15 How Secure are You?  
Craig Ratner, D.M.D.  
Our patients rely on us to protect their personal health information. Are you doing all you can to reassure them, and meet your legal obligation?

21 Guardian of America’s Number-One Profession  
A conversation with NYSDA President Lawrence J. Busino, D.D.S.

24 An Overview of Sinus Augmentation Application  
Reham AL Jasser; Sebastiano Andreana; Afiya Tamkeen  
A review of maxillary sinuses anatomy, indications and contra-indications, and an explanation of proper clinical and radiographic evaluations. Discussion of techniques of sinus augmentation procedure, possible complications and how to resolve them.

31 Surgically Enhanced Orthodontic Treatment  
Daniel A. Kuncio, D.D.S.; Maria A. Karpov, D.M.D., M.S.; Sherrill Fay, D.M.D., M.D.  
Recently, orthodontists have been teaming with oral surgeons to expand options for adult patients requiring treatment of severe malocclusion. How an osteotomy procedure was used to enhance comprehensive orthodontic treatment in an adult woman. Case report.

34 Management of Chronic Candidosis Associated with Severe Epithelial Dysplasia  
Case of chronic hyperplastic candidosis with areas of severe epithelial dysplasia in 40-year-old male patient is described. Includes discussion of several possible factors that could have led to development of condition and influence of microorganisms and important cellular changes.

39 Internal Revenue Service Confirms Economic Difficulties Faced by Dentists since Last Recession  
H. Barry Waldman, D.D.S., M.P.H., Ph.D.; Steven P. Perlman, D.D.S., MScD, DHL (Hon); Charles D. Larsen, D.M.D., M.S.  
IRS data reinforces need for profession to consider efforts to deal with inability to reach underserved populations, particularly high-risk children and individuals between 18 and 64 years of age.

43 Maxillary Arch Reconstruction in Patient with Moderate Wear Utilizing Zirconia Restorations to Restore Form, Function, Esthetics  
For all of its benefits as a restorative material, zirconia still presents technical complications. A demonstration of favorable clinical outcome is tempered by need for further study to better understand long-term restorative outcomes of zirconia.
Monotasking in a Multitasking World

Are your electronic devices getting in the way of quality patient care?

Sirens wail. Lights flash. “Doctor, do you know why I stopped you?” “Distracted doctoring?!?” As healthcare professionals, we increasingly consult electronic records, computers, smartphones and iPads during the treatment of our patients to ensure that we collect all pertinent data in the name of increased quality of care. Many see it as a necessary form of multitasking, to stay connected in a data-driven system. Others abuse the privilege and use the same technology to simultaneously conduct personal business. In either case, similar to distracted driving, the overreliance upon electronic devices—to the point of distraction in patient encounters—can actually reduce the quality of care and result in increased errors. More importantly, when attention to technology or the “e-patient” outweighs our focus on the real patient, the resultant lack of interpersonal contact impoverishes dialogue between doctor and patient.

While this trend has plagued medicine for years, with the widespread use of digital radiography and electronic recordkeeping, it now presents the same challenge for dentists. We, as dentists, must devote our undivided attention to and focus on our collaboration with our patients. Only with this form of monotasking can we successfully obtain the personal, subjective information critical to tailoring a treatment plan that accurately addresses our patients’ individual needs and desires.

The doctor-patient dialogue generates two key types of information. First, we obtain all the objective findings necessary to make a diagnosis and formulate a treatment plan. Connecting with electronic devices assists in this respect, since we can quickly collect and correlate all the information needed to support these decisions. Second, through collaborative dialogue, we utilize our skills of observation, active listening, problem solving and communication to understand the individual’s unique circumstances. If we fail to invest the hard work and time of personally connecting with the patient, we will lack the subjective knowledge essential to determining specific solutions to the patient’s problems. With reduced face-to-face patient interaction, we may gather all of the correct objective data gleaned from electronic record templates and Internet searches, but never hear and address the patient’s chief complaint and actual concerns.

Monotasking, or dedicating oneself to focusing on one given task until it is complete, provides the greatest opportunity for a doctor to observe, actively listen and personally connect with patients to earn their trust. Eye contact allows parties in a conversation to communicate nonverbally through body language, posture, facial expressions and appearance. The underlying emotions expressed in this manner often carry most of the intended meaning. Discovering an individual’s needs and desires requires dialogue at this level. Once this dialogue establishes mutual trust, patients will more willingly and truthfully reveal private, and sometimes embarrassing, facts, which could radically alter treatment.
As one would expect, cognitive scientists have shown that engaging in secondary tasks disrupts primary task performance. We mute interpersonal communication when we spend more time gazing at a computer monitor, feverishly completing templates, checking our email or texting than in face-to-face conversation with the patient. As a result, multitasking with electronic devices during patient encounters could easily preclude the dentist from learning the critical information necessary to act in the best interests of the patient.

Multitaskers feel pressure to interact with their electronic devices. In their analyses, they must stay electronically connected in order to gather the data necessary to meet the legal standard of care and to satisfy societal expectations of caregivers’ best practices. Furthermore, some neuroscientists maintain the brain actually does not know how to monotask. They contend everything we do as humans involves coordinating multiple cognitive tasks happening at once. Hence, monotasking, as defined, does not exist for them.

These contentions, regretfully, miss the point. Building trust requires the undivided attention of human beings in any relationship, and monotasking enables the process. Only a personal relationship with a trusted professional will empower patients to exercise their right to self-determination in healthcare decisions. We take the easy way out and compromise the dentist-patient dialogue when we substitute the search for electronic data for the search for the truth about our patients and their personal circumstances. In fact, dentists greatly increase the risk of rendering substandard care when we treat a stranger. We need and welcome the input of electronic information, but not at the expense of the patient’s autonomy. In the end, dentists must ensure that the best interests of the patient dictate the use of technology, rather than allowing the technology to dictate the patient’s best interests.
Orofacial Adverse Effects of Antiretroviral Therapy

Rationale for including dentists in medical team caring for HIV/AIDS patients.


Highly active antiretroviral therapy (HAART), which reduces viral load to facilitate recovery of immune function, has played a central role in reducing morbidity and mortality associated with HIV/AIDS. HAART consists of a combination of three or more medications from two different classes of antiretroviral drugs (two nucleoside reverse transcriptase inhibitors [NRTIs] and integrase strand transfer inhibitor [INSTI], non-nucleoside reverse transcriptase inhibitor [NNRTI] or protease inhibitor [PI] with pharmacokinetic [PK] enhancer).1

Although reductions in HIV-associated oral lesions have been documented in patients on HAART,2 a number of side effects that can increase risk for oral diseases and impact oral health-related quality of life (OHQoL) have been reported.3 Patients may discontinue HAART secondary to QoL declines.4 Dentists can play a central role in managing oral symptoms and discomfort, which is why it is important that dentists work with the medical team to educate patients about the need to adhere to HAART treatment regimens.

Oral Effects of HAART Medications

Notable orofacial adverse effects, such as xerostomia, oral ulceration, dysgeusia, parotid lipomatosis and cheilitis, have been documented in 7% to 57% of patients on HAART medications.5 Xerostomia and parotid lipomatosis may increase the risk for dental caries and oral candidiasis, and result in difficulty speaking, chewing and swallowing. In addition to drug-related adverse effects, immune reconstitution syndrome may result in oral mucosal consequences, most notably, an increased risk of developing oral warts in patients with HPV infection.6

Oral Management of Patient on HAART

Patients presenting with orofacial manifestations that are not life-threatening (e.g., dyslipidemia) may be managed by pharmacologic interventions, lifestyle changes or modification of the HAART regimen. Oral side effects associated with specific drugs and management strategies are listed in Table 1.

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REFERENCES


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<table>
<thead>
<tr>
<th>Orofacial Adverse Effect</th>
<th>Drug Class</th>
<th>Drug (Brand Name)</th>
<th>Management</th>
</tr>
</thead>
<tbody>
<tr>
<td>Xerostomia (may increase risk for dental caries)</td>
<td>NRTI</td>
<td>Didanosine (Videx)</td>
<td>• Replacement/stimulation of saliva: suggest saliva substitutes, sucking on sugar-free hard candies/ice chips, chewing sugar-free gum.</td>
</tr>
<tr>
<td></td>
<td>NNRTI</td>
<td>Emtricitabine (Emtriva)</td>
<td>• Recommend increased water intake.</td>
</tr>
<tr>
<td></td>
<td>PI</td>
<td>Lamivudine (Epivir)</td>
<td>• Systemic treatment with pilocarpine HCl 5 mg.</td>
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<td></td>
<td></td>
<td>Zidovudine (Retrovir)</td>
<td>• Consider fluoride varnish/chlorhexidine rinse/fluoride toothpaste/rinse.</td>
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<tr>
<td></td>
<td></td>
<td>Efavirenz (Sustiva)</td>
<td>• Reinforce oral hygiene.</td>
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<tr>
<td></td>
<td></td>
<td>Nelfinavir (Viracept)</td>
<td>• Recommend diet modification.</td>
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<tr>
<td></td>
<td></td>
<td>Ritonavir (Norvir)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Saquinavir (Invirase)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Darunavir (Prezista)</td>
<td></td>
</tr>
<tr>
<td>Parotid lipomatosis (may increase risk for dental caries)</td>
<td>PI</td>
<td>Amprenavir (Agenerase)</td>
<td>• Refer for evaluation of surgical management in patients concerned about facial esthetics.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Indinavir (Crixivan)</td>
<td>• Recommend increased water intake.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Nelfinavir (Viracept)</td>
<td>• Reinforce oral hygiene.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Ritonavir (Norvir)</td>
<td>• Recommend diet modification.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Saquinavir (Invirase)</td>
<td>• Consider fluoride varnish/chlorhexidine/fluoride toothpaste/rinse.</td>
</tr>
<tr>
<td>Bleeding Disorder</td>
<td>NNRTI</td>
<td>Delavirdine (DLV);</td>
<td>• Consultation with physician regarding need for therapy prior to dental procedures.</td>
</tr>
<tr>
<td></td>
<td>PI</td>
<td>Tipranavir (Aptivus)</td>
<td>• Ensure vigilance during dental procedures.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• Placement of absorbable gelatin, collagen/micro-fibrillar collagen/oxidized regenerated cellulose.</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>• Advise soft diet/avoiding behaviors that may provoke bleeding.</td>
</tr>
<tr>
<td>Taste Disturbances</td>
<td>NRTI</td>
<td>Zidovudine (Retrovir)</td>
<td>• No guidelines exist for pharmacologic management of taste disturbances.</td>
</tr>
<tr>
<td></td>
<td>NNRTI</td>
<td>Nevirapine (Viramune)</td>
<td>• Zinc sulfate may be useful, but may negatively impact immune system if used in excess.</td>
</tr>
<tr>
<td></td>
<td>PI</td>
<td>Indinavir (Crixivan)</td>
<td>• Recommend consuming foods that are cold/at room temperature.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Ritonavir (Norvir)</td>
<td>• Recommend avoiding use of silver metallic silverware.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Saquinavir (Invirase)</td>
<td></td>
</tr>
<tr>
<td>Oral Ulceration with or without Stomatitis</td>
<td>NRTI</td>
<td>Emtricitabine (Emtriva)</td>
<td>• Recommend topical corticosteroids (dexamethasone elixir) swished for one minute, then expectorated. Systemic corticosteroids such as prednisone may be used for more severe/recurrent occurrences.</td>
</tr>
<tr>
<td></td>
<td>NNRTI</td>
<td>Zidovudine (Retrovir)</td>
<td>• Manage pain using topical or systemic analgesics:</td>
</tr>
<tr>
<td></td>
<td>PI</td>
<td>Delavirdine (Rescriptor)</td>
<td>° Topical analgesic use may blunt taste buds and impact nutrition.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Nelfinavir (Viracept)</td>
<td>• Overtreatment oral formulation of 2-octyl cyanoacrylate (Orabase Soothe-N-Seal) may be used as barrier product for managing localized oral pain.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Ritonavir (Norvir)</td>
<td></td>
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<td></td>
<td></td>
<td>Saquinavir (Invirase)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Tipranavir (Aptivus)</td>
<td></td>
</tr>
<tr>
<td>Oral Warts</td>
<td>Specific drugs not documented</td>
<td></td>
<td>• Refer to oral and maxillofacial surgeon for surgical excision/directed liquid nitrogen sprays/intralesional treatment with bleomycin/interferon-alfa.</td>
</tr>
<tr>
<td>Increased Salivation</td>
<td>NNRTI</td>
<td>Delavirdine (Rescriptor)</td>
<td>No guidelines exist for pharmacologic management.</td>
</tr>
<tr>
<td>Erythema Multiforme</td>
<td>NRTI</td>
<td>Abacavir (Ziagen)</td>
<td>• Mild/localized lesions: topical steroids Fluocinonide/Fluocinonide ointment in Orabase (1:1); Clobetasol ointment in Orabase (1:1); Dexamethasone oral rinse (0.5 mg/5 ml).</td>
</tr>
<tr>
<td></td>
<td>NNRTI</td>
<td>Didanosine (Videx; Videx EC)</td>
<td>• Severe lesions: start patient on both topical and systemic steroids (prednisone).</td>
</tr>
<tr>
<td></td>
<td>PI</td>
<td>Delavirdine (Rescriptor)</td>
<td></td>
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<td></td>
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<td>Efavirenz (Sustiva)</td>
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<td>Etravirine (Intelence)</td>
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<tr>
<td></td>
<td></td>
<td>Nevirapine (Viramune)</td>
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<td></td>
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<td>Ritonavir (Norvir)</td>
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<td>Saquinavir (Invirase)</td>
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</tr>
<tr>
<td></td>
<td></td>
<td>Efavirenz (Sustiva)</td>
<td></td>
</tr>
<tr>
<td>Hyperpigmentation of Oral Mucosa or Lip</td>
<td>NRTI</td>
<td>Zidovudine (Retrovir)</td>
<td>• Rule out hairy leukoplakia.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Emtricitabine (Emtriva)</td>
<td>• Recommend use of lip moisturizers containing sunscreen and avoid sun exposure.</td>
</tr>
<tr>
<td>Cheilitis</td>
<td>PI</td>
<td>Indinavir (Crixivan)</td>
<td>• Application of Nystatin and Triamcinolone cream 2 to 4 times/day.</td>
</tr>
</tbody>
</table>

