Research Article

Rational Antibiotic Use in Adolescent Dental Care: Pharmacology, Clinical Evidence, and Stewardship—A Narrative Review

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Abstract

Objective. To review when systemic antibiotics are appropriate in adolescent dental care and the implications for pharmacological selection, prevention of complications and antimicrobial stewardship.

Data sources. A narrative review of literature described as searched in PubMed, Embase, Cochrane Library, LILACS, SciELO and Google Scholar for January 2000–September 2026, supplemented by professional guidance.

Data synthesis. Localised pulpitis and odontogenic infections usually require dental source control rather than systemic antibiotics. Guidance for children and adolescents supports antibiotics when infection spreads or systemic features develop. Extraction prophylaxis may reduce infection, but its routine use in otherwise healthy patients has uncertain net value. Selected high-risk cardiac patients may require prophylaxis for invasive procedures. Evidence for audit and feedback is promising but comes chiefly from broader primary-care populations.

Conclusion. Adolescent dental stewardship should combine timely dental treatment, careful assessment of allergy and body weight, conservative antibiotic selection and patient-centred counselling. More studies reporting outcomes separately for adolescents are needed.

Keywords: Adolescent; Dentistry; Anti-Bacterial Agents; Antimicrobial Stewardship; Drug Resistance, Bacterial.

Introduction

Dentistry accounts for approximately 10% of antibiotic prescriptions across health care; one review estimated that as many as 80% may be inappropriate, although estimates depend on the setting and definition used.[1] The 2021 Global Burden of Disease analysis estimated that oral disorders affected 3.69 billion people worldwide.[2] A separate analysis of 2019 Global Burden of Disease data found that untreated caries of permanent teeth was most prevalent at ages 20–24 years, reflecting disease accumulated through adolescence.[3]

Antibiotic resistance adds a wider public-health cost to unnecessary prescribing. An international analysis estimated 4.71 million deaths associated with bacterial antimicrobial resistance in 2021.[4] In India, a systematic review found substantial variation in dental antibiotic use and documented self-medication for dental problems.[5] However, most published prescribing and outcome studies do not report a distinct 10–19-year subgroup.

Adolescence is important because dental pain, third molar eruption, emerging independent health decisions and variable access to care intersect with medication use. This review focuses on clinically justified indications, pharmacological safety and practical strategies to reduce avoidable exposure. Findings from adults or mixed-age cohorts are identified as indirect evidence rather than presented as adolescent-specific results.

A scoping review of dental prescribing described wide variation in indications, regimens and sources of prescribing advice.[6] This inconsistency is particularly relevant at the boundary between paediatric and adult services: chronological age alone does not determine the appropriate formulation or dose. The review therefore treats adolescence as a transition in clinical responsibility, not as evidence that adolescents respond differently to every antibiotic. The focus is on decisions most likely to expose healthy young people unnecessarily, especially pain-driven prescribing and prophylaxis around third molar treatment.

Methods

This narrative review draws on the author-described search of MEDLINE/PubMed, Embase, the Cochrane Library, LILACS, SciELO and Google Scholar for publications dated 1 January 2000 to 30 September 2026. Search concepts included antibiotic or antimicrobial prescribing, dentistry, common odontogenic conditions, prophylaxis, antimicrobial stewardship and adolescent or paediatric care. Searches were described as using adolescent terms both with and without an age restriction to capture relevant mixed-age evidence.

The narrative approach was chosen because the questions concern several types of evidence: treatment decisions, prophylaxis, microbial mechanisms, drug safety, and clinician or patient behaviour. A single pooled effect would not be meaningful across these outcomes. However, a structured search description should not be mistaken for a completed systematic review: without the underlying search history, numbers of retrieved records, exclusion reasons and duplicate-screening procedures cannot be independently audited. Accordingly, no screening flowchart or numerical claims about the total body of evidence are included.

Priority was given to professional clinical guidance, systematic reviews, trials, observational prescribing studies and stewardship evaluations. Case reports, conference abstracts without full texts and studies with no discernible clinical relevance to adolescent permanent-dentition care were not prioritised. Evidence was summarised narratively across clinical indications, pharmacology and stewardship; effect estimates and certainty labels are attributed to the original reports. There was no independent pooled analysis or uniform study-level risk-of-bias assessment. Numerical screening counts could not be reconstructed from the supplied source material and are therefore not presented.

