

# Perioperative Dental Evaluation

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## ABSTRACT

Typically, a patient's intraoral condition is not a chief perioperative concern. The need for proper dental care is often unmet prior to a surgical procedure. Consequently, patients presenting for surgery may possess untreated decayed teeth and/or periodontal disease. These individuals may be harboring a

quiescent and potent odontogenic infection. In the perioperative period, the deleterious effects of such an infection can not only compromise surgical outcome, but also magnify treatment and expenses. This article will elaborate on the connection between oral health and systemic disease, and discuss the barriers that exist with improving oral health. It will review pertinent dental nomenclature and anatomy, as well as emphasize the practice and value of a preoperative dental evaluation. Various compromised intraoral conditions are presented among a range of patient populations. The importance of treating an acute odontogenic infection before surgery is also discussed. Healthcare providers who recognize significant perioperative dental conditions can implement effective and preventive actions that can contain costs and achieve optimal patient care. *Mt Sinai J Med* 79:34–45, 2012. © 2012 Mount Sinai School of Medicine

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Patients who present for surgical procedures may possess poor oral health. Individuals who have not had a dental examination for several years may be harboring an oral infection. During the perioperative period, the harmful effects of an intraoral infection may increase the need for additional interventional treatment(s) along with associated expenses, and result in potential deleterious effects toward surgical outcome. This article will elaborate upon the association between oral health and systemic disease. A review of several abnormal dental conditions, along with the many presentations of surrounding intraoral structures, will be discussed. The importance of obtaining a dental evaluation and treating evidence of any oral infection before elective major surgery cannot be overemphasized. Augmenting recognition of perioperative dental considerations may result in pertinent interventional measures that can minimize additional healthcare-related costs and optimize patient care.

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## CONNECTION BETWEEN ORAL AND SYSTEMIC HEALTH

The first theories of a connection between oral health and systemic health can be traced back to the 19th century.<sup>1</sup> During recent decades, the relationship between a patient's dentition and overall systemic health has been extensively studied. In May 2000, the US Surgeon General published the first-ever report on oral health in America, highlighting the association between oral and systemic health.<sup>2</sup> The report stated, "The mouth reflects general health and well-being. The mouth is a readily accessible and visible part of the body and provides healthcare providers and individuals with a window on their general health status." Former Surgeon General C. Everett Koop simply stated, "You are not healthy without good oral health."

Researchers have focused on the link between oral bacteria and undesirable systemic effects for many years.<sup>3,4</sup> A number of epidemiological studies have examined the relationship between oral health and cardiovascular disease (CVD).<sup>5,6</sup> Current information regarding the pathogenesis and treatment of CVD suggests that oral health can be an important factor in the exacerbation of preexisting coronary disease.<sup>7,8</sup> Oral microbes congregate as dental plaque, coating the surfaces of teeth. Dental plaque provides a microhabitat for organisms that can translocate and colonize in other parts of the body, damaging vital organs.<sup>8</sup>

### Oral Health and Cardiovascular Disease

Dental diseases are the most common infectious diseases in the world.<sup>9</sup> Chronic infections such as periodontal disease may play a role in the initiation and development of CVD. Evidence also supports an association between periodontal disease and diabetes mellitus (DM).<sup>10</sup> Periodontitis is a local inflammatory process involving a bacterial infection of the supporting structures of the teeth. Systemic inflammatory host responses that may contribute to the reported risk of CVD in patients with periodontal disease also characterize this disease process.<sup>11</sup> Several periodontal organisms including *Porphyromonas gingivalis*, *Treponema denticola*, *Streptococcus sanguinis*, and *Aggregatibacter actinomycetemcomitans* have been detected directly within atherosclerotic plaque lesions of vessel walls.<sup>12</sup> A dental infection that originates from within the tooth's pulp (nerve tissue) usually requires endodontic treatment (root canal). People with a greater self-reported history of endodontic therapy were found to be more likely to

have coronary heart disease.<sup>13</sup> Moreover, optimizing a patient's dentition and periodontal health has been shown to lower the risk of CVD.<sup>14</sup>

### Antibiotic Prophylaxis for Endocarditis

Poor oral health, especially involving a compromised periodontal disease status, presence of an intraoral abscess, and/or a chronic soft-tissue infection, remains an important associated risk factor for the development of infective endocarditis (IE). Infective endocarditis is a serious complication that can develop in individuals with an underlying structural cardiac defect who subsequently develop a bacteremia.<sup>15</sup> Blood-borne bacteria may become seeded in damaged or abnormal heart valve tissues, the endocardium, or the endothelium near cardiac defects, resulting in inflammation and possible IE. Therefore, preventive pharmacological measures such as prophylactic antibiotic therapy have been customarily utilized in the surgical environment when such concerns exist.

