ANTIBIOTICS FOR PAEDIATRIC PATIENTS IN DENTISTRY: AN OVERVIEW OF AVAILABLE GUIDELINES

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Abstract

The administration of antibiotics to children undergoing dental procedures is generally contemplated in specific instances to prevent or address potential infections. This thorough review aims to enhance current guidelines by integrating additional evidence regarding the need for administering antibiotics to children undergoing dental treatments. We conducted an extensive review of literature, focusing solely on English-language sources retrieved from Google Scholar, SCOPUS, MEDLINE, and PubMed databases up to August 2023. Our primary focus was on exploring the use of antibiotics in paediatric dental care. Inaccurate antibiotic prescriptions can result in widespread consequences, such as the development of bacterial resistance, complications in the gastrointestinal and haematological systems, and disruptions in the bacterial microbiota. This review highlights the importance of following existing guidelines for prescribing antibiotics in paediatric dental care, underscoring the crucial role of dentists' clinical judgement before authorising prescriptions. Additionally, it strongly promotes collaborative communication with medical practitioners to evaluate the patient's clinical condition. Consequently, it is imperative to establish comprehensive antibiotic prescribing guidelines for dental professionals.

Keywords: Antibiotic Therapy, Antibiotic Prophylaxis, Children, Dentistry, Paediatric

Introduction

Antibiotics find widespread application within the field of dentistry, serving dual roles in therapeutic and prophylactic capacities. Their fundamental purpose lies in safeguarding vulnerable individuals from diseases attributable to microbial agents (1). Prophylactic antibiotic administration is primarily aimed at preventing endocarditis, while therapeutic antibiotics are employed when persistent soft tissue conditions necessitate ongoing local treatments. In the absence of an infection, it is customary to recommend antibiotic prophylaxis (AP) to minimise the risk of either local or disseminated infections (2). The escalating prevalence of antibiotic resistance presents a formidable challenge, undermining the efficacy of a crucial tool in combating severe infections. The growing concern over resistance casts a shadow over progress in healthcare. Effectively addressing this challenge demands a collaborative approach aimed at managing the rise of resistance, which hinges on optimising antibiotic usage. Recognising the pressing necessity to combat the growing menace of resistance, multiple institutions have initiated measures to enhance antibiotic stewardship (3). The 2016 Antimicrobial Use and Resistance in Australia (AURA) report underscored that broad-spectrum antibiotics pose a greater risk of fostering antimicrobial resistance compared to their narrow-spectrum counterparts (4).

The pervasive and indiscriminate application of antibiotic prophylaxis is no longer considered appropriate. Nevertheless, challenges persist in formulating guidelines for judicious prescription. In the field of dentistry, this issue remains pertinent and an ongoing subject of discussion. Significantly, there exists a conspicuous divergence in the prescription patterns of antibiotic prophylaxis for infective endocarditis (IE) among healthcare professionals. This inconsistency can be attributed to conflicting recommendations offered by different national and international authorities (5).

The primary objective of this extensive review is to enrich current guidelines and strengthen the existing evidence

base by conducting a comprehensive assessment of the need for antibiotics in children undergoing dental procedures.

Materials and Methods

Our investigation involved thorough searches conducted in the Google Scholar, SCOPUS, MEDLINE and PubMed databases, utilising specific MESH terms: ("Child" OR "Children" OR "Pediatric" OR "Paediatric") AND ("Antibiotic Prophylaxis" OR "Antibiotic therapy") AND ("Oral Surgical Procedures" OR "Head, Neck, Surgery" OR "Dental Procedures" OR "Dental Extraction" OR "Dental Infection" OR "Dental General Anesthesia OR Dental General Anaesthesia"). We limited our search to articles published in the English language up to August 25, 2023. All identified articles were meticulously catalogued, and a rigorous examination of the full texts from pertinent studies was subsequently undertaken. This review has been officially registered within the National Medical Research Register (NMRR) under the auspices of the Ministry of Health (MOH) in Malaysia, identified by the NMRR ID-23-03384-TO8.

