Acute Pain Management for Pediatric Dental Patients

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Abstract

This statement summarizes current best practices in pediatric pain management for dentists and other stakeholders. Infants, children, adolescents, and individuals with special health care needs may experience pain resulting from dental/orofacial injury, infection, and dental procedures. Dental pain, an inflammatory condition, can be categorized as somatic (ie, periodontal, alveolar, mucosal) or visceral (ie, pulpal). Effective pain management begins with careful assessment for every patient, as inadequate treatment can result in significant physical and psychological consequences. Perioperative pain management approaches include preemptive pain management (eg, anesthetics), use of local anesthesia during general anesthesia for postoperative pain control, nonpharmacological anxiolytic interventions (eg, providing a calm environment, emotional support), distraction and imagery (eg, counting, video games), and pharmacological agents including non-opioid analgesics (eg, nonsteroidal anti-inflammatory drugs, acetaminophen) and opioid analgesics. Acetaminophen and nonsteroidal anti-inflammatory medications are first line pharmacologic therapies for pain management. Opioids should rarely be used in this population and, when necessary, should be prescribed with measures to minimize misuse.

This document was developed through a collaborative effort of the American Academy of Pediatric Dentistry Councils on Clinical Affairs and Scientific Affairs to offer updated information and guidance on acute pain management in infants, children, adolescents, and individuals with special health care needs.

KEYWORDS: PAIN MANAGEMENT; ACUTE PAIN; PAIN, POSTOPERATIVE; FACIAL PAIN; TOOTHACHE; ANALGESIA

Purpose

The American Academy of Pediatric Dentistry recognizes that infants, children, adolescents, and individuals with special health care needs can experience pain due to dental/orofacial injury, infection, and dental procedures. Inadequate pain management may have significant physical and psychological consequences for the patient. Appreciation of pediatric pain can help practitioners develop clinical approaches to prevent or substantially relieve dental pain. When pharmacological intervention is necessary to manage pain, the practitioner must understand the consequences, morbidities, and toxicities associated with the use of specific therapeutic agents. These recommendations are intended to provide oral health care professionals and other stakeholders with current best practices for acute pain management in pediatric dentistry.

Methods

This document was developed by the Council on Clinical Affairs, adopted in 2018,[1] and last revised in 2022.[2] It is based on a review of current dental and medical literature pertaining to pain management in pediatric dental patients. Review of federal and professional pain management guidelines and consensus statements were reviewed to assist with this document.

An electronic search was conducted in the PubMed/MEDLINE database using the terms: (*evidence based dentistry* [**Majr**] OR *pediatric dentistry* [Majr] OR *dental care for children* [Majr] OR *paediatric dentistry* [**Tiab**] OR *dental health services* [Majr] OR *dentistry* [Majr] OR *public health dentistry* [Majr] OR *community dentistry* [Majr] OR *oral health* [Majr]) AND (*dental pain management* [Tiab] OR *postoperative pain management* [Tiab] OR *pediatric pain management* [Tiab] OR *analgesic overdose** OR ***NSAIDs*** [Tiab] OR *nonsteroidal anti-inflammatory drug**); fields: all; limits: within the last 10 years, humans, English, systematic review, and clinical trials. There were 327 articles that 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 as "an unpleasant sensory and emotional experience

ABBREVIATIONS
CDC: Centers for Disease Control and Prevention. **FDA:** US Food and Drug Administration. **IV:** Intravenous. **Majr:** Medical subject headings major topic. **NSAIDs:** Nonsteroidal anti-inflammatory drugs. **Tiab:** Title and abstract.

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

associated with, or resembling that associated with, actual or potential tissue damage."[3] The association's expanded definition includes 6 items that provide further context to the complex topic of pain: (1) pain is always a personal experience; (2) pain is a lived experience that is distinct from the neural process known as nociception; (3) pain is learned through life experiences; (4) a person's report of pain should be respected and accepted; (5) pain can have adverse effects on function and well-being; and (6) pain can be expressed in many ways; verbal description is just 1 of several possible behaviors.[3]

Pain experienced during dental procedures can be distressing for the patient and caregivers as well as for the provider and staff and can also lead to difficult behavior, dental fear, and avoidance behavior in the child.[4] Moreover, pain experience in childhood may shape future pain experiences in adulthood.[5(p151),6]

Pain may be divided into diagnostic categories such as somatic, visceral, and neuropathic.[7(p4)] Pain encountered in dentistry is typically inflammatory and categorized as somatic (ie, periodontal, alveolar, mucosal) or visceral (ie, pulpal) pain.[7(p4)]

Three principal types of stimuli can activate dental sensory nerves: mechanical (such as trauma), chemical (including bacterial products and other irritants), and thermal (heat and cold).[7(p6)] Toothache is a frequent intraoral source of orofacial pain in children.[8] Dental pulp pain arises when Aδ (A-delta) fibers, which mediate sharp, transient pain, and C fibers, which mediate dull, lingering pain, are activated by inflammatory mediators in response to bacterial invasion, chemical irritation, thermal stimulation, or mechanical trauma.[7(p7)] Periodontal pain occurs when infectious or traumatic insults to the gingiva, periodontal ligament, and alveolar bone stimulate free nerve endings.[7(p4)] Other sources of orofacial pain include temporomandibular disorders (eg, joint pain, masticatory muscle pain), headaches (eg, migraine, tension type), or other non-odontogenic causes (eg, pathologic jaw lesions, oral ulcers, neuralgia).

Understanding nociception (ie, pain processing) is essential for the management of pain. Following tissue injury, infection, or invasive treatment, thermal, mechanical, and chemical stimuli activate receptors on free nerve endings in vital structures in the orofacial region.[9(p48),10] In turn, 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.

Sensitization of central and peripheral nervous system circuits occurs following significant tissue damage or prolonged neuronal stimulation[10] and can lead to an exaggerated pain response to noxious stimuli termed primary hyperalgesia (at the site of injury)[10] or secondary hyperalgesia (at other sites). Allodynia refers to pain perception following innocuous stimuli (eg, light touch) and is characteristic of central sensitization.[12] Both pharmacologic and nonpharmacologic methods target central nervous system (CNS) inhibitory processes to alter pain processing.[13(p633),14]

Pain also may be categorized as acute or chronic. Acute pain typically is of sudden onset, is closely linked to tissue injury, inflammation, or surgical procedures, and usually resolves as healing occurs.[15] If acute pain fails to respond to treatment, it may persist and transition into chronic pain.[15] Chronic pain refers to pain that is dysfunctional and persists beyond the time for typical tissue healing.[3,16] Chronic pain is a costly public health problem that is difficult to treat.[17,18] Temporomandibular disorder (TMD) is an example of a chronic pain condition encountered in dentistry.[19]

Pain assessment is an integral component of the dental history and comprehensive evaluation. When symptoms or signs of orofacial/dental pain are evident, a detailed pain assessment helps the dentist derive a clinical diagnosis, develop a prioritized treatment plan, and better estimate analgesic requirements for the patient. Direct questioning or a structured, comprehensive pain assessment can be clinically beneficial for pediatric and adolescent patients.[20,21(p322)] 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.[22] Extending the assessment beyond intensity scoring to include functional impact, temporal trajectory, sleep disturbance, emotional and behavioral effects, response to prior therapies, and patient and family goals facilitates clinical decision making.[3,23] 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.[21(p322)] Behavioral reactions[21(p324-325)] (eg, vocalizations, facial expressions, body movements) and physiological responses[12(p325-326)] (ie, heart rate, oxygen saturation, stress response) are informative when assessing pain in nonverbal patients, young patients, and patients with special health care needs.[24] Additionally, ethnic, cultural, and language factors may influence the expression and assessment of pain.[25]

Validated instruments for assessing pain in verbal or nonverbal patients, depending on age and developmental status, include: Wong-Baker FACES; Faces Pain Scale (Revised); visual analogue scale (VAS); numeric rating scale (NRS); Faces, Legs, Activity, Cry, and Consolability score (FLACC); Revised Faces, Legs, Activity, Cry and Consolability (r-FLACC); and the McGill Pain Questionnaire.[21(p323-325),24,26,27] Because no single tool is appropriate for all children, selection of pain assessment instruments may be based on the patient's developmental stage and the clinical setting. Validated pediatric pain assessment tools and their main strengths[26] are included in the following table.

