Office Anesthesia in Dentistry:

Assuring Safety While Reducing Anxiety

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BACKGROUND

An inability to cooperate with dental treatment may indicate the need for anesthesia "beyond" that of local anesthesia, including moderate and deep sedation and general anesthesia.

Further, given the number of patients with significant medical conditions that walk into dental offices on a daily basis, often requiring multiple medications in the effort to maintain some level of control, the possibility of a crisis occurring may be greater now than ever.

Given the above, 2 questions come to mind:

   1) How safe is anesthesia in the dental office and,

   2) What can be done to ensure the best opportunity for favorable outcomes?

HOW SAFE?

The incidence of anesthesia related complications in the dental office is difficult to estimate, in large part because they are a rare occurrence. Studies looking at adverse outcomes differ in the method used for counting and often rely on self-reporting. Further, given that there are no uniform requirements for reporting adverse events in different states and territories, there are likely many unreported crisis events that were handled without patient injury. It is safe to say that despite advances in safety over time, the risk of adverse anesthetic events is not zero.

Recently, both the California and Texas dental boards conducted 5-year retrospective reviews of deaths or permanent injuries associated with the administration of in the care of dental patients.

The California Board conducted a retrospective review of pediatric (21 & under) anesthesia deaths from 1/1/2010 – 12/31/2015. There was no reliable estimate of the number of patients treated during this time interval.

They identified 9 documented deaths. One occurred in an oral surgery office with the rest in the offices of general dentists, pediatric dentists and itinerant dentist anesthesiologists. Of interest was the fact that 3 occurred in a hospital or surgical center and 3 were associated with local anesthesia overdose.

The Texas panel reviewed "major events" (mortality or permanent morbidity) and "mishaps" (no permanent morbidity) of cases investigated by the state dental board between 2011 and 2016. Six cases were identified including 5 deaths and 1 brain injury. Two of the patients were adults, both of whom were medically compromised, and 4 were children, 3 were "healthy" and one who had cardiac disease. Four of the 6 cases involved "second" anesthesia providers including MD anesthesiologists and dentist anesthesiologists.

In a 2013 article in Pediatric Anesthesia, media reports of pediatric dental anesthesia mortality from 1980 – 2011 in dental offices, ambulatory surgery centers, and hospitals were reviewed.[1] The report did not likely capture every death and did not indicate if the death was directly

associated with the anesthetic. They found that most of the deaths occurred among 2–5 year-olds (n = 21/44), in an office setting (n = 21/44), and with a general/pediatric dentist (n = 25/44) as the anesthesia provider. In the latter group, 17 of 25 deaths were linked with a sedation anesthetic.

This series likely represents a fraction of the overall morbidity and mortality related to dental anesthesia and suffers from the absence of a database that could provide an estimate of incidence and prevalence of morbidity and mortality.

The best, although not definitive, data comes from the specialty of oral and maxillofacial surgery. At the American Association of Oral and Maxillofacial Surgeons (A.A.O.M.S.) Clinical Science Innovations in Oral and Maxillofacial Surgery meeting in April 2017, Thomas B. Dodson reviewed relevant outcomes studies in the effort to arrive at estimated death and adverse outcome rates.[2] Studies cited included:

1) 4 separate Massachusetts Society of Oral and Maxillofacial Surgeons anesthesia outcome studies - Self–reported surveys for 1992, 1999, 2003, and 2008.

2) A.A.O.M.S. Outcomes System 2001 – A 10 year prospective cohort study of consecutive subjects undergoing OMS procedures in the office-based ambulatory anesthesia setting by volunteer OMSs practicing in the United States.

3) A.A.O.M.S. Study on Anesthesia/Third Molar Benchmark Study 2011 to 2012 – A one-year prospective cohort practice based research network study that included consecutive subjects who underwent procedures in the private practice O.M.S. offices (randomly selected practices in the United States).

Together these studies suggest an estimated death rate of 1.5 per million anesthetics for the office based team model in oral and maxillofacial surgery, although this seems unrealistically high, likely because of the method of collecting data in the Massachusetts surveys.

