OFFICE-BASED ANESTHESIA

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INTRODUCTION

Oral and maxillofacial surgeons have practiced their specialty in office-based surgery facilities for years, offering safe, convenient care for millions of patients. Recent shifts in medicine toward this model of care have created controversies among many stakeholder groups, and our specialty has been caught in the crossfire. While we have pioneered many advances in office-based anesthesia, the landscape of current practice is changing as more and more parties of interest come to the table. Anesthesia, a key component of our practices, has a rich background that is forever intertwined with dentistry and oral and maxillofacial surgery. This issue of Selected Readings in Oral and Maxillofacial Surgery will focus on anesthesia in an office-based setting in particular. Rather than review common medications, dosages, and in-depth techniques, I will view anesthesia from a “30,000 foot level”, exploring our deep history as a specialty with anesthesia, the evolution of current-day standards, modern concepts of safety in medicine and industry, and a forecast of what the future holds for our profession. With this format, I hope to stimulate some thought on what each of us can do to improve patient care and how we view ourselves as part of the larger picture of medicine during an unprecedented era of cost containment, quality initiatives, and challenges to our autonomy.

HISTORY

Surgery today without modern anesthetic techniques would be viewed as cruel and unusual punishment. Although the roots of modern anesthesia did not begin until the mid-1840s, it is important to realize that documented procedures were actually recorded in The Edwin Smith Surgical Papyrus.¹ These describe several dozen cases performed from 3000 to 2500 BC. Varying techniques of pain control were attempted, from nerve compression² to hypnosis (referred to as mesmerism)³ and refrigeration,⁴ all in an attempt to alleviate patient suffering but with exceedingly poor results. Multiple agents and techniques over subsequent centuries had been attempted with varying success, and some prominent agents were initially overlooked.

Diethyl ether, for example, had been available for centuries but never applied for surgical use. Instead, it became known as a cheap alternative to gin,⁵ and for its use at “ether frolics”, where students would breathe from an ether-soaked towel and experience a thrill.

Similarly, nitrous oxide was used for recreational or entertainment purposes, but less frequently than ether due to the difficulty in preparation and storage of the gas. The first preparation of nitrous oxide was completed by Joseph Priestley, an English clergyman and scientist.¹ While Priestley is credited with the preparation of the gas, Davy was the first to study its effects on humans in great detail, culminating with his tome in 1800 entitled, Nitrous Oxide. Not coincidentally, Davy noted the “transient relief of a severe headache,
obliteration of a minor headache, and briefly quenched an aggravating toothache”. Sadly, despite his prolific research into the properties of nitrous oxide analgesia, he is best known for coining the term “laughing gas” to describe its effects on human subjects.

Later in the nineteenth century, one of the first reports of ether administration for surgical pain control emerged, although much later than it had actually occurred. On March 30, 1842, Dr. Crawford Long delivered ether anesthesia for removal of two neck lesions on his patient, James M. Venable. Long described the trial in his recording: “The patient continued to inhale ether during the time of the operation; when informed it was over, seemed incredulous, until the tumor was shown to him.”

While Long was the first to use ether in this clinical setting, he did not claim credit for it until 1849, which he attributed to his practice in a rural environment and his lack of opportunity for a large series of procedures. While Long was working with ether in Georgia, a series of events in New England began what many consider the birth of anesthesia as we know it.

During the mid-1800’s, many patients deferred dental treatment for fear of significant pain. This, of course, was a problem for dentists, who saw this as a threat to their livelihood. On December 10, 1844, Horace Wells observed a demonstration, in an entertainment setting, of the use of nitrous oxide by Gardner Colton in Hartford, Connecticut. He was so struck by the volunteer who injured himself without pain while under the influence of nitrous oxide that he contacted Colton and offered to be the subject of a dental extraction under the same protocol. When his tooth was extracted without pain, Wells was convinced of the therapeutic benefits of this technique. Colton showed Wells the technique of preparing the gas, and Wells then used this with success in his dental practice.

Emboldened by his success, Wells contacted John Warren, the chief of surgery at Massachusetts General Hospital. Warren arranged for Wells to lecture on pain prevention and to perform a demonstration of his nitrous oxide technique for tooth removal before Harvard Medical School students in January of 1845. Unfortunately, the patient cried out during the extraction, and Wells was widely ridiculed, despite the fact that the patient did not recall having any pain during the tooth removal. Wells continued to work with nitrous oxide, but never truly recovered from his failed demonstration in Boston. At the age of 33, Wells took his own life.

While Wells was practicing dentistry in Boston, William Morton joined him in practice. During this time, Wells gave instruction to Morton in the delivery of nitrous oxide for dental procedures. Morton then later enrolled in medical school at Harvard and met Charles Jackson, a physician and professor of chemistry. Morton had dropped his focus on nitrous oxide and narrowed his efforts to using chloric ether as an anesthetic. Jackson recommended the switch to sulfuric ether, and Morton became engrossed with this new agent.

Eventually, Morton became confident with this technique and began using it in his dental office. On October 16, 1846, at the
same site of Wells’ failed demonstration with nitrous oxide, Morton provided ether anesthesia to Edward Gilbert Abbott for removal of a neck tumor by the Professor of Surgery, John Collins Warren. At the conclusion of the procedure, the patient reported that while he was aware of the surgery he felt no pain. Warren then proclaimed the famous line, “Gentlemen, this is no humbug.”

Morton initially refused to tell his peers what the inhaled substance was, naming it “letheon”, and attempted to patent it for personal financial gain. Naturally, Jackson took issue with Morton’s claim as the man who discovered ether’s anesthetic properties, despite a congressional committee’s upholding of Morton as the discoverer of ether. This controversy carried on for several years, costing Morton his entire wealth and personal well-being. He died a pauper on July 5, 1868 at the age of 49, while Jackson died in an insane asylum, distraught over the prolonged battle with Morton and his lack of recognition in his role with ether anesthesia.

Eventually, all of these men were rewarded in the annals of history. Long was recognized as the discoverer of anesthesia by the American Society of Anesthesiologists, with annual recognition of his accomplishments on “Doctor’s Day”. Wells was recognized with the same honor by the Paris Medical Society in 1847, the American Dental Association in 1864, and the American Medical Association 1870. Morton, of course, is also given credit due to his publication in the Medical Examiner in December, 1846.

A crucial figure, who should not be forgotten in this history, is Dr. Nathan Cooley Keep, the first Dean of the Harvard Dental School and an exceptionally talented dentist-physician. Keep was a mentor to the young dentists Wells and Morton, allowing them access to his laboratory while they were enrolled in medical school. Some surmise that Keep may have introduced Morton to Charles Jackson.

Shortly after Morton’s demonstration in the Ether Dome in 1846, Keep and Morton entered a 10-year partnership agreement, but it only lasted a few weeks. Morton’s instability and materialism was a likely wedge between the two, but Keep advanced the use and understanding of ether as an anesthetic in 1847. His publication in the Boston Medical Surgical Journal entitled “Inhalation of Ethereal Vapor for Mitigating Human Suffering in Surgical Operations and Acute Diseases” documented the preparation, storage, and administration of ether in his own delivery apparatus.