Why source control comes first

Odontogenic infection develops in an organised microbial biofilm and may persist in a necrotic root canal without an effective vascular route for systemic drug delivery. A prescription can reduce spread beyond the tooth but cannot replace drainage, root canal treatment, pulp therapy or extraction. Microbiological diagnostic methods may help in refractory infection, yet source control remains central.[7] The oral microbiome also carries antibiotic-resistance determinants, providing a further reason to avoid unnecessary courses.[8]

Early odontogenic lesions commonly include facultative oral streptococci, while more established infections may contain larger anaerobic components, including Prevotella, Fusobacterium and related genera. This microbial shift helps explain why metronidazole may be added in selected severe or spreading infections, not why it should accompany amoxicillin routinely. Susceptibility and clinical circumstances vary. Where infection remains localised to a necrotic tooth, changing antibiotic spectra without eliminating the nidus is unlikely to provide a durable solution.[7,8]

Clinical urgency depends on the extent of spread and the patient's condition, not pain intensity alone. Fever, progressive extraoral swelling, trismus, dysphagia, systemic illness or a threatened airway require urgent assessment; severe infections may need hospital management, surgical drainage and parenteral treatment. In contrast, uncomplicated localised pulpitis or an apical lesion without systemic involvement is generally managed by definitive dental treatment and analgesia.[9,10,11]

An important age limitation is that the 2019 American Dental Association guideline addresses immunocompetent adults. Its findings help explain the evidence but should not be quoted as direct evidence for younger adolescents. Paediatric-specific recommendations provide the more appropriate clinical framework for minors.[9,10,11]

Pharmacological considerations

Amoxicillin is frequently selected for dental infections and was the most commonly recorded agent in a national United States Veterans Affairs analysis of 2019 dental prescribing; that cohort does not represent adolescents.[12] Australian dispensing data also show substantial use of amoxicillin, amoxicillin–clavulanate and metronidazole by non-medical prescribers, among whom dentists contribute heavily.[13] When antibiotics are needed, choice should reflect probable pathogens, allergy history, recent exposure, local resistance and severity rather than a routine broad-spectrum preference.

The World Health Organization Access, Watch and Reserve framework supports careful use of narrower-spectrum agents when suitable.[14] Amoxicillin and phenoxymethylpenicillin are commonly used first-line options; metronidazole adds anaerobic activity in selected spreading infections, but does not cover aerobic or facultative streptococci. Amoxicillin–clavulanate generally should not replace a narrower agent without a specific clinical reason. Clindamycin carries an important risk of Clostridioides difficile-associated diarrhoea, and macrolide resistance varies by population.

Dose selection in adolescence must be based on age, actual body weight, renal function when relevant and a current paediatric formulary. A single 40-kg threshold does not govern every antibiotic or formulation. For this reason, a universal dosage table would risk oversimplifying prescribing; the practical considerations are summarised in Table 1.[10,11]

Penicillins act through time-dependent bacterial killing, making adherence to the prescribed interval important. Their generally adequate oral absorption should not be confused with access to a devitalised root-canal space. A more complicated regimen may create practical barriers at school, while higher doses or broader combinations can increase

adverse effects without addressing the reason for treatment failure. If clinical deterioration occurs, the priority is to reassess drainage, the diagnosis and the need for urgent referral, rather than simply adding a second antimicrobial.[10,11]

Table 1. Practical antibiotic selection and safety considerations in adolescent dentistry

Agent / class	Potential use when indicated	Important limitations
Amoxicillin or penicillin V	Common first-line treatment for susceptible odontogenic infections	Check allergy, weight-based dose and local guidance; do not use in place of drainage
Amoxicillin–clavulanate	Selected severe, complicated or nonresponding infections	Broader coverage and more gastrointestinal adverse effects; not a routine first choice
Metronidazole	Selected adjunct where anaerobic coverage is needed	No reliable streptococcal coverage; review interacting medicines and current counselling guidance
Clindamycin	Restricted alternative after careful allergy review	Higher risk of C. difficile infection; avoid automatic substitution
Azithromycin / other alternatives	Selected patients with confirmed relevant beta-lactam allergy	Variable streptococcal susceptibility and resistance; use local guidance
Doxycycline	Selected periodontal or trauma-related indications	Not a routine empirical drug for simple odontogenic infection; assess age and indication

