

# Postoperative Pain Control in Oral Surgery

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## Abstract

Postoperative care in oral surgery is a key prerequisite for successful treatment and patient satisfaction. The most common postoperative sequel is pain, followed by facial edema, and trismus. Postoperative pain is defined as “an unpleasant sensory and emotional experience associated with actual or potential tissue damage”. It is caused by tissue trauma and the subsequent inflammatory response. This review aims to summarize and discuss the methods for pain management in oral surgery, identify the research gaps, and give some recommendations for further research. The study results demonstrated that postoperative pain is usually managed with non-steroidal anti-inflammatory drugs, opioid analgesics, and analgesic combinations. Other methods include corticosteroids, cryotherapy, intraoperative application of autologous platelet concentrates, and physical therapy. Further research is necessary to evaluate the role of these alternative approaches.

**Keywords:** oral surgery, postoperative pain management, postoperative pain control

## Introduction

Postoperative care begins from the moment of completion of the surgical procedure until the patient's complete return to their normal physiological state. Postoperative pain, edema, and trismus are usually regarded as complications after the surgical intervention. If they do not persist beyond certain periods, they are normal “consequences” and should not be defined as “complications”. It is important for the clinician to distinguish the usual phenomena after the intervention from complications that have already occurred and to master the techniques for controlling them.

Pain is defined as “an unpleasant sensory and emotional experience related to or resembling the feeling of actual or potential tissue damage” and “a complex perception involving the central nervous system, emotional state, and cognitive activity” (1, 2).

Postoperative pain is caused by surgical tissue trauma and the subsequent inflammatory response. Surgical trauma irritates the nociceptors in the periodontium and bone, which transmit the impulse via myelinated A $\delta$  fibers at a speed of 5-30 m/s (3). Slower unmyelinated C-fibers transmit inflammatory pain at a speed of 0.5-2 m/s. This pain usually peaks around 48-72 hours after surgery and is associated with inflammatory mediators (3, 4, 5).

Although nociceptive pain can resolve spontaneously with the removal of the causative agent, standard measures for pain control include drug prescriptions.

## Aim

This literature review aims to summarize the current knowledge on pain management in oral surgery, give some recommendations based on the scientific data, and identify the research gaps.

## Materials and Methods

An electronic search with the selected keywords was performed in December 2024 using the Web of Science, PubMed, Scopus, and Google Scholar databases. The Inclusion criteria were: full-text articles discussing postoperative pain control in oral surgery and articles written in English. The exclusion criteria were: articles not discussing postoperative pain management in oral surgery, abstracts, books, book chapters, and articles in languages other than English. After analyzing the obtained results, 43 studies were included in this review.

## Review results

### Postoperative pain control

Pain assessment is subjective, using standard scales such as the visual analog scale, the numeric pain rating scale, the Wong-Baker scale, etc (6, 7).

Various medicines are used postoperatively, such as nonsteroidal anti-inflammatory drugs (NSAIDs), and non-opioid and opioid analgesics (8, 9).

Paracetamol (acetaminophen) and NSAIDs are regarded as the drugs of choice. Some combinations of NSAIDs with opioid analgesics and glucocorticosteroids have also been suggested. Corticosteroids reduce plasma levels of prostaglandins and leukotrienes that are involved in the pathogenesis of trismus, edema, and pain (5).

Opioid analgesics target the  $\mu$ -opioid receptors and do not have anti-inflammatory effects. They can be used as a reserve in patients with severe nociceptive orofacial pain (5).

### Paracetamol

Paracetamol has a weak anti-inflammatory effect and is not classified as an NSAID. It is considered relatively safe, as it causes fewer adverse reactions from the cardiovascular, gastrointestinal, and excretory systems compared to most NSAIDs. However, irrational use can lead to serious liver damage. According to the recent US Food and Drug Administration (FDA) guidelines, the single dose of acetaminophen in drug combinations should not exceed 325 mg (10).

Paracetamol follows first-order pharmacokinetics (metabolism and elimination are constant and dose-dependent) and has a half-life of approximately 3 hours (5). The effective daily dose is two 500 mg tablets every 6 hours or 4000 mg daily. However, the recent recommendations are not to exceed a dose of 2000 mg daily due to the risk of severe liver failure.

### Nonsteroidal anti-inflammatory drugs

They inhibit the activity of the enzyme cyclooxygenase (COX) in the area of tissue damage and thus prevent the synthesis of prostaglandins. NSAIDs suppress pain, inflammation, and fever but exhibit some serious adverse reactions, such as gastropathy and duodenopathy, prolonged bleeding, delayed wound healing, and an increased risk of cardiovascular events. It has been reported, however, that taking NSAIDs for 10 days does not increase the risk of cardiovascular adverse reactions (11).