On April 7, 1847, Keep administered the first obstetric anesthesia to Fanny Longfellow, the wife of Henry Wadsworth Longfellow. His societal standing and professional reputation surely helped the use of ether anesthesia gain traction in the United States as a method to remove pain from surgery.

Dentistry Moves to Nitrous Oxide

Ether and chloroform became the inhalational anesthetics of the day in the 1850s in medicine, but dentistry still favored chloroform, given the difficulty in storage and production of nitrous oxide. As the 1860s moved on, a mixture of chloroform and ether became the favored anesthetic, but signifi-
significant advances were finally being made with nitrous oxide.

In 1863, Gardner Colton (the same man who removed Wells’ tooth) helped nitrous oxide regain its prominence in dentistry. He joined with two prominent dental surgeons in New York and formed the “Colton Dental Association”, which specialized in tooth extraction under nitrous oxide general anesthesia. In this setting, Colton reported over 100,000 cases of 100% nitrous oxide anesthesia with no fatalities. The lack of morbidity from this technique was attributed to the very short duration of the procedure, minimizing the effects of hypoxia on these patients.

Despite Colton’s remarkable safety record, Edmund Andrews, a Chicago surgeon, first presented the idea of mixing oxygen with nitrous oxide in 1868. Other pioneers contributed to the widespread acceptance of nitrous oxide, including Thomas Evans, a prominent dental surgeon in Paris, S.S. White in Philadelphia, and Sir Frederick Hewitt in England. Evans devised a way to compress the gas into a liquid form, easing storage and transport issues, and exhibited it at the Paris Exposition in 1869. This led to the widespread availability of compressed nitrous oxide in cylinders in the United States. In 1897, Hewitt was among the first to put it all together, creating the first machine that could deliver both oxygen and nitrous oxide. White patented a device similar to Hewitt’s in the United States. A physician in Toronto, named E.I. McKesson, refined Hewitt’s work, offering an intermittent flow head that allowed a very precise flow of nitrous oxide and oxygen in varying percentages.

While still more pioneers perfected inhalational anesthetic machines, Jay Heidbrink, a Minneapolis dentist, worked extensively on perfecting his nitrous oxide delivery machine and published a well detailed article in 1922 of his technique. In many ways, the work of Heidbrink markedly improved the opportunity for patients to have an ambulatory procedure that was safe and pain free. Despite these advances, the technique of using 100% nitrous oxide persisted until the 1950s. Seldin described the technique of inducing anesthesia to unconsciousness, and titrating the anesthesia to the specific shades of blue seen in the skin coloration. At this point, the mask was removed, and the procedure was completed as quickly as possible.

Fortunately, the agents and techniques used in inhalational anesthetics evolved. One of the most widely-accepted inhaled volatile anesthetics for dentistry was halothane, appearing in the 1950s and lasting well into the early twenty-first century. Of course, the formulation and use of this method of anesthesia has continued to evolve, with the modern use of sevoflurane in many of our offices today.

The Influence of Oral Surgery on Anesthesia

In the early 1900s, no formal anesthesia training was offered in dental schools, nor were there residencies for oral surgeons to practice and train in general anesthesia. While medicine began the education and training in hospitals that eventually led to separate anesthesia departments dedicated to the education of future practitioners, dentists were relegated to individual offices to learn
techniques much like an apprentice would in making shoes.

While the first medical department of anesthesiology was founded at the University of Wisconsin in 1926 by Dr. Ralph Watters, most dentists and oral surgeons were not allowed to participate in training at many of the other developing departments at major hospitals and universities. It was not until the development of oral surgery training programs in the 1940s that residents gained access to training with their medical colleagues, and the rapid expansion of knowledge and breakthroughs for ambulatory anesthesia began.

A pioneer by the name of Leonard Monheim began his career as a dentist, graduating from the University of Pittsburgh Dental School in 1933. He later completed a three-year residency in anesthesiology, and served as a staff anesthesiologist at St Francis Hospital in Pittsburgh. When he returned from serving in the Army in the South Pacific in 1946, he led the first independent Department of Anesthesia at the Pittsburgh Dental School as its Chair and also served as a professor at the School of Medicine. He also led a one-year organized training program in anesthesiology for dentists at Pittsburgh that provided applied basic science for oral surgery residents who had completed training in other hospitals.

He completely dedicated his career to the teaching of anesthesia to dentists and oral surgeons, and served as one of the founders of the American Dental Society of Anesthesiology (ADSA), an organization born from the increasing power of medical anesthesiology and its potential to limit the ability of dentists to provide anesthesia. Over the years, the ADSA exerted significant influence on organized dentistry and led to improvements in hospital residencies for dentists interested in anesthesiology.

John Lundy, one of the leaders in medical anesthesia, established one of the first departments of anesthesia at the Mayo Clinic. Sodium pentothal was developed in 1932, and Lundy became the first to use the drug clinically in 1934, advocating for an intermittent bolus of the drug for general anesthesia. During that time, outpatients rarely if ever received general anesthesia.

One of Lundy’s pupils was a dentist named Adrian Hubbell, who became convinced of the ideal properties of the drug for outpatient dental extraction. Lundy consistently opposed Hubbell, and refused to administer anesthesia to any patient who was not admitted to the hospital overnight.

Hubbell eventually completed his residency and returned home to Southern California, joining Berto Olsen, an exodontist, in practice. He steered Olsen from his nitrous oxide technique to intravenous pentothal, demonstrating the superior anesthetic technique. He also used pentothal on longer cases, supplementing the pentothal with a 50% mixture of nitrous oxide and oxygen. One of Hubble’s innovations was a foot pump to deliver the pentothal, which eliminated the need for multiple thiopental syringes and freed the surgeon’s hands to remain in the surgical field.

Hubbell eventually built a large facility in Long Beach geared to this technique,
often delivering over fifty anesthetics per day. His facility became a “Mecca” for oral surgeons to come and observe the efficiency of the thiopental anesthesia technique for oral surgery. Later, in the 1950s, Hubbell joined Harold Krough, an oral surgeon in Washington DC, and taught a very influential series of courses on the delivery of thiopental anesthesia all over the country. This sparked the generation of intravenous anesthetics delivered nationwide, with varying updates and additions to this technique over the years.

While Hubbell was helping to incorporate thiopental for outpatient general anesthesia in oral surgery, a dentist teaching at the Loma Linda University Dental School ushered in the era of conscious sedation. In the 1940s, Niels Jorgensen pioneered the “Loma Linda” or “Jorgensen Technique” of sedation. This generally consisted of three drugs: pentobarbital, scopolamine, and meperidine. The pentobarbital provided the “base” sedation, while a 4:1 mixture of meperidine:scopolamine allowed a longer period of sedation.

As less toxic amide local anesthetics, such as lidocaine, became available, the combination of a balanced sedation technique with local anesthesia opened the door for untold numbers of phobic dental patients to finally realize pain- and anxiety-free treatment.

Despite these advances and relatively good outcomes, the typical preoperative workup for patients was seldom more than a few passing questions about cardiac or respiratory status. In the pre-1960s era, most oral surgeons only delivered pentothal exclusively, omitting oxygen, nitrous oxide, local anesthesia, or monitors of any kind (other than observation of the patient). Clearly, a focus on the teaching of standards in pain and anxiety control was necessary for our profession to advance.

