Management Considerations for Pediatric Oral Surgery

Latest Revision
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Abstract

Oral surgery for the pediatric patient requires special considerations such as parental consent, knowledge of developing anatomy and dentition, potential for adverse effects on growth, behavior guidance, and peri- and postoperative management. Odontogenic infections usually are managed with pulp therapy or extraction, and those associated with swelling may need incision and drainage. Cases with systemic manifestations (eg, cellulitis, fever, lymphadenopathy) require adjunctive antibiotic therapy. Management of nonrestorable, overretained, impacted, traumatized, and supernumerary teeth, as well as teeth with eruption delays or failures, are discussed with emphasis on care to avoid injury to the neighboring teeth, permanent successors, and other nearby tissues. Considerations for surgical correction of frenulum attachments are reviewed. Guidance is provided for biopsies which can establish a definitive diagnosis for most oral lesions.

This document was developed through a collaborative effort of the American Academy of Pediatric Dentistry Councils on Clinical Affairs and Scientific Affairs to offer updated information and guidance on management considerations for pediatric oral surgery.

KEYWORDS: ORAL SURGICAL PROCEDURES; TOOTH EXTRACTION; SUPERNUMERARY TEETH; THIRD MOLARS; IMPACTED TEETH; INCISION AND DRAINAGE

Purpose

The American Academy of Pediatric Dentistry intends this document to set forth general considerations of oral surgery for pediatric patients. These recommendations should aid the oral health care professional in understanding surgical options for management of developmental, infectious, and traumatic conditions.

Methods

Recommendations on management considerations for pediatric oral surgery were developed by the Council on Clinical Affairs, adopted in 2005,[1] and last revised in 2020.[2] This revision is based on a review of current dental and medical literature related to pediatric oral surgery, including a search of the PubMed/MEDLINE database using the terms: (*dental care for children* [**Majr**] OR *evidence based dentistry* [Majr] OR *pediatric dentistry* [Majr]) AND (*tooth extraction** [**Tiab**] OR *odontogenic infection** OR *impacted canine** [Tiab] OR *third molar** [Tiab] OR *supernumerary teeth* [Tiab] OR *mesiodens* [Tiab] OR *surgery, oral* [Majr] OR *oral surgical procedures* [Majr]). One hundred seventy-one articles were identified, and papers for review were chosen from the resultant list and from references within selected articles. When data did not appear sufficient or were inconclusive, recommendations were based upon expert and/or consensus opinion by experienced researchers and clinicians.

* *Used in the PubMed search to identify all terms that begin with this truncated base.*

Background

Children and adolescents may present with a wide range of infectious, developmental, or traumatic conditions that involve the orofacial region. Oral health care professionals are educated to recognize dental anomalies, atypical tooth eruption patterns, soft tissue conditions and infections, and orofacial injuries that may require oral surgical and/or medical management. Early diagnosis and timely management may reduce severity of disease, correct aberrant tooth eruption, minimize negative sequelae of dental anomalies or orofacial trauma, and facilitate medical treatment of systemic conditions. An understanding of surgical principles is critical to guide dentists in making treatment recommendations and confidently managing patient needs. Referral to another provider is indicated when the patient's surgical needs are beyond the scope of practice of the dentist.[3] Expeditious referral to a higher level of care (eg, hospital admission) may be lifesaving in severe or complex cases.

General considerations

Oral surgery performed on pediatric patients involves considerations unique to this population.

Considerations continued on the next page.

ABBREVIATIONS
Majr: Medical subject heading major topic. **Tiab:** Title and abstract.

