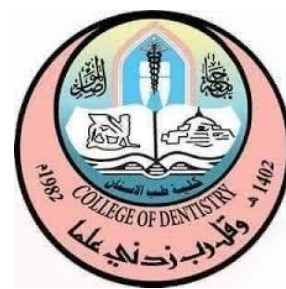




Republic of Iraq  
Ministry of Higher Education  
and Scientific Research  
University of Mosul  
College of Dentistry



# **ANALGESICS In DENTISTRY - A REVIEW**

A Project Submitted to  
The College of Dentistry, University of Mosul, Department of  
Pharmacology in  
Partial Fulfillment for the Bachelor of Dental Surgery

By

**Qamar Sabhan Mohammed Taeeb**

Supervised by:

**Prof.**

**Jawnaa Khalid Mamdoh**

FEB. 2025

## **Certification of the Supervisor**

I certify that this project entitled "**Analgesics**" was prepared by the fifth-year student **Qamar Sabhan Mohammed Taeeb** under my supervision at the College of Dentistry/University of Mosul in partial fulfilment of the graduation requirements for the Bachelor Degree in Dentistry.

**Prof. Jawnaa Khalid Mamdoh**

FEB. 2025

## **Dedication**

All my success as well as everything I do, I'm honored to dedicate it to my parents, the two people who gave me the values and paved the path for my journey in life.

My father, for always pushing me to shine and always trusting me, for being my backbone and my all times super hero.

My mother, my mentor and role model for the love she planted in me for this field and department and for her generosity in love, knowledge, wisdom and life lessons.

To my big family, for their presence, warmth and endless support.

And of course, my friends who shared the journey of learning with me, to our memories here and to the future we hold, may we grow and rise together.

Last but not least I dedicate this to all the young dreamers with hope for the future, this road may have obstacles but is worth each step.

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## **ABSTRACT**

Pain is a protective warning sign activated by tissue damage during different pathological processes. The clinical manifestation of pain is individual, multifactorial and very complex and requires the implementation of sound pharmacological approaches. The treatment of odontogenic pain is focused not only in the relief of pain but also in the suppression of causes of pain, mainly the inflammation. Acting as inhibitors of pain mechanism, analgesics are used for symptomatic treatment of pain. There are several groups of analgesic drugs used in dentistry practice and most frequent are nonsteroidal anti-inflammatory drugs (NSAIDs) and aniline analgesics. The contemporary strategies for the treatment of odontogenic pain are focused in analgesic drug combinations, which are more effective and have a better safety profile. Ibuprofen and acetaminophen agents are considered gold standard of dental analgesia for mild to moderate intensity of pain, while in moderate to severe pain the use of individual opioid analgesics or combination of opioid and nonopioid analgesics is recommended. The treatment of pain in children and elderly patients is associated with some limitations accompanied with safety concerns and dose reduction. Treatment of pain in dentistry is focused in achieving the satisfactory level of analgesia at low doses possible.

## INTRODUCTION

Pain is a subjective symptom signaling a requirement to act urgently and is usually associated with other subjective feelings such as anxiety, anger and discomfort. The expression of nature and intensity of pain is a subject of different patient-related characteristics. There are several patient factors having an impact in the patient's interpretation of pain, such as gender, age, physiological factors and drug abuse history, neuropathic and other disease and psychological profile of individual humans [1].

Dental pain (toothache or odontalgia) is a common subjective complaint of dental patients following the different interventional procedures and dental diseases. Dental pain presents one of the most common causes (approximately 12%) of patients seeking emergency treatment in dental healthcare in the United States [2].

Odontogenic pain is a complex cascade process initiated from dental tissue damage and accompanied with heterogeneous neuronal stimuli as a consequence of neurovascular, neuroinflammation and morphologic reactions [3].

The development of new analgesics is a very dynamic process and nowadays clinicians have a greater range of agents in order to select the most efficient and safe analgesic therapy. Taking into consideration the period 1960–2009, 59 analgesics have been introduced and their use still remains important [4].