Others numbers have been cited in the effort to quantify the incidence of serious adverse events, including the often referred to anesthetic death rate estimate by Oral and Maxillofacial Surgery National Insurance Company (O.M.S.N.I.C.) of 1 per 365,554 patients. This estimate has since been retracted by O.M.S.N.I.C. due to the difficulty of making an accurate determination.

Along with above efforts to establish a reliable safety estimate, there have been those who have used their own version of risk estimates to further specific political agendas. However, at this time it remains impossible to accumulate accurate data on the nature and frequency of anesthetic related complications.

WHAT IS THE SOURCE OF ADVERSE OUTCOMES?

Philosophers Samuel Gorovitz and Alasdair MacIntyre explored the nature of fallibility, proposing 3 major factors that come into play[3]:

1) Ignorance: Despite ongoing efforts, science affords only a limited understanding of how things behave,

2) Ineptitude: Even when knowledge is available, we may fail to apply it correctly.

3) Necessary Fallibility: Some things science and technology will never be able to explain of understand. This they categorized as "omniscience".

The first and second proposed reasons for fallibility seem to be surmountable sources of error. We generally believe that given time, science will overcome ignorance, and training and technology will overcome ineptitude. However, when we ask science (or medicine and dentistry) to move beyond explaining how things generally behave to predicting exactly how a particular thing (or patient) will behave, we may be asking too much. While we can and should do our best to limit uncertainty when we treat patients, in the end we cannot completely escape fallibility.

Attention began to focus on the issue of medical errors with the 1999 the Institute of Medicine, which reported that between 44,000 to 98,000 deaths per year were due to "adverse events". Despite many studies designed to identify ways to correct such errors, in 2016 it was reported that medical errors were the 3rd leading cause of death in the U. S., further illustrating the complexity of the problem.

It is now recognized that adverse events and bad outcomes are generally not just the result of personal errors. Often factors conspire in a manner that makes errors more likely to occur, which was presented graphically through the well-known "Swiss cheese" analogy proposed by psychologist James Reason.

Professor Reason is well known for his work on systems errors. In one of his public lectures, he stated (paraphrased) "Almost every day we choose whether or not to cut corners in order to meet operational demands. For the most part, such shortcomings bring no bad effects and so become a habitual part of routine work practices. It's easy to forget to fear things that rarely happen. Unfortunately, this gradual reduction in systems safety margins exposes it to increasingly vulnerable accident-causing factors."[4] This statement identifies an important human factor that increases the chance of an adverse event occurring and emphasizes the need for constant vigilance on the part of the entire anesthesia team.

THE PROCESS

Consider this triad (see Figure 1), which suggests an approach to safe anesthesia delivery:

Figure 1. An approach to safe anesthesia delivery

1) Risk evaluation and Optimization – Unique for every patient in the effort to develop a personal anesthetic plan. Should include consultation with other experts as needed and awareness of the limits of the facility and capabilities of the anesthetic team. Young patients and the medically compromised are at increased risk for respiratory or other complications and have a greater risk of sustaining

life-threatening events. Training and protocols should have specific measures for these patients. It is worth adding that "fear" can be a good thing when approaching the delivery of anesthesia, for as it has been rightly said, Chernobyl operators never learned to be afraid.

2) Anesthetic Delivery and Monitoring – Includes having a well-trained and functional team in place to assist with delivery of anesthesia and monitoring of the patient during the procedure.

3) Recognition and Response to Crisis Events – Ability to recognize pre-emergency and emergency events as well as the capability to effectively respond to crisis situations.

EFFORTS TO MINIMIZE ADVERSE OUTCOMES

The following diagram (adapted from the A.A.O.M.S. Culture of Safety meeting in 2017) provides a perspective on key factors that contribute to establishing a culture of safety in office-based anesthesia (see Figure 2).