Pain management

Preemptive pain management

Preemptive pain management is the use of an anesthetic agent, medication, or technique administered prior to a surgical procedure to minimize or prevent pain. Goals of preemptive pain management include attenuating central sensitization,

Table. PAIN ASSESSMENT TOOLS FOR USE IN THE PEDIATRIC DENTAL SETTING

Tool	Type	Age group	Strengths/notes
Wong-Baker FACES	Self-report (faces)	3+ years	Simple, widely used; culturally adaptable
Faces Pain Scale – Revised (FPS-R)	Self-report (faces)	4+ years	Validated internationally; avoids smiling faces issue
Visual Analogue Scale (VAS)	Self-report (line scale)	7+ years (with abstract thinking)	Sensitive but requires abstract thinking
Numeric Rating Scale (NRS)	Self-report (0–10 numeric)	8+ years	Quick and easy; widely validated
FLACC	Behavioral/observational	2 months–7 years	Reliable for acute/postoperative pain; simple scoring
r-FLACC	Behavioral/observational (cognitive impairment)	Children with cognitive impairment	Validated for children with developmental disabilities
McGill Pain Questionnaire	Multidimensional questionnaire	Adolescents and adults (adapted for pediatrics)	Comprehensive but time-consuming

decreasing postoperative pain, improving recovery, and reducing postoperative analgesic consumption.[11,13(p633),28,29] Data supports preemptive measures to optimize pain control for a variety of dental and surgical procedures.[22,29-31]

Achieving profound anesthesia prior to initiating invasive treatment decreases central sensitization.[22] Topical anesthetics are used in dentistry to minimize pain; yet, these medicaments alone may not be sufficient for dental procedures.[32,33] Compounded topical anesthetic formulations combining multiple local anesthetics have been developed to enhance efficacy and reduce discomfort during procedures such as local anesthetic injection, scaling, and minor soft tissue surgery; professional application is required. In pediatric populations, dosing and contraindications are key safety concerns when considering commercially available or compounded agents.[34,35] Adjunctive nonpharmacologic approaches, such as cryotherapy, and cooled topical anesthesia also have demonstrated benefit, with recent systematic review and meta-analysis evidence showing reduced intraoral injection pain compared with conventional topical anesthetics alone.[36]

Local anesthetic administration techniques, the anesthetic's properties, and the needle used during injection may contribute to a patient's pain experience.[37] Distraction techniques made at the time of the injection (eg, jiggling the patient's cheek, applying pressure to the palate with a mirror handle) take advantage of Aß (A-beta) fiber signal dominance and can significantly reduce the intensity of pain-related C-fiber signaling.[37-39]

Decreasing acidity of local anesthetics containing a vasoconstrictor by using sodium bicarbonate as a buffer can reduce injection site pain, facilitate faster onset, and decrease postoperative discomfort.[40] A recent systematic review demonstrated lower pain scores following inferior alveolar block injections in children when buffered versus nonbuffered local anesthesia was used; however, there was no difference in observer-reported pain behavior.[40] Finally, decreasing anesthetic delivery rate also has demonstrated pain reduction during injection.[41] Alternative delivery systems, including intraosseous and computer-controlled injection technologies, have been introduced and are sometimes marketed as improving comfort or onset characteristics. However, high-quality evidence demonstrating superiority over traditional techniques remains limited, and practical considerations such as equipment availability, training, and cost may influence their use.[42]

The use of preemptive analgesics in conjunction with local anesthetics has been shown to increase the ability to achieve pulpal anesthesia in patients with irreversible pulpitis,[43] suppress the intensity of injection pain, and reduce pain following extractions.[29,31] In dentistry, the most commonly used preemptive analgesics are nonsteroidal anti-inflammatory drugs (NSAIDs; eg, ibuprofen), which are considered first-line therapy, and acetaminophen, which may be used alone or in combination with NSAIDs for enhanced pain control.[29,30] NSAIDs are preferred because they address both pain and the inflammatory component associated with dental procedures, and they have consistently demonstrated superior efficacy compared to opioids for acute dental pain.[30] When used together, NSAIDs and acetaminophen provide additive or synergistic effects, offering greater analgesia than either drug alone while maintaining a favorable safety profile.[30] Analgesics with sedative properties may be administered in the pre-, peri-, or postoperative period when moderate to severe pain is anticipated. Their use can be incorporated into minimal, moderate, or deep sedation, as well as general anesthesia.[44-47]

Use of local anesthesia during general anesthesia

Although pain is not consciously experienced during general anesthesia, nociceptive stimuli activate peripheral or central nerves and can lead to increased future pain sensitivity.[22,48] Central sensitization is minimized with preemptive analgesia or local anesthesia. For this reason, regional block or infiltration anesthesia is commonly performed prior to surgical procedures to attenuate intraoperative nociceptive input and reduce peripheral and central sensitization, with decreased postoperative pain representing an additional benefit.[11,49] The decision to withhold local anesthesia containing vasoconstrictors during general anesthesia may reflect concerns about synergistic physiologic or cardiovascular effects when combined with systemic anesthetics or sedatives, as well as the desire to avoid postoperative numbness and the risk of self-inflicted oral trauma.[49,50]

Nonpharmacologic approaches to pain management

Nonpharmacologic interventions can be effective both alone and as adjuncts to pharmacological interventions in managing procedure-related pain, anxiety, and distress with minimal risk of adverse effects.[51-53] These interventions, which include distraction, relaxation techniques, guided imagery, cognitive-behavioral therapy, and newer modalities such as virtual reality, help redirect attention, reduce anticipatory anxiety, and improve cooperation during procedures.[53] Evidence suggests that the greatest benefit is achieved when nonpharmacologic strategies are combined with pharmacologic measures, yielding superior reductions in pain and anxiety.[38,54] Nonetheless, studies also acknowledge that in cases of mild pain or anxiety, such approaches may be sufficient on their own and contribute to fostering positive treatment experiences.[52,53,55]

Fear and anxiety activate circuits within the central nervous system that facilitate pain.[16] Establishing a safe, supportive, and child-friendly environment can help reduce perioperative anxiety and stress and contribute to improved postoperative comfort and pain coping in pediatric patients.[38,51,56,57] 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.[38,58,59]

Distraction and imagery

Distraction is a well-supported and effective nonpharmacologic method for managing pain, anxiety, and distress in the pediatric population.[25,38,60] It can be cognitive (eg, counting, nonprocedural talk) or behavioral (eg, videos, games), both of which aim to shift attention away from pain. Distraction techniques may be used by health care providers or the child's caregiver.[51,57] Distraction techniques may be of great use with patients with special needs who have shortened attention spans and cannot understand verbal reasoning or reassurance.[59]

Imagery guides the child's attention away from the procedure by harnessing imagination and storytelling. Imagery in combination with distraction has been shown to decrease postoperative pain significantly in children.[60,61]

