Review Article

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Antimicrobials; Wise Use In Pediatric Dentistry - A Detailed Literature Review

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ABSTRACT

In pediatric dentistry, antibiotics are crucial for controlling oral infections and preventing their spread. However, concerns about overuse and inappropriate prescriptions persist. Understanding the complexities of antimicrobial use is vital for optimal oral health outcomes, particularly due to the unique physiology and compliance issues in young patients. This narrative review comprehensively searched peer-reviewed literature, guidelines, and systematic reviews from databases involving PUBMED, Cochrane Library, Google Scholar, Trip Database, Lilacs, ProQuest, and Wiley Library, using keywords related to adverse effects, infection control, pediatric dentistry, and antibiotic use. No publication year restrictions were applied, and references from key papers were reviewed for additional relevant research. Results indicate that while antibiotics can effectively treat bacterial infections in pediatric patients, misuse can lead to adverse outcomes like antimicrobial resistance. Special considerations in pediatric dentistry necessitate tailored antibiotic administration approaches. Adhering to evidence-based guidelines and exercising sound clinical judgment are essential to mitigate the risks of antibiotic overuse. Comprehensive education for dental professionals, caregivers, and young patients is crucial to promote responsible antimicrobial practices and enhance oral health outcomes. A well-rounded strategy for antibiotic use in pediatric dentistry is key to achieving optimal dental health results while minimizing associated risks.

Keywords: Antibiotics, Antimicrobial resistance, Adverse effects, Oral health outcomes, Antibiotic overuse

1. Introduction

Orofacial infections encompass odontogenic and non-odontogenic types, originating within or outside tooth structures, respectively [1]. Prompt treatment is crucial to prevent severe complications like osteomyelitis or brain abscess. Eradicating the infection source via surgical or endodontic means is paramount, but antibiotics are necessary in complex cases or with immunocompromised patients (Figure 1) [2].

Dental infections vary in severity, especially concerning vulnerable populations. The Center of Disease Control [CDC] estimates a significant portion of pediatric antibiotic prescriptions may be unnecessary, stressing the need for judicious use. While antibiotics can mitigate bacteremia risk, they should not substitute for eliminating the infection source. Pediatric antibiotic prescribing necessitates careful consideration of anatomical and physiological differences [3]. This review will comprehensively explore antimicrobial utilization in pediatric dental practice, highlighting consequences of inappropriate use and providing insights into antimicrobial therapy management for dental infections in children.

2. Search Strategy

A detailed search was done with the following keywords: anti-infective agents, antimicrobial, pediatric dentistry, antibiotic, antibacterial, antifungal, dental infection, abscess, dentistry, infection, bacteremia, antibiotic prophylaxis, and dental infection in various databases involving PUBMED, Cochrane library, Google scholar, Trip database, Lilacs, ProQuest, Wiley library. Articles were assessed based on their titles and/or abstracts in total of 350 abstracts and title to determine their pertinence to antimicrobial use for children, adolescents, and individuals with special healthcare requirements.

3. The Requirements of Antibiotics In Pediatric Dentistry

Antimicrobials, also known as anti-infectives, are agents that have the capacity to eliminate or inhibit the growth and reproduction of microorganisms, encompassing bacteria, viruses, fungi, and parasites.

In pediatric dentistry, the use of antimicrobial drugs are crucial to address various conditions effectively such as odontogenic infections, oral wounds, periodontal disease, candidiasis, avulsion, salivary gland infections and primary herpetic gingivostomatitis.

Effective management of infections in pediatric dentistry hinges on the practitioner's understanding of the microbiology of odontogenic and intraoral infections, as well as their knowledge about the antimicrobial agents being prescribed, including their spectrum of activity, pharmacology, and potential adverse effects. Moreover, it is essential to take into account patient-specific factors, such as the child's overall health, any concomitant medications they may be taking, and their ability to afford or comply with the prescribed drug regimen. For pediatric patients, compliance with unpalatable liquid medications can be particularly challenging and may require alternative dosage forms or strategies to ensure successful treatment outcomes. Considering these factors is crucial in providing optimal care and promoting the well-being of young dental patients [4].

