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PHARMACOLOGICAL GUIDE IN PEDIATRIC DENTISTRY

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ABSTRACT

Medication selection in pediatric dentistry requires developmentally appropriate dosing, attention to comorbidity and avoidance of unnecessary prescribing. This narrative review summarizes pharmacological agents used for dental pain, local anesthesia, infection control, anxiety management and selected preventive or mucosal indications. A focused search of PubMed-indexed literature, Cochrane reviews and guidance from pediatric dental, pediatric medical and public-health organizations was undertaken through 9 October 2026. Recent guidelines and higher-level syntheses were prioritized, with earlier foundational pharmacology sources retained when relevant. Nonopioid analgesics, particularly ibuprofen and acetaminophen, remain first-line options for most acute dental pain. Local anesthetic doses should be calculated by body weight and total milligrams rather than cartridge count. For odontogenic infections, source control is essential and systemic antibiotics are generally reserved for spreading disease, systemic involvement or selected medical risks. Nitrous oxide and other sedatives require appropriate patient selection, trained personnel, monitoring and rescue capacity. Fluoride varnish and silver diamine fluoride provide additional, indication-specific non-systemic options; routine chlorhexidine for caries prevention lacks convincing evidence. Important limitations include variable national drug labeling, heterogeneous pediatric trials and limited comparative data in medically complex children. This practical synthesis supports indication-driven, weight-appropriate prescribing while emphasizing that product information and local regulations take precedence over summary doses.

KEYWORDS: Pediatric dentistry; pharmacotherapy; analgesics; local anesthesia; antibiotic stewardship; procedural sedation; drug safety.

INTRODUCTION

Pharmacotherapy in pediatric dentistry is an adjunct to diagnosis, prevention, effective local anesthesia and definitive treatment. A child with pulpitis needs dental source treatment rather than a prescription that merely suppresses symptoms; an anxious child needs developmentally tailored communication before sedative medication is considered. Recent professional guidance emphasizes nonopioid pain relief, conservative antibiotic use and the prevention of avoidable sedation-related harm.[1,2,3,4]

The same medication can have different effects across infancy, early childhood and adolescence because body composition, hepatic metabolism, renal clearance and airway anatomy are still developing. Pediatric dental practice must therefore integrate the medical history, drug history, body weight, route of administration and procedure-specific indication before selecting an agent.[5,6,7]

The aim of this narrative review is to provide a concise, clinically oriented pharmacological guide covering routine analgesics, injectable and topical anesthetics, systemic antimicrobials, sedatives, anti-inflammatory agents and selected adjunctive treatments, with particular attention to contraindications and decision-making rather than exhaustive drug monographs.

METHODS

A focused narrative literature search was performed using PubMed-indexed publications, Cochrane evidence summaries and publicly available guidance from the AAPD, American Academy of Pediatrics, American Dental Association, European Academy of Paediatric Dentistry, American Heart Association, World Health Organization and United States Food and Drug Administration. The principal search window was January 2015 through 9 October 2026; earlier foundational references were included when they clarified pediatric pharmacokinetics or safety.

Search concepts were combined in targeted queries using the terms 'pediatric dentistry', 'dental pain', 'analgesic', 'local anesthesia', 'lidocaine', 'articaine', 'odontogenic infection', 'antibiotic stewardship', 'endocarditis prophylaxis', 'nitrous oxide', 'midazolam', 'sedation', 'fluoride', 'silver diamine fluoride', 'chlorhexidine', 'drug interaction' and 'medically compromised child'. Eligible material included English-language pediatric dental or medical guidelines, regulatory safety communications, systematic reviews, and clinically relevant studies of indications, efficacy or safety. Non-pediatric publications without transferable guidance, unsubstantiated commentary, duplicate recommendations and sources of unverifiable provenance were excluded. Sources were selected purposively for clinical relevance; no formal evidence grading or quantitative pooling was performed.[8,9,10]

This was an interpretive, non-systematic synthesis. No exhaustive database screening, independent dual selection, formal risk-of-bias grading or pooled analysis was undertaken; consequently, the review does not claim systematic-review completeness or comparative-effectiveness estimates. The recommendations may differ across jurisdictions and should be interpreted alongside current local product labeling.

