lead to oral candidiasis by providing selective growth advantages for *Candida*. In addition, prolonged IC therapies could damage mucosal barriers predisposing to oral candidiasis. Furthermore, ICs are known to reduce salivary total immunoglobulin A (IgA), possibly predisposing to development of oral candidiasis when combined with additional host factors.

It is known that the local mucosal immunosuppressive effects of ICs revert to normal on discontinuation of the IC, but this therapy often must be continued indefinitely because of the condition being treated. In most cases, preventive measures should be recommended to minimize infections. Adequate oral hygiene and mouth rinsing following each use of ICs are simple ways of reducing local effects. Mouth rinsing with water (rinse and spit) after inhalation may reduce the risk of oropharyngeal candidiasis. Moreover, the use of prodrugs (e.g., ciclesonide) that are activated in the lungs but not in the oropharynx and new formulations and devices that reduce oropharyngeal deposition may minimize such side effects. Current evidence suggests that in adults, systemic effects of ICs are not a problem at doses of 400 μg or less of budesonide or equivalent a day. Spacer devices attached to inhalers could reduce the local effects of the steroids. However, topical or systemic antifungal therapy, such as with nystatin or fluconazole, may be necessary during the entire treatment.

Oral Hairy Leukoplakia

Oral hairy leukoplakia (OHL) was first described as a new oral lesion in association with AIDS in 1985. At that time, it was thought to be an AIDS-defining condition and seen exclusively in male homosexuals. However, soon after it was demonstrated in an HIV-seronegative, heterosexual man suffering from an acute myeloblastic leukemia who developed clinically and histologically typical hairy leukoplakia. Subsequently, other reports in the literature appeared.
documenting cases of hairy leukoplakia in patients with leukemia.55,56 In 1992, two cases of hairy leukoplakia were reported in patients with no known risk factors for HIV infection or any evidence of other forms of immunosuppression,57 suggesting that some instances of hairy leukoplakia can represent isolated and innocuous Epstein-Barr virus (EBV) infection. In 1994, hairy leukoplakia was reported for the first time in a patient on systemic steroids for the treatment of ulcerative colitis and in 1995 in a patient with asthma.58,59 Since then, cases have been reported in patients on long-term anticonvulsant treatment with the antiepileptic lamotrigine due to acquired immunodeficiency.60 The first large series of oral hairy leukoplakia in HIV-negative patients was reported in 2010, where eight of 10 patients were on steroid treatment for COPD, one patient was on prednisone therapy for a gastrointestinal stromal tumor and one patient had no history of immunosuppression.61 A review of the literature found 67 of 76 patients with OHL without HIV associated with immunosuppressant drug regimens, 32 of whom were on systemic immunosuppressant therapy for renal or bone marrow transplantation and 10 patients were being treated for COPD and asthma using ICs.62 Chambers et al. described 35 cases of non-HIV related OHL, 28 (80 percent) of whom were on chronic IC medication.63

OHL classically presents on the lateral border of the tongue as unilateral or bilateral, nonwipeable, white patches with a corrugated surface (FIGURES 2A–2C). More uncommonly, OHL can involve the ventral and dorsal surfaces of the tongue, floor of the mouth, buccal mucosa, soft palate and oropharyngeal mucosa.61,63,65 The pathogenesis of OHL is complex. After primary infection, those infected carry the virus throughout their lives and shed low levels of infectious particles in the saliva even in a state of health.66 In the immunocompetent, the virus is unable to replicate in the lingual epithelial cells, therefore it is likely that systemic conditions and local factors converge leading to suppressed immune function. These factors allow for abundant viral replication and activation of signaling pathways with upregulation of proliferative and anti-apoptotic genes that induce acanthosis and hyperproliferation of the epithelium. Due to widespread use of systemic, topical and inhaled corticosteroids in immunocompetent individuals, a rise in the incidence of reported cases of OHL in non-HIV infected individuals has occurred. The mechanism by which these medications lead to OHL is not completely understood, but they are thought to predispose users to opportunistic infections and to increased oropharyngeal excretion and rate of reactivation of EBV leading to re-infection of lingual epithelial cells by shed virus.62 The authors caution that the reported incidence of OHL in patients on inhaled steroids is quite low, although this could be a function of the lack of symptoms and awareness of this condition or that the clinical lesions of non-HIV OHL are more subtle than the HIV-related lesions.63

A diagnosis of OHL in patients not known to have HIV should trigger a complete review of the medical history, with particular attention to medications used, specifically, ICs. Once identified, further treatment is unnecessary.

**Angina Bullosa Hemorrhagica**

Angina bullosa hemorrhagica is a rare and benign disorder characterized by painless and sturdy blood-filled blisters of the mouth that appear suddenly and rupture within 24 to 48 hours (FIGURE 3). The cause is somewhat ill-defined but is
thought to be associated with various factors including diabetes and use of oral ICs, but has also been described as a result of trauma from mastication as well as dental or anesthetic procedures. These lesions tend to occur on the soft palate, but have been reported on other mucosal surfaces and are not associated with blood dyscrasias, bleeding disorders or autoimmune diseases. Lesions burst spontaneously and heal without scarring within one week. A recurrence rate of up to 30 percent has been reported. When assessing a blood-filled blister in the oral cavity, blisters associated with autoimmune diseases such as pemphigus, mucous membrane pemphigoid, epidermolysis bullosa acquisita and linear IgA disease should be considered as well as erythema multiforme and fixed drug eruptions. Blood-filled oral blisters may also be seen in patients with bleeding disorders, leukemia or vasculitic disease. Features that could distinguish angina bullosa hemorrhagica from these prior entities would include its isolated and infrequent appearance and lack of concomitant lesions, symptoms or illness. It is thought that this disorder, and its association with oral IC therapy, is underreported.

Other Less-Often Reported Effects

Churg-Strauss syndrome, or allergic granulomatosis and angitis, is characterized by bronchial asthma, severe sinusitis, nasal polyps and systemic vasculitis, has been reported as a result of IC therapy. Lesions may present in the oral cavity and usually appear as “strawberry gingivitis” — a proliferation of the gingival tissue characterized by inflammation and vasculitis affecting small vessels or oral ulcerations. Chronic ulceration of the tongue has also been reported as an adverse effect of IC use for respiratory disease.

Rare cases of reversible tongue hypertrophy have been reported in premature infants treated with inhaled beclomethasone for bronchopulmonary dysplasia and in a 4-month-old asthmatic child using inhaled budesonide. This side effect was theorized to be due to a direct effect of the IC causing either hypertrophy of tongue musculature or local fat accumulation. Hypothyroidism was ruled out as a possible cause of the tongue enlargement in the affected premature infants through T4 laboratory values.

Conclusion

IC formulations have reduced the need for systemic corticosteroids for chronic respiratory diseases such as asthma and COPD thus reducing the risk for potential serious complications. However, as demonstrated in this review, localized effects on the oropharynx and oral cavity mucosa have become increasingly prevalent with the increase in diagnosis of these respiratory diseases and consequent treatment by IC therapy. Therefore, it is important for all dentists and dental auxiliary personnel to keep these potential side effects in mind when involved in the care of patients on these common medications.

REFERENCES


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Traumatically Intruded Permanent Teeth: Three Case Reports and a Review of Current Recommendations

Samah Omar, BDS, DDS, MSD; William F. Freccia, DDS, MS; Bonnie Retamozo, DDS, MSD; and Leif K. Bakland, DDS

ABSTRACT Intrusion of permanent teeth is not extensively covered in the literature compared to other injuries. Treatment guidelines have been published and clinical data is accumulating to support the current recommendations, which are illustrated in the three cases here. This review evaluates the current information about management of traumatically intruded permanent teeth. As more data accumulates, uncertainties with respect to both treatment recommendations and long-term outcomes can be expected to be elucidated.

Intrusion is a traumatic dental injury (TDI) that affects primary and permanent dentition. The most frequently involved permanent teeth are maxillary incisors; 68.5 percent of intrusion injuries affect central incisors compared to 22.2 percent affecting lateral incisors.1,2 Other permanent teeth, however, may also be forcibly intruded.3 Because the consequences of traumatic intrusion are often quite severe, it is fortunate that the incidence is not high; various studies indicate that intrusion of permanent teeth constitute less than 2 percent of TDIs.1,4 In contrast, intrusion of primary teeth is quite common, comprising 50 percent of primary teeth luxation injuries and 29 percent of all primary teeth TDIs.5 Such injuries can lead to damage of succedaneous tooth buds leading to various developmental disturbances, including mild enamel hypoplasia, crown or root dilacerations, partial or total arrest of root development and/or eruption disturbances.5 Therapeutic orthodontic intrusions are sometimes performed following some TDIs such as extrusive and lateral luxations.7,8 Primary tooth intrusions and orthodontic intrusions are not covered further in this review.

Forty-nine percent of intrusion injuries occur from falling and hitting the maxillary incisors against a hard object. The remaining injuries occur from bicycle accidents (29 percent), motor vehicle accidents (12 percent) and sports and fights (10 percent).1 Usually only a single incisor is involved although several teeth can also be intruded at the same time.1,2,9 Concomitant injuries such as crown fractures may also occur, complicating...
both the treatment and the prognosis.\textsuperscript{1,2,10} The 6- to 15-year-old age group is most often involved.\textsuperscript{1,2,9,11,12} Wigen et al.\textsuperscript{12} found that 45 out of 51 (88.2 percent) intrusion cases affected 6- to 12-year-old children, and this carries with it special problems.

The damage that occurs to an intruded tooth can be extensive, including disruption of the blood flow to the pulp, crushing of the periodontal ligament (PDL) and stripping away of pieces of cementum and PDL, in addition to trauma to the surrounding alveolar bone and root.\textsuperscript{4,13} These injuries often lead to pulp necrosis, root resorption and marginal bone loss, in addition to disruption of normal tooth development and eruption.\textsuperscript{4,12,14–16}

Traumatic disruption of blood flow to the pulp has significant consequences.\textsuperscript{4,17,18} The pulp can recover from minor disruptions by increased reparative dentin deposition leading to a rapidly diminishing pulp space and extensive mineralization of the pulp. Insults that are more serious usually lead to pulp necrosis, which will arrest root development. This can be a serious sequel in children and adolescents resulting in thin walls and short, compromised roots. On the other hand, incomplete root development may permit revascularization of the pulp because of the wide apical opening of the root canal and increased blood flow. In cases of successful revascularization, normal root development will continue and new hard tissue can be deposited against the root canal wall leading to a thickening of the root. Occasionally during revascularization, ingrowth of bone can also take place.\textsuperscript{19} The presence of concomitant crown fracture contributes to the risk of pulp necrosis, which can facilitate bacterial invasion of a pulp that is defenseless due to loss of or diminished blood supply. Protecting the pulp from bacterial infection and monitoring the vitality status of the pulp are important steps to be taken as part of the initial management of intruded teeth.\textsuperscript{20}

The PDL is often severely damaged during the axial intrusion of a tooth. The trauma causes a crushing and tearing of the PDL and cementum covering the roots. Haas et al.\textsuperscript{13} showed that in severely intruded teeth about 50 percent of the root surfaces were denuded of PDL. Denuded root surface areas are targets for osteoclastic activity resulting in ankylosis-related resorption (\textbf{FIGURE 1A}), which can prevent an intruded tooth from re-erupting (\textbf{FIGURE 1B}).\textsuperscript{16,21} If bacteria gain access to the pulp before it revascularizes, they can stimulate infection-related external resorption of the root. Along with the pulpal and periodontal complications associated with intrusions, there is also the problem of marginal bone loss and alveolar fractures, often noted when several teeth are intruded.\textsuperscript{10}

