Review Article

Pharmacological and Non-Pharmacological Methods of Postoperative Pain Control Following Oral and Maxillofacial Surgery: A Systematic Review

Amin Rahpeyma[1], Majid Eshghpour[1], Tooraj Vaezi[1], Shams Abdolrahim[2*], Amir Manafi[3], Navid Manafi[3]

1. Department of Oral & Maxillofacial Surgery, Mashhad University of Medical Science, Mashhad, Iran
2. Department of Oral & Maxillofacial Surgery, Student Research Committee, Faculty of Dentistry, Mashhad University of Medical Science, Mashhad, Iran
3. Department of Anesthesia, Detroit Medical Center, NorthStar Anesthesia, Detroit, MI

***Corresponding Author:**

Shams Abdolrahim

Resident, Oral and Maxillofacial Surgery Department, Faculty of Dentistry, Mashhad University of Medical Sciences, Mashhad, Iran

Email: Shamsa971@mums.ac.ir

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ABSTRACT

Background: We aimed to investigate the pharmacological and non-pharmacological interventions used for mitigating pain.

Methods: We integrated randomized controlled trials (RCTs) chosen from PubMed, Google scholar, and Scopus and aimed at assessing the effectiveness of one or multiple variants of Non-steroidal anti-inflammatory drugs (NSAIDs), as well as Narcotic analgesics, compared to corticosteroids, curcumin, hyaluronic acid, and antibiotics. In addition, trials utilizing NSAIDs, including Rofecoxib, which have been withdrawn from market circulation, were deemed ineligible for inclusion.

Result: A total of 9 RCTs were evaluated in this study, and the patients' postoperative pain was assessed using the visual analog scale (VAS) and the time measurement. Moreover, there were various approaches to alleviating pain and discomfort.

Conclusion: The administration of ibuprofen prior to surgery leads to a marked reduction in pain. Pharmacological interventions, such as the administration of dexamethasone and oxycodone, alongside non-pharmacological interventions, such as laser therapy, have been shown to effectively alleviate the discomfort resulting from surgical procedures on the jaw and face.

KEYWORDS
Maxillofacial Surgery; Non-Pharmacological Methods; Pharmacological Method; Postoperative Pain Control

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INTRODUCTION

Pain is one of the most common concerns patients deal with it after maxillofacial surgery (93% of patients had pain after this surgery). It can be defined as an unpleasant experience that follows actual or potential tissue damage[1]. Different types of conglomerate pain mediators may be formed following inflammation or tooth damage, which causes pain. These stimuli cause the activation of pain sensory in the dentin [2]. The hydrodynamic theory states that pain occurs when fluid passes through the dentinal tubules, and there are ion channels that contribute

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to pain [3]. However, the most painful pain can be attributed to surgical pain because several cells may be damaged during surgery, and as a result, chemical mediators are released and cause a lot of pain. Reports showed that almost most patients did not define pain in the same way, and the intensity of pain was different for each person. The intensity and duration of the pain may affect all parts of a person's life, whether it affects communication and daily activities or the person's nutrition (Pathological pain exerts a substantial impact on the overall quality of life and presents formidable therapeutic challenges) [4]. Regarding dentistry, pain has frequently been reported as the primary issue raised by patients who are experiencing its effects. Dental professionals acknowledge that their primary objective is to mitigate such encounters. Additionally, dental materials and pharmaceuticals have been developed to remedy the concerns related to the aforementioned condition [5].

Pain cannot be avoided sometimes; accordingly, despite the improvements in treatment evaluation, postoperative management is still a problem. An appreciation of pain associated with oral and maxillofacial surgery is critical for practitioners to manage the said pain effectively. The management of pain is a fundamental aspect of the clinical environment of an oral surgeon following the completion of any oral and maxillofacial surgical intervention [6].

Maxillofacial surgery is important for two reasons: first, to raise and improve the function of the jaw, and second, to relieve pain. On the other hand, this surgery can solve dental problems by diagnosing reasons for chronic dental pain and treating oral diseases, such as cysts and tumors [4].