PHARMACOLOGICAL PRINCIPLES IN CHILDREN

Age-related differences in gastrointestinal absorption, protein binding, total-body-water content and drug-metabolizing capacity influence exposure even when a dose is correctly expressed in mg/kg. Drug clearance evolves substantially during early life, making simple scaling of an adult regimen inappropriate for neonates and young infants. Formulation strength, palatability, measuring-device accuracy and caregiver understanding are likewise integral components of therapeutic safety.[11,12,13]

At each encounter, clinicians should establish measured weight, age, significant organ disease, previous medication reactions, current prescriptions and nonprescription products, and the ability to swallow oral formulations. The smallest effective dose and shortest necessary duration should be used. A pediatric prescription must not exceed the corresponding adult limit; local formularies may impose lower daily maximums than international summaries. For children with high caries risk, consider sugar exposure from repeatedly administered syrups, without withholding a clinically necessary medicine.[8,14]

Nonpharmacological measures remain part of treatment: clear anticipatory guidance, distraction, effective injection technique, caregiver participation when appropriate and a comfortable recovery environment can reduce the need for rescue medication. Pain intensity should be assessed using an age-appropriate instrument and re-evaluated after definitive care.[7,15]

Medication errors can arise despite correct mg/kg arithmetic when a parent selects the wrong bottle strength or uses a kitchen teaspoon. Prescriptions should identify the generic ingredient, concentration and calibrated oral syringe; instructions should ideally be confirmed using caregiver teach-back. For medicines taken over several days, review any school-day administration, swallowing difficulty, vomiting after a dose and the risk of accidental access by siblings. These practical safeguards are especially valuable when the child is under six or caregivers face language barriers.[8,13]

DRUG CLASSES AND CLINICAL INDICATIONS

Analgesics

Ibuprofen is a commonly used first-line nonsteroidal anti-inflammatory drug (NSAID) for short-term dental pain in eligible children; acetaminophen (paracetamol) is appropriate when NSAIDs are unsuitable or as an additional agent when pain severity warrants combination treatment. Pediatric and adolescent guidance generally favors these nonopioid options over opioids. However, the certainty of pediatric dental efficacy evidence is often low or very low, and postoperative analgesia must not replace definitive treatment.[1,16,17]

Routine preoperative administration of an analgesic before every pediatric dental procedure is not supported by strong evidence. A Cochrane review found insufficient evidence of benefit for most dental treatments under local anesthesia, illustrating why preventive dosing should be individualized rather than automatic. Codeine and tramadol are contraindicated in children younger than 12 years under US labeling, and opioids are inappropriate as routine pediatric dental prescriptions.[2,18,19]

Local and topical anesthetics

Lidocaine with epinephrine is widely used for infiltration and regional block, while articaine may provide useful infiltration anesthesia for selected children aged at least four years where locally authorized. Calculate the total milligrams actually administered: a 1.7-mL cartridge of 2% lidocaine contains 34 mg, whereas a 1.7-mL cartridge of 4% articaine contains 68 mg. Conservative AAPD dental maximums are 4.4 mg/kg for lidocaine and 7 mg/kg for articaine; these are ceilings, not intended target doses.[5,8]

Comparative meta-analyses suggest broadly similar adverse-event profiles for lidocaine and articaine, although the magnitude and clinical relevance of any efficacy advantage remain uncertain. Avoid bupivacaine as a routine pediatric choice when prolonged soft-tissue numbness would increase cheek- or lip-biting risk. Topical anesthetics have limited depth of action, and benzocaine products must not be used for teething pain in children under two because of potentially life-threatening methemoglobinemia.[20,21,22]

Systemic antibiotics

Antibiotics are adjuncts for a defined bacterial indication, not analgesics and not substitutes for pulpotomy, endodontic treatment, extraction or drainage. In immunocompetent children with localized pulpitis, apical periodontitis or a localized abscess without fever or other systemic involvement, routine systemic antibiotics are generally not indicated when prompt source control is possible. Spreading facial cellulitis, systemic illness, dysphagia, progressive swelling or airway concerns require urgent evaluation and often hospital-level management.[3,4,23]