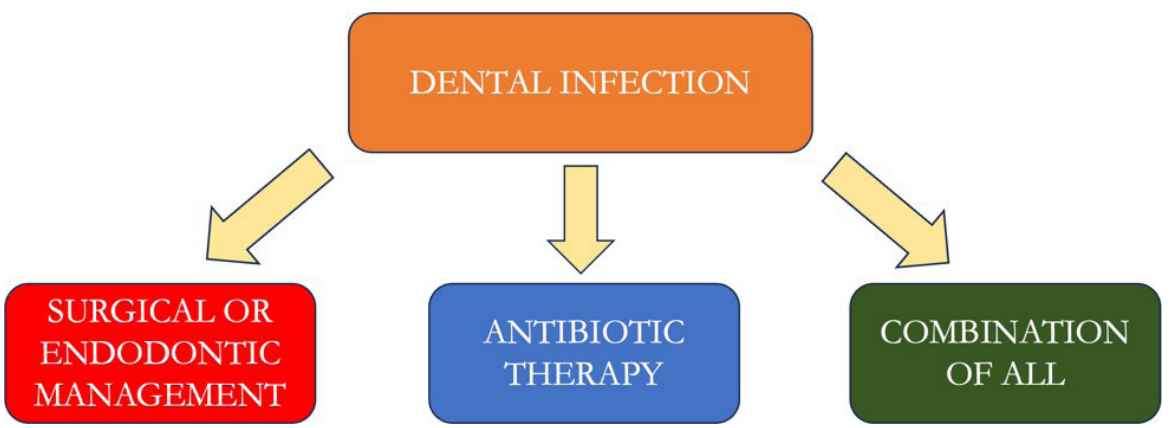

Figure 1. Strategy for management of dental infection

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4. Classification of Antimicrobial Agents

Antimicrobial agents, which encompass a diverse array of substances designed to combat microorganisms can be classified based on the organism of target. The classification of antimicrobials is a systematic framework that categorizes these agents based on their mechanisms of action, spectrum of activity, chemical structures, and clinical applications. This classification provides healthcare professionals with essential guidance in selecting the most appropriate antimicrobial treatment for various infections as follows based on chemical structure [4];

1. Beta-Lactams: Penicillins, Cephalosporins, Carbapenems, Monobactams
2. Aminoglycosides: Gentamicin, Amikacin, Streptomycin
3. Macrolides: Erythromycin, Azithromycin, Clarithromycin
4. Tetracyclines: Tetracycline, Doxycycline, Minocycline
5. Quinolones and Fluoroquinolones: Ciprofloxacin, Levofloxacin, Norfloxacin
6. Sulfonamides: Sulfamethoxazole, Sulfadiazine
7. Glycopeptides: Vancomycin, Teicoplanin
8. Lincosamides: Clindamycin, Lincomycin
9. Polypeptides: Polymyxins (Polymyxin B, Colistin), Bacitracin
10. Oxazolidinones: Linezolid, Tedizolid
11. Nitroimidazoles: Metronidazole, Tinidazole
12. Rifamycins: Rifampin, Rifabutin
13. Chloramphenicol: Chloramphenicol
14. Streptogramins: Quinupristin, Dalfopristin

5. Microbiology of Odontogenic Infection

Microorganisms found in odontogenic infections mirror the host's natural oral flora. Commonly isolated species include anaerobic Streptococci, Capnocytophaga, Actinobacillus fusobacteria, Prevotella, and Porphyromonas. Notably, Porphyromonas gingivalis and Prevotella intermedia, anaerobic black-pigmented Gram-negative bacilli, are frequently recovered from periodontal lesions.

Endodontic lesions result from microbial involvement, either directly or indirectly. This overview outlines the microbiology, diagnosis, and management of endodontic infections in children. Table 1 depicts the common isolates in endodontic infection in children [5].

6. Uses of Antibiotics

Antibiotics play a pivotal role in addressing diverse dental infections. In the realm of dentistry, both topical and systemic applications of these agents find significance, particularly in the context of pediatric dentistry. Systemic employment involves the oral or alternative parenteral administration of antibiotics to mitigate infection. Meanwhile, topical administration entails the utilization of antibiotics to achieve localized effects. Figure 2 depicts the systemic and topical use of antibiotics in pediatric dentistry (Table 2) [6-7].