Hypnotherapy

Hypnotherapy, a therapeutic technique that uses guided relaxation, focused attention, and suggestion, aims to alter sensory experiences and dissociate from pain experiences. Hypnosis is best for children of school age or older.[38,62] Systematic reviews have recommended more well-designed research on hypnosis as a tool for reduction of anxiety and pain in the dental setting.[63,64]

Virtual reality and smart phone applications

Using digital technology can provide distraction and reduction in pain and distress for children undergoing painful procedures.[65,66] The use of virtual reality, video games, and smartphone applications has shown a reduction in self-reported and observer-reported pain and distress during common procedures such as venipuncture and dental and burn treatments.[65] Some studies suggest that more immersive or interactive distraction modalities (eg, audiovisual media, virtual reality) may improve pain outcomes compared with less immersive approaches.[38,67-69] However, evidence is still limited, and further trials directly comparing a tablet to virtual reality glasses distraction in pediatric dental settings are warranted.[66,70]

Other techniques

Other effective techniques for pediatric pain management include relaxation and breathing exercises, transcutaneous electrical nerve stimulation, acupuncture, counterstimulation, video modelling, and music therapies.[59,60,71-76] Recently, auditory interventions such as binaural beats, which use sound frequency differentials to influence brainwave activity, have been explored as potential tools for reducing anxiety and modulating pain perception.[77] Use of these technologies may have synergistic analgesic effects. Additional research on different modalities is warranted.[75,78]

Pharmacologic/therapeutic agents

Management of pain in children has shifted significantly in recent years as understanding of pediatric pain and pharmacology has advanced.[25,79-81] NSAIDs alone or in combination with acetaminophen have been recommended as first-line therapy for acute dental pain in children; when used together, this combination provides superior analgesia compared to either agent alone.[30] Importantly, these medications have the strongest evidence base and the most favorable safety profile when dosed appropriately.[30] Still, many other pharmacologic agents continue to be prescribed off label due to the limited number of randomized controlled trials in children.[79,82]

Non-opioid analgesics

Nonsteroidal anti-inflammatory drugs. A recent network meta-analysis reported that NSAIDs as a class provide the greatest benefit and least harm for acute pediatric pain, with the added advantage of reducing the need for rescue mediations.[83] NSAIDs are among the most commonly used class of drugs and have anti-inflammatory, analgesic, antipyretic, and antiplatelet properties.[84] They inhibit prostaglandin synthesis, with specific action on cyclooxygenase (COX), the enzyme responsible for converting arachidonic acid into pro-inflammatory mediators that drive postoperative pain, swelling, and hyperalgesia.[46,85] Representatives of the major categories of NSAIDs are salicylic acids (aspirin), acetic acids (ketorolac), propionic acids (ibuprofen, naproxen), and selective cyclooxygenase-2 inhibitor (celecoxib). Ibuprofen in oral or intravenous (**IV**) form is a safe and commonly used analgesic and antipyretic agent in pediatrics.[81,84] Ketorolac, an IV or intranasal NSAID, is useful in treating moderate to severe acute pain in patients unable or unwilling to swallow oral NSAIDs.[46,86,87(p682)] Ketorolac has demonstrated effectiveness for short-term management of acute pain in pediatric patients, including in emergency department settings, but current evidence does not show superiority over other NSAIDs.[83,88] Systematic reviews emphasize its role as a useful

non-opioid option while underscoring the need for further research to establish optimal dosing, administration routes, and comparative effectiveness across clinical scenarios.[83,88]

Adverse effects associated with NSAIDs include: rash, inhibition of bone growth and healing, gastritis with pain and bleeding, decreased renal blood flow and kidney dysfunction, reversible inhibition of platelet function, hepatic dysfunction, and increased incidence of cardiovascular events.[87(p682),89(p103)] A specific concern with NSAIDs is the potential to exacerbate asthma due to a shift in leukotrienes.[79] Because NSAIDs and corticosteroids both act on the arachidonic acid pathway, their combined use does not provide additive analgesic benefit and instead increases the risk of adverse effects such as gastrointestinal irritation, bleeding, and impaired wound healing.[90] Ketorolac carries important safety concerns, including risks of gastrointestinal bleeding, platelet inhibition, and renal impairment, which limit its use to brief courses and make it less suitable for routine dental care.[83,88]

NSAIDs, including ibuprofen and naproxen, are recommended as first-line therapy for acute dental pain such as toothache.[30,91,92] Current evidence-based guidelines support NSAIDs as the initial pharmacologic approach because they target the inflammatory component of dental pain and provide effective analgesia when used appropriately.[30] Although naproxen is not labeled for all pediatric age groups, clinical guidelines note that it may be considered for older children and adolescents when clinically appropriate, with attention to age, weight, dosing, and contraindications.[30] NSAIDs should be used unless contraindicated and in conjunction with definitive dental treatment when indicated.[30]

Acetaminophen. Acetaminophen (acetyl-para-aminophenol [APAP], paracetamol) is an analgesic with efficacy for mild to moderate pain and is an antipyretic.[93] Unlike NSAIDs, acetaminophen is centrally acting and does not have anti-inflammatory effects or an effect on gastric mucosal lining or platelets.[93] Its mechanism of action is the blockade of prostaglandin and substance P production. Allergic reactions are rare,[89(p103)] but toxicity from overdose may result in acute liver failure.[94] Acetaminophen can be administered in tablets, capsules, and liquid but also is available as oral disintegrating tablets, oral disintegrating films, and rectal and IV forms.[46] Oral acetaminophen remains the preferred route for most pediatric patients due to its safety, ease of use, well-established efficacy, and cost. Rectal administration can be considered when oral dosing is not feasible, although variability in absorption limits its reliability.[95] If rectal is required, consider a loading dose to achieve therapeutic levels.[96,97] Intravenous acetaminophen typically is reserved for inpatient or critical care settings, where oral or rectal absorption may be compromised.[97] Therefore, its use should be restricted to cases of moderate to severe pain or when strict temperature control is required.[96,97]

Combination analgesia: NSAIDs and acetaminophen. Combination therapy using an NSAID and acetaminophen may be considered when a single agent fails to provide adequate pain relief or when moderate/severe postoperative pain is anticipated.[30,92] Concurrent use of these agents can provide greater relief for acute dental pain than either medication alone.[30,92] Scheduling alternating or staggered administration —rather than as-needed dosing—can help maintain consistent analgesia while minimizing peak dosing.[30,92] When used in combination, dosing of each medication should be based on age and weight, with attention to contraindications and maximum daily dose limits.[30]

Opioid analgesics

Opioid analgesics have long been used to provide profound pain relief in all age groups and may be considered for acute severe pain refractory to first-line therapies.[98] However, their role in dentistry is limited as opioids primarily interrupt nociceptive signaling via the μ receptor to inhibit pain perception but do not address the underlying inflammatory processes that drive most dental pain.[85] Opioids are not recommended for routine management of acute dental pain in children due to 1) limited efficacy[99,100]; 2) significant safety risks; 3) potential for misuse, diversion and accidental ingestion leading to overdose; and 4) lack of evidence demonstrating superiority over non-opioid regimens.[30,82,101,102] For these reasons, only short-acting, immediate-release opioids—prescribed at the lowest effective dose for the shortest duration possible—are appropriate.