The American Dental Society of Anesthesiology was very influential during this era and put on a number of national conferences on pain and anxiety control. This led to the “Guidelines for Teaching the Comprehensive Control of Pain and Anxiety in Dentistry” that the American Dental Association adopted in 1971. These guidelines have continued to evolve over time, establishing standards and ensuring adequate training in pain and anxiety control among dental students, residents, and private practitioners. With the accreditation of dental anesthesia programs in the past several years by the Commission on Dental Accreditation, it is likely that dental anesthesia will become a recognized dental specialty.

Increasingly safer and more effective pharmacologic methods for procedural sedation continued to be developed. The introduction and widespread acceptance of diazepam, however, led some to increasingly question the risk of general anesthesia in the dental office, given the new availability of sedating medications with a greater safety profile. These new benzodiazepines could finally alleviate anxiety for many patients without the inherent risk of a general anesthetic.

As drugs such as ketamine, fentanyl and methohexital became available, many practitioners shifted the focus of their practice to a conscious sedation anesthesia, with excep-
tional safety results, but with a blurring of the line between sedation and general anesthesia. Unfortunately, as the decades moved into the early 1980s, more reports of sedation-related deaths in the dental office began to appear. These events and subsequent media coverage ushered in a new era of oversight and regulation of office-based anesthesia as we know it.

A NEW ERA OF PUBLIC AWARENESS AND OVERSIGHT

In 1985, the National Institutes of Health (NIH) convened the “Anesthesia and Sedation in the Dental Office” consensus conference. The participants at the conference pointed out the critical need for greater research in dental anesthesia with regards to epidemiology, drug efficacy studies, monitoring of patients, behavioral and other non-pharmacologic approaches, environmental risk assessment, new drugs, and the need for resources to conduct this research. The conclusion of the conference was,

“The use of all effective drugs carries some degree of risk, however small. Available evidence suggests that use of sedative and anesthetic drugs in the dental office by appropriately trained professionals has a remarkable record of safety. However, even this record can be improved as scientific knowledge of dental anxiety and pain control is expanded, as strong training programs at all levels of professional education are developed, and as appropriate guidelines governing requirements for dental office personnel, facilities, and equipment are promulgated and adopted.”

A milestone multicenter clinical trial entitled “Relative Efficacy and Safety of Intravenous Premedication in Dentistry” was began in 1987 (funded by the NIH). It assessed 1,000 patients having third molars removed under general anesthesia via a double-blind, randomized sample. The trial concluded that deep sedation was more effective than moderate, and both were safe when administered by adequately trained personnel using appropriate monitoring.

Fortunately, the push for safety in oral surgery offices was well underway in the private sector as well. In 1968, the Southern California Society of Oral Surgeons developed the first program to evaluate office-based anesthesia and emergency management for its members, making this program a requirement for membership in 1970. In 1975, the American Association of Oral and Maxillofacial Surgeons adopted this program, and made it mandatory for all state component societies to require this office evaluation for membership in 1990. In 2003, the AAOMS House of Delegates further mandated recertification at least every six years to maintain membership.

Several studies of the safety of anesthesia gave credence to oral and maxillofacial surgeons’ claims of a high safety profile. Lytle and Stamper reported a mortality rate of 1 in 673,000 for general anesthetics in a survey of Southern California oral and maxillofacial surgeons in 1987. Similarly, D’Eramo noted one death, 1 in 1,733,055 anesthetized patients, in a survey of Massachusetts oral surgeons in 1988.

One of the most recent prospective cohort studies of anesthesia in an oral surgery
office setting was completed by Perrott et al. with over 34,000 patients. Encompassing the entire spectrum of anesthesia, they found a complication rate of 1.3 per 100 patients, with all complications deemed minor and self-limiting, and a patient satisfaction rate of over 94%.

**Medicine Focuses On Safety**

Particularly with anesthesia safety, medicine has come full circle in the pursuit of quality and transparency. This can be traced back to Dr. Ernest Codman, a Boston surgeon who was the first to attempt assessment of patient outcomes, in a process he described as “end result system of standardization” in 1910.

This was a radical concept, and not embraced warmly by his peers at Massachusetts General Hospital. Codman followed each of his patients with meticulous detail with his “end result cards” that contained patient demographics, diagnosis, treatment, and the outcome of the case. He hypothesized that successful outcomes should be applied in a standardized way to other patients with similar conditions. This also meant that treatment failures would be reviewed, and these regimens would not be repeated on future patients. Most shockingly to his colleagues, he pushed to make the failures in treatment public.

With his interest in outcomes, Codman also founded the first morbidity and mortality conferences to openly discuss treatment failures. For his efforts, his clinical privileges were revoked. He later founded his own hospital, named the “End Result Hospital” to pursue his passion for outcomes and performance measurements that he so strongly believed in. He eventually published his work, detailing 337 patient admissions and treatment, and documented 123 errors in his publicly released book, *A Study in Hospital Efficiency*.

The American College of Surgeons (ACS) announced the first “Hospital Standardization Committee” in 1912, based on Codman’s end result system. This committee, in testing its one page of minimum standards for hospital care, found that only 89 of the 692 hospitals surveyed met the standards. The list of standards, now known as the *Manual of Hospital Standardization*, had grown to eighteen pages in 1926, and more hospitals were being surveyed on these standards. By 1946, the manual had expanded to 118 pages, and Congress took note. Passing the Hill-Burton Act, Congress provided federal funding for hospitals, but only if those hospitals had acquired ACS certification.

As the need for certification grew, the sheer volume forced ACS to find new sponsors, because the process became a financial burden for a single professional society to bear alone. In 1951, the ACS, the American Hospital Association, the American Medical Association, and the American College of Physicians joined together to form the Joint Commission on Accreditation of Hospitals (JCAH). The first fees for surveys of hospitals were not charged until 1964, when the cost was a flat rate of 60 dollars, plus one dollar for each additional bed up to 250 beds.

The JCAH continued to grow and adjusted its mission from minimum standards
for hospitals to a focus on sustainable quality. This growth has added a host of non-traditional facilities to its accreditation standards services, including psychiatric facilities, substance abuse programs, long-term care organizations, home health care, hospice care, ambulatory surgery, office-based surgery and others. In 1979, the American Dental Association became a corporate member, and still has a member serve on the Joint Commission Board of Governors.

With this growth and expansion came name changes to reflect the shift of the organizational mission, changing to the Joint Commission on Accreditation of Healthcare Organizations (JCAHO) in 1987, and the current name of the Joint Commission (TJC) in 2007. With this increased scope of accredited facilities came a refocusing on how facilities became accredited. In the 1990s, surveys focused on organizational performance processes. Currently, the focus of the accreditation process is the review of outcomes and performance-based standards structured around functions central to patient care, effectively focusing on the quality of care delivered to the patient,26 including anesthesia care. Undoubtedly, Ernest Codman would be proud.

Of particular importance to the oral and maxillofacial surgery community is the rapid growth in accreditation of ambulatory surgery centers and office-based surgery facilities by the Joint Commission and other national accrediting agencies. While some specialties have mandated accreditation or its equivalent, organized oral surgery has not, relying instead on self-regulation.