There are clinical conditions which do not warrant or is not an absolute indication of the use of antimicrobials and these are listed in Table 3 [8].

Apart from the intracanal placement of the medication a variety of topical antimicrobials has been used for treating oral lesions [9]. According to the American Academy of Pediatric Dentistry [AAPD] guidelines some of the useful antimicrobials for topical use in oral lesion along with the direction and forms are depicted in Table 4 [10].

7. Review of Literature

The literature highlights a concerning trend of rampant antibiotic overprescription in pediatric dentistry, largely attributed to poor adherence to guidelines and a tendency to prescribe antibiotics unnecessarily. Cherry et al. reported that dentists often deviate from established protocols when managing pediatric odontogenic infections, suggesting the need for clearer directives to enhance adherence (11). Similarly, Sivaraman et al. surveyed members of the American Academy of Pediatric Dentistry (AAPD) and found significant over-prescription of antibiotics, advocating for educational programs to promote awareness of resistance and stewardship principles, thereby improving compliance with guidelines (12).

Dar-Odeh NS et al. identified a preference for prescribing Amoxicillin (62.9%) and antibiotic combi-

Table 1. Predominant microbes in endodontic infection [5]

S. No	Odontogenic Infection	Predominant Microorganism	Antimicrobial Sensitivity
1	Pulpitis	A. Aerobic and facultative anaerobic organisms (Streptococcus salivarius - <8%, Enterococcus faecalis – 10-30%) B. Yeasts and Gram-negative bacteria (Neisseriae - Proteus vulgaris and Escherichia coli) C. Anaerobes - 25% to 30% (Anaerobic Streptococci, anaerobic Gram- negative bacilli, Actinomyces, Propionibacteria, Veillonellae)	1. Penicillin or amoxicillin generally effective against most of the aerobic and anaerobic bacteria 2. Penicillin-resistant organisms and should be considered for treatment with drugs effective against these organisms. These agents include amoxicillin-clavulanate, clindamycin or the combination of metronidazole plus amoxicillin or a macrolide (12)
2	Dentoalveolar Abscess	A. Aerobic streptococci B. Fusiform bacilli and Bacteroides species C. Peptostreptococcus spp., Prevotella oralis, and Prevotella melaninogenica.	Most of them are sensitive to Penicillin Penicillin-resistant organisms may require the administration clindamycin, chloramphenicol, cefoxitin, a combination of penicillin and a beta-lactamase inhibitor or a carbapenem Metronidazole for aerobic or facultative Streptococci. (13)

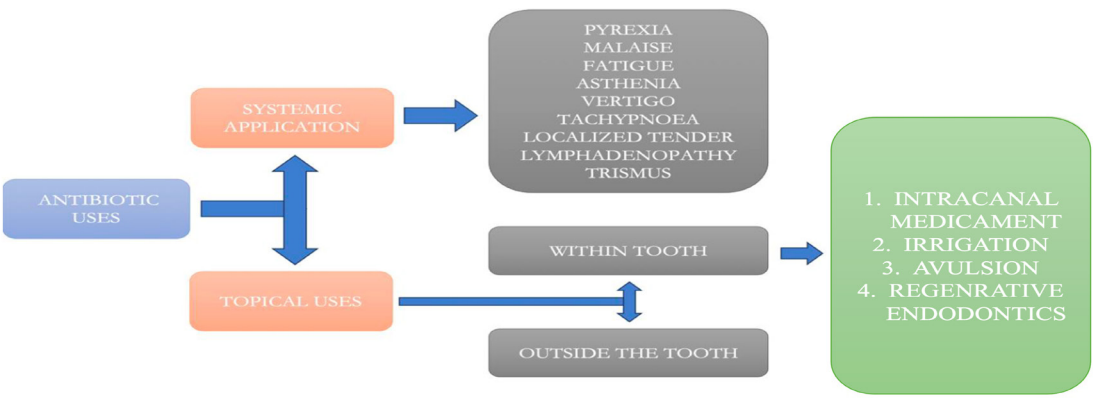

Figure 2. Systemic and topical application of antibiotics (14)