Patient assessment

Medical evaluation

Safe treatment of a pediatric patient requires obtaining a thorough medical history, along with any necessary medical consultations. Anticipation of potential medical risks will aid oral health professionals in implementing protocols to prevent and manage emergencies during surgical procedures.[4(p399)]

Dental evaluation

A thorough preoperative oral assessment includes clinical examination of extraoral and intraoral soft tissues and dentition as well as a radiographic examination based on patient history, clinical signs and symptoms, and susceptibility to oral disease.[4(p399),5] Radiographs can include intraoral films and extraoral imaging if the area of interest extends beyond the dentoalveolar complex. Surgery involving the maxilla and mandible of young patients is complicated by the presence of developing tooth follicles. Knowledge of the anatomy of a child's developing maxilla and mandible and the avoidance of injury to the dental follicles can prevent complications.[6] To minimize the negative effects of surgery on the developing dentition, careful planning using radiographs, tomography,[7] cone beam computed tomography,[8] and/or 3-dimensional imaging techniques[9] is necessary to provide valuable information to assess the presence, absence, location, and/or quality of individual crown and root development.[6,10,11]

Behavioral evaluation

Behavioral guidance of children presents a special challenge when planning for oral surgery. Assessment of the social, emotional, and psychological status and cognitive level of the pediatric patient prior to surgery can help determine which behavior guidance modalities may be best suited for each individual.[12] Children may have difficulty coping with procedures due to anxiety or fear concerning the surgical experience, and their psychological management requires the dentist to be cognizant of their emotional status. Answering questions about the procedure using language appropriate to the child's level of understanding can help shape the patient's response by allaying fear and building trust and ideally is done in the presence of the parent[13]/health care guardian. Some children may benefit from modalities beyond local anesthesia and nitrous oxide/oxygen inhalation to minimize their anxiety.[12,14] Management of children under sedation or general anesthesia requires extensive training and expertise.[15] Facility selection for cases requiring sedation or general anesthesia includes consideration of the child's age, comorbidities, complexity of surgery, and availability of medical support to safely complete the dental treatment.

Surgical considerations for the growing child

Traumatic injuries or surgery involving the maxillofacial region can adversely affect growth, development, function, esthetics, and quality of life. Therefore, a thorough clinical and radiographic evaluation of the pediatric patient is indicated before surgical interventions are performed to minimize the risk of damage to the growing facial complex.[12] Avoidance of injury to developing tooth follicles during surgery can prevent long-term dental complications in young patients.[6]

Peri- and postoperative considerations

Along with medical and dental histories, behavior assessment, and evaluation of growth and development, planning for oral surgery in pediatric patients involves considerations for procedure complexity (eg, simple exodontia vs. surgical extractions of multiple impacted supernumerary teeth) and additional treatment that may be completed during that same appointment. These factors may help inform decisions regarding the optimal setting (eg, dental clinic, surgical center, hospital) for the planned procedure. Each component of surgical planning involves attention to benefits and risks of both the intervention and perioperative management. Bleeding risk, for example, may be affected by medical comorbidities, invasiveness of the procedure, and need for intubation during general anesthesia. The benefits of preserving a child's psychological autonomy and avoidance of emotional distress may necessitate treatment in a hospital setting. A perioperative plan for airway management and additional personnel (eg, anesthesiologist) is essential for cases involving deep sedation or general anesthesia.[16] Additional perioperative considerations may include caloric intake, fluid and electrolyte management, antibiotic prophylaxis, and blood replacement. A children's hospital experienced in providing perioperative management in a comprehensive, safe manner may be the optimal setting for young children and children with medical complexity.

A detailed, clear discussion on perioperative recommendations is critical to informed consent. Informed consent is an essential component of oral health care and involves active and ongoing communication and education between the dentist and the patient/parent. This includes discussion of clinical findings and diagnosis, the nature and purpose of the proposed treatment, benefits and risks of associated with that treatment, alternative treatment options (including no treatment), and the risks of those alternatives prior to intervention.[14] Additionally, thorough delivery of preoperative instructions for patient families (eg, npo requirements, medication regimens) will help to minimize risk of perioperative complications.[16]

Postoperative care is similarly influenced by the patient's medical comorbidities, behavior management needs, and the extent of the completed procedure. Even simple procedures require postoperative instructions at discharge that address diet, anesthetized soft tissues, surgical site care, and analgesic recommendations.[17] For more complex procedures and cases completed under sedation or general anesthesia, advanced planning of ways to manage excessive bleeding, airway compromise, nausea and vomiting, and other adverse events will allow for timely interventions.[12]

Recommendations

Nonrestorable or overretained teeth

Maxillary and mandibular anterior teeth

Most primary and permanent maxillary and mandibular central incisors, lateral incisors, and canines have conical single roots.[4(p402)] However, accessory roots observed in primary canines,[18] dilaceration, or crown-root fractures may make extraction with rotation forces difficult.[4(p403)] Radiographic examination is helpful to identify differences in root anatomy prior to extraction.

