Original Research

Managing "Simple Toothache" in Children Presenting to the Emergency Department

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Background: *The frequency of opioid and antibiotic prescribing for pediatric patients presenting to emergency departments (ED) for dental pain without overt infection is not well known. The aim of this study is to analyze ED prescribing patterns for the treatment of "simple toothache" in children.*

Methods: *This was a retrospective, cohort analysis of consecutive pediatric patients (ages 1-19 years) diagnosed with dental pain without trauma or obvious infection (defined as fever, intraoral or extraoral swelling, purulence, or trismus). Patients were seen at seven emergency departments (ED) over a 4-year study period (2018-2021). Clinical findings, treatment in the ED, and final disposition were recorded using an institutional honest broker system. Our study hypothesis was that both opioids and antibiotics are overutilized for the ED treatment of simple toothache in children. Descriptive statistics (frequency tables, confidence intervals) were used to summarize the data.*

Results: *A total of 683 pediatric patients met the inclusion criteria. The average age was 11.6 ± 5.8 years. The 17- through 19-year age group had the highest rate of dental-related ED visits (33.1%). A higher proportion of Medicaid beneficiaries (66.6%) had dental visits compared with the commercially insured (26.9%) or uninsured (6.5%). Virtually all patients had a documented primary care physician (99.0%). The most common diagnoses were nonspecific odontalgia (55.4%) or dental caries (33.7%). An antibiotic, most often amoxicillin or penicillin, was prescribed in 60.1% (95% CI 57.3% to 64.7%) of ED visits. Opioids, most often hydrocodone, were prescribed in 18.7% (95% CI 15.9% to 21.9%). Dental nerve blocks were performed in only 43 patients (6.3%). Twelve percent of patients returned within 7 days requesting further analgesia.*

Conclusion: *The ED is a well-known safety net for children with a simple toothache who have no direct access to dental care. However, the recommended treatment for these patients are usually dental procedures rather than antibiotics or narcotics. Data-driven solutions, such as guideline implementation, provider education, use of nonsteroidal anti-inflammatory drugs, and dental nerve blocks could reduce medication-related harms and avert health care expenditures.*

Keywords: Antibiotic, opioid, toothache, pediatrics, emergency department, emergency medical services

INTRODUCTION

The number of pediatric patients presenting to the emergency department (ED) with a chief complaint of simple toothache increases annually in the United States and often results in the prescribing of antibiotics or opioids.[1-3] However, antibiotic treatment without overt infection has no clear benefit for toothache.[4] Simple toothache usually results from pulpitis (inflammation of the dental pulp), which is not a bacterial infection that spreads systemically. Instead, it is a localized condition that requires dental treatment rather than antibiotics.[3,4] Even patients with obvious dental infection, such as fever, intraoral swelling, and purulence, do not seem to benefit from antibiotic therapy.[5] Antibiotic overutilization also increases the risks of adverse drug reactions, antibiotic resistance, and unnecessary healthcare costs.[5] Instead, the recommended treatment for these children is a dental procedure, such as incision and drainage, pulpectomy, or nonsurgical root canal treatment. EDs are seldom equipped or staffed to perform these procedures in children, so patients are typically prescribed outpatient medications and referred for follow-up care with a dentist.

Previous research has found that approximately 55% of adults filled a prescription for an antibiotic, and 40% filled a

prescription for an opioid following a dental-related visit to an ED.[6] Simple toothache is best managed with non-opioid analgesics like ibuprofen and acetaminophen, which effectively reduce inflammation and relieve pain. The American Academy of Pediatric Dentistry (AAPD) and Centers for Disease Control and Prevention (CDC) recommend non-steroidal anti-inflammatory drugs (NSAIDs) and acetaminophen as first-line treatments for dental pain in children.[7,8] Both have been shown to have good safety and efficacy and are also cost-effective analgesics.[9] The use of opioids in children carries risks and their use in children should be rare.[10,11] Surprisingly, the frequency of antibiotic and opioid prescribing in the ED for nontraumatic dental pain in children is not well known. The aim of this community-based study is to analyze ED prescribing patterns for the treatment of "simple toothache" in children.