Figure 2. Key factors contributing to the safety culture
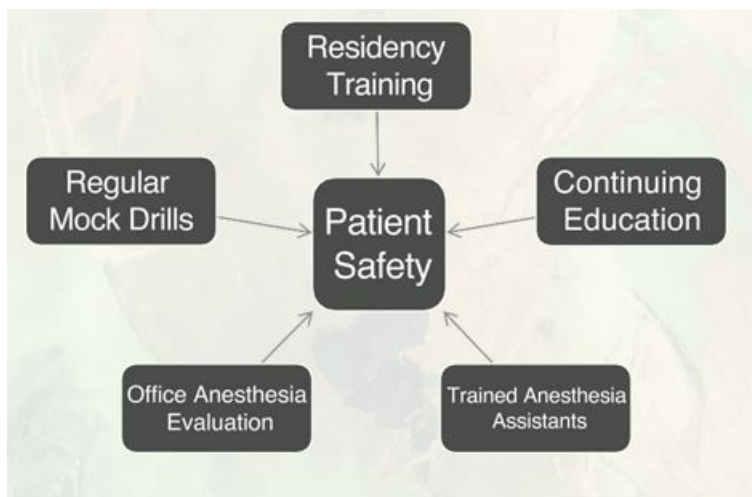
Education and Training – Targeted at pre-operative risk assessment and optimization of patients across a wide spectrum of age and risk factors, understanding of anesthetic agents, techniques of administration, monitoring, and the ability to recognize and manage adverse events. Training should emphasize patient selection with the understanding that some patients are not good candidates for anesthesia in the office setting.

Life-long Learning / Continuing Education – Ongoing education of the practicing anesthesia provider and his/her team must be targeted toward reinforcing skills and knowledge from residency and other formal educational programs. This must encourage development of good judgment with emphasis on the ability to determine if any given patient is an appropriate candidate for treatment. Ideally, training should include both didactic and simulation (ex. - A.C.L.S., A.A.O.M.S. simulation courses including Basic Emergency Airway Management and Crisis Management programs, etc.). Team members can be trained through formal programs like the Dental Anesthesia Assistants National Certification Exam (D.A.A.N.C.E.) or other similar programs.

Team Model – The anesthetic team must function in a manner that supports one another in the effort to provide the best possible care. Training must include the entire team of individuals responsible for the care of the patient ranging from trained assistants and nurses to the doctor in charge of treatment.

Management of Medical Emergencies – The anesthetic team and support personnel must be trained and current in recognition and management of emergencies.

REGULAR mock drills must be conducted and targeted to address a wide variety of potential likely emergency events.

Office Anesthesia Evaluation Program – Regular evaluations using the A.A.O.M.S. Office Anesthesia Evaluation (O.A.E.) assessment process assists in organizing the team and increasing awareness of strengths and weakness in the effort to identify and encourage change(s) as necessary. The O.A.E. or other like programs should be used to credential both practitioners and facilities.

In addition to evaluating the provider and staff, the facility must evaluated and found to be designed to promote safety in the management and recovery of patients. The necessary monitoring equipment must provide advance warning of hypoxic events. Facilities must be equipped with monitoring equipment, defibrillators, emergency drugs and age appropriate airway devices that allow effective crisis intervention and should be available and functional at all times. All resuscitative drugs should be checked and equipment tested at routine accepted intervals.

Note - In Delaware, individuals and practice venues offering anesthesia services are accredited by the state with inspections performed every 3 years. The current state program is built upon the A.A.O.M.S.'s Office Anesthesia Evaluation, an office inspection program required for all oral surgeons to maintain membership in their national organization. The state offers different "levels" of permits based on the depth of anesthesia provided.

KNOWLEDGE AND PERFORMANCE IN ANESTHESIA DELIVERY

The ability to deliver anesthesia in a safe manner requires not only knowing "what to do", but also the ability to put acquired knowledge and skills to work.

1) KNOWLEDGE: All anesthesia teams must have a contemporary base of knowledge and skills related to risk assessment, anesthesia delivery and crisis management.

2) PERFORMANCE: The ability to use accumulated skills and knowledge to work, employing a mindset that allows the team to recognize and respond in an effective manner.

