Case Series



# The effect of opioid-free anesthesia for temporomandibular joint surgery: a case series

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**Background:** Opioid-free anesthesia (OFA) is associated with decreased postoperative morphine requirements, less postoperative oxygen desaturation, and decreased post-operative nausea and vomiting. However, the effect of OFA on post-operative pain management and overall hospital course has not been systematically studied in patients undergoing temporomandibular joint (TMJ) surgeries. There is limited evidence to support the use of OFA in TMJ surgery; the level of pain control achieved by such methods compared to traditional methods that use opioids, the safety this model over traditional anesthesia and patient satisfaction have not been studied in detail. This study seeks to examine the effect of intraoperative OFA compared to a conventional opioid-based anesthetic on post-operative opioid requirements in patients undergoing TMJ surgery at a tertiary care center.

**Methods:** Institutional electronic medical records were queried for patients undergoing TMJ surgery. Adult patients undergoing TMJ surgery who received no pre- or intra-operative opioids were included in the study as part of the opioid-free group. Patients with chronic pre-operative opioid use were excluded from the study. The primary outcome was post-operative in-hospital opioid consumption as measured in morphine milligram equivalents. Secondary outcomes included post-operative pain scores and length of hospital stay.

**Results:** There was no statistically significant difference in mean morphine milligram equivalents consumed post-operatively, mean post-operative pain scores, or hospital length of stay between the opioid-free group and opioid-inclusive group.

**Conclusions:** Our analysis revealed that there was no significant difference in post-operative opioid consumption, post-operative pain scores, or overall hospital length of stay between patients who received OFA and opioid-inclusive anesthesia. Our small OFA sample size may have resulted in our inability to detect a significant difference among groups. There are several barriers to OFA specific to TMJ surgery that may explain our low numbers in the OFA group.

**Keywords:** Opioid-free anesthesia (OFA); opioid-sparing; analgesia; temporomandibular joint (TMJ); postoperative care

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## Introduction

Patients with temporomandibular joint (TMJ) disorders often seek out treatment for pain and physical dysfunction, such as limitation of mouth opening, episodes of joint locking, pain with mastication, facial pain, or headache (1). The intensity of pain after oral and maxillofacial (OMF) surgery is often underestimated, and inadequate pain control has been associated with impaired post-operative

functional recovery, increased opioid requirements and increased length of hospital stay (1,2).

Opioid analgesics are commonly used for perioperative pain control (3). However, they are associated with undesirable side effects including respiratory depression, hyperalgesia, increased incidence of postoperative nausea and vomiting, impaired gastrointestinal function, pruritus, urinary retention, delirium, the potential for developing opioid addiction, and delay in hospital discharge (4). As such, there has been a drive to explore the possibility of opioid-free anesthesia (OFA) and pain management techniques.

OFA has been associated with reduced postoperative nausea and vomiting, reduced postoperative pain scores, less postoperative morphine consumption, and a lower incidence of postoperative oxygen desaturation (5,6). OFA also has potential economic and societal benefits. Patients who develop opioid-related adverse events have been shown to have higher treatment costs, length of hospital stays, and readmission rates. Opioids prescribed in the perioperative period may also contribute to the ongoing opioid use crisis (7).

OFA protocols such as subanesthetic infusions of lidocaine, ketamine or dexmedetomidine supplemented with other non-opioid intravenous agents and inhaled anesthetics have been used widely in various surgical specialties. However, the effect of OFA on post-operative pain management and overall hospital course has not been systematically studied for OMF surgeries.

**Highlight box**

**Key findings**

- There was no significant difference in post-operative opioid consumption, post-operative pain scores, or overall hospital length of stay between temporomandibular joint surgery patients who received opioid-free anesthesia and opioid-inclusive anesthesia.

**What is known and what is new?**

- Opioid-free anesthesia (OFA) is associated with decreased postoperative morphine requirements, less postoperative oxygen desaturation, and decreased post-operative nausea and vomiting.
- The effect of OFA on post-operative pain management and overall hospital course has not been systematically studied in patients undergoing temporomandibular joint (TMJ) surgeries.

**What is the implication, and what should change now?**

- There is the opportunity to improve patient outcomes by reducing or eliminating the use of opioids. More research is needed in this topic and its application to various types of surgery.