Discussion

Antibiotic therapeutics (AT) for children

Antibiotics play a dual role in the field of dentistry, serving both as therapeutic agents and for prophylactic purposes. AT is employed when a bacterial infection is present, requiring extended treatment even in the absence of clear clinical signs of infection. Upholding excellent oral health in children is essential to avoid unnecessary exposure to antibiotics, as they should not be used for the treatment of routine dental infections (6).

Bacteraemia can occur due to invasive medical procedures, with varying reported frequencies. For example, reported incidences range from 18% to 85% following tooth extraction and from 60% to 90% during periodontal surgery (7). Beta-lactam antibiotics represent a category of antimicrobial substances distinguished by the presence of a beta-lactam ring within their molecular configuration. This ring consists of a cyclic amino structure consisting of three carbon atoms and one nitrogen atom (8). Bactericidal agents that hinder cell wall synthesis effectively target a wide range of bacteria, encompassing Gram-positive, Gram-negative, and anaerobic species (8).

Amoxicillin, belonging to the penicillin class of antibiotics, demonstrates effectiveness against Gram-negative bacilli and is frequently regarded as the primary treatment option for children without allergies (9). The recommended antibiotic therapy dosages, as outlined by the Ministry of Health Malaysia for managing acute odontogenic infections in children (10, 11), are presented in Table 1. The inclination toward amoxicillin can be attributed to several factors, including its moderate spectrum of activity, favourable bioavailability, and the capacity to attain substantial plasma concentrations through oral administration. Additionally, it is associated with relatively minor adverse effects (11-13).

Table 1: Antibiotic therapy in dental procedure

Regimen	Route of Administrations	Children
Phenoxy methyl Penicillin	Oral	Phenoxymethylpenicillin 125 mg/5 ml (Syrup) Up to 1 year (< 10 kg): 62.5 mg QID 1-5 years (10 to < 21 kg): 125 mg QID 6-12 years (21 - < 39 kg): 250 mg QID ≥ 12 years old and adult (≥ 39 kg): 500-750 mg QID
Ampicillin	Oral	Ampicillin Trihydrate 125 mg/ 5 ml Suspension 50-100 mg/kg/day 4 times daily Under 1 year: 62.5-125 mg QID daily 1-10 years: 125-250 mg QID daily
	Intravenous	Ampicillin Sodium 500 mg injection 150 mg/kg/daily in divided doses every 4-6 hours (Maximum 400 mg/kg/day) *Children dose less than 10 years, half adult doses (250-500 mg)
Amoxicillin *First choice in dental infection	Oral	**Mild infection** Amoxicillin 250 mg Capsule 15-50 mg/kg/day in divided doses 8 hourly (Maximum doses: 2 g) Amoxicillin Syrup 15-50 mg/kg/day in divided doses 8 hourly (Maximum doses: 2 g) **Moderate to severe infection** Amoxicillin 250 mg Capsule 50-80 mg/kg/day in divided doses 8 hourly (Maximum doses: 2 g) Amoxicillin Syrup 50-80 mg/kg/day in divided doses 8 hourly (Maximum doses: 2 g)
Cephalosporin	Oral	Cephalexin Monohydrate 125 mg or 250 mg/5 ml Syrup 25-100 mg/kg/day QID (Maximum 4 g daily).

Table 1: Antibiotic therapy in dental procedure (continued)

Regimen	Route of Administrations	Children
Metronidazole	Oral	Metronidazole 200 mg Tablet 7.5 mg/kg 8 hourly Metronidazole 200 mg/100 ml Suspension 7.5 mg/kg TDS
	Intravenous	Metronidazole 500 mg/100 ml Injection 7.5 mg/kg bodyweight TDS (Maximum doses: 500 mg)
Amoxicillin & Clavulanate	Oral	Amoxicillin & Clavulanate 228 mg/5 ml Syrup Mild-moderate infections; 15-50 mg/ kg/day (equivalent to Amoxicillin doses) in 2 divided doses Moderate to Severe infection; 50-80 mg/ kg/day (equivalent to Amoxicillin doses) in 2 divided doses Amoxicillin 500 mg & Clavulanate 125 mg Tablet Child more than 12 years and adult: 625 mg BD daily
	Intravenous	Amoxicillin 1 g & Clavulanate 200 mg Injection Amoxicillin 500 mg & Clavulanate 100 mg Injection Less than 3 months: 30 mg/kg BD 3 months-12 years: 30 mg/kg TDS/QID
Ampicillin/ Sulbactam	Oral	Ampicillin Sodium & Sulbactam Sodium 250 mg/ 5ml Suspension 25-50 mg/kg daily Ampicillin Sodium & Sulbactam Sodium 375 mg Tablet 25-50 mg/kg day in 2 divided doses *if > 30 kg, 375-750 mg BD