Traditionally, a patient with a known cardiac condition (ie, mitral valve prolapse with regurgitation) who presented to the dental office for procedures that were likely to cause bleeding, such as periodontal treatment or extractions of teeth, was routinely treated preoperatively with antibiotics. However, the most recent guidelines from the American Heart Association for the prevention of IE deviate greatly from the previous ones, and propose major changes regarding who should receive antibiotic prophylaxis.<sup>16</sup> The latest recommendations include the following: (1) even if such prophylactic therapy were 100 percent effective, only an extremely small number of cases of IE might be prevented by antibiotic prophylaxis for dental procedures; (2) IE prophylaxis for dental procedures should be recommended only for patients with underlying cardiac conditions associated with the highest risk of adverse outcome from IE (Table 1); (3) for patients with these underlying cardiac conditions, prophylaxis is recommended for all dental procedures that involve manipulation of gingival tissue or the periapical region of teeth, or perforation of the oral mucosa; and (4), prophylaxis is not recommended based solely upon an increased lifetime risk of acquisition of IE.

### Cardiac Surgery

Cardiac surgery consumes more healthcare resources than any other single therapy.<sup>17</sup> Infection in the setting of a cardiac operation increases morbidity,

**Table 1.** Cardiac conditions associated with the highest risk of adverse outcome from endocarditis for which prophylaxis with dental procedures is reasonable.<sup>16</sup>

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Prosthetic cardiac valve or prosthetic material used for cardiac valve repair
Previous infective endocarditis
CHD*
Unrepaired cyanotic CHD, including palliative shunts and conduits
Completely repaired congenital heart defect with prosthetic material or device, whether placed by surgery or by catheter intervention, during the first 6 months after the procedure <sup>†</sup>
Repaired CHD with residual defects at the site or adjunct to the site of a prosthetic patch or prosthetic device (which inhibit endothelialization)
Cardiac transplantation recipients who develop cardiac valvulopathy

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**Abbreviations:** CHD, congenital heart disease.

\*Except for the conditions listed above, antibiotic prophylaxis is no longer recommended for any other form of CHD.

<sup>†</sup>Prophylaxis is reasonable because endothelialization of prosthetic material occurs within 6 months after the procedure.

mortality, and cost.<sup>18,19</sup> Patients undergoing cardiac surgery appear to be at an increased risk for the development of infections, particularly nosocomial, due to the prevalence of multiple surgical wounds, frequent postoperative utilization of invasive devices (ie, intra-aortic balloon counterpulsation, pulmonary artery catheter), and the customary use of prophylactic or empiric antibiotics in the perioperative period.<sup>20</sup> If not treated preoperatively, any source of infection, including ones that are of dental origin (odontogenic), can compromise the outcome of the surgery.<sup>21</sup> Thus, the value of a thorough dental examination, and/or the detection of an oral infection prior to an elective cardiac procedure, cannot be underestimated.

## BARRIERS TO IMPROVING ORAL HEALTH

### Access to Oral Care

Improving one's oral health is usually dependent upon the individual receiving regular professional dental treatment.<sup>22</sup> However, unmet dental-care needs exist among patients with chronic diseases,<sup>23</sup> and obtaining routine intraoral care may be limited by several barriers.<sup>24</sup> For example, people who are tired or dependent upon help seem to be at a higher risk of not using dental services regularly.<sup>25</sup> Financial constraints, inaccessibility to dental professionals, a lack of patient education, and dental phobia all contribute to irregularly scheduled or even no visits to the dentist. It was also found that 31% of elderly patients had not seen a dentist in the previous 5 years.<sup>26</sup> These patients may experience a greater incidence of poor oral hygiene, tooth decay, and periodontal disease. Thus, patients presenting for surgery who have not had a dental examination for years may be harboring an undetected oral

infection that can significantly compromise surgical outcome—even before it commences.<sup>27</sup>

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### Patient Education

Patients scheduled for surgery who unknowingly have an intraoral infection may also lack proper education regarding its potential impact on the procedure. Studies have been conducted to assess patients' awareness of the association between oral health and heart disease. Lowry *et al.*<sup>28</sup> designed a qualitative focus group–based study on patients 3 months post–cardiac surgery. They discovered that patients did not accept the link between their oral health status and their general health. Additionally, the patients revealed that oral health was not included

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on the agenda of the surgical team and suggested that the surgeon defined what was important to the

patient and what was not. The inclusion of oral health professionals in the presurgical stage has the potential to enhance the importance of oral health in overall systemic health, especially if their role is endorsed by the surgeon.

