

# The Effectiveness of Different Management Strategies in Postoperative Pain Following Maxillofacial Surgery: A Systematic Review

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## Abstract

The objective of this systematic review was to evaluate the effectiveness of different pain management strategies in reducing postoperative pain following maxillofacial surgery. A comprehensive search of electronic databases was conducted to identify relevant studies. Twelve studies met the inclusion criteria and were included in the qualitative data synthesis. Data were extracted and synthesized, focusing on the study characteristics, interventions, outcomes (Visual Analog Scale [VAS] scores and analgesia requirements), and conclusions. The included studies investigated various pharmacological interventions, including morphine, naproxen, codeine, diclofenac, tramadol, pregabalin, celecoxib, MgSO<sub>4</sub>, nalbuphine, and melatonin. The administration routes ranged from intravenous to oral, and the timing of administration varied from preoperative to postoperative periods. The findings showed that the effectiveness of the interventions varied. Some interventions, such as PCA (morphine) and naproxen, demonstrated comparable effectiveness with significantly lower VAS scores and analgesia requirements compared to codeine. Diclofenac and tramadol were also found to be effective in reducing pain, while other interventions did not yield significant differences compared to control groups or placebos. Combination therapies, such as pregabalin and celecoxib, showed significant reductions in VAS scores and analgesia requirements. However, there were variations in the results among the included studies. This systematic review highlights the diverse effectiveness of different pain management strategies in reducing postoperative pain following maxillofacial surgery. The findings suggest that individualized treatment plans tailored to patient characteristics and preferences are essential. Further research, including larger randomized controlled trials, is needed to optimize pain management approaches and enhance postoperative recovery in this patient population.

**Keywords:** Effectiveness, Pain management, Postoperative pain, Maxillofacial surgery

## INTRODUCTION

Maxillofacial surgery is a specialized surgical discipline that involves the treatment of various conditions affecting the face, jaw, and associated structures [1, 2]. It encompasses a wide range of procedures, including orthognathic surgery, temporomandibular joint surgery, facial trauma reconstruction, and dental implant placement [2]. While these surgeries aim to improve function, aesthetics, and quality of life, they often result in postoperative pain, which can significantly impact patient comfort and recovery [3, 4].

Postoperative pain following maxillofacial surgery is a multifactorial phenomenon influenced by surgical trauma, tissue inflammation, nerve injury, and individual pain perception [5, 6]. Effective pain management plays a crucial role in promoting patient well-being, facilitating early mobilization, preventing complications, and ensuring successful surgical outcomes [7, 8]. Therefore, the implementation of appropriate pain management strategies is essential for optimizing patient care and satisfaction.

Various pain management strategies have been employed in the management of postoperative pain following maxillofacial surgery [5]. These strategies include pharmacological interventions, such as opioids, non-steroidal anti-inflammatory drugs (NSAIDs), and local anesthetics, as well as non-pharmacological approaches, such as acupuncture, transcutaneous electrical nerve stimulation (TENS), and cognitive-behavioral therapies [5]. However,

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the effectiveness of these strategies in the specific context of maxillofacial surgery remains a topic of debate.

Previous studies have investigated the efficacy of different pain management strategies; however, the results have been inconsistent and inconclusive. Some studies have reported significant reductions in postoperative pain scores and analgesia requirements with certain interventions [9, 10], while others have found no significant differences compared to control groups or placebos [11, 12]. The heterogeneity of the study designs, sample sizes, interventions, and outcome measures contributes to the conflicting findings.

Therefore, a comprehensive and systematic evaluation of the existing literature is necessary to provide a clear understanding of the effectiveness of different pain management strategies in reducing postoperative pain following maxillofacial surgery. By synthesizing the available evidence, this study aims to identify the most effective interventions and guide clinical decision-making regarding pain management in this patient population.

Furthermore, considering the potential risks associated with certain pain management strategies, such as opioid-related adverse effects and the development of drug tolerance [13, 14], it is essential to explore alternative approaches that minimize these risks while ensuring adequate pain control. Tailoring pain management strategies to individual patient characteristics and preferences can further enhance effectiveness and patient satisfaction.

The optimization of pain management strategies in postoperative maxillofacial surgery is of paramount importance. This systematic review aims to provide a comprehensive synthesis of the current literature to evaluate the effectiveness of various pain management strategies in reducing postoperative pain. The findings will contribute to the existing knowledge base and assist healthcare providers in making evidence-based decisions to improve patient outcomes and experiences in the field of maxillofacial surgery.

### Research Objective

The objective of this study was to conduct a systematic review to evaluate the effectiveness of different pain management strategies in reducing postoperative pain following maxillofacial surgery.

## MATERIALS AND METHODS

### Study designs

These systematic review findings were reported following the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines.

### Study Selection

A comprehensive search strategy was developed to identify relevant studies. Electronic databases, including PubMed, MEDLINE, and Cochrane Library, were searched. The search terms included variations of "maxillofacial surgery," "postoperative pain," and "pain management strategies." The search was limited to studies published in English.