Analgesics are considered one of the most important drugs groups in dental practice considering the prescription rate, clinical efficacy, cost-effectiveness and safety profile of this drug group. According to this level of importance in dental clinical practice, there are different approaches to develop treatment algorithm and guidelines for dental pain treatment in order to rationalize the use of analgesics. The rationalization of analgesics use is an

ongoing challenge, since some analgesics are over-the-counter (OTC) drugs and can be taken without medical prescription.

The management of dental pain in clinical practice is a complex part of dental care and requires high-level knowledge of analgesic pharmacology and implementing the standards of rational use.

There is a valuable evidence for significant relationship between nonrational use of analgesics and diminution of drug therapy, increased adverse drug reactions and socioeconomic consequences [5,6]

## **AIM OF THIS REVIEW**

1. Identify the effectiveness of various classes of analgesics (e.g., NSAIDs, opioids, acetaminophen, and adjuvant therapies) in alleviating dental pain, including postoperative pain and pain related to conditions such as pulpitis or temporomandibular disorders.
2. Outline the potential adverse effects and drug interactions associated with the use of analgesics in dental patients.
3. Describe the role of combination therapies and multimodal analgesia in optimizing pain relief and minimizing opioid reliance in dental practice.

# **Chapter one**

## **Review of literature**

## 1.1 Dental Indications of Analgesics

Analgesics play a vital role in managing pain associated with various dental conditions and procedures. With the availability of recent evidence-based guidelines, the selection of appropriate analgesics has become more refined to ensure safety and efficacy. [6]

### 1. Acute Dental Pain

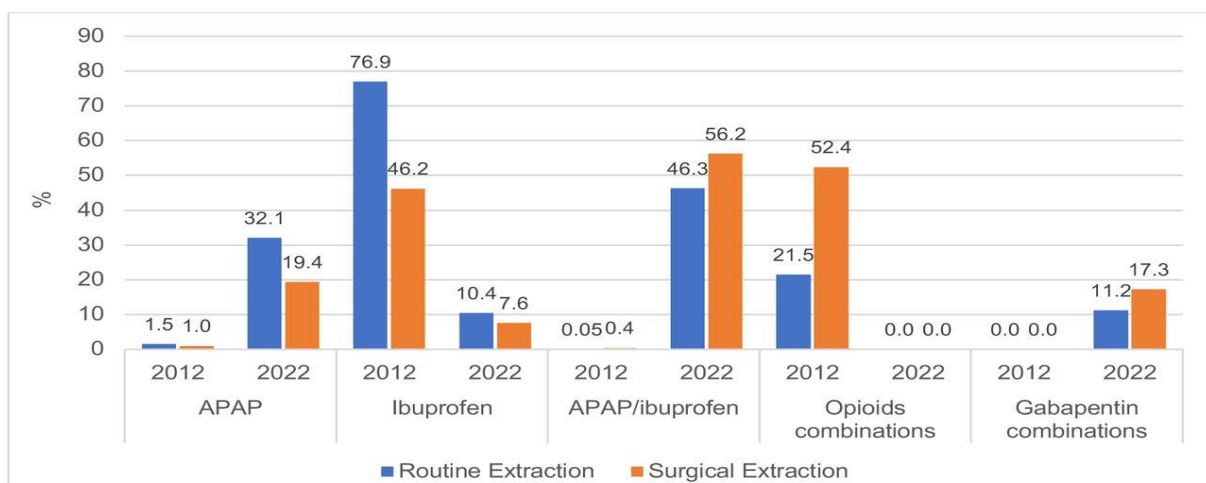
**Toothache:** Caused by pulpitis, periapical abscess, Traumatic Dental Injuries, or cracked teeth. NSAIDs such as ibuprofen are the first-line treatment. [7]

**Acute Apical Periodontitis:** Managing inflammation-induced pain around the tooth apex.

**2. Post-Operative Pain: Tooth Extractions:** Especially for impacted wisdom teeth, a combination of ibuprofen and paracetamol is preferred for optimal pain relief, **Implant Placement** NSAIDs effectively reduce post-surgical inflammation and pain. [8]

**3. Periodontal Pain:** Gingivitis and Periodontitis analgesics Relief from pain and inflammation caused by gum disease. [9]