Treatment considerations: Extraction of anterior teeth typically can be carried out with a rotational movement due to their single root anatomy. Other techniques may be needed during extraction of anterior teeth with less common root anatomy. Care should be taken to avoid placing any force on adjacent teeth that could become luxated or dislodged easily due to their root anatomy.

Maxillary and mandibular molars

Primary molars have roots that are smaller in diameter and more divergent than permanent molars. Root fracture in primary molars is not uncommon due to these characteristics as well as the potential weakening of the roots caused by the eruption of their permanent successors.[4(pp401,402)] Preoperative radiographs help determine the relationship of the primary roots to the developing succedaneous tooth.

Treatment considerations: Molar extractions are accomplished by using slow continuous palatal/lingual and buccal force allowing for the expansion of the alveolar bone to accommodate the divergent roots and reduce the risk of root fracture.[4(pp401,402)] Extraction or dislocation the permanent successor can be prevented by avoiding pressure in the furcation area or by sectioning the tooth. When extracting mandibular molars, support of the mandible helps protect the temporomandibular joints from injury.[4(p402)]

Fractured primary tooth roots

The presence of a root tip is not a positive indication for its removal. The decision of when to extract the root tip weighs the accessibility and ease of retrieval against the risk of damage to the succedaneous tooth. Radiographic assessment of the root tip position can aid in the decision process. Retained root tips often resorb naturally but may be susceptible to infection or affect eruption of the permanent successor.[4(p403)]

Treatment considerations: If the fractured root tip is accessible and can be removed easily, it should be removed.[4(p403)] If the root tip is very small, located deep in the socket, situated in close proximity to the permanent successor, or unable to be retrieved after several attempts, it is best left to be resorbed.[4(p403)]

Impacted teeth and other delays or failures of eruption

The spectrum of disorders of eruption in both primary and permanent teeth in children is wide. These may be syndromic or nonsyndromic and include[19-21] ankylosis, secondary retention, tooth impaction, or primary failure of eruption. Clinically, differentiating between the various disruptions may be difficult. Increasing evidence supports genetic etiology for some eruption disruptions which may help in a definitive diagnosis.[21]

Permanent maxillary canines are second to third molars in frequency of impaction.[22] Early detection of an ectopically erupting canine through visual inspection, palpation, and radiographic examination is important to detect presence, position, and any pathology.[23,24] Routine evaluation of patients in mid-mixed dentition includes identifying signs of impaction such as lack of or atypical canine bulges and asymmetry in pattern of exfoliation. Abnormal angulation, microdont lateral incisors, overretained primary canines or ectopic eruption of developing permanent cuspids can be assessed radiographically.[22,23] When the cusp tip of the permanent canine is just mesial to or overlaying the distal half of the long axis of the root of the permanent lateral incisor, canine palatal impaction usually occurs.[22]

Treatment considerations: Management of unerupted teeth may require orthodontics and/or surgical repositioning.[21] Consultation with such specialists may be helpful in finalizing treatment recommendations. Extraction of the primary canines is the initial treatment of choice to stimulate the eruption of the permanent canines or to prevent resorption of adjacent teeth[22,23] and has shown success[22,25,26] in children with early diagnosis and immature maxillary canines. If no improvement in permanent canine position occurs within a year of primary canine extraction, surgical and/or orthodontic treatment has been suggested.[22,23] Refer to the American Academy of Pediatric Dentistry's *Management of the Developing Dentition and Occlusion in Pediatric Dentistry*[27] for additional information.