nations (29.7%), often for durations exceeding five days (37%). Erythromycin (77.8%) and Clindamycin (22.2%) were frequently chosen as alternatives. Alarmingly, antibiotics were prescribed without clinical indications, such as for pulpitis and gingivitis, with over half of practitioners citing non-scientific reasons like treatment delays and sterilization concerns, raising the risk of antimicrobial resistance and adverse effects (13). Similarly, Peric et al. noted adherence to dental school curricula on antibiotics but reported instances of overprescription when not medically warranted, underscoring the need for comprehensive national guidelines to reduce unnecessary antibiotic use (14).

Yesudian et al. conducted an audit in pediatric dental departments in Northern England, initially identifying deficiencies in prescription practices. Educational interventions and memory aids improved prescription accuracy from 28% to 71% by the third audit cycle, significantly reducing inappropriate antibiotic use (15). In India, Konde et al. revealed a high prevalence of antibiotic prescriptions for oral diseases, with Amoxicillin being the most common choice. While pediatric dentists exhibited better prescribing practices than general dentists, limited awareness of guidelines persisted despite good understanding of prophylaxis and resistance (16).

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Table 2. Topical use of antibiotic containing compound within the tooth [7]

S. No	Antibitic Compound	Antibiotic Present	Usage
1.	Ledermix	Demethylchlortetracycline	Pulp capping agent Intracanal medicament
2.	Pulpomixine	Polymyxin B Sulfate Framycetin Sulfate	Pulp capping agent
3.	Odontopaste	Clindamycin hydrochloride 5%	Intracanal medicament
4.	Septomixine Forte	Neomycin Polymyxin B sulfate	Intracanal medicament
5.	BioPure MTAD	3% Doxycycline hyclate	Irrigant
6.	Tetraclean	Doxycycline	Irrigant
7.	Tetracycline-impregnated gutta percha (TGP)	10% tetracycline	Intracanal medicament, Final obturating material
8.	Sustained release delivery Gutta Percha point containing metronidazole (SRDGM)	Metronidazole	Intracanal medicament, Final obturating material
9.	Controlled-release delivery gutta-percha point containing metronidazole compound (CDGMC)	Metronidazole	Intracanal medicament, Final obturating material
10.	Triple antibiotic paste (TAP)	Metronidazole, Minocycline Ciprofloxacin,	Canal disinfection for pulp revascularization
11.	Antibiotic-Containing Scaffolds	Metronidazole or Ciprofloxacin	Canal disinfection for pulp revascularization
12.	Lesion sterilization and tissue repair	metronidazole, ciprofloxacin, and minocycline.	Non instrumentation endodontics

Table 3. Appropriate medication for dental clinical scenario [8]

S. No	Clinical Senario	Appropriate Medication
1.	Pain	Analgesics/Antiinflammatory drugs
2.	Edema	Antiinflammatory drugs
3.	Redness/heat	Antiinflammatory drugs
4.	Purulence	Resolved by drainage of pus/debridement
5.	Abscess-Localized	Resolves by incision and drainage
6.	Draining sinus tract	Removal of foci of infection resolves drainage and sinus tract may heal on its own or may have to be surgically excised

Globally, Ford et al. observed a rise in antibiotic and antifungal prescriptions over 12 years among Australian dentists, highlighting concerns about excessive antibiotic use (17). In Jeddah, Al-Johani et al. reported Amoxicillin (73.8%) as the most frequently prescribed antibiotic for orofacial infections, yet adherence to professional guidelines ranged from only 9.5% to 45%, reflecting inconsistencies in prescription practices (18).

