Council on Clinical Affairs 2017-2018

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Vision

The vision of the Council on Clinical Affairs (CCA) is to be a critical and vital aspect of American Academy of Pediatric Dentistry continuing as the world leader on children's oral health. Formed from a group of passionate, committed and bright pediatric dentists, this council draws on its long history and responsibility to the organization and the children its members serve. With the common goal of providing the best and most current evidenced based science, documents are drafted that are relevant to healthcare providers and organizations, governmental bodies, and other industry stakeholders. With that bold

platform, CCA is an invaluable resource for all of those parties that seek to impact the lives of children by vastly improving their oral health.

Duties

The duties of the Council on Clinical Affairs, Committee on Sedation and Anesthesia, as listed in the *AAPD Administrative Policy and Procedure Manual*, are to: 1) advise the Board of Trustees on matters concerning the clinical practice of pediatric dentistry; 2) review and develop oral health policies and guidelines regarding the clinical practice of pediatric dentistry and submit recommendations through the Board of Trustees; 3) perform such other duties as assigned by the President or the Board of Trustees.

Standing Charges

Charge 1

Review all definitions, oral health policies and clinical guidelines at no less frequent interval than every fifth year. Engage the Council on Scientific Affairs to perform a literature review for scientific validity.

Background and Intent: This is a standing charge to the Council. To be effective advocates for infants, children, adolescents, and persons with special health care needs, AAPD oral health policies and clinical guidelines must be supported by the best available evidence. Documents will be reviewed and revised/reaffirmed/retired in a cycle of not more than 5 year intervals. When there is sufficient reason (e.g., publications from a consensus conference), documents will be evaluated in advance of their scheduled review cycle.

Progress Report

Documents reviewed in 2017-2018 and workgroups assigned:

a) Definition of Dental Home
   Work group: CCA: Rachael Simon, Maria Estrella
   CSA: Matina Angelopoulou, Man Wai Ng

b) Policy on Minimizing Occupational Health Hazards Associated with Nitrous Oxide
   Work group: CCA: Sheila Brown, Ana Seminario, Ann Bynum
   CSA: Glenn Rosivack, Kaaren Vargas

c) Policy on Patient Safety
   Work group: CCA: Tom Stark, Elizabeth Gosnell
   CSA: Anna Jung-Wei Chen, Man Wai Ng

d) Policy on the Role of Pediatric Dentists as Both Primary and Specialty Care Providers
   Work group: CCA: Rishita Jaju, Oariona Lowe
   CSA: Kimberly Patterson, Matina Angelopoulou

e) Policy on the Use of Fluoride
   Work group: CCA: Jennifer Cully, Rishita Jaju, Carolyn Crowell
   CSA: Yasmi Crystal, Tim Wright

f) Policy on Prevention of Sports-related Orofacial Injuries
   Work group: CCA: Carolyn Kerins, Jennifer Cully
   CSA: Glenn Rosivack, Anne O'Connell

g) Policy on the Dental Home
Work group: CCA: Maria Estrella, Rachael Simon
CSA: Anne Wilson, Matina Angelopoulou

h) Best Practices on Periodicity of Examination, Preventive Dental Services, Anticipatory Guidance/Counseling, and Oral Treatment for Infants, Children, and Adolescents
Work group: CCA: Karin Weber-Gasparoni, Randy Lout
CSA: Francisco Ramos-Gomez, Anne Wilson

i) Best Practices on Dental Management of Heritable Dental Developmental Anomalies*
Work group: CCA: Ana Seminario, Elva Jordan, Judi Chin
CSA: Tim Wright, Kimberly Patterson

j) Best Practices on Dental Management of Pediatric Patients Receiving Chemotherapy, Hematopoietic Cell Transplantation, and/or Radiation Therapy
Work group: CCA: Oariona Lowe, Carolyn Kerins, Carolyn Crowell
CSA: Kaaren Vargas, Christel Haberland

k) Best Practices on Fluoride Therapy
Work group: CCA: Ashok Kumar, Jennifer Cully, Norman Tinanoff
CSA: Yasmi Crystal, Tim Wright

l) Best Practices on Use of Nitrous Oxide for Pediatric Dental Patients
Work group: CCA: Elizabeth Gosnell, Sheila Brown, Ann Bynum
CSA: Glenn Rosivack, Christel Haberland

m) Best Practices on Use of Anesthesia Providers in the Administration of Office-based Deep sedation/general Anesthesia to the Pediatric Dental Patient
Work group: CCA: Ed Rick

Progress Report

*"Best Practices on Dental Management of Heritable Dental Developmental Anomalies": CCA recommends that the document was no longer needed, could be retired, and that CSA investigate the literature on Molar Incisal Hypoplasia (MIH) to see if a "Best Practices on MIH" was needed.

The revised Policies and *Best Practices* Recommendations were posted on the AAPD website for review by the members. Approval at General Assembly.

Charge 2

Annually review all AAPD-endorsed policies and guidelines developed by other healthcare organizations.

Background and Intent: This is a standing charge to the Council to promote optimal standards of care. CCA annually will monitor the policies and guidelines of other dental and medical healthcare organizations to determine when revisions have been made by the authoring group and the appropriateness of AAPD's continued endorsement.

Progress Report

Nothing to report.

Charge 3

Annually review the tables, charts, graphs and other items found in the resource section of the Reference Manual.

Background and Intent: This is a standing charge to the Council to provide contemporary guidance in clinical practice. CCA will maintain a resource section within the Reference Manual that supplements AAPD oral health policies and clinical guidelines. An annual review will determine the accuracy of information and appropriateness for continued inclusion.

Progress Report

The resource section is under review for updates.

Charge 4

Identify potential topics for new definitions, oral health policies, clinical guidelines, and items for the resource section. Present a list of potential topics and recommendations to the Board of Trustees annually.

Background and Intent: This is a standing charge to the Council to anticipate and respond effectively to changes in the clinical and scientific environment.

Progress Report

Recommendation: To develop a clinical practice recommendations (Best Practices) on principles of periodontal diagnosis (including risk assessment) and management of pediatric periodontal conditions.

Background and Intent: Since 2003, the AAPD has endorsed and reprinted in the Reference Manual multiple documents produced by the American Academy of Periodontology. This includes Periodontal Diseases of Children (2004) which addresses five clinically distinct periodontal infections 1) dental plaque-induced gingival diseases; 2) chronic periodontitis; 3) aggressive periodontitis; 4) periodontitis as a manifestation of systemic diseases; and 5) necrotizing periodontal diseases. Clinical recommendations that are 13+ years old are likely to contain outdated and/or incomplete information, especially relative to antimicrobial therapy. By report, the leadership of AAPD reached out to the leadership of AAPerio, and that organization had no desire to update Periodontal Diseases of Children, either singularly or in a joint endeavor. In order for AAPD to continue to remain “The Big Authority on Little Teeth” and to be consistent with its goal of current evidence-based clinical recommendations, CCA is charged with developing clinical practice recommendations (best practices) on principles of periodontal diagnosis (including risk assessment) and management of pediatric periodontal diseases. This new document will replace the existing endorsement in the Reference Manual. Delineation of common periodontal diseases that affect pediatric patients (based on the 1999 classifications of the AAPerio), as well as specific treatment recommendations, is expected. A discussion regarding the need/how to distinguish aggressive or chronic periodontitis from inflammatory periodontal conditions having a systemic etiology should be included. The workgroup can determine if there is a logical and concise way in which to include other (i.e., non-infectious) periodontal conditions.

Charge 5

Develop definitions, policies, guidelines or other materials as requested by the Board of Trustees.

Background and Intent: This is a standing charge to the Council. To be effective advocates for infants, children, adolescents, and persons with special health care needs, AAPD must delineate the organization's position on new and emerging health issues and translate science into clinical practice.

Progress Report

New documents in 2017-2018, background, and workgroups assigned:

a) Pre-anesthesia form

Background and Intent: There are inherent risks associated with the use of sedation in the pediatric dental office. The dentist is responsible for the proper evaluation and determination of the appropriateness and clearance for any planned dental procedure. The use of a Pre Anesthesia form will provide a helpful guideline that will minimize the potential risk of morbidity and mortality to the patient. This form should contain a methodology to assess the patient pre operatively. The form should include the indications for the procedure, medical history, review of systems, ASA classification, dosage calculations, vitals and NPO status. In addition there should be a method of confirming that each step has been completed prior to initiating care to the patient.

The intent of the pre-sedation form is to assist the dental providers in providing optimal dental care to patient that are undergoing sedation in the office setting. The AAPD's goal is to provide resources to its members to optimize dental care for patients undergoing office based sedation.

Work group: CCA: Brian Sanders, Jeffrey Brownstein
CSA: Kimberly Patterson, Anna Check

Report

Workgroup reviewed existing sources and developed a form for inclusion in the Resource Section of the Reference Manual 2018-2019.

b) Chairside Resource: Use of Silver Diamine Fluoride for Pediatric Dental Patients

Background and Intent: The American Academy of Pediatric Dentistry (AAPD) recognizes that dental caries continues to be a prevalent and severe disease in children; especially those of low socioeconomic status. Treatment of incipient caries usually involves early therapeutic intervention using topical fluoride, and non-surgical restorative techniques like sealants and resin infiltration. Treatment of cavitated lesions traditionally requires surgical intervention to remove the diseased tooth structure followed by placement of a restorative material to restore form and function to the tooth.

Silver Diamine fluoride (SDF) has been used in Japan for over 40 years to arrest caries and reduce tooth hypersensitivity in permanent teeth. During the past decade many other countries such as Australia and China have begun been using this compound with similar success (Shah et al, J Adv Dental Res 2014). In 2016, the Food and Drug Administration approved SDF for reducing tooth sensitivity (ADA-CDT code 1354) and off label use for arresting caries is now permissible and appropriate for use in patients (Horst et al CDA 2016). In January of 2016, authors at the University of California at San Francisco published a systematic review on the efficacy, clinical indications and protocol for use of SDF to arrest caries (Horst et al CDA 2016). Since SDF is used off-label for arresting caries, the manufacturer does not have instructions

for use in their packaging material. This has created some confusion since there is no clear guidance from the only manufacturer in the U.S.

Recognizing its effectiveness, membership interest and increased use of SDF in pediatric dentistry, the AAPD should develop a resource for Chairside Instruction and Application on SDF. This evidence based document would go in the Resource Section of the Reference Manual. The document will support the use of SDF as part of an ongoing caries management plan with the aim of providing specific chairside instructions on the placement of SDF along with case selection considerations and follow-up recommendations.

Work group: CCA: Judi Chin, Karin Weber-Gasparoni
CSA: Yasmi Crystal, Tim Wright,

Report

The Chairside Resource: Use of Silver Diamine Fluoride for Pediatric Dental Patients to be included in Resource Section of the Reference Manual 2017-2018

c) Best Practices on Pain Management

Background and Intent: Pain is defined by the International Association of the Study of Pain (IASP) as an unpleasant sensory and emotional experience associated with actual or potential tissue damage. Pain management has been given national attention based on the pediatric deaths and the opioid epidemic that the country is facing. Recent recommendations coming from the office of the Surgeon General and the Center for Disease Control and Prevention include strategies to decrease opioid use and diversion. Dentists are at the forefront of this national conversation due to the frequent prescription of opioid analgesics. Pediatric dentists encounter varying scenarios where there is the potential for pain management in infants, children, adolescence and patients with special health care needs (SHCN). Pain management following orofacial traumatic injuries, invasive surgical procedures, odontogenic and non-odontogenic inflammatory conditions and infections, musculoskeletal injuries to temporomandibular structures, and neuropathic conditions are within the scope of practice for a pediatric dentist.

Pain management includes both pharmacologic and non-pharmacologic strategies to treat both acute and chronic pain. Many analgesic medications that are approved by the United States Food and Drug Administration in adults are not recommended for use in children. Safety concerns related to weight-based dosing and drug metabolism make pharmacologic pain management strategies in a pediatric population particularly difficult. Potential for diversion of opioid analgesics or misuse in the adolescence and adult population is also concerning. Therefore, formal recommendations would be useful for the practitioner to best manage their patients and avoid potential morbidity and mortality associated with prescribing medications for analgesia. The AAPD has an existing policy on “Acute Pediatric Dental Pain Assessment and Management.” A formal guideline or best practice should be considered useful in guiding practitioners on providing evidence-based recommendation regarding a broader scope of pain management.

Work group: CCA: Tom Stark, Randy Lout
CSA: Kaaren Vargas, Naomi Lane

Report

Best Practices on Pain Management completed.

d) Best Practices on Choosing an Anesthesia Provider

Background and Intent: It is the responsibility of the dentist to identify and evaluate the abilities of an anesthesia provider providing office-based care on behalf of the dentist. Current methods for examining an individual's credentials and abilities are extremely variable, if even existent. This has left AAPD members vulnerable to potential risks during the delivery of office-based anesthesia care. With the recent and ongoing changes surrounding the delivery of office-based general anesthesia in the pediatric dental setting, it is the intent of the AAPD to provide its members with a simplified process for the selection of a qualified anesthesia provider. This document should address information on: identifying qualified individuals and defining the standard education for each subtype (e.g., dentist anesthesiologist, physician anesthesiologist, certified registered nurse anesthetist, anesthesia assistant) investigating an individual's training, establishing an individual's level of experience within a particular patient population (e.g., infants, toddlers, special needs), collecting vital documentation (e.g., proof of liability insurance, state permits, DEA, dental license), verifying good standing, acquiring recommendations from previous dental clients, assessing experience, evaluating access to anesthesia care vs. considered risks (i.e., discussing rural locations, decreased access to hospital/ambulatory surgical care, or decreased access to mobile MD/DA anesthesiologist).

By establishing a dependable methodology for analyzing an individual abilities and experience, the AAPD anticipations to further mitigate morbidity and mortality associated with the use of office-based general anesthesia.

Work group: CCA: Jeffrey Brownstein, Brian Sanders
CSA: Anna Chen, Naomi Lane

Report

Policy for Selecting Anesthesia Providers for the Delivery of Office-Based General Anesthesia completed.

The new Policy and *Best Practices* Recommendation were posted on the AAPD website for review by the members. Approval at General Assembly.

Charge 6

Annually review AAPD pamphlets, brochures and other AAPD publications for scientific accuracy and consistency with AAPD Policies and Guidelines.

Background and Intent: This is a standing charge to the Council to ensure that the publications and promotional and educational materials offered to our members, other professionals, and the public are scientifically accurate and consistent with our Policies and Guidelines.

Progress Report

The Council was asked to review three new brochures based on Clinical Practice Guidelines: Indirect Pulp Treatment, Pulp Therapy, and Silver Diamine Fluoride. These brochures have been published.

Charge 7

At the request of the Executive Committee of the AAPD, provide timely review of policies, guidelines, and definitions submitted by the AAP Section on Oral Health, with particular attention to conformity with AAPD oral health policies and clinical guidelines.

Background and Intent: This is a standing charge to the Council. This mechanism implements the intent of the Memorandum of Understanding with the AAP Section on Oral Health, to review proposed documents for consistency with AAPD policies and guidelines. The Council will review these documents with sensitivity to the embargoed status of the drafts. A summary report will be submitted to the Executive Committee.

Progress Report

No requests have been made.

Charge 8

At the request of any council or committee of the AAPD, review proposed definitions, policies, guidelines, or other publications for scientific accuracy and consistency with AAPD Policies and Guidelines.

Background and Intent: This is a standing charge to the Council to ensure that any definition, policy, guideline or other publication offered to our members, other professionals, and the public are scientifically accurate and consistent with our Policies and Guidelines.

Progress Report

No requests have been made.

Charge 9

Using evidence based dentistry approaches; the Council on Clinical Affairs will participate in the development of evidence-based clinical guidelines, in conjunction with the Council on Scientific Affairs, under the direction of the Evidence-Based Dentistry Committee.

Background and Intent: This is a standing charge to the Council. Working with the Evidence-Based Dentistry Committee, the councils contribute to the development of evidence-based guidelines.

Progress Report

Nothing to report.

Charge 10

In conjunction with the Council of Scientific Affairs, identify and submit to the Evidence-Based Dentistry Committee those guidelines that may contain sufficient evidence to be considered for an evidence-based clinical guideline.

Background and Intent: This is a standing charge to the Councils to ensure that any guideline that has sufficient evidence is evaluated by the Evidence-Based Dentistry Committee for inclusion in the evidenced-based process.

Progress Report

This charge was shared with members of CCA along with a history of development of new Clinical Practical Guidelines (CPG). A request to identify guidelines that may contain sufficient evidence to be considered, other than those identified by EBDC, has been made. CCA recommends the “Best Practices on Fluoride Therapy” be considered by EBDC for fast track to an evidenced-based clinical guideline.

Project Charges

Charge 11

With the assistance of the Council on Scientific Affairs, assist the Council on Continuing Education to plan and conduct a series of podcasts on pertinent clinical guideline updates and practical reviews.

Background and Intent: Currently, a majority of pediatric dental residents receive a portion of their training electronically. Younger dentists communicate electronically for a majority of their professional and non-professional encounters. The Academy needs to be prepared to engage this group professionally through electronic continuing education.

Progress Report

No request has been made by the Council on Continuing Education.

This draft does not constitute an official AAPD health oral policy or clinical recommendation until approval by the General Assembly. Circulation is limited to AAPD members.

Definition of Dental Home

Review Council

Council on Clinical Affairs

Latest Revision

~~2015~~ 2018

The dental home is the ongoing relationship between the dentist and the patient, inclusive of all aspects of oral health care delivered in a comprehensive, continuously accessible, coordinated, and family-centered way. The dental home should be established no later than 12 months of age to help children and their families institute a lifetime of good oral health. Dental homes address anticipatory guidance, preventive, acute and comprehensive oral care and includes referral to dental specialists when appropriate.

This definition was originally developed by the Council on Clinical Affairs and adopted in 2006. This document is an update of the previous version, reaffirmed in ~~2010~~. 2015.

This draft does not constitute an official AAPD health oral policy or clinical recommendation until approval by the General Assembly. Circulation is limited to AAPD members.

Policy on Minimizing Occupational Health Hazards Associated with Nitrous Oxide

Review Council

Council on Clinical Affairs

Latest Revision

~~2013~~ 2018

Purpose

The American Academy of Pediatric Dentistry (**AAPD**) ~~recommends~~ recognizes that exposure to ambient nitrous oxide (**N_2O**) ~~be minimized to reduce occupational~~ may be an occupational health ~~hazards~~ hazard for dental personnel and encourages practitioners to take all precautions to minimize associated risks.

Methods

This policy was originally developed by the Clinical Affairs Committee and adopted in 1987. This document is a revision of the previous version, revised in ~~2008~~ 2013. ~~The policy is based on a systematic literature search of the PubMed® electronic data base using the terms: nitrous oxide, occupational exposure, AND dentistry; fields: all; limits: within the last 10 years, English. Sixteen articles met these criteria; three additional papers from the previous policy statement were reviewed and added to the references. Guidelines and recommendations from the National Institute for Occupational Safety and Health (**NIOSH**) also were reviewed[1,2].~~ The update used electronic database and hand searches of the articles in the medical and the dental literature using the following parameters: Terms: nitrous oxide, occupational exposure, AND dentistry. Fields: all; Limits: within the last 10 years, English. Additionally, guidelines and recommendations from the National Institute for Occupational Safety and Health (**NIOSH**) were reviewed[1,2]. Expert opinions and best current practices were relied upon when sufficient scientific data were not available.

Background

Effects of occupational exposure to ambient N_2O are uncertain, especially since the introduction of methods to scavenge N_2O and ventilate operatories[3]. ~~Studies that linked increased general health problems and reproductive difficulties among dental personnel to chronic exposure to significant levels of ambient N_2O have been challenged[3].~~ As of 2008, there were no definitive studies linking general health

problems and reproductive difficulties among dental personnel to chronic exposure to scavenged ambient N_2O[3]. A maximum safe level of ambient N_2O in the dental environment has not been determined[4,5,6].

Reduction of ambient N_2O through system maintenance, scavenging, ventilation, use of the minimal effective dose, and patient management is important to maintaining the lowest practical levels in the dental environment[1,2,7]. Frequent and regular inspection and maintenance of the N_2O delivery system, together with the use of a scavenging system, can reduce ambient N_2O significantly[8]. Using a well-fitted mask and an appropriate amount of suction via the scavenging system will minimize leakage, reducing ambient N_2O levels[8,9]. The use of a double-mask patient delivery system has also been shown to be more effective than a single-mask system in the removal of waste nitrous oxide[10,11]. The combined use of the double mask system and scavenging systems with a high evacuation rate have been demonstrated to decrease occupational exposure to nitrous[12]. NIOSH has recommended that the exhaust ventilation of N_2O from the patient's mask be maintained at an air flow rate of 45 L/min and vented outside the building away from fresh air intakes[1,5]. However, scavenging at this rate has been shown to reduce the level of pyschosedation achieved with N_2O inhalation[13]. Where possible, outdoor air should be used for dental operatory ventilation[1,14]. Supply and exhaust vents should be well separated to allow good mixing and prevent short-circuiting[1]. Female dental staff frequently exposed to nitrous oxide (3 or more days a week) have been found to have no elevated risk of spontaneous abortion in offices using appropriate scavenging systems[15,16].

Patient selection is an important consideration in reducing ambient N_2O levels[7]. Patients who are unwilling or unable to tolerate the nasal hood and those with medical conditions (e.g., obstructive respiratory diseases, emotional disturbances, drug dependencies) that contraindicate the use of N_2O should be managed by other behavior guidance techniques[7]. In the dental environment, patient behaviors such as talking, crying, and moving have been shown to result in significant increases in baseline ambient N_2O levels despite the use of the mask-type scavenging systems[17,18]. Utilization of appropriate nitrous concentration levels should also be considered in relation to procedure difficulty. Nitrous can be discontinued once adequate anesthesia is achieved[19], or decreased levels can be maintained during easier procedures and increased for stimulating procedures[5]. Furthermore, the use of scavenging systems alone cannot lower the ambient N_2O levels to the recommended standards[8,17,20]. Use of supplemental measures, such as a high-volume dental ~~aspirator~~ suction placed in proximity to the dental operative site, has been shown to reduce ambient N_2O levels significantly[17,21]. ~~During the first three to five minutes after terminating N_2O administration, a significant amount of the gas is exhaled by the patient. Once N_2O~~

~~administration is discontinued, administering 100 percent oxygen to the patient for at least five minutes allows oxygen to replace the N_2O in the gas delivery system[2,3]. This post-procedural oxygenation also decreases the risk of diffusion hypoxia to the patient.~~ Diligent use of the above practices in the pediatric dental environment has allowed for the reduction of ambient N_2O to the levels recommended by NIOSH[21,22]. Measurement of N_2O levels in the dental operatory can be helpful in determining the type and extent of remediation necessary to decrease occupational exposure.

Policy statement

The AAPD encourages dentists and dental auxiliaries to maintain the lowest practical levels of N_2O in the dental environment while using N_2O. Adherence to the recommendations below can help minimize occupational exposure to N_2O.

- Educate dental personnel on minimizing occupational exposure to and potential abuse of nitrous oxide.
- Use scavenging systems that remove N_2O during patient's exhalation.
- Ensure that exhaust systems adequately vent scavenged air and gases to the outside of the building and away from fresh air intake vents.
- Use, where possible, outdoor air for dental operatory ventilation.
- Implement careful, regular inspection, and maintenance of the nitrous oxide/oxygen delivery equipment.
- Carefully consider patient selection criteria (i.e., indications and contraindications) prior to administering N_2O.
- Select a properly-fitted mask size for each patient.
- During administration, visually monitor the patient and titrate the flow/percentage to the minimal effective dose of N_2O.
- Encourage patients to minimize talking and mouth breathing during N_2O administration.
- Use ~~rubber dam and~~ high volume dental ~~evacuator~~ suction when possible during N_2O administration.
- ~~Administer 100 percent oxygen to the patient for at least five minutes after terminating nitrous oxide use to replace the N_2O in the gas delivery system~~.

References

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This draft does not constitute an official AAPD health oral policy or clinical recommendation until approval by the General Assembly. Circulation is limited to AAPD members.

Policy on Patient Safety

Review Council

Council on Clinical Affairs

Revised

2018

Purpose

The American Academy of Pediatric Dentistry (**AAPD**) recognizes patient safety as an essential component of quality oral health care for infants, children, adolescents, and individuals with special health care needs. The AAPD encourages dentists to consider thoughtfully the environment in which they deliver health care services and to implement practices to improve patient safety ~~that decrease a patient's risk of injury or harm during the delivery of care~~. This policy is not intended to duplicate safety recommendations for medical facilities accredited by national commissions such as T~~t~~he Joint Commission ~~on Accreditation of Healthcare Organizations~~ or those related to workplace safety such as Occupational Safety & Health Administration.

Methods

This policy was originally developed by the Council on Clinical Affairs and adopted in 2008. This policy is based on a review of current dental and medical literature, including a literature search of the MEDLINE/PubMed® electronic data base using the terms: patient safety AND dentistry, fields: all; limits: within the last 10 years, humans, English. ~~Ten articles matched these criteria.~~ Eight hundred twenty-two articles met these criteria. Papers for review were chosen from this list and from the references within selected articles.

Background

All health care systems should be designed to provide ~~promote~~ a practice environment that promotes patient safety.[1] ~~health and protection.~~ The World Health Organization (WHO) defines patient safety as "the reduction of risk of unnecessary harm associated with healthcare to an acceptable minimum."[2]. The most important challenge in the field of patient safety is prevention of harm, particularly avoidable harm, to patients during treatment and care.[2]. Dental practices must be in compliance with federal laws that help protect patients from preventable injuries ~~misuse of personal information~~ [e.g., ~~Health Insurance~~

~~Portability and Accountability Act (**HIPAA**)] (US DHHS National Standards, WHO Guidelines, Boyce and Pittet, AAPD Infection Control)~~ and potential dangers such as the transmission of disease.[3,4,5] ~~State and local l~~ Laws help regulate hazards related to ~~potential~~ chemical and environmental factors (e.g., spills, radiation) ~~hazards~~ and facilities (e.g., fire prevention systems, emergency exits)[6]. American Academy of Pediatric Dentistry best practices and oral health policies provide additional information regarding the delivery of safe pediatric dental care[7-18]. Furthermore, state dental practice acts and hospital credentialing committees are intended to ensure the safety of patients and the trust of the public by regulating the competency of and provision of services by dental health professionals.[19,20,21].

~~Designing~~ Patient-centered health care systems that focus on preventing errors ~~and being more efficient and patient-family centered is~~ are critical to assuring patient safety[21,22]. Some possible sources of error in the dental office are miscommunication, interruptions, stress, fatigue, failure to review the patient's medical history (e.g., current medications ~~drugs~~ and allergies ~~medications~~), and lack of standardized records, abbreviations, and processes.[1,21,23]. Treating the wrong patient or tooth/surgical site, delay in treatment, disease progression after misdiagnosis, inaccurate referrals, incorrect medication dosages ordered/administered, unintentional swallowing, aspiration, or retention of a foreign object, and breaches in sterilization are examples of patient safety events that occur in dentistry.[24,25,26,27,28]. Adverse events may be classified in terms of severity of harm.[29].

Standardiz~~ation~~ed processes and workflows help~~s~~ assure clerical and clinical personnel execute their responsibilities in a safe and effective manner.[23]. Policy and procedure manuals that describe ~~each~~ a facility's established protocols serve as a valuable training tool for new employees and reinforce a consistent approach ~~for~~ to promoting safe~~,~~ and quality patient care[23]. Identifying deviations from ~~such~~ established protocols and studying patterns of occurrence can help reduce the likelihood of adverse events.[23,28,30].

Safety checklists are used by many industries and healthcare organizations to reduce preventable errors.[31,32]. Data supports the use of procedural checklists to minimize the occurrence of adverse events in dentistry (i.e. presedation checklist).[33,34,35]. In addition, order sets, reminders, and clinical guidelines built into an electronic charting system may improve adherence to best practices.[28].