The “drift” of our specialty towards this form of certification can be traced to medical events in the 1980s and 1990s. Medical anesthesia in outpatient settings began to see the spotlight of an unforgiving press.27 As a result of several highly publicized incidents in medical offices (particularly plastic surgery and gastroenterology) the public became much more interested in how safe outpatient anesthesia really was. The president of the American Society of Anesthesiologists formed the Committee on Patient Safety and Risk Management in 1984, partly as a response to the increasing public outcry, but also because of the rise in professional liability insurance premiums for anesthesiologists.

Shortly thereafter, in 1985, the Anesthesia Patient Safety Foundation was formed. This organization brings together multiple disciplines with an interest in patient safety (e.g., the anesthesiologists, the Joint Commission, representatives from the FDA, American College of Surgeons, and the American Medical Association) with the goal of conducting safety research and education, providing patient safety programs and campaigns, and promoting the national and international exchange of information and ideas. The Anesthesia Patient Safety Foundation’s influence continues to grow, publishing one of the most widely read publications on patient safety, and continues to fund a number of research grants to advance their mission and vision. A number of excellent resources can be found on their website at www.apsf.org.

As the focus continued on patient safety, the American Medical Association, along
with key corporate contributors founded the National Patient Safety Foundation (NPSF) in 1996. One of the key statements in their mission (as stated on their website, npsf.org) is “NPSF can make a long term, measurable difference by serving as a central voice, and NPSF will lead the transition from a culture of blame to a culture of safety”.

This statement is significant, and shows where the culture of quality improvement in health care is headed. Equally prescient within the vision statement from the NPSF: “The system of health care is fallible and requires fundamental change to sustain”. Many can argue that the fundamental change is well underway, as you will read later in this review.

At around the same time as the founding of the Anesthesia Patient Safety Foundation, published standards for minimum intraoperative monitoring were begun that led to the adoption of the ASA Standards on Basic Monitoring in 1986. Over the years, the American Society of Anesthesiologists has produced many guidelines for anesthesiologists and non-anesthesiologists alike, which are continually updated.

I strongly encourage you to explore the ASA website at www.asahq.org to review the latest guidelines. While some statements may be counter to the current AAOMS guidelines, good suggestions to improve clinical care are present, and should be at least considered. Some of the more relevant guidelines that should be reviewed are: Guidelines for Office-Based Surgery, The Anesthesia Care Team, Guidelines for Ambulatory Anesthesia and Surgery, Basic Anesthetic Monitoring Standards, and the Statement on the Safe Use of Propofol.

Current ASA Guidelines for Office-based Anesthesia specifically address the administration of and facility for providing the anesthetic, with recommendations on quality of care and safety procedures within the facility. The document reviews clinical care guidelines that include patient and procedure selection, perioperative care, monitoring and equipment, and emergency and transfer procedures. These are in agreement with the AAOMS parameters of care and the updated office anesthesia evaluation.

Advances in the safety of office-based anesthesia for medicine and dentistry are the result of a number of factors. Certainly, there is no substitute for a vigilant surgeon who practices within the standard of care in a responsible, cautious and ethical manner. Progress can also be cited in the development of standards cited above, from a variety of sources. Technologic advances in monitoring have also allowed for a greater safety margin.

In 1985, Harvard Medical School presented “Standards of Practice 1: Minimal Monitoring” and in doing so, became one of the first groups to set standards for safe practice. These new standards applied irrespective of whether the anesthetic was general, regional, or monitored anesthesia care. The standards included:

- Blood pressure and heart rate recorded at least every 5 minutes
- Continuous ECG throughout the case
- Continuous monitoring of ventilation and circulation by
  - Breathing system disconnect monitor with alarm
  - Oxygen analyzer with low concentration alarm
  - Temperature measurement

As the push for adherence to standards grew, pulse oximetry and end tidal CO₂ monitoring gained acceptance by the mid-1990s. As a result, by the late 1990s, medical malpractice claims for brain injury caused by inadequate ventilation decreased from 25% to 9% of all claims for brain damage or death with other causes remaining stable. Inadequate ventilation decreased significantly when either a pulse oximeter or capnograph was used.

Many surgeons had resisted this monitoring technique due to the “open system” with oral surgery patients and a lack of consistent carbon dioxide output with patients in our setting, but it is acknowledged that the waveform produced by the open system CO₂ sensing is an accurate reflection of ventilation, even if the absolute value of the measurement is less precise that it would be in a closed system. Starting in 2014, however, the AAOMS Office Anesthesia Evaluation will mandate the use of capnography. The guidelines state:

> During moderate or deep sedation and general anesthesia the adequacy of ventilation shall be evaluated by continual observation of qualitative clinical signs and monitoring for the presence of exhaled carbon dioxide unless precluded or invalidated by the nature of the patient, procedure or equipment.

Whether this addition to our standards will decrease outpatient morbidity and mortality remains to be seen, and, as with many safety measures, results may be difficult to quantify for some time.

**Controversy With Delivery Of Propofol**

Despite the long and consistent safety record of anesthesia in oral and maxillofacial surgery offices, challenges to the delivery method persist. This is somewhat due to “collateral damage” from the attempts by the American College of Gastroenterologists...
(ACG) to remove the following statement found on the package inserts in propofol containers: “For general anesthesia or monitored anesthesia care (MAC) sedation, DIPRIVAN Injectable Emulsion should be administered only by persons trained in the administration of general anesthesia and not involved in the conduct of the surgical/diagnostic procedure.”

In comments to the FDA challenging the ACG petition, the American Society of Anesthesiologists asserted that the insert was correct, offered its own statement on the safe use of propofol, and issued a joint statement with the American Association of Nurse Anesthetists. The statement read,

“Whenver propofol is used for sedation/anesthesia, it should be administered only by persons trained in the administration of general anesthesia, who are not simultaneously involved in these surgical or diagnostic procedures. This restriction is concordant with specific language in the propofol package insert, and failure to follow these recommendations could put patients at increased risk of significant injury or death.”

The controversy has waxed and waned, particularly with the increase in ability of nurse anesthetists to provide itinerant anesthesia services independent of anesthesiologist supervision. The push by nurse anesthetists for economic benefit and increase in scope has established an adversarial position with regard to all office-based facilities, including office-based oral and maxillofacial surgery practitioners.

THE CULTURAL SHIFT TO OFFICE-BASED SURGERY

The advancements mentioned previously have contributed to the ability to perform an ever-growing list of procedures in non-traditional settings, particularly among medical specialists. As the push by third-party payers to have procedures performed in an outpatient setting has increased, so too has the increase in complexity and duration of office-based procedures, resulting in the need for deeper sedation, analgesia, and general anesthesia. As the number of office-based procedures grew, the difference between an office facility and hospitals or ASCs became more and more obvious, with a lack of regulation and oversight of private offices. Because of this unregulated nature, the office-based surgery era has been referred to as the “wild, wild west of health care”.

As patient deaths and serious adverse events occurred, they were reported in the lay press, often in a sensational manner. A Wall Street Journal article highlighted the “crackdown” on doctors performing unregulated procedures in 2009. The data gathered from the American Society of Anesthesiologists closed claims project showed that 75% of injuries were due to respiratory or drug-related events (2:1 respiratory). The most common respiratory events were airway obstruction, bronchospasm, inadequate ventilation, and esophageal intubation. Drug events were due to incorrect dosing or drug, allergic reaction, or malignant hyperthermia. Of particular concern was the finding that 50% of the reviewed claims were judged to have substandard care, and a full 46% of
these could have been prevented with better monitoring. Even in the 36% of cases with acceptable care, the postoperative care after discharge was found to be inadequate.