Table 4. AAPD guidelines for topical antimicrobials for oral lesions [10]

S. No	Antimicrobial Agent	Usage	Forms	Use
1.	Chlorhexidine gluconate	Children ≥ 8 years and adults: Rinse with 15 mL 2 times daily (after breakfast and before bed) for 30 seconds and expectorate.	Dental solution 0.12%	gingivitis/ periodontitis and stomatitis
2.	Retapamulin	Apply a small amount of ointment to the affected area 2 times daily for 5 days	Ointment 1%	impetigo
3.	Clotrimazole	Apply a thin layer to the corners of the mouth 2-4 times daily for 7-14 days or until complete healing.	Cream 1%	Candidiasis associated angular cheilitis
4.	Miconazole nitrate	Children > 2 years and adults: Apply a thin layer to the corners of the mouth 2-4 times daily for 7-14 days or until complete healing.	Ointment 2%; cream 2%	
5.	Nystatin	Apply a thin layer to corners of mouth 2-4 times daily for 7-14 days or until complete healing	Ointment, cream (100,000 units/g)	
6.	Nystatin, triamcinolone acetonide	All ages > 2 months: Apply a thin layer to the corners of the mouth 2 times daily for no longer than 2 weeks. Should be used for the shortest period of time in children (3-5 days).	Ointment, cream (100,000 units nystatin/g and 0.1% triamcinolone acetonide)	
7.	Docosanol	Children ≥ 12 years and adults: Apply a thin layer on the lesion 5 times daily for up to 10 days.	Cream 10%	Herpes labialis
8.	Acyclovir	Children ≥ 12 years and adults: Apply a thin layer on the lesion 5 times daily for 4 days.	Cream 5%	
9.	Acyclovir	Children ≥ 12 years and adults: Apply 1 tablet 1 time to the upper gums in area of canine fossa.	Buccal tablet 50 mg	
10.	Acyclovir with hydrocortisone	Children ≥ 6 years and adults: Apply a thin layer on the lesion 5 times daily for 5 days.	Cream (5% acyclovir with 1%hydrocortisone)	
11.	Penciclovir	Children ≥ 12 years and adults: Apply a thin layer on the lesion every 2 hours while awake for 4 days.	Cream 1%	

Two systematic reviews analyzing antibiotic use and misuse trends indicate insufficient evidence linking prescribing practices in pediatric dentistry directly to the emergence of drug resistance. Nevertheless, these findings emphasize the urgent need for intervention initiatives such as antibiotic stewardship programs. Such programs could facilitate collaboration between pediatric dentists and patients, promoting responsible and effective antibiotic prescribing practices (19, 20).

8. Are Antibiotics Being Overused Due to Lack of Knowledge? – Misuse

An assessment of dental practitioners' prescribing practices globally indicates that their use of antibiotics constitutes around 7-11% of total antibiotic consumption. While the primary contributors to global antibiotic resistance are general physicians and pediatricians, the involvement of pediatric dentists in this issue has been noted as well. The adherence to guidelines set by the American Academy of Pediatric Dentistry (AAPD) was found to be lacking, ranging from 10% to 42%, with higher non-adherence observed during weekends (14-17%). The underlying factors influencing prescription behaviour have been studied across regions and nations, revealing several significant causes. A prominent reason for increased antibiotic usage is insufficient knowledge about appropriate indications and necessity. Over prescription in situations where antibiotics are not indicated, such as irreversible pulpitis, localized dentoalveolar abscesses, and minor traumatic conditions, has been observed. This suggests that antibiotics are often used for symptomatic pain and inflammation rather

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than actual infections. Inadequate clinical judgment in assessing the need for antibiotics also contributes to their negligent use. This misuse can stem from inappropriate, inadequate, or extended use of antibacterial agents to prevent potential infection recurrence. Within the realm of pediatric dentistry, specific factors could influence prescribing behaviour, such as pressure from parents and patients. Parental influence has been identified as a significant factor leading to unnecessary prescriptions. Non-clinical determinants of antibiotic use encompass uncertain diagnoses, the need to delay treatment due to unavailable appointments, and social dynamics [14,15].

Thus, antibiotic usage among dental practitioners contributes to global resistance rates, and factors influencing over-usage in pediatric dentistry include;

a. Inadequate knowledge

b. Clinical judgment

c. Parental pressure

d. Non-clinical considerations

e. Cost of the antibiotic and marketing factors

f. Self-Medication for Dental Problems

g. High antibiotic Prescription Rate [16]

Amoxicillin and phenoxymethyl penicillin are preferred for acute odontogenic abscesses, while clindamycin is indicated for cases unresponsive to initial treatment or in penicillin-allergic patients with odontogenic infections [21].