Patients may present with other orofacial adverse effects, including Steven-Johnson syndrome/toxic epidermal necrolysis, facial lipodystrophy, which should be managed in collaboration with medical team.
How Secure Are You?

Protecting patient information is not just a courtesy, the law requires it.

Craig Ratner, D.M.D.

In a recent interview, Julian Assange, founder of WikiLeaks, an international nonprofit organization that publishes secret information, news leaks and classified data from anonymous sources, claimed, “Everything is almost completely insecure now. Computer systems have become so complex that it is not possible to understand all the parts, let alone secure them. It’s just impossible.”

He was referring to the now famous hacking of the Democratic National Committee’s (DNC) emails. The release of such information may very well have been a critical turning point in the 2016 presidential election. When reporting on the hacking, however, the Wall Street Journal noted that the hackers had tried, and failed, to access the Republican National Committee (RNC) using the same methods as the DNC hackers. So, what made the RNC secure and the DNC vulnerable? We may never know. But the questions these events raise should concern us as individuals, professionals and business owners. What can we do to prevent unauthorized access to our information? How can we protect our patients’ information?

We think we are in the “dentistry business,” the business of restoring health and function to our patients. However, we are also in the information-collection and storage business. We generate and store vast amounts of data about our patients. Patient demographics, including sensitive financial information; medical and dental insurance information; medical and medication history; notations of existing clinical conditions; clinical progress notes; treatment plans; radiographic exams; photographs; and lab communications are just some of the information we gather and store. More than likely, we are storing and transmitting this information electronically.

To compound the problem, we must have our locally stored data interact with external agencies as well. Some of our dental practice management software systems are cloud-based. Most insurance claims and inquiries now are sent electronically. Some of us back up our systems to the cloud. We communicate and collaborate with labs, colleagues and specialists via email. We send e-prescriptions to pharmacies for controlled and non-controlled drugs. The more our systems interact with external systems, the more vulnerable they become.

As Mr. Assange said, electronically stored information is vulnerable to attack. This has been proven countless times in recent history, to the point we have become almost numb to news of major breaches into businesses such as Sony, eBay and Yahoo. Each of these businesses had millions of electronic records stolen and cost them millions of dollars. The healthcare industry is not
immune. Not too long ago, Anthem Blue Cross Blue Shield had eight million records breached and compromised. It cost them over $100 million in reparation costs.

High-Priced Medical Data
But why would someone want to breach a dental office computer or network? Information released by the Department of Health and Human Services estimates that as much as 36% of all electronic data breaches occur in the healthcare sector. So, obviously, healthcare information is a coveted target. There is money to be made from the information we, as dentists, store. According to Govtech.com, “a thief could make $50 for a medical identification number compared with $1 for a Social Security number.” Electronic dental records, most times, store both.

Besides the potential catastrophic financial liability, securing our patient’s electronic protected health information (ePHI) is required by law. The Security Rule of the Health Insurance Portability and Accountability Act (HIPAA) of 1996 dictates that health professionals who utilize or transmit ePHI must employ certain standards or protocols that protect their patients’ ePHI. Actually, per HIPAA security regulations, we have an obligation to uphold three main tenets related to our patients’ ePHI. We must keep their ePHI secure, protect its integrity and make it available when requested. This is a conundrum. It would be easy to secure the information if we could keep it locked away for only our eyes to see. It would be easy to ensure the information stored on our systems is correct and has not been changed if we did not have to interact with any outside systems. And, it would even be easy to make all the ePHI available to anyone who wanted it if we did not also have to ensure its integrity and security. But we must provide for all three.

Mr. Assange claims it is impossible to secure a system completely. He is probably right. So, what can you do to protect your business, your patients and yourself? Well, the good news is that HIPAA security regulations concede the fact that you probably cannot completely secure your ePHI. They only require that you assess the risks associated with the storage and transmission of your ePHI and develop a reasonable plan to manage and mitigate those risks by completing a formal ePHI risk analysis or assessment. This is a written assessment that identifies the threats to your ePHI systems and the impact a resulting breach would have from those threats. When the nature of the threat and the impact are combined, a resulting risk score is obtained. The dentist can then use this list to develop a reasonable plan to manage them.

Numerous sources have been developed to guide dentists in the risk assessment process. The ADA HIPAA Compliance Kit contains a risk assessment tool. It is available from ADA Publications and can be purchased on www.ada.org. The National Institute for Standards in Technology (NIST) has also developed a risk assessment tool that is available on its website, www.nist.gov. Additionally, there are many IT and compliance consultants available to help the dentist, for a fee. Our own NYSDA IT Committee devotes a lot of time to this process in its HIPAA Security Compliance Course. The course, which simplifies the compliance process and presents many commonsense protective strategies, is being presented throughout the state. Participants receive a complimentary “NYSDA HIPAA Security Compliance Manual” that includes this risk assessment and instruction on how to complete it. For more information on the course and dates it is being given near you, go to www.nysdental.org.

But just filling out a risk assessment does not absolve you of the responsibility to keep your patients’ ePHI safe and secure. You need to use your completed risk assessment to establish reasonable office security protocols. What does reasonable mean? The answer is “as much as you can.” I compare the security of my practice’s ePHI to the security I provide for my home. I maintain commonsense measures that make it more difficult for evildoers to penetrate my home defenses. In doing so, they might find an easier target elsewhere and, thus, leave me alone. We have all heard that it is wise to have a dog because burglars will not want to deal with a barking dog. Or, that even just having a sign that says you have an alarm system is better than nothing at all. If the perception is that you are a more difficult target, the burglar will seek to enter another less defended home. I am not implying that you should tape a sign to your office network’s server that says “Beware of Dog.” However, you should provide every reasonable protection for your data. And there are many reasonable protections that are well within the reach of all dental practices.

Locking up Your Files
Data protection can be grouped into two distinct categories: physical safeguards and technical safeguards. Physical protections are how we physically restrict access to the equipment containing the ePHI. Doors with locks, alarms, even security monitoring cameras are examples of physical defenses that prevent unauthorized access. Technical safeguards include electronic protections, such as firewalls, anti-virus programs, robust password protocols and diligent backup routines. Don’t let the term “technical safeguards” scare you. Protections such as firewalls and anti-virus programs are often included with computer equipment and are easy to use.

A firewall is a network security system, either hardware- or software-based, that uses rules to control incoming and outgoing network traffic. A firewall acts as a barrier between a trusted network, like your office, and an untrusted network, like the Internet. Software-based firewalls are included with most operating systems. Microsoft’s Windows 7, 8 and 10 all have firewalls included and are active by default. Apple’s OS X includes a software firewall.
While software firewalls provide some protection, hardware-based firewalls provide even more protection. You are probably unaware that you have hardware-based firewalls already installed in your office. If your office accesses the Internet through a router or switch, you have a hardware-based firewall. Typically, office networks use routers or switches to connect all of the offices computers through Ethernet cables or Wi-Fi. They control the flow of information from computer to computer. Typically, these pieces of equipment also have another connection, one to the Internet. It is the separation of this external connection from the internal connections that is critical. The hardware can then act as a filter between the external Internet and the internal office network. It can keep out unauthorized invasions from external sources. This is the protection that impedes hackers from accessing your office’s network. The firewall can also block outgoing internal requests that might lead to the download of harmful information that could infect the office network. Typical settings in the firewall can restrict employees from accessing unauthorized websites that might lead to infections from malware, such as computer viruses.

Antivirus and antimalware programs are very common and easily obtained. But none of them will work unless three very important factors are considered. First, the programs must be installed on every computer. Second, they must be up-to-date. Lastly, periodic scans must be completed.

Installing antivirus software on all the practice’s computers makes sense whether or not the computer is used to access external information. All computers can import information from external sources, such as jump drives and DVDs. Thus, if the computer has anything installed on it, or data transferred to it, it has the potential to be infected. Additionally, if the computer is connected to the practice’s network, infection through its network connection is certainly possible.

An antivirus program is only as good as its latest update. The software developer is constantly updating the program’s virus definitions to incorporate the latest threats. Unfortunately, these threats change daily. As long as there are individuals who want to gain access to others ePHI, they will constantly be trying to find new and different ways to get access to it. So, make sure you update the antivirus software often.