Reducing clinical errors requires ~~a~~ careful examination of adverse events~~,~~ and ~~including '~~near miss~~es',~~ events. ~~and root cause analysis of how the event could be avoided in the future so that safety practices can~~

~~be implemented.~~ [22,36] In a near miss event, an error was committed, but the patient did not experience clinical harm.[22,36]. Detection of errors and problems within a practice or organization may be used as teaching points to motivate changes and avoid recurrence.[37]. A root cause analysis can be conducted to determine causal factors and corrective actions so these types of events may be avoided in the future.[31,38,39]. Embracing a patient s~~S~~afety culture demands a ~~culture in which communication does not depend on hierarchy;~~ a non-punitive or no blame environment that ~~culture~~ encourages all personnel regardless of position to report errors and intervene in matters of patient safety.[1,22,38]. Alternatively, a fair and just culture is one that learns and improves by openly identifying and examining its own weaknesses; individuals know that they are accountable for their actions, but will not be blamed for system faults in their work environment beyond their control.[39]. Evidence-based systems have been designed for healthcare professionals to improve team awareness, clarify roles and responsibilities, resolve conflicts, improve information sharing, and eliminate barriers to patient safety.[40,41,42].

The environment in which dental care is delivered impacts patient safety. In addition to structural issues regulated by state and local laws, other design features should be planned and periodically evaluated for patient safety, especially as they apply to young children. Play structures, games, and toys are possible sources for accidents and infection.[43,44].

~~Consequently, t~~ The dental patient would benefit from a practitioner who follows current literature and participates in professional continuing education courses to increase awareness and knowledge of best current practices.[45]. Scientific knowledge and technology continually advance, and patterns of care evolve due, in part, to recommendations by organizations with recognized professional expertise and stature including: the American Dental Association, The Joint Commission (National Patient Safety Goals 2017), WHO, Institute for Health Improvement, and Agency for Healthcare Research and Quality. ~~Some recommendations can be based only on suggestive evidence or theoretical rationale (e.g., infection control); other concerns of clinical practice remain in flux (e.g., materials utilized in restorative dentistry). Consequently, the dental patient would benefit from a practitioner who follows current literature and participates in professional continuing education courses to increase awareness and knowledge of best current practices.~~ Data-driven solutions are possible through documenting, recording, reporting, and analyzing patient safety events.[26, 46,47]. Continuous quality improvement efforts including outcome measure analysis to improve patient safety should be implemented into practices.[28,45]. Patient safety incident disclosure is lower in dentistry compared with medicine since a dental-specific reporting system

does not exist in the United States. [47]. Identifiable patient information that is collected for analysis is considered protected under the Health Insurance Portability and Accountability Act (**HIPAA**).[48,49].

~~The AAPD emphasizes safe, age-appropriate, nonpharma-cological or pharmacological behavior guidance techniques for use with pediatric dental patients. It is important to base behavior guidance on each patient's individual needs with goals of fostering a positive dental attitude, safety, and providing quality dental care (AAPD Behavior Guidance). Appropriate diagnosis of behavior and safe and effective implementation of advanced behavior guidance techniques (i.e., protective stabilization, sedation, general anesthesia) necessitate knowledge and experience that generally are beyond the core knowledge that students receive during predoctoral education (AAPD Behavior Guidance, AAPD Protective Stabilization).~~

Policy statement

To promote patient safety ~~health and protection~~, the AAPD encourages:

1. Patient safety instruction in dental curricula to promote safe, patient-centered care ~~(Kiersman, Plake and Darbishire 2011)~~.
2. Professional continuing education by all licensed dental professionals to maintain familiarity with current regulations, technology, and clinical practices.
3. ~~Compliance with federal laws such as HIPAA to protect patients against misuse of information identifiable to them (US DHHS National Standards).~~
3~~4~~. Compliance and recognition of the importance of infection control policies, procedures, and practices in dental health care settings ~~in order~~ to prevent disease transmission from patient to care provider, from care provider to patient, and from patient to patient ~~(WHO Guidelines, Boyce and Pittett, AAPD Infection Control)~~.
4~~5~~. Routine inspection of physical facility in regard~~s~~ to patient safety. This ~~would~~ includes development and periodic review of office emergency and fire safety protocols and routine inspection and maintenance of clinical equipment.
5~~6~~. Recognition that informed consent by the parent is essential in the delivery of health care and effective relationship/communication practices can help avoid problems and adverse events ~~(AAPD Informed Consent)~~. The parent should ~~be encouraged to~~ understand and be actively engaged in the planned treatment~~be an active participant in the child's care~~.
6~~7~~. Accuracy of patient identification with the use of at least two patient identifiers, such as name and date of birth, when providing care, treatment, or services ~~(JCAHO 201712/13)~~.

7~~8~~. An accurate and complete patient chart that can be interpreted by a knowledgeable third party ~~(AAPD Record-Keeping)~~. Standardizing abbreviations, acronyms, and symbols throughout the record is recommended.

8~~9~~. An accurate, comprehensive, and up-to-date medical/dental history including medications and allergy list to ensure patient safety during each visit ~~(AAPD Record-Keeping)~~. Ongoing communication with health care providers, both medical and dental, who manage the child's health helps ensure comprehensive, coordinated care of each patient.

9~~10~~. A pause or time out with dental team members present before ~~an~~ invasive procedure(s) to confirm the patient, planned procedure(s), and tooth/surgical site(s) are correct.

10~~11~~. Appropriate staffing and supervision of patients treated in the dental office.

11~~12~~. Adherence to AAPD recommendations on behavior guidance, especially as they pertain to use of advanced behavior guidance techniques (i.e., protective stabilization, sedation, general anesthesia) ~~(AAPD Behavior Guidance, AAPD Protective Stabilization)~~.

12~~13~~. Standardization and consistency of processes within the practice. A policies and procedures manual, with ongoing review and revision, could help increase employee awareness and decrease the likelihood of untoward events. Dentists should emphasize procedural protocols that protect the patient's airway (e.g., rubber dam isolation) ~~(AAPD Restorative)~~, guard against unintended retained foreign objects (e.g., surgical counts; observation of placement/removal of throat packs, retraction cords, cotton pellets, and orthodontic separators), and minimize opportunity for iatrogenic injury during delivery of care (e.g., protective eyewear).

13~~14~~. Minimizing exposure to nitrous oxide by maintaining the lowest practical levels in the dental environment. This ~~would~~ includes routine inspection and maintenance of nitrous oxide delivery equipment as well as adherence to clinical ~~guidelines~~ recommendations for patient selection and delivery of inhalation agents ~~(AAPD N2O Policy)~~.

14~~15~~. Minimizing radiation exposure through adherence to ALARA (as low as reasonably achievable) principle, equipment inspection and maintenance, and patient selection criteria ~~(ADA 2012)~~.

15~~16~~. All facilities performing sedation for diagnostic and therapeutic procedures to maintain records that track adverse events. Such events then can be examined for assessment of risk reduction and improvement in patient safety ~~(AAPD/AAP Sedation Guideline)~~.

16~~17~~. Dentists who utilize in-office anesthesia ~~care providers~~ personnel take all necessary measures to minimize risk to patients. Prior to delivery of sedation/general anesthesia, appropriate documentation shall address rationale for sedation/general anesthesia, informed consent, instructions to parent, dietary precautions, preoperative health evaluation, and any prescriptions

along with the instructions given for their use. Rescue equipment should have regular safety and function testing and medications should not be expired. The dentist and anesthesia ~~care provider~~ personnel must communicate during treatment to share concerns about the airway or other details of patient safety ~~(AAPD Anesthesia Personnel)~~.

17~~18~~. Ongoing quality improvement strategies and~~. R~~routine assessment of risk, adverse events, and near misses. ~~mistakes with a~~A plan for ~~reduction and~~ improvement in patient safety and satisfaction is imperative for such strategies ~~(JCAHO 201712/13, Ramoni et al 2012)~~.

18. Comprehensive review and documentation of indication for medication order / administration. Review current medications, allergies, drug interactions, and correct calculation of dosage.

19. Promoting a culture of patient safety where staff members are empowered and encouraged to speak up or intervene in matters of patient safety.

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Policy on the Role of Pediatric Dentists as Both Primary and Specialty Care Providers

Review Council

Council on Clinical Affairs

~~Reaffirmed~~

~~2013~~

Latest Revision

2018

Purpose

The American Academy of Pediatric Dentistry (**AAPD**) emphasizes that health care providers and other interested third parties must recognize the dual role that pediatric dentists play in the provision of professional preventive and therapeutic oral health care, which includes both primary and specialty care services.

Methods

This policy was originally developed by the Council on Clinical Affairs and adopted in 2003. This is a revision ~~an affirmation~~ of the last ~~revision~~ version reaffirmed in 2013. ~~and was~~It is based on a review of the accreditation standards for advanced specialty training programs in pediatric dentistry and the AAPD position paper on the role of pediatric dentists as primary and specialty care providers[1,2]. An electronic search was conducted using the terms pediatric dentist, pediatric specialist, primary care provider, dual care provider, and specialty care provider.

Background

"Pediatric dentistry is an age-related specialty that provides both primary and comprehensive preventive and therapeutic oral health needs for infants and children through adolescence, including those with special health care needs"[2]. The American Dental Association, the American Academy of General Dentistry, and the AAPD all recognize the pediatric dentist as both a primary care provider and specialty care provider. The dual role of pediatric dentists is similar to that of pediatricians, gynecologists, and

internists in medicine. Within the medical profession, clinicians and third party payors recognize these physicians in a dual role and have designed payment plans to accommodate this situation.

The AAPD respects the rights of employers to negotiate health care benefits for their employees. ~~Unfortunately, t~~Third-party payors sometimes do not recognize pediatric dentists as primary care providers. This position restricts access to pediatric dentists for children who have reached a predetermined age and/or who may be best served by specialized oral health care providers and counseling. In some instances, this restriction results in necessity for a specialty referral to a pediatric dentist prior to evaluation.

Policy statement

The AAPD recognizes that infants, children, adolescents, and individuals with special health care needs have the right to quality oral health care. The AAPD encourages third party payors to recognize pediatric dentists as both primary and specialty oral health care providers and to refrain from age-related restrictions when a parent or referring clinician desires to utilize the services and expertise of a pediatric dentist to establish a dental home or for limited specialized care.

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Policy on Use of Fluoride

Review Council

Council on Clinical Affairs

Revised

~~2014*,~~ 2018

~~*Revisions limited to ADA 2014 guidelines regarding use of fluoride toothpaste in young children.~~

Purpose

~~The American Academy of Pediatric Dentistry (**AAPD**), affirms ing that the appropriate use of fluoride as an adjunct in the prevention of caries is a safe and effective. adjunct in an individualized prevention plan. The AAPD in reducing the risk of caries and reversing enamel demineralization, encourages dentists and other health care providers, public health officials, health care providers, and parents/caregivers to optimize fluoride exposure based on a caries risk assessment.~~ The American Academy of Pediatric Dentistry (AAPD), affirms that the use of fluoride as an adjunct in the prevention of caries is safe and effective. The AAPD encourages dentists and other health care providers, public health officials, and parents/caregivers to optimize fluoride exposures to reduce the risk for caries and to enhance the remineralization of affected tooth structures.

Methods

This document was originally developed by the Liaison with Other Groups Committee and adopted in 1967. This is an update from the last revision in 201~~3~~4. An electronic database search using the terms fluoride, fluoridation, acidulated phosphate fluoride, fluoride varnish, fluoride therapy, and topical fluoride was previously conducted to develop and update this policy. The current update relied upon systematic reviews, expert opinions and best current practices ~~also were relied upon for this policy.~~ The use of silver diamine fluoride is addressed in a separate AAPD policy.(Policy on the Use of Silver Diamine Fluoride for Pediatric Dental Patients, 2017)

Background

The adjustment of the fluoride level in community water supplies to optimal concentration is the most beneficial and inexpensive method of reducing the occurrence of caries.[1] ~~Epidemiologic data from the last half-century indicate reductions in caries of 55 to 60 percent, and recent data show caries~~

~~reduction of approximately 25 percent, without significant enamel fluorosis, when domestic water supplies are fluoridated at an optimal level~~.[2] ~~Evidence accumulated from~~ ~~long~~ Long-term use of fluorides has ~~demonstrated that~~ reduced the cost of oral health care for children ~~can be reduced~~ by as much as 50 percent.[3] ~~These savings in health dollars accrue to private individuals, group purchasers, and government care programs.~~ When public water is fluoridated to an optimal level, there is a 35~~%~~ percent reduction in decayed, missing, filled primary teeth and 26~~%~~ percent less decayed, missing, and filled permanent teeth. (Iheozor-Ejiofor Z, 2015) The occurrence of fluorosis, causing esthetic concerns, has been reported to be 12~~%~~ percent when public water contains 0.7 ppm F. (Iheozor-Ejiofor Z, 2015)

~~An even higher caries reduction can be obtained if the proper use of fluorides is combined with other dietary, oral hygiene, and preventive measures[4] as applied or prescribed by a dentist or physician familiar with the child's oral health and family history caries risk assessment~~. When combined with other dietary, oral hygiene and preventive measures[4], the use of fluorides can reduce the incidence of caries.

Professional fluoride products should only be applied by or under the direction of a dentist or physician who is familiar with the child's oral health and has completed a caries risk assessment.

~~A large body of literature supports the incorporation of optimal fluoride levels in drinking water supplies.~~ When fluoridation of drinking water is impossible, effective fluoride supplementation can be achieved through the intake of daily fluoride supplements, according to established guidelines[1,~~12-14~~ ~~13-15~~] . Before supplements are prescribed, it is essential to review dietary sources of fluoride (eg, all drinking water sources, consumed beverages, prepared food, toothpaste) to determine the patient's true exposure to fluoride[1,5,6] , and to take into consideration the caries risk of the child. The mean ~~F~~fluoride concentration of ready-to-~~use~~ feed infant formulas in the U.S. ~~and Canada ranges from~~ is 0.15ppm for milk-based formulas ~~to~~ and ~~0.3~~ 0.21ppm for soy-based formulas.~~mg/L~~ [7] ~~, which provides only a modest source of fluoride~~. The more important issue, however, is the fluoride content of concentrated or powdered formula when reconstituted with fluoridated water. The range of fluoride in ppm for reconstituted powdered or liquid concentrate, when reconstituted with water containing 1ppm fluoride, is 0.64 – 1.07.[7] ~~Considering the potential for mild fluorosis, caution is advised for infants consuming formula that is reconstituted with optimally fluoridated water.~~[8]As the Environmental Protection Agency/Department of Health and Human Services' recommendation[9,16] for optimizing community water supplies to 0.7 ppm F is instituted, fluorosis due to reconstituting infant formula

with fluoridated water ~~will be less~~ is less of an issue.

Significant cariostatic benefits can be achieved by the use of over-the-counter fluoride-containing preparations such as toothpastes, gels, and rinses, especially in areas without water fluoridation.[1] The brushing of teeth with appropriate amounts of fluoride toothpaste twice daily for all children is encouraged.[11] Monitoring children's use of topical fluoride- containing products, including toothpaste, may prevent ingestion of excessive amounts of fluoride.[10,11] Numerous clinical trials have confirmed the anti-caries effect of professional topical fluoride treatments, including 1.23 percent acidulated phosphate fluoride [APF; 1.23% F], ~~and five percent neutral sodium~~ 5 percent sodium fluoride varnish [NaFV; 2.26% F], 0.09 percent fluoride mouthrinse, and 0.5 percent fluoride gel/paste.[~~11~~12] For children under the age of 6 years, 5 percent sodium fluoride varnish [NaFV; 2.26% F], is the professionally applied topical fluoride of choice.[12]

A significant number of parents and caregivers are concerned about their child receiving fluoride and may refuse fluoride treatment even though fluoride is safe and effective. (Chi 2014) This is similar to opposition to community water fluoridation (Melbye and Armfield 2013). Topical fluoride refusal and resistance may be a growing problem and mirror trends seen with vaccination refusal in medicine.

Policy statement

The AAPD:

- Endorses and encourages the adjustment of fluoride content of ~~domestic community~~ public drinking water supplies to optimal levels where feasible.
- Endorses the supplementation of a child's diet with fluoride according to established guidelines[~~1,12-14 13-15~~]-when fluoride levels in ~~community water supplies~~ public drinking water are suboptimal and after consideration ~~of sources~~ of dietary sources of fluoride and the caries risk of the child.
- Encourages the brushing of teeth with appropriate amounts of fluoride toothpaste twice daily for all children [~~11~~].
- Encourages the application of professional fluoride treatments for ~~all children~~ all individuals at risk for dental caries.
- Encourages dental professionals to inform medical peers of the potential of enamel fluorosis

when excess fluoride is ingested prior to enamel maturation.

- Encourages the continued research on safe and effective fluoride products.
- Supports the delegation of fluoride application to auxiliary dental personnel or other trained allied health professionals by prescription or order of a dentist after a comprehensive oral examination, or by a physician after a dental screening and caries risk assessment ~~has~~ have been performed.
- Encourages all beverage and infant formula manufacturers to include fluoride concentration with the nutritional content on food labels.
- ~~encourages dentists and other health care providers to educate parents that infant formula, if constituted with optimally fluoridated water, contains fluoride. Dentists and other health care providers, therefore, should assist parents in determining the infant's fluoride exposure.~~
- Recognizes that drinking fluoridated water and brushing with fluoridated toothpaste ~~at least~~ twice daily are ~~perhaps~~ the most effective method in reducing dental caries prevalence in children.
- Encourages dental providers to talk to parents and caregivers about the benefits of fluoride and to proactively address fluoride hesitance through chairside and community education.

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This draft does not constitute an official AAPD health oral policy or clinical recommendation until approval by the General Assembly. Circulation is limited to AAPD members.

Policy on Prevention of Sports-related Orofacial Injuries

Review Council

Council on Clinical Affairs

Revised

2018

Purpose

The American Academy of Pediatric Dentistry (**AAPD**) recognizes the prevalence of sports-related orofacial injuries in our nation's youth and the need for prevention. This policy is intended to educate dental professionals, health care providers, and educational and athletic personnel on the prevention of sports-related orofacial injuries.

Methods

This policy was originally developed by the Clinical Affairs Committee and adopted in 1991. This document is a revision of the previous version, revised in ~~2010~~ 2018. The revision of this policy is based upon a review of current dental and medical literature related to orofacial injuries, including their prevention. Database searches were performed using the terms: sports injuries, injury prevention, dental injuries, orofacial injuries. Seventy citations were chosen from this method 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.~~The policies, recommendations, and listed references of the Academy for Sports Dentistry (**ASD**) and the International Association of Dental Traumatology (**IADT**) were consulted as valuable resources in preparation of this document.

Background

The tremendous popularity of organized youth sports and the high level of competitiveness have resulted in a significant number of dental and facial injuries (~~Castaldi 1986, Castaldi 1988~~. From 1990-2003, there was an average of 22,000 dental injuries annually in children <18 years of age. This is approximately 31.6 dental injuries per 100,000 children and adolescents[1]. Over the past decade, approximately 46 million youths in the United States were involved in "some form of sports" [2]. It is estimated that 30 million children in the U.S. participate in organized sport programs [3] All sporting activities have an associated

risk of orofacial injuries due to falls, collisions, contact with hard surfaces, and contact from sports-related equipment. A systemic review reported between 10-61% of athletes reported experiencing dental trauma [4]. ~~Sports accidents reportedly account for 10 to 39 percent of all dental injuries in children (Newsome, Tran and Cooke 2001).~~ A 10 year study of 3,385 craniomaxillofacial trauma cases presenting to an oral and maxillofacial surgery department found 31.8 percent of injuries in children occurred during sports activities.[5] ~~Children are most susceptible to sports-related oral injury between the ages of seven and 11 years (Tesini and Soporowski 2000, Rodd and Chesham 1997, ADA 2006, Stewart et al 2009). The administrators of youth, high school, and college football, lacrosse, and ice hockey have demonstrated that dental and facial injuries~~ Children age 17 years and younger represented 80.6% of the total (sport and not-sport related) dental injuries that presented that presented to U.S. emergency rooms from 1990-2003. In all age groups, males were more likely to have dental injuries than females.[1]

It has been demonstrated that dental and facial injuries can be reduced significantly by introducing mandatory protective equipment.[6,7] Currently football, lacrosse and ice hockey require protective equipment. Popular sports such as baseball, basketball, soccer, softball, wrestling, volleyball, and gymnastics lag far behind in injury protection for girls and boys. Baseball and basketball have been shown to have the highest incidence of sports-related dental injuries in children seven to 17 years of age.[1] More specifically, baseball accounted for ~~had~~ the ~~highest incidence~~ most dental injuries within the seven to 12 year old age group, while basketball was the most frequent sport associated with dental injuries in the 13 to 17 year age group.[1] Youths participating in leisure activities such as skateboarding, inline or roller skating, and bicycling also benefit from appropriate protective equipment. [8,9,10,11] A large national survey confirmed the bicycle as the most common consumer sports product related to dental injuries in children [1] followed by playground equipment, other riding equipment (skates, roller blades) and trampolines.

The use of the trampoline provides specialized training for certain sports. However, when used recreationally, a significant number of head and neck injuries occurs, with head injuries most commonly a result of falls.[12] The American Academy of Pediatrics (**AAP**) recommends practitioners advise patients and their families against recreational trampoline use and discuss that current safety measures have not significantly decreased injury rates.[12] The AAP also states that practitioners "should only endorse use of trampolines as part of a structured training program with appropriate coaching, supervision, and safety measures in place".[12]

Studies of dental and orofacial athletic injuries are reported throughout the medical and dental literature. [13,14,15,16] Injury rates vary greatly depending on the size of the sample, the sample's geographic location, the ages of the participants, and the specific sports involved in the study. [13,14,15,16,17] Rates of traumatic dental injuries also differ in regards to the athlete's level of competition; less-professional athletes exhibit a higher prevalence of sports-related injuries.[15] ~~The highest incidence of sports-related dental injuries has been demonstrated in 15- to 18-year-old males (Huang 2009).~~ Most of the current data regarding injuries comes from the National High School Sports-Related Injury Surveillance Study and captures information such as exposure (competition vs practice), the injury, and details of the event and type of protective equipment used.[18] Data from this source found that in 2016-2017 school year, of the 699,441 injuries reported during competition; of those, 223,623 (32 percent) occurred to the head/face; another 91,410 occurred during practice . A similar study using this database followed athletes from 2008-2014 and found the rate of dental injuries in competition was three times higher than in practice. For the majority of these reported injuries, the athlete was not wearing a mouthguard. Review of this database found the highest rates of dental injuries in high school athletes occurred in girls' field hockey and boys' basketball [17], Although the statistics vary, many studies reported that dental and orofacial injuries occurred regularly and concluded that participation in sports carries a considerable risk of injury.[14,15,5,9]

Consequences of orofacial trauma for children and their families are substantial because of potential for pain, psychological effects, and economic implications. Children with untreated trauma to permanent teeth exhibit greater impacts on their daily living than those without any traumatic injury.[19,20] The yearly costs of all injuries, including orofacial injuries, sustained by young athletes have been estimated to be between 500 million [21] and as high as 1.8 billion dollars.[3] Significant costs can accrue over a patient's lifetime for restorative, endodontic, prosthodontic, implant, or surgical treatment(s) resulting from dentoalveolar trauma. Piccininni et al suggested that the lifetime cost of an avulsed tooth in a teenage athlete can reach $20,000, exceeding the maximum benefits for most insurance companies. [22] Traumatic dental injuries have additional indirect costs that include children's hours lost from school and parents' hours lost from work, consequences that disproportionately burden lower income, minority, and non-insured children.[23,24,25,26]

The majority of sport-related dental and orofacial injuries affect the upper lip, maxilla, and maxillary incisors, with 50 to 90 percent of dental injuries involving the maxillary incisors.[13,14,27,22] The most

common dental injuries were lacerations (36.5%), chipped front teeth (23.9%) and avulsions (11.3%).[21] Use of a mouthguard can protect the upper incisors. However, studies have shown that even with a mouthguard in place, up to 25 percent of dentoalveolar injuries still can occur.[28]

Identifying patients who participate in sports and recreational activities allows the healthcare provider to recommend and implement preventive protocols for individuals at risk for orofacial injuries. In 2000, a predictive index was developed to identify the risk factors involved in various sports. This index is based upon a defined set of risk factors that predict the chance of injury including demographic information (age, gender, dental occlusion), protective equipment (type/usage), velocity and intensity of the sport, level of activity and exposure time, level of coaching and type of sports organization, whether the player is a focus of attention in a contact or non-contact sport, history of previous sports-related injury, and the situation (e.g., practice vs game). [9,29] Behavioral risk factors (e.g., hyperactivity) also have been associated significantly with injuries affecting the face and/or teeth.[30,31] While this predictive index looked at contact versus non-contact sport as a factor, non-contact sports can carry significant risk. For example., basketball is one of the sports with the highest incidence of dental injury, but these injuries usually involve player-player contact whereas greater than 87% of all dental injuries sustained by baseball, softball and field hockey players are due to player-object contact.[17]

The frequency of dental trauma is significantly higher for children with increased overjet (>6 mm) and inadequate lip coverage.[32,33] A dental professional may be able to modify these risk factors. Initiating preventive orthodontic treatment in early- to middle-mixed dentition of patients with an overjet greater than three millimeters has the potential to reduce the severity of traumatic injuries to permanent incisors.[32]

Although some sports-related traumatic injuries are unavoidable, most can be prevented.[33,34,35] Helmets, facemasks, and mouthguards have been shown to reduce both the frequency and severity of dental and orofacial trauma.[33] While facemasks may not significantly reduce the risk of orofacial trauma due to player-player contact, they might have a significant effect with player-object contact. The protective and positive results of wearing a mouthguard have been demonstrated in numerous epidemiological surveys and tests. [36,15,37,39,40] However, few sports have regulations that require their use. The National Federation of State High School Associations mandates mouthguards only for football, ice hockey, lacrosse, and field hockey and for wrestlers wearing braces.[41]Several states have attempted to increase the number of sports which mandate mouthguard use, with various degrees of success and acceptance. Four states

(Minnesota, New Hampshire, Maine and Massachusetts) have been successful in increasing the number of sports requiring mouthguard use to include sports such as soccer, wrestling, and basketball.[35,42,43] It is likely that the mandated mouthguard rule has not expanded to other sports due to complaints by athletes, parents, and coaches that mouthguards interfere with how the game is played and the athletes' enjoyment.[44,42] Regardless of the relatively limited use of mouthguards in sports, the American Dental Associations and International Academy of Sports Dentistry currently recommends the use of mouthguards in 29 sports or activities.[45]

Initially used by professional boxers, the mouthguard has been used as a protective device since the early 1900s.[14,4,46] The mouthguard, also referred to as a gumshield or mouth protector, is defined as a "resilient device or appliance placed inside the mouth to reduce oral injuries, particularly to teeth and surrounding structures."[47] The mouthguard was constructed to "protect the lips and intraoral tissues from bruising and laceration, to protect the teeth from crown fractures, root fractures, luxations, and avulsions, to protect the jaw from fracture and dislocations, and to provide support for edentulous space."[48] The mouthguard helps to prevent fractures and dislocations of teeth by absorbing and redistributing shock during forceful impacts and decreases the likelihood of jaw fracture by a similar mechanism and also by stabilizing the mandible.[40] The mouthguard decreases the incidence of soft tissue injuries by separating the teeth from the tissues. ~~works by "absorbing the energy imparted at the site of impact and by dissipating the remaining energy." (McClelland, Kinirons and Geary 1999).~~ Recent data suggests that a properly fitted mouthguard of 3.0 mm thickness might reduce the incidence of concussion injuries from a blow to the jaw by positioning the jaw to absorb the impact forces which without it would be transmitted through the skull base to the brain.[49]

The American Society for Testing and Materials (**ASTM**) classifies mouthguards by three categories (ASTM 2006)[50]:

1. Type I – Custom-fabricated mouthguards are produced on a dental model of the patient's mouth by either the vacuum-forming or heat-pressure lamination technique.[33] The ASTM recommends that for maximum protection, cushioning, and retention, the mouthguard should cover all teeth in at least one arch, customarily the maxillary arch, less the third mola.[50] A mandibular mouthguard is recommended for individuals with a Class III malocclusion. The custom-fabricated type is superior

in retention, protection, and comfort.[33,51,52,53,54] When this type is not available, the mouth-formed mouthguard is preferable to the stock or preformed mouthguard.[55,56,57]

2. Type II – Mouth-formed, also known as boil-and-bite, mouthguards are made from a thermoplastic material adapted to the mouth by finger, tongue, and biting pressure after immersing the appliance in hot water.[47] Available commercially at department and sporting-good stores, as well as online, these are the most commonly used among athletes but vary greatly in protection, retention, comfort, and cost.[36,33]
3. Type III – Stock mouthguards are purchased over-the-counter. They are designed for use without any modification and must be held in place by clenching the teeth together to provide a protective benefit.[33] Clenching a stock mouthguard in place can interfere with breathing and speaking and, for this reason, stock mouthguards are considered by many to be less protective.[36,48,54,58] Despite these shortcomings, the stock mouthguard could be the only option possible for patients with particular clinical presentations (e.g., use of orthodontic brackets and appliances, periods of rapidly changing occlusion during mixed dentition).