Not only do patients show a lack of awareness of the link between oral health and cardiac disease, but parents of pediatric cardiac patients are not being properly educated regarding this association. Balmer and Bu'Lock<sup>29</sup> administered questionnaires to the families of 38 pediatric cardiology patients and conducted brief dental examinations. They found that only 64% of parents were aware of the link between the oral health of their children and IE. Despite being vulnerable congenital heart disease patients, few children with or without known dental disease received basic education regarding oral health. Moreover, Da Silva *et al.*<sup>30</sup> conducted structured interviews with guardians, and oral examinations were performed on 104 children. The authors determined that only 10 of the guardians were aware of the term "heart infection." The guardians displayed unsatisfactory knowledge with respect to the importance of maintenance of good oral health for the prevention of IE.

In addition to the poor education of patients regarding this link, the incidence of dental caries in children undergoing such critical procedures is significant. Another study conducted dental screenings on 209 pediatric patients aged  $\geq 6$  months who were scheduled for cardiac surgery. Dental disease was diagnosed in 175 (84%) of the 209 patients. Other conditions that were found included the following: gingivitis, 164 (78%); caries, 60 (29%); dental abscess, 6 (7%); periodontal abscess, 3 (1%); and pericoronitis (ie, inflamed tissue surrounding the coronal/crown portion of a wisdom tooth) 5 (2%). Twenty-four (12%) cardiac surgeries were postponed. The authors concluded that all cardiac surgical patients should have a dental screening before cardiac surgery.<sup>31</sup>

## PREOPERATIVE DENTAL SCREENING

Preoperative dental screening prior to cardiac surgery or other major surgical interventions is not performed routinely. There are several possible reasons to explain this omission: First, surgeons may overlook the importance of detecting, treating, and eradicating any potential source of infection prior to surgery, and do not often impress upon their patients the value of good oral health.<sup>28</sup> Second, patient education regarding an association between oral and systemic health may be lacking.<sup>28,30</sup> Third,

patients may not have adequate resources (insurance, access to dental care, etc.) to address needed dental treatment.<sup>24–26</sup> As a result, many patients are now having elective surgery performed while harboring potentially dangerous intraoral infection(s). However, the hidden hazards of dental and oral infections can usually be easily detected with a routine preoperative dental evaluation.<sup>21</sup>

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A patient's preoperative examination by a dentist may include palpation of extraoral tissues (eg, in the submandibular region) in order to detect any abnormal swelling. Intraoral tissues such as the palate, tongue, floor of mouth, and buccal mucosa are also examined for any lesions or evidence of infection. Exploration of the patient's individual teeth and each existing dental restoration (eg, silver amalgams, composite resins, crowns, and bridges) for new or recurrent decay is also performed. An overall assessment of oral hygiene may also include probing of periodontal pocket depths. The space between a tooth and the surrounding gums (eg, gingiva) widens and deepens as periodontal disease progresses. A series of intraoral radiographs is taken to supplement the clinical examination and may show evidence of tooth decay or an infection occurring at surrounding structures. Bone levels visualized on such films can further support evidence of mild, moderate, or severe periodontal disease. Thus, during a clinical examination, the palpation and inspection of intraoral tissues, teeth, and their surrounding structures combined with radiographic evidence provide a thorough assessment of a patient's intraoral health.<sup>32</sup>

If not treated preoperatively, an infection of dental origin can significantly compromise surgical outcomes in terms of treatment and finances. Postoperative infections may result in greater morbidity, delay wound healing, and extend hospital

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stays beyond the expectations of the patient and the surgeon.<sup>33</sup> In addition to the long duration



of recovery, the development of a postoperative infection ultimately culminates in higher costs for those involved.<sup>34</sup>

In order to rule out any potential source of infection prior to a cardiac transplant or another transplantation procedure, some medical centers have mandated that the patient undergo a complete physical examination by a series of specialists. For example, patients awaiting a liver transplant may be on such a list due to alcohol-related cirrhosis of the liver.<sup>35</sup> Such systemic damage is often paralleled by intraoral neglect, which manifests as excessive tooth decay and/or moderate to severe periodontal disease. Therefore, included in this systemic checklist is the requirement of a thorough evaluation by a dentist. A clinical examination, intraoral radiographs, and any other indicated treatment is essential prior to the patient being cleared for surgery from an oral health standpoint. Although this action is currently often overlooked by the patient, primary physician, and surgical team, its routine implementation should be strongly considered.<sup>32</sup> In fact, efforts are being made at medical schools to expand the oral health component within the medical curriculum. Areas of focus include dental caries, periodontal disease, oral cancer, and oral-systemic interactions.<sup>36</sup> In the future, with the surgeon's acceptance of the link between oral health and systemic health, the dentist may eventually become a more regularly involved member in the presurgical phase.