Post-operative pain can be categorized as a type of acute pain that arises from surgical trauma. It is typified by damage to the skin or mucosa, as well as other tissues, resulting from incisions made during the surgical process. This is typically accompanied by exposure to thermal and chemical stimuli, as well as prolonged traction and manipulation of soft tissues, all of which contribute to triggering an inflammatory response and initiating an afferent neuronal barrage [6]. Postoperative pain management is conventionally executed through the utilization of two distinct categories of pharmaceutical agents: 1) Non-steroidal anti-inflammatory drugs (NSAIDs), which exert their analgesic and anti-inflammatory effects via the synthesis of prostaglandins, and 2) Narcotic analgesics, which directly affect opiate receptors in the central nervous system. However, the latter category of drugs is associated with potential adverse effects, such as drug dependency, respiratory depression, constipation, nausea, vomiting, and sedation [7]. In addition to the above methods, local anesthetics, corticosteroids, curcumin, hyaluronic acid, antibiotics, disinfectants, and many topical gels are used. As well, non-pharmacological methods, such as fibrin rich in platelets, low-level laser therapy, acupuncture, cold therapy, cavity irrigation, suture type, and suture techniques have been performed.

We aimed to assess the effectiveness of diverse pharmacological and non-pharmacological approaches in managing postoperative pain after maxillofacial surgery.

METHODS

Criteria for considering studies for this review

Types of studies

The present study incorporated randomized controlled trials (RCTs) that were both double-blinded and single-blinded. The majority of the utilized studies were in English.

Types of participants

The participants are aged 18 years or older, and each person's pain duration may differ. Moreover, individuals with acute, sub-acute, or chronic pain after maxillofacial surgery, and those with pain from trauma or dental caries were excluded from the study.

Types of interventions

This study incorporated RCTs that evaluated the efficacy of one or multiple forms of NSAIDs and Narcotic analgesics. "We studied investigations in cases that offered comparisons of non-steroidal anti-inflammatory drugs (NSAIDs)." As an illustration, the aforementioned study encompassed trials examining the efficacy of Narcotic analgesics and NSAIDs relative to corticosteroids, curcumin, hyaluronic acid, and antibiotics. Furthermore, trials that used NSAIDs, such as Rofecoxib, that are no longer available on the market were excluded.

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Types of outcome measures

The intensity evaluation of pain, using the Visual Analog Scale (VAS) or Numerical Rating Scales (NRS), has become increasingly common in clinical settings. These tools provide doctors and other healthcare professionals with a reliable means of assessing a patient's level of pain or discomfort, thereby facilitating the provision of appropriate treatment and care. The VAS and NRS are particularly useful for chronic pain management as they provide a quantitative representation of the subjective experience of pain, allowing for the tracking of changes over time. Additionally, these scales are cost-effective and easy to use, making them an ideal choice for routine pain assessments. Given their numerous benefits, the VAS and NRS have emerged as essential tools for healthcare providers seeking to improve patient outcomes and quality of care. NRS is a frequently utilized pain assessment tool designed to gauge the severity of pain in the current moment, utilizing a 0-10 scale. The scale ranges from 0, signifying the absence of pain, to 10, indicating the most excruciating pain conceivable[8].

The search methods for the identification of studies

To identify RCTs deemed suitable for inclusion in this study, a comprehensive search was conducted utilizing various databases until May 2023. Accordingly, PubMed, EMBASE, Cochrane databases, Scopus, and Google Scholar databases were extensively searched to identify studies about the research question.

Data collection and analysis

Selection of studies

Ineligible studies were excluded from the analysis based on an assessment of their title and abstract. During the search process, the selected Medical Subject Headings (MeSH) terms included "Maxillofacial Surgery", "Pain", "Pharmacological Method", and "Non-Pharmacological Methods". The titles of the articles were subsequently assessed to determine potential correlations between postoperative pain that arises following maxillofacial surgical procedures and the employment of either pharmacological methods, non-pharmacological methods, or a combination thereof. The data gathered from every conducted study encompassed various critical components, namely the author or authors responsible for the publication, the year of publication, age range, gender, skeletal classification, type of procedure, follow-up protocol, as well as the total number of patients involved.