The ASD "recommends the use of a properly fitted mouthguard. It encourages the use of a custom fabricated mouthguard made over a dental cast and delivered under the supervision of a dentist. The ASD strongly supports and encourages a mandate for use of a properly fitted mouthguard in all collision and contact sports."[59] During fabrication of the mouthguard, it is recommended to establish proper anterior occlusion of the maxillary and mandibular arches as this will prevent or reduce injury by better absorbing and distributing the force of impact.[59] The practitioner also should consider the patient's vertical dimension of occlusion, personal comfort, and breathing ability.[57] By providing cushioning between the maxilla and mandible, mouthguards also may reduce the incidence or severity of condylar displacement injuries as well as the potential for concussions.[36,60,49]

Due to the continual shifting of teeth in orthodontic therapy, the exfoliation of primary teeth, and the eruption of permanent teeth, a custom-fabricated mouthguard may not fit the young athlete soon after the impression is obtained.[61] Several block-out methods used in both the dental operatory and laboratory may incorporate space to accommodate for future tooth movement and dental development.[61] By anticipating required space changes, a custom fabricated mouthguard may be made to endure several sports seasons.[61]

Parents play an important role in the acquisition of a mouthguard for young athletes. In a 2004 national fee survey, custom mouthguards ranged from $60 to $285.54 In a study to determine the acceptance of the three types of mouthguards by seven and eight-year-old children playing soccer, only 24 percent of surveyed parents were willing to pay $25 for a custom mouthguard.[62] Thus, cost may be a barrier[62], however it could be more likely that children do not accept mouthguard use easily. Ina study of children receiving mouthguards at no cost, 29 percent never wore the mouthguard, 32 percent wore it occasionally, 15.9 percent wore it initially but quit wearing it after one month, and only 23.2 percent wore the mouthguard when needed.[63]

Attitudes of officials, coaches, parents, and players about wearing mouthguards influence their usage.[44] Although coaches are perceived as the individuals with the greatest impact on whether or not players wear mouthguards, parents view themselves as equally responsible for maintaining mouthguard use.[44,64] However, surveys of parents regarding the indications for mouthguard usage reveal a lack of complete understanding of the benefits of mouthguard use.[64] Compared to other forms of protective equipment, mouthguard use received only moderate parental support in youth soccer programs.[65] A survey commissioned by the American Association of Orthodontists (**AAO**) reported that 67 percent of parents stated their children do not wear a mouthguard during organized sports. The survey also found that 84 percent do not wear mouthguards while participating in organized sports because it is not required, even though other protective equipment such as helmets and shoulder pads is mandatory.[66] Players' perceptions of mouthguard use and comfort largely determine their compliance and enthusiasm.[51] Realizing athletes' speech as a potential hindrance to mouthguard compliance, the Academy for Sports Dentistry recommends that a properly fitted mouth guard should provide for adequate speech commiserate with the playing status of the athlete.[59] Given the multiple reasons for lack of compliance in wearing mouthguards, the dental profession needs to influence and educate all stakeholders about the risk of sports-related orofacial injuries and available preventive strategies. [55,50,70] Routine dental visits can be an opportunity to initiate patient/parent education and make appropriate recommendations for use of a properly-fitted athletic mouthguard.[33]

Policy statement

The AAPD encourages:

- Dentists to play an active role in educating the public in the use of protective equipment for the prevention of orofacial injuries during sporting and recreational activities.

- Continuation of preventive practices instituted in youth, high school and college football, lacrosse, field hockey, ice hockey, and wrestling (for wrestlers wearing braces).
- An ASTM-certified face protector be required for youth participating in baseball and softball activities.
- Mandating the use of properly-fitted mouthguards in other organized sporting activities that carry risk of orofacial injury.
- Coaches/administrators of organized sports to consult a dentist with expertise in orofacial injuries prior to initiating practices for a sporting season, for recommendations for immediate management of sports-related injuries (e.g., avulsed teeth).
- Continuation of research in development of a comfortable, efficacious, and cost-effective sports mouthguard to facilitate more widespread use of this proven protective device.
- Dentists of all specialties, including pediatric and general dentists, to provide education to parents and patients regarding prevention of orofacial injuries as part of the anticipatory guidance discussed during dental visits.
- Dentists to prescribe, fabricate, or provide referral for mouthguard protection for patients at increased risk for orofacial trauma.
- Third-party payors to realize the benefits of mouthguards for the prevention and protection from orofacial sports-related injuries and, furthermore, encourages them to improve access to these services.
- Pediatric dentists to partner with other dentists and child health professionals, school administrators, legislators, and community sports organizations to promote the broader use of mouthguards.
- Pediatric dental departments to teach dental students fabrication of custom-fitting mouthguards.

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Policy on the Dental Home

Originating Council

Council on Clinical Affairs

Review Council

Council on Clinical Affairs

Adopted

2001

Revised

2004, 2012, 2015, 2018

Reaffirmed 2010

Purpose

The American Academy of Pediatric Dentistry (**AAPD**) supports the concept of a dental home for all infants, children, adolescents, and persons with special health care needs. The dental home is inclusive of all aspects of oral health that result from the interaction of the patient, parents, dentists, dental professionals, and nondental professionals. Establishment of the dental home is initiated by the identification and interaction of these individuals, resulting in a heightened awareness of all issues impacting the patient's oral health[1]. This concept is derived from the American Academy of Pediatrics' (**AAP**) definition of a medical home which is an approach to providing comprehensive and high quality primary care and not a location or physical structure[2]. ~~states pediatric primary health care is best delivered or supervised by qualified child health specialists (AAP 2013, AAP 2002, Glick 2009~~).

Methods

This policy was originally developed by the Council on Clinical Affairs and adopted in 2001. This document is an update from the last revision in ~~2012~~2015. This policy is based on a review of the current dental and medical literature related to the establishment of a dental home. An electronic search was conducted using the terms: dental home, medical home in pediatrics, and infant oral health care; fields: all fields: limits: within the last 10 years, humans, English. Papers for review were chosen from this list and from references within selected articles. Expert opinions and best current practices were relied upon when clinical evidence was not available.

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Background

The AAP issued a policy statement defining the medical home in 1992[3]. Since that time, it has been shown that health care provided to patients in a medical home environment is more effective and less costly in comparison to emergency care facilities or hospitals[3-5] (~~Kempe et al 2000~~). Strong clinical evidence exists for the efficacy of early professional dental care complemented with caries-risk and periodontal risk assessment, anticipatory guidance, and periodic supervision[6]. ~~(Savage et al 2004)~~. The establishment of a dental home ~~may~~ follows the medical home model as a cost-effective measure to reduce the financial burden and number of dental treatment procedures experienced by young children[7,8]. It also serves as a ~~and~~ higher quality health care alternative ~~to~~ in orofacial emergency care situations[9].

Children who have a dental home are more likely to receive appropriate preventive and routine oral health care, therefore improving families' oral health knowledge and practices especially in children at high risk for early childhood caries[6]. Referral by the primary care physician or health provider has been recommended, based on risk assessment, as early as six months of age and no later than 12 months of age[10-12]. Furthermore, subsequent periodicity of reappointment is based upon risk assessment. This provides time-critical opportunities to implement preventive health practices and reduce the child's risk of preventable dental/oral disease[13].

Policy statement

The AAPD encourages parents and other care providers to help every child establish a dental home by 12 months of age. The AAPD recognizes a dental home should provide:

- Comprehensive, continuous, ~~ly~~-accessible, family-centered, coordinated, compassionate, and culturally-effective care for children, as modeled by the AAP[1,14]. (~~AAP 2013, AAP 2002, AAP 2005~~, ~~AAP 2004,~~).
- Comprehensive evidence-based oral health care including acute care and preventive services in accordance with AAPD periodicity schedules[1,15].
- Comprehensive assessment for oral diseases and conditions.
- Individualized preventive dental health program based upon a caries-risk assessment[16] and a periodontal disease risk assessment[12].
- Anticipatory guidance regarding growth and development[15].
- Management of acute/chronic oral pain and infection.
- Plan, ~~for~~ management and long-term follow-up of acute dental trauma[17-19].

- Information about proper care of the child's teeth, ~~and~~ gingivae and other oral structures. This would include the prevention, diagnosis, and treatment of disease of the supporting and surrounding tissues and the maintenance of health, function, and esthetics of those structures and tissues[20].
- Dietary counseling[21].
- Referrals to dental specialists when care cannot directly be provided within the dental home.
- Education regarding future referral to a dentist knowledgeable and comfortable with adult oral health issues for continuing oral health care.
- Recommendations and coordination of uninterrupted comprehensive oral health care during the transition from adolescence to adulthood[14,22].
- Referral at an age determined by patient, parent, and pediatric dentist.

The AAPD advocates interaction with early intervention programs, schools, early childhood education and child care programs, members of the medical and dental communities, and other public and private community agencies to ensure awareness of age-specific oral health issue[23].

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Best Practices on Periodicity of Examination, Preventive Dental Services, Anticipatory Guidance/Counseling, and Oral Treatment for Infants, Children, and Adolescents

Review Council

Council on Clinical Affairs

Revised

~~2013,~~ 2018

Purpose

The American Academy of Pediatric Dentistry (**AAPD**) intends ~~this guideline~~ these recommendations to help practitioners make clinical decisions concerning preventive oral health interventions, including anticipatory guidance and preventive counseling, for infants, children, and adolescents.

Methods

~~This guideline was~~These recommendations were originally developed by the Clinical Affairs Committee and adopted in 1991. This document is a revision of the previous version, last revised in ~~2009~~2013. The update used electronic database and hand searches of articles in the medical and dental literature using the terms: periodicity of dental examinations, dental recall intervals, preventive dental services, anticipatory guidance and dentistry, caries risk assessment, early childhood caries, dental caries prediction, dental care cost effectiveness and children, periodontal disease and children and adolescents U.S., pit and fissure sealants, dental sealants, fluoride supplementation and topical fluoride, dental trauma, dental fracture and tooth, non-nutritive oral habits, treatment of developing malocclusion, removal of wisdom teeth, removal of third molars; fields: all; limits: within the last 10 years, humans, English, and clinical trials; birth through age 18. From this search, ~~3,418~~ 1,884 articles matched these criteria and were evaluated by title and/or abstract. Information from ~~113~~49 articles was chosen for review to update this document. When data did not appear sufficient or were inconclusive, recommendations were based upon expert and/or consensus opinion by experienced researchers and clinicians.

Background

Professional dental care is necessary to maintain oral health[1] (~~US DHHS 2000~~). The AAPD emphasizes the importance of initiating professional oral health intervention in infancy and continuing through adolescence and beyond[2] (~~US DHHS 2000, US DHHS 2003, Lewis and Ismail 1995~~). The periodicity of professional oral health intervention and services is based on a patient's individual needs and risk indicators[3,4,5,6,7,8]. Each age group, as well as each individual child, has distinct developmental needs to be addressed at specific intervals as part of a comprehensive evaluation[2,9-11]. Continuity of care is based on the assessed needs of the individual patient and assures appropriate management of all oral conditions, dental disease, and injuries[12-18]. The early dental visit to establish a dental home provides a foundation upon which a lifetime of preventive education and oral health care can be built. The early establishment of a dental home has the potential to provide more effective and less costly dental care when compared to dental care provided in emergency care facilities or hospitals[19-23]. Anticipatory guidance and counseling are essential components of the dental visit[2,9,10,19,20,22,24-27] (~~CDC 2001~~). Collaborative efforts and effective communication between medical and dental homes is essential to prevent oral disease and promote oral and overall health among children. Medical professionals can play an important role in children's oral health by providing primary prevention and coordinated care. Equally, dentists can improve the overall health of children not only by treating dental disease, but also by proactively recognizing child abuse, preventing traumatic injuries through anticipatory guidance, preventing obesity by longitudinal dietary counseling, and monitoring of weight status[28]. In addition, dentists can have an important role in assessing immunization status and developmental milestones for potential delays, as well as making appropriate referral for further neurodevelopmental evaluations and therapeutic services[29]. The unique opportunity dentists have to help address overall health issues strengthens as children get older since annual well child visits decreases while dental recall visits increase. Research shows that children aged 6- to 12-years are, on average, four times more likely to visit a dentist than a pediatrician[30,31].

Recommendations

This ~~guideline~~ document addresses periodicity and general principles of examination, preventive dental services, anticipatory guidance/counseling, and oral treatment for children who have no contributory medical conditions and are developing normally. ~~An a~~Accurate, comprehensive, and up-to-date medical, dental, and social histories are necessary for correct diagnosis and effective treatment planning. Recommendations may be modified to meet the unique requirements of patients with special health care needs[32].

Clinical oral examination

The first examination is recommended at the time of the eruption of the first tooth and no later than 12 months of age[2,19,20,22,]. The developing dentition and occlusion should be monitored throughout eruption at regular clinical examinations[27]. Evidenced-based prevention and ~~Early~~ early detection and management of caries/oral conditions can improve a child's oral/general health, ~~general health and~~, well-being, and school readiness[5,24,33-36]. It has been reported that the number and cost of dental procedures among high-risk children is less for those seen at an earlier age versus later, confirming the fact that the sooner a child is seen by a dentist, the less treatment needs they are likely to have in the future[37]. On the other hand, ~~Delayed~~ delayed diagnosis of dental disease can result in exacerbated problems which lead to more extensive and costly care[8,33,38-41]. Early diagnosis of developing malocclusions may allow for timely therapeutic intervention[9,27].

Components of a comprehensive oral examination include assessment of:

- General health/growth assessment.
- Pain.
- Extraoral soft tissue.
- Temporomandibular joint.
- Intraoral soft tissue.
- Oral hygiene and periodontal health.
- Intraoral hard tissue.
- Developing occlusion
- Caries risk.
- Behavior of child.

Based upon the visual examination, the dentist may employ additional diagnostic aids (e.g., radiographs, photographs, pulp vitality testing, laboratory tests, study casts)[8,13,42-44].

The ~~most common~~ interval of examination ~~is six months~~ should be based on the child's individual needs or risk status/susceptibility to disease ~~however,~~ some patients may require examination and preventive services at more or less frequent intervals, based upon historical, clinical, and radiographic findings[4,7,8,16-18,25,45-48] (~~ADA—The Use of Dental Radiographs; Update and Recommendations 2006~~, ~~Greenwell 2001~~). Caries and its sequelae are among the most prevalent health problems facing infants, children, and

adolescents in America[49] (~~US DHHS 2000~~). ~~Carious~~ Caries lesions are cumulative and progressive and, in the primary dentition, are highly predictive of caries occurring in the permanent dentition[6,50] (~~Li and Wang 2002, Powell 1998~~). Reevaluation and reinforcement of preventive activities contribute to improved instruction for the caregiver of the child or adolescent, continuity of evaluation of the patient's health status, and repetitive exposure to dental procedures, potentially allaying anxiety and fear for the apprehensive child or adolescent[51]. Individuals with special health care needs may require individualized preventive and treatment strategies that take into consideration the unique needs and disabilities of the patient[32].

Caries-risk assessment

Risk assessment is a key element of contemporary preventive care for infants, children, adolescents, and persons with special health care needs. It should be carried out as soon as the first primary teeth erupt and reassessed periodically by dental and medical providers[6,25]. Its goal is to prevent disease by (1) identifying ~~and minimizing causative factors (e.g., microbial burden, dietary habits, plaque accumulation) and optimizing protective factors (e.g., fluoride exposure, oral hygiene, sealants)~~ children at high risk for caries, (2) developing individualized preventive measures and caries management, as well as (3) aiding the practitioner in determining appropriate periodicity of services[25,52,53]. Taking into consideration that the etiology of dental caries is multifactorial and complex, current caries-risk assessment models entail a combination of factors including diet, fluoride exposure, host susceptibility, and microflora analysis and consideration of how these factors interact with social, cultural, and behavioral factors. More comprehensive models that include social, political, psychological, and environmental determinants of health are also available[54-57]. Caries risk assessment forms and caries management protocols are available and aimed to simplify and clarify the process[25,58,59] (~~CDC 2001~~). Sufficient evidence demonstrates certain groups of children at greater risk for development of early childhood caries (ECC) would benefit from infant oral health care[24,33,60-64]. Infants and young children have unique caries-risk factors such as ongoing establishment of oral flora and host defense systems, susceptibility of newly erupted teeth, and development of dietary habits. Because the etiology of ECC is multifactorial and significantly influenced by health behaviors[65], preventive messages for expectant parents and parents of very young children should target risk factors (e.g., early mutans streptococci contamination, poor oral hygiene habits, nighttime feeding, high sugar consumption frequency) known to place children at a higher risk for developing caries[24,33,57,66]. ~~Children are most likely to develop caries if mutans streptococci are acquired at an early age (Harris et al 2004, Berkowitz 2006). The characteristics of ECC and the availability of~~

~~preventive approaches support age-based strategies in addressing this significant pediatric health problem (Berkowitz 2006). ECC can be a costly, devastating disease with lasting detrimental effects on the dentition and systemic health (AAPD Policy-ECC-Classifications, AAPD Policy-ECC-Challenges, Clarke et al 2006, Dye et al 2004, Jackson et al 2011, Davis, Deinard and Maiga 2010, Kobayashi et al 2005, Lee et al 2006, AAP 2011).~~ Motivational problems may develop when parents/patients are not interested in changing behaviors or feel that the changes require excessive effort. Therefore, it is important that health care professionals utilize preventive approaches based on psychological and behavioral strategies. Moreover, they should be sensitive to how they can effectively communicate their recommendations so that parents/patients can perceive their recommendations as behaviors worth pursuing. Two examples of effective motivational approaches used for caries prevention that share similar psychological philosophies are motivational interviewing and self-determination theory[67-73].

Consistently, studies have reported caries experience in the primary dentition as a predictor of future caries[74]. Early school-aged children are at a transition stage from primary to mixed dentition. These children face challenges such as unsupervised toothbrushing and increased consumption of cariogenic foods and beverages while at school, placing them at a higher risk for developing caries[75-77]. Therefore, special attention should be given to school-aged children regarding their oral hygiene and dietary practices.

Adolescence can be a time of heightened caries activity due to an increased number of tooth surfaces in the permanent dentition and intake of cariogenic substances ~~and~~, as well as low priority for oral hygiene[9,78] ~~procedures~~ (~~APA 2002~~). Risk assessment can assure preventive care (e.g., water fluoridation, professional and home-use fluoride and antimicrobial agents, frequency of dental visits) is tailored to each individual's needs and direct resources to those for whom preventive interventions provide the greatest benefit[9]. Because a child's risk for developing dental disease can change over time due to changes in habits (e.g., diet, home care), oral microflora, or physical condition, risk assessment must be documented and repeated regularly and frequently to maximize effectiveness[11,25].

Prophylaxis and professional topical fluoride treatment

The interval for frequency of professional preventive services is based upon assessed risk for caries and periodontal disease[3,4,7,8,10,11,25,58,59,60]. Prophylaxis aids in plaque, stain, and calculus removal, as well as in educating the patient on oral hygiene techniques and facilitating the clinical examination[10]. Gingivitis,

which is nearly universal in children and adolescents, ~~it~~ usually responds to thorough removal of bacterial deposits and improved oral hygiene[47,79,80]. Hormonal fluctuations, including those occurring during the onset of puberty and adolescent pregnancy, can modify the gingival inflammatory response to dental plaque[47,48,81]. Children can develop any of the several forms of periodontitis, with aggressive periodontitis occurring more commonly in children and adolescents than adults[47,48,80].

~~Caries risk may change quickly during active dental eruption phases. Newly erupted teeth may be at higher risk of developing caries, especially during the post-eruption maturation process.~~ Children who exhibit higher risk of developing caries and/or periodontal disease would benefit from recall appointments at greater frequency (e.g., every three months) than every six months[3,4,8,10,11,25,59]. This allows increased professional fluoride therapy application and improvement of oral health by demonstrating proper oral hygiene techniques, in addition to microbial monitoring, antimicrobial therapy reapplication, and reevaluation of behavioral changes for effectiveness[3,10,48,59,82-84].

Fluoride contributes to the prevention, inhibition, and reversal of caries[85-87] (~~CDC 2001~~). Professional topical fluoride treatments should be based on caries risk assessment and be part of a comprehensive preventive program in a dental home[19,25,86,89] (~~CDC 2001, Facts about Fluoride 2006, ADA Fluoride 2006~~). Plaque and pellicle are not a barrier to fluoride uptake in enamel[10] (~~Johnston and Lewis 1995, Ripa 1984, Bader, Shugars and Bonito 2001~~). Consequently, there is no evidence of a difference in caries rates or fluoride uptake in patients who receive rubber cup prophylaxis or a toothbrush prophylaxis before fluoride treatment[88,89] (~~Johnston and Lewis 1995, Ripa 1984~~). ~~Precautionary measures should be taken to prevent swallowing of any professionally applied topical fluoride.~~ Children at ~~moderate caries risk should receive a professional fluoride treatment at least every six months; those with~~ high caries risk should receive greater frequency of professional fluoride applications (e.g., every three ~~to six~~ months)[85,89-92] (~~Bader, Shugars and Bonito 2001~~).

Fluoride supplementation

~~Fluoride contributes to the prevention, inhibition, and reversal of caries (Adair 2006, AAPD Guideline Fluoride Therapy, CDC 2001, Tinanoff 2009).~~ The AAPD encourages optimal fluoride exposure for every child, recognizing fluoride in the community water supplies as the most beneficial and cost-effective preventive intervention. Fluoride supplementation should be considered for children at moderate

to high caries risk when fluoride exposure is not optimal[85]. Determination of dietary fluoride sources (e.g., drinking water, toothpaste, foods, beverages) before prescribing supplements is required and can help reduce intake of excess fluoride[85]. In addition, supplementation should be in accordance with the guidelines recommended by the AAPD[85,93,94].

Radiographic assessment

Radiographs are a valuable adjunct in the oral health care of infants, children, and adolescents used to diagnose and monitor oral diseases, evaluate dentoalveolar trauma, as well as monitor dentofacial development and the progress of therapy[45]. Timing of initial radiographic examination should not be based on the patient's age, but upon each child's individual circumstances[45,46]. The need for dental radiographs can be determined only after consideration of the patient's medical and dental histories, completion of a thorough clinical examination, and assessment of the patient's vulnerability to environmental factors that affect oral health[45]. Every effort must be made to minimize the patient's exposure by applying good radiological practices (e.g., use of protective aprons and thyroid collars, when appropriate) and by following the ALARA Principle (As Low as Reasonably Achievable)[45].

Anticipatory guidance/counseling

Anticipatory guidance is the process of providing practical, developmentally-appropriate information about children's health to prepare parents for the significant physical, emotional, and psychological milestones[2,9,19,20,95,96]. Individualized discussion and counseling should be an integral part of each visit. Topics to be included are oral/dental development, growth and speech/language development, nonnutritive habits, diet and nutrition, injury prevention, development, tobacco use, substance use/abuse, intraoral/perioral piercing and oral jewelry/accessories[2,9,15,19,27,95-102].

Anticipatory guidance regarding the characteristics of a normal healthy oral cavity should occur during infant oral health visits and throughout follow-up dental visits. This allows parents to measure against any changes such as, but not limited to, growth delays, traumatic injuries, and presence of poor oral hygiene or caries. Tooth development and chronology of eruption can help parents better understand the implications of delayed or accelerated tooth emergence, the role of fluorides in newly erupted teeth that may be at higher risk of developing caries, especially during the post-eruption maturation process[95]. Assessment of developmental milestones (i.e., fine/gross motor skills, language, social interactions) is crucial for early recognition of potential delays and appropriate referral to therapeutic services[29]. Speech

and language are integral components of a child's early development[101]. Deficiencies and abnormal delays in speech and language production can be recognized early and referral made to address these concerns. Communication and coordination of appliance therapy with a speech and language professional can assist in the timely treatment of speech disorders[101].

Oral habits (e.g., nonnutritive sucking - digital and pacifier habits, bruxism, tongue thrust swallow and abnormal tongue position, ~~abnormal tongue thrusts,~~ self-injurious/self-mutilating behavior) may apply forces to teeth and dentoalveolar structures. Although early use of pacifiers and digit sucking are considered normal, habits of sufficient frequency, intensity, and duration can contribute to deleterious changes in occlusion and facial development[27]. It is important to discuss the need for early pacifier and digit sucking, then the need to wean from the habits before malocclusion or skeletal dysplasias occur[27]. Early dental visits provide an opportunity to encourage parents to help their children stop sucking habits by age three years or younger. For school-aged children and adolescent patients, counseling regarding any existing habits (e.g., fingernail biting, clenching, bruxism) is appropriate[27]. Parents should be provided with information regarding the potential immediate and long-term effects on the craniofacial complex and dentition from a habit. If treatment is indicated, habit treatment include patient/parent counseling, behavior modification techniques, appliance therapy, or referral to other providers including, but not limited to, orthodontists, psychologists, or otolaryngologists[27].

Oral hygiene counseling involves the parent and patient. Initially, oral hygiene is the responsibility of the parent. As the child develops, home care is performed jointly by parent and child. When a child demonstrates the understanding and ability to perform personal hygiene techniques, the health care professional should counsel the child. The effectiveness of home care should be monitored at every visit and includes a discussion on the consistency of daily oral hygiene preventive activities, including adequate fluoride exposure[3,4,9,25,85,103].

~~Caries-conducive dietary practices~~ The development of dietary habits and childhood food preferences appear to be established early and may affect the oral health as well as general and well-being of a child[104]~~, probably by 12 months of age, and are maintained throughout early childhood~~ (~~Douglass 2000, Reisine and Douglass 1998~~). The establishment of a dental home no later than 12 months of age allows dietary and nutrition counseling to occur early. This helps parents to develop proper oral health habits early in their child's life, rather than trying to change established unhealthy habits later. During infancy,

counseling should focus on breastfeeding, bottle or no-spill cup usage, concerns with nighttime feedings, frequency of in-between meal consumption of sugar-sweetened beverages (e.g., sweetened milk, 100 percent juice, soft drinks, fruit drinks, sports drinks) and snacks, as well as special diets[26]. ~~Dietary practices, including prolonged and/or frequent bottle or training cup with sugar-containing drinks and frequent between-meal consumption of sugar-containing snacks or drinks (e.g., juice, formula, soda), increase the risk of caries (Reisine and Douglass 1998, Tinanoff and Palmer 2000). The role of carbohydrates in caries initiation is unequivocal. Acids in carbonated beverages and sports drinks can have a deleterious effect (i.e., erosion) on enamel (Li, Zou and Dig 2012, Jawale et al 2012, Gambon et al 2011).~~ Excess consumption of carbohydrates, fats, and sodium contribute to poor systemic health[105-107]. Dietary analysis and the role of dietary choices on oral health, malnutrition, and obesity should be addressed through nutritional and preventive oral health counseling at periodic visits[26,108]. The U.S. Department of Health and Human Services and the U.S. Department of Agriculture ~~Food Plate (USDA) and Center for Disease Control and Prevention/National Center for Health Statistics' Growth Charts (CDC Growth Charts)~~ provide dietary guidelines every five years to help Americans two years of age and older make healthy choices to help prevent chronic diseases and promote a healthy diet[109] ~~guidance for parents and their children and promote better understanding of the relationship between healthy diet and development~~.

Traumatic dental injuries that occur in preschool, school-age children, and young adults comprise 5 percent of all injuries for which treatment is sought for[110]. Facial trauma that results in fractured, displaced, or lost teeth can have significant negative functional, esthetic, and psychological effects on children[111] (~~Cortes, Marcenes and Shelham 2002~~). Practitioners should provide age-appropriate injury prevention counseling for oro-facial trauma[15,96]. Initially, discussions would include advice regarding play objects, pacifiers, car seats, and electrical cords. As motor coordination develops and the child grows older, the parent/patient should be counseled on additional safety and preventive measures, including use of athletic mouthguards for sporting activities. ~~The greatest incidence of trauma to the primary dentition occurs at two to three years of age, a time of increased mobility and developing coordination (Flores 2002). The most common injuries to permanent teeth occur secondary to falls, followed by traffic accidents, violence, and sports (Rocha and Cardoso 2001, Caldas and Burgos 2001, Skaare and Jacobsen 2003, Tapias et al 2003).~~ Dental injuries could have improved outcomes not only if the public were aware of first-aid measures and the need to seek immediate treatment, but also if the injured child had access to emergency care at all times. Concerns with caregivers' dissatisfaction with experienced barriers to access

care, specifically the referral out of the dental home for emergency dental care, have been reported[112]. Therefore, it is important that all primary care providers inform parents about ways to access emergency care for dental injuries and provide telephone numbers to access a dentist, including for after-hours emergency care[113].