Table 1: Antibiotic therapy in dental procedure (continued)

Regimen	Route of Administrations	Children
	Intravenous	Ampicillin Sodium 1 g & Sulbactam Sodium 500 mg Injection Ampicillin Sodium 500 mg & Sulbactam Sodium 250 mg Injection 150-300 mg/kg/day 6-8 hourly
Cefuroxime	Oral	Cefuroxime Axetil 125 mg Tablet Cefuroxime Axetil 250 mg Tablet 30 mg/ kg/ day in 2 divided doses (up to 500 mg daily) Cefuroxime Axetil 125 mg/ 5ml Suspension 30 mg/ kg/ day in divided doses (up to 500 mg daily)
	Intravenous	Cefuroxime Sodium 250 mg Injection Cefuroxime Sodium 750 mg Injection Cefuroxime Sodium 1.5 g Injection 30-100 mg/kg/day in 3-4 divided doses
Allergic to Penicillin		
Azithromycin	Intravenous	Azithromycin 200 mg/5 ml Granule Less than 15 kg: 10 mg/ kg 15-25 kg: 200 mg 26-35 kg: 300 mg 36-45 kg: 400 mg *Taken daily for 3 days or as Single dose on Day 1 then half dose on Day 2-5.
Clarithromycin		Clarithromycin 125 mg/5 ml Granule (Maximum 1 g/day) less than 8kg: 7.5 mg/kg 1-2 years: 8-11 kg 2.5 ml 2-4 years: 12-19 kg 5 ml 4-8 years: 20-29 kg 7.5 ml 8-12 years: 30-40 kg 10 ml
Cefazolin	Intravenous	Cefazolin Sodium 1 g Injection More than 1 month: 25-50 mg/kg/day in 3-4 divided doses

Table 1: Antibiotic therapy in dental procedure (continued)

Regimen	Route of Administrations	Children
Ceftriaxone	Intravenous	Ceftriaxone 0.5 Injection Neonate up to 2 weeks: 20-50 mg/kg body weight (Not exceed 50 mg/kg) 3 weeks-12 years: 20-80 mg/kg body weight daily Body weight more than 50 kg: Adult dose (1-2 g once daily)
Erythromycin	Oral	Erythromycin Ethylsuccinate 200 mg/5 ml Suspension Erythromycin Ethylsuccinate 400 mg/5 ml Suspension 30-50 mg/kg/day Less than 2 years: 500 mg daily in divided doses 2-8 years: 1 g daily in divided doses *Increased to twice the usual dose in severe case Erythromycin Ethylsuccinate 400 mg Tablet 30-50 mg/kg/day in divided doses Infant — less than 2 years: 500 mg daily in divided doses 2-8 years: 1 g daily in divided doses Erythromycin Stearate 250 mg Tablet 30-50 mg/kg/day Less than 2 years: 500 mg daily in divided doses 2-8 years: 1 g daily in divided doses *Increased to twice the usual dose in severe case
Important: Children's dosages should not exceed adult dosages.		