### Study Selection Criteria

Studies were considered eligible for inclusion if they met the following criteria:

- Investigated pain management strategies for postoperative pain following maxillofacial surgery.
- Included human participants.
- Presented original research findings.
- Reported outcomes related to pain intensity or analgesia requirements.
- Published in peer-reviewed journals.

Studies were excluded if they:

- Were animal studies, review articles, case reports, or conference abstracts?
- Did not provide sufficient data on pain management strategies or outcomes.

### Study Selection Process

Two independent reviewers screened the titles and abstracts of the identified studies to determine their eligibility for full-text assessment. Disagreements were resolved through discussion and consensus. The full texts of potentially relevant articles were obtained for further assessment.

### Data Extraction

Data were extracted from the included studies using a standardized data extraction form. The following information was collected:

- Study characteristics: author, publication year, study design, sample size.
- Intervention details: type of pain management strategy, administration route, dose, timing.
- Outcome measures: Visual Analog Scale (VAS) scores, analgesia requirements.
- Operating time: duration of the surgical procedure.
- Main findings: summary of the study results.
- Conclusions: authors' conclusions regarding the effectiveness of the pain management strategy.

### Data Synthesis

A qualitative synthesis of the included studies was conducted. The findings and conclusions of each study were summarized and compared to identify patterns, similarities, and discrepancies among the pain management strategies.

### Ethical Considerations

As this study involved a systematic review of published literature, ethical approval was not required.

## RESULTS AND DISCUSSION

A total of twelve studies were included in the qualitative data synthesis. The characteristics of these studies are presented in **Table 1** [9-12, 15-21].

**Table 1.** Characters of the included studies.

Study	Methods	Intervention	Conclusions
[10]	RCT	Pregabalin vs placebo	The study group had significantly lower VAS and analgesia requirements.
[9]	RCT	Pregabalin + celecoxib vs placebo	The study group had significantly lower VAS and analgesia requirements.
[15]	RCT	MgSo4 vs saline	The study group had significantly lower VAS and analgesia requirements.
[12]	RCT	Adenosine 5'-triphosphate vs saline	No significant difference in VAS.
[16]	RCT	Lidocaine vs placebo	The study group had significantly lower VAS and analgesia requirements.
[17]	RCT	Melatonin vs placebo	The study group had significantly lower VAS and analgesia requirements.
[11]	RCT	Diclofenac, butorphanol, and lidocaine vs placebo	No significant differences between the study and placebo.
[18]	RCT	Paracetamol vs diclofenac	No significant difference in VAS.
Precious <i>et al.</i> , 1997	RCT	PCA (morphine) vs naproxen vs codeine	PCA and naproxen were comparable with each other in terms of VAS and analgesia requirements while both were significantly lower than codeine.
[19]	RCT	0.25% bupivacaine hydrochloride vs placebo	The study group had significantly lower VAS and analgesia requirements.
[20]	RCT	Diclofenac vs tramadol vs placebo	Diclofenac and tramadol were comparable with each other in VAS and analgesia requirements and both were significantly lower than placebo.
[21]	RCT	Nalbuphine vs sufentanil	The study group (N) had significantly lower VAS and analgesia requirements.

The studies were conducted in a variety of settings, including university hospitals, community hospitals, and private practices. The participants were adults who had undergone maxillofacial surgery.

The pharmacological interventions examined in the included studies encompassed various analgesic agents such as morphine, naproxen, codeine, diclofenac, tramadol, pregabalin, celecoxib, MgSO<sub>4</sub>, nalbuphine, and melatonin. The administration routes of these interventions varied, including intravenous (IV), patient-controlled analgesia (PCA), rectal, intramuscular (IM), and oral routes. The timing of administration ranged from preoperative to postoperative periods.

Regarding the effectiveness of the pain management strategies, the findings from the included studies indicated varied outcomes. Precious *et al.* (1997) compared PCA (morphine) to naproxen and codeine, revealing that both PCA and naproxen were comparable in terms of Visual Analog Scale (VAS) scores and analgesia requirements. However, both PCA and naproxen exhibited significantly lower VAS scores and analgesia requirements than codeine. Nagatsuka *et al.* (2000) examined the effects of diclofenac, butorphanol, and lidocaine compared to placebo, and found no significant differences between the study groups and the placebo group [11]. Similarly, Tuzuner *et al.* (2007) investigated diclofenac, tramadol, and placebo and reported comparable effectiveness of diclofenac and tramadol, both of which showed significantly lower VAS scores and analgesia requirements compared to placebo [20].

Handa *et al.* (2009) explored the administration of adenosine 5'-triphosphate compared to saline and found no significant difference in VAS scores between the study and control groups [12]. Öncül *et al.* (2011) examined the effects of paracetamol and diclofenac and reported no significant difference in VAS scores [18]. Cillo *et al.* (2014) investigated the combination of pregabalin and celecoxib versus placebo, demonstrating that the study group had significantly lower VAS scores and analgesia requirements compared to the control group [9]. Eftekharian *et al.* (2016) evaluated the effectiveness of MgSO<sub>4</sub> compared to saline and found that the study group had significantly lower VAS scores and analgesia requirements [15]. Ahiskalioglu *et al.* (2016) examined pregabalin versus placebo and reported significantly lower VAS scores and analgesia requirements in the study group [10].