Amoxicillin is a widely used oral option when antibiotic therapy is indicated and a true penicillin allergy is absent; the choice, spectrum and duration should follow regional guidance and clinical reassessment. A 2026 systematic review identified ongoing unnecessary prescribing and variable guideline adherence in pediatric odontogenic infections. WHO AWaRe principles support narrow-spectrum Access antibiotics whenever clinically appropriate, avoiding routine broad-spectrum escalation.[9,10,24]

A stewardship-oriented prescription should state the clinical diagnosis, reason for systemic treatment, prescribed duration, expected response and explicit escalation criteria. Review is important if symptoms fail to improve within 48-72 hours, worsen earlier or recur after source treatment. No single fixed antibiotic duration is appropriate for all children; decisions should reflect infection severity, clinical response and national recommendations. Recurrent swelling despite medication demands a reassessment of the source and possible drainage, rather than repeated empiric courses.[3,4]

Infective endocarditis prophylaxis is a distinct indication limited to patients at highest risk of an adverse outcome from endocarditis who undergo specified invasive dental procedures. It is not justified merely because a child has a heart murmur or has undergone routine dental treatment. The cardiac diagnosis and allergy history should be verified with the child's cardiology team; clindamycin is no longer recommended for endocarditis prophylaxis in the AHA-based pathway.[25,26]

Sedatives and anesthetic care

Nitrous oxide/oxygen provides titratable anxiolysis and some analgesia in selected children able to tolerate nasal delivery. Oral midazolam has evidence for improving cooperation compared with placebo, but published trials differ in regimens and patient characteristics. Sedative drugs do not provide reliable local anesthesia and must never be used to compensate for inadequate pain control.[7,27,28]

Moderate and deep sedation and general anesthesia require preprocedural airway and medical assessment, fasting protocols when applicable, appropriately trained personnel, ventilation monitoring, resuscitation equipment and validated discharge criteria. Combinations of benzodiazepines, opioids or higher nitrous oxide concentrations can produce deeper-than-intended sedation; a provider must be able to rescue a child from the next deeper level. Doses for midazolam, ketamine, dexmedetomidine, propofol or other procedural sedatives are intentionally not presented as stand-alone office regimens because route, setting, local authorization and rescue capability determine safe use.[6,29,30]

Scavenging, ventilation, staff training and equipment maintenance are necessary to limit occupational exposure to nitrous oxide. For comprehensive dental rehabilitation under general anesthesia, intraoperative medication selection should remain coordinated with the pediatric anesthesia service.[31]

Nitrous oxide delivery may be impractical with severe nasal obstruction or when the patient cannot tolerate the nasal hood. Patients with relevant vitamin B12-related metabolic disorders or other specific contraindications need assessment before exposure. Recent upper-respiratory illness, substantial airway vulnerability and concurrent sedatives may also change the risk-benefit balance; documentation should distinguish minimal anxiolysis from deeper procedural sedation.[6,27]

Anti-inflammatory and adjunctive agents

The anti-inflammatory benefit of NSAIDs forms part of their analgesic role. Systemic corticosteroids are not routine medications for uncomplicated toothache, simple extraction or localized dental infection in children; possible use for substantial postoperative swelling or inflammatory pathology should be selective, brief and directed by the responsible specialist. Topical corticosteroids may be considered for certain diagnosed noninfectious mucosal conditions, after candidiasis or herpetic infection has been excluded.[2,32]

Topical fluoride varnish has a well-established preventive role, while 38% silver diamine fluoride may arrest selected cavitated primary-tooth lesions within a comprehensive care plan. Permanent dark discoloration of treated carious dentin requires informed consent. Chlorhexidine should not be promoted as a routine substitute for fluoride or plaque control in caries prevention: pediatric evidence for varnish and gel is inconclusive. Antifungal medication for oral candidiasis and antiemetics in anesthetic care have narrow, diagnosis-specific roles, not routine indications for every pediatric dental visit.[33,34,35,36,37]

These adjuncts should remain diagnosis-dependent. Silver diamine fluoride controls some carious lesions but does not restore lost tooth structure or resolve irreversible pulp disease, and follow-up is required to determine whether arrest has been achieved. Likewise, antiseptic rinses are inappropriate when a preschool child cannot reliably

expectorate. Table 1 summarizes the therapeutic selection logic across common indications.[14,34]

Table 1: Indication-based selection of pharmacological agents in pediatric dental care.