Lastly, installing and updating the antivirus software will not prevent problems unless you instruct the program to actively scan for malware. On installation of the software, make sure you do a complete scan, one that scans the entire hard drive, including the operating system folders. After that, most programs have func-
Be Creative with Passwords

A strong password protocol is essential to protect ePHI in the dental practice. This generally means three things: unique User IDs and passwords; best practices for choosing passwords; and a requirement that passwords are changed periodically. First, everyone who has access to the ePHI must have a unique User ID and password. The common practice of one User ID and password combination for the entire office is very insecure. Additionally, if someone in the office was corrupting the data or using the data for malicious uses, there would be no way for you to distinguish the identity of the culprit. Secondly, passwords need to be complex and not easily guessed. Using common passwords like “password” or “123456” will only lead to unwanted external access and problems. Passwords of at least eight characters utilizing combinations of upper and lower cases letters, combined with numbers and special characters, such as “%,” “&,” or “!” for example, tend to be the safest. It helps if the passwords have no connection to the practice or personnel. Nonsense phrases or completely random combinations of letters, numbers and special characters work well. Lastly, you should require everyone in the practice to change his or her password regularly. Stale or stagnant passwords are more easily hacked. The longer a password remains the same, the more opportunities external agents have of cracking it.

The leading reason for poor password hygiene is that complex passwords can be hard to remember especially with the large number of passwords we all have these days. One suggestion may be to use a password manager program. These inexpensive programs store all your passwords securely under one master password. They can also generate very complex passwords for you. A relatively easy solution is to combine contextual information, like the program name and the current timeframe with a random, nonsense word for your passwords. For example, if you were trying to generate a password for Eaglesoft, you might use a password such as “Eaglesoft%rufus052017.”

As Mr. Assange has said, no number of technical safeguards can categorically prevent problems from happening. Thus, no article on data protection would be complete without a strong word about proper backup. If your system is compromised with malware, or if you have a hardware failure, restoring your practice’s ePHI is relatively simple. After fixing the problem, such as using antivirus software to inoculate the computer or even replacing the entire computer, retrieving the data is a simple matter of restoring it from your backup. Separate backups of ePHI should be done daily, weekly, monthly and annually. A number of network servers do dynamic backups by mirroring the primary hard drive on a continuous basis. Backup can be done to a remote cloud-based service, to another computer on the network and/or to a removable media device. A combination of local backup and remote backup probably provides the most security and convenience.

If your main data server goes down from virus or hardware malfunction, having another computer on the same network that contains the same data certainly makes it easy to get going again. Simply direct your practice management software to the new location of the data and you will be running again. Removable and remote backups provide more security, in that they are removed from the premises. But they would need to be restored onto a new computer or hard drive to be functional again. With the amount of data most practice management and imaging systems currently contain, this can take many hours. Lastly, please be sure to do routine periodic tests of your backup. The only true way to ensure that your backup system is working properly is to periodically restore the data and try to use it. Do not assume that the backup program has actually copied all of your data.

It is truly unfortunate that we must be so concerned with the protection of our practice’s ePHI. It is unfortunate that we must protect that ePHI from external agents who seek to infiltrate our office data stores. But that is the reality. Employing tools such as risk assessments and risk management practices will put your practice in less peril. Firewalls, antimalware programs, vigorous password protocols and diligent backups are only some of the risk management best practices that today’s dental offices can use to protect themselves and their patients. Sure, HIPAA regulations require us to employ these measures. But, more importantly, our patients rely on us to protect their information, just as we rely on our own healthcare providers to protect our personal health information and on our banks and brokers to protect our financial information.

So, what are you doing to protect your patients’ information?
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An oral surgeon for 37 years, Larry Busino’s Albany office is well-staffed by, from left, Jenna Primiano, Aubrey Huestis, Mary Anne Crowder, Mary Klahr, Kay Foulke, Dr. Busino, partner Robert Doriot, Meghan Loiselle, Kaitlin Worobey, Sue Terradista, Alicia Dinuz, office manager Kyle Busino.

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As New York transitions its Medicaid program to managed care companies, practitioners and patients face new challenges. Members of the NYSDA Special Committee on Dental Medicaid have raised questions about whether the scope of patients’ Medicaid dental coverage changes when they are assigned to a managed care company (MCO) for their Medicaid benefits. Some have noted that managed care companies deny benefits for procedures covered by the New York State Department of Health (DOH) in accordance with its Medicaid Dental Policy Manual. DOH requires that all managed care companies providing services to Medicaid recipients offer, at a minimum, the same benefits as the state Dental Medicaid Program. An MCO may provide benefits that are more generous, but they cannot be more restrictive.

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Members of the NYSDA Special Committee on Dental Medicaid cite instances where a managed care company has denied a claim for benefits that the New York State Medicaid program covers. Given the minimal reimbursement provided by these plans, a practitioner may decide it is not worth the time and effort to appeal a denial or reduction in benefits. Patients have little incentive and are reluctant to pursue complaints when they do not have access to the services to which they are entitled. If an MCO does not provide benefits that are consistent with DOH Medicaid policy, practitioners are encouraged to notify DOH with an email to its managed care complaint line: managedcarecomplaint@health.ny.gov.

Allowances and limitations for fluoride and continued orthodontic treatment are two categories of service that are sources of problems for practitioners. What are New York State Medicaid policies?

Fluoride Treatments
A member of the Medicaid committee advised NYSDA that an MCO is denying claims for fluoride treatments (D1208) submitted for her adult patients with exemption code 95. These patients were transferred into the MCO from the “fee-for-service” (FFS) Medicaid program. The MCO’s stated basis for denying reimbursement is its policy that “D1208 is covered through age 16.”

According to the DOH Medicaid Dental Policy Manual, however, procedure code D1208 (topical application of fluoride—excluding varnish) is a covered benefit for “recipients between the ages of 1 and 20, inclusive.” For recipients 21 and older with exception codes RE 81 (traumatic brain injury) and RE 95 (OMRDD patients), this benefit is a covered service with no age restrictions.

Removing Orthodontic Bands from a New Patient
Another member of the Medicaid committee inquired as to whether he should be reimbursed when a patient who had previously been in orthodontic treatment and had orthodontic appliances placed by a former dentist transfers into his practice. Such patients may have been in treatment with a different orthodontist, with an orthodontist practicing in another state, or have had previous Medicaid coverage provided by FFS Medicaid or a different MCO. His complaint was that these patients’ MCOs deny payment for removing bands placed by the patients’ former orthodontists.

The policies described on pages 62, 63 and 68 of the Medicaid Dental Provider Manual address coverage for removing bands and brackets from patients. The first three policies (re-
produced below) apply specifically to billing when an orthodontist discontinues treatment.

**MEDICAID MEMBERS CANNOT BE BILLED**

Reimbursement for orthodontic services includes the placement and removal of all appliances and brackets. Should it become necessary to remove the bands due to non-compliance or elective discontinuation of treatment by the provider, parent, guardian or member, the appliance(s) must be removed at no additional charge to either the member, family or Medicaid.

**DISCONTINUATION OF TREATMENT**

In cases where treatment is discontinued, a “Release from Treatment” form must be provided by the dental office that documents the date and the reason for discontinuing care. The release form must be reviewed and signed by the parent/guardian and member. The “Release from Treatment” form must indicate that all those involved understand future orthodontic treatment will not be covered by Medicaid. A copy must be sent to DOH.

**BEHAVIOR NOT CONDUCTIVE TO FAVORABLE TREATMENT OUTCOMES**

If orthodontic treatment is discontinued for cause, the parent/guardian and/or member must sign a statement indicating they understand treatment is being discontinued prior to completion; the reason(s) for discontinuation of treatment; and, that it will jeopardize their ability to have further orthodontic treatment provided through the NYS Medicaid Program. The treating orthodontist must make reasonable provisions to provide necessary treatment during the transition of care to another provider or for debanding. Dismissal of a member (patient) from a practice is a medicolegal issue; therefore, the treating orthodontist should seek an appropriate legal counsel at their own discretion.

The Medicaid Provider Manual provides DOH’s policy and accepted CDT code for transfer cases on p. 68:

- D8690, Orthodontic treatment (alternative billing to a contract fee) (REPORT NEEDED). Services provided by an orthodontist other than the original treating orthodontist. This is limited to transfer care and removal of appliances.

For a transfer case, DOH pays $80 per arch for removal of orthodontic bands and brackets, procedure code D8690. DOH does not allow additional reimbursement for the patient’s original treating orthodontist for “debanding.”

In conclusion, as with any participating provider contract, it is important for Medicaid providers to be familiar with the limitations in their contracts with managed care companies. In addition, Medicaid providers should ensure that any managed care plan with which they have contracted is, at a minimum, providing the same benefits as the New York State Dental Medicaid Program.

In particular, when negotiating a contract with an MCO, practitioners should focus their attention on those procedures they perform in their practices. It is critical to understand the MCO’s reimbursement policy and any limitations associated with each procedure before signing a participating provider contract.

It also is imperative that practitioners participating in the Medicaid program consult the current DOH Medicaid Dental Policy Manual (available on the DOH website) and subscribe to the monthly Medicaid Update.

Members of the NYSDA Council on Dental Benefit Programs and NYSDA staff are available to assist members who are experiencing problems with managed care companies or other dental benefit providers. Contact NYSDA at 1 (800) 255-2100, or jshub@nysdental.org.△

Dr. Hanlon is chair of the NYSDA Special Committee on Dental Medicaid. Dr. Shub is NYSDA Assistant Executive Director for Health Affairs.
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An Overview of Sinus Augmentation Application

Reham AL Jasser; Sebastiano Andreana; Afiya Tamkeen

ABSTRACT

The purpose of this paper is to report important aspects related to a sinus augmentation procedure by reviewing maxillary sinuses anatomy, indications and contra-indications and explaining proper clinical and radiographic evaluations. It also discusses different techniques of the sinus augmentation procedure. These include lateral window sinus elevation and internal sinus elevation with or without simultaneous implant placement, as well as how to prevent complications related to these procedures and how to overcome them if they occur.

The posterior maxilla creates a unique challenge when minimal bone height remains inferior to the sinus floor. The inadequate bone volume often is encountered as a result of a combination of ongoing maxillary sinus pneumatization and normal post-extraction bone atrophy. It has been documented that 43% of residual ridge height of edentulous posterior maxilla measures 4 mm or less of residual bone crest to the sinus floor,1 therefore, showing a reduced vertical amount of bone. As an additional challenge, the posterior maxilla has poorer bone quality than the mandible, with the highest percentage of Type IV bone.2

Implant therapy in the posterior maxilla often is accomplished using shorter length implants. When an unfavorable crown-to-root ratio is anticipated, augmentation of the alveolar bone height should be considered. When the distance from maxillary sinus floor to the crest of the ridge is 5 mm or less, it is recommended that sinus elevation surgery be performed through a lateral window approach. However, when this distance is more than 5 mm, a less invasive approach—internal sinus elevation—can be considered.3,4 Proper knowledge of the anatomy of the maxillary sinuses and associated vital structures, adequate evaluation of each individual case—clinically and radiographically—and patient-related factors are crucial for achieving successful results with this surgical procedure.

Anatomy

Before performing sinus augmentation surgery, it is critical to understand the anatomy of the maxillary sinus. The maxillary sinus is the largest of all the paranasal sinuses. Its size is insignificant until eruption of the permanent dentition. The average dimensions of the adult sinus are 2.5 cm to 3.5 cm wide, 3.6 cm to 4.5 cm tall, and 3.8 cm to 4.5 cm deep. The maxillary sinus is lined with the sinus membrane, also known as the Schneiderian membrane. This membrane is around 1 mm thick and consists of ciliated epithelium, like the rest of the lining for the respiratory tract.

