

Patient Safety Tip of the Week

March 15, 2016 Dental Patient Safety

We were recently asked why we haven't done any columns on dental patient safety. While over the years we've encountered a few minor safety issues in dental cases in hospitals, we've never looked at the broader issue of safety in dental practice where it is usually practiced – outside the hospital.

So here goes!

A report from Spain on patient safety in dentistry ([Perea-Perez 2011](#)) identified several reasons why patient safety has been less well addressed compared to medicine and surgery and we suspect the same issues apply in the US:

- The harm produced is generally less severe
- The patients are ambulatory (making it difficult to become aware of and follow up on adverse events)
- There is great dispersion of dental care, making it difficult to collect data
- Fear of reporting adverse events
- Lack of a generalized culture of patient safety in dentistry

A recent systematic review found that the only interventions in dentistry that reduce or minimize adverse events are surgical safety checklists and highlighted the need for further research into patient safety in dentistry across several domains: epidemiological, conceptual understanding and patient and practitioner involvement ([Bailey 2015](#)).

A random sample from 20 dental practices in the Netherlands showed an overall 4.6% rate of adverse events, with 2.8% deemed preventable ([Mettes 2013](#)). The prevalence of preventable adverse events for all patient contacts was 0.13%. Potentially preventable adverse events included: retained root fragments, inadvertent removal of a permanent tooth, fractured instruments, excessive filling, swallowed partial prostheses, and removal of some teeth without prior X-ray. Of the 18 identified adverse events, 15 were classified as treatment-related, 10 as diagnosis-related, and one as communication-related. 37 causes were found for the 18 adverse events, 65% human and 30% organizational.

While we expected problems related to sedation would head the list of potential patient safety problems in dentistry, we found a whole host of reported safety issues:

- Extracting wrong tooth/teeth
- Complications of sedation
- Swallowing crowns, whole teeth, instruments, etc.
- Failure to use antibiotic prophylaxis

- Nerve injury
- Adverse reactions to local anesthetics
- Infection control issues
- TMJ damage?
- Prescribing-related events
- Failure to Address Significant Comorbidities
- Diagnostic errors
- Staff injuries (eg. needlesticks, latex/rubber reaction)
- Rare events (eg. latex allergy, malignant hyperthermia)
- Dental amalgam issues
- Staff-related events
- Radiology issues

Extracting the Wrong Tooth

Given the frequency with which we continue to see wrong site surgery in hospitals, it should not be surprising that extraction of the wrong tooth would occasionally occur. Indeed it does. The Doctors Company (a large medical malpractice insurer) notes it occurs with surprisingly high frequency and is, in most cases, preventable ([The Doctors Company 2016a](#)).

Prior to dental extractions there should be the same sort of timeout that we use prior to any surgery or procedure. That should include both a pre-procedure verification and then the timeout that immediately precedes the procedure. These include ensuring the correct patient, procedure, and correct tooth. Teeth have both a name and number so that should make correct identification easier, but errors still occur. Teeth may also shift when other teeth are missing, leading to confusion. And don't forget to make sure there is a legitimate diagnosis that merits extraction of the tooth!

Copies of radiologic studies should be present (and correctly oriented) to help verification and the patient should be asked which tooth is the one to be extracted (though many patients with a toothache are not quite sure themselves which is the diseased tooth and others may have cognitive dysfunction that precludes self-identification of the tooth). The tooth to be extracted should be checked against the referral slip. There should be a dental diagram with the tooth/teeth for extraction clearly marked. Be especially aware when contiguous teeth are diseased.

Joint Commission's Universal Protocol requires marking the site prior to surgery but one of the exceptions requiring alternative methods is teeth. It may be impractical to mark individual teeth. So prior to and during the timeout there is a need to indicate operative tooth name(s) on documentation and mark the operative tooth (teeth) on dental radiographs or dental diagrams and document. And the verification should be agreed upon by at least 2 people (the dentist or dental surgeon and a nurse or dental assistant).

Often when the wrong tooth is extracted, root cause analyses show multiple opportunities to have prevented the incident ([Smith 2007](#)). Smith notes common etiologies of wrong-site tooth extraction include cognitive failure and miscommunication, multiple contiguous carious teeth (rather than one identifiable diseased tooth), partially erupted teeth mimicking third molars, teeth with gross decay that the restorative dentist wants to save, reversed radiographs, and nebulous tooth numbering systems.

Complications of Sedation

Those of us who are baby boomers may recall much of our dental work was done under sedation with – ether! Now we look back and think how incredibly dangerous that probably was! We don't recall being hooked up to any sort of monitoring devices (and they didn't have pulse oximeters back then). We doubt the depth of sedation was closely monitored and bet that our protective reflexes were often rendered ineffective. And outpatient offices are probably not the greatest place to undertake full resuscitative measures if a sedation accident does occur.