Diagnosis of trauma-related intrusion is based on history and clinical and radiographic observations.\textsuperscript{1,2,22} The clinical evaluation usually reveals the presence of one of infraocclusion in relation to adjacent teeth, lack of physiologic mobility and little or no pain to percussion, which often has a metallic sound.\textsuperscript{1,2,21} The severity of intrusive injuries can vary from relatively minor intrusions to severely or totally displaced teeth into the alveolar bone or even the nose. The reported range of intrusion is 2–8 mm.\textsuperscript{1,22} Radiographic observation usually shows a reduction or absence of normal PDL space and

\begin{table}[h]
\centering
\caption{Intrusive Luxation Guidelines\textsuperscript{22}}
\begin{tabular}{|c|c|c|c|c|}
\hline
Apex & Intrusion & Spontaneous & Orthodontic & Surgical \\
\hline
Open & $<7\text{mm}$ & ■ & ■ & ■ \\
Open & $>7\text{mm}$ & ■ & ■ & ■ \\
Closed & $<3\text{mm}$ & ■ & ■ & ■ \\
Closed & $3–7\text{mm}$ & ■ & ■ & ■ \\
Closed & $>7\text{mm}$ & ■ & ■ & ■ \\
\hline
\end{tabular}
\end{table}

\textbf{Source:} 2012 IADT Guidelines for Traumatic Dental Injuries.\textsuperscript{22} The recommendations are based on current best evidence.
a more apical location of the root and cementoenamel junction compared to adjacent teeth.\textsuperscript{1,22,23} Pulp vitality testing using cold stimulus or electric pulp tester usually will give no response initially.\textsuperscript{1,22}

Managing intrusive injuries can be difficult and has the least predictable outcome among all TDIs. Long-term prognosis depends on several factors: extent and severity of the injury, stage of root development, patient’s age, tooth position and concomitant injuries to the crown and soft tissues.\textsuperscript{10,16,22,24–27} The stage of root development and the severity of the injury influence the healing process and the long-term outcome the most.\textsuperscript{15,17,25,26,28}

There are three recommended options to manage traumatic intrusions besides the choice of extraction (\textbf{TABLE}). The first option is to monitor...
the tooth for re-eruption. This should not be confused with “doing nothing.” Monitoring is an active process, in which the patient is on a scheduled, periodic program to record evidence of re-eruption, test for pulpal response and evaluate radiographs for possible pathological changes. A major unsolved problem is that the length of time to wait for re-eruption is not predictable. As more data is collected from clinical cases and research, a better understanding of this concept may emerge. It appears that immature teeth have better odds for re-eruption than more developed teeth.

The other two treatment options are surgical repositioning and orthodontic extrusion. The literature supports both options as well as suggestions for a combination of the two. Available data seem to indicate that either procedure has about the same expected outcome. If the teeth are fully formed or nearly so, root canal treatment needs to be part of the management.

Finally, surgical removal of an intruded tooth may be necessary either because of extensive complications associated with the injury or because of patient preference.

Intrusion of teeth has earned a reputation for being one of the most severe TDIs because of the fact that pulp necrosis, root resorption and ankylosis occur perhaps more often than with other TDIs. But using the knowledge that has been gained in recent years, active management and selecting the best treatment option for the specific case of intrusion may lead to more satisfactory outcomes.

The three case reports presented here describe the treatment and outcomes of intruded teeth managed with monitored re-eruption, orthodontic extrusion or surgical repositioning.

**Case One**
A healthy 7-year-old male fell and severely intruded his maxillary left central incisor so that only the incisal edge was visible (FIGURE 2A). The tooth was tender to percussion and radiographs confirmed the diagnosis of intrusion and absence of root fracture (FIGURE 2B). The treatment recommended to and accepted by his parent was to actively monitor the tooth for spontaneous re-eruption. Three weeks later, there were no signs of re-eruption. To allow for orthodontic extrusion, laser gingivectomy was performed to facilitate bracket attachment (FIGURE 2C).

Five months after the accident, the tooth had re-erupted less than 2 mm toward its normal position in the arch.

Ten weeks after the injury, no progress was noted. The adjacent teeth had tipped toward the intruded tooth, reducing the space available for it (FIGURE 2D), necessitating orthodontic expansion of the interdental space and repositioning of the tipped teeth. A slight dull metallic sound was heard when percussing the tooth, but no definitive radiographic change indicative of ankylosis was seen (FIGURE 2E). Even though ankylosis was not confirmed, because of the lack of any eruption of the intruded tooth, surgical repositioning was now considered.

During the following two months, the increasing space between the adjacent teeth was measured and found to gradually become adequate for surgical repositioning of the intruded incisor.

Percussion sounds also returned to normal. Five months after the accident, the tooth had re-erupted less than 2 mm toward its normal position in the arch. After evaluating the options, the child’s parent agreed to proceed with surgical repositioning. An appointment for the surgery was arranged for three weeks later.

On the day of the surgical appointment, six months posttrauma, the re-examination revealed a surprising finding — the tooth had re-erupted significantly (FIGURE 2F). It was asymptomatic; it responded normally to pulp vitality testing and the percussion sounds were normal. Radiographically, the PDL space appeared normal and the pulp space showed calcific change indicating continued root development (FIGURE 2G). The tooth continued to re-erupt, but because the axial position of the tooth was slightly rotated, it was orthodontically realigned about one year following the traumatic injury and completed in four months (FIGURE 2H). A final radiograph was taken four years after the traumatic intrusion (FIGURE 2I) and showed some blunting of the root apex and extensive calcification of the pulp. The tooth was asymptomatic, responded normally to pulp testing and had a normal percussion sound.

**Case Two**
An 11-year-old boy had a swimming pool accident in which he fractured the incisal edges of the maxillary central incisors and also intruded them about 5 mm into the alveolus. At the time, he was in active orthodontic treatment, which probably prevented the teeth from being intruded further. Two weeks after the accident the boy was examined by an endodontist. Radiographically, the roots were at a stage of development consistent with the boy’s age and with closed apices (FIGURE 3A). A few days later, the endodontist accessed the pulp.
of both teeth, extirpated the pulps, placed calcium hydroxide in the canals and sealed the coronal openings (FIGURE 3B). The boy was then referred back to his orthodontist who initiated orthodontic extrusion.

Three months later, the root canal treatment was completed; the canals were filled with gutta-percha and sealer and the coronal access openings were filled with zinc oxide-eugenol (FIGURE 3C). The six-month follow-up radiograph showed bony healing. A slight irregularity on the distal aspect of the root of the left central incisor suggested a possible ankylosis-related resorption, but the clinical tests did not support that (FIGURE 3D). At the 12-month follow-up visit, the teeth continued to be asymptomatic. No indications of ankylosis-related resorption were noticed clinically or radiographically, despite the appearance of slight irregularity on the distal aspects of the right incisor root (FIGURE 3E).

The teeth were evaluated about 10 years after the accident, and they responded normally to percussion and mobility testing and showed no signs of ankylosis-related resorption (FIGURE 3F).
Surgical repositioning of severely intruded maxillary right central incisor. This radiograph of intruded right lateral and central incisors was taken the day after the accident (4A). The wide apical openings are consistent with their stage of development. Radiograph taken four weeks posttrauma shows minimal re-eruption of the intruded teeth (4B). Radiograph three months posttrauma (4C). The lateral incisor had partially re-erupted while the central incisor showed no change. Note continued apical root development in both incisors. Six-month radiographic control shows no change in position of the central incisor while the lateral incisor had re-erupted completely (4D). Radiograph one year posttrauma shows continued root development and minor external apical surface irregularity (arrow) (4E). This radiograph was taken immediately after surgical repositioning and splinting of the central incisor (4F). Two weeks after surgically repositioning the tooth, root canal treatment was completed (4G). Three years posttrauma, the patient was referred to an orthodontist for an eruption problem associated with the right maxillary cuspid (4H). Eight years after the root canal treatment was done, the patient requested bleaching of the central incisor that had discolored (4I). Radiograph shows cervical invasive root resorption (arrows) (4J). This radiograph was taken 12 years after the traumatic intrusion of the central incisor; it had broken in the cervical area from a minor traumatic impact to the tooth (4K). (Courtesy of Dr. William F. Freccia, Fayetteville, N.C.)
The patient was re-examined four weeks later and the lateral incisor had re-erupted slightly, but the central incisor had barely moved (FIGURE 4B). The incisal edges of both teeth were visible and the teeth responded normally to dry ice pulp testing; they were not painful to percussion. Three months post-trauma the patient was examined again and the lateral incisor had continued to re-erupt while the central incisor remained in its intruded position with only the incisal edge barely visible. Radiographically, both root apices appeared to be closing (FIGURE 4C). While neither tooth was painful to percussion, the percussion sound from the central incisor was dull and suggested possible development of ankylosis.

Six months after his accident, the patient showed continued re-eruption of the lateral incisor while the central incisor showed no change in position (FIGURE 4D). Discussion about considering a surgical or orthodontic approach began, but due to various circumstances, the patient did not come for follow-up until six months later, about one year after the injury. The lateral incisor was in a normal position, but the central incisor had not moved. Radiographically, the root of the central incisor had continued to develop with a suggestion of external surface irregularity apically (FIGURE 4E). Percussion sound continued to be dull. Because of the possibility of ankylosis, surgical repositioning was favored over orthodontic extrusion.

The surgical repositioning was done 14 months posttrauma. Lidocaine hydrochloride (4.4 cc, 1:100,000 epinephrine) was used for local anesthesia, and a mucogingival soft tissue flap was raised to provide access to the intruded tooth. The root was covered by bone, but the crown was visible. Forceps were used to extract the tooth from its intruded position and then placed in a normal position. The soft tissue flap was repositioned and sutured securely. The tooth was splinted to the adjacent teeth using orthodontic wire and composite (FIGURE 4F). Root canal treatment was completed two weeks later (FIGURE 4G) and the splint was removed after another two weeks. The patient tolerated the procedure well and the healing was uneventful.

The patient was evaluated regularly; three years after the trauma, he was referred for orthodontic treatment for a problem with eruption of the maxillary right cuspid (FIGURE 4H). Nine years after the traumatic intrusion and eight years after repositioning and endodontic treatment, the patient returned for consultation regarding discoloration of the central incisor (FIGURE 4I). In preparation for bleaching, radiographic examination showed evidence of cervical root resorption (FIGURE 4J). Clinical observation after opening the coronal access showed resorptive perforation on the distal cervical aspects of the tooth. The perforation was sealed with zinc oxide-eugenol cement and successful bleaching was completed, but the patient was informed about the possibility of future crown fracture.

As expected, the crown did fracture (FIGURE 4K) following a minor traumatic intrusion to the teeth 12 years after the traumatic intrusion. The cervical resorption no doubt weakened the tooth and made it susceptible to fracture with even minor impact injuries. On the other hand, the lateral incisor that re-erupted spontaneously is doing fine and has showed no sign of resorption. The trauma management of this patient allowed him to retain the compromised central incisor during the growth and development of the maxilla until suitable prosthetic replacement was more feasible at a later age.