Commonly used antibiotics in pediatric dental practice have associated adverse reactions. Amoxicillin may cause diarrhea and rashes, while metronidazole can lead to gastrointestinal discomfort and peripheral neuropathy. Erythromycin and azithromycin may induce gastric upset, and clindamycin is linked to rashes and pseudomembranous enterocolitis. Cephalosporins may result in injection site pain and hypersensitivity reactions, while clarithromycin can cause reversible hearing loss and hepatic dysfunction. These adverse effects should be considered when prescribing antibiotics in pediatric dental patients [22].

9. Antibiotic Resistance - A Growing Concern

Bacteria's evolutionary process fosters antibiotic resistance, driven by their adept utilization of a variety of mechanisms to counteract the effectiveness of these medications. Indeed, this imminent danger has been accurately likened to a 'ticking time bomb,' demanding swift and decisive actions. This phenomenon, driven by genetic changes in bacterial strains due to selective pressure, is inevitably linked to increased use of antibiotics. Coupled with antibiotic resistance, it often results in side effects, hypersensitivity reactions, and superinfections. Notably, recent research has even identified a correlation between early childhood antibiotic usage and a heightened risk of allergic asthma. Inappropriate antibiotic use is also prevalent among children with orofacial infections. As pediatric dentists, understanding the proper indications for antibiotics is imperative. Systemic prescription of these drugs should be reserved as supplementary treatment for specific oral infections or as prophylaxis against serious cases of bacteremia [23,24]. Thus, to prevent the inadvertent usage of antimicrobials and the consequences of antibiotic resistance a pediatric dentist must weigh the dose of antimicrobial prescribed according to the child's age and weight. Table 5 depicts the commonly used formulas through literature [25].

10. Special Consideration in Antibiotic Uses

Apart from the routine prescription of antibiotic agent certain clinical scenario requires the wise choice of drugs for the subsidence of the infection and to achieve better prognosis for the desired treatment. These scenarios can be divided into two major headings.

10.1. Antibiotics for medically compromised children

The Clinical Affairs Committee devised antibiotic prophylaxis guidelines for infection-prone dental patients, initially adopted in 1990 and most recently revised in 2019 [26]. An investigation revealed that 80 percent of antibiotic prescriptions given before procedures were deemed unnecessary due to the absence of risk factors. This underscores a potential issue concerning the suitability of prescribed prophylaxis. For patients at the utmost risk of unfavorable consequences stemming from infections caused by bacteremia, antibiotic prophylaxis is advised in specific dental procedures (Table 6) [27-28].

Table 5. Drug dosage calculation [25]

S. No	Names	Formula	Importance
A.		Age based	
1.	Young rules	$\left(\frac{\text{Age in years}}{\text{Age}} + 12\right)$ x adult age	Can be applied quickly approach a situation in which the patient's weight is unknown and easy to remember because young refers to age
2.	Dilling rules	$\left(\frac{\text{Age in years}}{20}\right)$ x adult dose	It is the simplest and easiest and formula for child dose calculation
3.	Bastedo rules	$\left(\frac{\text{Age in years}+3}{30}\right)$ x adult dose	It is one of the child dose calculation formulae as an optional
4.	Fried's (Solomon) rule	$\left(\frac{\text{Age in months}}{150}\right)$ x adult dose	Commonly used for neonates
5.	Crowling rules	$\left(\frac{\text{Age in years}+1}{24}\right)$ x adult dose	the most safe and accurate techniques of pediatric dosage calculation
6.	Webster rule	$\left(\frac{\text{Age in years}+1}{\text{Age in years}+7}\right)$ x adult dose	Commonly used in older children
B.		Weight base	
1.	Clark rules	$\left(\frac{\text{weight in kg}}{70}\right)$ x adult dose or $\left(\frac{\text{weight in pounds}}{150}\right)$ x adult dose	It is best when the calculation is not possible from age, also more commonly used
2.	Modified weight rule	$\left(\frac{\text{weight in kg}}{50}\right)$ x adult dose	It is no need conversion between weight and pounds
C.		Body surface area base	
1.	B.S.A Mosteller formula	$\left(\frac{\sqrt{Height\ in\ cm\ X\ weight\ in\ kg}}{3600}\right)$	It is best when calculation is not possible by body weight and it is the more accurate and used in chemotherapeutic agents

