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POSTOPERATIVE PAIN MANAGEMENT IN DENTISTRY: A NARRATIVE REVIEW OF THE USE OF NONSTEROIDAL ANTI-INFLAMMATORY DRUGS

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ABSTRACT

Background. Postoperative pain is a frequent consequence of dental procedures and significantly affects patient comfort and recovery. The severity and duration of pain vary depending on the type of procedure and individual patient factors. Although it usually resolves within a few days, in some cases it may become chronic. Effective pain management is therefore essential.
Aim. This review presents contemporary strategies for managing postoperative dental pain, with particular emphasis on the use and efficacy of nonsteroidal anti-inflammatory drugs (NSAIDs).
Material and methods. A narrative review was conducted using PubMed and Google Scholar. Relevant peer-reviewed original articles, systematic reviews, and clinical trials published in English were selected. The inclusion criteria focused on studies concerning the use of NSAIDs in various dental disciplines, including conservative dentistry, pediatric dentistry, orthodontics, periodontology, prosthetics, and oral and maxillofacial surgery. Articles not related to dental postoperative pain or NSAID use, case reports, and expert opinions were excluded.
Results. NSAIDs such as ibuprofen, ketoprofen, and selective COX-2 inhibitors have proven effective in reducing postoperative dental pain across a broad range of procedures. Their mechanism involves cyclooxygenase inhibition and modulation of inflammatory pathways. In many clinical scenarios, NSAIDs surpass opioids and paracetamol alone in efficacy. Preoperative administration is often beneficial, especially in pediatric and orthodontic cases. Additional non-pharmacological methods, such as cryotherapy and laser therapy, further enhance outcomes. However, gastrointestinal, renal, and cardiovascular risks must be considered.
Conclusions. NSAIDs are fundamental in managing postoperative dental pain due to their anti-inflammatory and analgesic properties. The best outcomes are achieved through a personalized, multimodal approach combining NSAIDs with non-pharmacological strategies, ensuring effective pain relief while minimizing adverse effects.

KEYWORDS
NSAIDs, Dental Pain, Postoperative Pain, Analgesia, Dentistry

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Introduction.

The majority of patients undergoing surgical procedures, including dental surgeries, experience significant postoperative pain. Various preventive strategies can be implemented before, during, and after the procedure, alongside multiple therapeutic methods aimed at alleviating and managing pain [1].

Pain can be classified into three primary categories: nociceptive – serving a protective role and indicating harmful stimuli; inflammatory – associated with tissue damage and immune response, potentially supporting healing processes; and pathological – resulting from nerve damage or dysfunction [2].

Typical postoperative pain subsides within a week, but in some instances, it can develop into chronic pain, particularly following specific surgical interventions or due to patient-specific predispositions [3].

Chronic pain prevention involves pharmacological, non-pharmacological, and regional anesthetic strategies [4].

Among NSAIDs used for short-term pain therapy and fever management, ibuprofen, ketoprofen, naproxen, and selective COX-2 inhibitors are most common. The greatest efficacy is observed when treatment is continued for 3–5 days [5].

NSAIDs are considered the most effective agents in treating inflammatory pain, characterized by the presence of inflammatory mediators [6].

The mechanism of NSAIDs involves cyclooxygenase (COX) inhibition, the enzyme responsible for prostaglandin synthesis. COX-1 regulates physiological functions, whereas COX-2 is induced during inflammatory responses. Most NSAIDs inhibit both isoforms, potentially leading to adverse effects (e.g., gastrointestinal or cardiovascular). Selective COX-2 inhibitors, such as celecoxib, offer improved safety profiles. Some NSAIDs exert additional anti-inflammatory effects by reducing oxidative stress and inhibiting the NF-κB transcription factor. Drug selection in dentistry should be based on pain type and the patient's overall health status [7].

This review aims to summarize strategies for managing postoperative dental pain, focusing on NSAID application.

Results and Discussion

Dental procedures across various disciplines may cause postoperative pain. The descriptions by specific branches of dentistry are presented below.

Conservative Dentistry: Traditional caries treatment involves complete removal of demineralized dentin, potentially exposing the pulp, causing pain, and weakening the tooth structure [14]. Endodontic therapy aims to preserve the tooth by cleaning and sealing the root canals, supporting periapical tissue healing. NSAIDs and paracetamol are used to manage postoperative pain; however, some studies (e.g., Fuller et al., 2018) suggest that steroids like methylprednisolone may not always provide expected relief. Despite advances in endodontics, acute inter-appointment pain remains a common clinical challenge requiring urgent intervention [13].