Opioids increase risk of respiratory depression, sedation, physical dependence, and endocrine disruption.[87(p694),103] Use of opioids warrants additional caution for patients with hepatic or renal impairment.[87(p685)] In the setting of liver dysfunction, impaired metabolism can increase circulating drug concentrations and prolong effects, while renal impairment may delay clearance of active metabolites, elevating the risk of toxicity.[87(p685),104] These concerns are particularly relevant in pediatrics, where unpredictable pharmacokinetics already complicate safe prescribing.[87(p682)] Naloxone is a μ-receptor competitive antagonist usually administered parenterally to counter opioid overdose.[46]

Opioids vary in efficacy and safety among patients.[87(p684)] Morphine provides rapid relief of severe pain for 2 to 3 hours,[87(p685),105] and the potency of all opioids, including codeine, oxycodone, hydrocodone, fentanyl, methadone, and tramadol, is compared to morphine using a morphine milligram equivalent dose.[87(p685)] Considering the variability of drug metabolism, safety concerns, and the experience of pain, the 'right' dose for everyone does not exist.[87(p684)]

Codeine has more adverse effects and limited efficacy for dental pain when compared to over-the-counter analgesics.[85] Codeine, tramadol, and other opioids are broken down in the liver to active metabolites by the highly variable cytochrome enzyme, CYP2D6,[106-108] and in rapid metabolizers can increase risk of overdose.[107,108] In response, the US Food and Drug Administration (**FDA**) issued a strong warning against the use of codeine and tramadol in children less than 12 years of

age.[107,108] The FDA warns that in the 12- through 17-year age group, these medications should not be used in high-risk patients (eg, those with obesity, obstructive sleep apnea, lung tissue disease).[108]

Trends in opioid overdose, opioid misuse, and concerns for opioid addiction prompted the Centers for Disease Control and Prevention (**CDC**) and the World Health Organization to issue guidelines for prescribing opioids for chronic pain.[103] The CDC guideline focuses on adults while the World Health Organization guideline relates specifically to children.[103] Although chronic pain is the focus of the guidelines, both aim to improve prescribing practices and to ultimately benefit patient safety, emotional well-being, and quality of life.[18,103,109] The topics covered in the guidelines include limiting opioids for moderate to severe pain, restricting opioid prescriptions to 3 days, providing concurrent pharmacologic and nonpharmacologic therapy, and following accepted protocols for procurement, storage, and disposal of unused opioids.[18,103] The CDC guideline also advises against overlapping benzodiazepines and opioids prescriptions because of the increased potential for respiratory depression.[103]

Deaths due to opioid overdoses reached record highs and prompted the CDC to declare an opioid epidemic in 2011.[101,110] The pediatric mortality rate for opioid poisoning increased nearly threefold from 1999 to 2016, with nearly 9,000 children and adolescents in the US dying as a result of opioids.[110] A trend towards increased pediatric emergency department visits due to opioid ingestion and a greater than 5-fold increase in overdose death rates in the 15- through 24-year age group also have been demonstrated.[110] Risky use of opioids among children and adolescents is a growing trend, and the concern for opioid use disorder in adolescents is significant.[111,112] Since commercial opioids often are combined with acetaminophen, the potential for hepatotoxicity is an accompanying concern.[113,114] 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.[107]

Opioid risk mitigation involves recognizing drug-seeking behavior.[115] To address the potential risk of opioid misuse, screening patients prior to prescribing opioids has been advocated as standard practice.[103] However, a standardized assessment for adolescents has not been identified.[82,116] Therefore, at a minimum, a thorough review of medical history including analgesics used in the past is indicated before prescribing.[82] Despite the fact that screening of parents is recommended by the American Academy of Pediatrics, this is not a common practice.[117,118] Nonetheless, screening is essential for identifying children at risk of opioid exposure in the home. Children of parents who abuse opioids are at an increased risk for neglect and often suffer from parental instability and lack of structure in the home.[118]

For professionals who suspect patients have misuse issues, the FDA, National Institutes of Health, National Institute on Drug Abuse, the American Dental Association, and state prescription drug monitoring programs have resources available to review the history of prescriptions for controlled substances which may decrease their diversion.[103,119] Transparent discussion about the potential for physical and/or psychological dependence is a critical component of safe opioid practices in the adolescent population.[80,120] Furthermore, discussion regarding the proper disposal of unused controlled medications is key to reducing availability/diversion of opioids.[80,120] Safeguarding of opioids stored in offices for sedation can be accomplished by following security requirements for dispensers of controlled substances.[121]

Recommendations

Infants, children, and adolescents can and do experience pain due to dental/orofacial injury, infection, and dental procedures. Inadequate pain management may have significant physical and psychological consequences for the patient. Adherence to the following recommendations can help practitioners prevent or substantially relieve pediatric dental pain and minimize risk of associated morbidities. Practitioners should

- assess pain for all patients as part of the dental history.
- avoid sensitization by using techniques to minimize stimulation and tissue damage when providing dental treatment.
- achieve profound anesthesia prior to invasive treatment.
- use preemptive analgesia when moderate to severe postoperative pain is anticipated.
- manage odontogenic and non-odontogenic pain with combined nonpharmacologic (eg, distraction) and pharmacologic pain management.
- use NSAIDs as first-line pharmacologic therapy for pain management.
- use acetaminophen as an appropriate first-line pharmacologic option for pain management when NSAIDs are contraindicated or not tolerated.
- use an alternating schedule of NSAIDs and acetaminophen for multimodal pain management if single-agent therapy is ineffective.
- limit or avoid altogether opioid prescriptions in children and adolescents. In rare cases (eg, patient allergy to NSAIDs), use caution and carefully assess benefits and risks of adverse events when considering prescribing opioids for pain management in children and adolescents.
- minimize the risk of opioid misuse by screening patients and parents regarding previous/current opioid use before prescribing opioid analgesics.
- utilize prescription monitoring databases and inform parents to properly discard unused medications to avoid diversion of controlled substances.
- educate parents on the importance of adhering to recommended dosage and timing of prescribed and over-the-counter analgesic medications, associated risks, and anticipation and management of adverse effects (eg, asthma and NSAIDs, sedation and opioids.)

- seek expert consultation for patients with chronic pain or other complicated pain condition.
- be familiar with analgesic properties of agents when used in conjunction with sedation or general anesthesia.
- strongly advise against opioid use in high-risk patients (eg, patients with obesity, obstructive sleep apnea, lung tissue disease, benzodiazepines use).