The maxillary sinus has a pyramidal shape, with the base toward the lateral nasal wall and the apex toward the zygomatic arch. It has an anterior wall corresponding to the facial surface of the maxilla. Its posterior bony wall separates it from the pterygo-maxillary fossa medially and from the infra-temporal fossa laterally. Its medial wall is the lateral nasal wall, which separates the sinus from the nasal cavity and communicates with the nasal cavity via the ostium semilunaris to the hiatus semilunaris (middle meatus). The superior wall of the maxillary sinus is the floor of the orbit. The floor of the maxillary sinus consists of the alveolar
process of the maxilla. The sinus floor is usually convex, with its lowest point around the first and second upper molar.

All paranasal sinuses communicate with the nasal fossae. They serve mainly to moisten and heat the air we breathe in. They also contribute to reducing the weight of our facial bones, protect the base of the skull against trauma, thermally insulate the upper nerve centers and influence phonation by acting as an indirect resonance.5

Vascular Supply
The blood supply to the maxillary sinus is derived primarily from the posterior superior alveolar artery and the infra-orbital artery, both branches of the maxillary artery. There are significant anastomoses between these two arteries in the lateral antral wall. The greater palatine artery also supplies the inferior portion of the sinus.5 Alveolar antral artery is another vascular structure that is critical to address, especially during radiographic examination in preparation to lateral window sinus augmentation (Figure 1). It is a vascular structure that often passes through the area of the lateral window opening during sinus augmentation and can reach dimensions that, if the vessel is severed, can represent a serious complication of the surgical procedure.6

Indications and Contraindications
Sinus elevation procedures are indicated when inadequate vertical bone height remains for proper implant placement and to establish satisfactory occlusal, functional and esthetic restorative results. This often occurs due to sinus pneumatization, alveolar ridge resorption or a combination of both. Other indications include severely atrophic maxilla and poor bone quality in the posterior maxilla (Figure 2). On the other hand, several contraindications are present. These include, among others, the existence of sinus pathology, such as cysts; mucoceles or tumors; a diagnosis of acute, chronic or allergic sinusitis; a non-compliant patient, heavy smoker, alcoholic; a patient who is systemically compromised, has uncontrolled diabetes, is pregnant, undergoing maxillary radiation or exhibits an oral-antral fistula. Evidence of acute sinusitis, chronic sinusitis or other sinus pathology suggests the need to refer to the otolaryngologist for treatment prior to initiating the sinus augmentation procedure. Preoperative sinusitis is a positive predictive factor for the development of postoperative acute sinusitis.7

Patient Evaluation
Clinical
Because of the usual presence of alveolar ridge resorption, combined with sinus pneumatization, careful preoperative restorative evaluation is required. The restorative dentist must obtain a set of study models, a bite registration and face bow transfer for accurate mounting. A diagnostic workup is used to help determine the final crown position and crown-to-root (implant) ratio. If a ratio greater than 1:2 exists, then the case should not be treated by sinus augmentation alone. With regard to the occlusion, a cuspid-protected occlusion is best in this situation, and the occlusion must be checked to determine whether it is normal or in cross-bite.

Inter-arch space is another important factor. A minimum of 5 mm to 7 mm is required for prosthetic restoration. If the distance is inadequate, it will have to be created.7

Radiographic Analysis
Panoramic radiograph vs. cone beam CT scan (CBCT): The panoramic radiograph provides a gross overview of the sinus.
However, it is not recommended for presurgical analysis and sinus evaluation because of its limited two-dimensional display of the area and its up to 20% to 25% distortion error. It may distort or miss important anatomical features in the sinus area, such as the distance between the sinus floor and the crest of the ridge, size of the sinus, pathology and arteries, as well as vascular bundle.\textsuperscript{8} Therefore, it is recommended that CBCT scans be used for proper presurgical diagnosis and evaluation because of their accuracy and ability to provide a clear vision of the area in three dimensions\textsuperscript{9,10} (Figure 3).

**Grafting Materials and Membranes Used**

Augmentation of the sinus has been described using a variety of grafting materials, including autografts, allografts, xenografts, alloplasts, or combinations of different graft materials and block grafts and growth factors, such as BMP-2. According to the authors of this review, three factors should be considered when choosing the graft material: resorption/shrinkage of the graft; time of replacement by vital bone; and patient’s personal approach.

When different materials were compared in a three-year follow-up study, data suggested more reduction in graft height in the sinus associated with allografts and less with sinus grafts associated with alloplasts. An explanation for these differences may be the manner in which different graft materials affect healing. Alloplasts serve as a scaffold and conduct osseous growth around and within their particles, whereas demineralized, freeze-dried allografts propose to both induct and conduct osseous healing. The resorption of the hydroxyapatite may not be complete, as demonstrated by several histologic evaluations.\textsuperscript{11} The scaffold presented requires a longer time to resorb, or may never resorb, which can explain the stable dimensions of these grafts compared to allografts and autogenous grafts.\textsuperscript{12} Overall, all previous grafting materials have been used with success in maxillary sinus procedures, as the type of material can be selected based on patient and surgeon preferences.

With regard to membranes used, the placement of bioabsorbable or non-resorbable barrier membranes over the lateral sinus window and graft material aided in graft containment, prevented soft-tissue encleftation and enhanced the implant success rate. Histologic investigations of the regenerated bone following sinus augmentation procedures showed considerable variation in bone quality. Histomorphometric analysis of sinus graft biopsies revealed a large variation, typically 5% to 60%, in vital bone area.\textsuperscript{13-15}

**Lateral Wall Sinus Elevation**

This procedure involves a lateral approach via trap door access to the maxillary sinus. Careful elevation of the Schneiderian membrane creates a defined space between it and the sinus floor to receive the bone-grafting material of choice. No significant dif-
ference in the failure rate was found with simultaneous implant placement and sinus augmentation, compared to a delayed, two-stage approach, as long as primary stability can be achieved when implants are placed. In humans, several successful techniques for sinus augmentation were reported, with average implant success rates of 92%. 

Surgical Technique

All incisions are made on the palatal aspect of the edentulous ridge to ensure having a minimum of 3 mm to 5 mm of keratinized gingiva for closure and suture stability and to assure that the incision line closure does not approximate the osteotomy window. A sharp horizontal or beveled palatal incision is created posteriorly at the tuberosity or hamular notch and brought forward 8 mm to 10 mm beyond the anterior wall of the antrum or to the first premolar area or canine fossa. A vertical-releasing incision is then created anteriorly and high enough into the canine fossa area, passing the muco-gingival line, to allow for adequate flap reflection for proper access to the window osteotomy and to permit a tension-free flap closure during suturing. The incision has to be made divergent to ensure an adequate blood supply in the flap.

A second vertical-releasing incision is made in the tuberosity to gain more access and to provide additional relief from tension for the flap. Flap reflection is begun anteriorly and moved posteriorly using periosteal elevator. A full-thickness mucoperiosteal flap is reflected in a posterior-superior direction, exposing the lateral wall of the maxilla, the canine fossa and a portion of the zygoma. Sterile saline-moistened gauze is positioned posteriorly under pressure. This will aid in flap reflection, removal of granulation tissue and hemostasis. The lateral window osteotomy is performed with either a No. 2 or No. 4 round diamond bur using high-speed or piezotome with copious sterile saline irrigation to prevent overheating of the bone in the area.

Osteotomy is begun 3 mm to 4 mm above the remaining alveolar ridge to avoid small septa and to act as a lip to hold the graft, approximating the area of the first or second molar and moving forward, resulting in an approximate horizontal length of 15 mm to 20 mm. Extreme care must be taken to avoid damage to the underlying Schneiderian membrane during this procedure. This can be achieved by moving the bur or piezotome tip in a light paintbrush motion, stripping away the outer cortex until the membrane is visualized (appears gray or bluish). Pressure must be avoided, as contacting the membrane can cause tearing (Figure 4). According to Kao et al., the surgeon’s tactile skills have to be similar to those required to cut through an eggshell without cutting through the membrane beneath it.

The superior osteotomy is performed 10 mm to 15 mm above the inferior osteotomy, depending on the width of the residual alveolar ridge. It should be positioned superior enough to avoid having to carry out excessive superior membrane reflection. The osteotomy is continued until the membrane is almost completely visualized. During the osteotomy, gentle pressure is applied intermittently to the bony window with the flat edge of a bone chisel. This will permit the clinician to see if the window is freed or where further bone removal is required. Gentle tapping with a mallet on the flat end of an intraoral mirror is often all that is required to complete the osteotomy once the membrane is almost completely visualized. Rectangular-shaped windows often bind in the corners and require further reduction. Once the window is completely freed, it can be retained or removed. If the window is retained, it is preferable to obtain a final window with round edges, to prevent any sharp edges that can harm the Schneiderian membrane, which will become the superior wall of the sinus lift.

Once the window is freed on all sides, the patient is asked to breathe in and out. Membrane movement will indicate that no tear has occurred. Specially designed instruments are used for reflection, so that their sharp edges are maintained in contact with the bone, while their smooth convex surfaces are used to gently push against the membrane. This reflection is performed circumferentially, with gentle outward pressure, making sure that the sharp edge of the instrument is always in contact with the bone (Figure 5).

After full reflection is performed, a collagen resorbable membrane is placed, followed by the placement of grafting material. The grafting material used should promote osteogenesis through either osteoinduction or osteoconduction or both. Grafting materials used for sinus elevation have been intensely studied by comparing several materials, including autogenous, allografts, xenografts, alloplasts, and synthetics. Results have revealed that all materials reported satisfactory outcomes, and although it is generally agreed that autogenous bone grafts are the gold standard by which all others are compared, composite grafts (94.88%) and bone substitutes (95.98%) compared favorably with autogenous bone grafts (94%) if given enough healing time (≤ 10–12 months) and used with rough-surface implants.

The grafting material can be placed in a dappen dish and moistened with sterile saline. Antibiotic, such as amoxicillin 500 mg or clindamycin 150 mg, may be added to the graft. This can be helpful in reducing infection, but its use is totally dependent on the clinician’s protocol. A (one cc) disposable syringe or amalgam carrier can be used as a grafting material carrier. The sinus is filled anteriorly and medially first by placing the syringe into the sinus and discharging the graft material. This will ensure that the most difficult-to-reach areas are adequately filled first, and will enhance the initial stabilization of the membrane superiorly and medially. If implants are to be placed simultaneously, filling will be completed after implant placement. However, if simultaneous implant placement is not being considered, then the rest of the sinus is filled medially and posteriorly.

The grafting material is packed by gentle pressure to ensure adequate density of material yet not too tightly as to possibly restrict
suitable suture material, preferably nonresorbable. This is preferred to monitor flap closure in a more controllable fashion, as flaps should be stable for two to three weeks without infection. Interrupted or continuous sutures are preferred to help ensure primary flap closure (Figure 6).

Although the lateral window approach has more extensive literature support, the approach is determined by anatomic factors, such as the preoperative alveolar bone height and width dimensions and access, as well as the extent of the desired augmentation. When bone of sufficient volume and quality for achieving primary implant stabilization is present at the time of sinus augmentation, a single-stage approach may be used, where implant placement is performed simultaneously. Survival of implants placed at the time of sinus augmentation using the lateral window approach is increased with crestal ridge heights $\geq 3$ mm.$^{17,22}$ (Figure 7).