~~Nonnutritive oral habits (e.g., digital and pacifier habits, bruxism, abnormal tongue thrusts) may apply forces to teeth and dentoalveolar structures (AAPD Guideline Developing Dentition). Although early use of pacifiers and digit sucking are considered normal, habits of sufficient frequency, intensity, and duration can contribute to deleterious changes in occlusion and facial development (AAPD Guideline Developing Dentition). It is important to discuss the need for early pacifier and digit sucking, then the need to wean from the habits before malocclusion or skeletal dysplasias occur (AAPD Guideline Developing Dentition). Early dental visits provide an opportunity to encourage parents to help their children stop sucking habits by age three years or younger. For school aged children and adolescent patients, counseling regarding any existing habits (e.g., fingernail biting, clenching, bruxism) is appropriate (AAPD Guideline Developing Dentition).~~

~~Speech and language are integral components of a child's early development (American Speech Language Hearing Association). Deficiencies and abnormal delays in speech and language production can be recognized early and referral made to address these concerns. Communication and coordination of appliance therapy with a speech and language professional can assist in the timely treatment of speech disorders (American Speech Language Hearing Association).~~

Smoking and smokeless tobacco use almost always are initiated and established in adolescence[114-116] (~~CDC 1994~~). During this time period, children may be exposed to opportunities to experiment with other substances that negatively impact their health and well-being. The most common tobacco products include cigarettes, cigars, hookahs, snus, smokeless tobacco, pipes, bidis and kreteks (unfiltered cigarettes from India), dissolvable tobacco, and electronic cigarettes. In 2016, 7.2 percent of middle school students and 20.2 percent of high school students reported current tobacco product use[117]. E-cigarette use rose from 1.5 percent to 16.0 percent among high school students and from 0.6 percent to 5.3 percent among middle school students from 2011 to 2015[117]. Practitioners should provide education regarding the serious health consequences of tobacco use and exposure to second hand smoke[97,117] (~~CDC 1994~~). The practitioner may need to obtain information regarding tobacco use and alcohol/drug abuse confidentially from an adolescent patient[9,100]. When tobacco or substance abuse has been identified, practitioners should

provide brief interventions for encouragement, support, and positive reinforcement for avoiding substance use[97,100] ~~referral for appropriate intervention is indicated~~. If indicated, dental practitioners should provide referrals to primary care providers or behavioral-health/addiction specialists for assessment and/or treatment of substance use disorders in adolescents[100].

Complications from intraoral/perioral piercings can range from pain, infection, and tooth fracture to life-threatening conditions of bleeding, edema, and airway obstruction[99]. Although piercings most commonly are observed in the teenaged pediatric dental patient, education regarding pathologic conditions and sequelae associated with these piercings should be initiated for the preteen child/parent and reinforced during subsequent periodic visits (~~AAPD Policy Intraoral/Perioral Piercing~~). The AAPD strongly opposes the practice of piercing intraoral and perioral tissues and use of jewelry on intraoral and perioral tissues due to the potential for pathological conditions and sequelae associated with these practices[99].

~~**Radiographic assessment**~~

~~Appropriate radiographs are a valuable adjunct in the oral health care of infants, children, and adolescents (AAPD Guideline Radiographs, ADA – The Use of Dental Radiographs; Update and Recommendations 2006). Timing of initial radiographic examination should not be based on the patient's age (ADA – The Use of Dental Radiographs; Update and Recommendations 2006). Rather, after review of an individual's history and clinical findings, judicious determination of radiographic needs and examination can optimize patient care while minimizing radiation exposure (AAPD Guideline Radiographs, ADA – The Use of Dental Radiographs; Update and Recommendations 2006). The U.S. Food and Drug Administration/ADA guidelines were developed to as sist the dentist in deciding under what circumstances specific radiographs are indicated (ADA – The Use of Dental Radiographs; Update and Recommendations 2006).~~

Treatment of dental disease/injury

Health care providers who diagnose oral disease or trauma should either provide therapy or refer the patient to an appropriately trained individual for treatment[118]. Immediate intervention is necessary to prevent further dental destruction, as well as more widespread health problems. Postponed treatment can result in exacerbated problems that may lead to the need for more extensive care[22,34,35,40]. Early intervention could result in savings of health care dollars for individuals, community health care programs, and third-party payors[22,34,35,37,40].

Treatment of developing malocclusion

Guidance of eruption and development of the primary, mixed, and permanent dentitions is an integral component of comprehensive oral health care for all pediatric dental patients[27]. Dentists have the responsibility to recognize, diagnose, and manage or refer abnormalities in the developing dentition as dictated by the complexity of the problem and the individual clinician's training, knowledge, and experience[118]. Early diagnosis and successful treatment of developing malocclusions can have both short-term and long-term benefits, while achieving the goals of occlusal harmony and function and dentofacial esthetics[119] (~~Kanellis 2001, Woodside 2000, Kurol 2002, Sankey et al 2000~~). Early treatment is beneficial for many patients, but is not indicated for every patient. When there is a reasonable indication that an oral habit will result in unfavorable sequelae in the developing permanent dentition, any treatment must be appropriate for the child's development, comprehension, and ability to cooperate. Use of an appliance is indicated only when the child wants to stop the habit and would benefit from a reminder[27]. At each stage of occlusal development, the objectives of intervention/treatment include: (1) reversing adverse growth, (2) preventing dental and skeletal disharmonies, (3) improving esthetics of the smile, (4) improving self-image, and (5) improving the occlusion[27].

Sealants

A 2016 systematic review concluded sealants are effective in preventing and arresting pit-and-fissure occlusal caries lesions of primary and permanent molars in children and adolescents and can minimize the progression of noncavitated occlusal caries lesions[120]. ~~Sealants reduce the risk of pit and fissure caries in susceptible teeth and are cost-effective when maintained (Feigal 2002, Feigal and Donly 2006, AAPD Policy on Policy on Third-party Reimbursement of Fees Related to Dental Sealants, Beauchamp et al 2008, Isman 2010).~~ They are indicated for primary and permanent teeth with pits and fissures that are predisposed to plaque retention[121]. At-risk pits and fissures should be sealed as soon as possible. Because caries risk may increase at any time during a patient's life due to changes in habits (e.g., dietary, home care), oral microflora, or physical condition, unsealed teeth subsequently might benefit from sealant application[122] (~~Feigel 2002~~). The need for sealant placement should be reassessed at periodic preventive care appointments. Sealants should be monitored and repaired or replaced as needed[121-123].

Third molars

Panoramic or periapical radiographic assessment is indicated during late adolescence to assess the presence, position, and development of third molars[45,46] (~~ADA – The Use of Dental Radiographs; Update~~

~~and Recommendations 2006)~~. A decision to remove or retain third molars should be made before the middle of the third decade[124,125]. Impacted third molars are potentially pathologic. Pathologic conditions generally are more common with an increase in age. Evaluation and treatment may require removal, exposure, and/or repositioning. In selected cases, long-term clinical and radiographic monitoring may be needed. Treatment should be provided before pathologic conditions adversely affect the patient's oral and/or systemic health[119,124,125]. Consideration should be given to removal when there is a high probability of disease or pathology and/or the risks associated with early removal are less than the risks of later removal[14,119,125]. Postoperative complications for removal of impacted third molars are low when performed at an early age. A Cochrane review in 2012 reported that there was no difference in late lower incisor crowding with removal or retention of asymptomatic impacted third molars[126].

Referral for regular and periodic dental care

As adolescent patients approach the age of majority, it is important to educate the patient and parent on the value of transitioning to a dentist who is knowledgeable in adult oral health care. At the time agreed upon by the patient, parent, and pediatric dentist, the patient should be referred to a specific practitioner in an environment sensitive to the adolescent's individual needs[9,127]. Until the new dental home is established, the patient should maintain a relationship with the current care provider and have access to emergency services. For the patient with special health care needs, in cases where it is not possible or desired to transition to another practitioner, the dental home can remain with the pediatric dentist and appropriate referrals for specialized dental care should be recommended when needed[127]. Proper communication and records transfer allow for consistent and continuous care for the patient[42].

Recommendations by age

6 to 12 months

1. Complete the clinical oral examination with adjunctive diagnostic tools (e.g., radiographs as determined by child's history, clinical findings, and susceptibility to oral disease) to assess oral growth and development, pathology, and/or injuries; provide diagnosis.
2. Complete a caries risk assessment.
3. Provide oral hygiene counseling for parents.
3. Clean and r~~R~~emove supragingival and subgingival stains or deposits as indicated.
4. Assess the child's systemic and topical fluoride status (including type of infant formula used, if any, and exposure to fluoridated toothpaste) and provide counseling regarding fluoride.

~~Prescribe systemic fluoride supplements, if indicated, following assessment of total fluoride intake from drinking water, diet, and oral hygiene products.~~

5. Assess appropriateness of feeding practices, including bottle and breast-feeding, and provide counseling as indicated~~.~~
~~6. P~~; provide dietary counseling related to oral health.
7. Provide age-appropriate injury prevention counseling for orofacial trauma.
8. Provide counseling for nonnutritive oral habits (e.g., digit, pacifiers).
9. Provide required treatment and/or appropriate referral for any oral diseases or injuries.
10. Provide anticipatory guidance.
11. Assess overall growth and development and make appropriate referral to therapeutic services if needed.
12~~11~~. Consult with the child's physician as needed.
~~12. Complete a caries risk assessment.~~
14~~13~~. Determine the interval for periodic reevaluation based on the child's individual needs or risk status/susceptibility to disease.

12 to 24 months

1. Repeat the procedures for ages six to 12 months every six months or as indicated by the child's individual needs or risk status/susceptibility to disease ~~individual patient's risk status/susceptibility to disease~~.
2. Assess appropriateness of feeding practices (including bottle, breast-feeding, and no-spill training cups) and provide counseling as indicated.
3. Review patient's fluoride status ~~(including any childcare arrangements which may impact systemic fluoride intake)~~ and provide parental counseling.
4. Provide topical fluoride treatments every six months or as indicated by the child's individual needs or risk status/susceptibility to disease.

2 to 6 years

1. Repeat the procedures for 12 to 24 months every six months or as indicated by the child's individual needs or risk status/susceptibility to disease. Provide age-appropriate oral hygiene instructions.
2. Scale and clean the teeth every six months or as indicated by individual patient's needs.

3. Provide pit and fissure sealants for caries-susceptible primary molars and permanent molars, premolars, and anterior teeth.
4. Provide counseling and services (e.g., mouthguards) as needed for orofacial trauma prevention.
5. Provide assessment/treatment or referral of developing malocclusion as indicated by individual patient's needs.
6. Provide required treatment and/or appropriate referral for any oral diseases, habits, or injuries as indicated.
7. Assess speech and language development and provide appropriate referral as indicated.

6 to 12 years

1. Repeat the procedures for ages two to six years every six months or as indicated by the child's individual needs or risk status/susceptibility to disease ~~individual patient's risk status/susceptibility to disease~~.
2. Provide substance abuse counseling and/or referral to primary care providers or behavioral-health/addiction specialists if indicated (e.g., smoking, smokeless tobacco).
3. Provide counseling on intraoral/perioral piercing.

12 years and older

1. Repeat the procedures for ages six to 12 years every six months or as indicated by the child's individual needs or risk status/susceptibility to disease ~~individual patient's risk status/susceptibility to disease~~.
2. During late adolescence, assess the presence, position, and development of third molars, giving consideration to removal when there is a high probability of disease or pathology and/or the risks associated with early removal are less than the risks of later removal.
3. At an age determined by patient, parent, and pediatric dentist, refer the patient to a general dentist for continuing oral care.

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Recommendations for Pediatric Oral Health Assessment, Preventive Services, and Anticipatory Guidance/Counseling

Since each child is unique, these recommendations are designed for the care of children who have no contributing medical conditions and are developing normally. These recommendations will need to be modified for children with special health care needs or if disease or trauma manifests variations from normal. The American Academy of Pediatric Dentistry (AAPD) emphasizes the importance of very early professional intervention and the continuity of care based on the individualized needs of the child. Refer to the text of this guideline for supporting information and references. Refer to the text in the Recommendations on the Periodicity of Examination, Preventive Dental Services, Anticipatory Guidance, and Oral Treatment for Infants, Children, and Adolescents (*www.aapd.org/policies/*) for supporting information and references.

AMERICA'S PEDIATRIC DENTISTS **THE BIG AUTHORITY** on little teeth®	AGE				
	6 TO 12 MONTHS	12 TO 24 MONTHS	2 TO 6 YEARS	6 TO 12 YEARS	12 YEARS AND OLDER
Clinical oral examination [1]	•	•	•	•	•
Assess oral growth and development [2]	•	•	•	•	•
Caries-risk assessment [3]	•	•	•	•	•
Radiographic assessment [4]	•	•	•	•	•
Prophylaxis and topical fluoride [3,4]	•	•	•	•	•
Fluoride supplementation [5]	•	•	•	•	•
Anticipatory guidance/counseling [6]	•	•	•	•	•
Oral hygiene counseling [7]	Parent	Parent	Patient/parent	Patient/parent	Patient
Dietary counseling [8]	•	•	•	•	•
Injury prevention counseling [9]	•	•	•	•	•
Counseling for nonnutritive habits [10]	•	•	•	•	•
Counseling for speech/language development	•	•	•		
Assessment and treatment of developing malocclusion			•	•	•
Assessment for pit and fissure sealants [11]			•	•	•
Substance abuse counseling				•	•
Counseling for intraoral/perioral piercing				•	•
Assessment and/or removal of third molars					•
Transition to adult dental care					•

1 First examination at the eruption of the first tooth and no later than 12 months. Repeat every 6 months or as indicated by child's risk status/susceptibility to disease. Includes assessment of pathology and injuries.

2 By clinical examination.

3 Must be repeated regularly and frequently to maximize effectiveness.

4 Timing, selection, and frequency determined by child's history, clinical findings, and susceptibility to oral disease.

5 Consider when systemic fluoride exposure is suboptimal. Up to at least 16 years.

6 Appropriate discussion and counseling should be an integral part of each visit for care.

7 Initially, responsibility of parent; as child matures, jointly with parent; then, when indicated, only child.

8 At every appointment; initially discuss appropriate feeding practices, then the role of refined carbohydrates and frequency of snacking in caries development and childhood obesity.

9 Initially play objects, pacifiers, car seats; when learning to walk; then with sports and routine playing, including the importance of mouthguards.

10 At first, discuss the need for additional sucking: digits vs pacifiers; then the need to wean from the habit before malocclusion or skeletal dysplasia occurs. For school-aged children and adolescent patients, counsel regarding any existing habits such as fingernail biting, clenching, or bruxism.

11 For caries-susceptible primary molars, permanent molars, premolars, and anterior teeth with deep pits and fissures; placed as soon as possible after eruption.

This draft does not constitute an official AAPD health oral policy or clinical recommendation until approval by the General Assembly. Circulation is limited to AAPD members.

Best Practices on Dental Management of Pediatric Patients Receiving ~~Chemotherapy, Hematopoietic Cell Transplantation~~, Immunosuppressive Therapy and/or Radiation Therapy

Review Council

Council on Clinical Affairs

Latest Revision

~~2013~~ 2018

Keywords: Hematopoietic Stem Cell transplantation (HSCT), Low-level laser therapy (LLLT), Oral mucositis (OM), radiation therapy, chemotherapy, pediatric patient, immunosuppressed patient hematologic considerations.

Purpose

The American Academy of Pediatric Dentistry (**AAPD**) recognizes that the pediatric dental professional plays an important role in the diagnosis, prevention, stabilization, and treatment of oral and dental problems that can compromise the child's quality of life before, during, and after immunosuppressive therapy which lowers the body's normal immune response. This can be deliberate as in lowering the immune response to prevent the rejection of an organ or hematopoietic stem cell transplant (**HSCT**) or it can be incidental as in a side effect of chemotherapy, radiation therapy, or HSCT conditioning. Dental intervention with certain modifications must be done promptly and efficiently, with attention to the patient's medical history, treatment protocol, and health status

~~Chemotherapy,~~ ~~and/or~~ radiotherapy ~~for the treatment of cancer or in preparation for hematopoietic cell transplantation (**HCT**)~~ Immunosuppressive therapy may cause many acute and long-term side effects in the oral cavity. Furthermore, ~~because of the immunosuppression that patients experience~~, any existing or potential sources of oral/dental infections and/or soft tissue trauma can compromise the medical treatment, leading to morbidity, mortality, and higher hospitalization costs. It is imperative that the pediatric dentist be familiar with the patient's medical history as well as oral manifestations of the ~~patient's~~ underlying condition. ~~and the treatment differences for patients undergoing chemotherapy and/or radiotherapy and those who will receive HCT.~~

Methods

~~This guideline was~~ Originally developed by the Clinical Affairs Committee as Dental Management of Pediatric Patients Receiving Chemotherapy, Hematopoietic Cell Transplantation and/or Radiation Therapy ~~and adopted~~ in 1986, this document was ~~is a revision of the previous version~~, last revised in 2013 ~~2008~~. This revision included a ~~new~~ systematic literature search of the PubMed® electronic database using the terms: pediatric cancer, pediatric oncology, hematopoietic cell transplantation, bone marrow transplantation, immunosuppressive therapy, mucositis, stomatitis, chemotherapy, radiotherapy, acute effects, long-term effects, dental care, oral health, pediatric dentistry, and practice guideline; field: all; limits: within the last 10 years, humans, English, clinical trials, birth through age 18. ~~Sixty one thousand four hundred thirty two articles matched these criteria. One hundred thirty three papers were chosen for review from this list and from the 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.

Background

A multidisciplinary approach involving ~~oncologists~~ physicians, nurses, social workers, dieticians, dentists and other related health professionals is essential in caring for the child before, during and after any ~~cancer~~ immunosuppressive therapy[1,2]. ~~The oral cavity is highly susceptible to the effects of chemotherapy and radiation and is the most frequently documented source of sepsis in the immunosuppressed cancer patients. For these reasons, early and definitive dental intervention, including comprehensive oral hygiene measures, reduces the risk for oral and associated systemic complications (Hong, Brennan and Lockhart 2009, Scully and Epstein 1996, Hong et al 2010, Lalla Brennan and Schubert 2011, Elad et al 2008, Stiff et al 2006, Schubert and Peterson 2009, Bavier 1990, Little et al 2012, Semba, Mealy and Hallmon 1994, Sonis, Fazio and Fang 1995, Peterson, Bensadoun and Roila 2011/2012).~~

~~Acute oral sequelae as a result of cancer therapies and HCT regimens are common in children (Hong, Brennan and Lockhart 2009).~~ Oral and associated systemic complications that may occur as a sequelae of immunosuppressive therapy ~~may~~ include pain, mucositis, oral ulcerations, bleeding, taste dysfunction, secondary infections (e.g., candidiasis, herpes simplex virus), dental caries, salivary gland dysfunction (e.g., xerostomia), neurotoxicity, mucosal fibrosis, gingival hypertrophy post-radiation osteonecrosis, bisphosphonate related osteonecrosis, soft tissue necrosis, temporomandibular dysfunction (e.g., trismus), craniofacial and dental developmental anomalies, and oral graft versus host disease (**GVHD**)[1,3,4].

All patients ~~with cancer~~ undergoing immunosuppressive therapy should have an oral examination prior to the initiation of ~~the oncology therapy~~ treatment[1,2]. Prevention and treatment of pre-existing or concomitant oral disease is essential to minimize complications in this population[5]. The key to success in maintaining a healthy oral cavity during ~~cancer~~ therapy is patient compliance. The child and the parents should be educated regarding the possible acute side effects and the long-term sequelae of ~~cancer~~ immunosuppressive therapies in the oral cavity[3,5-9] (~~Scully and Epstein 1996~~, ~~da Fonseca 1998, da Fonseca 2000~~). ~~Because there are many oncology and HCT protocols,~~ Every patient should be managed on an individual basis; consultations with the patient's physicians and, when appropriate, other dental specialists should be sought before dental care is instituted[7].

Recommendations

Dental and oral care before the initiation of ~~cancer therapy~~ immunosuppressive therapy

Objectives

The objectives of a dental/oral examination before ~~cancer~~ therapy starts are three-fold to[9]: (~~da Fonseca 2000~~):

- ~~To~~ Identify and stabilize or eliminate existing and potential sources of infection and local irritants in the oral cavity—without needlessly delaying ~~the cancer~~ treatment or inducing complications.
- ~~To~~ Communicate with the medical ~~oncology~~ team regarding the patient's oral health status, plan, and timing of treatment.
- ~~To~~ Educate the patient and parents about the importance of optimal oral care in order to minimize oral problems/discomfort before, during, and after treatment and about the possible acute and long-term effects of the therapy in the oral cavity and the craniofacial complex.

Initial evaluation

Medical history review: should include, but not be limited to, disease/condition (type, stage, prognosis), treatment protocol (conditioning regimen, surgery, chemotherapy, radiation, transplant), medications (including bisphosphonates), allergies, surgeries, secondary medical diagnoses, hematological status [complete blood count (**CBC**)], coagulation status, immunosuppression status, presence of an indwelling venous access line, and contact of ~~oncology~~ medical team/primary care physician(s)[1]. For HSCT patients, include type of transplant, HSCT source (i.e., bone marrow, peripheral stem cells, cord blood stem cells), matching status, donor, conditioning protocol, expected date of transplant, and ~~presence of~~ GVHD prophylaxis ~~or signs of transplant rejection~~. ~~The American Heart Association (**AHA**) recommends that~~

~~antibiotic prophylaxis for nonvalvular devices, including indwelling vascular catheters (i.e., central lines) is indicated only at the time of placement of these devices in order to prevent surgical site infections (Baddour et al 2010, Hong et al 2010, Lockhart et al 2007). The AHA found no convincing evidence that microorganisms associated w ith dental procedures cause infection of nonvalvular devices at any time after implantation (Baddour et al 2010, Hong et al 2010, Lockhart et al 2007). The infections occurring after device implantation most often are caused by staphyloccal Gram-negative bacteria or other microorganisms associated with surgical implantation or other active infections (Baddour et al 2010, Hong et al 2010). Due to the risk of antibiotic adverse events, development of drug resistance among oral flora, spectrum of non-oral bacteria causing catheter-related infections, and lack of evidence from clinical trials, antibiotic prophylaxis is not necessary for patients with an indwelling central venous catheter who are undergoing dental procedures (Baddour et al 2010, Hong et al 2010). Immunosuppression is not an independent risk factor for nonvalvular device infections; immunocompromised hosts who have those devices should receive antibiotic prophylaxis as advocated for immunocompetent hosts (Baddour et al 2010, Hong et al 2010, Lockhart et al 2007, Wilson et al 2007). Consultation with the child's physician is recommended for management of patients with nonvalvular devices.~~ Patients with a compromised immune system may not be able to tolerate a transient bacteremia following invasive dental procedures. The decision regarding the need for antibiotic prophylaxis for dental procedures should be made in consultation with the child's physician. Unless advised otherwise by the physician, the American Heart Association's standard regimen to prevent endocarditis is an accepted option[2,10].

Dental history review: includes information such as fluoride exposure, habits, trauma, symptomatic teeth, previous care, preventive practices, oral hygiene, and diet assessment.

Oral/dental assessment: should include thorough head, neck, and intraoral examinations, oral hygiene assessment and training, and radiographic evaluation based on history and clinical findings.

Preventive strategies

Oral hygiene: Oral hygiene includes brushing of the teeth and tongue two to three times daily with regular soft nylon brush or electric toothbrush, regardless of the hematological status[7,8,11,12] (~~Bavier 1990~~, ~~Ransier et al 1995~~). Ultrasonic brushes and dental floss should be allowed only if the patient is properly trained[8]. If capable, the patient's teeth should be gently flossed daily. If pain or excessive bleeding occurs, the patient should avoid the affected area, but floss the other teeth[1]. Patients with poor oral hygiene and/or periodontal disease may use chlorhexidine rinses daily until the tissue health improves or mucositis

develops[13]. The high alcohol content of commercially-available chlorhexidine mouthwash may cause discomfort and dehydrate the tissues in patients with mucositis; thus, an alcohol-free chlorhexidine solution is indicated in this situation.

For Immunosuppressed Patients

Oral hygiene: Intensive oral care is of paramount importance because it reduces the risk of developing moderate/severe mucositis without causing an increase in septicemia and infections in the oral cavity[1,3,5-8,11,14,15]. Thrombocytopenia should not be the sole determinant of oral hygiene as patients are able to brush without bleeding at widely different levels of platelet count[8]. Patients should use a soft nylon brush two to three times daily and replace it on a regular (every two to three months) basis[8,11]. Fluoridated toothpaste may be used but, if the patient does not tolerate it during periods of mucositis due to oral burning or stinging sensations, it may be discontinued and the patient should switch to mild-flavored non-fluoridated toothpaste. If moderate to severe mucositis develops and the patient cannot tolerate a regular soft nylon toothbrush or an end-tufted brush, foam brushes or super soft brushes soaked in chlorhexidine may be used[9]. Otherwise, foam or super soft brushes should be discouraged because they do not allow for effective cleaning[2]. The use of a regular brush should be resumed as soon as the mucositis improves[8,11,16]. Brushes should be air-dried between uses[8]. Electric or ultrasonic brushes are acceptable if the patient is capable of using them without causing trauma and irritation[8]. If patients are skilled at flossing without traumatizing the tissues, it is reasonable to continue flossing throughout treatment[8]. Toothpicks and water irrigation devices should not be used when the patient is pancytopenic to avoid tissue trauma[8,15].

Diet: Dental practitioners should ~~encourage~~ discuss the importance of a healthy diet to maintain nutritional status with an emphasis on foods that do not promote caries. ~~a non-cariogenic diet and advise~~ Patients and parents should be advised about the high cariogenic potential of dietary supplements rich in carbohydrates and oral pediatric medications rich in sucrose[6]. They should also be instructed that sharp, crunchy, spicy, highly acidic foods and alcohol should be avoided during chemotherapy, radiation and HCT[1].

Fluoride: Preventive measures include the use of fluoridated toothpaste ~~or gel~~, fluoride supplements if indicated, neutral fluoride gels/rinses, or applications of fluoride varnish for patients at risk for caries and/or xerostomia[6,8]. A brush-on technique is convenient and may increase the likelihood of patient compliance with topical fluoride therapy[8].

Lip care: Lanolin-based creams and ointments are more effective in moisturizing and protecting against damage than petrolatum-based products[8] (~~Semba, Mealy and Hallmon 1994~~).

Trismus prevention/treatment: Patients who receive radiation therapy to the masticatory muscles may develop trismus. Thus, daily oral stretching exercises/physical therapy should start before radiation is initiated and continue throughout treatment[7,15]. ~~Therapy for trismus may include prosthetic aids to reduce the severity of fibrosis, trigger-point injections, analgesics, muscle-relaxants, and other pain management strategies (Scully and Epstein 1996~~).

Reduction of radiation to healthy oral tissues: In cases of radiation to the head and neck, the use of lead-lined stents, prostheses, and shields, as well as salivary gland sparing techniques (e.g., three-dimensional conformal or intensity modulated radiotherapy, concomitant cytoprotectants, surgical transfer of salivary glands), should be discussed with the radiation oncologist.

Education: Patient <u>and</u> parent education includes the importance of optimal oral care in order to minimize oral problems <u>and</u> discomfort before, during, and after treatment and the possible acute and long-term effects of the therapy in the craniofacial complex[1].