References

1. American Academy of Pediatric Dentistry. Pain management in infants, children, adolescents, and individuals with special health care needs. *Pediatr Dent.* 2018;40(6): 321-329.
2. American Academy of Pediatric Dentistry. Pain management in infants, children, adolescents, and individuals with special health care needs. *The Reference Manual of Pediatric Dentistry.* American Academy of Pediatric Dentistry; 2022:392-400.
3. Raja SN, Carr DB, Cohen M, et al. The revised International Association for the Study of Pain definition of pain: Concepts, challenges, and compromises. *Pain.* 2020;161 (9):1976-1982. DOI: 10.1097/j.pain.0000000000001939
4. Randall CL, Zahlis E, Chi DL. Pediatric dental procedure-related pain assessment practices in a rural Alaskan healthcare organization: A qualitative study. *Pediatr Dent.* 2020;42(5):350-353.
5. Baccei ML, Fitzgerald M. Development of pain pathways and mechanisms. In: McMahon SB, Koltzenburg M, Tracey I, Turk DC, eds. *Wall and Melzack's Textbook of Pain.* 6th ed. Elsevier Saunders; 2013:143-155.
6. Rivi V, Rigillo G, Toscano Y, Benatti C, Blom JMC. Narrative review of the complex interaction between pain and trauma in children: A focus on biological memory, preclinical data, and epigenetic processes. *Children.* 2023;10 (7):1217. DOI: 10.3390/children10071217
7. Klasser GD, Romero Reyes M. Introduction to orofacial pain. In: Klasser GD, Romero Reyes M, eds. *Orofacial Pain: Guidelines for Assessment, Diagnosis, and Management.* 7th ed. Quintessence Publishing; 2023:1-35.
8. Santos PS, Barasuol JC, Moccelini BS, et al. Prevalence of toothache and associated factors in children and adolescents: A systematic review and meta-analysis. *Clin Oral Investig.* 2022;26(2):1105-1119. DOI: 10.1007/s00784-021-04255-2
9. Dawes MM, Andersson DA, Bennett DLH, Bevan S, McMahon SB. Inflammatory mediators and modulators of pain. In: McMahon SB, Koltzenburg M, Tracey I, Turk DC, eds. *Wall and Melzack's Textbook of Pain.* 6th ed. Elsevier Saunders; 2013:48-67.
10. Latremoliere A, Woolf CJ. Central sensitization: A generator of pain hypersensitivity by central neural plasticity. *J Pain.* 2009;10(9):895-926. DOI: 10.1016/j.jpain.2009.06.012
11. Kaufman E, Epstein JB, Gorsky M, Jackson DL, Kadari A. Preemptive analgesia and local anesthesia as a supplement to general anesthesia: A review. *Anesth Prog.* 2005;52(1): 29-38. DOI: 10.2344/0003-3006(2005)52[29:PAALAA]2.0.CO;2
12. Woolf CJ. Central sensitization: Implications for the diagnosis and treatment of pain. *Pain.* 2011;152(3 Suppl): S2-15. DOI: 10.1016/j.pain.2010.09.030
13. Buvanendran A, Lubenow TR, Kroin JS. Postoperative pain and its management. In: McMahon SB, Koltzenburg M, Tracey I, Turk DC, eds. *Wall and Melzack's Textbook of Pain.* 6th ed. Elsevier Saunders; 2013:629-644.
14. Stinson J, Connelly M, Kamper SJ, Herlin T, Toupin April K. Models of care for addressing chronic musculoskeletal pain and health in children and adolescents. *Best Prac Res Clin Rheumatol.* 2016;30(3):468-482. DOI: 10.1016/j.berh.2016.08.005
15. Batoz H, Semjen F, Bordes-Demolis M, Bénard A, Nouette-Gaulain K. Chronic postsurgical pain in children: Prevalence and risk factors. A prospective observational study. *Br J Anaesth.* 2016;117(4):489-496. DOI: 10.1093/bja/aew260
16. Palmero T, Eccleston C, Goldschneider K, et al. Assessment and management of children with chronic pain: Position statement from the American Pain Society. American Pain Society; January 4, 2012. Accessed October 2, 2025. https://da7648.approby.com/m/3063bf5632bf22e3.pdf
17. Gewandter JS, Dworkin RH, Turk DC, et al. Research design considerations for chronic pain prevention in clinical trials: IMMPACT recommendations. *Pain.* 2015;156 (7):1184-1197. DOI: 10.1097/j.pain.0000000000000191
18. World Health Organization. Guidelines on the management of chronic pain in children. World Health Organization; 2020. Accessed October 2, 2025. https://www.who.int/publications/i/item/9789240017870
19. American Academy of Pediatric Dentistry. Temporomandibular disorders in children and adolescents, including those with special health care needs. *The Reference Manual of Pediatric Dentistry.* American Academy of Pediatric Dentistry; 2026:544-554.
20. Gouri AJ, Jaju RA, Tate A. The practice and perception of pain assessment in US pediatric dentistry residency programs. *Pediatr Dent.* 2010;32(7):546-550.
21. McGrath PJ, Unruh AM. Measurement and assessment of pediatric pain. In: McMahon SB, Koltzenburg M, Tracey I, Turk DC, eds. *Wall and Melzack's Textbook of Pain.* 6th ed. Elsevier Saunders; 2013:320-327.
22. Chou, R, Gordon, DB, de Leon-Cassola OA, et al. Management of postoperative pain: A clinical practice guideline from the American Pain Society, American Society of Regional Anesthesia and Pain Medicine, American Society of Anesthesiologists' Committee on Regional Anesthesia, Executive Committee, and Administrative Counsel. *J Pain.* 2016;17(2):131-157. DOI: 10.1016/j.jpain.2015.12.008
23. American Society of Anesthesiologists Task Force on Acute Pain Management. Practice guidelines for acute pain management in the perioperative setting: An updated report. *Anesthesiology.* 2012;116(2):248-273.