A study of pediatric care in office-based surgery settings found that permanent neurologic damage or death occurred more frequently in this setting as opposed to hospitals.\textsuperscript{37} As in the ASA Closed Claims Study, most events (80%) for pediatrics were respiratory and due to inadequate equipment or monitoring. Of particular note in this study was that the provider was often an oral surgeon, periodontist or nurse anesthetist supervised by a dentist. The conclusion of this paper was that providers should have airway management training as well as the ability to resuscitate children.

On the other hand, Perrott, et al’s paper on office-based outcomes for oral and maxillofacial surgery showed a more favorable complication rate of 1.3 per 100 cases, with these complications being minor and self-limiting.\textsuperscript{22} Despite this report and continuing ongoing efforts of our specialty to educate those in medicine about our methods of anesthesia training, experience, and consistent positive outcomes assessment, the tide is turning away from self-regulation of specialty practices and more towards third party oversight and public transparency.

The office anesthesia evaluation, while serving the oral and maxillofacial surgery community well for decades, is likely now obsolete and unlikely to prevent the encroaching tide of state regulations on our ability to provide anesthesia. In 1998, New Jersey became the first state to regulate office-based surgery, and California, Pennsylvania, Rhode Island and Texas followed suit in 1999. These states approached the regulations with a wide spectrum, from a limited approach focusing on the number and qualifications of personnel and general requirements for the administration of anesthesia to very specific regulations and prescriptions following American Society of Anesthesiologists guidelines and the reporting of adverse events.\textsuperscript{38}

In a follow-up report the next year, the same author noted that 24 states had either put regulations in place or were considering doing so, with some granting exceptions to accredited facilities or mandating accreditation by one of the three accrediting bodies.\textsuperscript{39} Currently in the oral and maxillofacial surgery spectrum, 34 states require (via statues or regulations) dental practitioners to undergo an office anesthesia evaluation, while 9 recognize the Office Anesthesia Evaluation (OAE) as the appropriate model for inspections, and only 4 replace a state inspection with the OAE.\textsuperscript{40}

Oral and maxillofacial surgery has begun to feel the same third party regulatory push, most notably in New York State in 2007, with the passage of legislation that would have required dual-degree oral and maxillofacial surgeons to have their practices accredited by either the Joint Commission, the American Association for the Accreditation of Ambulatory Facilities or the Association for the Accreditation of Ambulatory Health Care. This legislation stemmed from a commission that studied the quality of care in outpatient settings.\textsuperscript{41} Fortunately, intense lobbying resulted in an exception made for
oral and maxillofacial surgeons, as long as they practice within the scope of their dental license.\textsuperscript{42}

Because the waiver took over two years to be realized, a number of facilities in New York undertook the accreditation process, fearing a failure in the lobbying of the legislature. This created a “fish in a barrel” scenario for the oral and maxillofacial surgeons in that state, many of whom paid exorbitant fees for consultants to become accredited by a potential deadline. An excellent review of three different experiences undergoing this process can be found in detail in a recent *Journal of Oral and Maxillofacial Surgery* article.\textsuperscript{42}

Nevada surgeons also were caught in the crosshairs of state regulations with the passage of another law regulating office-based surgery in 2009. This was triggered by poor infection control in an endoscopy center. While dentists and oral and maxillofacial surgeons were not directly involved in the regulation, this statute requires each MD- or DO-operated ambulatory surgery facility to be accredited by a nationally recognized accrediting organization,\textsuperscript{43} with mandated reporting of complications, and stiff penalties for those not in compliance.

These experiences should serve as a wake-up call to our specialty that action to move out of the “cottage industry” and more into the current mainstream of transparent, accountable care with measured outcomes on a facility-by-facility basis is needed.

Is There a Role for Accreditation in OMS Offices?

Laskin makes a reasonable case both for and against outside regulation of oral and maxillofacial surgery offices in two editorials published in *Journal of Oral and Maxillofacial Surgery*.\textsuperscript{44,45} In his first editorial, he cites the moratorium on office-based surgery in Florida based on a sensational series of untoward patient outcomes, but references the ADA guidelines on teaching comprehensive control of anxiety and pain control, the AAOMS office anesthesia evaluation, and the *AAOMS Parameters of Care* as reasons for the ability of the oral and maxillofacial surgeons to self-regulate.

The following year, he acknowledged the rapid trend of regulation of medical offices and the opportunity for the oral and maxillofacial surgeons in practice to ensure safe, efficient, quality care that can enhance our practices. His final statement, “By implementing voluntary accreditation, we now have the opportunity to lead again in the future.” shows a remarkable turnabout in his thinking, and must be given significant consideration by the individual practitioner as well as organized oral and maxillofacial surgery societies and associations.

The delivery of anesthesia in our offices, like everything we do, is framed within our community standard of care and within best-practice guidelines. Contemporary practices base the standard of care on the *AAOMS Parameters of Care*, completion of the Office
Anesthesia Evaluation, the individual state permit or license to provide this care, and the practice within the anesthesia team model.

While not a standard for clinical care, the significance of adequate training of the entire anesthesia team has also been recognized by the Committee on Anesthesia of AAOMS. They developed the Oral and Maxillofacial Surgery Anesthesia Assistants Program to educate staff on basic sciences, systemic diseases and evaluation of patients, anesthetic drugs and techniques, equipment and monitoring, and emergency management. This was replaced with a certification program named DAANCE (Dental Anesthesia Assistant National Certification Exam) in 2008. It is hoped that by certifying our assistants, oral and maxillofacial surgery will be performing in a best-practices model for other specialties to emulate, as well as to gain some political capital in defending our treatment model.

At this writing, the latest AAOMS Parameters of Care was published in 2007, with current updates imminent. Applicable standards with regard to anesthesia contain updated definitions of sedation and general anesthesia, general standards, criteria and considerations for anesthesia in outpatient facilities, special considerations for medically compromised patients, and outcomes assessment indices for deep sedation and general anesthesia. This document generally follows the American Society of Anesthesiologists guidelines for office-based anesthesia, with the exception of propofol delivery by the operating surgeon. The Office Anesthesia Evaluation manual is considered to be a companion to the AAOMS Parameters of Care, with material on emergency protocols and monitoring standards.

The anesthesia team model is predicated on a surgeon with at least two assistants, one of whom has no other responsibilities other than to monitor the patient during anesthesia. The surgeon should be trained in advanced cardiac life support (ACLS), and the assistants in basic life support (BLS). The licensing and Office Anesthesia Evaluation, of course, speak for themselves as basic requirements that need no further description.

WHAT AND WHY DO WE NEED TO CHANGE?

So, you may ask, if the oral and maxillofacial surgery community has enjoyed such an exemplary record of safety over the years, has committed to maintaining standards that meet the American Society of Anesthesiologists and American College of Surgeons guidelines, and are continually modified as technology and science improve, what or why do we need to change?