METHODS

Study Design/Setting: This retrospective study examined a cohort of consecutive pediatric patients (ages 1-19 years) who had been diagnosed with dental pain without trauma or obvious infection. For the purposes of this study, infection was defined as pyrexia, intraoral or extraoral swelling, malaise, purulence, or trismus. Children were seen at seven EDs over a 4-year study period (2018-2021). Affiliated institutions span 13 counties in Michigan, and include three rural medical centers, three university-affiliated hospitals, and a children's tertiary care facility.

Study Population: Children and adolescents presented to the ED with a simple toothache (e.g., due to dental caries or reversible pulpitis) and a pain severity of mild to moderate using age-appropriate pain scales. All patients were healthy with no significant underlying medical conditions. Patients were excluded if there were signs of systemic infection or severe dental pathology, less than one year of age, dental trauma, symptoms were present for more than one-week, recent use of antibiotics or opioid analgesics, history of immunocompromised conditions (e.g., leukemia, HIV, uncontrolled diabetes) or neurological conditions that affect pain perception or reporting.

Data Collection: Electronic data extraction was used to collect and record clinical findings, ED treatment, and final disposition. This methodology has been previously validated using both manually abstracted and prospectively collected data, with agreement levels similar to those observed in prospective inter-rater data.[12,13]

Statistical Analyses: Our primary outcome measures were the frequency of dental procedures performed in the ED and the number of antibiotics and opioid prescriptions given to pediatric patients. Microsoft Excel (Microsoft Corp, Redmond, WA, USA) was used to create a simple database. All statistical analyses were performed using SAS statistical software (SAS Institute, Cary, NC, USA). Baseline characteristics were reported as means [± standard deviations (SD)] or proportions. The protocol was approved by the institutional review board for the affiliated institutions.

RESULTS

Demographics: 683 pediatric patients met the inclusion criteria. The average age of the included patients was 11.6 (SD 5.8) years, and 56.3% were female. The 17- to 19-year-old age group had the highest proportion of dental-related ED visits (33.1%). Medicaid beneficiaries had the highest rate of dental visits (66.6%) compared with the commercially insured (26.9%) or uninsured (6.5%). All patients had a documented primary care physician (99.0%). Common ED diagnoses were nonspecific odontalgia (55.4%) and dental caries (33.7%). The mean duration of dental pain was 41.0 (SD 55.3) hours.

ED Treatment: None of our pediatric patients had a procedure performed in the ED. An antibiotic, most often amoxicillin or penicillin, was prescribed in 60.1% (95% CI 57.3% to 64.7%) of ED visits. Additional antibiotics prescribed included amoxicillin clavulanate, clindamycin, and cephalexin (Table 1).

Table 1. Medications prescribed to children with simple toothache in the ED (*n=683*)

Antibiotics*	
Amoxicillin	201 (29.4%)
Penicillin	75 (11.0%)
Amoxicillin clavulanate	66 (9.7%)
Clindamycin	39 (5.7%)
Cephalexin	25 (3.7%)
Azithromycin	5 (0.7%)
Miscellaneous‡	6 (0.9%)
Opioids	
Hydrocodone	60 (8.9%)
Parenteral narcotics	8 (1.2%)
Oxycodone	32 (4.7%)
Acetaminophen/codeine	28 (4.1%)
Dental nerve block	**33 (4.8%)**
Tramadol	**2 (0.3%)**
Topical gel anesthetic	**58 (8.5%)**

*Some patients had more than one antibiotic or opioid administered.
‡Miscellaneous category included 4 different broad-spectrum antibiotics

This frequency of antibiotic prescriptions did not vary by diagnosis, age, or insurance status. Opioids, usually hydrocodone, were prescribed in 18.7% (95% CI 15.9% to 21.9%) of cases. Nonsteroidal anti-inflammatory (NSAID) drugs were seldom used. Parenteral narcotics were given to 8 patients (1.2%). Dental nerve blocks were performed in 33 patients (4.8%). A topical anesthetic gel was administered to 58 children (8.5%). Average length of stay in the ED was 1.4 hours (SD 1.1). Eighty-two patients (12%) returned to the ED within one week, requesting further analgesia.