**4. Orthodontic Pain:** Braces and Aligners Pain relief following adjustments or initial placement, **Orofacial and Neuropathic Pain:** Temporomandibular Joint (TMJ) Disorders NSAIDs are widely used to manage joint inflammation and associated pain. [10]



**FIGURE 1** Pain Management after Dental Extraction

## 1.2 Types of Analgesics in Dentistry

### 1. Non-Opioid Analgesics

#### -NSAIDs

e.g. Ibuprofen, Diclofenac, Naproxen, Mefenamic acid, Ketoprofen

#### -Acetaminophen (Paracetamol)

### 2. Opioid Analgesics

e.g. Codeine, Tramadol.

**TABLE 1** Classification of analgesics used in dental-practice

Classification of analgesics
Opioid analgesics
Hydrocodone, oxycodone, codeine, tramadol <sup>a)</sup>
Non-opioid analgesics
NSAIDs
tNSAIDs
Diflunisal, ibuprofen, naproxen, ketoprofen, loxoprofen, flurbiprofen, indomethacin, sulindac, etodolac, diclofenac, ketorolac, piroxicam, meloxicam, mefenamic acid, nabumetone
COX-2 inhibitors (COX-2-selective NSAIDs)
Celecoxib, etoricoxib, polmacoxib
Acetaminophen
Drugs used for neuropathic pain
Pregabalin, gabapentin, duloxetine

NSAIDs: non-steroidal anti-inflammatory drugs, tNSAIDs: traditional non-steroidal anti-inflammatory drugs, COX-2: cyclooxygenase-2.

## 1.3 NON-OPIOID ANALGESICS

Nonopioid analgesics include nonsteroidal anti-inflammatory drugs (NSAIDs), as well as Acetaminophen.

### 1.3.1 Non-Steroidal Anti-Inflammatory Drugs (NSAIDs)

are among the most commonly used medications for the treatment of pain, inflammation, and fever. [12] Their primary mechanism of action involves the inhibition of cyclooxygenase (COX) enzymes, which play a critical role in the synthesis of prostaglandins. [13] Prostaglandins are lipid compounds that mediate various physiological processes, including inflammation, pain, fever, and the protection of gastric mucosa.

The COX enzymes exist in two main isoforms: COX-1 and COX-2. NSAIDs can inhibit either or both of these enzymes, leading to their therapeutic and adverse effects. [14]

In dental practice, NSAIDs play a crucial role in managing pain, inflammation, and fever by targeting prostaglandins, which are key mediators of these conditions, their widespread use highlights their importance in improving patient comfort and outcomes in both acute and chronic dental conditions. [15]

#### 1.3.1.1 IBUPROFEN

Ibuprofen is commonly indicated for managing pain and inflammation resulting from dental procedures such as tooth extractions and periodontal surgeries, the drug's anti-inflammatory properties make it a preferred choice for temporomandibular joint (TMJ) disorders and soft tissue inflammation. [17] Adults dose 400–600 mg every 6–8 hours, Children dose 10 mg/kg, typically prescribed for 3–5 days for short-term pain management. [18]



**Figure 2** Brufen

### 1.3.1.2 NAPROXEN

Among NSAIDs, naproxen is considered to have a relatively lower cardiovascular risk compared to other NSAIDs, making it a preferred option in patients with inflammatory pain who have a moderate cardiovascular risk. [19] It provides pain relief lasting up to 12 hours, making it a preferred option for prolonged dental pain management compared to ibuprofen. [20] Dose: 220–440 mg initially, followed by 220 mg every 8–12 hours as needed. [21]



Figure 3 Aleve

### 1.3.1.3 DICLOFENAC POTASSIUM

Diclofenac potassium is an effective option for managing dental pain, offering rapid and sustained analgesic effects, diclofenac is effective in managing pain and inflammation following surgeries or injuries, such as fractures or soft-tissue trauma. However, due to potential gastrointestinal and cardiovascular risks, it should be used judiciously. [22] Adult dose 50 mg orally, 2–3 times daily, provides relief for 6–8 hours, Use for the shortest duration necessary. [23]