The 2021 AHA guidelines advocate minimizing clindamycin use due to severe adverse reactions, redirecting focus from antibiotic prophylaxis to oral hygiene for preventing infective endocarditis. Prophylaxis is reserved for high-risk patients with conditions like prosthetic cardiac valves, congenital heart defects, or previous infective endocarditis [29-30].

10.2. Antibiotics in emergency dental treatment

The use of antibiotics in both emergency and routine dental treatments has been extensively documented. In the context of emergency dental care, antibiotics play a critical role, particularly in managing dental trauma and septic infections. Their application helps control infection, reduce complications, and support

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Table 6. Antibiotic regimens for a dental procedure single dose 30 to 60 minutes before procedure [30]

Situation	Agent	Child Dose
Oral	Amoxicillin	50 mg/kg
Unable To Take Oral Mediciene	Ampicillin OR Cefazolin or ceftriaxone	50 mg/kg IM or IV 50 mg/kg IM or IV
Penicillin Allergy- Oral	Cephalexin OR Azithromycin or clarithromycin OR Doxycycline	50 mg/kg 15 mg/kg < 45 kg, 2.2 mg/kg > 45 kg, 100 mg
Penicillin Allergy -Unable To Take Oral Mediciene	Cefazolin or ceftriaxone	50 mg/kg IM or IV

the healing process in such urgent scenarios (Figure 3) [31].

11. What Next – A Ray of Hope – Antibiotic Stewardship

Defining antibiotic abuse is more challenging, but it could refer to a situation where a physician favours using a specific antibiotic due to aggressive promotion by a pharmaceutical representative or even financial incentives, rather than making choices solely based on medical necessity (Figure 4).

Antibiotic stewardship entails choosing the most appropriate antibiotics and determining the right dosage and duration, all to achieve optimal clinical outcomes in treating or preventing infections. This approach prioritizes patient safety and aims to minimize the development of resistance [32]. With the rising complexity of patient cases and the growing threat of antimicrobial resistance, effective antimicrobial therapy is becoming more challenging. Antimicrobial stewardship, which aims to prevent resource overuse and combat resistance, is crucial. International healthcare organizations have recognized the gravity of this issue. Initiatives like the Centers for Disease Control and Prevention's Get Smart campaign and the 2011 World Health Organization World Health Day underscore the need for action. This emphasizes the role of insurance providers, governments, and hospital administrators in supporting practitioners who integrate stewardship practices into patient care. Government-backed programs, like the California Department of Public Health Antimicrobial Stewardship Initiative, showcase how resources can be employed to promote proper antibiotic use. By incorporating antimicrobial stewardship into daily practice, we can improve patient care, conserve resources, and counteract resistance.

12. Conclusion

The extended review focused on various aspects of antibiotic prescribing, resistance, and their implications for pediatric dental practice. It encompassed global trends in antibiotic prescription patterns and their influencing factors, along with the prevalence and causes of antibiotic resistance. Highlighting the importance of a holistic approach, it is suggested that antibiotic stewardship involves collaborative care among medical professionals and proper documentation. Government-led cost-control measures as a means to improve clinical outcomes and tackle resistance is upcoming. The use of topical antibiotics, such as multi-antibiotic paste for root canals, exhibited potential in dental practice. As a pediatric dentist, it is necessary to understand the nature of the disease and prescribe the appropriate antibiotic of choice with accurate dosing to the child. Therefore, employing antibiotics judiciously has become an imperative requirement at present.

Conflict of Interest

The author has no conflicts of interest, financial or otherwise, to declare.