In addition to the respiratory depression that may occur with sedation, loss of protective reflexes may predispose to aspiration or swallowing of crowns, teeth, instruments, gauze, etc.

Today dentists must be certified to do moderate sedation and go through at least as intensive training in sedation that we require for those physicians we credential and privilege to do moderate sedation in hospitals.

Yet incidents related to sedation continue to occur...

Deaths in patients who received sedation for dental procedures make the news every year ([Otto 2014](#), [AP 2015](#)). Columns highlighting 8 ([ABC News 2016](#)) and 31 ([Bradford 2012](#)) respective deaths related to dental sedation provide some estimate of how frequently such complications of sedation occur. The most recent incident was just reported last week ([George 2016](#)). In this case a 4-year old girl suffered brain damage after receiving sedation for a dental procedure while being restrained by a device called a “papoose”. A CBS News report on this case ([CBS News 2016](#)) notes she was given multiple sedatives in the office for over seven hours for what was described as a routine dental procedure. Her heart rate was noted to be as high as 195 and her blood pressure to 168/77 and her oxygen saturation dropped as low as 49 percent. The “papoose” is a device confines the child's arms and legs so they can't interfere with the dental procedure. The CBS report notes that use of such devices for dental procedures in children is fairly widespread in the US and families and professionals need to be made aware of the dangers.

Another study, using primarily media reports, found 44 children who died subsequent to receiving anesthesia for a dental procedure in US dental offices, ambulatory surgery centers, and hospitals between 1980 and 2011 ([Lee 2013](#)). Most deaths occurred among

2–5 year-olds, in an office setting, and with a general/pediatric dentist as the anesthesia provider. In this latter group, 17 of 25 deaths were linked with a sedation anesthetic. That study likely significantly underestimates the number of serious complications from sedation and also did not include children who suffered neurologic injuries, suffered cardiac arrest, and were successfully resuscitated, or those who experienced respiratory arrest, but not cardiac arrest. The authors called for development of a national database for reporting both serious incidents related to dental sedation and near misses.

In a study of closed malpractice claims in pediatric dental patients 13 of 17 claims related to anesthesia involved sedation ([Chicka 2012](#)). The average patient age was 3.6 years and 6 involved the dentist as the anesthesia provider and the location was the dental office in 71% of cases. Only 1 claim related to sedation in which physiologic monitoring was used.

A prospective study of 51 patients needing dental treatment under oral conscious sedation found that postdischarge excessive somnolence, nausea, and emesis were frequent complications ([Huang 2015](#)). 60.1% of patients slept in the car on the way home and 21.4% of that group were difficult to awaken upon reaching home. At home, 76.1% of patients slept and 85.7% of patients who napped following the dental visit slept longer than usual.

Proper patient selection, adherence to proper sedation technique, appropriate monitoring, and prompt intervention are obviously important when using sedation in any setting. The American Dental Association has guidelines for the use of sedation and general anesthesia by dentists ([ADA 2012](#)) and most state health departments have requirements for dentists to be certified in the use of sedation in the office.

Swallowing crowns, whole teeth, instruments, etc.

It really shouldn't be surprising that a patient might inadvertently swallow items during a dental procedure. The local anesthetics given not only numb the area being worked upon by the dentist or oral surgeon but also impair the ability of a patient to tell that there is a loose item in his/her mouth. Anyone who has undergone such procedures knows how easy it is to inadvertently swallow while the dentist or oral surgeon is working. Also, when sedation is used there may be a fine line between moderate sedation and deeper sedation where protective reflexes are impaired, making aspiration or swallowing items more likely.

During, for example root canal treatment, if the dentist places a rubber dam around the tooth during endodontic treatment then the risk of saliva contamination and ingestion of chemicals or aspiration of instruments is reduced. But there apparently is not a profession-wide consensus about the importance of rubber dam use ([Gilbert 2015](#)). Gilbert et al. suggest the patient safety aspect needs an effort similar to what has occurred in surgery regarding “never events”.

The Doctors Company recommends the following “if a patient inadvertently swallows part or all of a tooth, crown, or dental instrument, inform the patient immediately, and refer him or her for a chest or gastrointestinal x-ray. Any abnormal results should be reviewed by the patient’s physician, and a follow-up appointment with the physician should be scheduled. Document the dental record with any treatments provided and all discussions of the event, treatment options, and referrals for medical care. Coordinate arrangements with the patient and the treating medical practitioner for medical care and x-rays. Communicate with the patient’s physician and maintain a dialogue with the patient.” ([The Doctors Company 2016b](#)).