Home whitening is popular among patients. Two main techniques exist: in-office and at-home whitening. At-home methods require longer use, increasing the risk of sensitivity. In-office treatments can show visible results after one or two sessions, though patients often consider them insufficient. Differences between techniques include the type and concentration of active agents and exposure time. At-home products typically

contain 10–22% carbamide peroxide or 4–8% hydrogen peroxide, while in-office applications use higher hydrogen peroxide concentrations (25–50%) often with light activation. Despite the popularity of light activation, research does not confirm its efficacy and suggests increased post-treatment sensitivity [15].

Pediatric Dentistry: Pediatric patients are particularly vulnerable to postoperative pain. A prospective study at AlRass dental clinics (Qassim University, Saudi Arabia, Feb 2021–Apr 2022) involved 182 children aged 4–12 years who underwent procedures like restorations, extractions, and stainless steel crowns (SSC) with or without pulpotomy. Pain was assessed via phone within 48 hours using the Wong-Baker FACES Pain Rating Scale (WBF). Responses were obtained from 146 caregivers (response rate: 80.2%). Most children (WBF $\geq$2) reported pain or discomfort, especially after SSC placement on primary molars—44.8% of cases ($p<0.001$), with no significant difference between SSC with and without pulpotomy (46.5% vs. 44.8%). OTC analgesics were used in 19.9% of cases. Pain frequency after SSC was higher than after extractions or restorations [16].

Another study at Kerman Dental School (Oct 2013–Jun 2014) found that preoperative ibuprofen reduced pain intensity within 24 hours versus placebo. After 48–72 hours, the difference disappeared. Ibuprofen group patients also used fewer analgesics (37.8% vs. 62.2% in placebo). No patient reported pain on day four [17].

Orthodontics: Orthodontic treatment, aimed at improving aesthetics and occlusion, often involves pain, particularly early in therapy or after specific procedures. Common pain-inducing interventions include orthodontic separators, which cause peak pain within 24 hours; archwire activation, with pain lasting 3–4 days; surgical exposure of impacted canines, with pain peaking on the first day; and mini-implant placement, where ibuprofen premedication improves comfort [31–36].

Premolar extractions can cause pain comparable to mini-implant placement. Orthognathic surgeries (e.g., maxillary or mandibular osteotomies) cause moderate to severe pain, sometimes less than after fixed appliance activation [37].

Oral Surgery: This includes extractions, implant placement, root removal, tooth exposure, cyst enucleation, biopsies, frenectomies, and laser or cryosurgical procedures. Postoperative complications include swelling, bruising, limited mouth opening, and eating difficulties [8–10]. A 2022–2023 clinical study compared three pain control strategies: Group A (ibuprofen), Group B (paracetamol + diclofenac), and Group C (non-pharmacological ice packs). Group C had the best outcomes, emphasizing non-pharmacological effectiveness. For moderate/severe pain, combination therapy is recommended [11]. A 2023 systematic review found NSAIDs (with or without paracetamol) superior to opioids, except for paracetamol 650 mg + oxycodone 10 mg [12].

Prosthodontics: Removable prostheses, though increasingly replaced by implant-supported options, remain crucial due to affordability. Benefits include improved mastication, breathing, speech, and aesthetics. However, continuous wear may cause pressure sores and pain [18].

Prosthetic stomatopathies, often Candida albicans-related, are another pain source [19]. Temporomandibular disorders (TMD) arise from occlusal issues, parafunctional habits, or psychological factors [20,21], potentially causing headaches and migraines [22]. In severe cases, NSAIDs like ibuprofen (400–800 mg/day) or meloxicam (7.5–15 mg/day) are effective adjuncts [20].

Periodontology: This includes surgical and non-surgical procedures, commonly for periodontitis. Scaling and root planing (SRP) is the gold standard [23]. Flap surgery involves gingival reflection for deep cleaning; peak pain occurs within six hours but is manageable with NSAIDs or dexamethasone [24,25]. Gingivectomy and frenectomy with laser yield less pain and bleeding [26]. Gingival grafting causes more pain at donor than recipient sites. Cyanoacrylate on collagen sponge reduces discomfort and analgesic use [27,28]. Guided tissue regeneration (GTR) with membranes and bone substitutes may induce pain [24]. Ibuprofen is effective postoperatively, especially when administered after, rather than before, the procedure [29,30].