In this case series, we sought to determine the effect of intraoperative OFA compared to a conventional opioid-based anesthetic in patients undergoing TMJ surgery at a tertiary care center. We hypothesized that participants receiving intraoperative OFA would have decreased postoperative opioid consumption, lower postoperative pain scores, and decreased hospital length of stay. We present this article in accordance with the STROBE reporting checklist (available at https://joma.amegroups.org/article/view/10.21037/joma-22-22/rc).

## Methods

The study was conducted in accordance with the Declaration of Helsinki (as revised in 2013). The study was deemed exempt for review by our Institutional Review Board (IRB; Protocol 2020P002221). No written informed consent was required by participants according to the institutional review board.

We used our institutional electronic medical records to identify adult patients undergoing TMJ surgery between January 1, 2020 and September 1, 2020. Participants were identified using *International Classification of Diseases*, 10$^{th}$ edition (ICD-10) codes for TMJ surgery including M26.60, M26.602, M26.603, M26.609, 524.60, 21240, 21242, and 21243. Patient characteristics of age, race, gender, body mass index (BMI), American Society of Anesthesiologists (ASA) status height and weight were matched for comparable groups. The OFA group included any patient who did not receive opioids in the pre-operative or intra-operative period and who were not on chronic opioids in the outpatient setting prior to surgery. The control group included any patient that has had exposure at any point during the case to opioids including but not limited to fentanyl, hydromorphone, remifentanil, sufentanil, alfentanil, codeine, morphine, meperidine, and methadone. Patients with chronic pre-operative opioid use were excluded from the study.

The medical records were queried for information on patient demographics (age, gender, and race) and clinical information such as ASA status, weight, BMI, and height. The primary outcome was post-operative in-hospital opioid consumption as measured in morphine milligram equivalents (MME). Secondary outcomes included post-operative pain scores as measured by the Visual Analogue Scale and length of hospital stay.

Descriptive statistics were reported using mean and standard deviations for continuous variables, and

**Table 1** Baseline demographic characteristics of all participants (n=126)

| Baseline characteristics | Opioid-free group (n=6) | Opioid-based group (n=120) | SMD |
|---|---|---|---|
| Gender, n (%) | | | – |
| Female | 5 (83.3) | 91 (75.8) | |
| Male | 1 (16.7) | 29 (24.2) | |
| Age (years), mean (SD) | 50.8 (16.6) | 46.2 (15.8) | 0.285 |
| Race, n (%) | | | – |
| White | 6 (100.0) | 95 (79.2) | |
| Black of African American | 0 (0) | 9 (7.5) | |
| Hispanic or Latino | 0 (0) | 2 (1.7) | |
| Asian | 0 (0) | 5 (4.2) | |
| Other | 0 (0) | 9 (7.5) | |
| Weight (kg), mean (SD) | 87.7 (23.0) | 71.3 (20.2) | 0.740 |
| BMI (kg/m$^2$), mean (SD) | 30.5 (8.5) | 26.2 (6.2) | 0.590 |
| Height (cm), mean (SD) | 169.8 (8.3) | 165.0 (8.8) | 0.557 |
| ASA, n (%) | | | – |
| I | 1 (16.7) | 10 (8.9) | |
| II | 5 (83.3) | 84 (75.0) | |
| III | 0 (0.0) | 18 (16.1) | |

SMD, standard mean deviation; SD, standard deviation; BMI, body mass index; ASA, American Society of Anesthesiologists.

frequencies and percentages for categorical variables. Standardized mean difference (SMD) were reported and SMD >0.15 was considered to be statistically different. We performed a preliminary analysis using two-independent sample bootstrapped *t*-test to compare the mean differences (MD) of total MME between the study group and controls. 95% confidence intervals (CIs) and bootstrapped P values were reported, along with the un-bootstrapped *t*-test results. All data were analyzed using R software Version 4.0 (R Foundation, Vienna, Austria).

## Results

A total of 126 patients were included in our study. Patients who received no intraoperative opioids were included in the opioid-free group (n=6) and those who did receive intraoperative opioids were considered the control group (n=120). Patient characteristics are found in *Table 1*. Participants were predominantly female (exposure group, n=5, 83.3%; control group, n=91, 75.8%). Average ASA scores were similar between the two groups.