Note: Individual regimens and duration should follow a current national paediatric formulary and the clinical scenario, not this summary table.[14,10,11]

Adverse reactions and allergy labels

Antibiotic exposure can cause rash, gastrointestinal effects, allergic reactions and disruption of commensal microbial communities. An unconfirmed childhood penicillin allergy label may lead to broader or less suitable alternatives. A UK study reported how electronic health records supported delivery of a primary-care randomised trial of allergy assessment; it describes implementation infrastructure, not proof of efficacy in adolescent dental practice.[15] Dental visits provide an opportunity to ask what reaction occurred and, where appropriate, refer for formal evaluation rather than remove an allergy label without assessment.

For adolescents, instructions should be given to the young person as well as caregivers. Regimens may conflict with school schedules, and counselling should include adverse effects, missed doses and indications for prompt reassessment. Most commonly prescribed dental antibiotics do not meaningfully reduce the effectiveness of combined hormonal contraception, unlike enzyme-inducing rifamycins; non-judgemental medication review remains useful.[10]

Evidence for prophylaxis

Third molar extraction

A Cochrane review of 23 randomised trials involving approximately 3,206 participants found that antibiotics may reduce postoperative infection after extraction, especially impacted third molars (relative risk 0.34; 95% confidence interval 0.19–0.64; low-certainty evidence; number needed to treat 19). The reported number needed to treat for dry socket was 46.[16] A more recent network meta-analysis also suggested benefit, but included mostly healthy patients undergoing lower third molar surgery.[17] These trials overlap the age range of older adolescents but rarely provide adolescent-specific results. Routine prophylaxis for uncomplicated removal in a healthy young person therefore needs a case-specific risk–benefit assessment rather than automatic prescription.

A relative risk reduction should be considered alongside the absolute number of events. In the Cochrane trials, the average untreated postoperative infection risk was low and the authors also found no clear advantage of preoperative, postoperative or combined scheduling. Many individual studies were at high or unclear risk of bias, and participants were mainly healthy adults in their twenties. Thus the results offer indirect guidance for late adolescence, but do not establish that every healthy 16- or 17-year-old will benefit from prophylaxis. Operating complexity and host risk should be assessed separately.[16]

Infective endocarditis and orthodontic procedures

The Cochrane review of endocarditis prophylaxis found very-low-certainty evidence and no convincing demonstration of benefit in its limited comparative data.[18] In contrast, a large observational US analysis found an association between

prophylaxis and lower endocarditis risk after invasive dental procedures among high-risk patients; the observational design cannot establish causality.[19] The 2021 American Heart Association statement limits prophylaxis to patients at highest risk of adverse outcomes who undergo procedures involving gingival or periapical manipulation or perforation of oral mucosa.[20]

High-risk cardiac groups include patients with a previous episode of infective endocarditis, selected prosthetic valve or valve-repair material, and particular congenital heart conditions. They are not interchangeable with all patients who have congenital heart disease or a history of cardiac surgery. A patient with a repaired lesion may or may not qualify depending on residual defects and the precise diagnosis. For dental clinicians treating adolescents, a clear medical history and communication with the cardiology team are preferable to making a prophylaxis decision solely from a broad chart label.[20]

This distinction matters in orthodontics: routine bracket bonding and archwire adjustment usually do not require prophylaxis, but placement of an orthodontic band may involve gingival manipulation and should be assessed individually in a qualifying high-risk cardiac patient.[20] The presence of a heart murmur alone does not establish eligibility. A documented cardiac diagnosis and the current procedure-specific recommendations should determine the decision.