The simple fact remains that while 15% to 20% of all medical procedures are done in an office setting (with rapidly increasing percentages annually), over 90% of oral and maxillofacial surgery procedures are within our offices.46 As medicine expands the use of the office-based model, and the resulting regulations continue to increase, so too will public scrutiny of the traditional oral and maxillofacial surgery model. As we have seen all too often in the past, a reluctance to self-regulate and raise the bar only allows those outside of the specialty to set it for us.
It remains my opinion that if oral and maxillofacial surgery stays complacent, with the attitude of maintaining the status quo, we will surely be swept into a tsunami of onerous third-party regulation without significant input. Lessons should be learned from the New York and Nevada experiences, and action should be taken to accredit our facilities. The era of “We’ve always done it this way” or “We control the dental board” are foolish arguments that will doom our specialty to the loss of autonomy that we have worked so hard to preserve.

Currently, accreditation for an oral and maxillofacial surgery practice can be provided by the Joint Commission, the Association for the Accreditation of Ambulatory Health Care, or the American Association for the Accreditation of Ambulatory Facilities. Each organization maintains different standards, but there are significant consistencies in how they view an ambulatory or office facility’s organizational structure, governance, patient care, and monitoring of outcomes. There are certain advantages and disadvantages within each accrediting organization that should be researched in detail before an oral and maxillofacial surgery facility submits an application for accreditation.

Advantages to becoming an accredited facility include a clear demonstration to your patients that you offer the highest level of patient safety and care, a competitive edge in marketing your practice, attainment of a national benchmark of quality, and the availability of constructive educational opportunities for your office on surveys. The process also creates internal checks and balances to ensure safe and appropriate care is delivered.

Our office has been able to negotiate favorable insurance payments for our services, with a premium added to payments due solely to the accredited status of our facility. The accrediting organizations also offer an online search tool for patients to find accredited facilities, and offer patient resources for the patient to partner with you in their care. The Joint Commission offers an online publicity kit to promote the accredited status of your practice, and has materials that can be downloaded for your media campaigns.

| TABLE 1: AREAS FOR WHICH THE JOINT COMMISSION OFFICE-BASED SURGERY PROGRAM SETS STANDARDS-BASED PERFORMANCE |
|-------------------------------------------------|-------------------------------------------------|
| Environment of Care                              | National Patient Safety Goals                   |
| Emergency Management                              | Performance Improvement                         |
| Human Resources                                  | Provision of Care, Treatment & Services         |
| Infection Prevention and Control                 | Records of Care, Treatment & Services           |
| Information Management                           | Rights and Responsibilities of the Individual   |
| Leadership                                       | Transplant Safety                               |
| Life Safety                                      | Waived Testing                                  |
| Medication Management                            |                                                 |
Figure 1. Example of a monthly report score from Validare, Inc.. (Images reproduced with permission from Validare, Inc.).

<table>
<thead>
<tr>
<th>TABLE 2: SERVICES AND REPORTS AVAILABLE FROM CONSULTANT WEBSITES</th>
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<tbody>
<tr>
<td><strong>Quality Improvement Studies</strong></td>
</tr>
<tr>
<td><em>Audits</em> (allergy notation, biopsy specimens, infection control, legibility of records, etc.)</td>
</tr>
<tr>
<td><em>Benchmark Studies</em> (sequelae monitoring, medication error, perioperative times, post-op nausea and vomiting)</td>
</tr>
<tr>
<td><em>Essential Internal Studies</em> (cost of care/medical supplies, patient satisfaction, patient waiting times)</td>
</tr>
<tr>
<td><em>High Risk Process Analysis</em> (biopsy follow-up, abbreviation misuse, crash cart)</td>
</tr>
<tr>
<td><em>Speciality Benchmarking</em> (e.g., recovery room audit)</td>
</tr>
<tr>
<td><strong>Policy And Procedure Manual Review</strong></td>
</tr>
<tr>
<td>Administrative, anesthesia, clinical governance, infection control, personnel and safety/ADA policies and procedures</td>
</tr>
<tr>
<td><strong>Safe Task List</strong></td>
</tr>
<tr>
<td>Gives current items that are due for accreditation, such as internal audits, studies, re-credentialing, policy and procedure review.</td>
</tr>
<tr>
<td>Includes overdue items that need immediate attention</td>
</tr>
<tr>
<td><strong>Forms Repository</strong></td>
</tr>
<tr>
<td>Includes forms to help with data collection for studies and audits, sample bylaws for your organization, clinical forms to help documentation, equipment and inspection checklists, perioperative checklists, links to specialty guidelines, emergency management drills, human resources forms, etc.</td>
</tr>
</tbody>
</table>
While the cost to become accredited varies among the agencies, the current direct cost of accreditation by the Joint Commission as an office-based surgery facility is $3,130 for an on-site survey, with additional fees for multiple locations. There are also annual fees to remain accredited, currently $1,340 per year or a three-year accreditation cycle of $4,020. This brings the total direct fees for a three-year accreditation cycle to $7,150. This does not include the fees to hire a consultant for the initial evaluation, or for ongoing maintenance of your accredited status. These fees vary widely, both among consulting companies as well as among the accrediting organizations.

The Joint Commission Office-based Surgery program currently sets standards-based performance in the areas listed in Table 1 (on P. 17). The Joint Commission accreditation process focuses on operational systems critical to the safety and quality of patient care. The survey process evaluates actual care processes by “tracing” patients through the care, treatment and services they received. In addition to the patient tracer activity, the surveyor also reviews key operational systems that directly impact patient care. These surveyors are health care professionals who practice in the ambulatory care field and have practical experience in similar settings. Often, the surveyor during site visits is a fellow oral and maxillofacial surgeon or dentist.47

Following the survey, the practice will receive a summary of findings, with ample time to make corrections if needed. Once any deficiencies are corrected, a final accreditation decision is made; maintenance of accreditation is fairly straightforward.

Many accredited facilities retain a consultant to help keep Joint Commission policies and procedures updated, and keep practices informed of changing standards. One of the most useful benefits that consultants offer is the ability to perform self-studies and audits in many areas, with the ability to benchmark your results to a national average. One such company, Validare, Inc.,48 offers monthly email that reports scores for your practice and reminders to keep records, studies, and policies up to date, as shown in Figure 1 (on P. 18). This monthly score directly correlates with your chance of success should you encounter an unannounced survey. Links to some of the various services and reports available from the consultant website for practices are listed in Table 2 (on P. 18).

One of the major benefits of using a consulting service is the ability to use their templates for quality improvement studies. (Fig.
2 on P. 19) These are scheduled throughout the year, and many choices are available. To align your practice with current accreditation standards, a calendar of studies is posted, many of which have the ability to enter data to benchmark your practice to a national pool of data.

After review of the level of detail within these links, it is reasonable to conclude that an accredited facility has far more failsafe mechanisms in place to avoid adverse events and raise the bar on patient care and safety. When comparing the ongoing continuous process improvements that an accredited practice lives by, it should be fairly easy to see how our current model could be seen as outdated. While the Office Anesthesia Evaluation may refresh a practicing oral and maxillofacial surgeon in emergency drills every six years, it offers little in those areas of accreditation in the above discussion, particularly in quality improvement, system-wide analysis and risk prevention.

This is not meant to malign a valuable tool that has served our specialty well, but rather to serve as a wake-up call to our specialty to do the right thing and move in the direction of transparency and accountability, as the rest of health care has done. Shouldn’t our facilities review “near misses” that could have resulted in harm to a patient in a logical, progressive manner to ensure it never happens again? Why can’t the vast majority of oral and maxillofacial surgery practices give an accurate infection rate for their facilities when asked? How do we explain multiple medication errors in facilities if there is no formal medication management plan?