DISCUSSION

Given that the ED is a well-known safety net for kids with basic toothaches but no direct access to dental care, it is surprising that there have been so few studies of pediatric dental problems in the ED.[14-16] One previous study found that patients covered by Medicaid had a higher proportion of visits for dental problems than those with commercial insurance (4.9% vs 1.3%).[6] This aligns with earlier research that Medicaid patients and the uninsured rely disproportionately on EDs as a primary source of dental care.[14] Our patient demographics followed a similar pattern in that over 66% of our pediatric dental patients were covered by Medicaid. Medicaid plays a crucial role in providing dental care for pediatric patients, ensuring that children from low-income families have access to necessary oral health services.[6] However, many states have dental provider shortages, particularly in rural and low-income urban areas, which makes it difficult for families to find care.[14] When children cannot access a dentist, families often turn to emergency departments for pain relief. This increases healthcare costs and fails to address the root cause of dental disease.[15,16]

Dental visits are typically categorized as non-urgent, which contributes to ED inefficiencies as well as increased costs. Treatment provided to these pediatric patients often overlooks comprehensive or emerging oral health problems, which may lead to subsequent visits. This contributes to inefficient use of the ED, as after a brief evaluation most individuals are given antibiotics and pain-relieving medications and referred to a dentist. However, during the COVID-19 pandemic, many dental offices were closed, increasing the need for dental treatment in the ED. Fleagle and colleagues found that while the pediatric ED census decreased during the pandemic, the number of children with dental complaints increased by 28%.[17]

Antibiotics were prescribed to most of the children in our study. These prescriptions did not vary by diagnosis, age or insurance status. A few of these ED visits may have warranted antibiotic treatment, such as the high likelihood that a family will not follow up with a dentist after discharge from the ED. However, many dental complaints were likely appropriate for an outpatient setting and did not require antibiotics. Antibiotics are necessary when a child shows signs of a spreading bacterial infection or a condition that could lead to serious complications. Overprescribing antibiotics contributes to resistance and unnecessary side effects, so they should be reserved for the situations outlined in Table 2.

Table 2. Dental Conditions in Children That Should be Treated Promptly with Antibiotics[3,6,15,18-20]

• **Facial cellulitis or rapidly progressive facial swelling** of dental origin, particularly with diffuse edema, asymmetry, skin involvement, or extension beyond the alveolus.
• **Systemic manifestations of odontogenic infection:** fever, malaise, tachycardia, toxicity, lymphadenitis, or clinical concern for bacteremia/sepsis
• **Acute apical/periapical abscess with systemic involvement** or extension into facial soft tissue; arrange source control through incision and drainage, extraction, or endodontic treatment.
• **Deep fascial-space infection** or concern for spread to submandibular, sublingual, submental, masticator, buccal, or parapharyngeal spaces.
• **Airway or swallowing-risk features:** trismus, dysphagia, drooling, voice change, floor-of-mouth elevation, neck swelling, dyspnea, or inability to manage secretions.
• **Failure of appropriate dental source control** or persistent/progressive infection after drainage or definitive dental treatment.
• **Avulsed permanent incisors** as an adjunct to urgent dental replantation and splinting; this does not generally apply to avulsed primary teeth
• **Contaminated intraoral lacerations,** especially those with extrinsic contamination, associated open fracture/joint injury, or extensive/deep orofacial wounds.
• **Acute pericoronitis** with fever, trismus, or spread beyond local tissue.
• **Aggressive periodontal disease** or periodontal infection associated with systemic disease, as an adjunct to local periodontal therapy
Infective endocarditis prophylaxis before invasive dental procedures