Statement of Contribution of Researchers

Concept – P.B., D.S., R.S., S.K.; Design – P.B., D.S., R.S, S.K.; Supervision – P.B.; Resources P.B.; Materials – P.B., D.S., R.S., S.K.; Data Collection and/or Processing – P.B., D.S., R.S., S.K.; Analysis and/

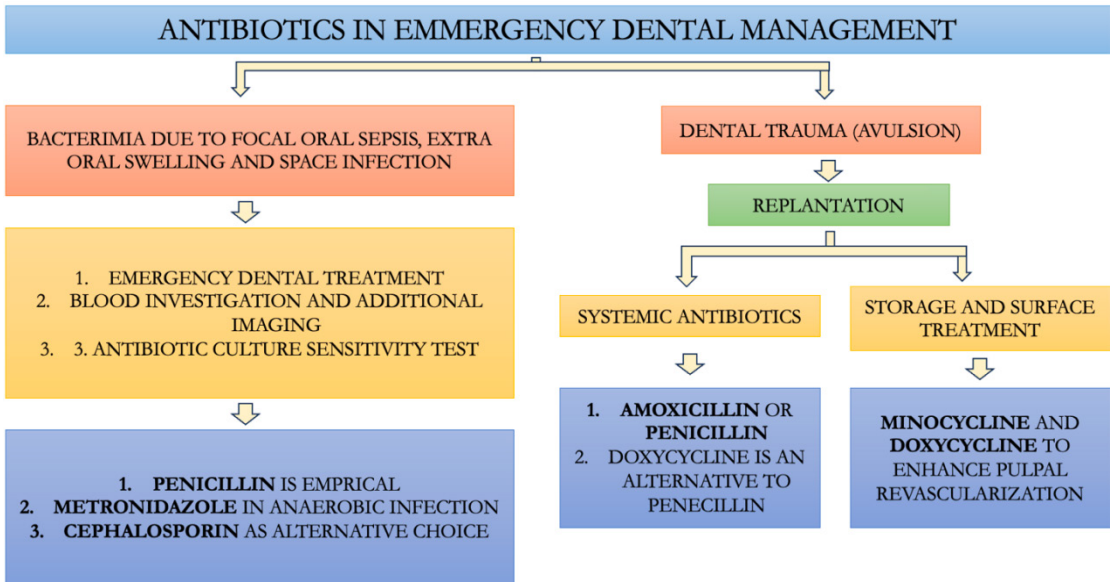

Figure 3. Antibiotics during emergency dental treatment

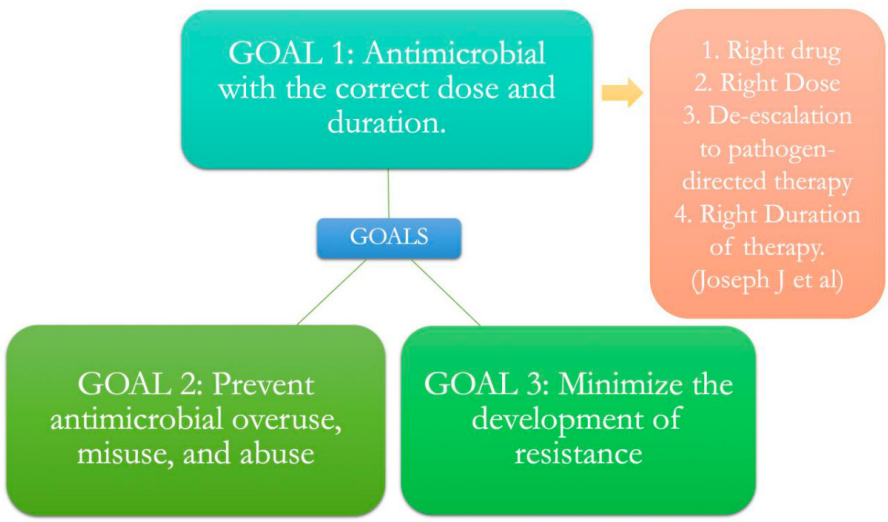

Figure 4. Goals of antibiotic stewardship

or Interpretation – P.B., D.S., R.S., S.K.; Literature Search – P.B., D.S., R.S., S.K.; Writing – P.B., D.S., R.S., S.K.; Critical Reviews – P.B., D.S., R.S., S.K.

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