Discussion

Developing recommendations for the management of traumatically intruded permanent teeth is a work in progress. An example of such an evolving change is evident with the modifications in the International Association for Dental Traumatology (IADT) Guidelines between 2007 and 2012. Agreement is emerging concerning the intruded immature tooth. Allowing for spontaneous re-eruption appears to have general support. More than 30 years ago, Jacobsen reported on the results of 37 intruded immature teeth that were allowed to re-erupt. The degree of intrusion varied from complete to minimal intrusion and all re-erupted. More recently, Wigen et al. reported on a similar number of immature teeth and found that 35 of 37 incisors re-erupted satisfactorily over a period of three to 12 months. In the study by Andreasen et al., there were less healing complications when immature teeth were allowed to re-erupt compared to active (orthodontic or surgical) repositioning. Identifying the degree of developmental maturity in an intruded tooth is frequently based on the description
suggested by Moorrees et al.\textsuperscript{21} in which seven stages of root development were described. For the purpose of categorizing the maturity of intruded teeth, while not usually mentioned in the case reports and other articles, the root apex is recognized as having a wide-open apical foramen (Moorrees stage five), a half-closed foramen (stage six) or a narrow apical foramen (stage seven). It is reasonable to expect intruded teeth with stage five apical openings to re-erupt in most instances, while those with stage seven openings are less likely to do so, although some may re-erupt.\textsuperscript{12} Those in stage six with half-closed foramina are less predictable, but should be given an opportunity to re-erupt. One possible explanation for the frequent re-eruption of the very immature intruded teeth is that less damage may have occurred to the tooth because of the softer bone surrounding the teeth in young children.\textsuperscript{10}

When choosing re-eruption as the treatment choice, determining how long to wait for movement of the intruded tooth is challenging. The IADT Guidelines\textsuperscript{22} recommend “a few weeks” while others suggest two to three weeks.\textsuperscript{14} It is clear that data is not available to base a more precise recommendation. As illustrated in case one reported here, more than five months after the intrusion the tooth began to show signs of re-eruption, possibly as a result of adequate space generated by separating the adjacent teeth orthodontically. Other unusual cases of late re-eruption have been reported.\textsuperscript{23,27}

Orthodontic repositioning of intruded teeth is also supported in the literature.\textsuperscript{4,9,14,22,28,32,33} However, it does not appear to be superior to surgical repositioning.\textsuperscript{4,9,14} A possible advantage to the orthodontic approach is that it may result in less marginal bone loss.\textsuperscript{14} The IADT Guidelines\textsuperscript{22} attempt to specify when the choice of orthodontics may be suitable, such as when spontaneous eruption fails and when a mature tooth has been intruded between 3–7 mm. Clinical data will need to be collected to test such recommendations. The timing of orthodontic extrusion seems to be quite flexible in that immediate or delayed initiation of extrusion leads to similar outcomes.\textsuperscript{14} If choosing orthodontic extrusion, probably the most obvious disadvantages would be the treatment cost and time involved.

When choosing re-eruption as the treatment choice, determining how long to wait for movement of the intruded tooth is challenging.

Surgical repositioning has been described and has the advantage of less time involvement than orthodontic treatment.\textsuperscript{4,9,14,25,34} The IADT Guidelines indicates that surgery should be considered for all teeth with > 7 mm traumatic intrusion.\textsuperscript{22} Stabilization of surgically repositioned teeth is recommended for four to eight weeks using a nonrigid splint.\textsuperscript{22} While the IADT Guidelines are moving toward developing fairly specific recommendations, clinical data must be collected over time to test such recommendations.

Disruption of pulpal blood supply in intruded teeth is a major concern. If revascularization does not take place, the bloodless pulp tissue becomes a target for bacterial invasion through the apex as well as other avenues available, such as cracks and unprotected dentinal tubules. This will lead to infected pulp necrosis and the teeth will require endodontic treatment.\textsuperscript{31,12} If root canal treatment becomes necessary in a very immature tooth, it will have reduced resistance to fracture as can be seen in case three. Revascularization occurs more frequently in cases of spontaneous re-eruption than in assisted repositioning.\textsuperscript{14}

The most serious outcome complication is root resorption,\textsuperscript{4,12} which is related to damage to the cementum covering of the external root surface.\textsuperscript{11} The exposed dentin is subject to osteoclastic activity if the damaged area is not repaired with new cementum after the injury. As in other traumatic dental injuries, there are two types of resorption: infection-related and ankylosis-related.\textsuperscript{35} Infection-related can be prevented and arrested if already present when the diagnosis is made with endodontic treatment. On the other hand, ankylosis-related resorption is progressive and cannot be arrested. It has been pointed out that antibiotics are of no value in preventing either pulp necrosis or root resorption.\textsuperscript{14}

TDIs that result in intrusion of teeth are sometimes so severe that the choice of extraction may be unavoidable.\textsuperscript{4,13} Retaining compromised teeth for as long as possible in children and adolescents should be considered for supporting continued growth and development and allowing better options for replacement at a later time. It is difficult to know if in some cases severely intruded teeth have been surgically removed simply because of expediency or lack of updated information on dental traumatology. The availability of the IADT Guidelines and the Andreasen Trauma Guide on electronic media may help to change that situation if it exists. The websites are available to all at iadt-dentaltrauma.org and dentaltraumaguide.org.
Information is gradually accumulating regarding all aspects of traumatic intrusive luxation of permanent teeth. The evolving knowledge base will provide a continuing opportunity for advancement in treatment protocols for this very serious type of traumatic dental injury.

References


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Antibiotic Resistance and Good Stewardship

George Maranon, DDS

ABSTRACT This article examines dentistry’s role in managing the antibiotic resistance problem through a more appropriate use of antibiotics.

Author

George Maranon, DDS, is a diplomate of the American Board of Oral and Maxillofacial Surgery. He received his dental degree from the University of California, Los Angeles, and his medical degree from New York Medical College and completed his residency in oral and maxillofacial surgery at the Westchester County Medical Center. He maintains a private practice in oral and maxillofacial surgery in Encino, Calif. Conflict of Interest Disclosure: None reported.

It seems counterintuitive, but the greatest cause of antibiotic resistance is the use of antibiotics. The inappropriate prescribing and overuse of antibiotics has, over time, led to an epidemic of bacterial resistance. The CDC estimates that in the United States more than 2 million people become ill every year with antibiotic-resistant infections, with at least 23,000 dying as a result.1

With respect to the use of antibiotics in dentistry, Waldron reported on the successful treatment of odontogenic infections using penicillin in 1943. In 1947, Glaser et al. reported on the effect of penicillin on transient bacteremias following dental extractions. Patterns of antibiotic resistance soon began to emerge.2 As early as 1945, Demerec published a series of papers describing patterns of antibiotic resistance and advancing a theory that mutations were responsible. These changes originated as mutations that resulted in a stepwise development to higher levels of resistance.3–7

Glaser presented his general principles of antibiotic therapy at a 1953 session of the American Dental Association. He stated that the choice of antimicrobial agent should be based on the following criteria: efficacy, ease of administration, toxicity, development of resistant strains, use of combinations and cost. He recognized that antibiotic resistant strains were more likely to develop in chronic infections requiring longer therapy. Glaser went on to state, “The widespread use of a given agent in a given infection may ultimately result in the development of resistance in all strains, with the result that a different drug must be used in the treatment of the infection.”8

Caldwell wrote that antibiotic drugs do not supersede sound surgical principles. Caldwell said there were numerous reasons to discourage the indiscriminate use of antibiotic drugs and warned that resistance of bacteria to these drugs was an increasingly serious problem. In the article, Caldwell put forward antibiotic treatment algorithms for clinical situations in oral surgery. He cautioned that an accurate diagnosis and appropriate surgical treatment were of primary importance and that “indiscriminate antibiotic therapy is unwarranted and may even be hazardous, especially if it delays a full and accurate diagnosis of a pathologic condition.”9

Concerning the dental specialties of periodontics and endodontics,
Ostrander published an article in 1953 that questioned the efficacy of topical antibiotics as a cure for Vincent’s stomatitis and other stomatitis. He warned of the risks of development of resistant strains of bacteria and advocated for “the usual procedures for restoring good mouth hygiene.” Ostrander recognized the importance of systemic antibiotics in managing severe periapical infections associated with swelling, fever and malaise, but emphasized that the use of these drugs should not be used to overlook the importance of “adequate root canal filling.”

The words of the warning concerning antibiotic resistance started to be forgotten. For the next two decades, the trend toward increased bacterial antibiotic resistance was challenged by the development of penicillinase resistant penicillins, cephalosporins, clindamycin and aminoglycosides.

**Mechanisms of Bacterial Antibiotic Resistance**

In the Archives of Internal Medicine, Dever et al. described some of the antibiotic resistance. The first is the deactivation of the antibiotics by bacterial enzymes. An example of this is β-lactamase hydrolysis of the penicillins and cephalosporins. The second involves the alteration of bacterial proteins that are the targets of antibiotics. Methicillin resistance occurs by this mechanism by alteration of the antibiotic target protein, penicillin-binding protein. Other antibiotics affected by this mechanism include the tetracyclines, the macrolides, trimethoprim, sulfonamides, aminoglycosides, chloramphenicol and the quinolones. A third mechanism involves alteration of the bacterial cell membrane permeability to the antibiotics. This mechanism is responsible for resistance to several antibiotics including the β-lactams, aminoglycosides and the quinolones. In addition, there are mechanisms where antibiotics may be actively removed from the bacteria through efflux pumps. This is a major source of resistance against the tetracyclines. Bacteria may also develop the ability to prevent the activation of the antibiotic within the
This can occur between bacteria of plasmids or transposons to other bacteria. Conjugation is the direct cell-to-cell transfer of DNA via (bacterial viruses). Conjugation is the other bacteria via bacteriophages. This occurs when DNA is acquired from into the bacteria’s genome. Transduction acquired by the bacteria and incorporated bacteria in the surrounding environment is conferring antibiotic resistance from lysed is an uncommon process where DNA is not aff ected by this peptide antibiotic. Antibiotic resistance develops quickly because of rapid bacterial cell division rates, the large number of bacterial cells and the combination of horizontal and vertical gene transfer11 (TABLE 2).

TABLE 2
Mechanisms of Resistance for Antibiotics Used in Dentistry

<table>
<thead>
<tr>
<th>Antibiotic</th>
<th>Target for antibiotic activity</th>
<th>Microbial response</th>
</tr>
</thead>
<tbody>
<tr>
<td>Penicillin and cephalosporins</td>
<td>Cell wall synthesis</td>
<td>□ Beta-lactamase destroys penicillin lactam ring</td>
</tr>
<tr>
<td></td>
<td></td>
<td>□ Enzymes making cell wall become resistant to penicillin effect</td>
</tr>
<tr>
<td></td>
<td></td>
<td>□ Proteins that bind penicillin change shape</td>
</tr>
<tr>
<td></td>
<td></td>
<td>□ Reduced autolysis</td>
</tr>
<tr>
<td>Erythromycin</td>
<td>Ribosome protein synthesis</td>
<td>□ Antiporter efflux pump molecules out as fast as it gets in</td>
</tr>
<tr>
<td></td>
<td></td>
<td>□ Alter the shape of microbial molecules that would otherwise bind the antibiotic</td>
</tr>
<tr>
<td>Tetracycline and related antibiotics</td>
<td>Ribosome protein synthesis</td>
<td>□ Antiporter efflux pump molecules out as fast as it gets in</td>
</tr>
<tr>
<td></td>
<td></td>
<td>□ Alter the shape of microbial molecules that would otherwise bind the antibiotic</td>
</tr>
<tr>
<td>Sulfua drugs, trimethoprim</td>
<td>Interferes with normal bacterial metabolism (e.g., sulfua drugs and trimethoprim interfere with folate metabolism)</td>
<td>□ Microbial metabolic processes are changed and enzyme systems change their characteristics</td>
</tr>
<tr>
<td>Metronidazole</td>
<td>DNA is damaged when the drug is activated by bacterial nitro-reductase enzymes</td>
<td>□ Microbial nitro-reductase is changed and no longer activates metronidazole into damaging form</td>
</tr>
<tr>
<td>Vancomycin</td>
<td>Peptide antibiotic interferes with manufacture of cell wall</td>
<td>□ Microbial enzyme systems change to make a slightly different cell wall that is not affected by this peptide antibiotic</td>
</tr>
</tbody>
</table>


cell, alter their growth requirements and dilute the antibiotic effect by overproduction of antibiotic target sites. Bacteria can have innate or natural immunity or they can acquire resistance by mutation. With mutation, a single point mutation conferring antibiotic resistance allows strains with this mutation to proliferate while susceptible strains are inhibited or killed. The progeny of these resistant bacteria will develop resistance through replication. This is referred to as vertical gene transfer. Antibiotic resistance can also occur by horizontal gene transfer through the processes of transformation, transduction and conjugation. Transformation, however, is an uncommon process where DNA conferring antibiotic resistance from lysed bacteria in the surrounding environment is acquired by the bacteria and incorporated into the bacteria’s genome. Transduction occurs when DNA is acquired from other bacteria via bacteriophages (bacterial viruses). Conjugation is the direct cell-to-cell transfer of DNA via plasmids or transposons to other bacteria. This can occur between bacteria of the same or different species (TABLE 1). But is there justification for the use of prophylactic antibiotics prior to dental procedures to reduce the risk of IE? The United Kingdom’s National Institute for Health and Clinical Excellence (NICE) went beyond the AHA guidelines in March 2008 and recommended complete cessation of antibiotic prophylaxis for prevention of infective endocarditis. In a 2014 report in The Lancet, Dayer et al. report on the incidence of infective endocarditis in England from 2000–2013. In their study, they noted that the number of antibiotic prescriptions written for the prevention of endocarditis decreased substantially. During that same period, they reported an increased number of cases of IE in both high-risk and low-risk individuals.14