Data extraction and management

As reported, the principal measure of interest (i.e., the severity of pain) was assessed utilizing the VAS or NRS using a score range of 0-100 and 0-10, respectively. The assessment of overall betterment is gauged by the ratio of individuals who have successfully recuperated. The quantification of disability is undertaken through a variety of disability assessment tools. The adverse events are quantified through the identification of the ratio of individuals who have undergone any unintended harmful effects during the study.

Dealing with missing data

The data that were not reported in the articles and were deemed to be absent were deliberately excluded. During the trials, if the presentation of data in the graph form was utilized as opposed to a textual description, we extracted the necessary data from the aforementioned graphical representations.

Assessment of heterogeneity

The clinical heterogeneity of all RCTs that reported outcomes of similar nature was evaluated. The trials under investigation were evaluated by the parameters of their environment, study participants, and interventions employed. In instances where clinical heterogeneity was observed within trials, aggregation was not performed.

RESULTS

Description of studies

A total of 554 prospective articles were detected through the updated electronic search in our study. Upon completing a thorough review of the titles and abstracts, a comprehensive evaluation of the full-text articles was performed (n=10), and one trial that used Rofecoxib, a medication subsequently

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withdrawn from the market, was excluded from the present review (Fig. 1) [1].

Included studies

To procure research that pertained directly to the central theme of the study, specific selection criteria were employed. These criteria consisted of solely original articles, comprising of RCTs, prospective, retrospective, or cohort studies that necessitated the accessibility of full-text literature, instead of just the abstract. Furthermore, it is imperative to employ research that pertains to maxillofacial surgery for both genders. Studies were included if the pain was reported after surgery. In every investigation, the assemblage of data incorporated particulars, such as author/year, age cohort, the ratio of males to females, skeletal association, surgical intervention, diagnostic mode, duration of follow-up, and the entire count of patients. Among these, three articles were about pain [1-3]and the treatment of pain following nasal surgery [7], and others were about maxillofacial surgery.

Excluded studies

Studies with the following characteristics were excluded: non-English and non-original articles, including systematic or literature reviews and case reports. Moreover, studies that reported pain that is not after maxillofacial surgery was excluded.

Main results

Many pharmaceutical and non-pharmacological methods reduce pain after jaw and facial surgery, which are more common pharmaceutical methods; however, recently, many non-pharmacological methods, such as medical hypnosis and laser therapy also help to reduce pain. The pain is