In a *Journal of Oral and Maxillofacial Surgery* editorial, Assael made a strong case to incorporate the Joint Commission National Patient Safety Goals into practice.\(^{49}\) Surely, if modeling our practices along the practices that the Joint Commission encourages is good, it should follow that the office-based surgery model that we have been privileged to practice for so many years has room for the improvement that accreditation can offer.

In 2009, AAOMS commissioned a task force to review the concept of the suitability of the current Office Anesthesia Evaluation and the potential role for accreditation in oral and maxillofacial surgery practices. While this committee’s work is still ongoing, progress is being made towards working with one of the accrediting agencies to tailor a program.

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**TABLE 3: APPLICABLE GOALS FOR A WELL-RUN OMS PRACTICE**

<table>
<thead>
<tr>
<th>Goal</th>
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<tbody>
<tr>
<td>Redesign of care processes based on best practices</td>
</tr>
<tr>
<td>Use of information technologies to improve access to clinical information and support clinical decision making</td>
</tr>
<tr>
<td>Knowledge and skills management</td>
</tr>
<tr>
<td>Development of effective teams</td>
</tr>
<tr>
<td>Coordination of care across patient conditions, services and settings over time</td>
</tr>
<tr>
<td>Incorporation of performance and outcomes measurements for improvement and accountability</td>
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for either certification with the Office Anesthesia Evaluation as a central component, or developing an accreditation program specific for the typical oral and maxillofacial surgery practice, with the goal of making the process more friendly and approachable.

**HOW DOES OMS FIT IN WITH THE NEW CULTURE OF SAFETY AND TRANSPARENCY?**

The 1999 report by the Institute of Medicine entitled, “To Err Is Human” was a landmark in a national reckoning to improve patient safety. It concluded that tens of thousands of Americans die each year from errors in their care, and hundreds of thousands suffer or barely escape from nonfatal injuries that a truly high-quality care system would largely prevent. Medication errors alone, occurring either in or out of the hospital, are estimated to account for over 7,000 deaths annually.

In a follow-up report, “Crossing the Quality Chasm: A New Health System for the 21st Century”, the Institute of Medicine research found “a health care system that frequently falls short in its ability to translate knowledge into practice, and to apply new technology safely and appropriately.” One of the most salient points in the report was that medicine is using outdated systems to deliver care. That is, if we want safe, high quality care we will need to have “redesigned systems of care, including the use of information technology to support clinical and administrative processes.”

While the focus of these reports was largely aimed at chronic conditions in medicine, there are applicable goals that a well-run oral and maxillofacial surgery practice typically already incorporates, and others that could be of benefit. (Table 3 on P. 20)

James Reason, a British psychology professor, published a seminal article that addressed safety and human error. He describes two ways human error problems can be viewed: the person and the system approaches. The **person approach** (which is all too common in medicine) focuses on errors of individuals, placing blame on inattention, forgetfulness or moral weakness. The **system approach** focuses more on the conditions that individuals work under, and works to build in defenses that avoid errors or lessen their effects. This approach understands that humans are fallible and errors are to be expected, even in the best organizations.

He notes in his paper that it is often the best people that make the worst mistakes, and that “error is not the monopoly of an unfortunate few”. He also points out that errors or mishaps tend to occur in recurrent patterns, hence the need for the system approach. Reason’s **Swiss Cheese Model** (Fig. 3) of sys-
Preoccupation with failure: every error or near miss is reviewed to address system failures.

Reluctance to simplify: does not allow a process to rely on a single person without redundancy.

Sensitivity to operations: encourages situational awareness and information sharing.

Committed to resilience: ability to recover from a system failure and limits its effects

Deference to expertise: Those with the most relevant skill set are empowered to fix problems.

In our offices, for example, there are many defense layers that are technology-based (such as alarms, physical barriers, etc.), person-based (doctors, nurses, clerical staff), procedural-based, and administrative in nature. While any one of these “layers” could potentially prevent the wrong tooth from being extracted, for example, a series of errors in the system could leave this potential error undetected until the adverse event happened.

Reason surmises that almost all adverse events that occur involve a combination of active failures and latent (system) conditions. While adverse events will occur in any setting, the best practices make their systems as reliable as possible and follow the models we will discuss below.

Office-based anesthesia involves a high-risk environment that requires significant cognitive function, dynamic tasks, changing technologies, and time pressures while avoiding catastrophic events. In military and industrial areas like this (such as an aircraft carrier, a nuclear power plant or air traffic control) systems have been formed with great effectiveness that are exceedingly reliable and safe. These are referred to as High Reliability Organizations (HROs). These are defined as institutions where individuals, working together in high-acuity situations and facing great potential for error and disastrous consequences consistently deliver positive results.54

The goal of these organizations, besides high reliability, is the tenet of constant improvement (as in auto manufacturing with the Six Sigma model of continuous quality improvement to reduce the rate of defects). In health care, this should be a reflexive tendency, stemming from our training in the scientific method.55 Two overriding principles in quality improvement are the use of measurement tools to eliminate inappropriate variation (known in medicine as the “art” of practice, i.e., without grounded scientific rationale) and to document the continuous improvement (via outcomes).56

HROs consistently maintain two major themes:57 anticipation (constant vigilance for potential error sources as a cultural baseline) and containment (immediate actions taken to reduce further damage when an error is identified). HROs also share five key principles.58 (Table 4)

A HRO treats “near misses” as a gift, because they occur 3 to 300 times more frequently than adverse events, and can rapidly
allow data collection on the system in question, and act as powerful reminders of system hazards. HROs have developed the “knack” of converting these occasional setbacks into system-wide reviews and a more resilient care system. This method of continual assessment and improvement makes systems (such as anesthesia in an office-based surgery setting) more reliable, consistent, and produces better results.

The Institute of Medicine report, mentioned above, noted that “health care is a decade or more behind other high-risk industries in its attention to ensuring basic safety.” In fact, one of the recommendations specifically made in the Institute of Medicine report was for health care to adopt team training programs modeled on the crew resource management used in the aviation industry, as well as incorporation of simulation-based training. Similarities between this and the anesthesia team model should be appreciated.

Some of the positive benefits of crew resource management are to produce positive change in organizations, promote changes in behavior, and make learning more effective. Crew resource management incorporates team training sessions, simulation, group debriefings, and performance measurement of the crew involved. As an organization perfects this concept, they can potentially become a high reliability organization. This is exactly what has happened in aviation, and the parallels in anesthesia are easy to see.

In accredited organizations, this is referred to as a “failure mode analysis” where breaking down an adverse outcome does not blame an individual, but rather finds out where the weakness in the system resides that allowed the event to happen. As Merrill and Lair note, “Effective leadership of an ambulatory surgical center requires that leadership emphasize constant improvement in the process of care to achieve maximum patient safety and satisfaction, delivered with the highest efficiency.”