Dental care

Hematological considerations[4]:

- Absolute neutrophil count (**ANC**):
  - — >2,000/mm^3: no need for antibiotic prophylaxis[1,15];
  - — 1000 to 2000/mm^3: Use clinical judgment[1] based on the patient's health status and planned procedures. Some authors[1,7] suggest that antibiotic coverage (dosed per AHA recommendations[13]) may be prescribed when the ANC is between 1,000 and 2,000/mm^3. If infection is present or unclear, more aggressive antibiotic therapy may be indicated and should be discussed with the medical team; and
  - — <1,000/mm^3: defer elective dental care[4]. In dental emergency cases, discuss antibiotic coverage (antibiotic prophylaxis versus antibiotic coverage for a period of time) with medical team before proceeding with treatment. The patient may need hospitalization for dental management ~~(Sonis, Fazio and Fang 1995).~~
- Platelet count[4,7]:
  - — >75,000/mm^3: no additional support needed;

- 40,000 to 75,000/mm^3: platelet transfusions may be considered pre- and 24 hours post-operatively. Localized procedures to manage prolonged bleeding may include sutures, hemostatic agents, pressure packs, and/or gelatin foams; and
- <40,000/mm^3: defer care. In dental emergency cases, contact the patient's physician to discuss supportive measures (e.g., platelet transfusions, bleeding control, hospital admission and care) before proceeding. In addition, localized procedures (e.g., microfibrillar collagen, topical thrombin) and additional medications as recommended by the hematologist/oncologist (e.g., aminocaproic acid, tranexamic acid) may help control bleeding[1]).

- Other coagulation tests may be in order for individual patients.

Dental procedures:

- ~~In general terms, most oncology/hematology protocols (exclusive of HCT, which will be discussed later) are divided into phases (cycles) of chemotherapy, in addition to other therapies (e.g., radiotherapy, surgery). The patient's blood counts normally start falling five to seven days after the beginning of each cycle, staying low for approximately 14 to 21 days, before rising again to normal levels for a few days until the next cycle begins.~~ Ideally, all dental care should be completed before ~~cancer~~ immunosuppressive therapy is initiated. When that is not feasible, temporary restorations may be placed and non-acute dental treatment may be delayed until the patient's hematological status is stable[1,7], The patient's blood counts normally start falling five to seven days after the beginning of ~~each cycle,~~ treatment cycle staying low for approximately 14 to 21 days, before rising again to normal levels for a few days until the next cycle begins.
- Prioritizing procedures: When all dental needs cannot be treated before ~~cancer~~ therapy is initiated, priorities should be infections, extractions, periodontal care (e.g., scaling, prophylaxis), and sources of tissue irritation before the treatment of carious teeth, root canal therapy for permanent teeth, and replacement of faulty restorations[4,15]. The risk for pulpal infection and pain determine which carious lesions should be treated first[8]. Incipient to small carious lesions may be treated with fluoride, silver diamine fluoride and/or sealants until definitive care can be accomplished[7]. Some patients requiring an organ transplant will be best able to tolerate dental care at least three months after transplant when overall health improves[2]. It is important for the practitioner to be aware that the signs and symptoms of periodontal disease may be decreased in immunosuppressed patients[7].
- Pulp therapy in primary teeth: ~~Although there have been no studies to date that address the~~ Few studies have evaluated the safety of performing pulp therapy in primary teeth prior to the

initiation of chemotherapy and/or radiotherapy. Many clinicians choose to provide a more definitive treatment in the form of extraction because pulpal/periapical/furcal infections during immunosuppression periods can become life-threatening[4,7,8] (~~Semba, Mealy and Hallmon 1994~~). Teeth that already have been treated pulpally and are clinically and radiographically sound should be monitored periodically for signs of internal resorption or failure due to pulpal/periapical/furcal infections.

- Endodontic treatment in permanent teeth: Symptomatic non-vital permanent teeth should receive root canal treatment at least one week before initiation of ~~cancer~~ therapy to allow sufficient time to assess treatment success before the chemotherapy[4,7,15]. If that is not possible, extraction is indicated. Extraction is also the treatment of choice for teeth that cannot be treated by definitive endodontic treatment in a single visit. In that case, the extraction should be followed by antibiotic therapy (penicillin or, for penicillin-allergic patients, clindamycin) for about one week[7,15] (~~Sonis, Fazio and Fang 1995~~). Endodontic treatment of asymptomatic non-vital permanent teeth may be delayed until the hematological status of the patient is stable[4,15] (~~Semba, Mealy and Hallmon 1994~~, ~~Peters et al 1993~~). It is important that the etiology of periapical lesions associated with previously endodontically treated teeth be determined because they can be due to a number of factors including pulpal infections, inflammatory reactions, apical scars, cysts, and malignancy[8]. If a periapical lesion is associated with an endodontically treated tooth and no signs or symptoms of infection are present, there is no need for retreatment or extraction since the radiolucency likely is due to an apical scar[17] (~~Peters et al 1993~~).
- Orthodontic appliances and space maintainers: Poorly-fitting appliances can abrade oral mucosa and increase the risk of microbial invasion into deeper tissues[7]. Appliances should be removed if the patient has poor oral hygiene and/or the treatment protocol or HCT conditioning regimen carries a risk for the development of moderate to severe mucositis[4]. Simple appliances (e.g., band and loops, fixed lower lingual arches) that are not irritating to the soft tissues may be left in place in patients who present good oral hygiene[4,8]. Removable appliances and retainers that fit well may be worn as long as tolerated by the patient who maintains good oral care[7,8] (~~Sheller and Williams 1996~~). Patients should be instructed to clean their appliance daily and routinely clean appliance cases with an antimicrobial solution to prevent contamination and reduce the risk of appliance-associated oral infections[7]. Consider removing orthodontic bands or adjusting prosthesis if a patient is expected to receive Cyclosporine or other drugs known to cause gingival hyperplasia. If band removal is not possible, vinyl mouth guards or orthodontic wax should be used to decrease tissue trauma[8].

- Periodontal considerations: Partially erupted molars can become a source of infection because of pericoronitis. The overlying gingival tissue should be excised if the dentist believes it is a potential risk and if the hematological status permits[8,15]. Patients should have a periodontal assessment and appropriate therapy prior to receiving bisphosphonates as part of ~~cancer~~ treatment[18-20]. Extraction is the treatment of choice for teeth with a poor prognosis that cannot be treated by definitive periodontal therapy. If the patient has had bisphosphonates and an invasive periodontal procedure is indicated, risks must be discussed with the patient, parents, and physicians prior to the procedure.
- Extractions: There are no clear recommendations for the use of prophylactic antibiotics for extractions[4]. Recommendations generally have been empiric or based on anecdotal experience. Surgical procedures must be as atraumatic as possible, with no sharp bony edges remaining and satisfactory closure of the wounds[7,8,15,] (~~Semba, Mealy and Hallmon 1994, Sonis, Fazio and Fang 1995~~). If there is documented infection associated with the tooth, antibiotics (ideally chosen with the benefit of sensitivity testing) should be administered for about one week[7,8,15] (~~Sonis, Fazio and Fang 1995~~).

To minimize the risk of development of osteonecrosis, osteoradionecrosis, or bisphosphonate-related osteonecrosis of the jaw (**BRONJ**), patients who will receive radiation to the jaws or bisphosphonate treatment as part of the ~~cancer~~ therapy must have all oral surgical procedures completed before those measures are instituted[18-20]. If the patient has received bisphosphonates or radiation to the jaws and an oral surgical procedure is necessary, risks must be discussed with the patient, parents, and physician prior to the procedure. In patients undergoing long-term potent, high-dose intravenous bisphosphonates, there is an increased risk of BRONJ after a tooth extraction or with periodontal disease[18-20], although most of the evidence has been described in the adult population[19]. Patients with a high risk of BRONJ are best managed by a dental specialist in coordination with the ~~oncology~~ medical team in the hospital setting.

Loose primary teeth should be allowed to exfoliate naturally. Nonrestorable teeth, root tips, teeth with periodontal pockets greater than six millimeters, symptomatic impacted teeth, and teeth exhibiting acute infections, significant bone loss, involvement of the furcation, or mobility should be removed ideally two weeks (or at least seven to 10 days) before ~~cancer~~ therapy is initiated to allow adequate healing[4,7,8,15] (~~Semba, Mealy and Hallmon 1994~~).

Some practitioners prefer to extract all third molars that are not fully erupted, particularly prior to HCT, while others favor a more conservative approach, recommending extraction of third molars at risk for pulpal infection or those associated with significant pathology, infection, periodontal disease, or pericoronitis or if the tooth is malpositioned or non-functional[8,21,22].

Communication:

It is vital that the dentist communicate the comprehensive oral care plan with the ~~oncology~~ medical team. Information to be shared includes the severity of dental caries (number of teeth involved and which teeth need immediate treatment), endodontic needs (pulpal versus periapical infection), periodontal status, number of teeth requiring extraction, soft tissue pathology, and any other urgent care needed. Furthermore, it is important for the dentist to discuss with the ~~oncology~~ medical team how much time is needed for the stabilization of oral disease as this will also affect the timing of the treatment or conditioning protocols[1].

Dental and oral care during immunosupression periods

~~*Objectives*~~

~~The objectives of a dental/oral care during cancer therapy are three-fold:~~

~~1. To maintain optimal oral health during cancer therapy.~~
~~2. To manage any oral side effects that may develop as a consequence of the cancer therapy.~~
~~3. To reinforce the patient and parents' education regarding the importance of optimal oral care in order to minimize oral problems/discomfort during treatment.~~

~~*Preventive strategies*~~

~~Diet: Dental practitioners should encourage. a non-cariogenic diet and advise patients/parents about the high cariogenic potential of dietary supplements rich in carbohydrates and oral pediatric medications rich in sucrose (Hong et al 2010).~~

~~Fluoride: Preventive measures include the use of fluoridated toothpaste or gel, fluoride supplements if indicated, neutral fluoride gels/rinses, or applications of fluoride varnish for patients at risk for caries and/or xerostomia. A brush-on technique is convenient, familiar, and simple and may increase the likelihood of patient compliance with topical fluoride therapy (Schubert and Peterson 2009).~~

~~Lip care: Lanolin-based creams and ointments are more effective in moisturizing and protecting against damage than petrolatum-based products (Schubert and Peterson 2009, Semba, Mealy and Hallmon 1994).~~

~~Education: Patient/parent education includes reinforcing the importance of optimal oral hygiene and teaching strategies to manage soft tissue changes (e.g., mucositis, oral bleeding, xerostomia) in order to minimize oral problems/discomfort during treatment and the possible acute and long-term effects of the therapy in the craniofacial complex.~~

Dental care

During immunosuppression, elective dental care should not be provided. If a dental emergency arises, the treatment plan should be discussed with the patient's physician who will make recommendations for supportive medical therapies (e.g., antibiotics, platelet transfusions, analgesia). The patient should be seen every six months (or in shorter intervals if there is a risk of xerostomia, caries, trismus, and/or chronic oral GVHD) for an oral health evaluation during treatment, in times of stable hematological status and always after reviewing the medical history.

Management of oral conditions related to ~~cancer~~ immunosuppressive therapies

~~Trismus:~~

~~Trismus prevention/treatment: Patients who receive radiation therapy to the masticatory muscles may develop trismus. Thus, daily oral stretching exercises/physical therapy should start before radiation is initiated and continue throughout treatment. Therapy for trismus may include prosthetic aids to reduce the severity of fibrosis, trigger point injections, analgesics, muscle relaxants, and other pain management strategies (Scully and Epstein 1996, Lalla, Brennan and Schubert 2011, Little et al 2012).~~

~~Lip care: Lanolin-based creams and ointments are more effective in moisturizing and protecting against damage than petrolatum-based products (Schubert and Peterson 2009, Semba, Mealy and Hallmon 1994).~~

Mucositis:

~~Mucositis care remains focused on palliation of symptoms, and efforts to reduce the influence of secondary factors on mucositis, (Lalla, Brennan and Schubert 2011, Little et al 2012, Sonis, Fazio and Fang 1995, Keefe et al 2007).~~ The Multinational Association of Supportive Care in Cancer/International Society of Oral Oncology (MASCC/ISOO) has published guidelines for treatment of mucositis[11,16,23]. The

most common prescriptions for management of mucositis include good oral hygiene, analgesics, non-medicated oral rinses (e.g., 0.9 percent saline or sodium bicarbonate mouth rinses four to six times/day), and parenteral nutrition as needed[1,11,14]. Mucosal coating agents (e.g., Amphojel®, Kaopectate®, hydroxypropylmethylcellulose) and film-forming agents (e.g., Zilactin®) and Gelclair® also have been suggested[1]. ~~The use of palifermin, also known as keratnocyte growth factor-1, for prevention of oral mucositis associated with HCT and oral cryotherapy as prophylaxis and treatment to decrease mucositis recently have been recommended (NCI 2016, Lalla et al 2014, Peterson, Bensadoun and Roila 2011/2012, Keefe et al 2007). Palifermin has been observed to decrease the incidence and duration of severe oral~~ *mucositis* ~~in patients undergoing conditioning with high-dose chemotherapy, with or without radiotherapy, followed by HCT (Lalla et al, 2014, Stiff et al 2006). The guidelines, however, did not recommend the use of sucralfate, antimicrobial lozenges, pentoxifylline, and granulocyte–macrophage-colony stimulating factor mouthwash for oral mucositis (Lalla et al 2014, Peterson, Bensadoun and Roila 2011/2012, Keefe et al 2007).~~

Effective interventions for mucositis prevention include the use of palifermin, low-level laser therapy (LLLT), and cryotherapy. The use of sucralfate, antimicrobial lozenges, pentoxifylline, and granulocyte–macrophage-colony stimulating factor mouthwash for oral mucositis are not recommended[11,16,23].

Palifermin (keratinocyte growth factor-1) is an FDA approved drug for the prevention and treatment of oral mucositis. Palifermin is recommended for mucositis prophylaxis for patients undergoing conditioning with high-dose chemotherapy and total body irradiation followed by HCT[23]. Palifermin is believed to stimulate epithelial cell reproduction, growth, and development so that mucosal cells damaged by chemotherapy and radiation are replaced quickly, accelerating the healing process[24].

~~There is limited, but encouraging, evidence to support the use of low-level laser therapy to decrease the duration of chemotherapy-induced oral mucositis; further studies are required to evaluate the efficacy and develop specific recommendations (Keefe et al 2007, Kuhn et al 2009, Migliorati et al 2013~~

The current MASCC/ISOO guidelines support the use of low-level laser therapy to prevent oral mucositis for patients undergoing HSC conditioning with high-dose chemotherapy with or without total body irradiation as well as patients undergoing radiation treatment for head and neck cancer[23]. Low-level laser therapy can decrease pain, duration and severity of chemotherapy induced mucositis in children[25-27]. LLLT may not be available at all cancer treatment centers due to the cost of the equipment and the need

for trained personnel. Appropriate protocol must be followed when using LLLT to prevent contamination and occupational risks to the child and dental team.

Oral cryotherapy, the cooling of intraoral tissue with ice during chemotherapy treatment, is recommended as mucositis prophylaxis for patients receiving bolus infusion of chemotherapy drugs with short half-lives[23,28]. This includes patients treated with fluorouracil as well as patients receiving high-dose melphalan as conditioning for HCT[23]. Oral cryotherapy reduces blood flow to the mouth by narrowing the blood vessels, limiting the amount of chemotherapy drugs delivered to the tissues. Cryotherapy is inexpensive and readily available, but further research is needed to confirm the effectiveness of oral cryotherapy in pediatric oncology[28].

Studies on the use of chlorhexidine for mucositis have given conflicting results. Most studies have not demonstrated a prophylactic impact or a reduction in the severity of mucositis, although reduced colonization of candidial species has been shown[14,16,29,30] (~~Sonis, Fazio and Fang 1995~~). Chlorhexidine is no longer recommended for preventing oral mucositis in patients undergoing radiotherapy[11,23].

Patient-controlled analgesia has been helpful in relieving pain associated with mucositis, reducing the requirement for oral analgesics. There is no significant evidence of the effectiveness or tolerability of mixtures containing topical anesthetics (e.g., Philadelphia mouthwash, magic mouthwash)[16] The use of topical anesthetics has been recommended for pain management although there are no studies available to assess the benefit and potential for toxicity. Topical anesthetics only provide short term pain relief[11]. Lidocaine use may obtund or diminish taste and the gag reflex and/or result in a burning sensation, in addition to possible cardiovascular and central nervous system effects.

Oral mucosal infections: The signs of inflammation and infection may be greatly diminished during neutropenic periods. Thus, the clinical appearance of infections may differ significantly from the normal[15]. Close monitoring of the oral cavity allows for timely diagnosis and treatment of fungal, viral, and bacterial infections. Prophylactic nystatin is not effective for the prevention and/or treatment of fungal infections[7,31]. Oral cultures and/or biopsies of all suspicious lesions should be performed and prophylactic medications should be initiated until more specific therapy can be prescribed[1,7,8,15,] (~~Bavier 1990, Semba,~~ ~~Mealy and Hallmon 1994, Sonis, Fazio and Fang 1995~~).

Oral bleeding: Oral bleeding occurs due to thrombocytopenia, disturbance of coagulation factors, and/or damaged vascular integrity. Management should consist of local approaches (e.g., pressure packs, antifibrinolytic rinses or topical agents, gelatin sponges) and systemic measures (e.g., platelet transfusions, aminocaproic acid)[7,8,15].

Dental sensitivity/pain: Tooth sensitivity could be related to decreased secretion of saliva during radiation therapy and the lowered salivary pH[7,8,15]. Patients who are using plant alkaloid chemotherapeutic agents (e.g., vincristine, vinblastine) may present with deep, constant pain affecting the mandibular molars with greater frequency, in the absence of odontogenic pathology. The pain usually is transient and generally subsides shortly after dose reduction and/or cessation of chemotherapy[7,8,15].

Xerostomia: Sugar-free chewing gum or candy, sucking tablets, special dentifrices for oral dryness, saliva substitutes, frequent sipping of water, alcohol-free oral rinses, and/or oral moisturizers are recommended[8,32]. Placing a humidifier by bedside at night may be useful[15]. Saliva stimulating drugs are not approved for use in children. Fluoride rinses and gels are recommended highly for caries prevention in these patients.

Trismus: Daily oral stretching exercises/physical therapy must continue during radiation treatment. Management of trismus may include prosthetic aids to reduce the severity of fibrosis, trigger-point injections, analgesics, muscle relaxants, and other pain management strategies[7,15] ~~(Scully and Epstein 1996)~~.

~~**Dental and oral care after the cancer therapy is completed (exclusive of HCT)**~~

~~*Objectives*~~

~~The objectives of a dental/oral examination after cancer therapy ends are three-fold:~~

- ~~To maintain optimal oral health.~~
- ~~To reinforce to the patient/parents the importance of optimal oral and dental care for life.~~
- ~~To address and/or treat any dental issues that may arise as a result of the long-term effects of cancer therapy.~~

~~*Preventive strategies*~~

~~Oral hygiene: Patients must brush their teeth two to three times daily with a soft nylon toothbrush. Brushes should be air-dried between uses (Schubert and Peterson 2009). Patients should floss daily.~~

~~Diet: Dental practitioners should encourage a non-cariogenic diet and advise patients/parents about the high cariogenic potential of dietary supplements rich in carbohydrates and oral pediatric medications rich in sucrose (Hong et al 2010~~

~~Fluoride: Preventive measures include the use of fluoridated toothpaste and gel, fluoride supplements if indicated, neutral fluoride gels/rinses, or applications of fluoride varnish for patients at risk for caries and/or xerostomia. A brush-on technique is convenient, familiar, and simple and may increase the likelihood of patient compliance with topical fluoride therapy (Schubert and Peterson 2009).~~

~~Lip care: Lanolin-based creams and ointments are more effective in moisturizing and protecting against damage than petrolatum-based products (Schubert and Peterson 2009, Semba, Mealy and Hallmon 1994).~~

~~Education: The importance of optimal oral and dental care for life must be reinforced. It is also important to emphasize the need for regular follow-ups with a dental professional, especially for patients who are at risk for or have developed GVHD and/or xerostomia and those who were younger than six years of age during treatment due to potential dental developmental problems. caused by cancer therapies.~~

~~*Dental care*~~

~~Periodic evaluation: The patient should be seen at least every six months (or in shorter intervals if issues such as chronic oral GVHD, xerostomia, or trismus are present). Patients who have experienced moderate or severe mucositis and/or chronic oral GVHD should be followed closely for malignant transformation of their oral mucosa (e.g., oral squamous cell carcinoma) (Elad et al 2008, Euvrard et al 2003).~~

~~Orthodontic treatment: Orthodontic care may start or resume after completion of all therapy and after at least a two-year disease-free survival when the risk of relapse is decreased and the patient is no longer using immunosuppressive drugs (Sheller and Williams 1996). A thorough assessment of any dental developmental disturbances caused by the cancer therapy must be performed before initiating orthodontic treatment. The following strategies should be considered when providing orthodontic care for patients with dental sequelae: (1) use appliances that minimize the risk of root resorption, (2) use lighter forces, (3) terminate treatment earlier than normal, (4) choose the simplest method for the treatment needs, and (5) do not treat the lower jaw (Zahrowski 2007). However, specific guidelines for orthodontic management, including optimal force and pace, remain undefined. Patients who have used or will be~~

~~given bisphosphonates in the future present a challenge for orthodontic care. Although bisphosphonate inhibition of tooth movement has been reported in animals, it has not been quantified for any dose or duration of therapy in humans (Zahrowski 2007). Consultation with the patient's parents and physician regarding the risks and benefits of orthodontic care in this situation is recommended.~~

~~Oral surgery: Consultation with an oral surgeon and/or periodontist and the patient's physician is recommended for non-elective oral surgical and invasive periodontal procedures in patients who have used or are using bisphosphonates or those who received radiation therapy to the jaws in order to devise strategies to decrease the risk of osteonecrosis and osteoradionecrosis, respectively (Saad et al 2012, Kuhl et al 2012, Dodson 2009). Elective invasive procedures should be avoided in these patients (Dahllöf et al 2001). Patients with a high risk of BRONJ are best managed by in coordination with the oncology team in the hospital setting.~~

~~Xerostomia: Sugar-free chewing gum or candy, special dentifrices for oral dryness, saliva substitutes, frequent sipping of water, alcohol-free oral rinses, and/or oral moisturizers are recommended (Schubert and Peterson 2009, Euvrard, Kanitakis and Claudy 2003, Jensen et al 2010). Placing a humidifier by bedside at night may be useful (Little et al 2012). Saliva stimulating drugs are not approved for use in children. Fluoride rinses and gels are recommended highly for caries prevention in these patients.~~

~~Trismus: Daily oral stretching exercises/physical therapy should continue after radiation therapy is finished in order to prevent or ameliorate trismus. Management of trismus may include prosthetic aids to reduce the severity of fibrosis, trigger point injections, analgesics, muscle relaxants, and other pain management strategies (Scully and Epstein 1996, Lalla, Brennan and Schubert 2011, Little et al 2012).~~

Hematopoietic stem cell transplantation

Hematopoietic stem cell transplant can be used in children to treat malignancies, hematologic disorders as well and certain metabolic syndromes. Examples include:

Malignant disorders treated with autologous HSCT

leukemia

Brain tumors

Ewing sarcoma

Germ cell tumors

Hodgkin lymphoma
Neuroblastoma
Non-Hodgkin lymphoma
Retinoblastoma
Rhabdomyosarcoma
Wilms tumor

Malignant disorders treated with allogenic HSCT
Acute lymphocytic leukemia
Acute myeloid leukemia
Juvenile myelomonocytic leukemia
Myelodysplastic syndrome
High-risk solid tumors

Non-malignant disorders treated with allogenic HSCT
Bone marrow failure syndromes
Chronic granulomatous disease
Fanconi anemia
Metabolic storage disorders
Osteogenesis imperfecta
Osteopetrosis
Severe aplastic anemia
Sickle cell anemia
Thalessemia
Wiskott-Aldrich syndrome

Specific oral complications can be correlated with phases of HSCT[1,4,8] (~~da Fonseca 1998~~).

Phase I: Preconditioning

The oral complications are related to the current systemic and oral health, oral manifestations of the underlying condition, and oral complications of recent medical therapy. Oral complications observed include oral infections, gingival leukemic infiltrates, bleeding, ulceration, temporomandibular

dysfunction[1]. Most of the principles of dental and oral care before the transplant are similar to those discussed for pediatric cancer[9]. The two major differences are: 1) in HSCT, the patient receives all the chemotherapy and/or total body irradiation in just a few days before the transplant, and 2) there will be prolonged immunosuppression following the transplant. Elective dentistry will need to be postponed until immunological recovery has occurred, at least 100 days following HSCT, or longer if chronic GVHD or other complications are present[7,8]. Therefore, all dental treatment should be completed before the patient becomes immunosuppressed.

Phase II: Conditioning neutropenic phase

In this phase, which encompasses the day the patient is admitted to the hospital to begin the transplant conditioning to 30 days post-HCT, the oral complications are related to the conditioning regimen and supportive medical therapies[8]. Mucositis, xerostomia, oral pain, hemorrhage, opportunistic infections, taste dysfunction, neurotoxicity (including dental pain, muscle tremors), and temporomandibular dysfunction (including jaw pain, headache, joint pain) may be seen, typically with a high prevalence and severity of oral complications[1]. Oral mucositis usually begins seven to 10 days after initiation of conditioning, and symptoms continue approximately two weeks after the end of conditioning[1]. Among allogeneic transplant patients, hyperacute GVHD can occur, causing more severe inflammation and severe mucositis symptoms, although its clinical presentation is difficult to diagnose[1]. The patient should be followed closely to monitor and manage the oral changes and to reinforce the importance of optimal oral care. Dental procedures usually are not allowed in this phase due to the patient's severe immunosuppression. If emergency treatment is necessary, the dentist should consult and coordinate with the attending ~~hematology/oncology~~ transplant team.

Phase III: Engraftment to hematopoietic recovery

The intensity and severity of complications begin to decrease normally three to four weeks after transplantation. Oral fungal infections and herpes simplex virus infection are most notable[1]. Acute GVHD can become a concern for allogeneic graft recipients. Xerostomia, hemorrhage, neurotoxicity, temporomandibular dysfunction, and granulomas/papillomas sometimes are observed[1]. A dental/oral examination should be performed and invasive dental procedures, including dental cleanings and soft tissue curettage, should be done only if authorized by the HCT team because of the patient's continued immunosuppression[8]. Patients should be encouraged to optimize oral hygiene and avoid a cariogenic diet. Attention to xerostomia and oral GVHD manifestations is crucial. HSCT patients are particularly sensitive to intraoral thermal stimuli between two and four months post-transplant[8]. The mechanism is not

well understood, but the symptoms usually resolve spontaneously within a few months. Topical application of neutral fluoride or desensitizing toothpastes helps reduce the symptoms[8].

Phase IV: Immune reconstitution/recovery from systemic toxicity

After day 100 post-HCT, the oral complications predominantly are related to the chronic toxicity associated with the conditioning regimen, including salivary dysfunction, craniofacial growth abnormalities, late viral infections, oral chronic GVHD, and oral squamous cell carcinoma[1,8]. Xerostomia and relapse-related oral lesions may also be observed[1]. Unless the patient is neutropenic or with severe chronic GVHD, mucosal bacterial infections are less frequently seen. Periodic dental examinations with radiographs can be performed, but invasive dental treatment should be avoided in patients with profound impairment of immune function[8]. Consultation with the patient's physician and parents regarding the risks and benefits of orthodontic care is recommended.

~~*Phase V: Long-term survival*~~

~~Craniofacial, skeletal, and dental developmental issues are some of the complications faced by cancer survivors (NCI 2016, Schubert and Peterson 2009, da Fonseca 2011) and usually develop among children who were less than six years of age at the time of their cancer therapy (Schubert and Peterson 2009, da Fonseca 2011). Long term effects of cancer therapy may include tooth agenesis, microdontia, crown disturbances (size, shape, enamel hypoplasia, pulp chamber anomalies), root disturbances (early apical closure, blunting, changes in shape or length), reduced mandibular length, and reduced alveolar process height (da Fonseca 2011). The severity of the dental developmental anomaly will depend on the age and stage of development during exposure to cytotoxic agents or ionizing radiation. Patients may experience permanent salivary gland hypofunction/dysfunction or xerostomia (Dahllöf et al 2001, Jensen et al 2010). Relapse or secondary malignancies can develop at this stage (NCI 2016). Routine periodic examinations are necessary to provide comprehensive oral healthcare. Careful examination of extraoral and intraoral tissues (including clinical, radiographic, and/or additional diagnostic examinations) are integral to diagnosing any secondary malignancies in the head and neck region. Dental treatment may require a multidisciplinary approach, involving a variety of dental specialists to address the treatment needs of each individual. Consultation with the patient's physician is recommended when relapse or the patient's immunologic status declines.~~

Dental and oral care after ~~the cancer therapy~~ <u>immunosuppressive therapy</u> is completed ~~(exclusive of HCT)~~

Objectives

The objectives of a dental/oral examination after cancer therapy ends are three-fold:

- ~~To~~ Mmaintain optimal oral health.
- ~~To~~ Rreinforce to the patient/parents the importance of optimal oral and dental care for life.
- ~~To~~ Aaddress and/or treat any dental issues that may arise as a result of the long-term effects of cancer therapy.