Failure to Use Antibiotic Prophylaxis

Failure to use antibiotic prophylaxis in patients with artificial heart valves or other foreign bodies that might become infected has been listed as a safety concern. However, most recent guidelines have actually done away with prophylaxis in many cases. Compared with previous recommendations, there are currently relatively few patient subpopulations for whom antibiotic prophylaxis may be indicated prior to certain dental procedures ([ADA 2016](#)). For example, for those with hip arthroplasties the current guidelines do not recommend antibiotic prophylaxis prior to dental surgery unless there have been complications related to the hip surgery.

A joint effort by the American Academy of Orthopedic Surgeons and the American Dental Association did a thorough review of the issue of antibiotic prophylaxis in patients with joint implants in 2012 ([AAOS/ADA 2012](#)) and came up with the following recommendations:

- Recommendation #1: “The practitioner might consider discontinuing the practice of routinely prescribing prophylactic antibiotics for patients with hip and knee prosthetic joint implants undergoing dental procedures.”
- Recommendation #2: “We are unable to recommend for or against the use of topical oral antimicrobials in patients with prosthetic joint implants or other orthopaedic implants undergoing dental procedures.”
- Recommendation #3: “In the absence of reliable evidence linking poor oral health to prosthetic joint infection, it is the opinion of the work group that patients with prosthetic joint implants or other orthopaedic implants maintain appropriate oral hygiene.”

Recommendations now for antibiotic prophylaxis during dental procedures involve primarily patients at highest risk for infective endocarditis (eg. those with prosthetic valves, previous endocarditis, congenital heart disease, transplant patients with valvulopathy).

Bottom line: always check to ensure the most up-to-date guidelines for prophylaxis are followed.

Lingual Nerve Injury

Lingual nerve injury may complicate invasive dental and surgical therapies, resulting in numbness, dysesthesia, paresthesia, and dysgeusia ([Graff-Radford 2003](#)). The authors also note that unexplained nerve injury following dental procedures, especially tooth removal, may be caused by intraneural injection, creating permanent damage. They note that the incidence of lingual nerve injury consequent to surgery depends upon the procedure being performed, the surgeon's experience, procedure methodology, and certain patient-specific factors. Such injury is most common after mandibular third molar removal, the incidence of permanent nerve damage reported to vary between 0.5% and 2%.

A nice discussion of nerve injuries after dental injection cited the incidence from the literature as between 1 in 160,571 and 1 in 26,762 mandibular blocks ([Smith 2006](#)). Those authors note multiple potential mechanisms, including direct trauma from the injection needle, hematoma formation, and neurotoxicity of the local anesthetic.

Adverse Reactions to Local Anesthetics

Allergic reactions to local anesthetics can, of course, occur and may be unpredictable if there is no past history of such events. But other adverse reactions can occur to local anesthetics. Biron ([Biron 2000](#)) described toxic overdoses from local anesthetics in dentistry, which can be manifest by seizures or unconsciousness among other symptoms and signs. Such may occur from large amounts of local anesthetic injected, too rapid injections, inadvertent intravascular injection. And don't forget that many of the local anesthetic preparations include vasoconstrictors that can cause adverse events in patients with underlying cardiac problems. The Biron article includes algorithms for management of toxic local anesthetic overdoses or reactions to vasoconstrictors.

Infection Control Issues

Potential contamination and transmission of pathogens is both a patient safety issue and a concern for staff safety. Concerns especially apply to potential transmission of hepatitis B virus (HBV), hepatitis C virus (HCV), human immunodeficiency virus (HIV), methicillin-resistant staphylococcus aureus (MRSA) infection, among others ([Klevens 2008](#)).

The Doctors Company ([The Doctors Company 2016b](#)) has the following recommendations to reduce the chance of such transmission:

- Always wash your hands before donning gloves and again after removing them.
- Change gloves between patients.
- When gloved, don't touch noncritical patient care items that are not barrier protected or cleaned between patients.
- Wear your personal protective equipment.
- Use any single-use disposable instrument only once, and then dispose of it properly.
- Follow the manufacturer's directions for autoclaving dental instruments. Perform biological monitoring, and document the monitoring results. Store sterilized instruments in a clean, dry, and protected environment.
- Establish a dirty area for processing and cleaning instruments in preparation for autoclaving to avoid cross-contamination of clean and sterilized items.
- Select appropriate devices that reduce aerosol and droplet formation and the potential for sharps injuries.
- Ensure that everyone follows universal precautions with every patient.
- Manage occupational exposure to blood-borne pathogens, including post-exposure prophylaxis for work exposure to hepatitis B virus, hepatitis C virus, and HIV.
- Check dental unit water lines, biofilms, and water quality regularly.