When appropriately prescribed in the setting of bacterial infection, antibiotics are an effective treatment. However, according to the Centers for Disease Control and Prevention (CDC), more than 2.8 million antibiotic-resistant infections occur in the U.S. annually, and 35,900 people die as a result.[21] A previous cross-sectional retrospective study showed that ED physicians, specifically non-pediatric ED physicians, prescribe antibiotics more frequently for conditions in which antibiotics are unnecessary.[22] Our results

are similar to those of Olivia et al., who found that 82% of pediatric patients with a dental complaint were discharged from the ED with a prescription for oral antibiotics.[23] Frequent, unnecessary antibiotic use allows bacteria to develop resistance, reducing the effectiveness of these drugs over time.[21] A simple infection that could have been treated with a basic antibiotic may require stronger drugs, IV therapy, or surgery. In addition, children's immune systems are still developing, making them more susceptible to resistant infections.[24] Common antibiotic-resistant infections in children include methicillin-resistant Staphylococcus aureus (MRSA), drug-resistant Streptococcus pneumoniae, and multidrug-resistant Escherichia coli.

Table 3. Non-opioid Methods to Treat a Simple Toothache in a Child[4,7,16,18-20]

• Nonsteroidal anti-inflammatory drugs (NSAIDs) are recommended as the first-line therapy for acute pain management.
• Acetaminophen is very effective for dental pain. Parent should check instructions for correct dosage and contraindications.
• Ice pack or cold compress on the child's outer cheek near the affected area. If cold does not relieve the pain, may try switching to a warm compress.
• Peppermint tea bags can be used to numb pain and relax sensitive gums. Place warm freshly-used tea bags between the child's cheek and gums to relieve toothache. As an alternative, apply a few drops of peppermint essential oil to a cotton ball, and place it against the irritated area.
• Clove oil - soak a small cotton ball with clove oil and apply it where your child is feeling pain. Clove oil can have an unpleasant taste and side effects if eaten, so it should only be used for older children who won't swallow any.
• Hydrogen peroxide is an effective solution to dull toothaches caused by infection but can also be dangerous if swallowed. Create a 3% mixture with water and use as a mouthwash for about 30 seconds.
• Saline rinse eases discomfort and reduces gum swelling. Take an 8 oz glass of warm water, mix in half a teaspoon of salt, then use the mixture as a mouthwash.
• Garlic - simply smash a clove of garlic, chop it and apply it on the tooth. Rinse the mouth with warm water after a few minutes.
• Over-the-counter benzocaine gel may be used topically in children older than 2 years.
• Oral nerve blocks - topical lidocaine should be used prior to nerve block. The parent can assist with positioning and de-escalating the child's anxiety. Use buffered anesthetic, bupivacaine with epinephrine when available.

In our pediatric ED population, narcotics appear to be over-prescribed as well. Nearly 20% of our patients were prescribed an opiate for pain control upon discharge, and NSAIDs were seldom used. This is contrary to a 2023 policy statement by the ADA, which indicated that acetaminophen in combination with ibuprofen is comparable to opiates when managing oral pain.[7] The use of opioids (such as morphine, oxycodone, hydrocodone) in children, including for dental pain, has become a serious concern in pediatric care due to their high potential for abuse, overdose, addiction, adverse effects, and developmental consequences.[6,9,11,25,26] The use of opioids has been linked to altered brain development, including changes in the areas of the brain involved in decision-making, reward, and self-regulation.[25] Long-term opioid use in children can impair cognitive function and academic performance, impacting their learning and social development.[26] Given the availability of safer and equally effective alternatives, such as ibuprofen or acetaminophen, there is no reason to prescribe opioids for simple tooth pain in children (Table 3).

Dental nerve blocks are a safe and effective alternative to opioid prescription in children for the management of acute dental pain. Although nerve blocks were performed in only 5% of our patients, they can provide long-lasting pain relief (hours) without unnecessary sedation or other systemic side effects.[11] There are also fewer concerns regarding drug interactions, overdose, or long-term consequences with nerve blocks compared to opioids. The success of dental nerve blocks in pediatric patients depends heavily on the clinician's skill and experience in administering the block.[11,27] Young children may be more anxious or less cooperative, so it is important to have appropriate behavior management strategies in place, such as sedation, distraction techniques, or topical numbing agents, before administering the block.