Third molars

Panoramic or periapical radiographic examination is indicated in late adolescence to assess the presence, anatomy, position, inclination, and development of third molars, as well as their proximity to adjacent anatomical structures (eg, inferior alveolar nerve, maxillary sinus) and any associated pathology.[28] Clinical assessment of tooth eruption, functionality, and periodontal and caries status aids in decision making regarding third molar management.[28] Risk for surgical complications[29,30] (eg, nerve damage, exacerbation of temporomandibular joint disease, provocation of systemic comorbidities, sinus perforation) and position and inclination of the molar in question[31] may affect surgical decisions. The age of the patient is only a secondary consideration.[31]

Treatment considerations: Evidence-based research supports the removal of third molars when pathology (eg, cysts or tumors, caries, infection, pericoronitis, periodontal disease, detrimental changes of adjacent teeth or bone) is associated and/or the tooth is malpositioned or nonfunctional (ie, an unopposed tooth).[29,30,32] Removal also may be necessary when a third molar interferes with an overlying removable prosthesis or a planned orthognathic surgery.[28,33(p63)] Active surveillance is recommended in the absence of disease, pathology, or interference with prosthetic or orthognathic surgical needs.[28] When a

decision is made to retain impacted third molars, they should be monitored for change in position and/or development of pathology, which may necessitate later removal.

Supernumerary teeth

Supernumerary teeth more often are observed in the maxillary arch versus the mandibular arch.[34(pp76,77)] The maxillary midline is the most common site, [34(pp76,77),35] in which case the supernumerary tooth is known as a mesiodens; the second most common site is the maxillary molar area,[34(pp76,77)] with the tooth known as a paramolar or fourth molar. A mesiodens can be suspected if there is an asymmetric eruption pattern of the maxillary incisors, delayed eruption of the maxillary incisors with or without any overretained primary incisors, or ectopic eruption of a maxillary incisor.[36] The morphology (eg, conical, tuberculate), size, position, location, orientation, and quantity of supernumerary teeth, along with the patient's dental development, may impact surgical approach.[37] Radiographic images[7,8,35,38] (eg, occlusal, periapical, panoramic, cone beam computed tomography) can be used to confirm presence, location, and characteristics of a supernumerary tooth. Following the ALARA principle (as low as reasonably achievable) when determining imaging needs will help minimize unnecessary radiation exposure.[5]

Complications of supernumerary teeth can include delayed and/or lack of eruption of the permanent tooth, crowding, ectopic eruption of the normal complement of teeth, resorption of adjacent teeth, dentigerous cyst formation, pericoronal space ossification, and crown resorption.[34(p78),37] Early diagnosis and appropriately timed treatment are important in the prevention and avoidance of these complications.

Treatment considerations: The treatment objective for a non-erupting permanent mesiodens is to minimize eruption problems for the developing dentition.[37] The treatment objective for a non-erupting primary mesiodens differs in that the removal of these teeth usually is not recommended, as the surgical intervention may disrupt or damage the underlying developing permanent teeth.[39] Erupted primary mesiodens typically are left to exfoliate normally upon the eruption of the permanent dentition.[39]

Extraction of a mesiodens is recommended during the mixed dentition to allow the normal eruptive force of the permanent incisor to bring itself into the oral cavity but consideration should be given to the timing of procedures to avoid iatrogenic damage to adjacent developing teeth.[35] Waiting until the adjacent incisors have at least two-thirds root development will present less risk to the developing teeth but still allow spontaneous eruption of the incisors.[40] In 75% of cases, extraction of the mesiodens during the mixed dentition results in spontaneous eruption and alignment of the adjacent teeth.[39,41] If the adjacent teeth do not erupt within 6 to 12 months, surgical exposure and orthodontic treatment may be necessary to aid their eruption.[27,36]

Odontogenic infections and facial cellulitis

Odontogenic infections may involve 1 or more teeth and usually are due to pulpal necrosis periodontal disease, or other dental pathology (eg, dens invaginatus, dens evaginatus, cysts, tumors).[42] Facial cellulitis—an acute infection characterized by inflammation and spread to the connective tissues in the head and neck region[43,44]—may be of odontogenic or non-odontogenic origin.[45] Non-odontogenic causes[45,46] may be infections of adjacent anatomical sites (eg, sinuses, lymph nodes, salivary glands, skin) or idiopathic. Children with facial cellulitis may present with severe pain, difficulty eating and sleeping, progressing facial swelling, dehydration, lymphadenopathy, systemic involvement (eg, fever, malaise, tachycardia), difficulty breathing, dysphagia, and/or trismus.[33(pp55-57),46] Untreated facial cellulitis can lead to conditions such as septicemia, endocarditis, necrotizing fasciitis, cavernous sinus thrombosis, brain abscess, or osteomyelitis,[43,47] as well as a rare but life-threatening airway compromise[43] known as Ludwig's angina.