## DENTAL NOMENCLATURE AND DENTAL ANATOMY

The complete adult (permanent) dentition classically includes 32 teeth supported by 2 opposing arches of bone: the upper jaw (maxilla) and lower jaw (mandible). The dentition is further divided into 4 quadrants (right and left in both the maxilla and mandible), and each quadrant includes up to 8 teeth. The posterior portion of each quadrant typically contains 3 molars and 2 premolars (bicuspid). The anterior segment of a quadrant usually contains 1 canine, 1 lateral incisor, and 1 central incisor.

In the United States, the Universal Numbering System is utilized (Figure 1). Teeth are numbered from 1 through 32, counted sequentially whether they are present or missing. Numbering of the teeth is based as if one were directly facing the patient, beginning at the maxillary right quadrant's third molar (no. 1) and sweeping in a clockwise fashion through the maxillary left then mandibular left quadrants and ending at the mandibular right third molar (no.

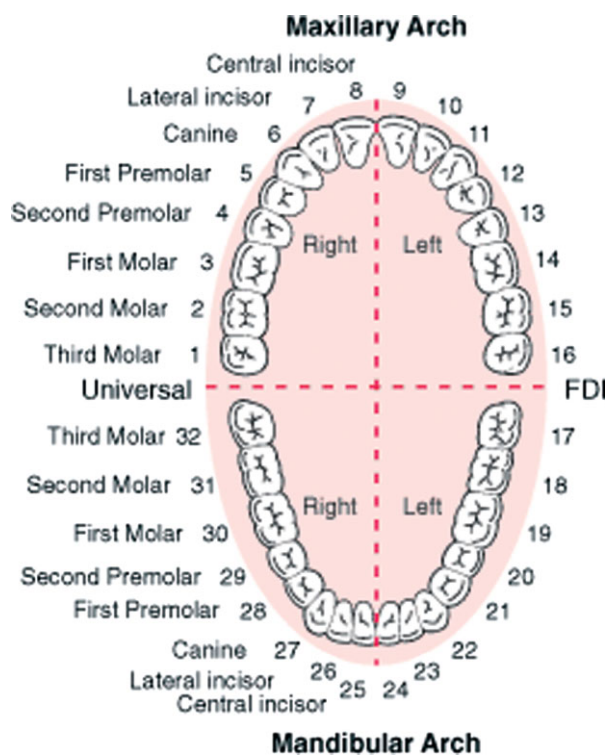


Fig 1. Universal numbering system. Adult dentition divided into 4 quadrants, up to 8 teeth per quadrant, numbered in a clockwise fashion.

32). A child's dentition (also known as primary or deciduous) consists of a maximum of 20 teeth. Each quadrant is composed of 2 molars, a canine, a lateral incisor, and a central incisor. In the United States, each baby tooth is designated a letter from A through T. In many other countries, the Federation Dentaire Internationale system is commonly used. In this system, each tooth is designated a specific 2-digit number based upon 2 components. The first digit denotes its specific quadrant, determined by a clockwise arrangement, permanent dentition (1–4) or primary dentition (5–8). The second digit refers to the tooth's location from the midline of the dentition. For example, the permanent mandibular right first molar is designated as tooth no. 46 (ie, it is situated in the fourth quadrant and is the sixth tooth from the midline).