Problem or clinical goal	Usually appropriate approach	Avoid / safety issue
Acute dental pain	Definitive treatment; ibuprofen and/or acetaminophen when indicated	Avoid routine opioids or analgesics instead of source treatment
Dental procedure requiring analgesia	Age-appropriate local infiltration or block; smallest effective dose	Calculate total mg; avoid intravascular injection and prolonged numbness
Localized infection without systemic disease	Pulp treatment, extraction or drainage	No routine systemic antibiotic
Spreading infection or systemic symptoms	Urgent assessment and source control; targeted antibiotic when indicated	Do not delay referral for possible airway compromise
Dental anxiety or noncooperation	Communication and behavioral guidance; selected nitrous oxide / sedation when justified	Never sedate without supervision, monitoring and rescue capability
Caries prevention / lesion arrest	Risk-based fluoride varnish; selected 38% SDF for cavitated lesions	Consent for staining; not a substitute for comprehensive care

Sources: synthesized from ADA, AAPD, and EAPD clinical guidance cited in the text.

DOSAGE AND SAFETY CONSIDERATIONS

Table 2 offers selected reference doses and conservative dental anesthetic ceilings; it is not a universal prescribing protocol. For any systemic drug, recalculate in milligrams from the patient's verified weight, select the exact marketed concentration, specify route and interval, and compare the 24-hour total with both regional pediatric labeling and the adult maximum. Avoid guessing from age bands when a current weight is available, particularly at extremes of body size.[8,13]

A caregiver should be given a written instruction listing the active ingredient, mg per dose, mL per dose when relevant, minimum interval, duration, maximum in 24 hours and explicit warning against duplicate ingredients. For local anesthetic, document concentration, vasoconstrictor, injection site, cartridges or volume and total mg; consider additive toxicity when multiple anesthetics are given. Sedative administration and recovery require a separate time-based medication and monitoring record.[5,6,38]

A calculation example illustrates why formulation matters: a hypothetical 20-kg child receiving a reference dose of 10 mg/kg requires 200 mg of active ingredient per administration. At a concentration of 100 mg/5 mL, this corresponds to 10 mL, whereas 200 mg/5 mL corresponds to 5 mL. This is an arithmetic example rather than a patient-specific prescription. Product authorization, minimum age, therapeutic need and daily maximum must still be checked before any drug is administered.[8,13]

Table 2: Selected pediatric reference doses and safety limits (not a stand-alone prescription chart).

Agent or situation	Reference dose or limit	Essential qualification
Acetaminophen (paracetamol)	10-15 mg/kg orally per dose every 4-6 h as needed	Consult local daily maximum (commonly 60-75 mg/kg/day); never exceed product or adult limit; review liver disease
Ibuprofen	4-10 mg/kg orally per dose every 6-8 h as needed	Check jurisdictional minimum age and maximums; avoid dehydration, renal dysfunction and NSAID hypersensitivity
Amoxicillin for indicated infection (>3 months; <40 kg)	20-40 mg/kg/day divided every 8 h OR 25-45 mg/kg/day divided every 12 h	These are broad reference ranges, not automatic dental prescriptions; use local infection protocol and re-evaluate
Endocarditis prophylaxis: amoxicillin (only eligible patients)	50 mg/kg oral single dose, maximum 2 g, 30-60 min before intervention	Confirm high-risk condition, procedure and current cardiac guidance
2% lidocaine for dental infiltration/block	Conservative pediatric dental maximum 4.4 mg/kg; 34 mg per 1.7-mL cartridge	Use the lowest effective dose; count all administered local anesthetic
4% articaine for dental infiltration/block	Reference maximum 7 mg/kg; 68 mg per 1.7-mL cartridge	Generally not recommended below age 4; verify product-specific labeling and maximum

Sources: AAPD medication and local anesthesia guidance and AHA prophylaxis recommendations cited in the text. Verify doses against national prescribing information and patient factors.