In 1955, the American Heart Association (AHA) first developed guidelines concerning the use of prophylactic antibiotics prior to dental procedures to prevent infective endocarditis (IE). The guidelines have been modified and their indications pared significantly in recent years (TABLE 3). The revisions had been based primarily on consensus opinions of risks and benefits and not evidence based. Concerns remain surrounding the fact that the guidelines were based primarily on consensus opinions and that there is no evidence that antibiotic prophylaxis prevents IE.12,13

Risks of Bacteremia From Dental Procedures

Infective Endocarditis

The risk of endocarditis from bacteremia secondary to dental procedures was recognized in 1923. In 1955, the American Heart Association (AHA) first developed guidelines concerning the use of prophylactic antibiotics prior to dental procedures to prevent infective endocarditis (IE). The guidelines have been modified and their indications pared significantly in recent years (TABLE 3). The revisions had been based primarily on consensus opinions of risks and benefits and not evidence based. Concerns remain surrounding the fact that the guidelines were based primarily on consensus opinions and that there is no evidence that antibiotic prophylaxis prevents IE.12,13

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In 2007, the AHA in collaboration with the ADA published the most recent prophylaxis guidelines for prevention of bacterial endocarditis. The guidelines state, “Only an extremely small number of cases of infective endocarditis might be prevented by antibiotic prophylaxis for dental procedures even if such prophylactic therapy were 100 percent effective.” The AHA states that antibiotic prophylaxis

TABLE 3
Guidelines for Prophylaxis Against Infective Endocarditis

<table>
<thead>
<tr>
<th>antibiotic</th>
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<td>peptide antibiotic interferes with manufacture of cell wall</td>
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</tr>
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</table>
Summary of Nine Iterations of AHA-Recommended Antibiotic Regimens From 1955 to 1997 for Dental/Respiratory Tract Procedures

<table>
<thead>
<tr>
<th>Year</th>
<th>Primary regimen for dental procedures</th>
</tr>
</thead>
<tbody>
<tr>
<td>1955</td>
<td>Aqueous penicillin 600 000 U and procaine penicillin 600 000 U in oil containing 2% aluminum monostearate administered IM 30 minutes before the operative procedure.</td>
</tr>
<tr>
<td>1957</td>
<td>For two days before surgery, penicillin 200 000 to 250 000 U by mouth four times per day. On day of surgery, penicillin 200 000 to 250 000 U by mouth four times per day and aqueous penicillin 600 000 U with procaine penicillin 600 000 U IM 30 to 60 minutes before surgery. For two days after, 200 000 to 250 000 U by mouth four times per day.</td>
</tr>
<tr>
<td>1960</td>
<td>Step I: Prophylaxis two days before surgery with procaine penicillin 600 000 IM on each day. Step II: Day of surgery – procaine penicillin 600 000 U IM supplemented by crystalline penicillin 600 000 U IM one hour before surgical procedure. Step III: For two days after surgery – procaine penicillin 600 00 U IM each day.</td>
</tr>
<tr>
<td>1965</td>
<td>Day of procedure: Procaine penicillin 600 000 U, supplemented by crystalline penicillin 600 000 U IM one to two hours before the procedure. For two days after procedures: Procaine penicillin 600 000 U IM each day.</td>
</tr>
<tr>
<td>1972</td>
<td>Procaine penicillin G 600 000 U mixed with crystalline penicillin G 200 000 U IM one hour before and once daily for two days after the procedure.</td>
</tr>
<tr>
<td>1977</td>
<td>Aqueous crystalline penicillin G (1 000 000 U IM) mixed with procaine penicillin G (600 000 U IM) 30 minutes to one hour before procedure and then penicillin V 500 mg orally every six hours for eight doses.</td>
</tr>
<tr>
<td>1984</td>
<td>Penicillin V 2 g orally one hour before, then 1 g six hours after initial dose.</td>
</tr>
<tr>
<td>1990</td>
<td>Amoxicillin 3 g orally one hour before procedure, then 1.5 g six hours after initial dose.</td>
</tr>
<tr>
<td>1997</td>
<td>Amoxicillin 2 g orally one hour before procedure.</td>
</tr>
</tbody>
</table>

IM indicates intramuscularly.
* These regimens were for adults and represented the initial regimen listed in each version of the recommendations. In some versions, > 1 regimen was included.


is now only indicated for patients with the highest risk of adverse outcomes from infective endocarditis and should not be based on an increased lifetime risk of acquiring infective endocarditis. In the report, the AHA recognizes the importance of optimal oral health and hygiene as it relates to bacteremia from daily activities (toothbrushing) and state that this is more important than antibiotic prophylaxis in reducing the risk of IE.15

In spite of the guidelines, compliance is a concern. Nelson and Van Blaricum reported that physicians and dentists had “extraordinarily” low rates of compliance with the AHA guidelines for prophylaxis against bacterial endocarditis.16 A random survey of 450 dental hygienists and 450 dentists in Alberta, Canada, published in October 2015 found that dental hygienists were more likely than dentists to recommend antibiotic prophylaxis for low-risk cardiac patients. In addition, the study found that neither dentists nor hygienists consistently recommend prophylaxis for high-risk cardiac patients.17 Seto et al. reported that among physicians antibiotic prophylaxis overuse among negligible-risk patients and underuse among moderate-risk patients was common.18 A survey of 878 dentists found that 75 percent of those dentists had patients who took antibiotic prophylaxis prescribed by their physicians even though it was not indicated by the guidelines.19

Prophylactic antibiotics were favored by the majority of orthopedic surgeons and dentists.17,18 There was no consensus as to the antibiotic, duration and dose. In 1990, the ADA published the results of a consensus conference of orthopedic surgeons, dentists and infectious diseases specialists. The report stated that there was limited data to support the use of antibiotic prophylaxis prior to dental procedures to reduce the risk of LPJI.19 In 1997, the Infectious Diseases Society of America (IDSA), the ADA and the American Academy of Orthopedic Surgeons (AAOS) published an advisory statement on the issue.10 This statement was slightly revised in 2003 by these same organizations. These reports failed to justify the use of antibiotic prophylaxis on the basis of risk/benefit and cost/effectiveness ratios.41

In 2015, the ADA Council on
Scientific Affairs published the results of a 2014 panel of experts and recommended that “in general, for patients with prosthetic joint implants, prophylactic antibiotics are not recommended prior to dental procedures to prevent prosthetic joint infection. The practitioner and patient should consider possible clinical circumstances that may suggest the presence of a significant medical risk in providing dental care without antibiotic prophylaxis, as well as the known risks of frequent or widespread antibiotic use. As part of the evidence-based approach to care, this clinical recommendation should be integrated with the practitioner’s professional judgment and the patient’s needs and preferences.” The panel noted the potential adverse effects of antibiotics (for anaphylaxis, antibiotic resistance and opportunistic infections) may exceed the benefits. Lastly, the panel stated that each patient circumstance and preference should be considered by the dentist when making the decision to prescribe prophylactic antibiotics prior to dental procedures.42

**Other Medical Conditions or Devices**

In the past, antibiotic prophylaxis has been recommended to patients with other types of heart disease and other medical conditions because of the risk of bacteremia. In a 2007 systematic review, Lockhart et al. studied eight medical conditions looking for support for the use of antibiotic prophylaxis during invasive dental procedures. These conditions included heart valve disease, prosthetic heart valves and pacemakers; hip, knee and shoulder prosthetic joints; renal dialysis shunts; cerebrospinal fluid shunts; vascular grafts; immunosuppression secondary to cancer and cancer chemotherapy; systemic lupus erythematosus; and insulin-dependent (type 1) diabetes mellitus. The authors found no evidence that bacteremias after dental procedures or antibiotic prophylaxis had a significant effect on the other medical conditions reviewed.43 Finally, a cost-effectiveness analysis published in November 2015 showed that “on the basis of available cost and clinical outcomes data, the results produced by our model suggest that a general no-antibiotic prophylaxis strategy is more cost-effective than prophylaxis strategies.”44

The authors found no evidence that bacteremias after dental procedures or antibiotic prophylaxis had a significant effect on the other medical conditions reviewed.

**Antibiotic Resistant Bacteria**

It is well documented that there are strains of Staphylococcus aureus, Enterococcus and others that are resistant to multiple antibiotics, including vancomycin. Methicillin-resistant S. aureus is one of the most common hospital-acquired pathogens. In 2013, the CDC published *Antibiotic Resistance Threats in the United States* that included a list of 18 multidrug-resistant organisms (bacteria, fungi and viruses) that represent an urgent or serious threat.45 Documented high rates of resistant strains of viridans streptococcus have also been reported.46,47,48 A study of 43 U.S. medical centers conducted during 1993–1994 found high levels of penicillin resistance were noted in 13.4 percent of the strains and 42.9 percent of the strains were found to have intermediate resistance.49

In a review article for the March 2000 *Journal*, Pallasch reported on studies that have shown significant resistance to the tetracyclines, clindamycin and the newer macrolides (azithromycin and clarithromycin) among viridans streptococci. Beta-lactamase production is common in oral *Prevotella*, *Porphyromonas* and *Fusobacterium* species in both children and adults. His report cited studies that showed that amoxicillin and doxycycline resistance was found in approximately one-third of moderately advanced periodontitis patients. Methicillin resistant staph aureus has also been found to colonize not only appliances like dentures but also natural dentition.50

Other studies document that antibiotic resistance in oral flora is a worldwide problem. One study found antibiotic resistant genes of gram-negative facultative anaerobes associated with periodontal disease in children who did not have previous dental care or preventative procedures.51

**Antibiotic Dosing for the Management of Oral Infections**

In the management of infections, Pallasch wrote that successful antibiotic treatment requires that serum concentrations delivered to the infected tissues have to be greater than or equal to the antibiotics’ minimum inhibitory concentration (MIC) for the responsible bacteria. In order to accomplish this, Pallasch recommends a loading dose at the beginning of antibiotic treatment followed by aggressive dosing for the shortest period of time.