Therapeutic antibiotic indications

Table 2 summarises the main practical decisions. Localised symptomatic irreversible pulpitis, uncomplicated apical periodontitis and localised swelling without systemic involvement usually call for dental intervention rather than antibiotics.[9,10,11] However, the adult ADA guideline contains conditional delayed-prescription options in selected cases of pulp necrosis when definitive treatment is unavailable; the manuscript should not claim that antibiotics are never considered under any circumstances.[9] In children and younger adolescents, the paediatric guidance and timely reassessment should take priority.

Table 2. Antibiotic decisions in common dental presentations

Presentation	Antibiotic decision	Primary action / qualification
Pulpitis, localised apical disease or small swelling without systemic illness	Usually not indicated	Dental source control, analgesia and follow-up; apply age-appropriate guidance
Diffuse swelling, fever, progressive cellulitis or systemic illness	Indicated as adjunct to urgent care	Assess severity; arrange drainage and urgent dental or hospital treatment
Dysphagia, floor-of-mouth elevation or airway concern	Emergency; systemic treatment may be required	Immediate emergency referral and airway assessment
Localised pericoronitis	Usually not indicated	Irrigation, local cleaning and definitive management of causative tooth
Severe periodontitis in selected young patients	May be considered as adjunct	Subgingival debridement and specialist assessment before antimicrobial selection
Avulsed permanent tooth after replantation	Recommended in trauma guidance, evidence limited	Urgent replantation/trauma protocol; evaluate contamination and tetanus status
Dry socket or uncomplicated crown fracture	Not routinely indicated	Local management; reconsider only with a separate infection or wound indication

Note: Recommendations combine adult and paediatric guidance where noted; antibiotic treatment never replaces definitive dental care.[9,10,21,11]

Periodontal disease and trauma

A systematic review of adjunctive systemic antimicrobials for periodontitis found an average additional reduction in probing depth of around 0.45–0.49 mm alongside subgingival debridement, but adverse events occurred more often with antibiotics.[22] These effects do not justify medication for plaque-induced gingivitis or mild disease. For an

adolescent with severe molar–incisor pattern periodontitis, periodontal assessment, mechanical treatment and careful case selection remain essential.

The periodontal findings require care in interpretation. Small mean differences in probing depth can be statistically significant but may have limited clinical importance in mild disease. Responses also vary with baseline pocket depth, the quality of mechanical treatment and the periodontal phenotype. Although early-onset severe disease merits specialist attention, the literature does not support extending an amoxicillin–metronidazole regimen to routine gingivitis in otherwise healthy adolescents. Discussing oral hygiene, smoking or smokeless tobacco exposure where relevant, and follow-up attendance remains part of treatment.

The International Association of Dental Traumatology recommends systemic antibiotics after replantation of avulsed permanent teeth, while noting limited direct evidence of benefit.[21] Antibiotics are not routinely indicated for an uncomplicated crown fracture. Contaminated wounds should be assessed separately, and clinical urgency should not distract from immediate management of the injured tooth.

Prescribing behaviour and adolescent-specific gaps

In the Veterans Affairs study, 92,224 dental antibiotic prescriptions were linked to 88,539 visits, and only 17.5% of visits met a consensus-based definition of appropriate use; these results concern a largely adult US population.[12] In a survey of dentists at five Karachi teaching institutions, adherence to paediatric prescribing recommendations varied substantially across clinical scenarios.[23] Another survey found that many paediatricians were willing to prescribe for localised dental sepsis without fever, underlining the need to engage medical services that see children with toothache.[24]

Adolescents may obtain medicines through dental care, medical consultations or self-medication. An Indian review reported self-medication for dental complaints in general populations but did not establish an adolescent-specific prevalence.[5] Rurality, deprivation and access barriers also shape prescribing; a Welsh study reported associations between prescribing, deprivation and rural residence in general medical practice.[25] The wider US evidence on equity similarly shows variation by demographic and socioeconomic characteristics but does not quantify effects for adolescent dental patients specifically.[26]

A health-equity response should not rely exclusively on prescribing restrictions. Adolescents who attend only when pain becomes intolerable may have missed opportunities for prevention and early restorative care. If definitive dental treatment is delayed by cost, travel or service capacity, a repeat prescription can appear convenient despite offering little lasting benefit. Pathways to urgent dental appointments and age-appropriate explanations of the treatment plan are therefore essential components of stewardship, especially where medicines can be obtained without close clinical oversight.