Following clinical assessment, additional aids such as imaging and laboratory testing may help determine the extent of involvement and the most efficient and effective course of management.[48] Diagnostic assessment may include radiographs, ultrasound/tomography, blood tests (eg, complete blood count, inflammatory markers), microscopy, culture and sensitivity testing, and, in severe cases, blood cultures.[49] Computed tomography (CT) scans may aid in the management of patients with deep fascial space infections in the head and neck region that cross the midline or compromise the airway.[50]

Treatment considerations: Prompt treatment of the source of infection is imperative. Management of facial cellulitis includes removal of necrotic tissue (eg, root canal treatment, extraction, excision) and establishment of a pathway for drainage.[4(p405),51] Antibiotics are indicated to halt local spread and control swelling[52-54]; however, they should not replace source control and drainage.[55-59] In cases of systemic involvement, immediate surgical intervention and medical management with intravenous antibiotic therapy contribute to more rapid cure.[4(p405),43,46,58-60]

Orofacial trauma

Orofacial trauma requires both acute and ongoing management to prevent or address negative sequelae in a timely fashion. Initial care focuses on pain control, hemorrhage control, wound cleansing, accounting for missing teeth, and confirmation of tetanus immunity.[4(p404),61]

Treatment considerations: Soft tissue injuries may require debridement and primary closure.[4(p404)] When a tooth or fragment remains unaccounted, radiographs are required rule out aspiration or presence within surrounding tissues (eg, imbedded in a lip laceration).[4(p404)] Required surgical intervention for dental trauma may include extraction, reimplantation, stabilization/splinting, autotransplantation, decoronation, root burial, and implant placement.[62] The International Association of Dental Traumatology provides guidelines for management of dental injuries.[63] Consultation with and/or referral to an endodontist,

orthodontist, oral and maxillofacial surgeon, periodontist, or prosthodontist may aid in managing complex cases.

Frenulum attachments

Ankyloglossia (tongue-tie) and hypertrophic/restrictive maxillary or mandibular frenula may contribute to[64-70] difficulties with breastfeeding, articulation difficulties, caries formation, gingival recession, and aberrant skeletal growth. Scientific literature[65,66,71-76] has shown differences in treatment recommendations among pediatricians, otolaryngologists, lactation consultants, speech pathologists, surgeons, and dental specialists. Clear indications and timing of surgical treatment remain controversial due to lack of consensus regarding accepted anatomical and diagnostic criteria for degree of restriction and relative impact on growth, development, feeding, oral motor function, or periodontal health.

Treatment consideration: Observation, speech therapy, frenuloplasty/frenotomy (various methods to release the frenulum and correct the anatomic situation) or frenectomy (simple cutting of the frenulum) may be part of a successful approach to alleviate the problem.[65,66,76,77] Each of these procedures involves surgical incision, establishing hemostasis, and wound management.[77] Postoperative advice includes maintaining a soft diet, regular oral hygiene, and analgesics as needed.[78] Collaboration and follow-up with the pediatrician and lactation specialist may result in improved outcomes for infants who have undergone frenectomy. Likewise, frenectomies performed for improvement of speech, hygiene, periodontal health, or development are best coordinated with other specialists involved in the patient's care.

The use of electrosurgery or laser technology for frenectomies has demonstrated a shorter operative working time, a better ability to control bleeding, reduced intra- and postoperative pain and discomfort, fewer postoperative complications (eg, swelling, infection), no need for suture removal, and increased patient acceptance.[74,78,79] These procedures require extensive training as well as skillful technique and patient management.[65,66,76,77,80-82]

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