Lee *et al.* (2017) investigated the effects of lidocaine compared to placebo and found that the study group had significantly lower VAS scores and analgesia requirements [16]. Xi *et al.* (2020) examined nalbuphine versus sufentanil administered via PCA and reported significantly lower VAS scores and analgesia requirements in the nalbuphine group [21]. Lee *et al.* (2020) explored the administration of melatonin versus placebo and found that the study group had significantly lower VAS scores and analgesia requirements [17]. Lastly, Shetty *et al.* (2020) investigated the use of 0.25% bupivacaine hydrochloride administered locally and reported significantly lower VAS scores and analgesia requirements in the study group [19].

The qualitative data synthesis of the included studies revealed varying effectiveness of different pain management strategies in reducing postoperative pain following maxillofacial surgery. While some interventions showed comparable effectiveness to each other and demonstrated significantly lower VAS scores and analgesia requirements compared to control groups, other interventions did not show significant differences or had mixed outcomes.

The present systematic review aimed to evaluate the effectiveness of different pain management strategies in reducing postoperative pain following maxillofacial surgery. The qualitative data synthesis of twelve included studies provided insights into the various pharmacological interventions and their outcomes in terms of Visual Analog Scale (VAS) scores and analgesia requirements.

The findings of this review revealed that different pharmacological interventions yielded diverse outcomes in postoperative pain management. Among the interventions investigated, some demonstrated comparable effectiveness to each other, while others showed significant differences compared to control groups or placebo. These results emphasize the importance of carefully selecting and tailoring pain management strategies to individual patients, taking into account the specific characteristics of each intervention.

One of the interventions assessed in this review was PCA (morphine) compared to naproxen and codeine. Precious *et al.* (1997) reported that both PCA and naproxen showed comparable effectiveness, with significantly lower VAS scores and analgesia requirements compared to codeine. These findings suggest that PCA and naproxen may be viable options for postoperative pain management in maxillofacial surgery, providing effective analgesia and potentially reducing the need for stronger opioids such as codeine.

The effectiveness of diclofenac, tramadol, and placebo was examined by Tuzuner *et al.* (2007). Both diclofenac and tramadol demonstrated comparable effectiveness, with significantly lower VAS scores and analgesia requirements compared to placebo [20]. This implies that diclofenac and tramadol may serve as effective alternatives for postoperative pain management, potentially reducing the reliance on placebo or less effective interventions.

In contrast, Nagatsuka *et al.* (2000) found no significant differences between the study groups and the placebo group when investigating the effects of diclofenac, butorphanol, and lidocaine [11]. Similarly, Handa *et al.* (2009) reported no significant difference in VAS scores between the study group receiving adenosine 5'-triphosphate and the control group receiving saline [12]. These findings suggest that while certain interventions may not yield significant improvements in pain management, they may still play a role in individual patient cases or serve as adjunctive therapies.

The combination of pregabalin and celecoxib was examined by Cillo *et al.* (2014), who reported significantly lower VAS scores and analgesia requirements in the study group compared to the control group [9]. This suggests that the combination therapy of pregabalin and celecoxib may be an effective approach for postoperative pain management in maxillofacial surgery.

Other interventions such as MgSO<sub>4</sub> [15], nalbuphine [21], and lidocaine [16] also demonstrated significantly lower VAS scores and analgesia requirements compared to their respective control groups. Hsu *et al.* (2021) findings also support the effectiveness of these interventions in reducing postoperative pain following maxillofacial surgery [22].

### Limitations

It is important to consider the limitations of the included studies and this systematic review. The studies varied in terms of sample size, study design, and outcome measures, which may have introduced heterogeneity in the results. Additionally, the timing, route, and dosage of interventions varied across studies, further complicating direct comparisons. Furthermore, the studies were conducted in different settings and populations, which may limit the generalizability of the findings.

### Recommendations

Future research should focus on conducting well-designed randomized controlled trials with larger sample sizes to provide more robust evidence on the effectiveness of pain management strategies in maxillofacial surgery. Standardization of outcome measures and reporting guidelines would facilitate better comparison and synthesis of findings across studies. Additionally, investigations into the long-term effects and potential adverse events associated with these interventions would further contribute to the understanding of their efficacy and safety profiles.

### CONCLUSION

In conclusion, the findings of this systematic review suggest that different pain management strategies can have varying effectiveness in reducing postoperative pain following maxillofacial surgery. While some interventions demonstrated significant improvements in pain outcomes compared to control groups or placebos, others did not yield significant differences. Individualized treatment plans considering patient characteristics and preferences are crucial in selecting the most appropriate pain management strategies. Further research is warranted to optimize pain management approaches in this patient population and to enhance postoperative recovery and patient satisfaction.

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