CONTRAINDICATIONS AND ADVERSE EFFECTS

NSAIDs warrant caution or avoidance in children with dehydration, renal impairment, active gastrointestinal bleeding, clinically significant platelet dysfunction or an established NSAID-triggered hypersensitivity phenotype; relevant asthma history should be clarified rather than treated as an automatic contraindication. Acetaminophen overdose can cause severe hepatotoxicity, especially when combined cold remedies or analgesics contain the same ingredient. Aspirin is generally avoided for routine childhood analgesia because of the risk of Reye syndrome and bleeding concerns.[8,38]

Local anesthetic systemic toxicity can present with early neurologic symptoms, seizure, arrhythmia or cardiovascular collapse following excessive or intravascular administration. Prevention includes weight-based calculation, careful aspiration where relevant, slow injection and observation. Benzocaine and prilocaine deserve additional caution in patients susceptible to methemoglobinemia. Postanesthetic self-biting is a common preventable pediatric complication; parents should supervise eating and chewing until sensation returns.[5,22]

Beta-lactams can cause rash, gastrointestinal disturbance and rare anaphylaxis. A documented allergy should specify the implicated drug, phenotype, severity and timing rather than only the label 'penicillin allergy'. Macrolides can prolong the QT interval in susceptible patients, while clindamycin is associated with clinically important *Clostridioides difficile* risk. The practice should maintain an emergency plan and pediatric-appropriate rescue medications for anaphylaxis and sedation complications.[4,8,39]

DRUG INTERACTIONS

Medication reconciliation must include antiepileptic and psychotropic agents, anticoagulants, systemic steroids, inhaled therapies, antimicrobial courses, herbal products and drugs received during recent anesthesia. NSAIDs may increase bleeding risk with anticoagulants or antiplatelet therapy and may worsen kidney injury in dehydrated children or when combined with nephrotoxic medication. Concurrent systemic corticosteroids may further increase gastrointestinal complications.[8,40]

Macrolide antibiotics, especially clarithromycin, can inhibit drug metabolism and increase exposure to certain benzodiazepines or anticonvulsants; QT-prolonging combinations require additional scrutiny. Metronidazole can potentiate warfarin. Vasoconstrictor-containing local anesthetics merit individualized review in children with significant cardiovascular disease or taking certain sympathomimetic or psychotropic medicines. Multiple CNS depressants can interact synergistically during sedation, even if individually administered doses appear ordinary.[4,5,6]

Whenever a clinically relevant interaction is possible, clinicians should use a current pediatric interaction checker, consult the child's treating physician or pharmacist, and document the resulting modification.

SPECIAL POPULATIONS: MEDICALLY COMPROMISED CHILDREN

Children with renal dysfunction may require alterations in antibiotic selection or dosing and often should avoid NSAIDs; significant hepatic disease increases concern about acetaminophen and some sedatives. Obesity, very low body weight and younger age complicate simple total-body-weight dosing, especially for lipophilic sedatives; dosing strategy should follow the specific drug and pediatric anesthesia or pharmacy protocol.[11,40]

For children receiving chemotherapy, immunosuppressive therapy or hematopoietic stem-cell transplantation, coordinate invasive treatment with the medical team and review infection risk, current blood counts and potential treatment-related mucositis. Routine prophylaxis in a child with immune compromise is not automatically indicated for every dental procedure; the decision should reflect the disease, degree of immunosuppression, procedural risk and specialist advice. Oral care and prevention are particularly important before immunosuppression.[25,37,41]

Children with congenital heart disease require case-specific assessment for infective endocarditis prophylaxis, not blanket antibiotic treatment. Suspected or diagnosed obstructive sleep apnea, craniofacial airway anomalies, neuromuscular disease and significant developmental impairment raise sedation-related airway and monitoring concerns. In children with complex special health care needs, individualized care planning and medical coordination may be more consequential than the choice between equivalent first-line medicines.[6,26,40,42]