Dental care

Periodic evaluation: The patient should be seen at least every six months (or in shorter intervals if issues such as chronic oral GVHD, xerostomia, or trismus are present). Patients who have experienced moderate or severe mucositis and/or chronic oral GVHD should be followed closely for malignant transformation of their oral mucosa (e.g., oral squamous cell carcinoma)[5,33].

Education: The importance of optimal oral and dental care for life must be reinforced. It is also important to emphasize the need for regular follow-ups with a dental professional, especially for patients who are at risk for or have developed GVHD and/or xerostomia and those who were younger than six years of age during treatment due to potential dental developmental problems. ~~caused by cancer therapies.~~

Orthodontic treatment: Orthodontic care may start or resume after completion of all therapy and after at least a two year disease-free survival when the risk of relapse is decreased and the patient is no longer using immunosuppressive drugs[4] (~~Sheller and Williams 1996~~). A thorough assessment of any dental developmental disturbances caused by the ~~cancer~~ therapy must be performed before initiating orthodontic treatment. The following strategies should be considered when providing orthodontic care for patients with dental sequelae: (1) use appliances that minimize the risk of root resorption, (2) use lighter forces, (3) terminate treatment earlier than normal, (4) choose the simplest method for the treatment needs, and (5) do not treat the lower jaw[34]. However, specific guidelines for orthodontic management, including optimal force and pace, remain undefined. Patients who have used or will be given bisphosphonates in the future present a challenge for orthodontic care. Although bisphosphonate inhibition of tooth movement has been reported in animals, it has not been quantified for any dose or duration of therapy in humans[34]. Consultation with the patient's parents and physician regarding the risks and benefits of orthodontic care in this situation is recommended.

Oral surgery: Consultation with an oral surgeon and/or periodontist and the patient's physician is recommended for non-elective oral surgical and invasive periodontal procedures in patients who have used or are using bisphosphonates or those who received radiation therapy to the jaws in order to devise strategies to decrease the risk of osteonecrosis and osteoradionecrosis, respectively[18-20]. Elective invasive procedures should be avoided in these patients (~~Dahllöf et al 2001~~). Patients with a high risk of BRONJ are best managed by in coordination with the oncology team in the hospital setting.

Long Term Concerns

Craniofacial, skeletal, and dental developmental issues are some of the complications faced by ~~cancer~~ survivors[1,4,8] and usually develop among children who were less than six years of age at the time of their ~~cancer~~ therapy[4,8]. Long term effects of ~~cancer therapy~~ immunosuppressive therapy may include tooth agenesis, microdontia, crown disturbances (size, shape, enamel hypoplasia, pulp chamber anomalies), root disturbances (early apical closure, blunting, changes in shape or length), reduced mandibular length, and reduced alveolar process height[4]. The severity of the dental developmental anomaly will depend on the age and stage of development during exposure to cytotoxic agents or ionizing radiation. Patients may experience permanent salivary gland hypofunction/dysfunction or xerostomia[35] (~~Dahllöf et al 2001~~). Relapse or secondary malignancies can develop at this stage[1]. Routine periodic examinations are necessary to provide comprehensive oral healthcare. Careful examination of extraoral and intraoral tissues (including clinical, radiographic, and/or additional diagnostic examinations) are integral to diagnosing any secondary malignancies in the head and neck region. Dental treatment may require a multidisciplinary approach, involving a variety of dental specialists to address the treatment needs of each individual. Consultation with the patient's physician is recommended ~~when~~ if relapse or the patient's immunologic status declines.

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This draft does not constitute an official AAPD health oral policy or clinical recommendation until approval by the General Assembly. Circulation is limited to AAPD members.

Best Practices on Fluoride Therapy

Review Council

Council on Clinical Affairs

Latest Revision

~~2014*~~ 2018

~~** The 2014 revision was limited to use of fluoridated toothpaste in young children*~~

Purpose

The American Academy of Pediatric Dentistry (**AAPD**) intends ~~this guideline~~ these recommendations to help practitioners and parents make decisions concerning appropriate use of fluoride as part of the comprehensive oral health care for infants, children, adolescents, and persons with special health care needs.

Methods

This guideline was originally developed by the Council on Clinical Affairs Committee and adopted in 1967. This document is a revision of the previous version, last revised in ~~2013~~2014. To update this guidance, an electronic search from 2012 to 2017 pertaining to ~~A thorough review of~~ the scientific literature ~~in the English language pertaining to~~regarding the use of systemic and topical fluoride was conducted.~~completed to revise and update this guideline.~~ Database searches were conducted using the terms: fluoride caries prevention, fluoridation, fluoride gel, fluoride varnish, fluoride toothpaste, fluoride therapy, and topical fluoride. Because ~~over two million~~ 720 papers were identified through these electronic searches, an alternate strategy ~~strategies~~ of limiting the information gathering to systematic reviews using term "fluoride caries prevention" yielded 95 papers since 2012. Nine well conducted systematic reviews and their references primarily were used for this update [1-9]. ~~such as appraisal of references from recent evidence-based reviews and meta-analyses, as well as hand searches, were performed. This strategy yielded 105 manuscripts, primarily related to randomized clinical trials and evidence-based reviews, that were evaluated further by abstract. Of those, 45 manuscripts each had full examination and analysis in order to revise this guideline.~~ Expert opinions and ~~best current~~ clinical practices also were relied upon for ~~this guideline~~ these recommendations.

Background

~~Widespread use of f~~Fluoride has been a major factor in the decline in prevalence and severity of dental caries in the U.S. and other economically developed countries. ~~When used appropriately, fluoride is both safe and effective in preventing and controlling dental caries. Decisions concerning the administration of fluoride are based on the unique needs of each patient, including the risks and benefits (i.e., risk of mild or moderate fluorosis versus the benefits of decreasing caries increment and, in some cases preventing, devastating dental disease).~~

Fluoride has several caries-protective mechanisms of action. Topically, low levels of fluoride in plaque and saliva inhibit the demineralization of sound enamel and enhance the re-mineralization of demineralized enamel. Fluoride also inhibits dental caries by affecting the metabolic activity of cariogenic bacteria [10]. High levels of fluoride, such as those attained with the use of topical gels or varnishes, produce a temporary layer of calcium fluoride-like material on the enamel surface. The fluoride is released when the pH drops in response to acid production and becomes available to remineralize enamel or affect bacterial metabolism [11]. The original belief was that fluoride's primary action was to inhibit dental caries when incorporated into developing dental enamel (i.e., the systemic route), but the fluoride concentration in sound enamel does not fully explain the marked reduction in dental caries. It is oversimplification to designate fluoride simply as systemic or topical. Fluoride that is swallowed, such as fluoridated water and dietary supplements, may contribute to a topical effect on erupted teeth (before swallowed, as well as a topical effect due to increasing salivary and gingival crevicular fluoride levels). Additionally, elevated plasma fluoride levels can treat the outer surface of fully mineralized, but unerupted, teeth topically. Similarly, topical fluoride that is swallowed may have a systemic effect [12].

Fluoridation of community drinking water is the most equitable and cost-effective method of delivering fluoride to all members of most communities [13]. Water fluoridation at the level of 0.7-1.2 mg fluoride ion/L (ppm F) was introduced in the U.S. in the 1940s. Since fluoride from water supplies is now one of several sources of fluoride, the Department of Health and Human Services ~~recently~~ has ~~proposed~~ recommended ~~to~~ not ~~have~~ having a fluoride range, but rather to ~~limit the recommendation to the lower~~ standardize all water to the l~~imit of~~ 0.7 ppm F level. The rationale is to balance the benefits of preventing dental caries while reducing the chance of fluorosis [1].

Community water fluoridation has been associated with the decline in caries prevalence in adolescents from 90 percent in at least one permanent tooth in U.S. 12-17 years-olds in the 1960s, to 60 percent in a

1999-2004 survey [14]. When used appropriately, fluoride is both safe and effective in preventing and controlling dental caries. Although adverse health effects, such as decreased cognitive ability, endocrine disruption and cancer, have been ascribed to the use of fluoride over the years, the preponderance of evidence from large cohort studies and systematic reviews does not support an association of such health issues and consumption of fluoridated water [1]. Regarding cognitive ability, a recent study of mothers' urinary fluoride levels and their child's IQ levels suggested an association with exposure levels greater than those recommended in the U.S. for water fluoridation [15]. However, a prospective study in New Zealand did not support an association between fluoridated water and IQ measurements [16], and a national sample in Sweden found no relationship between fluoride levels in water supplies and cognitive ability, non-cognitive ability, and education [17]. Consumption of fluoride during the mineralization of teeth, however, can cause fluorosis (children 1-3 years of age being most susceptible for fluorosis of the permanent incisors). The NHANES 1999-2004 study found 23 percent of the U.S. population had very mild or mild fluorosis [18]. Decisions concerning the administration of fluoride are based on the unique needs of each patient, including the risks and benefits (e.g., risk of mild or moderate fluorosis versus the benefits of decreasing caries increment and, in some cases preventing, devastating dental disease).

Fluoride supplements also are effective in reducing prevalence of dental caries and should be considered for children at high caries risk who drink fluoride-deficient (less than 0.6 ppm F) water [19] (see Table). Determination of dietary fluoride before prescribing supplements can help reduce intake of excess fluoride. Sources of dietary fluoride may include drinking water from home, day care, and school; beverages such as soda [20], juice [21], and infant formula [22]; prepared food [23], and toothpaste. Concentrated ~~I~~infant formulas requiring reconstitution with water have raised concerns regarding ~~especially powdered formulas that have been reconstituted with fluoridated water, have been associated with~~ an increased risk of fluorosis [24]. Infants may be particularly susceptible because of the large consumption of such liquid in the first year of life, while the body weight is relatively low [12]. ~~However, a recent~~ An evidence-based review found that consumption of ~~suggests that reducing fluoride intake from~~ reconstituted infant formula can be associated with an increased risk of mild fluorosis, but recommended the continued use of fluoridated water [25]. One study has shown that dental fluorosis levels do not vary in fluoridated areas regardless of premixed versus reconstituted formula [26]. Standardization of the optimal fluoride levels in drinking water to 0.7 ppm F, however, makes this issue mute. ~~alone will not eliminate the risk of fluorosis development. Fluorosis is associated with cumulative fluoride intake during enamel development, with the severity dependent on the dose, duration, and timing of intake. Findings from a national survey report that eight percent of 12-15 year-olds have mild fluorosis and five percent have moderate fluorosis.~~

Table. DIETARY FLUORIDE SUPPLEMENTATION SCHEDULE

Age	<0.3 ppm F	0.3 to 0.6 ppm F	>0.6 ppm F
Birth to 6 months	0	0	0
6 mo to 3 years	0.25 mg	0	0
3 to 6 years	0.50 mg	0.25 mg	0
6 to at least 16 years	1.00 mg	0.50 mg	0

Professionally-applied topical fluoride treatments are efficacious in reducing prevalence of dental caries. The most commonly used agents for professionally-applied fluoride treatments are ~~five~~ 5 percent sodium fluoride varnish (**NaFV;** 2.26%F, 22,600 ppm F) and ~~1.23 percent~~ acidulated phosphate fluoride (**APF**; 1.23%F 12,300 ppm F). ~~The efficacy of~~ Meta-analyses of 23 clinical trials, most with twice yearly application, favors the use of fluoride varnish in primary and permanent teeth [2]. Unit doses of fluoride varnish are the only professional topical fluoride agent that are recommended for children younger than age six [2]. ~~when used at least twice a year has been reported in at least four randomized controlled trials. The efficacy of fluoride varnish in permanent teeth, applied at three or six month intervals, also has been reported in at least four randomized controlled trials.~~ Meta-analyses of ~~14~~ placebo-controlled trials show that fluoride gels, applied at three month to one year intervals, also are efficacious in reducing caries in permanent teeth [27]. Some topical fluoride gel and foam products are marketed with recommended treatment times of less than four minutes, but there are no clinical trials showing efficacy of shorter than four-minute application times [28]. There also is limited evidence that topical fluoride foams are efficacious in children [2]. Children at ~~increased~~ risk for caries ~~risk~~ should receive a professional fluoride treatment at least every six months [28]. ~~As the risk categories may change over time, the type and frequency of preventive interventions should be adjusted.~~

Silver diamine fluoride (**SDF**; 5%F 44,800 ppm F) recently has been approved by the U.S. Food and Drug Administration and currently is used most frequently to arrest dentinal caries. SDF arrests caries by the antibacterial effect of silver and by remineralization of enamel and dentin [9]. Some clinical trials show a caries arrest rate greater than 80 percent [7], but such studies have a high risk of bias and a wide variation of results, leading to conditional recommendations at this time [29]. Although the product is highly

concentrated, less than a drop is needed to treat several caries lesions. The only reported side effect of the SDF is that caries lesions stain black after treatment, and will temporarily stain skin with contact.

~~Other topical fluoride products, such as 0.2 percent sodium fluoride (**NaF**) mouthrinse (900 ppm F)*(Torell; Horowitz; Heifetz)* and brush-on gels/pastes (e.g., 1.1 percent NaF; 5,000 ppm F) also have been shown to be effective in reducing dental caries in permanent teeth.~~ Home use of fluoride products for children should focus on regimens that maximize topical contact, in lower-dose higher-frequency approaches [30]. Meta-analyses of more than 70 randomized or quasi-randomized controlled clinical trials show that fluoride toothpaste is efficacious in reducing prevalence of dental caries in permanent teeth, with the effect increased in children with higher baseline level of caries ~~and by~~with higher concentration of fluoride in the toothpaste, greater frequency of use, and supervision of brushing [31,32]. A meta-analysis of eight clinical trials on caries increment in preschool children also shows that tooth brushing with fluoridated toothpaste significantly reduces dental caries prevalence in the primary dentition [6]. Using no more than a smear or rice-size amount of fluoridated toothpaste for children less than three years of age may decrease risk of fluorosis. Using no more than a pea-size amount of fluoridated toothpaste is appropriate for children aged three to six [8] (see Figure). To maximize the beneficial effect of fluoride in the toothpaste, ~~teeth~~ supervised toothbrushing should be ~~brushed~~done twice a day,~~-~~and rinsing after brushing should be kept to a minimum or eliminated altogether [4]. Other topical fluoride products (e.g., prescription strength, home-use 0.5 percent fluoride gels and pastes; prescription-strength, home-use 0.09 percent fluoride mouthrinse have benefit in reducing dental caries in children six years or older [2].

Recommendations

1. There is confirmation from evidence-based reviews that fluoride use for the prevention and control of caries is both safe and highly effective in reducing dental caries prevalence.
2. There is ~~evidence~~ support from ~~randomized clinical trials and~~ evidence-based reviews that fluoride dietary supplements are effective in reducing dental caries and should be considered for children at caries risk who drink fluoride-deficient (less than 0.6 ppm) water.
3. There is ~~evidence~~ support from ~~randomized controlled trials and meta-analyses~~ evidence-based reviews that professionally applied topical fluoride treatments as ~~five~~2.26 percent NaFV or 1.23 percent F gel preparations are efficacious in reducing caries in children at caries risk.
4. There is ~~evidence~~ support ~~from meta-analyses~~ evidence-based reviews that fluoridated toothpaste is effective in reducing dental caries in children with the effect increased in children with higher

baseline level of caries, higher concentration of fluoride in the toothpaste, greater frequency in use, and supervision. Using no more than a smear or rice-size amount of fluoridated toothpaste for children less than three years of age may decrease risk of fluorosis. Using no more than a pea-size amount of fluoridated toothpaste is appropriate for children aged three to six.

5. There is ~~evidence~~ support from ~~randomized clinical trials~~evidence-based reviews that prescription strength, home-use 0.5 percent fluoride gels and pastes and prescription-strength, home-use 0.09 percent fluoride mouthrinse ~~0.2 percent NaF mouthrinse and 1.1 percent NaF brush-on gels/pastes~~ also are effective in reducing dental caries ~~in children~~.
6. There is support from evidence-based reviews to recommend the use of 38% silver diamine fluoride for the arrest of cavitated caries lesions in primary teeth as part of a comprehensive caries management program.

Figure. Comparison of a smear (left) with a pea-sized (right) amount of toothpaste.

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This draft does not constitute an official AAPD health oral policy or clinical recommendation until approval by the General Assembly. Circulation is limited to AAPD members.

Best Practices on Use of Nitrous Oxide for Pediatric Dental Patients

Review Council

Council on Clinical Affairs

Latest Revision

~~2013~~ 2018

Purpose

The American Academy of Pediatric Dentistry (**AAPD**) recognizes nitrous oxide/oxygen inhalation as a safe and effective technique to reduce anxiety, produce analgesia, and enhance effective communication between a patient and health care provider. The need to diagnose and treat, as well as the safety of the patient and practitioner, should be considered before using nitrous oxide. By producing this guideline, the AAPD intends to assist the dental profession in developing appropriate practices in the use of nitrous oxide/oxygen analgesia/anxiolysis for pediatric patients.

Methods

This guideline was originally developed by the Council on Clinical Affairs ~~Committee~~ and adopted in 2005. This document is a revision of the previous version, last revised in 2013~~09~~. The revision is based on a review of the current dental and medical literature related to nitrous oxide use. An electronic search was conducted using PubMed® with the terms: nitrous oxide, analgesia, anxiolysis, behavior management, diffusion hypoxia, scavenging, occupational exposure, and dental treatment; fields: all; limits: within the last 10 years, humans, English, and clinical trials. Forty articles met these criteria, and papers were added to the references from the previous document. Additionally, the American Dental Association Guideline for the use of sedation and general anesthesia by dentists and the American Dental Association Oral Health Topics – Nitrous oxide dental best practices for nitrous oxide-oxygen use were reviewed. When data did not appear sufficient or were inconclusive, recommendations were based upon expert and/or consensus opinion by experienced researchers and clinicians.

Background

Dentists have expertise in providing anxiety and pain control for their patients. While anxiety and pain can be modified by psychological techniques, in many instances pharmacological approaches are required[1]. Analgesia/anxiolysis is defined as diminution or elimination of pain and anxiety in a conscious

patient[2]. The patient responds normally to verbal commands. All vital signs are stable, there is no significant risk of losing protective reflexes, and the patient is able to return to pre-procedure mobility. In children, analgesia/anxiolysis may expedite the delivery of procedures that are not particularly uncomfortable, but require that the patient not move[2]. It also may allow the patient to tolerate unpleasant procedures by reducing or relieving anxiety, discomfort, or pain. The use of nitrous oxide increases reaction time, reduces pressure-induced pain, but does not affect pulpal sensitivity, as shown in a double-blind, crossover study[3]. The outcome of pharmacological approaches is variable and depends upon each patient's response to various drugs. The clinical effect of nitrous oxide/oxygen inhalation, however, is more predictable among the majority of the population.

Nitrous oxide is a colorless and virtually odorless gas with a faint, sweet smell. It is an effective analgesic/anxiolytic agent causing central nervous system (**CNS**) depression and euphoria with little effect on the respiratory system[4,5]. Nitrous oxide has multiple mechanisms of action. The analgesic effect of nitrous oxide appears to be initiated by neuronal release of endogeneous opioid peptides with subsequent activation of opioid receptors and descending Gamma-aminobutyric acid type A (**GABAA**) receptors and noradrenergic pathways that modulate nociceptive processing at the spinal level. The anxiolytic effect involves activation of the GABAA receptor either directly or indirectly through the benzodiazepine binding site[6,7]. Nitrous oxide has rapid uptake, being absorbed quickly from the alveoli and held in a simple solution in the serum. It is relatively insoluble, passing down a gradient into other tissues and cells in the body, such as the CNS. It is excreted quickly from the lungs. ~~As nitrous oxide is 34 times more soluble than nitrogen in blood, diffusion hypoxia may occur~~. ~~Studies (Patel et al 1994, Patel, Norden and Hannallah 1988, Kinouci et al 1992) have shown that children desaturate more rapidly than adolescents, and administering 100 percent oxygen to the patient once the nitrous oxide in a closed system has been terminated is important (Patel et al 1994).~~ Nitrous oxide causes minor depression in cardiac output while peripheral resistance is slightly increased, thereby maintaining the blood pressure[4]. This is of particular advantage in treating patients with cerebrovascular system disorders.

Nitrous oxide is absorbed rapidly, allowing for both rapid onset and recovery (two to three minutes). It causes minimal impairment of any reflexes, thus protecting the cough reflex[4]. It exhibits a superior safety profile with no recorded fatalities or cases of serious morbidity when used within recommended concentrations[8-11] ~~(Nathan 1989). Studies have reported negative outcomes associated with use of nitrous oxide greater than 50 percent and as an anesthetic during major surgery (Schmitt and Baum 2008, Zeir and Doescher 2010). Although rare, silent regurgitation and subsequent aspiration need to be considered~~

~~with nitrous oxide/oxygen sedation. The concern lies in whether pharyngeal-laryngeal reflexes remain intact. This problem can be avoided by not allowing the patient to go into an unconscious state (Hogue, Ternisky and Iranour 1971). Side effects such as nausea and vomiting are more likely to be observed when titration is not employed (Malamed and Clark 2003). As nitrous oxide is 34 times more soluble than nitrogen in blood, diffusion hypoxia may occur. This can be avoided by administering 100 percent oxygen for five minutes once the nitrous oxide flow is terminated.~~

The decision to use nitrous oxide/oxygen analgesia/anxiolysis must take into consideration alternative behavioral guidance modalities, the patient's dental needs, the effect on the quality of dental care, the patient's emotional development, and the patient's physical considerations. Nitrous oxide generally is acceptable to children and can be titrated easily. Most children are enthusiastic about the administration of nitrous oxide/oxygen; many children report feeling a tingling or warm sensation. Objectively, children may appear with their hands open, legs limp, and with a trancelike expression[12]. ~~dreaming or being on a "space-ride" (Hogue, Ternisky and Iranour 1971).~~ For some patients, however, the feeling of "losing control" may be troubling and children with claustrophobia~~e patients~~ may find the nasal hood confining and unpleasant[13].

Nitrous oxide has been associated with bioenvironmental concerns because of its contribution to the greenhouse effect[14]. Nitrous oxide is emitted naturally by bacteria in soils and oceans; it is produced by humans through the burning of fossil fuels and forests and the agricultural practices of soil cultivation and nitrogen fertilization. Altogether, nitrous oxide contributes about five percent to the greenhouse effect[15,16]. Only a small fraction of this five percent (0.35 to two percent), however, is actually the result of combined medical and dental applications of nitrous oxide gas[16].

The objectives of nitrous oxide/oxygen inhalation include:

1. Reduce or eliminate anxiety.
2. Reduce untoward movement and reaction to dental treatment.
3. Enhance communication and patient cooperation.
4. Raise the pain reaction threshold.
5. Increase tolerance for longer appointments.
6. Aid in treatment of the mentally/physically disabled or medically compromised patient.
7. Reduce gagging.
8. Potentiate the effect of sedatives.

Disadvantages of nitrous oxide/oxygen inhalation may include[4]:

1. Lack of potency.
2. Dependant largely on psychological reassurance.
3. Interference of the nasal hood with injection to anterior maxillary region.
4. Patient must be able to breathe through the nose.
5. Nitrous oxide pollution and potential occupational exposure health hazards.

Recommendations

Indications for use of nitrous oxide/oxygen analgesia/anxiolysis include:

1. A fearful, anxious, or obstreperous patient.
2. Certain patients with special health care needs.
3. A patient whose gag reflex interferes with dental care.
4. A patient for whom profound local anesthesia cannot be obtained.
5. A cooperative child undergoing a lengthy dental procedure.

Review of the patient's medical history should be performed prior to the decision to use nitrous oxide/oxygen analgesia/anxiolysis. This assessment should include:

1. Allergies and previous allergic or adverse drug reactions.
2. Current medications including dose, time, route, and site of administration.
3. Diseases, disorders, or physical abnormalities and pregnancy status.
4. Previous hospitalization to include the date and purpose.
5. Recent illnesses (e.g., cold or congestion) that may compromise the airway.

Contraindications for use of nitrous oxide/oxygen inhalation may include:

1. Some chronic obstructive pulmonary diseases[17].
2. Current upper respiratory tract infection[18].
3. Recent middle ear disturbance/ surgery[18].
4. ~~2.~~ Severe emotional disturbances or drug-related dependencies[18].
5. ~~3.~~ First trimester of pregnancy[19].
6. ~~4.~~ Treatment with bleomycin sulfate[20].
7. ~~5.~~ Methylenetetrahydrofolate reductase deficiency[21].
8. ~~6.~~ Cobalamin (Vit B12) deficiency[7].

Whenever possible, appropriate medical specialists should be consulted before administering analgesic/anxiolytic agents to patients with significant underlying medical conditions (e.g., severe obstructive pulmonary disease, congestive heart failure, sickle cell disease[22], acute otitis media, recent tympanic membrane graft[23], acute severe head injury[24]. In addition, consultation with the prenatal medical provider should precede use of nitrous oxide/oxygen analgesia/ anxiolysis during pregnancy[25].

Technique of nitrous oxide/oxygen administration

Nitrous oxide/oxygen must be administered only by appropriately licensed individuals, or under the direct supervision thereof, according to state law. The practitioner responsible for the treatment of the patient and/or the administration of analgesic/anxiolytic agents must be trained in the use of such agents and techniques and appropriate emergency response.

Selection of an appropriately sized nasal hood should be made. A flow rate of five to six L/min generally is acceptable to most patients. The flow rate can be adjusted after observation of the reservoir bag. The bag should pulsate gently with each breath and should not be either over- or underinflated. Introduction of 100 percent oxygen for one to two minutes followed by titration of nitrous oxide in 10 percent intervals is recommended. During nitrous oxide/oxygen analgesia/anxiolysis, the concentration of nitrous oxide should not routinely exceed 50 percent. Studies have demonstrated that gas concentrations dispensed by the flow meter vary significantly from the end-expired alveolar gas concentrations; it is the latter that is responsible for the clinical effects[26,27]. To achieve sedation, the scavenging vacuum should not be so strong as to prevent ad-equate ventilation of the lungs with nitrous oxide[28]. A review of records of patients undergoing nitrous oxide-oxygen inhalation sedation demonstrated that the typical patient requires from 30 to 40 percent nitrous oxide to achieve ideal sedation ~~(Malamed and Clark 2003)~~. Clinicians should keep patients' talking and mouth breathing to a minimum to prevent expired nitrous oxide from contaminating the operatory[29]. Nitrous oxide concentration may be decreased during easier procedures (e.g., restorations) and increased during more stimulating ones (e.g., extraction, injection of local anesthetic). One study found that there was no benefit to continuous administration of nitrous oxide after profound anesthesia had been achieved[30]. ~~Side effects such as nausea and vomiting are more likely to be observed when titration is not employed (Malamed and Clark 2003).~~ During treatment, it is important to continue the visual monitoring of the patient's respiratory rate and level of consciousness. The effects of nitrous oxide largely are dependent on psychological reassurance. Therefore, it is important to continue traditional behavior guidance techniques during treatment. Once the nitrous oxide flow is

terminated, 100 percent oxygen should be administered until the patient has returned to pre-treatment status[31]. ~~should be delivered for five minutes~~. The patient must return to pretreatment responsiveness before discharge.

Monitoring

The response of patients to commands during procedures performed with analgesia/anxiolysis serves as a guide to their level of consciousness. Clinical observation of the patient must be performed during any dental procedure. During nitrous oxide/oxygen analgesia/anxiolysis, continual clinical observation of the patient's responsiveness, color, and respiratory rate and rhythm must be performed. Spoken responses provide an indication that the patient is breathing[2]. If any other pharmacologic agent is used in addition to nitrous oxide/oxygen and a local anesthetic, monitoring guidelines for the appropriate level of sedation must be followed[32].