QID = four times a day, TDS = three times a day, BD = twice a day, g = gram, mg = milligram,
kg = kilogram, ml = milliliter

Dental trauma in children

Administration of antibiotics to a child may be warranted depending on their medical condition. However, the use of systemic antibiotics in the emergency treatment of luxation injuries lacks robust supporting evidence. Furthermore, there is no evidence indicating that antibiotics enhance outcomes for teeth with root fractures and luxation injuries in the primary dentition. Dentists can choose whether to use antibiotics, especially when dealing with traumatic dental injuries, which often involve additional soft tissue and related injuries that require various surgical approaches. Moreover, the patient's general health condition may justify the administration of antibiotics for comprehensive coverage (14, 15). Any questions should be directed to the child's paediatrician. If there's a chance the injury got contaminated, a tetanus booster may be needed. If unsure, it's recommended to consult a medical practitioner within 48 hours (15).

The International Association of Dental Traumatology (IADT) consistently recommends the use of antibiotics for replanted avulsed teeth. These recommendations are derived from research involving animals such as dogs and monkeys, as well as expert opinions in the field (16). However, the current systematic review has underscored a lack of substantial evidence supporting the effectiveness of systemic antibiotics in the replantation process of avulsed permanent teeth. Consequently, the routine prescription of antibiotics cannot be recommended for medically fit children (17).

Surgical procedure in children

Experts from several Italian paediatric-focused scientific societies, such as the Italian Society of Paediatrics, Neonatology, Paediatric Infectious Diseases, Infectious and Tropical Diseases, Paediatric Surgery, Microbiology, Pharmacology, Anaesthesia, Neonatal and Paediatric Resuscitation, and Childhood Respiratory Diseases, collaborated to formulate a consensus on a set of recommendations (18). In the realm of paediatric maxillo-facial fracture surgery, Rigotti et al. have advocated for the judicious application of preoperative antibiotic prophylaxis. Their investigation highlights the importance of employing amoxicillin given orally at a recommended dose of 50 mg/kg, administered 30 minutes before the surgical procedure as part of preoperative preparation. Notably, Rigotti et al. (18) emphasise this practice, especially when the surgical intervention pertains to the mandible. It is crucial to underscore that prophylactic antibiotic usage is cautioned against in cases of surgeries involving the maxilla or zygoma.

When dealing with neonatal and paediatric patients undergoing surgery for cleft lip or cleft palate correction, it is crucial to acknowledge the importance of perioperative antibiotic prophylaxis (18). It is recommended to administer ampicillin/sulbactam at a dosage of 50 mg/kg (calculated based on ampicillin) via intravenous delivery 30 minutes prior to surgery (18). Moreover, Rigotti et al. (18) recommended the care of neonates and children undergoing clean-contaminated Ear, Nose, and Throat (ENT) surgery. These procedures involve intricate operations, including oral cavity resection, laryngectomy, phrenectomy, tracheotomy, and extraction of upper airway

tumour masses. In this scenario, it suggests administering perioperative antibiotic prophylaxis, particularly with cefazolin. The prescribed dosage is 30 mg/kg, not exceeding 2 grams, administered intravenously and timed precisely within 30 minutes before the surgery (18). Moreover, it is recommended to administer metronidazole concurrently at a dose of 15 mg/kg (with a maximum dose of 500 mg) alongside cefazolin to augment the effectiveness of the prophylactic approach (18).

There is no explicit guideline for antibiotic prescription during the surgical removal of impacted teeth or gold chain bonding procedures. The decision should consider the duration of the procedure and the extent of bone removal. If warranted, cefazolin is recommended at a dosage of 30 mg/kg, not exceeding 2 grams, administered intravenously 30 minutes before surgery (18). Furthermore, it is advised to administer metronidazole concurrently at a dosage of 15 mg/kg (with a maximum dose of 500 mg) (18).

Localised abscess in children

Systemic antibiotics use is not recommended for conditions such as reversible/irreversible pulpitis, localised dentoalveolar abscess (superficial), dry socket, and chronic gingivitis (11). Conversely, systemic antibiotics should be used for conditions including localised dentoalveolar abscess (deep infection/medically compromised), localised pericoronitis (if systemic signs and symptoms are present), chronic periodontitis (in cases of acute infection with systemic manifestations/medically compromised), aggressive periodontitis, osteomyelitis of the jaws of dental origin, cellulitis with or without abscess of dental origin, surgical site infection, traumatic wound infection, traumatic wound involving skin/infection of skin origin, and peri-implantitis (10, 11).