24. Jain A, Yeluri R, Munshi AK. Measurement and assessment of pain in children – A review. *J Clin Pediatr Dent.* 2012;37(2):125-136. DOI: 10.17796/jcpd.37.2.k84341490806t770
25. Lee GY, Yamada J, Kyolo O, Shorkey A, Stevens B. Pediatric clinical practice guidelines for acute procedural pain: A systematic review. *Pediatrics.* 2014;133(3):500-515. DOI: 10.1542/peds.2013-2744
26. Friedrichsdorf SJ. Evaluation and management of pain in children. In: Sun LS, Armsby C, eds. *UpToDate* [Internet]. UpToDate Inc; 2025. Accessed October 11, 2025. https://www.uptodate.com/contents/evaluation-and-management-of-pain-in-children
27. Wong DL, Baker CM. Pain in children: Comparison of assessment scales. *Pediatr Nurs.* 1988;14(1):9-17.
28. Ashley PF, Parekh S, Moles DR, Anand P, MacDonald LC. Preoperative analgesics for additional pain relief in children and adolescents having dental treatment. Cochrane Database Syst Rev 2016;(8):CD008392. DOI: 10.1002/14651858.CD008392.pub3
29. Raslan N, Zouzou T. Comparison of preemptive ibuprofen, acetaminophen, and placebo administration in reducing peri- and postoperative pain in primary tooth extraction: A randomized clinical trial. *Clin Exp Dent Res.* 2021;7(6):1045-1052. DOI: 10.1002/cre2.465
30. Carrasco-Labra A, Polk DE, Urquhart O, et al. Evidence-based clinical practice guideline for the pharmacologic management of acute dental pain in children: A report from the American Dental Association Science and Research Institute, the University of Pittsburgh School of Dental Medicine, and the Center for Integrative Global Oral Health, University of Pennsylvania. *J Am Dent Assoc.* 2023;154(9):814-825. DOI: 10.1016/j.adaj.2023.06.014
31. Kharouba J, Ratson T, Somri M, et al. Preemptive analgesia by paracetamol, ibuprofen, or placebo in pediatric dental care. A randomized controlled study. *J Clin Pediatr Dent.* 2019;43(1):51-55. DOI: 10.17796/1053-4625-43.1.10
32. Mundiya J, Woodbine E. Updates on topical and local anesthesia agents. *Oral Maxillofac Surg Clin North Am.* 2022;34(1):147-155. DOI: 10.1016/j.coms.2021.08.003
33. Shavit I, Peri-Front Y, Rosen-Walther A, et al. A randomized trial to evaluate the effect of two topical anesthetics on pain response during frenotomy in young infants. *Pain Med.* 2017;18(2):356-362. DOI: 10.1093/pm/pnw097
34. Kravitz ND. The use of compound topical anesthetics: A review. *J Am Dent Assoc.* 2007;138(10):1333-1339; quiz 1382. DOI: 10.14219/jada.archive.2007.0048
35. Patel TJ. Update on dental topical anesthetics. *Decis Dent.* 2019;5(5):36-39. Accessed February 24, 2026. https://decisionsindentistry.com/article/update-on-dental-topical-anesthetics/
36. Saeedi P, Sarraf Shirazi A, Ghorbani M. The effectiveness of cryotherapy and cooled topical anesthesia compared with conventional topical anesthesia in alleviating intraoral injection pain: A systematic review and meta-analysis. *Int J Paediatr Dent.* 2025;35(4):655-674. DOI:10.1111/ipd.13275
37. Glass JS, Hardy CL, Meeks NM, Carrol BT. Acute pain management in dermatology: Risk assessment and treatment. *J Am Acad Dermatol.* 2015;73(4):543-560. DOI: 10.1016/j.jaad.2015.04.050
38. Birnie KA, Noel M, Chambers CT, Uman LS, Parker JA. Psychological interventions for needle-related procedural pain and distress in children and adolescents. *Cochrane Database Syst Rev.* 2018;10:CD005179. DOI: 10.1002/14651858.CD005179.pub4
39. Malamed SF, Tavana S, Falkel M. Faster onset and more comfortable injection with alkalinized 2% lidocaine with epinephrine 1:100,000. *Compend Contin Educ Dent.* 2013;34(Spec No 1):10-20.
40. Tirupathi SP, Rajasekhar S. Buffered versus unbuffered local anesthesia for inferior alveolar nerve block injections in children: A systematic review. *J Dent Anesth Pain Med.* 2020;20(5):271-279. DOI: 10.17245/jdapm.2020.20.5.271
41. Garret-Bernardin A, Cantile T, D'Antò V. Pain experience and behavior management in pediatric dentistry: A comparison between traditional local anesthesia and the wand computerized delivery system. *Pain Res Manag.* 2017;2017:7941238. DOI: 10.1155/2017/7941238
42. Libonati A, Nardi R, Gallusi G, et al. Pain and anxiety associated with computer-controlled local anaesthesia: Systematic review and meta-analysis of cross-over studies. *Eur J Paediatr Dent.* 2018;19(4):324-332. DOI: 10.23804/ejpd.2018.19.04.14
43. Shirvani A, Shamszadeh S, Enghbal MJ, Marvasti LA, Asgary S. Effect of preoperative oral analgesics on pulpal anesthesia in patients with irreversible pulpitis–A systematic review and meta-analysis. *Clin Oral Investig.* 2017;21(1):43-52. DOI: 10.1007/s00784-016-1974-1
44. American Academy of Pediatric Dentistry. Use of nitrous oxide for pediatric dental patients. *The Reference Manual of Pediatric Dentistry.* American Academy of Pediatric Dentistry; 2026:439-446.
45. Conner ER, Musser D, Colpitts KM, Laochamroonvorapongse DL, Koh JL. Perioperative opioid administration in children with and without developmental delay undergoing out-patient dental surgery. *J Clin Anesth.* 2017;37:92-96. DOI: 10.1016/j.jclinane.2016.12.006
46. Laskarides C. Update on analgesic medication for adult and pediatric dental patients. *Dent Clin North Am.* 2016;60(2):347-366. DOI: 10.1016/j.cden.2015.11.006
47. Pacheco GS, Ferayorni A. Pediatric procedural sedation and analgesia. *Emerg Med Clin North Am.* 2013;31(3):831-852. DOI: 10.1016/j.emc.2013.04.002
48. Keles S, Kocaturk O. Immediate postoperative pain and recovery time after pulpotomy performed under general anaesthesia in young children. *Pain Res Manag.* 2017;2017:9781501. DOI: 10.1155/2017/9781501

References continued on the next page.

49. American Academy of Pediatric Dentistry. Use of local anesthesia for pediatric dental patients. *The Reference Manual of Pediatric Dentistry.* American Academy of Pediatric Dentistry; 2026:431-438.
50. Parekh S, Gardener C, Ashley PF, Walsh T. Intraoperative local anaesthesia for reduction of postoperative pain following general anaesthesia for dental treatment in children and adolescents. *Cochrane Database Syst Rev.* 2014;2014(12):CD009742. DOI: 10.1002/14651858.CD009742.pub2
51. Fein A, Zempsky WT, Cravero JP. Relief of pain and anxiety in pediatric patient in emergency medical systems. *Pediatrics.* 2012;130(5):e1391-1405. DOI: 10.1542/peds.2012-2536
52. Lewin D, Dahl R. Importance of sleep in the management of pediatric pain. *J Devel Beh Pediatrics*. 1999;20(4):244-252. DOI: 10.1097/00004703-199908000-00007
53. Raja J, Parmar D, Subramaniam SD, et al. Anxiety and pain management in dental patients: A systematic review of pharmacological and non-pharmacological approaches. *J Pharm Bioallied Sci.* 2025;17(Suppl 1):S77-S79. DOI: 10.4103/jpbs.jpbs_1454_24
54. American Academy of Pediatric Dentistry. Behavior guidance for the pediatric dental patient. *The Reference Manual of Pediatric Dentistry.* American Academy of Pediatric Dentistry; 2026:403-423.
55. Landier WN, Tse A. Use of complementary and alternative medical interventions for the management of procedure-related pain, anxiety, and distress in pediatric oncology: An integrative review. *J Pediatr Nurs.* 2010;25(6):566-579. DOI: 10.1016/j.pedn.2010.01.009
56. American Academy of Pediatrics, American Pain Society. The assessment and management of acute pain in infants, children and adolescents. *Pediatrics.* 2001;108(3):793-797.
57. Ruest S, Anderson A. Management of acute pediatric pain in the emergency department. *Curr Opin Pediatr.* 2016;28(3):298-304. DOI: 10.1097/MOP.0000000000000347
58. Goettems ML, Zborowski EJ, Costa FC, Costa VP, Torriani DD. Nonpharmacologic intervention on the prevention of pain and anxiety during pediatric dental care: A systematic review. *Acad Pediatr.* 2017;17(2):110-119. DOI: 10.1016/j.acap.2016.08.012
59. Lyons RA. Understanding basic behavioral support techniques as an alternative to sedation and anesthesia. *Spec Care Dent.* 2009;29(1):39-50. DOI: 10.1111/j.1754-4505.2008.00061.x
60. Davidson F, Snow S, Haydenc JA, Chorney J. Psychological interventions in managing postoperative pain in children: A systematic review. *Pain.* 2016;157(9):1872-1886. DOI: 10.1097/j.pain.0000000000000636
61. Bukola IM, Paula D. The effectiveness of distraction as procedural pain management technique in paediatric oncology patients: A meta-analysis and systematic review. *J Pain Symptom Manag.* 2017;54(4):589-600. DOI: 10.1016/j.jpainsymman.2017.07.006
62. Kohen DP, Kaiser P. Clinical hypnosis with children and adolescents – What? Why? How?: Origins, applications, and efficacy. *Children (Basel).* 2014;1(2):74-98. DOI: 10.3390/children1020074
63. Merz AE, Campus G, Abrahamsen R, Wolf TG. Hypnosis on acute dental and maxillofacial pain relief: A systematic review and meta-analysis. *J Dent.* 2022;123:104184. DOI: 10.1016/j.jdent.2022.104184
64. Wolf TG, Schläppi S, Benz CI, Campus G. Efficacy of hypnosis on dental anxiety and phobia: A systematic review and meta-analysis. *Brain Sci.* 2022;12(5):521. DOI: 10.3390/brainsci12050521
65. Gates M, Hartling L, Shulhan-Kilroy J, et al. Digital technology distraction for acute pain in children: A meta-analysis. *Pediatrics.* 2020;145(2):e20191139. DOI: 10.1542/peds.2019-1139
66. Cunningham A, McPolin O, Fallis R, Coyle C, Best P, McKenna G. A systematic review of the use of virtual reality or dental smartphone applications as interventions for management of paediatric dental anxiety. *BMC Oral Health.* 2021;21(1):244. DOI: 10.1186/s12903-021-01602-3
67. Dahlquist LM, Weiss KE, Clendaniel LD, Law EF, Ackerman CS, McKenna KD. Effects of videogame distraction using a virtual reality type head-mounted display helmet on cold pressor pain in children. *J Pediatr Psychol.* 2009;34(5):574-584. DOI: 10.1093/jpepsy/jsn023
68. Eijlers R, Utens EMWJ, Staals LM, et al. Systematic review and meta-analysis of virtual reality in pediatric pain Management. *Anesth Analg.* 2019;129(5):1344-1353. DOI: 10.1213/ANE.0000000000004165
69. Gold JI, Mahrer NE. Is virtual reality ready for prime time in the medical space? A randomized control trial of pediatric virtual reality for acute procedural pain management. *J Pediatr Psychol.* 20181;43(3):266-275. DOI: 10.1093/jpepsy/jsx129
70. Egly A, Gremeau-Richard C, Devoize L. Does immersive virtual reality reduce pain and anxiety in pediatric dentistry? A systematic review and meta-analysis. *J Oral Med Oral Surg.* 2024;30(2):14. DOI:10.1051/mbcb/2024017
71. Brown ML, Rojas E, Gouda S. A mind–body approach to pediatric pain management. *Children (Basel).* 2017;4(6):50. DOI: 10.3390/children4060050
72. Fisher E, Law E, Dudeney J, Palermo TM, Stewart G, Eccleston C. Psychological therapies for the management of chronic and recurrent pain in children and adolescents. *Cochrane Database Sys Rev.* 2018;9(9):CD003968. DOI: 10.1002/14651858.CD003968.pub5
73. Kasat V, Gupta A, Ladd R, Kathariya M, Saluja H, Farooqui AA. Transcutaneous electric nerve stimulation (TENS) in dentistry – A review. *J Clin Exp Dent.* 2014;6(5):e562-568. DOI: 10.4317/jced.51586
74. Klassen JA, Liang Y, Tjosvold L, Klassen TP, Hartling L. Music for pain and anxiety in children undergoing medical procedures: A systematic review of randomized controlled trials. *Ambul Pediatr.* 2008;8(2):117-128. DOI: 10.1016/j.ambp.2007.12.005