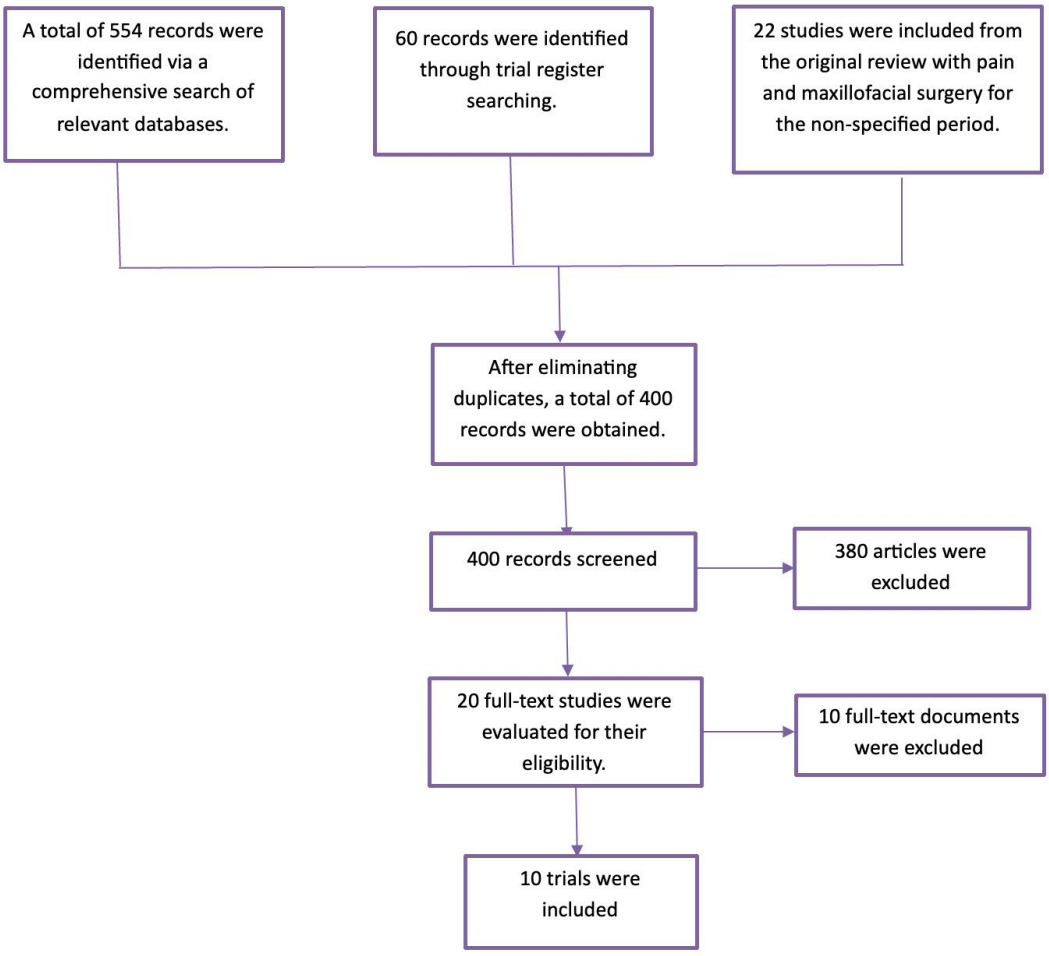

Figure 1: Study flow diagram

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measured using VAS and NRS. Some methods have a significant reduction before and after, and in some, this reduction in pain is less.

Allocation

Of the 9 included studies, six reported a randomization procedure[9-11]. Only three adequately described the concealment of treatment allocation[11, 12]. Most studies did not report the method of allocation concealment and were scored as 'unclear' on these items.

Risk of bias in included studies

We have presented the 'Risk of bias' assessment in Fig. 2. Six of the 9 studies were considered to have a low risk of bias[10, 13-17].

Blinding

Five included trials that reported blinding of patients, care providers, and outcome assessors. The other three trials did not blind patients, care providers, or outcome assessors or they did not report on blinding[10, 13-15, 18].

DISCUSSION

This study included 9 RCTs that assessed NSAID, Narcotic analgesics, and non-pharmacological methods efficacy for managing pain after maxillofacial surgery. Dirk Hermes et al. chose a non-drug method or medical hypnosis for the emergency treatment of patients undergoing maxillofacial surgery. Besides this method, they used techniques, such as anxiety relief and sedation on 174 randomly selected patients. These patients were 13 to 18 years old and underwent surgeries, such as oral, plastic and septic, oncological, reconstruction, and trauma within one year as combined local/medical hypnosis. The result was that this type of treatment (medical hypnosis) was a good supplement for anti-anxiety drug methods[12].

BDS et al. investigated the effect of thromboembolic prophylaxis in maxillofacial surgery as a questionnaire, and their response rate was obtained at 73%. This drug (thromboembolic prophylaxis) has various risks, such as long-term immobility, long-term surgeries preoperative trauma, cardiovascular disease, and varicose veins. In total, 18% of the patients did not take any precautions, and the rest used various methods of prevention, the