Cellulitis or spreading odontogenic infection in children

Antibiotics are necessary for treating acute infectious conditions, including but not limited to necrotising ulcerative gingivitis, stage III-grade C or incisor-molar pattern periodontitis (formerly categorised as localised aggressive periodontitis), acute periapical abscess, cellulitis, infections associated with periodontal abscesses, pericoronitis, peri-implantitis, deep-seated infections in the head and neck fascial layers, and cases presenting with concurrent fever and/or malaise (19, 20). In these circumstances, it is necessary to contemplate antibiotic treatment as part of the clinical management approach (19, 20).

Antibiotic prophylaxis (AP) in children

In contrast, AP is a customary recommendation for cases lacking infection, aimed at preemptively diminishing the risk of localised or widespread infection (4). The oral microbiome, consisting of approximately 200 primary bacterial species and 700 primary taxa, emphasises the intricate interactions among the diverse bacterial species present in this ecosystem (4).

As per the results of a meta-analysis, the provision of antibiotic prophylaxis resulted in a reduction in infection risk by approximately 60% to 70% after tooth extractions (21). Nevertheless, the postoperative infection rate in individuals undergoing third molar extraction is expected to be below 1% (21). Considering this minimal baseline infection rate, cautious deliberation is necessary regarding the use of antibiotics, particularly given that adverse effects have been documented in approximately 6% to 7% of patients (21). Additionally, the potential risks associated with the development of antibiotic resistance should also be considered (21, 22).

The classification of individuals with significantly compromised immune systems can be divided into distinct groups, as specified by the guidelines provided by the Centres for Disease Control and Prevention (CDC) (23), which outline several groups that should be considered: 1) Individuals in stage III of HIV/AIDS, identified by either a CD4 T lymphocyte count below 200 or the presence of opportunistic infections. 2) Patients undergoing chemotherapy who develop fever (with an absolute neutrophil count (ANC) below 2000/mm3) at a temperature of 39°C or those experiencing severe neutropenia (ANC below 500/mm3), with or without fever, require consideration. 3) Patients diagnosed with rheumatoid arthritis (RA) and undergoing treatment with disease-modifying biologic agents, particularly tumour necrosis factor-alpha (TNF-α), or those prescribed prednisolone at doses exceeding 10 mg per day should be evaluated. 4) Individuals who have received solid organ transplants and are currently on immunosuppressive medications necessitate careful assessment. 5) Patients with congenital or hereditary immunosuppressive disorders should be taken into consideration. 6) Those who have undergone bone marrow transplants from pre-transplantation throughout the duration of immunosuppressive therapy, typically spanning around 36 months post-operation, should be included in the evaluation (23).

In accordance with the Malaysia National Antibiotic Guideline, the recommended antibiotic of choice for prophylaxis is amoxicillin/clavulanic acid, even though no cases of adverse drug reactions or instances of infective endocarditis were observed during the study (11). The recommended dosage for antibiotic prophylaxis is as presented in Table 2.

Table 2: Antibiotic prophylaxis dosage

Regimen	Route of Administrations	Initial dose strength	Timing before procedure
Amoxicillin	Oral	50 mg/kg (Not exceeding adult doses: 2 g)	60 minutes prior
Ampicillin	Parental	50 mg/kg (Not exceeding adult doses: 2 g)	30 minutes prior
Amoxicillin/ Clavulanic acid	Oral	50 mg/kg (equivalent to amoxicillin doses) (Not exceeding adult doses: 2 g)	60 minutes prior
Cefuroxime	Oral	500 mg	
Allergic to penicillin			
Cephalexin/ Cefadroxil	Oral	50 mg/kg (Not exceeding adult doses: 2 g)	60 minutes prior
Clarithromycin/ azithromycin	Oral	15 mg/kg (Not exceeding adult doses: 500 mg)	60 minutes prior
Allergy to amoxicillin/penicillin/ampicillin			
Cefazolin	Parental	50 mg/kg (Not exceeding adult doses: 1 g) *30 minutes prior procedure	30 minutes prior
Note: It is no longer advised to use clindamycin for antibiotic prophylaxis during dental procedures (25).			

mg = milligram, kg = kilogram, g = gram, ml = milliliter

The recommendation against using clindamycin for dental procedures stems from its higher likelihood to cause frequent and severe adverse reactions compared to other antibiotics (9). A study conducted in the United Kingdom revealed that a single dose of clindamycin could potentially lead to complications, including severe cases that might result in fatalities due to Chloridoids difficile infection (24). Consequently, the use of clindamycin for antibiotic prophylaxis during dental procedures is no longer endorsed (25).