75. Monteiro J, Tanday A, Ashley PF, Parekh S, Alamri H. Interventions for increasing acceptance of local anaesthetic in children and adolescents having dental treatment. *Cochrane Database Syst Rev.* 2020;2(2):CD011024. DOI: 10.1002/14651858.CD011024.pub2
76. Munshi AK, Hegde AM, Girdhar D. Clinical evaluation of electronic dental anesthesia for various procedures in pediatric dentistry. *J Clin Pediatr Dent.* 2000;24(3):199-204.
77. Garcia-Argibay M, Santed MA, Reales JM. Efficacy of binaural auditory beats in cognition, anxiety, and pain perception: A meta-analysis. *Psychol Res.* 2019;83(2):357-372. DOI: 10.1007/s00426-018-1066-8
78. Shukla AD, Subhadra HN, Unnikrishnan S, Katre AN. Effectiveness of binaural beats in reducing dental pain and anxiety among children and adults: A systematic review and meta-analysis. *Int J Clin Pediatr Dent.* 2025;18 (8):1023-1030. DOI: 10.5005/jp-journals-10005-3230
79. Hartling L, Ali S, Dryden DM, et al. How safe are common analgesics for the treatment of acute pain for children? A systematic review. *Pain Res Manag.* 2016;2016: 5346819. DOI: 10.1155/2016/5346819
80. Kelley-Quon LI, Kirkpatrick MG, Ricca RL, et al. Guidelines for opioid prescribing in children and adolescents after surgery: An expert panel opinion. *JAMA Surg.* 2020;156(1):76-90. DOI: 10.1001/jamasurg.2020.5045
81. Koh SWC, Li CF, Loh JSP, Wong ML, Loh VWK. Managing tooth pain in general practice. *Singapore Med J.* 2019;60(5):224-228. DOI: 10.11622/smedj.2019044 Correction in *Singapore Med J.* 2023;64(6):413. DOI: 10.4103/0037-5675.377939
82. Walco GA, Gove N, Phillips J, Weisman SJ. Opioid analgesics administered for pain in the inpatient pediatric setting. *J Pain.* 2017;18(10):1270-1276. DOI: 10.1016/j.jpain.2017.06.001
83. Olejnik L, Lima JP, Sadeghirad B, et al. Pharmacologic management of acute pain in children: A systematic review and network meta-analysis. *JAMA Pediatr.* 2025;179(4): 407-417. DOI: 10.1001/jamapediatrics.2024.5920
84. Vittinghoff M, LÖnnqvist PA, Mossetti V, et al. Postoperative pain management in children: Guidance from the pain committee of the European Society for Paediatric Anaesthesiology (ESPA Pain Management Ladder Initiative). *Paediatr Anaesth.* 2018;28(6):493-506. DOI: 10.1111/pan.13373
85. Teoh L. Managing acute dental pain without codeine. *Aust Prescr.* 2020;43(2):64. DOI: 10.18773/austprescr.2020.013
86. Neri E, Maestro A, Minen F, et al. Sublingual ketorolac versus sublingual tramadol for moderate to severe posttraumatic bone pain in children: A double-blind, randomized, controlled trial. *Arch Dis Child.* 2013;98(9): 721-4. DOI: 10.1136/archdischild-2012-303527
87. Peterson SJB, Weisman SJ. Pediatric pain management. In: Kliegman RM, Stanton BF, St. Geme JW, Schor NF, Behrman RE, eds. *Nelson Textbook of Pediatrics*. 22nd ed. Elsevier; 2024:677-700in.e2
88. Tessitore A, Zupin L, Celsi F, et al. Ketorolac use in the emergency department in children: A systematic review and meta-analysis. *Eur J Pediatr.* 2025;184(5):296. DOI: 10.1007/s00431-025-06128-2
89. Gosnell ES, Thikkurissy S. Assessment and management of pain in the pediatric patient. In: Nowak AJ, Christensen JR, Mabry, TR, Townsend JA, Wells MH, eds. *Pediatric Dentistry: Infancy through Adolescence.* 6th ed. Elsevier; 2019:97-115.
90. Moore N, Pollack C, Butkerait P. Adverse drug reactions and drug-drug interactions with over-the-counter NSAIDs. *Ther Clin Risk Manag.* 2015;15(11):1061-1075. DOI: 10.2147/TCRM.S79135
91. American Association of Oral and Maxillofacial Surgeons. Opioid prescribing: Acute and postoperative pain management. American Association of Oral and Maxillofacial Surgeons. Reaffirmed January 2025. Accessed February 9, 2026. https://aaoms.org/wp-content/uploads/2024/03/opioid_prescribing.pdf
92. American Dental Association. Chairside guide: Managing acute dental pain from pulpitis in children. American Dental Association; 2024. Accessed May 30, 2026. https://www.ada.org/-/media/project/ada-organization/ada/ada-org/files/resources/research/2024-pain-guidelines/14205b_chairside_guide_children_pulpitis_fina.pdf?rev=c3b734b420604ae1bd55d09eaf0024da&hash=DC0584527A0B84DE1AE03E053ABEEE87
93. Becker DE. Pain management: Part 1: Managing acute and postoperative dental pain. *Anesth Prog.* 2010;57(2): 67-80. DOI: 10.2344/0003-3006-57.2.67
94. Dart RC, Mullins ME, Matoushek T, et al. Management of acetaminophen poisoning in the US and Canada: A consensus statement. *JAMA Netw Open.* 2023;6(8):e2327739. DOI: 10.1001/jamanetworkopen.2023.27739 Erratum in: JAMA Netw Open. 2023;6(9):e2337926. DOI: 10.1001/jamanetworkopen.2023.37926.
95. Kearns GL, Abdel-Rahman SM, Alander SW, Blowey DL, Leeder JS, Kauffman RE. Developmental pharmacology—drug disposition, action, and therapy in infants and children. *N Engl J Med.* 2003;349(12):1157-1167. DOI: 10.1056/NEJMra035092
96. Osorio D, Maldonado D, Rijs K, van der Marel C, Klimek M, Calvache JA. Efficacy of different routes of acetaminophen administration for postoperative pain in children: A systematic review and network meta-analysis. *Can J Anesth.* 2024;71(8):1103-1116. DOI: 10.1007/s12630-024-02760-y
97. Thibault C, Pelletier É, Nguyen C, et al. The three w's of acetaminophen in children: Who, why, and which administration mode. *J Pediatr Pharmacol Ther.* 2023;28(1): 20-28. DOI: 10.5863/1551-6776-28.1.20