Internal Sinus Elevation

As an alternative, sinus augmentation can be performed by a less-invasive osteotome technique, where elevation of the sinus floor is performed by inward collapse of the residual crestal floor with specially designed osteotomes. The amount of bone gain by the osteotome technique was $3\text{ mm to } 5\text{ mm}$. Depending on the proposed length of implant, a minimum preoperative ridge height of $5\text{ mm}$ is desired to achieve adequate elevation of the sinus floor without undue risk for perforation of the Schneiderian membrane.$^{23-27}$

Surgical Technique

A full-thickness mucoperiosteal flap is reflected to allow total visualization of the site. All tissue tags and granulation tissue are removed from the alveolar crest. A pilot drill is used to penetrate the cortex for $2\text{ mm to } 3\text{ mm}$. A $2\text{ mm}$ drill is used within $1\text{ mm}$ crestal to the sinus floor. Radiographic verification of $2\text{ mm}$ drilling depth is obtained to check for length achieved. After verification, a sequence of No. 2 and No. 3 flat-ended osteotomes are gently tapped using a mallet to infracture the sinus floor and perform the sinus elevation. Once the final infracture is accomplished, the Valsalva maneuver is performed, that is, the patient is asked to blow with nostrils closed to check for the Schneiderian membrane’s integrity.$^{23,28}$ A collagen membrane is then inserted for insurance and protection.

Bone-grafting material is introduced into the osteotomy with the aid of either a disposable syringe or an amalgam carrier. As each load is inserted, the No. 3 osteotome is returned to the sinus floor. The grafting material and fluids create hydraulic pressure, which raises the Schneiderian membrane. Pascal’s law of physics explains the widened dome shape of the graft plug under the sinus membrane. Following graft placement, the final diameter of the osteotomy can be altered with insertion of the No. 4 or No. 5 osteotomes, depending on the size of the implant being placed in the area. The implant is placed after the last load of material is
inserted into the osteotomy. This allows the implant to perform the last stage of sinus elevation. Implants placed at the time of sinus elevation require four to six months to heal. Flap closure is achieved to submerge the implants and is performed in a fashion identical to other conservative flap closure techniques.

Postoperative Instructions and Medication
It is advisable to see the patient weekly to monitor healing and flap closure until complete flap closure is obtained and sutures are removed. The patient is advised to keep the area clean using 0.12% chlorhexidine mouth rinse twice daily for the first two weeks postoperatively. Analgesics such as ibuprofen (400 mg to 600 mg per day) can be used to mitigate postoperative pain. The patient should be instructed not to blow his or her nose for a week and to sneeze with the mouth open. Finally, the patient needs to stop smoking and reduce alcohol consumption, as both would interfere with the healing process. Although not frequent, significant complications with sinus augmentation have been reported. They include infection, bleeding, cyst formation, graft slumping, membrane tears, ridge resorption, sinusitis and wound dehiscence. Use of an antibiotic, such as amoxicillin or clavulanic acid and clindamycin, for 7 to 10 days postoperatively is suggested. Although these studies did not evaluate treatment without antibiotics, antibiotic prophylaxis reduced the infection rate for oral surgical procedures.

Survival Rate of Implants Placed into Grafted Maxillary Sinus
Studies concluded that success rates for grafted sinus implants were similar to those for implants placed conventionally into the posterior (92% vs 95.1%), but significantly higher than the rate for implants placed in Type IV bone with no grafting procedures (92% vs 65%). In terms of implants used, rough-surface implants have a significantly higher survival rate than machined implants when placed into grafted sinuses (95.11% vs 82.4%). Additionally, particulate grafts have a significantly higher rate of implant survival in grafted sinuses than block-grafted implants (92.3% vs 83.3%). Conclusively, simultaneous versus delayed implant placement resulted in no difference (89.7% vs 89.6%).

Complications
Intraoperative Complications
Bleeding: Since there are no major blood vessels at the surgical site, most bleeding is either extra-osseous or intra-osseous. When bleeding occurs, the source should be determined, whether extra-osseous or intra-osseous. If the source was extra-osseous, direct pressure should be applied with a moist saline gauze or by packing the area with moist gauze for 5 to 10 minutes. Injection of a local anesthetic solution containing 1:50,000 epinephrine can aid in controlling the bleeding. If the bleeding cannot be controlled, additional material, such as Gelfoam or Surgicel, can be used. If the bleeding source was intra-osseous, sterile bone wax is burnished into the bone. The bone opening is crushed, burnished or gently infractured to close the opening.

Schneiderian Membrane Perforation: In cases with smaller internal sinus angles, there was an increase in the incidence of membrane perforation. In addition, a small perforation (5 mm to 10 mm) most often occurs intraoperatively during initial window osteotomy, infraction of the lateral wall and can be treated by placement of Gelfoam, Surgicel or a bioabsorbable membrane. If a larger perforation occurs (>10 mm), two layers of resorbable collagen membranes, in conjunction with a suitable slow resorbing biodegradable membrane, should be used to seal the perforation. Lamellar bone may be added to form a stable roof against which to pack the graft material.

Postoperative Complications
Acute Maxillary Sinusitis: Acute maxillary sinusitis is usually associated with signs and symptoms, such as facial pain, tenderness, swelling, purulence and fever. If these signs and symptoms are noticed, a thorough examination should be undertaken. If purulence is present, a culture and sensitivity test should be performed, and antibiotics prescribed for the patient. The following
antibiotic regimen is recommended by Misch and should last for 10 to 14 days:
1. Augmentin (amoxicillin clavulanate) 500 mg to 1 g every 6 hours, as the presence of clavulanic acid will control beta-lactamase-producing organisms.
2. Metronidazole (Flagyl) 250 mg three times daily will control the anaerobes.
3. Clindamycin (Cleocin) 300 mg to 450 mg to start, followed by 150 mg to 300 mg three times daily.
Chlorhexidine gluconate oral rinses are also recommended to keep the area disinfected intraorally. If infection and purulence persist, the graft may have to be removed. If symptoms do not improve or begin to worsen, the patient should be referred immediately to a specialist for consultation and evaluation.

**Incision Breakdown Dehiscence:** Incisions should be made far from the surgical area and the flap undermined adequately to permit tension-free closure and to prevent soft-tissue dehiscence. Membrane exposure will require premature removal to prevent infections. Graft exposure may necessitate part or complete removal. Small fistulae will generally heal over time, and 0.12% chlorhexidine mouthrinse should be used to reduce bacterial infiltrate.

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Surgically Enhanced Orthodontic Treatment

Case Presentation

Daniel A. Kuncio, D.D.S.; Maria A. Karpov, D.M.D., M.S.; Sherrill Fay, D.M.D., M.D.

ABSTRACT

Comprehensive adult treatment has always been a challenging subspecialty in orthodontics because of the lack of a helpful growth component and frequent multidisciplinary cases. Recently, orthodontists have been teaming with oral surgeons to expand options for adult patients requiring treatment of severe malocclusion. This case report details the use of an osteotomy procedure to enhance comprehensive orthodontic treatment in an adult woman.

Dentoalveolar distraction osteogenesis (DDO) is a surgical technique for the mechanical induction of new bone and soft-tissue formation after controlled displacement of the dental alveolus. DDO has several applications in dentistry, including bone formation for dental implant placement and modification of craniofacial defects. Combined with comprehensive orthodontics, the technique has been used as an alternative to orthognathic surgery for correcting alveoloskeletal relationships. Other indications for DDO in orthodontics include moving ankylosed teeth or malpositioned implants, and increasing the rate of orthodontic movement for shorter treatment times.
As described in this case report, after full diagnosis and treatment planning with the orthodontist, oral surgeon and restorative dentist, the patient is bonded in the edgewise orthodontic appliances of choice. Once the patient is in heavy orthodontic arch wires, the surgeon incises through both the cortical and medullary bone around the entirety of the teeth/bony segments to be displaced.

After a brief healing period (no more than 7 to 10 days), traction is begun on those segments using the orthodontic appliances. Because of distraction and the regional acceleratory phenomenon (RAP), the teeth/bony segments move rapidly, requiring weekly orthodontic adjustments. The orthodontist has four to five months to complete the planned tooth/bone movement, after which enough healing has taken place to make DDO no longer possible. At this point, normal orthodontic principles are applied to finish the case and to get the patient into retention.\textsuperscript{3,4,5}

**Case Report**

F.B. is a 32-year-old female whose chief complaints on presentation are jaw pain and that her bite is “off.” Orthodontic diagnosis is a Class III skeletal pattern from a hypoplastic, narrow-tapered maxilla/mandibular shift to the left, with condylar displacement causing a bilateral posterior cross-bite, anterior cross-bite and mild dental crowding in both arches. Teeth #2, #8, #13, #19 and #30 are missing. The left temporomandibular joint is painful upon palpation and the condyle is displaced (Figure 1).

The treatment plan was three to six months of splint therapy to deprogram the mandible into centric relation (CR) (Figure 2).\textsuperscript{6,7} Once the mandibular position was set and stable, a full maxillary osteotomy procedure was performed (Figure 3), and a quad-helix orthodontic appliance was cemented and immediately activated, along with complete maxillary straight-wire braces (Innovation, GAC) (Figure 4).
A week later, the mandibular arch was bonded and elastics were begun to address the Class III occlusion (Figure 5). Normal orthodontic adjustments were performed weekly for four months, at which point, the skeletal discrepancy was corrected (Figure 6). With the DDO complete, regular monthly orthodontic adjustments proceeded until the patient was ready for restorative work (Figure 7).

The restorative treatment plan included fixed bridges: teeth #7 through #10, #18 through #20 and #29 through #32; PFM crowns on teeth #4, #5, #12; implant crown tooth #13. All appliances were then removed and final restorations cemented (Figure 8). Clear removable retainers were fabricated to be worn 24 hours a day for three months and during sleep afterwards. The total treatment time was 22 months.

Comparison of before and after photographs and superimpositions illustrates the dramatic change in the patient’s face and occlusion, with relatively subtle and stable tooth movement (Figure 9). The maxillary dentoalveolus was expanded and repositioned for better symmetry and occlusion. Previously, only orthodontics, combined with orthognathic surgery, could have produced such a result. But cases using DDO are being completed routinely in our offices.

The clinical orthodontic work described in this report was performed by Dr. Karpov; surgery by Dr. Fay; implant placement by Dr. Rada Sumareva; restorative work by Dr. Vasos Eracleous. Queries about this article can be sent to Dr. Kuncio at drkuncio@gmail.com.

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Management of Chronic Candidosis Associated with Severe Epithelial Dysplasia


ABSTRACT

Chronic hyperplastic candidosis is a rare clinical presentation. Clinically, it is characterized by white, translucent or opaque plaques of different sizes that cannot be removed when scraped and may develop in any part of the mouth. However, they are most frequently observed in the buccal mucosa in close proximity to the oral commissures (retrocommissures), dorsum of the tongue and the hard palate. This study reports a case of chronic hyperplastic candidosis with areas of severe epithelial dysplasia in a 40-year-old male patient, a waiter, who was hospitalized for alcohol detoxification treatment. He was also a smoker and was moderately dependent upon nicotine (Fagerström =4). Cytological and histological examination showed the presence of Candida sp. hyphae. The oral epithelium was hyperplastic, with areas of nuclear hyperchromatism and severe dysplasia. The lesions present in the commissure were removed surgically in two sessions; the prosthetic stomatitis and angular cheilitis were treated with antifungal medication. Many factors may contribute to the host’s susceptibility to Candida sp. infection, such as, immunosuppression, endocrine disorders, nutritional deficiencies, use of certain medications, malignancies, poorly cleaned dentures, skin changes, changes in the amount or quality of saliva, carbohydrate-rich diet, age, poor oral hygiene and tobacco use. In the case presented here, there are several possible factors that could have led to the development of this condition. We include an important discussion of the influence of microorganisms on development and important cellular changes.