These findings favour interventions that improve access to timely dental care as well as reduce prescribing. Simply refusing an unnecessary antibiotic without arranging definitive treatment may leave a patient in pain and encourage further unsupervised medication use.

Antimicrobial stewardship and implementation

Audit and feedback has the clearest measurable evidence in general primary care. A meta-analysis of 56 randomised trials found relative reductions of 11% in total antibiotic prescribing and 23% in unnecessary initiation. The studies were heterogeneous and predominantly outside dentistry, so those percentages cannot be presented as proven effects in adolescent dental care.[27] Nonetheless, providing clinicians with periodic, case-mix-adjusted prescribing feedback is a reasonable candidate for local evaluation.

A dental preimplementation study found that confidence in prescribing increased with professional seniority without a corresponding gain in knowledge, supporting decision aids and training tailored to real clinical scenarios.[28] An international Delphi process developed a common outcome set for dental antibiotic stewardship studies, which could help future evaluations compare appropriateness and patient outcomes rather than prescription numbers alone.[29]

Implementation should be measured at the level of clinical appropriateness rather than antibiotic volume alone. A simple reduction in prescriptions can conceal under-treatment of severe infection, while a high prescribing rate in a referral centre may reflect a different case mix. Useful measures include the indication recorded, whether source control was provided, the spectrum and duration selected, complications, adverse drug reactions and the adolescent's understanding of instructions. These endpoints can be aligned with the international core outcome set to permit comparisons between services.[29]

Table 3. Priority stewardship actions for adolescent dental services

Action	How to implement	Evidence boundary
Improve access to source control	Fast-track painful cases for pulp therapy, drainage or extraction	Clinical rationale and paediatric guidance; access effects need local evaluation
Document indication, allergy and weight	Use a short clinical checklist and a current paediatric formulary	Guideline-consistent process, not an adolescent-specific trial outcome
Reduce routine prophylaxis	Review third molar and cardiac-risk protocols separately	Extraction trials mainly involve healthy young adults; high-risk cardiac evidence is observational
Audit and feedback	Provide prescriber-specific reports and peer comparison	11% and 23% effect estimates are from general primary-care trials
Teach adolescents and caregivers	Explain why operative care is needed and the risks of self-medication	Patient-directed dental stewardship intervention trials are lacking
Measure outcomes consistently	Record appropriateness, complications, adverse effects and patient experience	Use the international dental stewardship core outcome set

Note: Table synthesises clinical guidance and research; implementation proposals are not outcomes proven specifically in adolescents.[27,29,10,11]

Strengths, limitations and research priorities

A strength of this review is the combined examination of antibiotic indications, pharmacology, surgery and prescribing behaviour from an adolescent-health perspective. Its main limitation is that much of the underpinning evidence concerns adults or mixed-age cohorts. The narrative design, selection by one reviewer and absence of a uniform risk-of-bias assessment increase the possibility of selection and interpretation bias. The original search log, complete search outputs and screening counts were not available for this editorial check, so exhaustive retrieval and the precise screening pathway cannot be independently confirmed.

Future studies should report prescribing and treatment outcomes specifically for ages 10–19; examine whether third molar prophylaxis effects differ by age and procedural risk; estimate self-medication in school and community settings; test patient-directed education alongside improved dental access; and use comparable stewardship outcomes. Longitudinal assessment of resistance and microbiome changes after repeated dental antibiotic courses is also needed.

Conclusion

For most localised adolescent dental presentations, timely operative treatment is more useful than an antibiotic prescription. Systemic antibiotics remain important for spreading infection, selected trauma and periodontal indications, and clearly defined high-risk prophylaxis. Clinicians should avoid applying adult recommendations uncritically to minors, confirm allergy and weight before prescribing, and use current paediatric guidance to select the narrowest appropriate regimen. Adolescent-focused stewardship needs better dental access, prescriber feedback and direct communication with young patients; its effectiveness requires prospective evaluation.

Declarations

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