References continued on the next page.

98. Carrasco-Labra A, Polk DE, Urquhart O, et al. Evidence-based clinical practice guideline for the pharmacologic management of acute dental pain in adolescents, adults, and older adults: A report from the American Dental Association Science and Research Institute, the University of Pittsburgh, and the University of Pennsylvania. *J Am Dent Assoc.* 2024;155(2):102-117.e9. DOI: 10.1016/j.adaj.2023.10.009
99. Dancel R, Liles EA, Fiore D. Acute pain management in hospitalized children. *Rev Recent Clin Trials.* 2017;12(4):277-283. DOI: 10.2174/1574887112666170816151232
100. Schnabel A, Reichl SU, Meyer-Frießem C, Zahn PK, Pogatzki-Zahn E. Tramadol for postoperative pain treatment in children. *Cochrane Database Syst Rev.* 2015;(3):CD009574. DOI: 10.1002/14651858.CD009574.pub2
101. Rudd RA, Seth P, David F, Scholl L. Increases in drug and opioid-involved overdose deaths–United States, 2010-2015. *MMWR Morb Mortal Wkly Rep.* 2016;65(50-51):1445-1452. DOI: 10.15585/mmwr.mm655051e1
102. Van Cleve WC, Grigg EB. Variability in opioid prescribing for children undergoing ambulatory surgery in the United States. *J Clin Anesth.* 2017;41:16-20. DOI: 10.1016/j.jclinane.2017.05.014
103. Dowell D, Ragan KR, Jones CM, Baldwin GT, Chou R. CDC Clinical practice guideline for prescribing opioids for pain–United States, 2022. *MMWR Recomm Rep.* 2022;71(No. RR-3):1-95. DOI: 10.15585/mmwr.rr7103a1
104. Soleimanpour H, Safari S, Shahsavari Nia K, Sanaie S, Alavian SM. Opioid drugs in patients with liver disease: A systematic review. *Hepat Mon.* 2016;16(4):e32636. DOI: 10.5812/hepatmon.32636
105. Smith HS. Opioid metabolism. *Mayo Clin Proc.* 2009;84(7):613-624. DOI: 10.1016/S0025-6196(11)60750-7
106. Crews KR, Monte AA, Huddart R, et al. Clinical pharmacogenetics implementation consortium guideline for CYP2D6, OPRM1, and COMT genotypes and select opioid therapy. *Clin Pharmacol Ther.* 2021;110(4):888-96. DOI: 10.1002/cpt.2149
107. Tobias JD, Green TP, Coté CJ; Section on Anesthesiology and Pain Medicine; Committee on Drugs. Codeine: Time to say "no". *Pediatrics.* 2016;138(4):e20162396. DOI: 10.1542/peds.2016-2396
108. FDA Drug Safety Communication: FDA restricts use of prescription codeine pain and cough medicines and tramadol pain medicines in children; recommends against use in breastfeeding women. US Food and Drug Administration; April 20, 2017. Accessed October 2, 2025. https://www.fda.gov/drugs/drug-safety-and-availability/fda-drug-safety-communication-fda-restricts-use-prescription-codeine-pain-and-cough-medicines-and
109. Tompkins DA, Hobelmann JG, Compton P. Providing chronic pain management in the 5th vital sign era: Historical and treatment perspectives in a modern-day medical dilemma. *Drug Alcohol Depend.* 2017;173(Suppl 1):S11-21. DOI: 10.1016/j.drugalcdep.2016.12.002
110. DePhillips M, Watts J, Lowry J, Dowdy MD. Opioid prescribing practices in pediatric acute care settings. *Pediatr Emerg Care.* 2019;35(1):16-21. DOI: 10.1097/PEC.0000000000001239
111. Allareddy V, Rampa S, Allareddy V. Opioid abuse in children: An emerging public health crisis in the United States! *Pediatr Res.* 2017;82(4):562-563. DOI: 10.1038/pr.2017.166
112. McCabe SE, West BT, Veliz P, McCabe VV, Stoddard SA, Boyd CJ. Trends in medical and nonmedical use of prescription opioids among U.S. adolescents: 1976-2015. *Pediatrics.* 2017;139(4):e20162387. DOI: 10.1542/peds.2016-2387
113. Drew S. Best practices for management of pain, swelling, nausea, and vomiting in dentoalveolar surgery. *Oral Maxillofac Surg Clin North Am.* 2015;27(3):393-404. DOI: 10.1016/j.coms.2015.04.011
114. Pimenta RP, Takahashi CM, Barberato-Filho S, et al. Preemptive use of anti-inflammatories and analgesics in oral surgery: A review of systematic reviews. *Front Pharmacol.* 2024;14:1303382. DOI: 10.3389/fphar.2023.1303382
115. Shaefer J, Barreveld AM, Arnstein P, Kulich RJ. Interprofessional education for the dentist in managing acute and chronic pain. *Dent Clin North Am.* 2016;60(4):825-842. DOI: 10.1016/j.cden.2016.05.003
116. Smith SM, Paillard F, McKeown A, et al. Instruments to identify prescription medication misuse, abuse, and related events in clinical trials: An ACTTION systematic review. *J Pain.* 2015;16(5):389-411. DOI: 10.1016/j.jpain.2015.01.009
117. Lane WG, Dubowitz H, Feigelman S, et al. Screening for parental substance abuse in pediatric primary care. *Ambul Pediatr.* 2007;7(6):458-462. DOI: 10.1016/j.ambp.2007.07.007
118. Spehr MK, Coddington J, Ahmed A, Jones E. Parental opioid abuse: Barriers to care, policy, and implications for primary care pediatric providers. *J Pediatr Healthcare.* 2017;31(6):695-702. DOI: 10.1016/j.pedhc.2017.05.007
119. Screening and Assessment Tools Chart. National Institute on Drug Abuse; January 2023. Accessed October 12, 2025. https://nida.nih.gov/nidamed-medical-health-professionals/screening-tools-resources/chart-screening-tools
120. American Academy of Pediatric Dentistry. Policy on substance use by adolescent patients. *The Reference Manual of Pediatric Dentistry.* American Academy of Pediatric Dentistry; 2026:173-177.
121. Code of Federal Regulations (CFR) Title 21. Volume 9, Chapter 2, Part 1303. Registration of Manufacturers, Distributors, and Dispensers of Controlled Substances (eCFR 2025). Accessed October 2, 2025. https://www.ecfr.gov/current/title-21/chapter-II/part-1303