Adverse effects of nitrous oxide/oxygen inhalation

Nitrous oxide/oxygen analgesia/anxiolysis has an excellent safety record. When administered by trained personnel on carefully selected patients with appropriate equipment and technique, nitrous oxide is a safe and effective agent for providing pharmacological guidance of behavior in children. Acute and chronic adverse effects of nitrous oxide on the patient are rare[33]. Nausea and vomiting are the most common adverse effects, occurring in 0.5 – 1.2 percent of patients[34,35]. A higher incidence is noted with longer administration of nitrous oxide/oxygen, fluctuations in nitrous oxide levels, ~~and~~ lack of titration, increased concentrations of nitrous oxide, and a heavy meal prior to administration of nitrous oxide[4,28,29] . Fasting is not required for patients undergoing nitrous oxide analgesia/anxiolysis. The practitioner, however, may recommend that only a light meal be consumed in the two hours prior to the administration of nitrous oxide[36]. Studies have reported negative outcomes associated with use of nitrous oxide greater than 50 percent and as an anesthetic during major surgery[37,38]. Although rare, silent regurgitation and subsequent aspiration need to be considered with nitrous oxide/oxygen sedation. The concern lies in whether pharyngeal-laryngeal reflexes remain intact. This problem can be avoided by not allowing the patient to go into an unconscious state[39].

As nitrous oxide is 34 times more soluble than nitrogen in blood, diffusion hypoxia may occur. Diffusion hypoxia can occur as a result of rapid release of nitrous oxide from the blood stream into the alveoli, thereby diluting the concentration of oxygen. This may lead to headache, ~~and~~ disorientation, and nausea and can be avoided by administering 100 percent oxygen once the nitrous oxide flow is terminated[4]..

~~Diffusion hypoxia can occur as a result of rapid release of nitrous oxide from the blood stream into the alveoli, thereby diluting the concentration of oxygen. This may lead to headache, and disorientation, and nausea and can be avoided by administering 100 percent oxygen after nitrous oxide has been discontinued (Paterson and Tahmassebi 2003).~~ While the standard recommendation is to administer 100% oxygen at the end of the procedure, several studies have questioned the necessity for this step in nitrous oxide protocols in healthy patients[18,40-42].

Documentation

Informed consent must be obtained from the parent and documented in the patient's record prior to administration of nitrous oxide/oxygen. The practitioner should provide instructions to the parent regarding pretreatment dietary precautions, if indicated. In addition, the patient's record should include indication for use of nitrous oxide/oxygen inhalation, nitrous oxide dosage (i.e., percent nitrous oxide/oxygen and/or flow rate), duration of the procedure, and post treatment oxygenation procedure.

Facilities/personnel/equipment

All newly installed facilities for delivering nitrous oxide/oxygen must be checked for proper gas delivery and fail-safe function prior to use. Inhalation equipment must have the capacity for delivering 100 percent, and never less than 30 percent, oxygen concentration at a flow rate appropriate to the child's size. Additionally, inhalation equipment must have a fail-safe system that is checked and calibrated regularly according to the practitioner's state laws and regulations[38]. The system components, including the reservoir bag, should be inspected routinely for cracks, wear, and tears. If detected, repairs should be made immediately. Pressure connections should be tested for leaks when delivery system is turned on and each time a tank is changed. ~~Compressed gas tanks must be kept in a locked room.~~ Consult state and federal guidelines regarding storage of compressed gas tanks. Additional locks at the tanks, or mixer/ delivery level are available from many manufacturers to deter individuals from accessing nitrous oxide inappropriately[43]. If nitrous oxide/oxygen delivery equipment capable of delivering more than 70 percent nitrous oxide and less than 30 percent oxygen is used, an inline oxygen analyzer must be used. The equipment must have an appropriate scavenging system to minimize room air contamination and occupational risk. The scavenging system should vent outside[44]. Additionally, it has been shown that the double-mask system is more effective than the single-mask system in the removal of waste nitrous oxide[46,47].

The practitioner who utilizes nitrous oxide/oxygen analgesia/anxiolysis for a pediatric dental patient shall possess appropri-ate training and skills and have available the proper facilities, personnel, and equipment to manage any reasonably foresee-able emergency. The practitioner is responsible for managing the potential complications associated with the intended level of sedation and the next deeper level. Therefore, because moderate sedation may occur, practitioners should have the appropriate training and emergency equipment to manage this[31]. Training and certification in basic life support are required for all clinical personnel. These individuals should participate in periodic review of the office's emergency protocol, the emergency drug cart, and simulated exercises to assure proper emergency management response.

An emergency cart (kit) must be readily accessible. Emergency equipment must be able to accommodate children of all ages and sizes. It should include equipment to resuscitate a non-breathing, unconscious patient and provide continuous support until trained emergency personnel arrive. A positive-pressure oxygen delivery system capable of administering greater than 90 percent oxygen at a 10 L/min flow for at least 60 minutes (650 L, "E" cylinder) must be available. When a self-inflating bag valve mask device is used for delivering posi-tive pressure oxygen, a 15 L/min flow is recommended. There should be documentation that all emergency equipment and drugs are checked and maintained on a regularly scheduled basis[32]. Where state law mandates equipment and facilities, such statutes should supersede this guideline[32].

Occupational safety

In the medical literature, long-term exposure to nitrous oxide used as a general anesthetic has been linked to bone marrow suppression and reproductive system disturbances[7,47-49]. However, it has been shown that appropriate scavenging is effective in reducing these reproductive system effects[19,50]. In an effort to reduce occupational health hazards associated with nitrous oxide, the AAPD recommends exposure to ambient nitrous oxide be minimized through the use of effective scavenging systems and periodic evaluation and maintenance of the delivery and scavenging systems[51-53].

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This draft does not constitute an official AAPD health oral policy or clinical recommendation until approval by the General Assembly. Circulation is limited to AAPD members.

Best Practices on Use of Anesthesia Providers in the Administration of Office-based Deep Sedation/General Anesthesia to the Pediatric Dental Patient[1]

Review Council

Council on Clinical Affairs

Latest Revision

2017~~8~~8*

*Revision limited to personnel section (line 129-154)

Purpose

The American Academy of Pediatric Dentistry (AAPD) recognizes that there are pediatric dental patients for whom routine dental care using nonpharmacological behavior guidance techniques is not a viable approach.[1] The AAPD intends this guideline to assist the dental practitioner who elects to use a licensed anesthesia provider for the administration of deep sedation/general anesthesia for pediatric dental patients in a dental office or other facility outside of an accredited hospital or ambulatory surgical center. This document discusses personnel, facilities, documentation, and quality assurance mechanisms necessary to provide optimal and responsible patient care.

Methods

This guideline was originally developed by the Clinical Affairs Committee – Sedation and General Anesthesia Subcommittee and adopted in 2001. This document is a revision of the previous version, last revised in 2012. The revision of this guideline is based upon a review of current dental and medical literature pertaining to deep sedation/general anesthesia of dental patients, including a search of the PubMed® /MEDLINE database using the terms: office-based general anesthesia, pediatric sedation, deep sedation, sleep dentistry, and dental sedation; fields: all; limits: humans, all children from birth through age 18, English, clinical trials, and literature reviews. The search returned 69 articles; the reviewers agreed upon the inclusion of 12 articles that met the defined criteria. When data did not appear sufficient

[1] ABBREVIATIONS
AA: Anesthesia assistant. **AAPD**: American Academy of Pediatric Dentistry. **ASA**: American Society of Anesthesiologists. **CO_2**: Carbon dioxide. **CRNA**: Certified registered nurse anesthetist.

or were inconclusive, recommendations were based upon expert and/or consensus opinion by experienced researchers and clinicians.

Background

Pediatric dentists seek to provide oral health care to infants, children, adolescents, and persons with special health care needs in a manner that promotes excellence in quality of care and concurrently induces a positive attitude in the patient toward dental treatment. Behavior guidance techniques have allowed most pediatric dental patients to receive treatment in the dental office with minimal discomfort and without expressed fear. Minimal or moderate sedation has allowed others who are less compliant to receive treatment. Some children and individuals with special care needs who have extensive oral healthcare needs, acute situational anxiety, uncooperative age-appropriate behavior, immature cognitive functioning, disabilities, or medical conditions require deep sedation/general anesthesia to receive dental treatment in a safe and humane fashion.[2] Access to hospital-based anesthesia services may be limited for a variety of reasons, including restriction of coverage of by third-party payors.[2,3] Pediatric dentists and others who treat children can provide for the administration of deep sedation/general anesthesia by utilizing properly trained and currently licensed anesthesia providers in their offices or other facilities outside of the traditional surgical setting.

Office-based deep sedation/general anesthesia can provide benefits for the patient and the dental team. Such benefits may include:

- Improved access to care;
- Improved ease and efficiency of scheduling;
- Decreased administrative procedures and facility fees when compared to a surgical center or hospital;
- Minimized likelihood of patient's recall of procedures;
- Decreased patient movement which may optimize quality of care; and
- Use of traditional dental delivery systems with access to a full complement of dental equipment, instrumentation, supplies, and auxiliary personnel.

The use of licensed anesthesia providers to administer deep sedation/general anesthesia in the pediatric dental population is an accepted treatment modality.[4-8] Caution must be used in patients younger than two years of age. Practitioners must always be mindful of the increased risk associated with office- based deep

sedation/general anesthesia in the infant and toddler populations. This level of pharmacologic behavioral modification should only be used when the risk of orofacial disease outweighs the benefits of monitoring, interim therapeutic restoration, or arresting medicaments to slow or stop the progression of caries. The AAPD supports the provision of deep sedation/general anesthesia when clinical indications have been met and additional properly-trained and credentialed personnel and appropriate facilities are used.[1,3,4] In many cases, the patient may be treated in an appropriate outpatient facility (including the dental office) because the extensive medical resources of a hospital may not be deemed necessary for delivering routine health care.

Recommendations

Clinicians may consider using deep sedation or general anesthesia in the office to facilitate the provision of oral health care. Practitioners choosing to use these modalities must be trained in rescue emergency procedures and be familiar with their patient's medical history, as well as the regulatory and professional liability insurance requirements needed to provide this level of pharmacologic behavior management. This guideline does not supersede, nor is it to be used in deference to, federal, state, and local credentialing and licensure laws, regulations, and codes.

Personnel

Deep sedation/general anesthesia techniques in the dental office require at least three individuals:

- Independently practicing and currently licensed anesthesia provider.
- Operating dentist.
- Support personnel.

The anesthesia care provider's responsibilities are to administer drugs or direct their administration and to continuously monitor the patient's vital signs, airway patency, cardiovascular and neurological status, and adequacy of ventilation. Both the surgical and anesthesia teams are responsible for maintaining optimal patient positioning, such as keeping the head and neck aligned and supported while padding all pressure points. Additional attention should be placed on moving extremities during long procedures so as to avoid the possibility of complications secondary to prolonged immobility (e.g., peripheral neuropathy).

It is the exclusive responsibility of treating practitioners, when employing anesthesia providers to administer deep sedation/general anesthesia, to verify and carefully review their credentials and

experience. Significant pediatric training, including anesthesia care of the very young, and experience in a dental setting are important considerations, especially when caring for young pediatric and special needs populations.

In order to provide anesthesia services in an office-based setting:

- The anesthesia care provider must be a licensed dental and/or medical practitioner with current state certification to independently administer deep sedation/general anesthesia in a dental office. He/She must be in compliance with state and local laws regarding anesthesia practices. Laws vary from state to state and may supersede any portion of this document.
- If state law permits a certified registered nurse anesthetist (**CRNA**) or anesthesia assistant (**AA**) to function under the direct supervision of a dentist, the dentist is required to have completed training in deep sedation/general anesthesia and be licensed or permitted for that level of pharmacologic management, appropriate to state law. Furthermore, to maximize patient safety, the dentist supervising the CRNA or AA would not simultaneously be providing dental treatment. The CRNA or AA must be licensed with current state certification to administer deep sedation/general anesthesia in a dental office. He/She must be in compliance with state and local laws regarding anesthesia practices. Laws vary from state to state and may supersede any portion of this document.

The dentist and anesthesia care provider must be compliant with the American Academy of Pediatrics/AAPD's Guideline on Monitoring and Management of Pediatric Patients Before, During, and After Sedation for Diagnostic and Therapeutic Procedures: Update 2016[4] or other appropriate guideline(s) of the American Dental Association, American Society of Anesthesiologists (ASA), and other organizations with recognized professional expertise and stature. The recommendations in this document may be exceeded at any time if the change involves improved safety and/or is superseded by state law.

The dentist and licensed anesthesia provider must collaborate to enhance patient safety. Continuous and effective perioperative communication and appropriately timed interventions are essential in mitigating adverse events or outcomes. The dentist introduces the concept of deep sedation/general anesthesia to the parent, justifies its necessity, and provides appropriate preoperative instructions and informational materials. The dentist or his/her designee coordinates medical consultations when necessary and conveys pertinent information to the anesthesia care provider. The anesthesia care provider explains potential risks

and obtains informed consent for sedation/anesthesia. Office staff should understand their additional roles and responsibilities and special considerations (e.g., loss of protective reflexes) associated with office-based deep sedation/general anesthesia.

Advanced training in recognition and management of pediatric emergencies is critical in providing safe sedation and anesthetic care. During deep sedation/general anesthesia in the dental setting, there must be at least two individuals present with the skills in patient rescue and pediatric advanced life support (PALS) .~~o~~One of the two must be an independent observer whose sole responsibility is to constantly ~~person whose only responsibilities are to continuously monitor~~ observe the patient's vital signs, levels of sedation, airway patency, and adequacy of ventilation. The independent observer must, at a minimum, be trained in PALS and capable of managing any emergency event.[4] ~~to either administer drugs or direct their administration.~~[4] The independent observer must be capable of recognizing the depth of sedation as well as be skilled to establish intravenous access, draw up and administer rescue medications, ~~An independent anesthesiologist often assumes this role. However, if this individual is not an anesthesiologist but is functioning under the supervision of a licensed and legally permitted practitioner, then this individual, at a minimum, must be trained in advanced pediatric life support (e.g., PALS) and capable of assisting with any emergency event. The supervisor must be physically present during the intraoperative period, free from surgical responsibilities, trained in and capable of providing advanced pediatric life support, and skilled to rescue a child with apnea, laryngospasm, and/or airway obstruction.~~ have management skills to rescue the non-breathing child, a child with air way obstruction, a child with hypotension, anaphylaxis, or cardiorespiratory arrest including ~~This provider must have the skills and~~ the ability to open the airway, suction secretions, provide continuous positive airway pressure (CPAP), insert supraglottic devices (oral airway, nasal trumpet, laryngeal mask airway [LMA]), and perform successful bag-valve-mask ventilation, tracheal intubation, and cardiopulmonary resuscitation.[4] The independent observer must be one of the following: (1) a physician anesthesiologist, (2) a dental anesthesiologist, (3) a certified registered nurse anesthetist, (4) an oral and maxillofacial surgeon. ~~Furthermore, at least one practitioner skilled in obtaining vascular access in children must be immediately available.~~[4] The second individual who is responsible dental practitioner must be trained in and capable of providing pediatric advanced life support and skilled in assisting the independent observer with the rescue of a child with any of the adverse events described above.

Personnel experienced in post anesthetic recovery care and trained in advanced resuscitative techniques (e.g., PALS) must be in attendance and provide continuous respiratory and cardiovascular monitoring during the recovery period.[4] The supervising anesthesia provider, not the operating dentist, shall determine when the patient exhibits respiratory and cardiovascular stability and appropriate discharge criteria[4] have been met. The operating dentist and his/her clinical staff must be well-versed in emergency recognition, rescue, and emergency protocols including maintaining cardiopulmonary resuscitation certification for healthcare providers.[6] In addition, it is highly recommended that the operating dentist be trained in advanced resuscitative techniques. Contact numbers for local emergency medical and ambulance services must be readily available, and a protocol for immediate access to back-up emergency services must be clearly outlined.[4] Emergency preparedness must be updated and practiced on a regular (e.g., semi-annual) basis [see Table 1], so as to keep all staff members up to date on established protocols.[9]

Facilities

A continuum exists that extends from wakefulness across all levels of sedation. Often these levels are not easily differentiated, and patients may drift among them.[10] When anesthesia care providers are utilized for office-based administration of deep sedation or general anesthesia, the facilities in which the dentist practices must meet the guidelines and appropriate local, state, and federal codes for administration of the deepest possible level of sedation/anesthesia. Facilities must be in compliance with applicable laws, codes, and regulations pertaining to controlled drug storage, fire prevention, building construction and occupancy, accommodations for the disabled, occupational safety and health, and disposal of medical waste and hazardous waste.[4] The treatment room must accommodate the dentist and auxiliaries, the patient, the anesthesia care provider, the dental equipment, and all necessary anesthesia delivery equipment along with appropriate monitors and emergency equipment. Expeditious access to the patient, anesthesia machine (if present), and monitoring equipment should be available at all times.

It is beyond the scope of this document to dictate equipment necessary for the provision of deep sedation/general anesthesia, but equipment must be appropriate for the technique used and consistent with the guidelines for anesthesia providers, in accordance with governmental rules and regulations. Because laws and codes vary from state to state, Guidelines for Monitoring and Management of Pediatric Patients Before, During, and After Sedation for Diagnostic and Therapeutic Procedures: Update 2016[4] should be followed as the minimum requirements.

For deep sedation/general anesthesia, there must be continuous monitoring of the patient's level of consciousness and responsiveness, heart rate, blood pressure, respiratory rate, expired carbon dioxide (CO_2) values, and oxygen saturation.[4] When adequacy of ventilation is difficult to observe using capnography, use of an amplified, audible precordial stethoscope (e.g., Bluetooth technology) is encouraged.[4] In addition, an electrocardiographic monitor and a defibrillator capable of delivering an attenuated pediatric dose are required for deep sedation/general anesthesia.[4] Emergency equipment must be readily accessible and should include Yankauer suction, drugs necessary for rescue and resuscitation (including 100 percent oxygen capable of being delivered by positive pressure at appropriate flow rates for up to one hour), and age-/size-appropriate equipment to resuscitate and rescue a non-breathing and/or unconscious pediatric dental patient and provide continuous support while the patient is being transported to a medical facility.[4,5] The licensed practitioners are responsible for ensuring that medications, equipment, and protocols are available to treat malignant hyperthermia when triggering agents are used.[11] Recovery facilities must be available and suitably equipped. Backup power sufficient to ensure patient safety should be available in case of emergency power outage.[4]

Documentation

Prior to delivery of deep sedation/general anesthesia, patient safety requires that appropriate documentation shall address rationale for sedation/general anesthesia, anesthesia and procedural informed consent, instructions to parent, dietary precautions, preoperative health evaluation, and any prescriptions along with the instructions given for their use.[4] Because laws and codes vary from state to state, Guidelines on Monitoring and Management of Pediatric Patients Before, During, and After Sedation for Diagnostic and Therapeutic Procedures: Update 2016[4] should be followed as minimum requirements for a time-based anesthesia record.

- Vital signs: Pulse and respiratory rates, blood pressure, heart rhythm, oxygen saturation, and expired CO_2 must be continuously monitored and recorded on a time-based record throughout the procedure, initially every five minutes and then, as the patient awakens, at 10-15 minute intervals until the patient has met documented discharge criteria.[4]
- Drugs: Name, dose, route, site, time of administration, and patient effects (e.g., level of consciousness, patient responsiveness) of all drugs, including local anesthesia, must be documented.[4] When anesthetic gases are administered, inspired concentration and duration of inhalation agents and oxygen shall be documented.[4]

- Recovery: The condition of the patient, that discharge criteria have been met, time of discharge, and into whose care the discharge occurred must be documented. Requiring the signature of the responsible adult to whom the child has been discharged, verifying that he/she has received and understands the post-operative instructions, is encouraged.[4]

Various business/legal arrangements may exist between the treating dentist and the anesthesia provider. Regardless, because services were provided in the dental facility, the dental staff must maintain all patient records, including time-based anesthesia records, so that they may be readily available for emergency or other needs. The dentist must assure that the anesthesia provider also maintains patient records and that they are readily available.

Risk management and quality assurance

Dentists who utilize office-based anesthesia care providers must take all necessary measures to minimize risk to patients. The dentist must be familiar with the ASA physical status classification.[12] Knowledge, preparation, and communication between professionals is essential. Prior to subjecting a patient to deep sedation/general anesthesia, the patient must undergo a pre-operative health evaluation by an appropriate and currently licensed medical or anesthesia provider.[4,6] High-risk patients should be treated in a facility properly equipped to provide and staffed for their care.[4,6] The dentist and anesthesia care provider must communicate during treatment to share concerns about the airway or other details of patient safety. Furthermore, they must work together to develop and document mechanisms of quality assurance.

Untoward and unexpected outcomes must be documented and reviewed to monitor the quality of services provided. This will decrease risk, allow for open and frank discussions, document risk analysis and intervention, and improve the quality of care for the pediatric dental patient.[4,5]

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TABLE 1

Table 1. CONSIDERATIONS IN FREQUENCY OF CONDUCTING EMERGENCY EXERCISES[9]	
Changes in plans	Changes in the emergency response plan need to be disseminated and practiced.
Changes in personnel	New staff members need training in their emergency response roles. Emergency roles left by former staff members need to be filled.
Changes in property	Infrastructure changes can affect how the plan is implemented. New equipment may require training for their use.
Foreseen problems	Protocols for newly identified problems must be established, practiced and implemented.

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This draft does not constitute an official AAPD health oral policy or clinical recommendation until approval by the General Assembly. Circulation is limited to AAPD members.

Best Practices for Pain Management in Infants, Children, Adolescents and Individuals with Special Health Care Needs

Originating Council

Council on Clinical Affairs

Adopted

2018

Purpose

The purpose of this document is to provide dental professionals and other stakeholders with current best practices for pain management in pediatric dentistry.

Methods

This document was developed by the Council on Clinical Affairs and adopted in 2018. It is based on a review of current dental and medical literature pertaining to pain management in pediatric dental patients. Review of existing Federal and professional pain management guidelines and consensus statements were used to assist with this document. An electronic search was conducted using PubMed® with the terms: dental pain management, pediatric pain assessment, preemptive analgesia, pediatric and acetaminophen, adolescent and acetaminophen, pediatric and NSAIDs, adolescent and NSAIDs, pediatric and opioids, adolescent and opioids, opioid risk, adolescent orofacial pain, pediatric and adolescent chronic pain, non-pharmacologic pain management; fields: all; limits: within the last 10 years, humans, English, and clinical trials. 1395 articles met these criteria. Papers for review were chosen from this 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.

Background

Pain is defined by the International Association of the Study of Pain (IASP) as "an unpleasant sensory and emotional experience associated with actual or potential tissue damage or described in terms of such damage."[1] Pain management includes both pharmacologic and nonpharmacologic strategies to treat both acute and chronic pain, and professional and educational requirements are being reviewed at multiple levels.[2,3,4,5]. This document discusses pain processing, pain assessment, pain categories, pre-emptive

analgesia, non-pharmacologic pain management, pharmacologic pain management, and best practices for prescribing opioids.

Pain processing

Understanding pain processing is essential for the management of pain. Pain experience in childhood may shape future pain experiences in adulthood.[6] Dental pain is an inflammatory condition resulting from invasive treatment, tissue damage, or infection.[7] Swelling, hyperthermia, and activation of biochemical cascades are hallmarks of inflammatory pain.[7,8] Thermal, mechanical, and chemical stimuli activate free nerve endings.[9,10] Sensory signals travel along afferent trigeminal nerve fibers and relay information to the brainstem and higher structures involved with the perception of pain.[11] Under normal conditions the perception of pain persists until the stimulus is removed.

Peripheral sensitization

Terminal nerve endings at the site of tissue injury exhibit an enhanced neuronal response.[9] This local increase in nerve membrane excitability is referred to as peripheral sensitization.[12]. The exaggerated response to stimuli in the region of tissue damage is called primary hyperalgesia.[11].

Central sensitization

Central sensitization refers to enhanced functional status of pain circuits and pain processing at the level of the central nervous system (CNS).[8, 12, 13] Both secondary hyperalgesia, which is an increase in pain intensity to noxious stimuli outside of the area of tissue damage, and allodynia, which refers to pain perception following innocuous stimuli such as light touch, are characteristics of central sensitization.[13]

Pain modulation

Modulation of pain pathways occurs through CNS excitatory and inhibitory processes. Ascending facilitating and descending inhibitory processes enhance or suppress the pain experience, respectively.[12] Both pharmacologic and nonpharmacologic methods target these processes to alter pain processing[14, 15].

Pain assessment

Ethnic, cultural, and language factors may influence expression and assessment of pain.[16] Pain is assessed using self-report, behavioral (vocalization, facial expression, body movement) and biological measures (heart rate, transcutaneous oxygen, sweating, stress response).[17] Direct questioning or a structured, comprehensive pain assessment can be clinically beneficial for pediatric and adolescent patients.[17,18]

Conducting a structured interview begins with asking specific questions regarding pain onset, provoking factors, palliative factors, quality or character, region or location, severity or intensity, timing or duration, and impact on daily activities. Obtaining information through self-report can be aided by asking the child to make comparisons, using temporal anchors and facilitating communication through objects or gestures.[17] Assessing behavioral reactions and physiological reactions to pain are required in non-verbal and young patients.[17] Patients 4-12 years old can likely quantify pain based on a series of faces.[19] Patients older than seven should be able to mark pain using a Visual Analogue Scale (VAS) or numeric scale.[19, 20]. Validated instruments such as Faces Pain Scale (Revised), Visual Analogue Scale (VAS), numeric rating scale, Faces, Legs, Activity, Cry, and Consolability score (FLACC), Faces, Legs, Activity, Cry and Consolability, and the McGill Pain Questionnaire are available for assessing pain in verbal or nonverbal patients.[19,21,22]

Pain categories

Pain may be divided into diagnostic categories as somatic, visceral and neuropathic.[23,24,25,26] Pain encountered in dentistry is typically inflammatory and categorized as somatic (i.e. periodontal, alveolar, mucosal) or visceral (i.e. pulpal) pain.[27]

Pain may be categorized as acute or chronic. Acute pain that fails to respond to treatment may become chronic over time.[28] Chronic pain refers to pain that is dysfunctional and persists beyond the time for typical tissue healing.[29,30,31,32] Temporomandibular disorder (TMD) is an example of a chronic pain condition encountered in dentistry.[33]

Pain management

Pre-emptive pain management

Pre-emptive pain management refers to administration of an anesthetic agent, medication, or technique prior to a surgical event with the goal of decreasing pain. Goals of pre-emptive pain management include: attenuating central sensitization, decreasing postoperative pain, improving recovery, and reducing postoperative analgesic consumption.[11,15] Postoperative pain management in pediatric patients has been suboptimal in large part because of the misconception that children do not feel pain as severely as adults do[34] and the fear of adverse events.[35]. It has been shown that nearly 50% of patients undergoing dental rehabilitation describe moderate to severe pain[36] and there is data to support pre-emptive measures to optimize pain control for a variety of dental and surgical procedures.[37] However, level of evidence is low due to sparse well-controlled trials.[38,39,40]

Achieving profound anesthesia prior to initiating treatment decreases central sensitization[37]. Topical anesthetics are used in a dentistry to minimize pain; however, these medicaments alone may not be sufficient for dental procedures.[41,42] Other factors that may contribute to a patient's pain experience are the anesthetic properties and the needle used during the injection.[43] Distraction techniques made at the time of the injection such as jiggling the patient's cheek take advantage of Aß fiber signal dominance and can significantly reduce the intensity of pain-related C-fiber signaling.[43] Buffering or decreasing acidity of local anesthetic using sodium bicarbonate can decrease injection site pain and postoperative discomfort by increasing the pH of the anesthetic. This is a well-accepted technique in medicine but has not been commonly used in dentistry.[43,44] Finally, decreasing anesthetic delivery rate has also demonstrated pain reduction during injection.[45]

In a study by Shivani, the use of pre-emptive analgesics in conjunction with local anesthetics increased the ability to achieve pulpal anesthesia in patients with irreversible pulpitis when compared with placebo.[46]. The pre-emptive analgesics most commonly used in dentistry are nonsteroidal anti-inflammatory drugs (**NSAIDS**) and acetaminophen either alone or in combination.[47] Analgesics with sedative properties are often administered during the pre, peri, and postoperative periods when moderate to severe pain is anticipated.[48,49,50,51]

Use of local anesthesia during general anesthesia

Although pain is not experienced during general anesthesia, central sensitization occurs when peripheral nerves are stimulated.[37,52,53]. Operating without local anesthesia may result in "priming" of CNS neurons and increased future pain sensitivity.[6]. Central sensitization is minimized with pre-emptive analgesia or anesthesia. For this reason, regional block or infiltration anesthesia is commonly performed prior to surgical procedures to decrease postoperative pain.[11,54,55] However, pharmacologic and cardiac considerations along with avoiding the numb sensation and potential for self-inflicted oral trauma are reasons providers may choose not to provide local anesthesia during general anesthesia.[55,56]

Non-pharmacologic approaches to pain management

Studies suggest that nonpharmacologic interventions may be effective alone or as adjuncts to pharmacological interventions in managing procedure related pain, anxiety and distress with minimal risk of adverse effects.[9,57,58,59]. Fear and anxiety activate circuits within the CNS that facilitate pain.[29] Creating a safe, friendly environment may help a child feel more comfortable and less stressed.[58,60] The American

Academy of Pediatrics and the American Pain Society recommend that providers reduce distress-producing stimulation and provide a calm environment for procedures to improve pain management.[3] Emotional support is a key component in creating a comfortable environment.[61] Although there is no evidence that the presence of parents decreases pain, there is data to support that it may decrease the child's anxiety and distress.[60] Conversely, parental catastrophizing has been associated with poor outcomes for pediatric pain management.[62] The American Academy of Pediatrics and American Pain Society jointly advise expectation management for parents along with preparation for comforting their children when pain is anticipated.[3]. Individual studies have shown the efficacy of psychologic techniques, including preparation and information, parent coaching or training, suggestion, memory alteration or change, and coping self-statements.[63,64,65] However, a 2013 Cochrane review concluded that there is no strong evidence available to support the efficacy of preparation and information, combined cognitive or behavioral strategies, parent coaching plus distraction, or suggestion for reducing needle-related pain and distress.[66]

Distraction and Imagery

Distraction is an effective method of pain management in the pediatric population.[16,67] It can be cognitive (counting, nonprocedural talk) or behavioral (videos, games), both of which aim to shift attention away from pain. Distraction techniques such as bubbles, counting, conversation, music, television, toys and video games may be used by health care providers or the child's caregiver.[58,60] There is strong evidence supporting the efficacy of distraction techniques for needle-related pain and distress in children and adolescents.[66] Distraction has been shown to be significantly effective when measuring pulse rates, respiratory rates, and self-reported pain.[3,60] Additionally, distraction intervention has been shown to lower the perception of pain distress in younger children as reported by parents.[61] Distraction techniques may be of great use with patients with special needs that have shortened attention spans and are unable to understand verbal reasoning or reassurance.[63]

Imagery guides the child's attention away from the procedure by harnessing imagination and story-telling. Imagery in combination with distraction have been shown to be helpful in decreasing postoperative pain in children.[67,68]. This technique requires the active cooperation of the patient and is most effective when used for children over 8 years old.[57]

Hypnosis

Hypnotherapy aims to alter sensory experiences and dissociate from pain experiences, and hypnosis is best for school aged or older children.[26] There is strong evidence that hypnosis is effective in reducing needle-related pain and distress in children and adolescents.[66,69] There is no evidence that hypnosis alone is capable of producing an anesthetic effect for dental procedures; therefore, it should always be combined with good local anesthetic techniques.[69]

Other Techniques

Studies have shown efficacies for pediatric pain management with other techniques such as relaxation and breathing exercises, transcutaneous electrical nerve stimulation, acupuncture, counterstimulation, virtual reality, and music therapies.[65, 67,70-75]. Additional research is need on these interventions to measure their effectiveness.