According to Pallasch, there are three considerations in determining the appropriate dosing interval. The first are the post-antibiotic effects (PAEs) of the drug. PAEs are defined as the continued suppression of antibacterial growth after the administration of the antibiotic has
ceased and serum concentrations have fallen below the minimum inhibitory concentration. Antibiotics like erythromycin, clindamycin and tetracycline have PAEs that last between two to seven hours because they act within the microbial cytoplasm. The second consideration is merits of continuous or pulse dosing. Pulse-dosed antibiotics are given at higher doses on a regular schedule that allows the serum concentration of the drug to drop below the MIC for the pathogen. Metronidazole and the quinolones act by suppressing nucleic acid synthesis. For this reason, these drugs can be used at higher doses and at more widely spaced dosing intervals. Lastly, antibiotics like penicillin, amoxicillin and the cephalosporins work by interfering with cell division. Bacteria have different division rates and times; therefore, steady-state levels must be maintained. A steady-state condition is achieved after an adequate number of doses of a drug is given so that a continuous blood level of the drug is reached. This requires that the drug be taken at an adequate dose, at the prescribed interval and without missing a dose. In deciding whether antibiotics are necessary, Pallasch states that there are six possible outcomes of the use of antibiotics to treat infection. Of those, the only positive outcome is when antibiotic treatment supports the patient’s immune system in resolving the infection. The negative outcomes include toxicity, allergy, superinfection, chromosomal mutations leading to resistance, gene transfer to vulnerable organisms and expression of dormant resistant genes.52

**Stewardship**

It is recognized that some of the most important ways to reduce increases in antibiotic resistance are stewardship and improving prescribing practices. The CDC reported in December 2001 that among physicians prescription rates for nonhospitalized patients dropped by about one-fourth in the 1990s. Unfortunately, the CDC found during the same time an increase in the number of prescriptions for broad-spectrum antibiotics. The unnecessary use of these antibiotics will likely lead to more antibiotic resistance. Finally, they reported that the antibiotic prescription rate did not change in emergency departments and outpatient clinics.53 This is an important finding for dentistry because due to decreasing reimbursements and access to care issues, larger numbers of patients with dental problems are being seen in these locations. A November 2000 survey of dentists in Canada reported that there was confusion among the dentists about prescribing antibiotics and found inappropriate prescribing practices. Even though most oral facial infections resolve in three to seven days, 16.7 percent of the respondents routinely prescribed antibiotics for more than seven days. The authors also found that 17.5 percent of the respondents were not using the current guidelines for prophylaxis against endocarditis and artificial hip prosthesis. Further, they found that antibiotics were prescribed postsurgically when there was no evidence for these drugs improving outcomes.54

Sweeney et al. published a review examining the antibiotic prescribing habits of general dentists in the United Kingdom. Their review found numerous studies that in general, dentists were prescribing antibiotics as treatment before resorting to appropriate surgical procedures. This is in spite of the fact that dental students are taught that management of dental infections should be primarily through surgical or mechanical means, not by the initial use of antibiotics. They found wide inconsistencies in the frequency and duration of antibiotic prescriptions. The authors concluded that these practices contributed significantly to the development of antibiotic resistance in oral flora.55 A study of the antibiotic prescribing practices of general and pediatric dentists in the management of odontogenic infections in children in North Carolina found a low adherence to accepted guidelines. In their summary, the authors concluded that more specific clinical guidelines may improve adherence to the guidelines.56

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Sweeney et al. published a review examining the antibiotic prescribing habits of general dentists in the United Kingdom. Their review found numerous studies that in general, dentists were prescribing antibiotics as treatment before resorting to appropriate surgical procedures. This is in spite of the fact that dental students are taught that management of dental infections should be primarily through surgical or mechanical means, not by the initial use of antibiotics. They found wide inconsistencies in the frequency and duration of antibiotic prescriptions. The authors concluded that these practices contributed significantly to the development of antibiotic resistance in oral flora.55 A study of the antibiotic prescribing practices of general and pediatric dentists in the management of odontogenic infections in children in North Carolina found a low adherence to accepted guidelines. In their summary, the authors concluded that more specific clinical guidelines may improve adherence to the guidelines.56

**General dentists’ perceptions of antimicrobial use and resistance in the U.K. was studied by Cope et al. They found that dentists were aware of resistant bacteria such as methicillin-resistant staph aureus (MRSA), but that there were differences of opinions as to whether antibiotic resistance was a problem in dental alveolar infections. Some U.K. dentists recognized that the antibiotic failure could be due to antibiotic resistance. Though the U.K. dentists in the study linked prescribing practices with a risk of increased antibiotic resistance, most felt that the prescribing practices of dentists had less of an impact on antibiotic resistance than those of physicians. Some said that the decision to prescribe antibiotics was influenced by clinical
pressures, such as a waiting room full of patients. Dentists who practiced in the National Health Service (NHS) suggested greater incentives to provide operative treatment might result in fewer prescriptions. Providers primarily in private practice felt raising awareness of the public about resistance and the appropriate management of dental conditions would reduce patients' expectations of the need for antibiotics.57

The American Dental Association has clarified its position on whether dental prescribing practices are responsible for the development of antibiotic resistance in oral flora. In a 1997 report, the ADA Council on Scientific Affairs noted that antibiotic resistance was a significant worldwide problem, but felt that the prescribing practices of dentists had been “relatively conservative” and did not contribute significantly to the problem.58 A 2004 report stated that the council “recommends the prudent and appropriate use of antibacterial drugs to prolong their efficacy and promotes reserving their use for the management of active infectious disease and the prevention of hematogenously spread infection, such as infective endocarditis or total joint infection, in high-risk patients.” The council went on to provide guidelines for the use of antibiotics that included making an accurate diagnosis, using appropriate antibiotics and dosing schedules and using narrow spectrum antibiotics for simple infections. The recommendations also called for the appropriate use of antibiotics solely for bacterial infections and revision of antibiotic treatment regimen based on the patient's response and any microbiological test results. The council recommended that dentists obtain a thorough knowledge of the side effects and drug interactions of antibiotics before prescribing them.

The council recommended that dentists educate the patients regarding the use of these medications and completing the full course of therapy as prescribed.59

On June 2, 2015, the American Dental Association announced that it was one of 15 health professional organizations that participated in a White House forum on antibiotics stewardship. The forum discussed plans to implement changes in antibiotics stewardship over the next five years to reduce the development of antibiotic resistant bacteria. In commenting about the meeting, Daniel Meyer, DDS, chief science officer for ADA’s Science Institute and the association, said that a CDC-U.S. Department of Health and Human Services partnership will provide data about antibiotic use and prescribing trends to “help physicians and providers improve antibiotic use and cut inappropriate prescribing by 50 percent in practices and 20 percent in hospitals.” In a statement, the ADA pledged to “provide appropriate scientific and clinical expertise to fully assess and respond to antibiotic health care issues, offer continuing education at professional meetings and provide systematic reviews and current scientific information on the proper use of antibiotics in online resources.” The ADA’s position on the use of antibiotics is posted on ada.org.60

Future of Infection Control

Current culturing methods and antibiotic sensitivity techniques may not be sensitive enough to identify all microorganisms responsible for oral infections. These methods are also time consuming and delay effective and directed antibiotic therapy. Since the late 1990s, molecular methods such as polymerase chain reactions, fluorescence in situ hybridization, sequencing of the 16S rRNA gene and other phenotypic methods have been developed.61 Studies utilizing these techniques have appeared in the periodontal, oral and maxillofacial surgery and endodontic literature.62-67 Genotyping of patients may help to identify individuals at risk for infections.68

Conclusions

Patients have clearly benefitted from the use of antibiotics for the prevention and management of infection. It is also clear that the miracle cures of antibiotics are not without personal and population risk and cost. The indiscriminate and inappropriate use of antibiotics in health care and agriculture has led to antibiotic resistance yielding multidrug-resistant organisms, many with life-threatening consequences. Approximately 10 percent of antibiotic prescriptions are written by dentists. As with other health care providers, it has been shown that, at times, dentists prescribe antibiotics inappropriately.69

Antibiotics are not a replacement for appropriate surgical management. Scaling and root planing, endodontics, incision and drainage and/or extraction should be considered as first-line treatment. Dentists are fortunate in the fact that most odontogenic infections are sensitive to penicillin. In selecting the use of an antibiotic, clinicians must remember that there are many considerations that must be addressed. Before prescribing a drug, a complete history and clinical
examination must be performed. A bacterial etiology must be confirmed and the source of the infection identified. Patient-related factors including health status, other medications, allergies or previous adverse events must be addressed. If empirical antibiotic therapy is planned, likely pathogens, their characteristics and replication patterns must be known.

The clinicians must be familiar with pharmacodynamics and potential adverse side effects of the drugs.

The dosages prescribed need to deliver the highest and safest loading dose of the antibiotic at the beginning of treatment. The antibiotic should have the narrowest spectrum and be used for the shortest period of time. The selection of an antibiotic should take into account compliance related factors including the ease and frequency of administration. Patients who are prescribed antibiotics must be followed closely. An antibiotic should be used for the shortest period of time and only as an aid to the patient’s own host defenses. Once the patient’s signs and symptoms improve, the antibiotic should be discontinued. If the patient fails to improve after 48 hours, the patient must be re-examined and the initial diagnosis reconfirmed. The need for additional surgical management and bacterial cultures should be considered. It is also important that antibiotics are not changed too quickly.

Patients must be educated on the importance of adherence to drug dosing regimens as they relate to treatment success while minimizing the risk of developing antibiotic resistance. They should receive complete informed consent including alternatives to antibiotic therapy, adverse reactions, superinfection, antibiotic failure and the possibility of antibiotic resistance. Bacterial cultures and antibiotic sensitivities should be taken in rapidly evolving infections to aid in the selection of an appropriate antibiotic. Lastly, financial cost must be considered.

The use of antibiotics in the management of infectious disease and antibiotic prophylaxis is evolving. Clinicians should make decisions on the management of infections in an evidence-based manner. Guidelines can be used to assist practitioners in those decisions, but should not be considered a cookbook approach to patient care. Unfortunately, they are not necessarily evidence based. By definition, guidelines are meant for the management of the majority of patients and therefore serve as a starting point to individualize care. The use of guidelines should take into account each patient’s health status and comorbidities and may require consultation with the patient’s physicians. As part of the health care system, dentists need to recognize their responsibility in limiting the proliferation of multidrug-resistant organisms by appropriate use of antimicrobials.

ACKNOWLEDGMENT
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REFERENCES
25. Lattimer GI, Kablich PA, Dickson TB Jr., Vernick CG,
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**LOS ANGELES COUNTY**

BEVERLY HILLS—Implant/Perio/Prosth office located in a prestigious 4 story bldg. Has 3 eq ops w/ views to the city. PPO & Cash only. Buyer’s net of $80K. Property ID # 5131.

BEVERLY HILLS—Modern designed Periodontal practice in multi story elite medical professional bldg. Has 3 eq ops / 1 plmbd not eq. In a 1,410 sq ft ste. Property ID #5157.

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VAN NUYS—General Practice w/ 30 years of goodwill. Has 6 eq ops. Projecting approx. $452K. Net of $139K. Property ID # 5148.

KERN, VENTURA, & SAN LUIS OBISPO COUNTIES


**ORANGE COUNTY**


Huntington Beach—Leasehold Improvements & Equipment Only! Modern designed office w/ 3 eq ops and 1 plmbd not eq in a 2 story med bldg. Property ID #5154.

LAGUNA HILLS—With over 30 yrs of goodwill this GP is located in a 2 story med bldg. Has 5 eq ops in a 1,600 sq ft suite. See an average of 14-16 new patients/mo. Grossed approx. $304K for 2016. Property ID #5127.

LAGUNA HILLS—GP in single shopping center right off the freeway in a growing area of LG. Established in 2003 w/ 4 eq ops. Has digital X-ray with Eagle soft technology. Net of $171K. Property ID #5144.