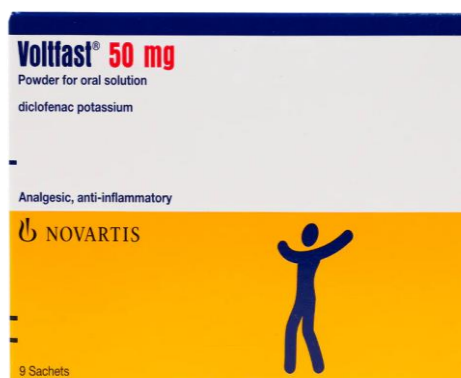


Figure 4 Voltast

### 1.3.1.4 MEFENAMIC ACID

Mefenamic acid is an NSAID used for short-term relief of mild to moderate dental pain. [24] Initial dose 500 mg Maintenance dose 250 mg every 6 hours as needed, Provides pain relief for 4–6 hours maximum duration 7 days. [25]



**Figure 5** Ponstan

### 1.3.1.5 KETOPROFEN

Ketoprofen, a nonsteroidal anti-inflammatory drug (NSAID), is utilized in dental practice for its analgesic and anti-inflammatory properties, particularly in managing postoperative pain following procedures like tooth extractions. Clinical studies have demonstrated that single doses ranging from 12.5 mg to 37.5 mg are effective in alleviating dental pain, with a rapid onset of action and a duration of relief lasting up to six hours, in comparative studies, intramuscular administration of ketoprofen (100 mg) has been found to be more effective than diclofenac (75 mg) in managing pain after mandibular third molar extractions. [26]



**Figure 6** Ketoprofen

### **1.3.1.6 Adverse effect and Drug interaction of NSAID**

One of the most significant adverse effects of NSAIDs is their potential to cause gastrointestinal issue like gastric irritation, ulceration, gastritis, and GI bleeding, impair renal function, increase the risk of cardiovascular events especially with diclofenac and ibuprofen, allergic reactions such as angioedema or anaphylaxis, interfere with blood clotting, drug interactions with anticoagulants, antihypertensive drugs, diuretics, lithium, corticosteroids, and alcohol. [13,14]

In dental patients, those with a history of gastric ulcers or those on concurrent medications like corticosteroids or anticoagulants may be at a higher risk for these adverse effects. [15]

### **1.3.1.7 Contraindications of NSAID**

including those with GIT disorders, renal impairment, cardiovascular conditions, hypersensitivity to NSAIDs, pregnancy, coagulation disorders, and asthma. Dental practitioners must carefully assess a patient's medical history and existing conditions before prescribing NSAIDs. [16]

### **1.3.2 ACETAMINOPHEN**

Acetaminophen (paracetamol) is a widely used analgesic and antipyretic in dental practice. Its mechanism of action primarily involves the inhibition of prostaglandin synthesis in the central nervous system. Acetaminophen weakly inhibits cyclooxygenase (COX) enzymes, particularly COX-3, leading to reduced pain perception and fever. Unlike NSAIDs, it has minimal anti-inflammatory effects, making it more suited for conditions where inflammation is not the primary concern. [26]

Acetaminophen is a valuable option for managing dental pain, particularly when NSAIDs are contraindicated or in combination with NSAIDs for enhanced analgesic effects. Adherence to recommended dosing guidelines is crucial to ensure safety and efficacy. Consultation with a healthcare professional is recommended to determine the most appropriate pain management strategy based on individual patient needs and medical history. [27] Standard Dosage 500 mg every 4 to 6 hours as needed, do not exceed 4,000 mg within 24 hours to minimize the risk of hepatotoxicity. [28]

Acetaminophen alone provides effective pain relief for mild to moderate dental pain. However, studies suggest that it may be less effective than nonsteroidal anti-inflammatory drugs (NSAIDs) like ibuprofen for certain types of dental pain. [29]