The tooth is divided into 2 parts, the crown and the root, each consisting of 3 layers (Figure 2). Enamel is the outer layer of the crown that becomes fragile if not supported by viable dentin. Dentin is the middle layer, yellowish in color, and provides the bulk of the tooth's structure. The pulp is the innermost layer and consists of blood vessels and nervous tissue.<sup>37</sup> Cementum is the outer layer of the root. Dental caries is the most common disease affecting teeth. The process involves bacteria

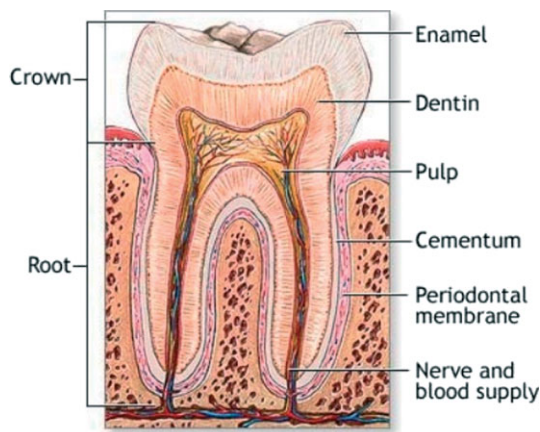


Fig 2. Tooth anatomy.

adhering to a tooth and producing acids that decalcify and undermine the enamel.<sup>38</sup> As the decay develops further, passing through the dentin toward the pulp, sensitivity is noted by the patient. A deep carious lesion may require endodontic (root canal) therapy. Treatment of caries involves removal of the decayed

portion of the tooth and the placement of a dental restoration (filling)<sup>39</sup> (Table 2).

COMPROMISED INTRAORAL  
CONDITIONS IN  
PERIOPERATIVE PERIOD

The presence of advanced periodontal disease is potentially harmful in the perioperative period. Periodontal disease is an inflammatory process involving a bacterial infection of the periodontium.<sup>40</sup> The periodontium (ie, surrounds the teeth) is the tissue that provides the teeth with support and anchors them into the tooth sockets of the maxilla and mandible. It is made up of gingiva (ie, gums) as well as the underlying alveolar bone and periodontal ligament.<sup>41,42</sup> Periodontal disease commonly manifests in an adult's mouth as inflamed gingiva, gingival recession, and calculus (ie, tartar) accumulation (Figure 3). The presence of poor oral hygiene, as well as red, boggy, inflamed gingival tissue that easily bleeds, are classic signs of advanced periodontitis. As periodontal

**Table 2.** Common Dental Terminology.

Amalgam (silver filling)	A silver-colored restoration (filling) containing a mixture of metals such as silver, tin, copper, and mercury. It is usually placed in posterior teeth due to its superior strength and resilience properties.
Bridge	A fixed, nonremovable, multiple-unit prosthesis. To maximize esthetics and strength, it commonly consists of an exterior layer of porcelain fused to a metal substructure. Cemented onto prepared teeth, its continuous design spans the (edentulous) space of a missing tooth or teeth.
Calculus (tartar)	A yellow or brown layer coating the surfaces of teeth formed upon the mineralization of dental plaque. It can develop above or below the gingival margin (gum line) and lead to periodontal disease.
Composite resin (bonding)	A tooth-colored (white) restoration made of a resin-based matrix and filler of glass ceramics. It chemically adheres to prepared tooth structure by means of polymerization during a light curing process. It is often placed in anterior teeth because of its superior esthetic qualities.
Crown (cap)	A single-unit prosthesis cemented on top of a tooth that was mechanically reduced. Posterior teeth requiring maximal strength properties may be covered with a full metal crown (ie, alloy gold, platinum). Crowns for anterior teeth that demand greater esthetics are commonly composed of an outer layer of tooth-colored porcelain.
Denture	An acrylic-based prosthesis for restoring function and esthetics to an edentulous space. A removable partial denture incorporates metal clasps into its design that flex around natural teeth (abutments) to provide stability and retention. A complete denture has no metal clasps and replaces an entire edentulous arch.
Implant	A fixed structure made of a biocompatible titanium alloy screw that is surgically inserted into the bone of an edentulous space, simulating a natural tooth's root. Osseointegration occurs between the screw and the bone. Following healing of the surrounding soft tissue, a prosthetic crown is attached to the screw, restoring function and esthetics.
Plaque	A sticky, clear film that develops from a combination of saliva, food debris, bacteria, and bacterial byproducts. Its accumulation on the surfaces of teeth leads to gingival inflammation and the onset of periodontitis.
Veneer (lamine)	An ultrathin tooth-colored restoration made of composite or porcelain, bonded or cemented onto a tooth's minimally or unprepared labial surface. It is primarily used to optimize the esthetics of anterior teeth.