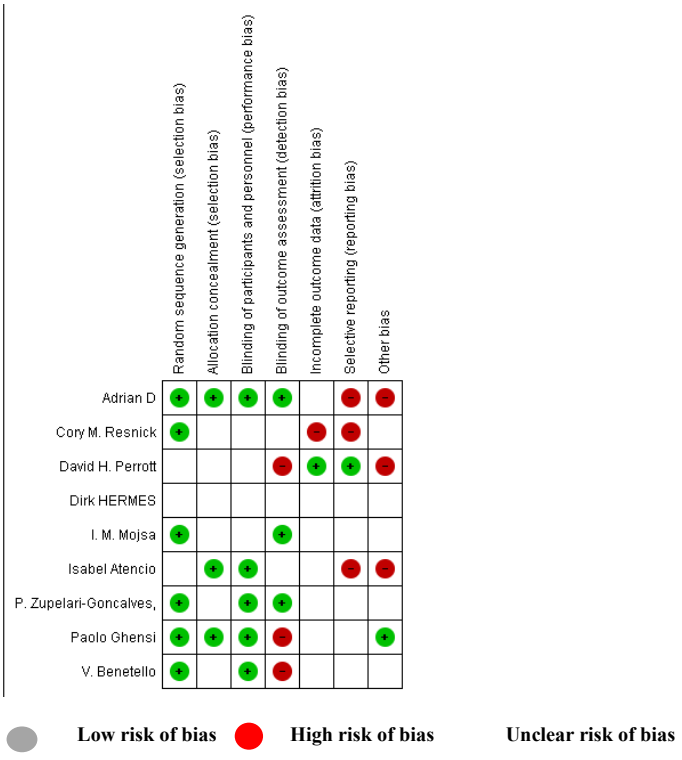

Figure 2: 'Risk of bias' summary for each trial

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most common were methods of elastic compression stockings and subcutaneous heparin with a low dose. In patient populations at moderate and low risk, the thromboembolism prevention techniques employed in oral and maxillofacial surgery provide adequate protection[19].

Perrot et al. gave a general overview of oral and maxillofacial surgery anesthesia. This prospective cohort study includes local anesthesia (LA), conscious sedation (CS), and deep sedation/general anesthesia (DS/GA). A total of 3411 patients were in this plan, 71.9%, 15.5%, and 12.6% of whom received CS, DS, and LA, respectively. In addition, 1.3 complications in 100 cases had minor complications, and 80.3% of patients had pain before surgery. In the end, 94.3% of patients were satisfied with their operation. The result was that the administration of LA, CS, or DS/GA in an office-based setting, using the services of oral and maxillofacial surgery teams, was found to be a safe procedure with high satisfaction among patients [19].

Sailer stated that oral surgeries are often performed with local anesthesia. There are various methods that reduce the pain, and as a result, the fear of the patients is much less. Some patients receive local anesthesia from a non-pharmacological method, which in fact should be made and individualized for each patient so that it does not have many side effects. The survey was designed to meet these needs, and the results showed that 43.2% requested more sedation measures before treatment and 54.1% requested sedation measures during treatment. The application of calming measures made up 30.3% of interventions, while the dissemination of treatment-related information represented 27.0% of the aforementioned interventions. Moreover, according to the data, 18.9% of the participants reported a preference for music, while 8.2% of the individuals favored breathing exercises. The figures show that anti-stress ball usage accounts for 6.6%, whereas muscle relaxation was 4.1%. The results of a survey show that music was the dominant preference, accounting for 50% of the respondents' choices [13].

In the same line, Meechan et al. discussed the diverse squeal that was manifested after third molar surgery while highlighting their utility in evaluating the effectiveness of different therapeutic interventions. The surgical intervention affords an opportunity to examine the initiation, extent, longevity, and systemic impacts of regional analgesic formulations. The immediate aftermath of a surgical procedure, characterized by pain, facial swelling, and restricted mouth opening, presents a valuable clinical framework to assess the effectiveness of analgesic and anti-inflammatory medications. The result of the study revealed that the effectiveness of painkillers, anti-inflammatory agents, local anesthetics, sedation techniques, and antimicrobials is higher in this surgery [10].