Oral and Maxillofacial Surgery: Orthognathic surgeries cause moderate to severe pain, best managed with nerve blocks, cold therapy (hilotherapy), and ERAS protocols [38]. Impacted third molar extractions often lead to pain and swelling; preoperative corticosteroids (e.g., dexamethasone) reduce symptoms [39]. Mandibular and facial fractures are painful and worsen with poor preparation [40]. Rhinoplasty, though less invasive, causes moderate pain for 48–72 hours, managed with paracetamol; opioids are rarely required [41]. Implants and reconstructive procedures cause mild to moderate pain; low-level laser therapy (LLLT) and infiltration anesthesia enhance postoperative comfort [42].

Conclusions

Dental procedures—from conservative dentistry to oral surgery, orthodontics, prosthodontics, and periodontology—may cause postoperative pain of varying severity and duration [14–28]. Pain intensity depends on procedure type, patient condition, and pain sensitivity.

NSAIDs play a key role in dental postoperative pain management due to their anti-inflammatory, antipyretic, and analgesic effects. They effectively reduce pain and aid recovery [6,7,29–31]. However, gastrointestinal, renal, and cardiovascular risks necessitate careful patient-specific use [7].

Best outcomes are achieved with integrated strategies combining NSAIDs with non-pharmacological methods (e.g., cryotherapy, laser therapy, patient education), improving pain control and reducing complications [11,12]. Postoperative pain is a common dental complication that, although transient, significantly impacts comfort, satisfaction, and healing. Multicenter clinical studies confirm NSAIDs outperform paracetamol and opioids post-extraction, periodontal procedures, or orthodontic treatments [43–45].

NSAIDs primarily act by inhibiting cyclooxygenase enzymes, especially COX-2, reducing prostaglandin synthesis and inflammation [46]. Ibuprofen 400–600 mg preoperatively reduces pain for 6–8 hours post-procedure [47]. NSAIDs combined with paracetamol have synergistic effects, recommended for more invasive dental procedures [48].

Potential side effects include gastrointestinal, renal, and cardiovascular issues. Current guidelines recommend the lowest effective dose for the shortest duration [49]. COX-2 selective inhibitors (e.g., celecoxib) may be used for GI-risk patients, though cardiovascular safety remains debated [50].

In pediatric patients, preemptive ibuprofen use significantly reduces the need for postoperative analgesics [51]. Non-pharmacological methods (e.g., ice packs, laser therapy, education) are gaining traction as effective adjuncts to NSAIDs [52].

An integrated pain management approach—accounting for procedure type, risk profile, and psychosocial factors—is essential. Future research should focus on optimizing NSAID dosing protocols per procedure and comparing selective versus non-selective NSAIDs in risk-specific populations.

Conflicts of Interest: The authors declare no conflict of interest.

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Appendices

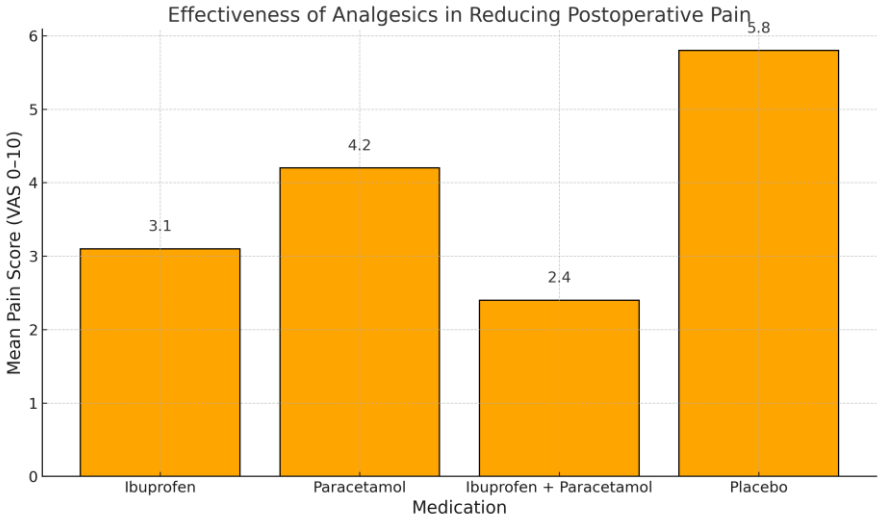

Fig. 1. *Effectiveness of Analgesics in Reducing Postoperative Pain*

Table 1. Mean Postoperative Pain Scores (VAS) by Analgesic

Medication	**Mean Pain Score (VAS)**
Ibuprofen	3.1
Paracetamol	4.2
Ibuprofen + Paracetamol	2.4
Placebo	5.8