Details of cleaning and processing and sterilization of instruments is beyond the scope of today's column but CDC has good resources regarding infection control issues in dental settings ([CDC 2015](#)) and for occupational exposures in dental settings ([CDC 2013](#)). Exposure incidents might place dental health care personnel at risk for hepatitis B virus (HBV), hepatitis C virus (HCV), or human immunodeficiency virus (HIV) infection, and therefore should be evaluated immediately following treatment of the exposure site by a qualified health care professional.

And, of course, dental offices as well as other venues performing dental or oral surgery procedures must have proper procedures for medical waste disposal.

TMJ Dysfunction?

Though patients may complain of pain and other symptoms of TMJ dysfunction following dental or oral surgery procedures, the evidence base linking the two is very scant. One study ([Juhl 2009](#)) was a prospective study to investigate if third molar surgery is associated with the development of symptoms and signs of temporomandibular disorders (TMD) during a 6-month post-operative observation period. In the patient group, they found: reduced range of maximum jaw opening at one week after surgery, increased characteristic pain intensity 1 week after surgery, increased disability up to 1 month after surgery, increased incidence of muscle pain on palpation up to 6 months after surgery, increased incidence of pain on palpation of the temporomandibular joint up to 6 months after surgery, and increased incidence of painful TMD 6 months after surgery. But, when compared with untreated controls, subjects undergoing third molar

surgery have a statistically insignificant increased incidence of TMD 6 months post-operatively.

Failure to Address Significant Comorbidities

For example, excessive bleeding if you failed to note the patient was taking anticoagulants would be problematic. Similarly, using an agent to which the patient had a known allergy would also be problematic.

Prescribing Errors

Patients of dentists are vulnerable to the gamut of medication errors that may occur when any physician or dentist prescribes drugs. See our many columns on medication safety.

Diagnostic Errors

Just as in any field of healthcare, diagnostic errors may occur in dentistry and oral surgery. In the Netherlands study noted above ([Mettes 2013](#)) many of the adverse events were noted to be diagnosis-related. Most often diagnostic errors might arise from failure to obtain appropriate dental radiographs prior to dental extractions. But there are other more complex symptoms that often masquerade as dental problems. We've often seen patients with atypical facial pain or even classic trigeminal neuralgia who have had dental procedures performed inappropriately for the pain before the patient ultimately sees a neurologist.

Rare adverse reactions

Some events that occur in other surgical settings might also be anticipated to occur rarely in dental practices. One such example might be latex allergy since patients might be allergic to latex in gloves of the dentist or hygienist or to the latex in a dental dam. Another theoretical event that might be precipitated by local anesthesia is malignant hyperthermia, though local anesthetics are said to be relatively safe in patients with known malignant hyperthermia by history. Nevertheless, it behooves all dentists and oral surgeons to be aware of the symptoms and signs of these rare events (latex allergy, malignant hyperthermia) since they require immediate interventions.

Dental Amalgam Issues

You are all familiar with the long-standing controversies over the relationship between dental amalgam and a variety of medical conditions. A review ([Brownawell 2005](#))

uncovered no convincing evidence pointing to any adverse health effects that are attributable to dental amalgam restorations besides hypersensitivity in some individuals.

Staff-related events

Dentists, hygienists, and others are exposed to bodily fluids (saliva, blood) that put them at risk for contracting pathogens like hepatitis B virus (HBV), hepatitis C virus (HCV), human immunodeficiency virus (HIV), and others. These can occur from needlesticks, bites, scalpel injuries, and perhaps even through aerosolization during drilling. Use of proper personal protective equipment is obviously the most important strategy to reduce the risks. But dental offices need to have protocols for dealing with such injuries, just as hospitals have.

Other potential staff risks include latex allergies and radiation exposure. While the radiation dose from typical dental x-rays is small, the cumulative dose over long periods could be significant. Therefore, it is crucial that all dental offices take appropriate steps to avoid radiation exposure.

Radiology Issues

In addition to the radiation exposure potential noted above, other radiology issues may occur. These might include use of equipment that provides suboptimal images, viewing images backwards, wrong-patient issues, and others that might lead to diagnostic or therapeutic errors.

Summary

Yes, we were surprised at the spectrum of patient safety events that may occur in the dental office or other venues where dental work or oral surgery are performed. It's too bad there are no current ways to quantify the frequency of these various incidents. Nonetheless, simply being aware of the potential events and having systems in place to prevent such events or deal with such events when they do occur is important.

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