MISSION VIEJO (TURN-KEY) Modern designed GP located in a 2 story med/dent bldg. Has 3 eq / 3 plmbd for expansion. Property ID #5138.


NEWPORT BEACH—Price Adjustment! General Practice w/ over 50 years located in multi story building with beautiful views to the ocean. Has 3 ops. Long term lease. Buyer’s net $136K . Property ID #5137.

ORANGE—GP Patient Charts Only!!

SAN JUAN CAPISTRANO—Leasehold Improvements & Equipment Only! Located in a single story bldg w/ 3 eq ops in a 1,420 sq ft suite. Property ID # 5164.

SAN DIEGO COUNTY

EL CENTRO (GP)—This practice is located in a single story building. Building is for sale. 5 equipped operatories. Grossed $327K for 2015. Buyer’s net of $63K. Property ID #5023.

SAN DIEGO COUNTY—Modern designed multi specialty office located in remodeled sy shopping center. Has 8 eq ops. Grossed $1.1M. NET $300K. Property ID #5162.

RIVERSIDE & SAN BERNARDINO COUNTIES

CHINO—Real Estate Only! This a rare opportunity to purchase a condo located in a single story strip mall. Has been a dental practice for 40 years. Property ID 5076.


FONTANA—GP + Real Estate!! Premier office with 50 years of goodwill. In a 3,000 sq ft bldg with 8 eq ops. Has the latest technology. Grossed approx. $2.3M in 2016. Net of $968K. Property ID #5140.


TEMCULA—Modern designed practice w/ 3 eq ops. Projecting approx. $1.2M . Net of $444K. Property ID #5155.

TEMCULA—Turn Key modern designed General Practice with 3 eq ops and 3 plumbed not eq. Established in 2005. NO HMO. Grossed approx. $263,156 for 2016. Property ID #5149.

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Well-Stocked Emergency Medical Kits Can Help Mitigate Risk
TDIC Risk Management Staff

Dentists put their education, skills and training into action every day, but when faced with a life-threatening emergency, they are truly put to the test. While dentists may not like to think about the unfortunate possibilities of medical emergencies, they should be prepared to handle anything that occurs under their roof, whether it is a patient suffering an allergic reaction or a diabetic employee with low blood sugar.

Emergency preparedness can sometimes mean the difference between life and death. Well-trained staff and clear emergency protocols are essential, as are regularly performed drills to ensure expediency should an emergency occur. But one of the simplest ways to prevent an emergency from becoming a tragedy is a well-stocked and up-to-date emergency kit.

While all dental practices are required to have emergency medical kits on hand, the type of kit and what it contains is determined by each practice’s type, patient base and level of training. The Dentists Insurance Company recommends dental practices have two emergency kits: one for patients and one for employees.

Patient Kits
There are no regulations governing what should be contained within an emergency kit for patients; however, dental practices that contract with dental plans should be aware that many plans have specific requirements. In addition, individual states may have their own requirements, so TDIC recommends dentists check with their state dental boards. For example, the California Dental Practice Act requires dentists to have both adult and pediatric Magill forceps on hand and be trained in their use to clear the airway of foreign objects, according to attorney Arthur Curley of Bradley, Curley, Barrabee & Kowalski.

Dentists can refer to the American Dental Association’s general

The Dentists Insurance Company recommends dental practices have two emergency kits: one for patients and one for employees.

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recommendations on office emergency
kits at ada.org. TDIC’s kit content
recommendations, which are aligned
with ADA’s, include the following:
■ Ammonia inhalants
■ Aspirin
■ Antihistamine
■ Blood pressure monitoring equipment
■ Bronchodilator (asthma inhaler)
■ CPR pocket mask
■ Epinephrine 1:1,000 (injectable)
■ Glucose (orange juice or
sugar-sweetened soda)
■ High-volume suction and
aspiration tips or tonsillar suction
■ Nitroglycerin (sublingual
tablet or aerosol spray)
■ Oxygen with positive-pressure
administration capability
■ Syringes
■ Tourniquet
TDIC advises practice owners
to designate a staff member to be
in charge of regularly checking
kits to ensure each is complete and
medication contained within is not
expired. One helpful practice is to
check the kit on the same schedule as
checking smoke detector batteries: on
the dates daylight saving time begins
and ends. Alternatively, practice
owners can purchase commercial
emergency medical kits with refill
service options that automatically
send up-to-date medications when
existing medications are due to expire.
But simply having a comprehensive
medical emergency kit is not enough.
Dentists and staff must know where
it is located and how to use the items
within it, especially medications.
Many off-the-shelf kits come with
instruction manuals or DVDs, and
TDIC recommends dentists obtain
training in the administration of the
emergency medications in their kits.

Offices that provide general
anesthesia or conscious sedation are
required to have specific medications in
their emergency kits. The requirements
vary from state to state, so dentists
should check with their state dental
board or dental association for
details. In California, emergency
kits for offices that provide general
anesthesia or conscious sedation are
required to include the following:
■ Fifty percent dextrose or
other antihypoglycemic
■ Antiarrhythmic (not required
for conscious sedation)
■ Anticholinergic
■ Anticonvulsant
■ Antihistaminic
■ Antihypertensive (not required
for conscious sedation)
■ Appropriate drug antagonist
■ Bronchodilator
■ Coronary artery vasodilator
■ Epinephrine
■ Intravenous medication for
treatment of cardiopulmonary
arrest (not required for
conscious sedation)

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CONTINUES ON 258
4166 PALO ALTO GP
Well established practice serving young professionals and their families looking to transition to a confident dentist capable of handling a busy schedule. Remodeled 750 square foot office with 3 fully equipped ops. Approximately 1,800 active patients. 8 hygiene days per week. $1M+ average GR. Asking $800K.

4127 MENLO PARK GP
GP offering 35+ yrs of goodwill, this gem on the Peninsula is truly a find. Incredible downtown location in upscale office with ample onsite parking. 4 ops in 950 sq. ft. 2016-2014 average GR $567K with average adj. net of $156K. Most services other than crown & bridge are referred out. 750+ active patients. 4 hygiene days a week generate 40-45% of the revenue. Owner will help for a smooth transition. Resume must be provided. Asking $417K.

4155 SAN MATEO GP
General family and restorative practice with special emphasis on esthetic dentistry. Established over 38 years in desirable San Mateo neighborhood. 1,060 square foot has been continuously upgraded and has 3 fully-equipped ops and 3 digital x-ray units. Average gross receipts $558K+ with just 3 doctor days and 3 hygiene days per week. 100% of patients are private pay. Asking $379K.

4103 SAN FRANCISCO GP
Vibrant downtown location in historic high-rise bldg. Retiring doctor offering 30+ years of goodwill. 4.5 days of hygiene, 1,500+ active patients, 20-25 new patients/mo. Gorgeous, spacious facility in approx. 2,500 sq. ft. 2015 GR $796K. 2014 GR $768K. Average adjusted net income $274K+ Asking $599K.

4145 ROSEVILLE GP

4219 PETALUMA GP
GP located in stunning 1,856 sq. ft. seller owned facility. State-of-the-art office includes 6 ops, staff lounge, reception area, private office, business office, lab area, sterilization area, consult room, separate storage area, bathroom plus private bathroom. Asking $525K.

4091 SOUTH VALLEY - HOLLISTER GP & PEDIATRIC
Country living at its best. Fully equipped 1,600 sq. ft. office with 2 enclosed adult ops and 3 open pedo ops. Asking price only $125K.

4151 MARIN COUNTY GP
Well established and respected, quality general practice located in desirable Marin County location. Office has convenient ample parking, overlooking a beautiful park like setting adjacent to a peaceful creek. Office contains 5 ops in ~1,300 sq. ft. Gross receipts average $1.2M annually with 3 doctor days/week.

4150 SANTA CRUZ COUNTY GP
Seller retiring from successful 33 year general practice. Fee-for-service only practice. Fully-equipped 4 op facility in beautiful, remodeled Seller owned building. Located in desirable residential and commercial neighborhood. Asking 654K. Building also for sale.

4108 HUMBOLDT COUNTY GP
Well-established, high performing general practice boasts 6 fully equipped ops. in 2,900 sq. ft. free standing office w/ Digital X-ray, 2 platinum Dexis sensors, & Cerec Omnicam & MCXL units. Loyal & stable pt. base in charming community, w/ a small town feel. Perfect for a dentist who wants to escape the grind and live along the coastline. 2016 GR $1.5M+. Seller willing to help for smooth transition. Asking $995K.

4140 SAN FRANCISCO GP

4093 SAN JOAQUIN ORTHO
Established over 35 years with a solid reputation, near several referral sources in seller owned building. 2,500 sq. ft. office with 7 chair open bay in professional center on a well-travelled street with many retailers. Avg. Gross Receipts $763K. Seller retiring and willing to help for smooth transition. Asking $561K. The building is available to purchase as well for $608K.

UPCOMING: NAPA COUNTY GP
Muscle relaxant (not required for conscious sedation)

Oxygen

Vasopressor (other than epinephrine)

Employee Kits

The U.S. Department of Labor’s Occupational Safety and Health Administration requires employers to keep emergency medical kits on-site should an employee be injured on the job. In addition to the required items in the following list, employers are advised to consider the types of injuries likely to occur on the job and add to their kits accordingly. Some states, including California, require a doctor to sign off on medical emergency kits, while other states do not.

Following are required emergency kit items as outlined by OSHA:

- Adhesive tape
- Box of adhesive bandages
- Directions for requesting emergency assistance
- Elastic wraps (two)
- Gauze pads (at least 4 by 4 inches)
- Gauze pads (two, at least 8 by 10 inches)
- Latex gloves

- One blanket (minimum)
- One package gauze roller bandage at least 2 inches wide
- Resuscitation equipment such as resuscitation bag, airway or pocket mask
- Scissors
- Splint
- Tweezers
- Triangular bandages (two)
- Wound cleaning agent such as sealed moistened towelettes

Keeping office medical emergency kits stocked and up to date is a simple way for dentists to keep their patients and employees safe and to protect themselves from liability. It is the responsibility of the practice owner to ensure emergency kits are regularly maintained and staff members understand their roles during emergencies. In addition, it is crucial to make sure the entire team knows where the emergency kits are located. Preparing for the worst can go a long way in preventing tragedy and can help mitigate risk should an emergency occur.

TDIC’s Risk Management Advice Line at 800.733.0633 is staffed with trained analysts who can answer emergency preparedness and other questions related to a dental practice.
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**6122 SANTA CLARA**  Great exposure and fantastic curb appeal. Office suite has just been remodeled. 5-ops. 2016 topped $700,000 on 4-day week. Perfect platform to operate 6-days a week. With focus and youthful enthusiasm, this practice easily tops $1+ Million/year in short order.

**6121 NAPA VALLEY FAMILY PRACTICE**  Highly respected community asset. Collections last 5-years has averaged $1.28 Million per year. Strong profits. Does no marketing to the community. 100% out-of-network. 2016 collected $525,000+ with strong profits.

**6120 OAKLAND’S PIEDMONT AREA**  Highly coveted area. Right off Highway 13. 3-days of Hygiene. 4-ops with 5th available. 2016 collected $650,000+.

**6119 NORTH BAY ORTHO**  Perfectly positioned for Ambitious Ortho. Desirable family community. Best technology, cone beam and paperless. Owner works part-time. Revenue streams averaged $775,000/year in past. Strong profits. Does no marketing to the local Dental Community.

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**6115 SAN FRANCISCO’S RUSSIAN HILL – CHINESE PRACTICE**  2016 shall collect $300,000 with Profits of $145,000. Has been a $400,000 year performer. Full Price $90,000.

**6112 HEALDSBURG**  Ideal as part-time practice in desirable locale or nice foundation to grow. 100% out-of-network. 2016 topped $210,000 in collections. Full Price $30,000.