KNOWLEDGE

The usual approach to learn the science and related information that support safe anesthesia delivery is to apply traditional learning skills we developed as students / residents / fellows. There are plenty of courses, books and other resources available to help in the effort to obtain and update this base of knowledge. In addition, "guidelines" have been issued by a number of organizations in an effort to improve and standardize anesthetic management. An example is the Parameters of Care, Clinical Practice Guidelines for Oral and Maxillofacial Surgery, which reflects clinical practice guidelines that reviews standards for treating patients receiving office-

based anesthesia, including the monitoring procedures and equipment that should be followed by the surgeon and staff.

It is important to recognize that both knowledge and skills decline over time. For example, in Resuscitation (2008), Smith, Gilcrest and Pierce reported that A.C.L.S. skills degrade faster than B.L.S. skills.[4] They considered 133 subjects and found the following:

- B.L.S.: 63% passed B.L.S. skills at 3 months 58% passed at 12 months.
- A.C.L.S.: 30% passed A.C.L.S. skills at 3 months 14% passed at 12 months.

The take home point should be that knowledge (and skills) need to be updated and reinforcement on a regular basis.

After obtaining the necessary knowledge base, teams should develop a written plan that concisely summarizes (protocols) keys to management, especially should be done in the event of a crisis. This should guide the organization of appropriate equipment and medications along with how and when to administer each.

PERFORMANCE

Of equal importance is developing a productive mindset that keeps the team from getting sidetracked by the negative influences stress and fear can have in the moment of crisis. Making decisions under pressure is never a simple undertaking, particularly given the emotions and complexity inherent in crisis situations.

Pressure occurs when you are attempting to do something you are not sure you are capable of. The further you are from the familiar, the further away you are from being comfortable and confident. With pressure, "outside things" begin to interfere with your ability to execute a skill or apply knowledge.

This applies to everything we do in all walks of life. Consider a multi-year study of the top 10% of 12,000 athletes and business leaders using 360 degree multiple rater assessments.[5] The study found that:

1) Pressure adversely impacts cognitive success,

2) Pressure downgrades behavioral skills,

3) Pressure makes people perform below their capacity, and

4) Pressure is often camouflaged.

In the face of pressure and anxiety, the team must be able to process a barrage of imperfect and sometimes conflicting information. It is crucial that they be able to quickly assimilate and process such information, weed out that which is not important, prioritized what is left, test information against prior medical knowledge and experience, make tentative differential diagnoses, decide on a course of action, manage resources effectively, all the while reevaluating the situation in light of evolving information. All this must be done in a timely manner.

Things that can be done to reduce errors include:

- Reduce interruptions
- Reduce distractions

• Improve communications

• Use "stop" or "check" points at critical times during the procedure

• Team training

It is important that the team adopt a productive mindset during a crisis. Such a mindset is often referred to as the being in "the zone", when we are able to focus on one thing to the extent that we do not notice other less important distractions.

One way to encourage entering the zone of performance is to use tools commonly employed by sports psychologists, for example "imagery". This is done by rehearsing in a manner that allows us to visualize / live through a potential adverse event in advance. So equipped, we are better able to access and act on the knowledge and skills we have built up and respond in an effective manner when a real crisis occurs, having already "felt and experienced" what it is like.

MOCK DRILLS/CRISIS RESOURCE MANAGEMENT

Given that adverse events are not entirely preventable, it is important to understand that once an incident is triggered, the best chance of a successful outcome occurs when there are well-trained people and systems in place to recognize and respond effectively.

While simulators provide the best method for conducting mock crisis experiences, they are not yet readily available and affordable for most. The next best approach is mock drills.

Properly conducted, mock drills allow team to "be there in advance" of the real thing, so that if and when a crisis occurs, members of the anesthesia team will be familiar with their role in the response process. The familiarity and confidence that can result from having practiced for such events equips us to embrace the challenge when it presents itself rather than allowing the challenge to control the moment.