Oral candidosis may manifest in various clinical forms, ranging from erythematous regions, white plaques that cannot be removed by scraping and atrophic areas with pseudomembranes. Chronic hyperplastic candidosis is a rare clinical presentation. Clinically, it is characterized by white, translucent or opaque plaques of different sizes. It has a soft and moist surface when palpated, with clearly defined borders and occasional erythematous areas. Hyperplastic or nodular lesions are able to develop in any part of the mouth, but they are most frequently observed in the buccal mucosa, in close proximity to the oral commissures (retrocommissures), dorsum of the tongue and the hard palate. A notable characteristic of this
The lesion is that it cannot be removed when scraped. The aim of this study is to report a case of chronic hyperplastic candidosis with areas of severe epithelial dysplasia in a patient being treated for alcohol addiction.

**Case Report**

A 40-year-old male patient, employed as a waiter, was hospitalized at the Hospital San Julian for alcohol detoxification treatment. During the interview, the patient did not relate any health problems. According to hospital records, he had been hospitalized three times previously for treatment of alcoholism. The patient related that for 30 years he consumed 1 liter of spirits daily and smoked an average of 10 cigarettes a day. According to the nicotine dependency test, the patient was classified as low-to-moderate dependency (Fagerström=4).

The dental examination showed that the patient had poor oral health. He presented caries lesions, periodontal disease, mouth dryness and missing teeth. Furthermore, he used an upper complete denture for approximately seven years. The appliance showed signs of wear and poor oral hygiene. The oral mucosa in contact with the base of the denture presented an erythematous aspect and was diagnosed as prosthetic stomatitis. The patient also presented bilateral erythema in the buccal commissures, compatible with angular cheilitis.

Another lesion, in the form of a white plaque, was observed bilaterally in the labial retrocommissural mucosa (Figures 1, 2). The lesion had a triangular shape and was resistant to scraping. The patient was unable to provide any information about the lesion, as he was not aware of its presence. Based on the clinical aspects of the lesion and the patient’s history of smoking and alcoholism, chronic hyperplastic candidosis was diagnosed.

In order to evaluate the patient’s general health, laboratory tests, including blood glucose, urea, creatinine, anti-HIV and a complete blood count, were ordered. Leukocytosis was the only observed alteration in the test results (leukocytes = 15,000 cells/mm³). An exfoliative cytology was carried out on the retrocommissural lesions. Epithelial cells with dysplastic and inflammatory changes were revealed by the exfoliative cytology. Fungal structures, similar to the hyphae and yeast of Candida sp., were observed by PAS staining (Figure 3).

The lesions present in the commissure were removed surgically in two sessions. The prosthetic stomatitis and angular cheilitis were treated with daily mouthrinsing of nystatin (100,000 UI/mL) every 8 hours for 15 days. The patient was also shown how to improve daily care of the denture. When the lesions had completely disappeared, the patient was referred for dental and prosthetic treatment.

Histological cross-sections showed the presence of cell structures compatible with fungus within the epithelial tissue. This finding confirmed the diagnosis of chronic hyperplastic candidosis. In addition, the oral epithelium was found to be hyperplastic, with
areas of nuclear hyperchromatism and severe dysplasia. The patient was advised to decrease his consumption of cigarettes and to return periodically for follow-up and control of the treated areas.

**Discussion**
Chronic hyperplastic candidosis can present as a nodular form or as whitish plaques that cannot be attributed to any other disorder. The lesions do not detach upon scraping, and are typically located on the buccal mucosa and tongue, and especially bilaterally at both labial retrocommissures. In this presentation of the disease, the *Candida* hyphae are found not only at the epithelial surface level; they also invade deeper levels where epithelial dysplasia can be observed, with the associated risk of malignization. This case report involved a patient in treatment for chemical dependency with different clinical presentations of oral candidosis.2

Many factors may contribute to the host's susceptibility to *Candida* sp. infection, such as, immunosuppression, endocrine disorders, nutritional deficiencies, use of certain medications, malignancies, poorly cleaned dentures, skin changes, changes in the amount or quality of saliva, high-carbohydrate diet, age, poor oral hygiene and tobacco use.3-6

In this case, several factors could have led to development of oral candidosis. First, the patient’s use of an upper complete denture should be considered. Dentures predispose users to infection with *Candida* in as many as 65% of elderly people who wear full upper dentures. Wearing of dentures produces a microenvironment conducive to the growth of *Candida* with low oxygen, low pH and an anaerobic environment. This may be due to the enhanced adherence of *Candida* sp. to acrylic, reduced saliva flow under the surfaces of the denture fittings, improperly fitted dentures or poor oral hygiene.7

Furthermore, the patient in question was hospitalized for alcohol detoxification treatment. Alcoholic patients suffer from harmful neurologic changes in the brain, causing an acute withdrawal syndrome upon cessation of drinking, followed by a protracted abstinence syndrome and an increased risk of relapse to heavy drinking.8 During the course of this type of treatment, some drugs may be used, including antidepressants and anxiolytics. A large number of prescribed drugs elicit xerostomic side effects. Those most commonly implicated include antidepressants, antipsychotics, anticholinergics, antihypertensives and antiadrenergics.9 Impaired salivary gland function can predispose one to oral candidosis. Antimicrobial proteins in the saliva, such as lactoferrin, sialoperoxidase, lysozyme, histidine-rich polypeptides and specific anti-candida antibodies, interact with the oral mucosa and prevent overgrowth of *Candida*.6

Generally, the diagnosis of oral candidosis is based on clinical signs and symptoms, in conjunction with a thorough medical history. Provisional diagnoses are often confirmed through further laboratory testing of clinical specimens.10 Exfoliative cytology and histopathology were used to help establish the diagnosis of chronic, hyperplastic candidosis in the retocommissural area. The fungus *Candida albicans* is the species most associated with leukoplasic lesions, making the differential diagnosis between leukoplasic by *Candida* and idiopathic leukoplaxis is clinically difficult. Therefore, it is sometimes necessary to carry out histology of the lesion, in order to observe the presence of hyphae in the superficial layer of the epithelium, accompanied by neutrophil infiltration.11-14

The role of the *Candida* genus in the induction of cellular atypia and keratotic changes is still controversial. As reported by Jepsen and Winther, the fungus invades an already pre-existing lesion. On the other hand, Cawson and Lehner argue that infection by *Candida* is the principal cause of leukoplasia.11-12 McCullough et al. showed a strong association between the amount of yeast in the mouth, the degree of severity of epithelial dysplasia and squamous cell carcinoma.15 Histopathology of chronic hyperplastic candidosis can vary in clinical presentation and degree of hyperplasia, having notable variations in the thickness of the epithelium. Accord-

![Figure 3. Fungal structures similar to hyphae and yeast of Candida sp. were observed by PAS staining. A: 100x. B: 400x.](image-url)
leukoplasias uninfected by fungus. These lesions have demonstrated significantly more dysplasia and with greater severity than lesions uninfected by Candida.21-22

Aguirre Urizar observed the treatment of oral candidosis is based on four principles: a) an early and accurate diagnosis of the infection; b) correction of the predisposing factors or underlying diseases; c) evaluation of the type of Candida infection; and d) appropriate use of antifungal drugs, evaluating the efficacy/toxicity ratio in each case.23

For healthy patients, the treatment of oral candidosis is relatively simple and effective. Topical medications are usually adequate. Currently accepted treatment regimens for oral candidiasis are clotrimazole (lozenges or torches), nystatin (tablets or lozenges) or miconazole (oral gel or buccal tablets).24 The antifungal agent that is usually prescribed is clotrimazole, which generally resolves most infections. Clotrimazole is a well-tolerated fungistatic drug with anticandidal and antistaphylococcal activity.25 Other treatment options are nystatin, at doses of 100,000 IU/mL (5mL 4 times daily), and amphotericin b, at 50mg (5mL 3 times per day).26 They are poorly absorbed by the intestinal tract and, therefore, mostly excreted without undergoing any change, thereby reducing hepatotoxicity.27
On the other hand, chronic candidosis did not always respond satisfactorily to treatment with nystatin. According to Scardina et al., there are different ways to treat chronic hyperplastic candidosis. These possibilities include: clinical management with antifungal therapy; topical retinoids; bleomycin; beta-carotene; and surgery (cryosurgery, laser therapy and conventional surgery). In the case presented here, the patient received topical treatment with an antifungal and surgical removal. Once the lesions disappeared, the patient was monitored because of the presence of severe epithelial dysplasia.

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Internal Revenue Service Confirms Economic Difficulties Faced by Dentists since Last Recession

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Abstract

The ADA Policy Institute report for sole proprietorship dental practices indicated increasing median net income prior to the Great Recession, followed by decreases during the period of and after the last recession. An Internal Revenue Service tax report followed these findings for business receipts and net income. The IRS data reinforce the need for the profession to consider efforts to deal with the inability to reach underserved populations, particularly high-risk children and individuals between 18 and 64 years of age.

“Dentistry has a busyness problem. As numerous analyses from the ADA Health Policy Institute show, the percentage of dentists who report they are not busy enough and can see more patients has been rising steadily for approximately a decade.”

At the national level and in “...New York State, between 2007 and 2012, current dollar business receipts per establishment increased. However, standard dollar business receipts (removing the effects of inflation) decreased.”

The latest projections from the Office of the Actuary detail the anticipated faster growth in national health expenditures. “Health spending growth in the United States for 2016-25 is projected to average 5.6 percent ... and to represent 20 percent of the total economy by 2025.... The insured share of the population is projected to increase from 90.9 percent in 2015 to 91.5 percent by 2025.”

The projections for annual spending for dental services report an expected increase in expenditures from $118 billion in 2015 to $185 billion in 2025 (Table 1). [Note: these are current dollars and do not take into consideration inflationary factors.] However, these projections indicate that the annual growth in spending for dental services in virtually all past, current and projected years has been and will continue to be lower than all other areas of personal health services (Table 1). These projections through 2025 reinforce the concern spelled out in the January 6, 2014, ADA News that “dentists remain cautious about (the) economy.”

Payment Sources

Reporting comparisons between total expenditures for dental and other health services masks the significant difference in the payment sources for these services. In 2014, 40.3% of dental expenditures were paid out-of-pocket, compared to 12.9% of all personal health services, 3.2% for hospital care and 9.0% for physician services. The projections for the proportion of out-of-pocket spending for dental and all personal health services in 2024 will decrease somewhat (37.5% for dental services, compared to 11.9% for all personal health services). Nevertheless, the reality is that spending for dental services is and will continue to...

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(1) Consumer Price Index (CPI): A measure that examines the weighted average of prices of a basket of consumer goods and services, such as transportation, food and medical care. The CPI is calculated by taking price changes for each item in the predetermined basket of goods and averaging them; the goods are weighted according to their importance. Changes in CPI are used to assess price changes associated with the cost of living. “Current dollars” represent actual costs at a particular period; “standard dollars” represent the comparative costs based upon the CPI for inflationary factors.
be significantly “felt” and a factor in the decision to seek preventive and restorative services (Table 2).