#### **1.3.2.1 Adverse effects and Drug Interactions**

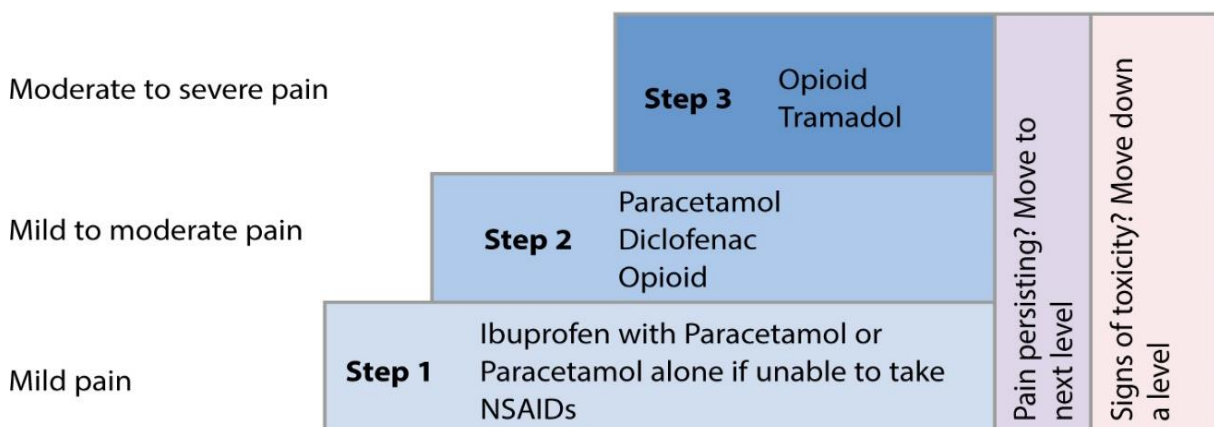
The most serious adverse effect of acetaminophen is hepatotoxicity, which can result in acute liver failure if the recommended dose is exceeded (typically 4 grams per day for adults), allergic reactions to acetaminophen, including skin rashes, itching, or, more severely, Stevens-Johnson syndrome, acetaminophen interactions with alcohol, anticoagulants, and other liver-metabolized drugs. [30]

## 1.4 Opioid analgesics

Opioids are a class of potent analgesics that are commonly used in dentistry to manage moderate to severe pain, particularly in post-operative settings, they are effective in controlling pain that cannot be adequately managed by NSAIDs or Acetaminophen. However, due to their potential for abuse and side effects, opioids are generally reserved for short-term use and for specific types of pain [31]

Opioids exert their analgesic effects primarily by binding to opioid receptors in the central nervous system, particularly the mu-opioid receptors, these receptors are part of the body's endogenous pain control system, when opioids bind to these receptors, they inhibit the transmission of pain signals to the brain, resulting in pain relief. This action also leads to an increase in dopamine release, which contributes to the feeling of euphoria and can lead to dependency with prolonged use. [32]

The analgesic effect of opioids is achieved through a combination of reducing the perception of pain and decreasing the emotional response to pain. This makes opioids highly effective for managing intense or severe pain, such as that experienced after dental surgeries like tooth extractions, root canals, or other invasive procedures. [33]



**Figure 7** WHO Analgesic ladder

### **1.4.1 Adverse Effect and Drug interaction of OPIOIDS**

Common side effects of opioids are sedation, gastrointestinal discomfort, including nausea, vomiting, and constipation, respiratory Depression. [36] prolonged use of opioids can lead to physical dependence, meaning that the body becomes accustomed to the drug and withdrawal symptoms occur if the drug is suddenly discontinued, opioids can produce feelings of euphoria by increasing dopamine release in the brain, which contributes to their potential for addiction and abuse. [37]

Drug Interactions of Opioids include CNS Depressants, Monoamine Oxidase Inhibitors (MAOIs), Antidepressants (SSRIs, SNRIs), Antihypertensive Medications, Anticoagulants (e.g., Warfarin).