AP is recommended for various dental and maxillofacial surgeries, including minor clean-contaminated procedures like those involving submandibular and parotid glands, as well as temporomandibular joint (TMJ) surgeries. Additionally, surgeries for dental implants and bone grafts, along with major clean-contaminated surgeries such as orthognathic procedures and tumour removals, necessitate antibiotic coverage (26-28). Patients with specific cardiac conditions, renal haemodialysis or ventriculoarterial shunts, and immunocompromised individuals undergoing root canal treatment should also receive prophylactic antibiotics. These recommendations aim to prevent postoperative infections in susceptible populations and ensure optimal outcomes for patients undergoing dental and maxillofacial procedures (26-28).

AP is not recommended for various dental procedures, including minor surgery in healthy paediatric patients within the maxillofacial region, such as submandibular and parotid gland surgery and temporomandibular joint (TMJ) surgery (26-28). Additionally, antibiotic coverage is not advised for extraction of lower third molars, routine periodontal surgical procedures, restorative dental procedures with or without a retraction cord, local anaesthetic injections (excluding intraligamentary injections), intracanal endodontic procedures, placement of rubber dams, removal of postoperative sutures, placement of removable orthodontic or prosthodontic appliances, taking oral impressions, administration of fluoride treatments, taking oral radiographs, adjustment of orthodontic appliances, or natural shedding of primary teeth (26-28).

The current guidelines offer a disparate range of suggestions for managing paediatric patients with heart conditions (11, 28-30), as in Table 3. This disparity has consequently engendered a sense of ambiguity among dentists regarding the judicious selection of antibiotics for their clinical practice.

Table 3: Current available guideline on antibiotic in dental procedures

Conditions/ Procedures	AHA (2021)	JCS (2017)	ESC (2016)	NICE (2008)	MOH (2019)
Individuals with any prosthetic valve	/	/	/	x	/
Individuals with a history of Infective Endocarditis (IE)	/	/	/	/	/
Individuals diagnosed with congenital heart disease	/	/	/	/	/
Any dental procedures entailing: a) Manipulation of gingival tissue or the periapical region of teeth b) Perforation of the oral mucosa	/	/	*	#	/
Administering local anaesthetic injections in uninfected tissues	n/a	n/a	n/a	n/a	n/a
Placing or modifying removable prosthodontic or orthodontic appliances or braces.	n/a	n/a	n/a	n/a	n/a
Shedding of primary teeth	n/a	n/a	n/a	n/a	n/a
Bleeding resulting from injury to the lips or oral mucosa	n/a	n/a	n/a	n/a	n/a

* For procedures inducing bleeding and bacteraemia, antibiotic prophylaxis is advised; #: the National Institute of Health and Care Excellence (NICE) does not recommend antibiotic prophylaxis against infective endocarditis (IE) for patients undergoing dental procedures. "n/a" denotes not applicable; AHA: the American Heart Association; ESC: the European Society of Cardiology; JCS: the Japanese Circulation Society; MOH: the Ministry of Health Malaysia.

Many countries, including Australia, Brazil, Canada, Denmark, France, the Netherlands, Norway, Portugal, and the United Kingdom (comprising England, Scotland, Wales, and Northern Ireland), have revised their stance and now discourage the use of antibiotic prophylaxis for invasive dental procedures in individuals with prosthetic joint replacements (31-33). There is insufficient justification for administering antibiotic prophylaxis prior to invasive dental procedures in patients with prosthetic joint implants (33, 34).