Pharmacologic Agents

Management of pain in children is changing rapidly as a result of improvements in the appreciation of pediatric pain and pharmacologic knowledge; however randomized controlled trials are lacking in children so the use of many pain medications are still considered "off label."[76,77] The American Academy of Pediatrics consensus statement on the assessment and management of pain in children recommends acetaminophen, ibuprofen and opioids as the top three medication choices for the treatment of acute pain in children.[3,16]

Non-opioid analgesics

Nonsteroidal anti-inflammatory drugs (NSAIDS):

NSAIDS are among the most commonly used class of drugs and have anti-inflammatory, analgesic, antipyretic and antiplatelet properties.[78] They inhibit prostaglandin synthesis; with specific action on cyclooxygenase (COX).[50] Representatives of the major categories of NSAIDS are: Salicylic acids: aspirin; Acetic acids: Toradol; Proprionic acids: ibuprofen, naproxen; and Cyclooxygenase 2 selective: Celebrex. Ibuprofen in oral or IV form is a commonly used analgesic and antipyretic agent used in pediatrics.[78] Ketorolac, an IV or intranasal NSAID is useful in treating moderate to severe acute pain in patients unable or unwilling to swallow oral NSAIDS.[26,54,79] Some of the adverse effects associated with NSAIDS include: inhibition of bone growth and healing, gastritis with pain and bleeding, decreased renal blood flow, inhibition of platelet function, and increased incidence of cardiovascular events.[26] A specific concern with NSAIDS is the potential to exacerbate asthma due to a shift in leukotrienes.[76] Due to shared

pathways NSAIDS and steroidal anti-inflammatory medications should not routinely be co-administered.[81]

Acetaminophen (APAP, paracetamol):

Acetaminophen is an analgesic with efficacy for mild to moderate pain and is an antipyretic.[81] Unlike NSAIDS, acetaminophen is centrally-acting and does not have effects on gastric mucosal lining or platelets.[81] The mechanism of action of acetaminophen is the blockade of prostaglandin and substance P production; and is administered in tablets, capsules, liquid but also available as oral disintegrating tablets (ODT) and oral disintegrating films (ODF), rectal and IV forms.[50] Studies have shown that rectal administration has somewhat higher bioavailability and faster onset than the oral route since it partially bypasses hepatic metabolism.[80] Pain control can be optimized when acetaminophen and NSAIDs are alternated or staggered which is known as multi-modal therapy.[76,81,82]

Opioid analgesics

Opioid analgesics have been used for many years to produce profound pain relief in all age groups. Opioid analgesics are considered for acute moderate to severe pain refractory to other therapies. Common use in pediatric patients include: cancer pain, sickle cell crises, osteogenesis imperfecta pain, epidermolysis bullosa pain, and pain related to neuromuscular disease.[83,84,85] Limited studies are available regarding postoperative opioid use in pediatric dentistry, but it is also rare that pediatric dental patients should require opioid analgesics following dental treatment.[50] Major concerns of opioid analgesics in the pediatric population are: efficacy, safety, misuse, and accidental deaths.[77,86,87]

Opioids interact differentially with mu, kappa, and delta receptors in the central nervous system. Opioid agonists act on receptors located in the brain, spinal cord and digestive tract. Pathways of opioid receptor signaling are multiple and include G-protein receptor coupling, cyclic adenosine monophosphate inhibition and calcium channel inhibition.[50] Activation of opioid receptors can cause respiratory depression, pupil constriction (miosis), euphoria, sedation, physical dependence, endocrine disruption, and suppression of opiate withdrawal.[26] Pruritus (itching) may also occur due to histamine release that accompanies some opioid analgesics.[48] Naloxone is a mu opioid receptor competitive antagonist usually administered parenterally to counter opioid overdose.[50] If patients are actively prescribed opioids for cancer or non-cancer pain, providers should choose another agent for analgesia or consult with specialty provider regarding opioid dosing.[77]

Opioids with active metabolites

Codeine, tramadol, and hydrocodone are opioids that are broken down in the liver to active metabolites by highly variable cytochrome enzyme CYP2D6.[22,81,88] These drugs are ineffective in some children due to poor drug metabolism.[9] Yet other patients known as "hyper-metabolizers" break these prodrugs to their active forms too quickly potentially resulting in overdose, respiratory depression, and even death.[88] The FDA and European Medicines Agency (EMA) have issued warnings and contradiction statements over the past few years on codeine and tramadol because of this. [88,89] Hydrocodone also relies on cytochrome p450 metabolism and has potential for similar adverse effects. Although systematic reviews have demonstrated that these medications might provide appropriate analgesia when compared to placebo, evidence is not convincing and safety concerns exist[90,91]. In 2017, the FDA issued a warning specifically for codeine and tramadol in all patients less than 12 years of age, stating they are no longer considered safe to use in this age group.[88] Deaths have occurred in children using these medicines for post tonsillectomy and/or adenoidectomy pain management, general pain, sore or strep throat pain, and cold and cough.[88] The FDA warns that in the 12-17-year age group, these medications should not be used in high-risk patients (obesity, OSA, lung tissue disease).[88]. Furthermore, tramadol and codeine should not be used if breastfeeding since active metabolites are present in breastmilk.[88]

Opioids without active metabolites

Inactive metabolites refer to metabolites that do not have a noticeable effect on the CNS. Naturally-occurring morphine and the synthetics oxycodone and fentanyl do not have CYP2D6 considerations since they do not contain active metabolites.[81]. Potency of all opioids is compared to morphine. Morphine provides rapid relief of severe pain for 2-3 hours and is associated with histamine release and respiratory depression. Fentanyl is 100X more potent than morphine, is ultra-short acting, and is used for invasive procedures and sedations.[26] Chest wall rigidity is a well-known adverse reaction to fentanyl.[26] Rapidly-acting oxycodone has a longer half-life than morphine and is more potent. Oxycodone is available as a single agent or is combined with aspirin, ibuprofen or acetaminophen. It comes in tabs, caps, oral solution and oral concentrate and use is considered off label in children 12 years of age and younger.[50]

Opioid concerns and CDC recommendations:

Trends in opioid overdose, opioid misuse, and concerns for opioid addiction prompted the CDC to issue guidelines for prescribing opioids for chronic pain.[30] The guideline aims to improve prescribing practices to ultimately benefit patient health and quality of life.[93] Although the guidance is specific for adults with chronic pain, all prescribers should be mindful of high-risk prescribing practices.[83] The guideline

recommends limiting opioids for moderate to severe pain, restricting prescription to three days, and providing concurrent pharmacologic and non-pharmacologic therapy.[30] The guideline also advises against overlapping benzodiazepines and opioids prescriptions.[30] Dentists can have a role in decreasing the overall availability of opioids for nonmedical use and abuse in the home and community.[95]

Deaths due to opioid overdoses are at record highs prompting the CDC to declare an opioid epidemic in 2011.[87,95] Poisoning deaths of opioids nearly quadrupled from 1999 to 2011 with the most recent data at 5.4 per 100,000 individuals. The study also demonstrated a trend towards increased pediatric emergency department (ED) visits due to opioid ingestion and a greater than 5-fold increase in overdose death rates in the 15-24-year age group.[95] Since commercial opioids are often combined with acetaminophen; the potential for hepatic failure from toxic levels of acetaminophen must also be considered.[7] As previously stated, providers treating pediatric and adolescent populations should avoid prescribing opioid analgesics when patients are using benzodiazepines.[30]

Risky use of opioids among children and adolescents is a growing trend and the concern for opioid use disorder (OUD) in adolescents is significant.[96,97] In 2016, the American Academy of Pediatrics released a policy statement that recommended timely intervention to curb opioid use disorder with the goal of eliminating long-term medical, psychiatric and social consequences of ongoing substance abuse.[98]

Risk mitigation begins with understanding how to recognize drug seeking behavior.[2] To address the potential risk of opioid use/abuse in pediatric patients, the CDC recommends that practitioners use screening tools. Unfortunately, there is no common standard for adolescent patients. Therefore, the practitioner should, at least, perform a thorough review of medical history including analgesics used in the past before prescribing.[77]. It is also known that children of parents that abuse opioids are at an increased risk for neglect and often suffer from parental instability and lack of structure in the home setting.[99] Therefore, behavioral health support may be required for emotional disturbances such as drug abuse, depression, or PTSD.[99] Although, screening of parents is recommended by the American Academy of Pediatrics, this is not a common standard practice.[99,100] Nonetheless, screening is essential for identifying children at risk of opioid exposure in the home.

For professionals that suspect patients have use / abuse issues, the Federal Drug Administration (FDA), National Institute of Health (**NIH**), National Institute on Drug Abuse (**NIDA**), the American Dental Association (**ADA**), and state prescription drug monitoring programs have resources available to review

the history of controlled substance prescriptions, as well as controlling the diversion of controlled substances.[101,102,103] Risk mitigation begins with understanding how to recognize drug seeking behavior.[2] Screening patients prior to prescribing opioids should be standard practice.[30] Screening is commonly performed with adult patients using a variety of screening tools.[104] Most agree some screening should be done for adolescents, however there is no common standard.[77] Transparent discussion of medication use with teens is important.[106]

Recommendations

- Pain assessment should be considered for all patients.
- Minimize tissue damage and use careful technique when providing dental treatment.
- Achieve profound anesthesia prior to invasive treatment.
- Consider use of pre-emptive analgesia when postoperative pain is anticipated.
- Nonpharmacologic techniques (i.e. distraction) should be carefully considered as potentially valuable interventions for pain management
- Use of APAP/NSAIDS as first line pharmacologic therapy for pain management.
- Use of opioids should be rare for pain management for pediatric dental patients.
- Screening of parent and patient is recommended when prescribing opioid analgesics.
- Proper disposal measures for all medications is recommended.
- Provider should be knowledgeable of risks associated with analgesic medications prescribed and anticipate and manage adverse effects (asthma and NSAIDS, sedation and opioids, etc.)
- Consider seeking expert consultation for patients with chronic pain or other complicated pain condition
- Providers should be familiar with analgesic properties of agents used during sedation or general anesthesia
- Avoid prescribing opioid analgesics if patient is using benzodiazepines
- Synergistic effect from multiple medications (multi-modal analgesia) may be considered

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This draft does not constitute an official AAPD health oral policy or clinical recommendation until approval by the General Assembly. Circulation is limited to AAPD members.

Policy for Selecting Anesthesia Providers for the Delivery of Office-Based General Anesthesia

Originating Council

AAPD Board of Trustees, Council on Clinical Affairs

Review Council

Council on Clinical Affairs

Adopted

2018

Purpose

The purpose of this policy is to guide dental professionals in selecting a qualified anesthesia provider for the delivery of deep sedation/general anesthesia in an office-based setting, specifically for pediatric and special healthcare needs populations. It is not the intent of this policy to suggest that any individual group of anesthesia provider is more qualified than another.

Methods

This policy was developed by the Council on Clinical Affairs, adopted in 2018, and is based on a review of current dental and medical literature pertaining to the education and training accreditation requirements of potential anesthesia providers.

Background

Pediatric patients and patients with special healthcare needs who are unable to accept dental care using a customary approach due to a lack of cooperation may have dental treatment accomplished by deeper forms of sedation or general anesthesia. Historically, these levels of care were provided in a surgical center or hospital-based setting by an anesthesiologist selected and vetted by the facility or institution. The dental surgeon had little, if any, choice as to who would provide these services. Current trends find an increasing number of dental providers electing to complete such care in the confines of their personal office using the services of a mobile anesthesia provider. Over the last decade, office-based deep sedation/general anesthesia in the dental office has proven to be safe and effective when delivered by a

highly competent and attentive individual. Substantial societal cost savings associated with the delivery of cases outside of a surgical center or hospital setting have also been well documented.[1] In an effort to establish the safest care possible, the American Academy of Pediatric Dentistry (AAPD) wishes to assist its members in screening potential anesthesia providers. The following document shall serve to help guide members during the screening process associated with selecting a competent and experienced anesthesia provider for the delivery of office-based care for the pediatric and special needs populations.

With the use of office-based deep sedation/general anesthesia, the primary dental provider takes on the significant responsibility of creating a team of highly qualified professionals to deliver care in an optimal and safe fashion. No other responsibility is more important than identifying an anesthesia provider that is meticulous and highly competent. Dentists collaborate closely with mobile anesthesia providers to expand the field of dental medicine, provide access to care, establish an enhanced level of patient cooperation, improve surgical quality, and offer an elevated level of patient safety during the delivery of dental care.

It is important to acknowledge that not all anesthesia providers have equal training and experience delivering care during procedures performed within and around the oral cavity, especially in the pediatric or special healthcare needs patient populations or on a mobile basis. With this, we offer a summary of the advanced training and certifying credentials associated with the anesthesia providers that most commonly provide mobile anesthesia care in an office-based dental setting.

Anesthesia Assistant (AA). A non-physician, dentist or nurse who practices anesthesia under the medical direction of a licensed practitioner. To attain AA credentials, one must complete a 24-28 month, Master's level program, accredited by the Commission for the Accreditation of Allied Health Educational Programs (CAAHEP) and pass the National Commission for the Certification of Anesthesiologist Assistants (NCCAA) examination administered and graded by the National Board of Medical Examiners. AA clinical training includes the completion of approximately 600 administered anesthetics.[2]

After completion of a formal anesthesia assistant educational program, AA's commonly work within the profession under the direct supervision of a licensed medical or dental anesthesia provider in hospital and ambulatory surgical centers, as mobile anesthesiologists, in office-based settings, and as anesthesia faculty in AA academic institutions.

There are societies within medicine that offer resources to learn more about the anesthesia training provided to AAs including the American Academy of Anesthesiologist Assistants (www.anesthestist.org).

Certified Registered Nurse Anesthetist (CRNA) or **nurse anesthetist** is a licensed professional nurse who is trained to provide the same anesthesia services as a physician anesthesiologist. Once a licensed registered nurse, a CRNA must first complete one year of critical care experience followed by graduation from an accredited 2-3 year nurse anesthesia educational program. Graduates may then sit for the National Board of Certification and Recertification for Nurse Anesthetists (NBCRNA) certifying examination.[3] (CRNA educational reference?)

CRNA's commonly work under the supervision of a licensed anesthesia provider within the profession as anesthesia providers in hospital and ambulatory surgical centers, mobile anesthesiologists in office-based settings, and as anesthesia faculty in CRNA, medical and/or dental academic institutions. Certain states and rural facilities within the United States allow CRNA's to provide anesthesia services void of the presence of a medical or dental licensed anesthesia provider.

There are societies within medicine that offer resources to learn more about the anesthesia training provided to CRNAs, such as the American Association of Nurse Anesthetists (www.aana.com), National Board of Certified and Recertification for Nurse Anesthetists (www.nbcrna.com), International Federation of Nurse Anesthetists (www.ifna.site).

Dentist anesthesiologists (DA) are anesthesia providers dedicated to providing services exclusively for patients undergoing orofacial and dental procedures. They receive post-graduate specialty training following dental school during a 3-year anesthesia residency program outlined by the Commission on Dental Accreditation (CODA) standards. A dental anesthesia residency clinical curriculum typically consists of emergency rescue, advanced airway management, internal medicine, emergency medicine, cardiology, general/internal medicine, pain medicine, pediatrics, pulmonary medicine, and intensive care rotations. DA residents participate alongside their physician colleagues performing anesthesia during general surgery, ENT, ophthalmic, complex oral surgery, cosmetic and body contouring, orthopedic, obstetric, trauma and organ transplant surgeries. Clinical training includes a minimum requirement of completing 800 total anesthetic cases, 125 pediatric cases on children 7-years old and under, as well as 75 patients with special needs.[4] DA training programs also provide residents with experience providing mobile office-based sedation and anesthesia care during the delivery of pediatric, special healthcare needs and adult dental procedures. DAs are obligated to maintain current BLS, ACLS and/or PALS

certifications, based on state board and permitting requirements.

The practice of dental anesthesiology is recognized by the American Dental Association and has recently gained specialty status in select states, with other states expected to follow. Subsequent to the successful completion of a residency program, graduates are eligible to sit for the written and oral examination of the American Board of Dental Anesthesiology (ABDA) and the written certifying examination of the National Dental Board of Anesthesiology (NDBA).

Dentist anesthesiologists work within the profession as mobile anesthesia providers in office-based dental and medical settings, hospital anesthesiologists for medical and dental cases, anesthesiologists in ambulatory surgical centers, and anesthesia faculty in medical and dental academic institutions.

There are societies within dental medicine that offer resources to learn more about dentist anesthesiologists, such as the American Society of Dentist Anesthesiologists (www.asdahq.org), American Dental Society of Anesthesiology (www.adsahome.org), American Board of Dental Anesthesiology (www.adba.org), National Dental Board of Anesthesiology (www.ndbahome.org), and the International Federation of Dental Anesthesiology Societies (www.ifdas.org).

Physician anesthesiologists provide anesthetic services for medical and dental procedures. They receive post-graduate anesthesia training during a 3-year residency following medical or osteopathy school and a year of hospital internship. Traditional medical anesthesia training provides exposure to a minimum of 100 total pediatric patients under the age of 12-years old; 20 of which must be younger than 3 years of age, including five patients under 3-months old.[5] Though there are no prescribed requirements for the delivery of anesthesia care specifically for dental and oral surgical procedures, most physician anesthesiologists will obtain some exposure to these populations while providing care in a hospital setting. Few physician anesthesiologists, however, obtain experience providing mobile or office-based anesthetic care outside a hospital or ambulatory surgical setting during their formal anesthesia training program.

After residency, anesthesiologists have the option to complete an additional 1-2 year fellowship in areas such as pain management, cardiac anesthesiology, pediatric anesthesiology, neuro-anesthesiology, obstetric anesthesiology or critical care medicine. During an advanced fellowship in pediatric anesthesiology, the doctor gains more in-depth experience providing care for both healthy and sick pediatric populations within a hospital setting.

Following successful completion of an anesthesiology residency program, graduates are eligible to sit for the American Board of Anesthesiology (ABA) written and oral examinations. All anesthesiologists must be licensed to practice medicine in their given state and are required to maintain ACLS and/or PALS certification. Additional certifications are available from the ABA in critical care and pain management.

Physician anesthesiologists commonly work within the profession as anesthesia providers in hospital and ambulatory surgical centers, as mobile anesthesiologists in office-based medical and dental settings, and as anesthesia faculty in medical and/or dental academic institutions.

There are societies within medicine that offer resources to learn more about physician anesthesiologists, such as the American Society of Anesthesiologists (www.asahq.org), American Dental Society of Anesthesiology (www.adsahome.org), American Board of Anesthesiology (www.theaba.org), Society for Ambulatory Anesthesia (www.sambahq.org), and the Society for Pediatric Anesthesia (www.pedsanesthesia.org).

Oral and Maxillofacial Surgeons (OMFS) are dental specialists with specialty training in the diagnosis, surgical and adjunctive treatment of diseases, injuries and defects involving both the functional and esthetic aspects of the hard and soft tissues of the oral and maxillofacial regions. Following dental school training, oral and maxillofacial residents enter a 4-6 year specialty training program which includes a minimum of 5 consecutive months of anesthesia training alongside their medical and dental anesthesia counterparts. During this training, OMFS residents perform anesthesia care during general surgery, ENT, ophthalmic, complex oral surgery, cosmetic and body contouring, orthopedic, obstetric, trauma and organ transplant surgeries. During these 5-months of exclusive training in anesthesia, one month must be dedicated solely to pediatrics, which may include rotations in a PICU or NICU setting and/or through direct delivery providing pediatric anesthesia in a hospital or ambulatory setting. The cumulative anesthetic experience of each graduating resident must include administration of general anesthesia/deep sedation to a minimum of 300 total patients. At least 150 of these cases must be ambulatory anesthetics during oral and maxillofacial surgeries. A minimum of 50 patients must be pediatric (OMFS defines a pediatric patient as 18 years of age or younger). Both ACLS and PALS training is required prior to the completion of OMFS training.[6] Those successfully completing an OMFS specialty training program are eligible to take the National Dental Board of Anesthesiology (NDBA) written examination.

Oral and maxillofacial surgeons commonly work within the profession as an operator-anesthetist in a private office environment, as a surgeon in a hospital setting, providing mobile anesthesia within dental facilities, and as faculty in medical and/or dental academic institutions.

There are societies within dental medicine that offer resources to learn more about the anesthesia training provided to oral and maxillofacial surgeons, such as the American Academy of Oral and Maxillofacial Surgeons (AAOMS) (www.aaoms.org) or the National Dental Board of Anesthesiology (www.ndbahome.org).

Table 1. Anesthesia Training Comparison[1]

Anesthesia Provider	Able to Function As An Independent Anesthesia Provider	Minimum Length of Focused Anesthesia Training	Minimum Number of DS/GA Cases	Minimum Number of Pediatric DS/GA Cases	Definition of Pediatric Patient	Minimum Number of Special Needs DS/GA Cases	Graduate Qualifies for Anesthesia Board Certification with the…
Anesthesia Assistant	No	24 mon[2]	600	N/A	N/A	N/A	None
Certified Registered Nurse Anesthetist	No	24 mon[2]	600	40	≤12 yrs	N/A	NBCRNA
Dentist Anesthesiologist	Yes	36 mon[2]	800	125	≤7 yrs	75	ABDA NBDA
Medical Anesthesiologist	Yes	36 mon[2]	N/A	100	≤12 yrs	N/A	ABA
Oral and **Maxillofacial Surgeon**	Yes	5 mon[3]	300	50	≤18 yrs	N/A	NBDA

[1]*Abbreviations:*

DS/GA – Deep Sedation/General Anesthesia

ABDA – American Board of Dental Anesthesiology

NBDA – National Board of Dental Anesthesiology

ABA – American Board of Anesthesiology

NBCRNA – National Board of Certified Registered Nurse Anesthetists

[2]*Please note that this period includes hospital-based rotations under non-anesthesia services.*

[3]*Includes 1 month of dedicated pediatric anesthesia, however, this period may contain informal anesthesia experiences in a PICU and/or NICU setting.*

It is important for operating dentists to appreciate the diversity in anesthesia education among potential providers, and if appropriate, further investigate an individual's training and experience. A candid discussion with a potential anesthesia provider to establish the individual's comfort and experience with

unique patient populations (special needs, infants and toddlers, certain comorbidities, etc.) is extremely important, especially if it is anticipated that this will represent a large portion of a dental practice's anesthesia focus. Lastly, dentists must recognize the additional exposure to potential liability issues associated with the delivery of deep sedation/general anesthesia within their personal office and establish a rigorous vetting strategy to help mitigate this risk. Selection of a skilled and knowledgeable anesthesia provider is paramount in providing patients with the safest care possible.

20 QUESTIONS TO ASK A POTENTIAL ANETHESIA PROVIDER

1. What is your experience with providing mobile deep sedation/general anesthesia care?
2. What is your experience with pediatric patient populations? …special healthcare needs populations?
3. How did your training prepare you for the delivery of anesthesia on a mobile basis?
4. What is your experience with providing anesthesia for dental cases?
5. How long have you provided mobile dental anesthesia care for pediatric patients? …special needs patients?
6. Explain how you evaluate a dental facility and staff prior to initiating mobile anesthesia services.
7. What expectations and requirements do you have for the dentist, auxiliary staff and facility?
8. What equipment and/or medications should be maintained by the dental facility?
9. How would you manage a medical emergency?
10. What are some potential emergencies associated with the delivery of deep sedation/general anesthesia?
11. What is the role of the dentist and auxiliary staff during a medical emergency?
12. How do you prepare the dentist, auxiliary staff and facility for the possibility of a medical emergency?
13. Explain how you prepare a patient for office-based deep sedation/general anesthesia?
14. What is the office's role in preparing a patient for office-based deep sedation/general anesthesia?
15. What is your discharge criteria and follow-up protocol for patients who receive office-based deep sedation/general anesthesia on an outpatient basis?
16. Explain a typical general anesthesia case from start to finish.
17. What is your protocol for ordering, storing and recording controlled substances for deep sedation/general anesthesia cases?
18. Do you have any specific patient criteria (ie: age, weight, comorbidities, etc.) in identifying potential candidates for office-based deep sedation/general anesthesia?

19. What are the patient costs associated with the deep sedation/general anesthesia services?
20. What are the long and short-term effects of anesthetic agents on neurologic development in young patients?

References

1. Rashewsky S, Parameswaran A, Sloane C, et al, Time and Cost Analysis: Pediatric Dental Rehabilitation with General Anesthesia in the Office and the Hospital Settings. *Anesthesia Progress*. 2012 Winter; 59(4):147-158.
2. Commission on Accreditation of Allied Health Education Programs. Standards and guidelines for the accreditation of educational programs for the anesthesiologist assistant. Approved 1987, revised 2009.
3. CRNA educational reference (need to find a formal reference source listing CRNA educational requirements)
4. Commission on Dental Accreditation. Accreditation Standards for Advanced General Dentistry Education in Dental Anesthesiology, 2017.
5. Accreditation Council for Graduate Medical Education Program Requirements for Graduate Education in Anesthesiology, July 1, 2017.
6. Commission on Dental Accreditation. Accreditation Standards for Advanced Specialty Educational Programs in Oral and Maxillofacial Surgery, 2017.