Fig 3. Periodontitis. Gingival inflammation, recession, and reduced bony support can result in tooth mobility.

disease progresses, bone support is lost and tooth mobility becomes more pronounced. In the perioperative period, this condition can present as a dental abscess with significant systemic consequences or lead to less-obvious repercussions. One such implication can occur during the administration of general anesthesia and the placement of an endotracheal tube. Any loose, unstable teeth are at risk for avulsion (removal from a tooth's bony socket) and subsequent aspiration into the lungs or ingestion into the stomach.<sup>43</sup>

The presentation of a patient's dentition is highly variable. Teeth are sometimes worn excessively by attrition (wear between opposing teeth), physical damage (abrasion), or chemical damage (erosion),<sup>44</sup> which may be caused by dietary or gastric acids.<sup>45</sup> Chronic use of medications can adversely affect dental and periodontal health. In adults, a plethora of medications, especially those with anticholinergic activity, are the most common cause of the subjective sensation of a dry mouth (xerostomia).<sup>46,47</sup> This condition is also one of the most common complaints following radiation therapy for head and neck cancers,<sup>48</sup> and leads to hyposalivation-induced rampant caries.<sup>49</sup>

### Geriatric Patients

The percentage of older adults losing all of their natural teeth (ie, edentulous) has declined substantially since the 1950s, when the majority of persons aged  $\geq 65$  years were edentulous.<sup>50</sup> With greater tooth retention over the past few decades, elderly patients are now at a greater risk for dental caries (tooth decay) and periodontal disease.<sup>51</sup> Intraoral characteristics of geriatric patients warrant particular attention. Xerostomia was found to affect 25% of the elderly population.<sup>52</sup> Severe hyposalivation compromises taste, swallowing, digestion, and nutrition. Erosion

and ulceration of intraoral mucosal tissues can occur, as well as fungal infections such as candidiasis due to diminished immunity. Also, the beneficial buffering effects of saliva are reduced, yielding teeth that become more susceptible to decay. Dry mouth can negatively affect denture fit in edentulous individuals. New and recurrent decay was found to be untreated in 30% of adults with teeth (ie, dentate).<sup>53</sup> Another effect of aging is gingival recession (hence the term "long in the tooth"), which exposes root surfaces. Root caries can develop on these surfaces, usually along the gingival margin (ie, gumline). Fifty percent of persons aged  $\geq 75$  years were found to have root caries.<sup>54</sup> In addition to compromising the structural integrity of a tooth and rendering it more vulnerable to fracture, the presence of root decay can lead to a periodontal or endodontic infection.

### Pediatric Patients

Eruption of primary (ie, baby or deciduous) teeth usually begins at 6 months of age, and most children have a complete set of primary teeth by the age of 3 years.<sup>55</sup> The natural exfoliation of primary teeth usually begins at the age of 5 to 6 years, when the primary mandibular central incisors are replaced by permanent central incisors. As permanent (ie, adult) teeth begin to erupt into a child's/adolescent's mouth, they resorb the roots of the primary teeth that they are replacing. This process will lead to mobility and eventual exfoliation of the primary dentition. The period of tooth replacement (tooth turnover) commonly occurs during the ages of 5–12 years, producing a mixed dentition containing both primary and permanent teeth. Children in this age group are more susceptible to tooth injury.<sup>56</sup> Due to the presence of resorbing primary teeth as well as the incomplete formation of the newly erupting permanent teeth, children possessing a mixed dentition and having surgery with general anesthesia are at an increased risk for avulsion and aspiration. For example, newly erupted permanent incisors may be readily avulsed in children aged 6–8 years because their immature roots may not fully develop for another 3 years.<sup>57</sup>

Young children may present for surgery with an intraoral condition known as early childhood caries or baby bottle syndrome. This situation arises from the following sequence of events: To soothe a crying child at night, a parent will give the child a bottle filled with sugar-containing liquids, such as milk or juice. Night after night, repeated bathing of a young child's teeth in these acid-promoting substances leads to rampant decay.<sup>58</sup> The primary





Fig 4. Early childhood (baby bottle) caries. Primary maxillary incisors and mandibular molars are affected by repeated nocturnal bathing in sugary liquids.

maxillary incisors and mandibular molars are directly subjected to the sugary liquids; consequently, they are the teeth that are most commonly affected by this decaying process (Figure 4). Interestingly, the child's tongue tends to protect the mandibular incisors from the liquid emanating from the bottle's nipple, which is positioned between the tongue and the palate. This unfortunate yet preventable situation is principally due to a lack of parental education and typically manifests in children between the ages of 18 and 48 months.