Dental Visits

The Centers for Disease Control and Prevention reported that for 1997 and 2014, 65.1% of the total U.S. population (two years and older) had a dental visit in the past year. Among most demographic groups of youngsters 2 to 17 years and the elderly 65 years and older, there were increases in the proportions with dental visits in the past year. There were, however, in the 18- to 64-age group, decreases in the proportion with a dental visit in the past year, including males and females, white, black and Hispanic populations, individuals with disabilities, those living in poverty, residents in and outside of metropolitan statistical areas and those living in the Northeast, Northwest and southern regions of the country (Table 3).

According to the ADA Health Policy Institute, “The average gross billing per dentist for owner dentists in 2014 was $646,330 for a general practitioner and $910,060 for a specialist. The average net income for a private practitioner in 2014 was $174,780 for a general practitioner and $322,200 for a specialist.... (The median annual net income for a general practitioner in private practice was) $140,000 for a recent graduate (2010-2013).”

The institute reported that between 2000 and 2007, there was a progressive increase in current and standard median net incomes of sole proprietors. The onset of the Great Recession (in December 2007 and ending in June 2009) brought with it decreases in both current and standard median net incomes, which have not rebounded in the post-recession years (2011-2015) to the levels prior to the onset of the recession (Table 4).

Internal Revenue Service

At times, “creative accounting techniques” may be used to limit income tax payments, probably no more frequently than when individual practitioners tend to enhance their incomes at a cocktail party discussion. Reviewing IRS data over time (if one may assume that the effect of “creative accounting” is constant), provides another view of trends in practice income.

Between 1996 and 2014, there were marked decreases in the number of sole proprietorship IRS returns from dentists, reflecting evolving practice arrangements during the past years, with increasing numbers of partnerships and varying corporate arrangements for the delivery of dental services. Current- and standard-dollar mean business receipts and net income data mirrored the ADA Health Policy Institute, that is, increases prior to the Great Recession, followed by decreases during the recession and failure to rebound since the end of the recession (Tables 4,5).

Future Directions

In 2014, the editor of Quintessence International “...described the current marked decline
in tooth decay and the accompanying reduction in traditional dental treatment patients."15 In 2015, the chief economist of the ADA Health Policy Institute (HPI) addressed dental economic concerns from the perception of the “busyness problem.” The percentage of dentists who report they are not busy enough and can see more patients has been rising for approximately a decade.16 “The best available data show that dental care use has increased among children.”16 “There is evidence that early preventive visits can reduce the need for restorative and emergency care, therefore reducing dentally related costs among high-risk children.”17 However, “…dental care use among adults has declined steadily for more than a decade,”16 “…results of a new study show that cost and low perceived need are by far the top reasons adults avoid going to the dentist.”18

The chief economist of the ADA HPI commented: “The federal government has a fairly clear position on the value of dental care for adults: it is not essential. Dental benefits are not required within Medicare or Medicaid, and they are not part of the essential health benefit package under the Affordable Care Act. Dental care for children, on the other hand, is treated differently.”1

The historic reality is quite different from these comments: “In the mid-1960s, the American Dental Association strongly objected to the substantial inclusion of dentistry within the early development of Medicare for fear of the ‘bogeyman’ of socialized medicine. It was a time when the eventual scope and costs for the Medicare and Medicaid programs were not fully understood; a time when opportunities were available to expand financial coverage for adults (both the young and the elderly) in need of oral health care. The sudden loss of a young president marked a time when the nation sought solace to bring the country together.”19

But pointing out past decisions does not provide solutions. The reality is that trends in economics and population-based changes affecting U.S. dental practices indicate a continuing downturn in practice busyness and stagnation of expenditures for dental services. The long-term customary populations that provided the bulwark for many successful dental practices are being replaced by minority populations, particularly the Hispanic population. Decades of studies based on race/ethnicity, income, residency locations, lack of adequate insurance and disparity in the delivery of dental care to the general public, including even those with special needs, have filled innumerable pages in journals and special government reports. IRS reports only confirm the difficulties facing the profession.

The traditional approach to lobbying for change is to amass great numbers of residents in favor of particular issues. Numbers may reach into the thousands or even millions. The use of mega numbers may play a critical role in some situations. In other circumstances, the use of mega numbers become “just numbers.” This approach loses a critical appreciation of the impact of the needs for individuals and their families as legislators seek to respond to multiple demands for recognition. Legislators, whether at the national, state or local level, tend to be more responsive to “their constituents.”

Fortunately, demographic statistics are readily available from the U.S. Census Bureau through its American Community Survey and other national, regional and local studies, which detail in many instances unmet needs for oral health services for constituents who vote (and their family members) by age, gender and racial/ethnicity in states, counties, urban and rural areas, school districts and, significantly, in Congressional districts.

To remain resigned to the current situation, where third parties seem intractable toward the deteriorating economics of the oral health system, is to replay the 1960s, when the dental profession stepped back from negotiations seeking to develop a new systematic approach to health insurance, branding it a form of socialized medicine.

| TABLE 3 | Percent of Persons with Dental Visit in Past Year by Age: 1997, 2014* |
|---------|----------------------|----------------|-----------------|----------------|
| **Total** | 72.7% | 82.3% | 60.4% | 58.1% | 55.4% | 64.1% | 82.4% | 54.8% | 62.4% |
| **Male** | Male | 72.3% | 82.3% | 70.6% | 58.1% | 55.4% | 64.1% | 82.4% | 54.8% |
| **Female** | Female | 73.0% | 83.8% | 67.7% | 65.8% | 54.4% | 62.5% | 54.4% | 62.5% |
| **Race/Ethnicity** | | | | | | | | | |
| White | 74.0% | 83.4% | 65.7% | 63.3% | 56.8% | 63.3% | 56.8% | 64.9% |
| Black | 68.8% | 83.0% | 57.0% | 54.8% | 35.4% | 54.8% | 42.7% |
| Asian | 69.9% | 78.9% | 63.7% | 64.8% | 63.0% | 55.0% |
| Hispanic | 61.0% | 81.4% | 50.8% | 50.2% | 47.8% | 51.3% |
| **Poverty** | | | | | | | | | |
| Below Poverty Level | Poverty Level | 72.0% | 78.2% | 46.9% | 41.9% | 31.5% | 35.1% |
| Income 400% + | 82.4% | 90.5% | 70.8% | 77.8% | 64.9% | 81.5% |
| **Disability** | | | | | | | | | |
| Action Difficulty | No Difficulty | 54.7% | 52.4% | 48.7% | 56.1% |
| **Residence** | | | | | | | | | |
| In MSA* | 73.6% | 83.3% | 65.7% | 63.0% | 57.6% | 62.6% |
| Outside MSA | 69.3% | 81.3% | 58.0% | 53.9% | 46.1% | 52.9% |
| **Geographic Region** | | | | | | | | | |
| Northeast | 77.5% | 84.6% | 69.6% | 69.2% | 55.5% | 67.7% |
| Northwest | 76.4% | 82.5% | 67.4% | 64.4% | 57.6% | 63.3% |
| South | 68.0% | 82.4% | 59.4% | 56.7% | 49.0% | 58.7% |
| West | 71.5% | 83.3% | 62.9% | 65.1% | 61.9% | 62.9% |

Note: Underlines represent decreases in proportion of population with dental visit between 1997 and 2014.

* Metropolitan Statistical Area
At a time when the government is torn between modifying and eliminating major health insurance programs, surely the dental profession must play an active role in these negotiations if we are to make our case at a time when the profession is faced with significant economic concerns.

Indeed, unless the profession comes together to lobby Congressional leaders, work with third parties and take the lead to reach minority and other underserved populations, we may be confirming Walt Kelly’s well-known aphorism, as uttered by his comic strip character Pogo, “We have met the enemy and he is us.”

Queries about this article can be sent to Dr. Waldman at h.waldman@stonybrook.edu.

<table>
<thead>
<tr>
<th>TABLE 4</th>
<th>Sole Dentist Proprietor Business Receipts and Net Income in Current Dollars (in 000s), Selected Years 1996-201511-13</th>
</tr>
</thead>
<tbody>
<tr>
<td>ADA Internal Revenue Service</td>
<td></td>
</tr>
<tr>
<td>Net Income (Median)</td>
<td>Number Returns</td>
</tr>
<tr>
<td>2015 $150</td>
<td>na</td>
</tr>
<tr>
<td>2014 $150</td>
<td>77,737</td>
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<tr>
<td>2011 $156</td>
<td>70,589</td>
</tr>
<tr>
<td>Recession ends – June 2009</td>
<td></td>
</tr>
<tr>
<td>2009 $165</td>
<td>89,617</td>
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<tr>
<td>2008 $160</td>
<td>85,583</td>
</tr>
<tr>
<td>Recession starts – Dec. 2007</td>
<td></td>
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<tr>
<td>2007 $175</td>
<td>93,114</td>
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<tr>
<td>2000 $129</td>
<td>85,832</td>
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<td>1996 na</td>
<td>102,434</td>
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<table>
<thead>
<tr>
<th>TABLE 5</th>
<th>Sole Dentist Proprietor Business Receipts and Net Income in Standard Dollars (in 000s), Selected Years 1996-201511-13</th>
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<tbody>
<tr>
<td>Consumer Price Index</td>
<td>ADA Internal Revenue Service</td>
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<tr>
<td>Net Income (Median)</td>
<td>Mean Receipts</td>
</tr>
<tr>
<td>(1982-1984 = 100)</td>
<td></td>
</tr>
<tr>
<td>2016 237.0  $63</td>
<td>na</td>
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<tr>
<td>2015 236.9  63</td>
<td>$141</td>
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<tr>
<td>2011 224.9  73</td>
<td>156</td>
</tr>
<tr>
<td>Recession ends – June 2009</td>
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</tr>
<tr>
<td>2009 214.5  77</td>
<td>154</td>
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<tr>
<td>2008 215.3  74</td>
<td>161</td>
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<tr>
<td>Recession starts – Dec. 2007</td>
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</tr>
<tr>
<td>2007 207.3  84</td>
<td>155</td>
</tr>
<tr>
<td>2005 195.3  82</td>
<td>165</td>
</tr>
<tr>
<td>2000 172.2  75</td>
<td>179</td>
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<tr>
<td>1996 156.9  na</td>
<td>151</td>
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REFERENCES

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Maxillary Arch Reconstruction in Patient with Moderate Wear Utilizing Zirconia Restorations to Restore Form, Function, Esthetics

A Clinical Report


ABSTRACT

Zirconia has been indicated as a restorative material with favorable esthetic and biomechanical properties for patients with extensive tooth wear. Even with these benefits, it is important to be aware of common technical complications associated with this material. This clinical report demonstrates the use of full-arch, single-unit tooth and implant-borne zirconia restorations when presented with a worn maxillary arch. It includes a 1.5-year follow-up. Although this report demonstrates a favorable clinical outcome, further studies must be done to better understand the long-term restorative outcomes of zirconia.

Tooth wear has been classified into the categories of mechanical wear (attrition and abrasion) and chemical wear (erosion). It is important to identify the etiology of tooth wear, as this will likely impact the definitive restorative treatment plan and prognosis. Additionally, factors that may contribute to tooth wear, such as bruxism, stress, psychological medications, occlusal interferences, and chemical wear, may further complicate successful diagnosis and treatment.