TIPS FOR EFFECTIVE CRISIS MANAGEMENT

During the crisis:

• Call for help early

• Mobilize resources

• Allocate attention wisely

• Use all available information

• Communicate effectively

Failure to speak up because of fear of being wrong or intimidation, failure to confirm communication (not closing the loop), and neglecting to include important facts are common errors in communication. Clear, unambiguous language is preferable during all medical communication, and especially during critical incidents. An effort should be made to avoid implied and inferred communication, communicating in a manner so that you cannot be misunderstood
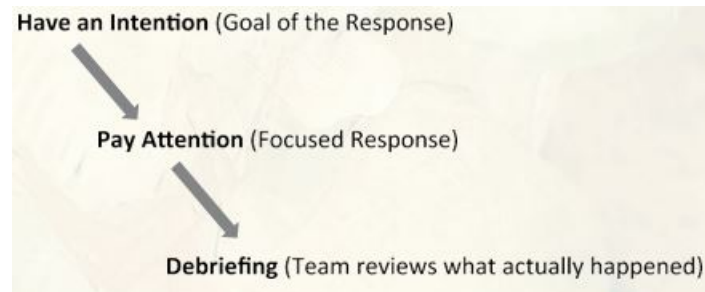
A popular approach to crisis management follows the acronym "STOP":

S - Stop (control anxiety and fear)

T - Think (get properly organized

O - Observe (identify key factors / avoid denial)

P - Plan

A - Act (deliberate and decisive actions)

R - Revise / Reassess

Flow chart (see Figure 3) of how mock drills should work:

Figure 3. Mock Drill Flow Chart

Have an Intention (Goal of the Response)

Pay Attention (Focused Response)

Debriefing (Team reviews what actually happened)

By paying attention to the results of a mock drill (virtual or real), the team gains an opportunity to identify what worked and what did not work. Ideally, someone from the outside should conduct the training, as they are better able to identify things that may not be obvious to those that work there all the time and are involved in the drill.

Mock drills should be realistic, immersive learning experiences that support:

• Identification of shortcomings

    o Were communications clear?

    o Roles and responsibilities understood?

    o Resources available?

    o What errors were made?

    o What went well?

• Implementation of strategies to solve them.

    o Use the "1-2-3 approach";

    o Tell, 2) Show, and 3) Do.

    o Revise / Improve systems to improve team performance.

FINAL THOUGHTS

Employing best practices in anesthesia care is critical in the effort to ensure a culture of safety. The office environment should encourage trust among team members, be non-putative when mistakes are identified and exhibit a willingness to learn and change in the effort to reduce errors and improve safeguards.

Offices that provide mild, moderate and deep sedation and general anesthesia should employ an ongoing process to monitor and evaluate clinical performance, patient outcomes and adverse events in an effort to support continuous performance improvement.

Unfortunately, safety is an asymtope and unanticipated crisis events can and do occur. Therefore the anesthetic team should be well prepared to respond in a timely and effective manner to any adverse event that may occur.

Currently this is best accomplished through regular mock safety drills that address the spectrum of potential and actual crisis situations.

Going forward, it is important for the dental community to make a concerted effort to improve their anesthesia data base and work to standardize reporting requirements of adverse or near miss events. While the A.A.O.M.S. is in the process of gathering such data nationwide through their data registry system (OMSQOR registry with FIGmd), there is no such mechanism currently in place for non-oral surgeons who provide mild, moderate and deep sedation and general anesthesia.

ANESTHESIA GUIDELINES:

1) American Association of Oral and Maxillofacial Surgeons, Parameters of Care: Clinical Practice Guidelines for Oral and Maxillofacial Surgery, 2017.

2) American Association of Oral and Maxillofacial Surgeons, Office Anesthesia Evaluation Guidelines, (revision due 2018).

3) American Society of Anesthesiologists Guidelines for Sedation by Non-Anesthesiologists, 2017.

4) American Society of Anesthesiologists Standards for Basic Anesthetic Monitoring, 2015.

5) American Society of Anesthesiologists Guidelines for Office- Based Anesthesia, 2014.

6) American Academy of Pediatrics Guidelines for Monitoring and Management of Pediatric Patients Before, During, and After Sedation for Diagnostic and Therapeutic Procedures: Update 2016.

7) American Dental Associations Guidelines for the Use of Sedation and General Anesthesia by Dentists, 2016.

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