High-risk cardiac categories include a history of infective endocarditis, certain prosthetic valves or prosthetic material used for valve repair, and selected congenital heart conditions; a routine heart murmur alone is not sufficient. For children with bleeding disorders, anticoagulation or significant thrombocytopenia, the primary plan may need local hemostasis and coordination rather than routine systemic analgesic or antibiotic escalation. The treating specialty team should determine individualized precautions for truly complex cases.[25,26,40]

CLINICAL DECISION-MAKING

The first decision is whether the child has a treatable dental source requiring an intervention. For routine caries-related pulp pain, arrange definitive restorative or pulpal care and provide age-appropriate nonopioid analgesia only if needed. For a local abscess, drain or remove the source when clinically feasible; antibiotics alone should not delay treatment. Fever, rapid extraoral spread, trismus, difficulty swallowing, dehydration or

airway symptoms mandate escalation rather than an empiric outpatient prescription without review.[3,23,43]

For painful procedures, match local anesthetic to the treatment duration and calculate its dose before injection. Escalate from nonpharmacological behavior guidance to nitrous oxide, sedation or general anesthesia only when benefits clearly outweigh risks and appropriate supervision is available. For children with high caries risk, select fluoride and lesion-arrest interventions according to developmental stage, parental preference and disease activity. Table 3 provides an indication-based pathway.[5,7,14,44]

The main controversies and evidence gaps are not the existence of standard drugs, but the boundaries of their use: few high-certainty pediatric dental studies compare multidrug analgesic schedules; benefits of routine premedication are uncertain; articaine-versus-lidocaine comparisons may have heterogeneous outcomes; antibiotic duration and choice vary between national guidelines; and medically complex children are underrepresented in sedation and pharmacotherapy trials. Updating local protocols against new guidance should therefore be a continuous quality activity.[15,17,18,20,24]

Before completing a prescription, clinicians can apply six checks: (1) Is there an evidence-based indication? (2) Has the dental source been addressed? (3) Is the agent suitable for the age and medical conditions? (4) Has the weight-based dose and dosage form been verified? (5) Are interactions, allergy and the total daily exposure acceptable? (6) Does the caregiver understand use and red-flag symptoms? Such an audit is practical during routine pediatric dentistry, even when specialist prescribing support is unavailable.[2,4,8]

Table 3: Pragmatic decision pathway for common pediatric dental scenarios.

Presentation	First clinical action	Role of medication
Pulpal pain; no systemic signs	Diagnose and deliver definitive dental treatment	Short-course nonopioid analgesic if needed; antibiotic usually not indicated
Small localized abscess; well child	Drain / extract / treat source; review clinically	No routine antibiotic if localized and controlled
Facial cellulitis, fever or spreading swelling	Urgent source control and severity assessment	Systemic antibiotic as adjunct; hospital referral if systemic/airway concerns
High-risk cardiac condition before invasive procedure	Confirm indication with current cardiac recommendations	Single preprocedure prophylactic dose only when criteria are met
Severe anxiety or extensive rehabilitation	Assess behavior guidance, airway risk and treatment burden	Nitrous oxide or formal sedation/anesthesia only in appropriate setting
Active caries with high-risk profile	Risk-based prevention and lesion-specific treatment	Fluoride varnish; selected SDF with informed consent

Sources: synthesized from AAPD, ADA, and EAPD clinical guidance cited in the text. Decisions require individualized assessment.

CONCLUSIONS

Safe pharmacological pediatric dentistry is an exercise in selecting fewer, better-indicated medications. Nonopioid analgesics, correctly calculated local anesthetics and carefully selected preventive agents address most routine needs. Antibacterial prescriptions require a clear indication and definitive source treatment; procedural sedation requires specialized infrastructure, trained personnel and readiness to rescue. Actual pediatric weight, comorbidities, concurrent drugs and caregiver instructions should be checked at every prescription. International guidance provides a sound framework, but the final regimen must follow current country-specific licensing, formulations and clinical judgment.[1,2,3,6]

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