#### PREOPERATIVE ASSESSMENT BY NON-DENTAL PROFESSIONALS

Prior to surgery, it is not always a dentist who initiates or discovers the necessity of dental treatment for a patient. In the preoperative period, it may be a primary care physician, nurse, anesthesiologist, or other healthcare provider who is the first caregiver to look inside a patient's mouth in years. For

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most patients presenting for surgery, adoption of a formalized and more-extensive intraoral examination by these same practitioners is not suggested. However, there are circumstances in which a hands-on evaluation of the patient's dental condition is necessary and recommended, in order to better appreciate the presence of any intraoral lesions, vulnerable teeth, and the condition of oral soft tissues (Figure 5).

Notable redness, swelling, purulent discharge, or fistulas may be visible along the gingiva and indicative of an odontogenic infection (Figure 6). An intraoral abscess can also aggressively track through bone, resulting in an endodontic or periodontal infection that can manifest as an extraoral swelling in the submandibular, submental, or mid-face regions. If a suspicious area is detected, a consultation with a dentist should be considered before proceeding with the surgical procedure.<sup>32</sup> If the procedure is emergent and the risk of delaying the surgery outweighs the benefits, a dental examination is not suggested. Although all intraoral swellings should

*If a dubious area is detected, a consultation with a dentist should be considered before proceeding with the surgical procedure.*



Fig 5. Dental examination. Manual retraction of lip or cheek can improve one's visualization for an intraoral inspection.



Fig 6. Dental abscess. Infection is endodontic or periodontal in origin and can manifest as a swelling along the gingiva.



be investigated and documented preoperatively, they are not all indicative of an infectious process. For example, a torus is a prominently benign bony growth that can develop in a patient's palate or mandibular premolar region and would not require preoperative intervention.<sup>59</sup>

### Considerations for Anesthesia Care Provider

During the preoperative assessment, an essential focus for the anesthesiologist is the patient's airway. At the time of this examination, some patients may demonstrate an obviously poor dentition with extremely mobile teeth that are at risk for avulsion and aspiration during the perioperative period. When patients present preoperatively with significantly loose teeth, they are usually aware of their mobility but may not admit it because of embarrassment or their underestimation of the condition's potentially significant perioperative implications. Moreover, the anesthesia care provider may be the final clinical gatekeeper in a long line of caregivers whose objective is to optimize the patient prior to surgery. During the preoperative airway assessment, a thorough dental examination can lead to an important discovery that, if undetected, would otherwise produce adverse sequelae postoperatively.<sup>60</sup>

Upon examining a patient's airway, the existence of any abnormalities of the tongue, lip, or palate should be noted. Being cognizant of lesions in any of these areas can reduce the perioperative trauma of oral soft tissues. The presence of any removable prostheses (eg, dentures, orthodontic appliances) or soft-tissue piercings of the lip or tongue should be removed, labeled, and stored before the anesthetic induction to prevent any accidental loss or damage.

Intraoral devices used for breaking the childhood habits of tongue thrusting and thumb sucking often suspend from the hard palate and may interfere with laryngoscopy.<sup>61</sup>

### Perioperative Dental Damage

Perioperative dental damage is the most common of all medicolegal complaints related to anesthesia, comprising one-third of all medicolegal anesthetic claims.<sup>62–68</sup> It is also the adverse event responsible for the greatest number of malpractice claims against anesthesiologists.<sup>63,69</sup> In the perioperative period, the majority of dental injuries (50%–75%) occur during tracheal intubation.<sup>63,64,69–72</sup> When a satisfactory view of the glottis is difficult to obtain during laryngoscopy,

the patient's maxillary anterior teeth are sometimes used as a fulcrum by the laryngoscope blade, which can lead to a dental injury.<sup>73</sup>

When a tooth's natural structure has been compromised by decay or the placement of a restoration, it becomes proportionally weaker and more prone to injury.<sup>74,75</sup> Newland *et al.*<sup>76</sup> found that patients with poor dentition or reconstructive work were 3.4× more likely to have dental injuries related to anesthesia. An increased incidence of dental injury has also been reported in cases exhibiting the following anesthesia risk factors: general anesthesia, endotracheal intubation, emergency surgery, and a difficult airway (ie, Mallampati class 3 or 4).<sup>77</sup> The combination of a preexisting dental condition (ie, periodontal disease, decayed or restored teeth) with any of the aforementioned anesthesia risk factors results in a dentition that is even more vulnerable to damage.<sup>71</sup>

In many instances, it is not practical to obtain a dental consultation and definitive treatment immediately before surgery. Securing a loose tooth is a cautious measure to prevent aspiration and aid in a tooth's retrieval should it become dislodged. A 3-0 silk suture without the needle can be wrapped several times around the gingival margins of the mobile tooth and adjacent teeth for increased stability (Figure 7). The suture can be secured with adhesive tape to the ipsilateral cheek and removed after the procedure upon recovery.<sup>60</sup>