**6111 SANTA ROSA**  Perfectly positioned for next Owner. Best equipment, networked and digital including Pano. 3-days of Hygiene. 2016 collected $525,000+ with strong profits. Conservative Owner. Great location.

**6107 EUREKA**  100% out-of-network with insurance industry. 2016 collected $930,000+ on Doctor’s 20-hour week. Doctor's schedule booked 3-months out. 7 days of Hygiene. Highly respected. Full Price $250,000. Condo is optional purchase.

**6098 WEST PETALUMA**  Petaluma has become the business center of the North Bay! Business parks are growing and young families are drawn to this great family community per the unique amenities of this historic river city. Collected $468,000 with Profits of $212,500. 4-days of Hygiene.

**6089 MOUNT SHASTA**  Small town living renowned for outdoor lifestyle. 3-day week collected $950,000. Very strong bottom line. Digital including Pano. Full Price $350,000.

### SOUTHERN CALIFORNIA

**6126 CERRITOS - EMERGENCY SALE**  Grossing $450,000. Digital with Pano. Well-equipped for Implants. Full Price $350,000.

**6125 DENTAL LOCATION**  Previously grossed $1.5+ Million. Rebuild & flip, or investment. Seller will stay and work. Great for MSO.

**6124 FASTEST SOUTHERN CALIFORNIA GROWTH AREA**  Proven location. 60,000 autos/day. 8-ops. Full Price $300,000.

**6123 GLENDALE**  Practice and high identity Real Estate available. Owner/Operator will do $500,000+. Gorgeous office. Full Price $350,000.

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**6119 PASADENA AREA - PEDO**  Grossing $450,000. Refers 30+ ortho cases/month. Margin at $390,000. Real Estate available.

**6118 RIVERSIDE**  Location to share. 4-ops, nice corner suite. Share $1,500 month rent. Seller willing to sell facility and work-back. Many options. Asking $90,000.

**6117 SAN FERNANDO VALLEY**  Established 40-years. Recently renovated with the best. Absolutely gorgeous. Absentee Owner. Previously did $1 Million. 6-ops. Grossing $550,000.

**6116 TOLLANCE**  Strip Center on Hawthorne. Gross $300,000. Refers endo, OS, implants, perio, ortho. Close to Palos Verdes. Double the gross. Full Price $295,000.

**6115 TORRANCE**  Grossing $150,000 part-time. 4-ops. No lease. Merger candidate or low cost to build up. Full Price $110,000.

**6114 TORRANCE**  Rare contract with Unions. Great fees. 100's of members get free dentistry. Another PPS client with same contract calls 50+ members every day to schedule exams. Full Price $185,000.

**6113 MORE OPPORTUNITIES AVAILABLE**  Bellflower, Corona, Dana Point, East LA, LA HMO Grossing $1.5 Million, Ladera Ranch, Norco.

**6112 COMING UP**  La Jolla, Lake Elsinore with Seller to work back, Murrieta grossing $1.5 Million, Newport, Pasadena, Poway, San Diego grossing $2.2 Million.

**CALL Tom Fitterer 714-345-9659**
A review of Cal/OSHA dental facility inspection data from October 2011 to September 2016 provides useful information to dentists who seek to reduce compliance risk. A total of 81 dental practices were inspected during that period and 49 of them were cited. Most of the cited facilities had between one and three citations. The most citations given to one facility was 13.

Most Common Citation

The most common citation issued to dental facilities was for not having a written injury and illness prevention plan. Twenty-six facilities did not have a written plan that must:

1. Identify the person(s) who has the authority and responsibility for implementing the injury and illness prevention program.
2. Describe a system for ensuring employees comply with safe work practices, such as a recognition program, disciplinary actions and training.
3. Describe how safety information is communicated to employees and how employees can inform employers of workplace hazards.
4. Include procedures for identifying and evaluating workplace hazards, including scheduled periodic inspections.
5. Include a procedure to investigate occupational injury or illness.
6. Include methods or procedures for correcting unsafe conditions or work practices.

If a dental practice claims exemption of the Cal/OSHA Aerosol Transmissible Disease (ATD) regulation, the plan must include procedures for screening patients for ATDs and the management of patients suspected of having an ATD. A sample injury and illness prevention plan is available on cda.org/practicesupport as part of the Regulatory Compliance Manual.

The second most common violation was failure to have a written exposure-control plan. Fourteen facilities did not have this plan as required by the Blood-Borne Pathogens regulation. A sample plan also is available as part of the Regulatory Compliance Manual.
**Serious Citations**

Cal/OSHA categorizes its citations by factors such as whether a violation was willful and by the extent and severity of the violation. Violations of the following Cal/OSHA regulations were deemed “serious” rather than “regulatory” or “general” and resulted in proposed penalties ranging from $1,575 to $5,400 each.

- Contaminated sharps shall not be bent, recapped or removed from devices. Cal/OSHA does allow contaminated sharps to be bent, recapped or removed from devices if the employer can demonstrate, and document in the Exposure Control Plan, that no alternative is feasible or that such action is required by a specific medical or dental procedure that is performed using a mechanical device or a one-handed technique.
- Immediately or as soon as possible after use, contaminated sharps shall be placed in sharps containers. Sharps containers shall be easily accessible to personnel and located as close as is feasible to the immediate area where sharps are used or can be reasonably anticipated to be found. Sharps containers should be placed in each operatory. Sharps containers must be disposed within 30 days of contents reaching the fill line.
- Handling, storage, treatment and disposal of all regulated waste shall be in accordance with the California Medical Waste Management Act. Sharps containers must be constructed and closed to prevent spillage or protrusion of contents during handling. Containers of nonsharps regulated waste shall be in closeable containers constructed to prevent spillage and leaks. All containers of regulated waste shall be labeled as biohazardous.
- Make HBV vaccination available to occupationally exposed employees.
- Carry out prescribed post-exposure evaluation and follow-up procedures.
- Take safe measures to neutralize or dispose of spills and overflows promptly where a corrosive substance is handled in an open container or drawn from a reservoir or pipe line. Appropriate precautions should be taken when employees continue to work while on-site construction projects are underway. A dental facility was cited when an employee fell through a temporary opening on a second floor. Both the dental facility and contractor were cited for not securing a cover to the opening and for not posting a warning sign. The initial penalty amount was greater than $10,000, but later was reduced on appeal.

**Other Significant Citations**

Other violations, while not deemed “serious,” did result in the assessment of significant initial penalties. These include:

- Failure to maintain a sharps injury log. The log is a record of each exposure incident involving a sharp. The log must contain information specified in the Blood-Borne Pathogens regulation.
- Failure to handle contaminated sharps using effective patient-handling techniques and other methods designed to minimize the risk of a sharps injury and to immediately place contaminated sharps in a sharps container after use.
- Failure to immediately report to Cal/OSHA an employee’s serious work-related injury. The hospitalization of an employee due to a work-related incident also requires reporting to Cal/OSHA.

Most Cal/OSHA citations of dental facilities are due to violations of the Blood-Borne Pathogens regulation. As dental employers are required to provide annual training on this regulation to employees, the mandatory training session is a good opportunity to review the violations described here and ensure appropriate procedures are followed in the facility.

Regulatory Compliance features resources about laws that impact dental practices. Visit cda.org/practicesupport for more than 600 practice support resources, including practice management, employment practices, dental benefits plans and regulatory compliance.
Life Outside the Operatory and Dental Ethics

Kenneth Jacobs, DDS

What is the essence that separates a profession from an occupation? Of course as professionals, we have committed ourselves to lifelong learning and service to the public, but the division between routine work and professional endeavors is deeply rooted in the concept of self-governance. In exchange for a commitment in seeking the greater good for society, we as professionals have been granted the ability to set many of our own rules of conduct within dentistry. We have been given the opportunity to be leaders not only within dentistry itself, but have also been given the responsibility to be legal, moral and ethical examples throughout society. With this great privilege comes enormous expectations. When we fail to uphold this privilege, not just within our professional community, but equally important in our basic societal endeavors, the ramifications can be devastating.

Section 4 of the CDA Code of Ethics plays a central role in emphasizing the essential nature of the elevated expectations placed on each of us. This section sets the bar so that each member of the association is expected to abide by ethical and legal standards accepted by the profession and society. Section 4 of the code specifically states, “A dentist has the obligation to comply with all state and federal laws and regulations. It is unethical for a dentist to violate any law of the state of California relating to the practice of dentistry or to engage in activity for which the dentist may be reprimanded, disciplined or sentenced by final action of any court or other authority of competent jurisdiction, when such action reflects unfavorably on dentists or the dental profession. It is also unethical for a dentist to engage in unprofessional conduct as it is defined by the Dental Practice Act.”

Within the practice of dentistry, a dentist must be well informed to ensure compliance with expected legal and ethical standards. Malpractice and negligence obviously breach intended clinical standards. Material misrepresentations and false claims to the public occur in violation of stated regulations. Misuse of dental auxiliaries and inappropriate prescription of medications violate state and federal laws. Yet, upon closer reading of Section 4 of the code, we see it extends beyond merely the practice of dentistry. By virtue of our covenant with society, this section of the code dictates that we are obligated to comply with state and federal laws and not engage in activity for which we could be prosecuted. Therefore, we place our livelihood in jeopardy by committing illegal acts that one might feel are unrelated to the practice of dentistry. We as dentists must avoid the misconception that we can separate an ethical life in the operatory from life outside of dentistry and vice versa. For example, conviction of tax evasion or operating a motor vehicle while under the influence could profoundly affect the status of your membership in organized dentistry, and more important, the standing of your dental license.

We as dentists must avoid the misconception that we can separate an ethical life in the operatory from life outside of dentistry and vice versa.

...continued...

Kenneth Jacobs, DDS, is a general dentist in Beverly Hills, Calif. He is a member of the CDA Judicial Council.

For more information or further guidance, contact your local ethics committee or Brittney Ryan, CDA Judicial Council manager, at 800.232.7645.