It is recommended to evaluate the need for prescribing antibiotic prophylaxis for patients with a history of infections linked to their orthopaedic prostheses during second-stage implant surgeries. Additionally, it is wise to proceed with caution, avoiding scheduling surgeries within three months after orthopaedic surgical procedures (35).

The American Dental Association (ADA) does not offer standardised guidelines for antibiotic prophylaxis (36). The administration of antibiotic prophylaxis before dental procedures as a preventive measure against infective endocarditis (IE) lacks comprehensive evidence. However, its demonstrated effectiveness in reducing the incidence of IE makes it a topic of paramount interest and significance in the field of medical research (29). This stance appears to contradict established clinical practice, which strongly advocates for universal antibiotic prophylaxis, regardless of risk, due to the severe consequences associated with infective endocarditis (37).

In practical situations, it is recommended to delay non-urgent dental procedures for a minimum of 10 days following the completion of a brief antibiotic treatment (25). When patients have multiple dental appointments scheduled in succession, if possible, it is recommended to wait for a 10-day interval after the last antibiotic dose before proceeding with the next procedure (25). For patients receiving intravenous antimicrobial therapy for conditions such as infective endocarditis or other infections that require dental interventions, it is considered appropriate to maintain the continuity of the same intravenous antibiotic therapy throughout the dental procedure (25).

Nevertheless, the ADA advises caution when considering their administration in specific patient populations. This includes individuals with diabetes or compromised immune function (36). In the subset of immunocompromised patients, the ADA extends this consideration to include individuals with antibiotic resistance, those undergoing systemic steroid or immunosuppressive therapy, individuals diagnosed with certain types of cancer, and/or those with a history of chronic renal disease (36).

The recent systematic review undertaken by Rutherford et al. (38) concludes that the existing body of evidence fails to definitively ascertain whether antibiotic prophylaxis is effective or ineffective in preventing bacterial endocarditis in individuals at risk undergoing invasive dental procedures. The inquiry persists regarding whether the potential drawbacks and expenses linked with antibiotic administration outweigh any potential advantages (38).

There remains uncertainty surrounding the link between dental interventions and infective endocarditis. Current trends indicate a shift towards a more targeted approach, considering medical conditions in relation to a restricted range of invasive dental procedures. While some situations are clearly outlined, others remain subjects of debate and apprehension. The imperative to clarify these matters underscores the significance of heightened research endeavours and thorough investigations.

Children undergoing radiotherapy or chemotherapy or receiving bisphosphonate therapy

Upon diagnosis, acute lymphoid leukaemia (ALL) often manifests with notable signs and symptoms in the head and neck area and the oral cavity, including enlarged lymph nodes, sore throat, laryngeal discomfort, gum bleeding, oral mucositis, and oral ulcers (39). Infections in the oral and dental regions can complicate oncology treatments and lead to delays, consequently increasing morbidity and reducing the child's quality of life (40). A prompt dental consultation for a newly diagnosed patient is crucial to allow adequate time for necessary care before initiating cancer therapy. Neutrophils play a key role in defending against infections, and the likelihood and severity of infections decrease as their count increases. When the absolute neutrophil count falls below 1,000/mm^3, the platelet count drops below 75,000/mm^3, or abnormalities in clotting factors are detected, it is prudent to defer elective dental procedures (39, 40). This precautionary measure is based on the significantly heightened susceptibility to infection. Conversely, in cases not meeting these critical haematologic parameters, judicious consideration of antibiotic prophylaxis is appropriate (41).

Patients receiving treatment with oral or intravenous bisphosphonates, such as Pamidronate and Zoledronic acid, face a considerable risk of developing medication-related osteonecrosis of the jaw (MRONJ) or bisphosphonate-related osteonecrosis of the jaw (BRONJ) (42-43). Bisphosphonates are utilised in paediatric patients for various purposes, including correcting primary structural defects in type 1 collagen and other essential bone proteins, managing fibrous dysplasia of bone, addressing bone abnormalities associated with systemic diseases or treatments, rectifying bone matrix abnormalities, treating conditions marked by deficient bone mineralisation, controlling hypercalcemia linked with malignancy, and managing focal orthopaedic disorders (42-43).