Topical gel anesthetics are an effective, non-invasive solution for managing localized dental pain in children.[28] These anesthetics were used in 9% of our patients, typically used to prepare the area before deeper injections, such as a dental nerve block. Topical anesthetics contain active ingredients such as lidocaine, benzocaine, or prilocaine, which block nerve signals in the area where they are applied.[28] The gel form allows for easy application on the mucous membranes of the oral cavity, and the anesthetic quickly numbs the surface to reduce pain during dental treatment. The key benefits include rapid onset, minimal side effects, and the ability to manage mild pain without the need for opioids or deeper anesthetic injections. However, care should be taken to ensure the correct dosage is used and that safety protocols are followed to avoid adverse effects. Products containing benzocaine, for example, are not recommended for infants or children under 2 years old due to the risk of methemoglobinemia.[29]

Provider education should focus on evidence-based pain management, emphasizing NSAIDs and acetaminophen as first-line treatments while promoting dental nerve blocks as a safer alternative to opioids. Training should reinforce appropriate antibiotic use, following AAPD and CDC guidelines, and highlight the risks of opioid dependency and antibiotic resistance in children. Additionally, providers should be educated to identify high-risk patients with limited dental care access and to improve referral pathways to community dental resources.

Practical implementation strategies include online CME modules, in-person workshops, and simulation-based training to enhance prescribing practices. Clinical decision support tools, such as EHR alerts and quick-reference treatment algorithms, can help guide real-time decision-making. Establishing Opioid Stewardship Champions, peer mentorship programs, and interdisciplinary collaborations with dental professionals can further support the adoption of best practices. By integrating these approaches, healthcare systems can reduce opioid and antibiotic overuse while improving pain management and dental care access for pediatric patients.

LIMITATIONS

Given the retrospective nature of this study, there is likely some variability in clinical assessment and documentation by ED clinicians. Thus, documentation of clinical findings may not have been consistent. Our sample population was drawn from thirteen counties located in the Midwestern United States. We had a combination of rural and urban settings for this community-based study; patient demographics and treatment considerations might differ in other settings. However, due to its multi-center design, diverse patient demographics, and focus on widely recognized prescribing issues, this study is generalizable to other emergency departments, urgent care centers, and healthcare systems that serve pediatric patients with dental pain. Its findings support nationwide efforts to improve pain management, reduce medication-related harms, and enhance access to appropriate dental care.

TARGET AREAS FOR FURTHER RESEARCH

Future research should focus on improving pediatric dental pain management while reducing opioid and antibiotic overuse. Studies should explore the effectiveness of alternative pain management strategies, such as dental nerve blocks, NSAIDs, and topical anesthetics, compared to opioids. Additionally, research should assess the long-term outcomes of opioid and antibiotic prescriptions in children, including potential risks of dependence and antibiotic resistance. Investigating barriers to dental care, particularly among Medicaid recipients and uninsured populations, can help identify solutions such as school-based interventions or telehealth services to reduce ED visits for non-emergency dental pain.

Further research should also evaluate provider education and guideline implementation to improve prescribing practices in emergency settings. Studies assessing racial, ethnic, and socioeconomic disparities in dental pain management could inform more equitable healthcare policies. Lastly, research into the cost-effectiveness of integrating dental care into EDs or primary care settings could provide data-driven solutions to reduce healthcare expenditures and improve access to timely dental treatment.

CONCLUSIONS

The ED is a well-known safety net for children with a simple toothache and who have no direct access to dental care. However, the recommended treatment for these patients is usually dental procedures rather than antibiotics or narcotics. Families who present for emergency dental services want assurance and guidance as much as treatment. Data-driven solutions, such as guideline implementation, provider education, use of nonsteroidal anti-inflammatory drugs, and dental nerve blocks could reduce medication-related harms, avert health care expenditures, and reduce ED return visits.

Conflict of interest and funding

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