Responsibilities. While balancing harms and benefits, dentists are expected to minimize harms and maximize benefits for the patient. Similarly, having the good sense to practice utilizing the concept of “doing no harm” readily translates to our lives outside of clinical dentistry. Thus, driving under the influence can certainly do great harm beyond the practice of dentistry, and a criminal conviction for such an act would initiate notification and investigation by the dental board and ultimately a violation of Section 4 of the code. Furthermore, the ethical principle of integrity exemplifies that the dentist who practices with honor and decency affirms the core values and recognizes when words, actions or intentions are in conflict with one’s own values and conscience. Living a life with integrity shows us that clinical excellence in dentistry on one hand and the blatant violation of societal laws (such as spousal abuse) on the other hand are in conflict and thus a Section 4 violation. When making decisions in potentially murky waters, the professional ethical principles of the CDA Code of Ethics can certainly play a valuable role.
Extensive Buyer Exposure allows us to offer you

**BAY AREA**

**AC-566 SAN FRANCISCO**: Spectacular views of Washington Square. 3 ops +2 add’l, 1400sf
Price Reduced to $200k

**AC-578 SAN FRANCISCO Patient Charts**: near Union Sq., 7 Doctor pts/day and 8 Hygiene pts/day $190k

**AC-624 SAN FRANCISCO**: Wonderful Patients, solid income in great stand-alone bldg. $475k

**AC-640 SAN FRANCISCO**: On 23rd Floor of Prestigious SF Bldg, 2 ops in 700sf. Seasoned Staff, Seller Retiring $175k

**AC-649 SAN FRANCISCO Facility Only**: Richmond District, 3 ops+1 add’l, Equipment less than 5 yrs old $155k

**AG-655 SAN FRANCISCO**: Low Overhead, compact practice ready for expansion or relocation. Retail/Commercial area. 2nd Floor $125k

**AG-669 SAN FRANCISCO**: RARE opportunity in the heart of the City! 2 ops LOW OVERHEAD! $88k

**AN-513 REDWOOD CITY**: The practice of your dreams! 900 sf w/ 4 ops + 2 add’l! Now $350k

**AN-642 SAN BRUNO**: Don’t miss this one! FFS, 5 ops 1950 sf $740k (Real Estate $1.2M)

**AN-686 SAN FRANCISCO**: The office designed w/ patient flow and maximum office efficiency. 1,000 sf w/ 4 ops. $825k

**BC-520 HAYWARD Facility**: Located in Downtown, 1500 sf, 4 equipped ops, X-Rays in 3 ops. $65k

**BC-662 HAYWARD**: Starter Practice in the “Heart of the Bay”, near Hospital, 3 ops in 1056sf ONLY $75k

**BC-681 WALNUT CREEK**: Recently remodeled office located in this semi-rural community in a serene environment. 1000sf w/ 4 Ops. $432k

**BC-682 CONCORD**: located in desirable, bustling community w/ seasoned, caring staff. 836sf w/ 3 Ops. $224k

**BN-504 RICHMOND**: Established Practice & Real Estate! 1450 sf w/ 2 ops + 2 add’l $100k/RE $700k

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**BAY AREA CONTINUED**

**BN-679 ANTIQUE**: Established for more than 50 years W/ Large patient base! 3,600 sf w/ 9 Ops. $1.1mil/RE $1.2mil

**CC-611 SO. MARIN CO**: Desirable, well-established neighborhood, 20npts/mo 3 ops, 1100 sf Price Reduction $625k

**CC-632 SAN RAFAEL**: Small town life, vibrant-growth city, 6-8 pts/day, 3 ops in 800sf office in beautiful bldg $165k

**CC-661 SAN RAFAEL**: Located at busiest location in a well-known retail center in, 12+- npts/mo, 4 ops in 1,905sf $600k

**CN-616 NAPA**: State of the Art Practice - Seller moving out of state! $425k

**DC-480 SILICON VALLEY**: Multi-Specialty Practice, 14+ ops in 7500 sf, Owner Financing available Terms $1.075M

**DC-671 SAN JOSE**: Desirable neighborhood, 6 npts/mo, 3 ops in 900sf $150k

**DN-631 CAMPBELL**: Rare Opportunity! 1100 sf w/ 3 ops, busy retail center $249k

**DG-519 SANTA CLARA Facility**: Move In Ready! 2240 sf w/ fully equipped ops $225k

**DG-635 CASTRO VALLEY**: Excellent Location & Stellar Reputation! Solo Group Practice $650k

**DG-643 SAN JOSE**: Seller Motivated! 3,300 sf w/ 4 ops + 2 add’l available! Call for Details! **Only $65k**

**DN-665 SANTA CRUZ AREA**: Loyal, stable, multi-generational patient base. FFS. 1,460 sf w/ 4 ops. $540k

**DN-691 SAN JOSE**: One of the most unique practices you will ever see! 1450 sf w/ 5 ops $985k

**DN-688 MONTEREY**: Equipped with state-of-the-art equip& latest technology! 1,900 w/ 5 ops. $1.4mil/RE $795k

**DN-693 SAN JOSE Facility**: Attractive & Spacious! Faces one of the city’s major thoroughfares. 1,080 sf w/4 ops. $150k

800.641.4179 WPS@SUCCEED.NET
EC-531 GREATER SACRAMENTO: Beautiful 1750 sf w/ 4ops + 1 add’l office, 8npts/mo. $800k for Practice & Real Estate
EG-673 SACRAMENTO: Beautiful established dental practice lease opportunity! Call for Details!
EG-685 LINCOLN/ROCKLIN: Perfect Location in amazing community! Retail Shopping Center w/ 4 ops $570k
EN-625 SACRAMENTO: Looking for a HMO practice in a great Location? 2,500 sf w/5 ops $450k
EN-626 CARMichael: Lifestyle you just can’t be beat! HMO 1,250 sf w/ 3 ops $300k
EN-628 ORANGEVAL: Great place to work, play & live. HMO 1,310 sf w/ 4 ops + 1 add’l $375k
EN-627 CARMichael: Remarkable HMO opp. awaits your talent & skill! 1,200 sf w/3 ops + 1 add’l $268k
EN-634 ROSEVILLE: Beautifully designed, well-appointed and fully digital! 2352 sf w/4 ops + 2 add’l $235k
EN-660 ROSEVILLE: Highly-esteemed, well-respected, fee-for-service practice w/ loyal patient base. 2,950 sf w/ 5 ops $995k
EN-654 CITRUS HEIGHTS: Well-Established, & loaded with 30+ years of goodwill! 1300 sf, 3 ops + 2 add’l. $150k
EN-651 SACRAMENTO: Well-known for delivery excellent & compassionate care. 1750 sf, w/ 4 ops. $150k
EN-664 SACRAMENTO Facility: Great corner location, excellent visibility and easy access! 2,300 sf w/ 4 ops. $55k
EN-680 GREATER SACRAMENTO: Pristine in rural Northern California! Practice dentistry like it used to be! 1,500 sf w/ 4 ops. $295k
EN-689 SACRAMENTO Facility: Bring your talents, hang your sign & make it your own! 2,000 sf w/ 4 ops. $150k
FC-489 CLEARLAKE: Great lifestyle. 2015 Gross $915k on 3 day week, 4ops. Real Estate 3600 sf shared, interest “Pride Institute” designed office $470k
FC-650 FORT BRAGG: Family-oriented Practice, 5ops in 2000sf, 6 npts/mo $350k for the Practice & $400k for the Real Estate
FC-677 FORT BRAGG: Beautiful, FFS Practice, 4ops +1 add’l, in 2375sf, Grosses over $1M annually $500k
GC-472 ORLAND: Live & Practice in charming small town community. 1000 sf w/2 ops, Seller Retiring. $160k
GG-453 CHICO: 5000 sf w/ 7 ops Perfect for 1 or more dentists! $325k
GG-454 PARADISE: 2500 sf w/ 9 ops, 40 yrs goodwill! Amazing Opportunity! $525k
GN-244 OROVILLE: Must See! Gorgeous, Spacious 2500 sf w/5 ops! $315k

GN-399 REDDING: Loyal patient base & relaxed workweek schedule, 1440 sf w/3 ops $150k
GN-606 BUTTE COUNTY: Hesitate & you’ll miss out on this one-of-a-kind opportunity! 1700 sf w/ 4 ops Reduced $125k
GN-641 BUTTE COUNTY: Remodeled in 2010! In a well-maintained, long-established Professional complex. 1,200 sf w/ 2 ops. $95k
HN-213 ALTURAS: Well-managed, consistent revenues! Collected ~$760 in 2016! 2200 sf w/ 3 ops + 1 add’l. $195k
HN-280 NO EAST CA: Only Practice in Town 900 sf w/ 2 ops REDUCED! ONLY $60k
HN-618 SIERRA FOOTHILLS: Seller Retiring! Much room for growth by increasing office hours! 750 sf w/ 2 ops $95k
IG-687 TURLOCK: Established quality practice is a remarkable opportunity for you! 2,000 sf w/ 5 Ops. $298k

CENTRAL VALLEY

IC-468 SAN JOAQUIN VALLEY: High-End Restore Practice! 6 ops in 2500+ sf office. Call for Details! $425k
IN-569 MADERA: Stellar reputation and load with goodwill! 2,900 sf w/ 7 ops $634k
IN-690 LINDSAY: Stable, multi-generational patient base who are loyal & appreciative. 1,700 sf w/ 3 ops. $150k/ RE 150k

SOUTHERN CALIFORNIA

KC-678 LOMPOC & SANTA MARIA: Live and Price along the central coast, 10 npts/mo, plenty of room for growth, Call for Details! $240k

SPECIALTY PRACTICES

BC-600 CONCORD Ortho/Pedo Charts Only: Continue treatment to these Ortho/Pedo patients Call for Details! $400k
FN-536 LAKE COUNTY Pedo: Focusing on Prevent dental problems before they begin! 1750 sf w/ 3ops $225k
IC-543 CENTRAL VALLEY Ortho: 1650 sf w/ 5 chair bays & plumbed for 2 add’l, Strong Refs & Satisfied Pts Base $125k

“Ask the Broker” can now be found at www.westernpracticesales.com
A look into the latest dental and general technology on the market

Amazon’s Alexa Comes to iOS Shopping App

Alexa, the intelligent personal assistant developed by Amazon, has only been available exclusively through Amazon Echo and Echo Dot voice-controlled speakers, until now. Amazon recently updated its iOS shopping app to bring all the features of Alexa to the iPhone without the need to purchase additional hardware.

Users of the Amazon shopping app may have noticed the microphone icon in the upper right of the screen next to the search field. Previously, the microphone icon allowed users to perform product searches, reorder items previously purchased and track orders. With the shopping app update, users can now tap the microphone icon to activate Alexa directly from the iPhone without the need for saying “Alexa” as a wake-word. Alexa accepts the same commands from the shopping app as with the Echo or Echo Dot, including controls for any enabled Smart Home skills. Alexa can also be activated on the iPhone by using 3D Touch on the Amazon shopping app or through its app widget.

To take advantage of Smart Home devices and other skills, users must, in addition to the Amazon shopping app, download and setup the Amazon Alexa app on their device. As confusing as it sounds, this process is just like configuring an Amazon Echo or Echo Dot to use Alexa with the difference being only that the assistant resides in the shopping app and not from a voice-controlled speaker that is sold separately. Once Smart Home device configuration and enabling of skills are complete, users can activate Alexa on their iPhones to take advantage of all the features the assistant provides. Alexa has many abilities, from controlling lights and thermostats to simply asking it for the latest news or weather forecast.

Bringing Alexa to the iPhone opens Amazon’s powerful voice-controlled assistant to the masses. No longer tethered to speakers that reside in the home, Alexa can now be activated anywhere that an iPhone can be used. Along with the many Smart Home and app integrations that support Alexa, Amazon has released a powerful combination of features and portability that make it a strong competitor to other digital personal assistants available today.

—Hubert Chan, DDS

Asthma Study Relies on Smartphones

The idea that smartphones could play a big role in research was validated after a new study on asthma patients was conducted completely through iPhones. Mount Sinai Health System conducted its Asthma Mobile Health Study in 2015 using an app that was downloaded by 50,000 people. The app included surveys and the participants needed to check in daily using an “electronic asthma diary.” The number of individuals who participated was 7,593, and 85 percent of those who participated completed at least one survey and 2,317 completed multiple surveys in a six-month span. As a result, researchers were able to link asthma symptoms to an outbreak of wildfires and pollen levels and heat. Learn more about this study in the journal Nature Biotechnology, 2017; doi:10.1038/nbt.3826.

—Blake Ellington, Tech Trends editor

Professionalism Course Changes Medical Students’ Social Media Behavior

First-year medical students at George Washington University School of Medicine and Health Sciences altered how they were acting online after taking a course about social media and professionalism. The study included analyzing students who took the course between 2012 and 2014. The results found that 94 percent of those students who participated had an “increased awareness of their social media behavior.” This means they understood how it could tie into their careers. In addition, 64 percent of the students changed how they approached their social media use. The course delved into the challenges and opportunities of social media so students could use it to their advantage professionally. For more information, see the study in the journal Teaching and Learning in Medicine, 2017; 1-9 dx.doi.org/10.1080/10401334.2016.1275971.

—Blake Ellington, Tech Trends editor

Would you like to write about technology?

Dentists interested in contributing to this section should contact Andrea LaMattina, CDE, at andrea.lamattina@cda.org.
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