Several studies involving a total of 483 children who received either pamidronate infusion or bisphosphonate therapy were conducted. Among these children, 165 underwent invasive dental procedures, including dental extractions. In this group, no complications were observed, and there were no clinical or radiographic signs of bisphosphonate-related osteonecrosis of the jaw (BRONJ) (44-46). AP is also recommended for patients who undergo high-dose irradiation on jawbones and for those receiving intravenous bisphosphonates or denosumab (2).

For children at the highest risk, including those undergoing invasive surgery (such as surgical or traumatic procedures), those with bacterial contamination at the surgical site, and those who have been on bisphosphonate therapy for two or more years, with their last infusion within the past two years, antibiotic prophylaxis is recommended (42), as outlined in Table 4. Patients undergoing denosumab treatment are advised to schedule surgical procedures either within three months after the last infusion or within 45 days before the next administration to facilitate optimal tissue healing (47, 48). Additionally, the use of a 0.12% chlorhexidine gluconate mouthwash administered twice daily for five consecutive days before a procedure aid in reducing inflammation and decreasing the microbial load at the surgical site (47, 48).

Table 4: Antibiotic regime preoperative, perioperative and post-operative

Pre-Operative Day 1-7*	
Amoxicillin	Amoxicillin 250 mg Capsule 20-40 mg/kg/day in divided doses 8 hourly (Maximum doses: 2 g) Amoxicillin Syrup 20-40 mg/kg/day in divided doses 8 hourly (Maximum doses: 2 g) Amoxicillin/Clavulanic Acid Injection 3 months-12 years: 30 mg/kg TDS/QID
Chlorhexidine Gluconate Mouthwash	0.12% 3-4 times a day
Perioperative Antibiotic Prophylaxis (Refer Table 2) *	
Post-Operative Days 7-14*	
Amoxicillin	Amoxicillin 250 mg Capsule 20-40 mg/kg/day in divided doses 8 hourly (Maximum doses: 2 g) Amoxicillin Syrup 20-40 mg/kg/day in divided doses 8 hourly (Maximum doses: 2 g) Amoxicillin/Clavulanic Acid Injection 3 months-12 years: 30 mg/kg TDS/QID
Chlorhexidine Gluconate Mouthwash	0.12% 3-4 times a day

mg = milligram, kg = kilogram, g = gram, ml = milliliter, QID = four times a day, TDS = three times a day, g = gram, mg = milligram,

*The appropriate steps to take will be determined by the patient's condition and discussions with the paediatric medical team.

Paediatric dentists and paediatric medical teams collaborate to identify and manage dental and oral health issues in children (49). As the treatment outcomes for childhood cancers continue to improve, it becomes essential for dental professionals to provide customised care for these young patients (49). In this review, a specific set of criteria warranting antibiotic prophylaxis in dental settings has been outlined. However, despite the available body of evidence, this assessment refrains from making definitive guidelines. Nevertheless, considering the potential risks

associated with infective endocarditis cases in paediatric patients, a cautious and risk-averse approach is advocated. Therefore, this evaluation emphasises the prudent use of antibiotic therapy and prophylaxis when necessary. Substantially more extensive research is needed to address the current knowledge gaps. Engaging in comprehensive consultations and discussions with fellow physicians, including cardiologists and paediatricians, is of utmost importance in the meticulous evaluation of potential benefits for paediatric patients.

Conclusion

A comprehensive approach that considers the patient's condition and needs, along with multidisciplinary team discussions is crucial for reducing the risk of incorrect antibiotic prescriptions. Precise administration of antibiotics is of utmost importance when managing dental infections. This review underscores the importance of adhering to existing antibiotic prescription guidelines for children undergoing dental procedures, emphasising the need for dentists to exercise careful clinical judgement before prescribing antibiotics. Furthermore, it strongly advocates for collaborative discussions with physicians to assess the patient's condition comprehensively. Therefore, the development of comprehensive antibiotic prescribing guidelines for dental professionals is recommended.

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Competing interests

The authors declare that they have no competing interests.

Ethical Clearance

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