The side effects of most NSAIDs can be avoided by using COX2-selective NSAIDs such as celecoxib, meloxicam, nimesulide, etc. They attenuate the inflammatory response without blocking COX1 and without the undesirable effects of non-selective NSAIDs (5). The optimal duration of the course for postoperative pain control is 3 days, and should not exceed 5 days (12, 13).

Ibuprofen demonstrates better analgesic properties than acetylsalicylic acid (ASA). A dose of 400 mg gives a better and longer analgesic effect than 600-1000 mg of ASA or acetaminophen, as well as 60 mg of codeine, demonstrating similar efficacy to traditional drug combinations with opioid analgesics (14). The maximal anti-inflammatory effect of ibuprofen requires higher doses (2400-3600 mg/day) than those for effective analgesia (200-600 mg/4 hours and a maximum dose of 2400 mg/day) (15).

Weil et al. (16) reported that paracetamol is an effective and safe drug for pain control after extraction of impacted mandibular wisdom teeth. Bailey et al. (17) found that ibuprofen had a better analgesic effect than paracetamol for such interventions, but their combination gave even better results. The latter is supported by a study by Moore et al. (18), who compared the effect of 21 over-the-counter analgesics. They found that the combination of 1000 mg of paracetamol and 400 mg of ibuprofen had a stronger analgesic effect than their single use. Analgesia can be initiated preoperatively to reduce postoperative pain. This strategy includes acetaminophen and/or NSAIDs or corticosteroids when pain, edema, and trismus are expected. Celecoxib 400 mg 30 minutes before the procedure reduces the inflammatory response without delaying wound healing or prolonging bleeding time (19).

### Opioid analgesics

Their representatives include codeine, tramadol, and oxycodone, etc. They cause serious adverse reactions, such as nausea, constipation, dizziness, risk of addiction, etc (20). Thus, their use in oral surgery is limited and usually in analgesic combinations.

### Drug combinations

An effective combinations used in oral surgery is that of paracetamol and ibuprofen. Some studies support the use of opioid analgesics after mandibular wisdom tooth extraction. In a meta-analysis by Au et al., ten drug combinations were examined, with the strongest analgesic effect being reported for the combined administration of oxycodone and ibuprofen (21). However, the combination of paracetamol/codeine gave conflicting results and the analgesic effect was weaker than that of paracetamol/ibuprofen (22, 23).

Analgesic combinations can provide an additive effect compared with monotherapy (24). Combining analgesics with different mechanisms of action ensures multimodal coverage of the pain spectrum and sometimes drug synergism (21). Furthermore, the combination of analgesics allows for a lower dosage regimen of each medication, which should limit the frequency of adverse reactions.

### Other methods for pain management

Corticosteroids also have analgesic properties, but this is more of a secondary effect. Systemic corticosteroids reduce tissue levels of bradykinin and inhibit phospholipase A2 and prostaglandin synthesis (25, 26).

It has been suggested the use of autologous platelet concentrates, such as platelet-rich plasma (PRP) and platelet-rich fibrin (PRF), has significant regenerative potential (27 - 32). PRP can significantly improve healing processes and reduce postoperative pain, edema, and trismus (33,34).

Cryotherapy is believed to reduce postoperative pain and swelling. Ice packs can be applied extraorally for the first 24 hours after surgery because the low temperature causes vasoconstriction and decreased metabolism, which limits postoperative edema and bacterial growth. In addition, cooling slows the transmission of nerve impulses and has an analgesic effect (35).

Various topical agents have been used to improve soft tissue healing and pain and reduce bacterial count. These include mouthwashes and gels with chlorhexidine, chitosan, hyaluronic acid, different NSAIDs, and other active ingredients (36-38).

Ozone therapy has a strong oxygenating effect and antibacterial action. Ozone gels have been demonstrated to reduce postoperative pain and the risk of infectious complications after wisdom tooth extractions. In addition, it activates the immune response, induces enzyme activity, and improves tissue regeneration (39-41).

Other alternative methods include low-level laser therapy (LLLT) and acupuncture. The LLLT exerts its effect through photobiomodulation, which enhances tissue healing and assists in pain management (42). The effect of acupuncture is based on antinociception and has been proven efficient after oral surgery (43).

Further research, including randomized clinical trials, is necessary to evaluate the role of these alternative approaches in pain control after oral surgery and compare them to the conventional treatment modalities.

## Conclusion

Pain management in oral surgery is a key component of the successful treatment. It utilizes different approaches, the most common and effective of which is selecting and prescribing the most appropriate analgesic for each patient. Some non-pharmaceutical approaches have also been suggested. However, there is still some study heterogeneity regarding their effectiveness. Further studies should validate or disclaim their use.

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