Post-operative opioid consumption was described by MME taken over the course of the peri-operative period. The mean of the opioid-free group was 8.75 (SD 9.32) versus 14.80 (SD 14.28) mg in the control group (*Figure 1*). The difference was not statistically significant (P=0.1811). Utilizing a bootstrapped *t*-test, we found this difference had a highly skewed CI of –1.72 to 12.90 (P=0.2328). Un-bootstrapped *t*-test similarly showed statistically insignificant and highly skewed results between study group and controls (95% CI: –3.6973 to 15.8056, P=0.1811).

There was no significant difference in mean post-operative pain score between the two groups. The mean of post-operative pain score in the opioid-free group was 4.56 (SD 3.38) versus 4.91 (SD 1.87) points in the control group. The difference was not statistically significant (P=0.8359). Results were similar using an un-bootstrapped *t*-test (95% CI: –3.1954 to 3.8990, P=0.8104).

The hospital length of stay was not significantly different between the opioid-free group (mean 36.07 days, SD 31.01 days) and control group (mean 60.38 days, SD 114.69 days; P=0.2234). Un-bootstrapped *t*-test similarly

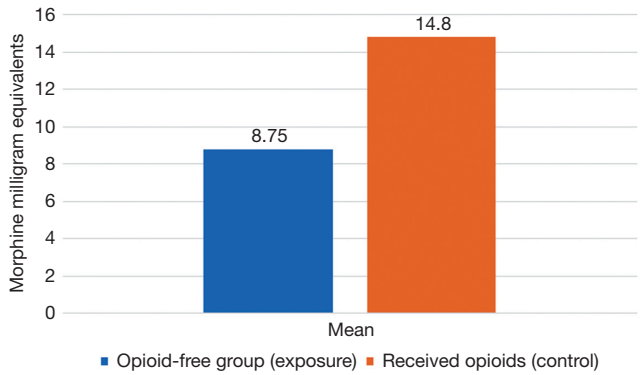


**Figure 1** Comparison graph of morphine milligram equivalents for the opioid-free group (exposure group, n=6) and the group who received opioids (control group, n=120) for all time periods.

showed statistically insignificant and highly skewed results between study group and controls (95% CI: −5.43 to 54.05, P=0.9874).

## Discussion

Our analysis revealed that there was no significant difference in post-operative opioid consumption, pain scores, or overall hospital length of stay between patients who received OFA versus opioid-inclusive anesthesia. Our small OFA sample size may have resulted in our inability to detect a significant difference between groups.

Although OFA has been suggested as an alternative to the standard opioid-based approach of anesthetic management, research in this area is limited. Accurate monitoring to measure intraoperative nociception and guide the use of adjuvants is not available (8). There are currently no guidelines for when OFA is appropriate or indicated (5). Although multimodal pain management has been shown to be efficacious in treating pain, the existence of so many treatment strategies makes it difficult to identify one superior strategy (9). Lastly, although OFA has been shown to reduce the amount of opioid consumed postoperatively, it does not lead to a lower amount of opioids being prescribed to patients postoperatively (10).

A challenging exclusion criterion in our study was home opioid use. Chronic opioid use prior to surgery has the potential to lead to increased opioid use in the perioperative and postoperative periods. However, TMJ surgery is often performed because the patients are experiencing pain, which means many are on opioids as an outpatient. Moreover, patients arriving to our institutional preoperative care unit may be given opioids as part of a standardized nursing protocol. It is also important to note that if patients require opioids preoperatively, it may undermine the feasibility of performing this surgery utilizing OFA.

There are several barriers to OFA that are specific to TMJ surgery that may explain our low numbers in the OFA group. TMJ surgery can be very stimulating and presents a unique challenge for anesthesia providers. Permissive hypotension is sometimes requested during osteotomy in TMJ surgery. When performing OFA, this hypotension can be difficult to obtain as osteotomy is a short but stimulating part of the procedure. In addition, some providers may be less comfortable providing OFA than others.

## Conclusions

There is the opportunity to improve patient outcomes by reducing or eliminating the use of opioids. More research is needed in this topic and its application to various types of surgery. OFA has not been studied systematically for TMJ surgery. By studying the effect of OFA on patients undergoing TMJ surgery, providers can begin developing protocols to standardize its administration.

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## Footnote

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