Barach notes that several complex, non-medical industries have developed robust reporting systems for near misses that are confidential and emphasize the system approach for data collection, analysis and improvement. In office-based anesthesia, standard protocols for anesthesia delivery and care should be easy to build and deliver. By becoming an HRO, the oral and maxillofacial surgery team can enhance the safety for their patients and make their offices ever more sustainable in both a business sense and in a political sense, because we would no longer be “low hanging fruit” to a legislature seeking to “do something”. This process shifts the identification of problems as an individual’s “fault” to a “system defect”. When this culture takes hold, members of the team can truly work together for the common goal of safe, effective care.

Oral and maxillofacial surgeons have clearly heeded the call to improve skill sets and participate in team training. This is seen by the increased use of patient simulation programs for residents and practitioners alike.

While many current oral and maxillofacial surgeons have participated in some type of simulation in preparation for an Advanced Cardiac Life Support (ACLS) course or through programs provided by the AAOMS
Committee on Anesthesia, technology continues to improve to the point that teams can train around surgical events and simulate the effects of an anesthetic.

Simulation dates back to the ancient Romans, when soldiers practiced for battle on a wooden model of a soldier. Medical simulation has advanced from humble beginnings, when simple mannequins were used for CPR training. As technology has advanced, the simulation models have incorporated model theories that integrate mathematical equations to simulate multiple responses based on the input of the user, and now are the basis of the modern Human Patient Simulator (HPS). Residents can now train on high fidelity HPS machines that allow simulation of heart and breath sounds pulses, ventilation, carbon dioxide exhalation, and arterial, central venous and pulmonary artery pressure as well as allowing management of the airway by mechanical means.

The ability to extend this technology to multiple remote users has also become popular via virtual-world simulation through the internet. These were first developed by the
Figure 5. Second segment of an anesthesia record. (Image courtesy of Carestream Dental, LLC)

military for deployment of troops in Iraq, and were revised for training for responses to chemical, biologic, radiologic-nuclear, and explosive incidents.\textsuperscript{63,64} The advantages of multiple users in remote locations and the flexibility of creating an online “immersive” experience show unlimited potential for training of health care and industrial professionals worldwide.

PUTTING IT ALL TOGETHER...
WHERE DO WE GO FROM HERE?

Bringing these elements of best practices together can be done in the oral and maxillofacial surgery office, especially when it comes to office-based anesthesia. One of the major initiatives in healthcare has been to convert to electronic medical records. These records, coupled with improvements in monitoring systems can help us incorporate the above-mentioned elements into our practices to ensure a high level of care, and can help us apply the quality and error reduction models mentioned previously.

Below, are some sample screen shots from an anesthesia record (within the patient’s electronic medical record) to tie some con-
cepts together. These, in combination with a system approach to error reduction and the elements within an HRO can show significant benefits to the practicing oral and maxillofacial surgeon.

This anesthesia record is divided into different segments, following a logical sequence that corresponds with the appropriate steps in patient care and team flow during a case (all images courtesy of Carestream Dental, LLC). Let’s begin with the first segment, shown in Figure 4 (on P. 24). It allows a quick review of medical conditions and allergies, a listing of providers, and a failsafe checkbox to ensure a completion of informed consent.

It also identifies the American Society of Anesthesiologists classification of the patient. The value of this particular tab is the incorporation of the team in the care process, and the provision of another opportunity for the assistants and surgeons to confirm the patient’s medical history and allergies, and answer any questions before the consent is signed.

The documentation of these key elements can also be helpful in risk management.
Consider how these steps can be done in our offices, much like the initial “checklist” that pilots review before initiating a flight.

Figure 5 (on P. 25) shows the benefit of importing monitored data at the onset of the patient visit. This segment documents the preoperative baseline vitals that are automatically imported from the monitors, and allows the doctor to record the pertinent findings on the preoperative evaluation, as well as the documentation of extremity positioning to avoid pressure injuries, and the use of safety belts or any other items deemed appropriate.

Figure 6 (on P. 26) displays the recording for the surgical “time out”, assurance of the correct patient and procedure, and marking of the operative site (performed on the digital film in a separate window). It also allows the recording of IV sites and type of catheter. These steps are critical to involve the entire surgical team, much like in the review of crew resource management discussed earlier.

The chronologic time details are automatically entered from the monitor at the completion of the case. Many of these
elements incorporate the National Patient Safety Goals from the Joint Commission, and are easily and seamlessly incorporated into the patient record, and include the culture of safety in an oral and maxillofacial surgery facility.

The section below (Fig. 7 on P. 27) is one of the most exciting portions of the electronic anesthesia record, because it allows real-time recording of the patient’s vitals during anesthesia, without the team members being distracted from the patient’s care. Note the incorporation of a graphical user interface that allows an easily read printout to be made. The ECG is recorded at the beginning of the procedure and stored within the anesthetic record for review should the monitor show changes, allowing a comparison to the baseline.

The times are either manually entered by the staff, or can be easily imported automatically, should the team wish. If doses of medications are provided during the case, they can easily be added to the record, allowing a “real time” recording of events. Typical
combinations of medications tailored to your individual practice can be created, easing the use of the record and improving efficiency.

At the conclusion of the case (Fig. 8 on P. 28) the surgeon stops the recording of data and imports a final set of vital signs to the record. At this point, he or she can make notations on any complications or anesthetic events. On this tab, the discharge vitals are later entered in the recovery room, as well as documentation of the escort and instructions provided for postoperative care.

The final page of the record (Fig. 9) documents the finer points of recovery. The Aldrete recording sheet that is used for collection of data is later scanned into the anesthetic record after completion, and is used during the follow-up phone call to the patient on the following day. This allows the patient another opportunity to review postoperative care, ask questions and ensure that they are recovering as expected.
CONCLUSIONS

Oral and maxillofacial surgeons have contributed in significant and meaningful ways to the progress in anesthesia for well over one hundred and fifty years. We can be proud of our long track record of safety in our offices, and the initiatives that we have championed to improve patient care. Times, however, are changing, and with the increased scrutiny of office-based anesthesia from a multitude of sources, we must raise the bar on how we provide care.

As medicine has begun to adopt industry best-practices as done in aviation and the military, our specialty should embrace the opportunity to again lead the way in this new era of patient care. Outcomes-centered practices, with transparency in the quality and safety of the care delivered, the development of a blame-free culture to improve our systems of care, and the modeling of our practices after high-reliability organizations offer the best chance for our specialty to leap forward and preserve the autonomy that we have worked so hard to gain.

While politically challenging, we should seriously consider the accreditation of our office facilities by an outside agency to spur our colleagues to improve the quality of care and shift the culture to a patient-centered organization that produces the right outcomes for the right patients all of the time. To offer anything less to our patients undermines not only our credibility, but undermines the work of the pioneers in oral and maxillofacial surgery before us.

Dr. Mark Zajkowski is a graduate of the University of Florida, the UCLA School of Dentistry, and Harvard Medical School. He completed his residency in oral and maxillofacial surgery at Massachusetts General Hospital in 1999. Mark is a partner in a four-doctor practice in South Portland, Maine that practices the full scope of the specialty, and became voluntarily accredited by the Joint Commission in 2006. Dr. Zajkowski is active in organized oral and maxillofacial surgery, having served on numerous committees and task forces.

Mark’s interests outside of the specialty include the study of business and health care policy, as well as cooking, boating, and exploring the coast of Maine with the love of his life Michele and their two children. This issue of SROMS is dedicated to them.
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