Similarly, Resnik et al. discussed the quantification of opioids administered by a patient after the extraction of a third molar. According to the results, 81 patients participated in this trial, the mean number of oxycodone tablets consumed by the patient was 0.04±0.24, and the peak utilization of oxycodone occurred on postoperative day two, with an average intake of 1.0±0.0 tablet. On the first postoperative day (POD 1), three patients (4%) were administered Oxycodone. In addition, on POD 2, four patients (5%) took this medication. On PODs 3 and 4, two patients (3%) ingested Oxycodone, while patients refrained from consuming the drug on PODs 5 to 7. Among a total of 75 patients, a sizeable majority (93%) did not employ any postoperative Oxycodone. The analgesic Ibuprofen in a dosage of 600 mg was administered for a mean duration of 4.6±2.2 post-operative days, while Acetaminophen in a dose of 650 mg was administered for a mean duration of 3.4±1.9 post-operative days. The result showed that the utilization of oral opioids following third molar extractions was negligible, and it is imperative to exercise prudence to prevent prescribing [14].

Patel et al. discussed the amount of variation in opioid prescribing practices among maxillofacial surgeons. There was a significant reduction in both the mean number of opioid claims per beneficiary ($P<0.001$), and the number of days' worth of supply per opioid ($P<0.001$) during the period. As a result, while there has been a steady increase in the overall number of opioids prescribed by oral and maxillofacial surgeons over time, their prescribing patterns have become more prudent [18].

Ghensi et al. announced that Corticosteroids, specifically Dexamethasone, are frequently employed in oral surgery to manage postoperative pain and edema while facilitating greater mouth-opening capacity. Corticosteroids elicit their chief anti-inflammatory and analgesic modes of action via suppressing phospholipase A2. Within a particular research endeavor, participants were subjected to

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the administration of either a submucosal agent of 4 mg dexamethasone with local anesthesia, or 8 mg dexamethasone submucosally. The present investigation ascertained that there was a noteworthy decrease in both VAS scores and inflammation on the second day following the surgical procedure between the experimental and control groups [15].

Mojsa et al. indicated that the preoperative administration of submucosal Dexamethasone did not result in a statistically significant reduction in postoperative pain. However, the administration of submucosal Dexamethasone 15 min post-operation demonstrated a significant decrease in VAS scores [16].

Two studies have determined that the inclusion of 60 mg of codeine in a treatment plan comprising 1000 mg of Acetaminophen and 400 mg of Ibuprofen consumed every 6 hours does not confer further pain relief after the removal of the third molars[20, 21].

According to investigations, individuals who utilized a fentanyl transdermal patch experienced significantly reduced pain levels, compared to subjects in a control cohort. However, the report notes that patients utilizing a fentanyl transdermal system may be inclined towards misuse or abuse of the drug due to its euphorigenic properties[22-24].

Renato Fraga et al. examined the efficacy of antimicrobial photodynamic therapy (aPDT) and low-level laser therapy (LLLT) for minimizing postoperative pain and swelling subsequent to molar tooth extraction. The study sample comprised 40 individuals, whose mean age was calculated as 41.25±13.97 years. Of these participants, 25 (62.5%) cases were female, and each treatment group consisted of 10 subjects. The mean of measured pain experienced by the subjects following their surgical procedures exhibited a significant and gradual decline over a period of time. The present study revealed that the group receiving adjunctive treatment with aPDT and LLLT exhibited a statistically significant reduction in postoperative pain levels on the 1st, 2nd, 3rd, 5th, 6th, and 7th day following a tooth extraction, compared to other treatment modalities ($P<0.05$) [24]. There were no statistically significant disparities in edema identification among the groups. The findings indicate that the concomitant application of aPDT and LLLT was efficacious in mitigating postoperative discomfort. These procedures can be applied in everyday surgical practice[11].

CONCLUSION

There are various medicinal and non-medicinal methods that maxillofacial surgeons can prescribe to patients before, during, and after the operation. Still, some of these methods are more accessible and cost-effective. However, some studies have stated that before surgery, Ibuprofen causes a significant reduction in pain. Additionally, other medicinal methods, such as Dexamethasone, and Oxycodone, as well as non-medicinal methods, such as laser therapy, can help reduce the pain caused by jaw and facial surgery.

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CONFLICT OF INTEREST

The authors declare that there is no conflict of interests.

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