Contraindications of Opioids including patients with respiratory disorders, liver or renal impairment, a history of drug abuse, pregnancy, and gastrointestinal issues. [38]

### **1.4.2 TRAMADOL**

Tramadol is an effective, centrally acting analgesic that offers a safer alternative to stronger opioids for managing moderate dental pain. Its dual mechanism of action binding to opioid receptors and inhibiting the reuptake of serotonin and norepinephrine makes it a versatile option in dental pain management. However, while tramadol has a lower risk of abuse compared to opioids, it still carries some potential for dependence and side effects, making it important for dental practitioners to carefully monitor its use in patients. [35] Available as injections (IM, IV), 50-100 mg every 4–6 hours as needed, Maximum daily dose 400 mg. [36]

## 1.5 Analgesics in Special Populations

### 1.5.1 Pregnancy

The use of analgesics in dentistry during pregnancy necessitates a careful balance between alleviating maternal pain and minimizing potential risks to the developing fetus, **Acetaminophen (paracetamol)** is widely regarded as the **safest and first-line** option for managing mild to moderate dental pain during pregnancy, supported by its well-established safety profile when used at recommended doses, In contrast, **NSAIDs (e.g., ibuprofen) should be avoided**, particularly in the third trimester, due to the risk of fetal complications such as premature closure of the ductus arteriosus, Opioids (e.g., codeine) are reserved for severe pain and used sparingly, as they carry risks of neonatal withdrawal syndrome and respiratory depression. [10]

### 1.5.2 Pediatrics

Pain management in pediatric dentistry is crucial to ensure a child's comfort and positive dental experience. Choosing the right analgesic depends on factors such as age, weight, medical history, and the severity of pain, for mild to moderate pain, **Acetaminophen (paracetamol)** is often the first choice due to its safety and effectiveness. It helps relieve pain and fever without causing stomach irritation, when pain is accompanied by inflammation, such as after extractions or orthodontic adjustments, **ibuprofen** is preferred, It reduces both pain and swelling but should not be given to infants under six months, in some cases, such as severe dental trauma or post-surgical pain, opioids like codeine or hydrocodone may be considered. However, these are rarely used in pediatric dentistry due to risks of side effects, dependence, and breathing difficulties. [11]

# **Chapter two**

## **Discussion**

## **Discussion**

Pain is one of the most common reasons patients seek dental care, and managing this pain effectively is critical to ensuring patient comfort and successful treatment outcomes. Analgesics play an essential role in dental practice, providing relief for both acute and chronic pain caused by oral diseases, surgical procedures, and traumatic injuries. This essay explores the use of analgesics in dentistry, including their types, mechanisms of action, clinical applications, and challenges associated with their use. [20] In dental practice, three main categories of analgesics are commonly utilized:

Firstly, non-steroidal anti-inflammatory drugs (NSAIDs) such as ibuprofen and aspirin are the most frequently prescribed analgesics for dental pain. NSAIDs work by inhibiting cyclooxygenase (COX) enzymes, which reduces the production of prostaglandins responsible for pain and inflammation. They are particularly effective in conditions such as pulpitis, periapical abscesses, and post-operative pain following dental surgeries like extractions or periodontal procedures, [38]

Secondly, paracetamol (acetaminophen) is often used for mild to moderate pain. Unlike NSAIDs, it lacks anti-inflammatory properties but provides effective analgesia and antipyretic effects. Paracetamol is a suitable alternative for patients who cannot tolerate NSAIDs, such as those with gastrointestinal issues or allergies. [39]

Finally, opioids, including codeine or tramadol, are reserved for severe dental pain or when other analgesics prove insufficient. While highly effective, opioids come with a risk of dependency and side effects, which limits their use to short-term and carefully monitored cases. [40]

# **Chapter three**

## **Conclusions**

## **Conclusion**

Analgesics are medications that relieve pain. There are three main types. non-opioid analgesics, opioid analgesics, and compound analgesics that combine the two previous forms.

Most non-opioid analgesics work by reducing inflammation at the site of pain.

In comparison, opioid analgesics work by interacting with opioids receptors to change the way the brain processes and perceives pain.

Many non-opioid analgesics are available over the counter, whereas opioids are available only via prescription. The latter have a higher likelihood of causing dependence and addiction. People taking opioid medications require careful monitoring and a regular review of their medications to reduce the risk of these side effects.

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