In addition to proper diagnosis, successful treatment is influenced by the selection of the appropriate restorative materials for the diagnosed condition. Utilization of all-ceramic materials is an option when managing a patient’s esthetic demands; however, these materials have limitations.

In patients with parafunctional habits, it is important to evaluate the biomechanical properties of the selected restorative materials. The introduction of zirconia has allowed a more esthetic restorative option than that offered by previous metallic systems. Additionally, it has been reported that highly polished zirconia restorations have less wear on enamel than conventional feldspathic porcelain restorations. Zirconia has physical properties superior to many other all-ceramic restorative materials, is biocompatible, and meets many of the esthetic demands of patients, who are less likely to accept metallic-colored restorations.
Although there has been increasing application of zirconia restorations in recent years, reports outlining its indication and protocol for use are limited. Current reports of the success rates of zirconia-based single crowns lack well-designed, controlled clinical trials. Zirconia may present a favorable option from an esthetic and biomechanical perspective when restoring properly diagnosed cases involving extensive tooth wear.

The aim of this clinical report is to demonstrate the utilization of monolithic zirconia and porcelain-veneered zirconia restorations in a properly diagnosed clinical situation, with a 1.5-year follow-up.

Clinical Report

A 63-year-old male presented to the Dental Service of the Department of Veterans Affairs in the New York Harbor Healthcare System with the chief concern that his front teeth were chipped and worn, and he wanted to fix them. After a review of systems, the patient reported a medical history significant for hypertension, coronary artery disease, diverticulitis, gastroesophageal reflux disease (GERD), schizophrenia and personality disorders. All of his medical conditions were being managed with medications prescribed by his multidisciplinary team of medical providers. The patient reported a dental history significant for extractions due to caries, dental restorations and root canal therapies. He denied acute dental pain or discomfort. He also denied a known history or presence of parafunctional habits. The patient reported a significant cigarette habit, but that he had quit over 20 years ago.

The extraoral exam was within normal limits, with no significant signs or symptoms associated with the head or neck. Intraorally, the patient exhibited normal gingival tissues and an adequate zone of attached gingiva. A periodontal exam revealed generalized, mild, chronic periodontitis. His oral hygiene was fair. His maxillary anterior teeth displayed a smile with a reverse curve due to the fractured and chipped incisors. The maxillary teeth were discolored, with visible craze lines, and mechanical and chemical wear from bruxism and GERD, respectively. The maxillary posterior restorations were worn, and a retained root #4 with a chronic periapical radiolucency (PARL) was present; there were failing and unesthetic restorations; and tooth #14 had a chronic PARL. The mandibular teeth showed wear at the anterior incisal edges, wear on tooth #20 buccal cusp, an over-contoured tooth #29 metal-ceramic restoration, missing tooth #30, as well as existing composite and amalgam restorations (Figures 1-4). An endodontic consult was obtained to assess retreatment of tooth #14.

The physiologic rest position was determined by facial measurements and confirmed by phonetics. The interocclusal rest...
space was judged to be approximately 6 mm to 7 mm using the technique described by Toolson et al. The occlusal vertical dimension (OVD) was assessed clinically. It was determined that the patient was functioning at a decreased vertical dimension of occlusion. An arbitrary facebow transfer was taken to mount the maxillary cast on a semi-adjustable articulator (Denar Mark 320; Whip Mix Corp., Louisville, KY). Two sets of diagnostic casts were obtained from irreversible hydrocolloid impressions and mounted for evaluation. It was concluded that the OVD needed to be restored by approximately 1.5 mm to 2 mm.

A diagnostic wax-up was performed on one set of the diagnostic casts at the desired OVD, creating a canine protective occlusal scheme, duplicated and then followed by fabrication of a clear temporary matrix (Copyplast 0.5mm; Great Lakes Orthodontics, Tonawanda, NY) to be used for an intraoral mock-up with bisacryl provisional material (Luxatemp; DMG America, Englewood, NJ). The bisacryl was placed in the clear matrix and tested in the patient’s mouth to evaluate the esthetics and phonetics of the proposed wax-up. The patient accepted the proposed anterior wax-up.

After a review of the diagnostic casts, diagnostic wax-up, exam findings, full-mouth series radiographs and panoramic radiograph (Figure 5), the Prosthodontic Diagnostic Index (PDI) was ruled a Class IV, based on the extent of restorative work needed and the restoration of lost OVD. The differential diagnosis for tooth wear, especially of the maxillary anterior teeth, included mechanical attrition or bruxism affiliated with stress, psychological medications, and occlusal interferences, coupled with chemical erosion from a past history of GERD. All of the above findings and diagnoses were explained to the patient, who was also presented with the following treatment options: no treatment; fixed dental prosthesis; implants; or removable partial dentures. The patient requested something fixed, individual teeth to floss, and nice-looking teeth with no more metal showing.

The treatment goals were: (1) to restore the vertical dimension of occlusion; (2) to correct the maxillary occlusal plane; (3) to restore function; and (4) to restore esthetics to the patient’s satisfaction. Lab-processed acrylic resin provisional restorations in three sections were fabricated in shade A2 (VITA Classical Shade Guide; VITA North America, Yorba Linda, CA). Preparation of the maxillary arch proceeded with a clear temporary matrix (Copyplast 0.5mm; Great Lakes Orthodontics, Tonawanda, NY) as a guide for reduction.

Maxillary provisionalization addressed the patient’s chief concern, during which time, endodontic re-retreatment was completed on tooth #14. Tooth #4 was extracted with socket preservation using allograft material, and all existing abutment cores were replaced. The patient wore the maxillary provisionalals for several months while the desired occlusion and esthetics were established.

The mandibular treatment consisted of a tooth #20 lithium disilicate onlay preparation and provisionalization, tooth #29 provisionalization and implant placement for tooth #30. The maxillary arch (except on teeth #3, #4, #5) and mandibular tooth preparations were refined, and impressions were taken with polyether impression material (Impregum Penta/Impregum Soft; 3M ESPE, St. Paul, MN). The working casts were mounted after providing the laboratory with a custom acrylic incisal guide table created from the mounted provisional restoration casts. The definitive single-unit maxillary anterior zirconia crowns (ICE Zirconia; Zirkonzahn USA Inc.) with porcelain veneering (Ceramco
Discussion

In the case presented here, the patient desired esthetically pleasing restorations and to restore his smile. Tooth wear from mechanical and chemical means, the patient’s occlusal scheme, normal gingival display, esthetics, biomechanical forces and wear of the opposing dentition all had to be considered. Zirconia was the material of choice in this case for several reasons. Yttrium partially stabilized tetragonal zirconia polycrystalline (Y-TZP), which can be used with computer-assisted design/computer-assisted manufacturing (CAD/CAM) technology, shows better mechanical properties and superior resistance to fracture. Y-TZP has a high-fracture toughness, from 5 MPa to 10 MPa, and a flexural strength of 900 MPa to 1400 MPa. When a crack initiates on the surface of Y-TZP, the stress concentration at the top of the crack causes the tetragonal crystal to transform into a monoclinic crystal, with associated volumetric expansion. In the vicinity of a propagating crack, the stress-induced transformation leads to compressive stress that shields the crack tip from the applied stress and enhances the fracture toughness. This is also called transformation toughening.5,13

After osseointegration of implant #4, the maxillary right posterior segment (teeth #3, #4, #5) was restored in the same manner as above. A hard acrylic resin occlusal guard designed in mutually protected occlusion was fabricated for the patient to wear at night. A protocol of brushing twice daily with a 1.1% sodium fluoride toothpaste and a chlorhexidine gluconate 0.12% oral rinse twice daily for one week out of each month was given to the patient per the Caries Management By Risk Assessment (CAMBRA) protocol outlined by Featherstone et al.12 Upon conclusion of restorative treatment, the patient was seen for follow-up at six months, one year and 18 months. There were no reported issues or signs of ceramic veneer fracturing on the zirconia, loss of retention or noticeable wear of the opposing teeth. The patient continued an oral hygiene regimen with cleanings and using the above-mentioned CAMBRA protocol and was very pleased with the outcome of the treatment (Figures 6-10).

PFZ; Dentsply International Inc., York, PA) on teeth #6 through #11 and the maxillary posterior full-contour zirconia crowns (Prettau Zirconia; Zirkonzahn USA Inc.) on teeth #12, #13, #14 in shade A3 (VITA Classical Shade Guide; VITA North America, Yorba Linda, CA) were delivered and cemented with a self-adhesive resin cement (Rely-X Unicem; 3M ESPE, St. Paul, MN).

After osseointegration of implant #4, the maxillary right posterior segment (teeth #3, #4, #5) was restored in the same manner as above. A hard acrylic resin occlusal guard designed in mutually protected occlusion was fabricated for the patient to wear at night. A protocol of brushing twice daily with a 1.1% sodium fluoride toothpaste and a chlorhexidine gluconate 0.12% oral rinse twice daily for one week out of each month was given to the patient per the Caries Management By Risk Assessment (CAMBRA) protocol outlined by Featherstone et al.12 Upon conclusion of restorative treatment, the patient was seen for follow-up at six months, one year and 18 months. There were no reported issues or signs of ceramic veneer fracturing on the zirconia, loss of retention or noticeable wear of the opposing teeth. The patient continued an oral hygiene regimen with cleanings and using the above-mentioned CAMBRA protocol and was very pleased with the outcome of the treatment (Figures 6-10).
similar to or even less for metal-ceramic crowns, which can be beneficial for patients with structural tooth loss. 

Cementation and internal surface treatment protocols for zirconia are conflicting in the literature, because zirconia cannot be bonded to a tooth since it cannot be etched. Also, it does not contain silica in its structures to bond to a silane coupling agent, like other all-ceramic systems.

In this case, the maxillary posterior teeth were fabricated in full contour monolithic zirconia without the need for porcelain veneer layering. Designing the posterior restorations in this way...
can eliminate the most common technical problem associated with zirconia, that is, ceramic veneer chipping.15 The amount of remaining tooth structure in this case also allowed for proper resistance and retention form, so it was not necessary to rely as much on the self-adhesive resin cement used, thus helping to mitigate the other technical complication of loss of retention.15,16

The overall prognosis of this rehabilitation is favorable due to the high esthetic, strong biomechanical properties, and easy wear resistance of zirconia against the patient’s enamel. The proper patient, design of the zirconia restorations, as well as the patient’s established canine-protected occlusal scheme and occlusal night guard use can, it is hoped, lead to a predictable, long-term prosthodontic outcome.20,21,22 The patient must also maintain his recall/hygiene visits, proper oral hygiene habits using the CAMBRA protocol and wear his occlusal guard. As far as esthetic expectations, the patient was extremely pleased with the zirconia restorations.

Conclusions
Zirconia can be used as an all-ceramic restorative treatment option in cases with high esthetics and biomechanical requirements, such as in instances of tooth wear. Clinicians need to realize that zirconia has its limitations with regard to esthetics, porcelain veneering and retention. It should be used in properly selected treatments, while trying to minimize its technical complications. This clinical report outlines a complex oral rehabilitation utilizing zirconia restorations with proper design to minimize zirconia’s technical complications and wear his occlusal guard. As far as esthetic expectations, the patient was extremely pleased with the zirconia restorations.

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REFERENCES