Because dental damage is one of the most likely adverse outcomes during general anesthesia, it is recommended that the patient be made aware of this possibility during the preoperative evaluation by an anesthesia care provider, especially with an anticipated difficult intubation and/or a patient's vulnerable dentition. Forewarning patients about this potential adverse incident preoperatively can substantially decrease the likelihood of facing an



Fig 7. Tied teeth. Vulnerable teeth at an increased risk of avulsion and/or aspiration are secured preoperatively with silk suture.

uninformed, unprepared, or angry patient post-operatively. Also, detailed documentation of the patient's preoperative dental condition serves to minimize the potential for inflated dental treatment estimates following a perioperative dental incident.<sup>60</sup>

### OPTIMIZING DENTAL HEALTH BEFORE SURGERY: RISKS AND BENEFITS

When a patient with a poor dentition or evidence of an intraoral infection has been identified before a major operation, the benefits of treating such conditions prior to the planned surgical procedure must be evaluated from a proper perspective. A patient may sometimes present with a chronic intraoral condition such as periodontitis (moderate to severe) that has been relatively asymptomatic over the past several years. A tooth or multiple teeth may be loose, broken, chipped, or present with significant dental caries, yet there are no signs of acute infection and the patient reports no signs of pain or distress. Ideally, treatment of these undesirable conditions would be performed prior to proceeding with major surgery, but this may not be practical given the immediacy or urgency of the planned surgical procedure.

Comprehensive treatment of such a long-standing periodontal condition is not cured overnight. It usually requires multiple and meticulous dental sessions, whose duration may span several months. Therefore, the benefit of properly treating such a chronic condition at the expense of delaying the procedure, which most likely poses a more urgent threat to the patient's overall health, is usually not practical. In fact, the consequences of postponing a case may include the depressing effect of cancellation on patients and their families because of the high levels of emotional stress and anxiety that are associated with surgery,<sup>78,79</sup> working days lost, and disruption of daily life. There is also the potential for revenue losses incurred by the hospital.<sup>80,81</sup>

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should be the primary focus of any preoperative dental evaluation. As described earlier, its presence

can have significantly deleterious effects in the perioperative period. If possible, this infection should be aggressively treated. If the tooth is deemed to be nonrestorable, its removal (extraction) may be necessary. Whether an extraction, periodontal treatment, or endodontic therapy is indicated, healing of surrounding structures (bone, gingiva) is recommended. Dental procedures should be performed a minimum of 1 week before the scheduled operation to ensure adequate healing time and promote proper resolution of the disease process.<sup>21</sup> A prolonged asymptomatic period of 1 month is even more beneficial to minimize the potential for recurrence of the infection and adverse effects on the surgery. The time for allowing sufficient intraoral healing from such dental treatment may be compromised because of scheduling constraints and/or urgency of the surgery. In these situations, an appropriate risk-benefit analysis is warranted.<sup>21</sup>

### CONCLUSION

The perioperative community is encouraged to view oral health from the perspective of systemic health. Oral neglect often mirrors systemic disease. Compounding the situation are barriers to improving oral health, such as limited access to oral care and deficient patient education. Therefore, many patients scheduled for surgery inherently possess poor oral hygiene and untreated dental infections. Consequently, dental abscesses and/or advanced periodontal disease that have not been properly addressed in the preoperative period can lead to unexpected and expensive treatment postoperatively. The inclusion of a preoperative dental examination has been used effectively for surgical procedures. Thoroughly assessing a patient's level of oral hygiene, teeth, and surrounding tissues prior to the surgery provides the perioperative team the opportunity to definitively treat a potentially dangerous odontogenic infection.

In many instances, resources for obtaining optimal healthcare immediately prior to surgery are unavailable. A detailed inspection of each tooth and all intraoral tissues by members of the perioperative community, as well as taking dental radiographs, is not realistic either. However, a consultation with a dentist in elective cases should be considered before moving forward with a significant operation. If a dental abscess is detected and time permits, the surgery should not proceed until the infection is thoroughly addressed preoperatively. This preemptive action may postpone the procedure, but in the long run, a preoperative dental examination and any indicated treatment may save invaluable time

and money. Healthcare providers who become more familiar with perioperative dental considerations in their patients can implement effective and preventive measures that improve surgical outcomes, contain costs, and achieve optimal patient care.

## DISCLOSURES

*Potential conflict of interest:* Nothing to report.

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