7-1-2021

# A Retrospective Cross-Sectional Study of the Effect of Liposomal Bupivacaine on Postoperative Opioid Prescribing After Third Molar Extraction

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# A Retrospective Cross-Sectional Study of the Effect of Liposomal Bupivacaine on Postoperative Opioid Prescribing After Third Molar Extraction

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**Purpose:** Reducing opioid prescriptions after third molar extraction may decrease the risk of opioid dependence. This study compared prescribed morphine milligram equivalents (MMEs) in patients undergoing mandibular third molar removal with and without use of liposomal bupivacaine (LB).

**Methods:** This retrospective cross-sectional study included deidentified data from electronic medical records of patients who underwent extraction of ≥1 partial bony—or full bony—impacted mandibular third molar at 2 oral surgery centers in the United States in 2012 or 2018. The primary predictor variable was use of LB 133 mg. The primary outcome variable was total prescribed opioids in MMEs. The secondary outcome variable was rate of prescription refills. Both univariate and multivariable regression analyses were used to compare MMEs between groups with a significance level of $P < .05$.

**Results:** The study sample included 600 subjects (n = 300 each for LB and non-LB groups). Mean age (22–24 years) and sex distribution (55%–58% female) were comparable between groups, although significant differences were observed in anesthesia type and race distribution ($P < .05$). In univariate analysis, the LB group was prescribed 59% fewer MMEs than the non-LB group (47.1 vs 113.8 MMEs; rate ratio, 0.41 [0.39–0.44]; $P < .0001$). After adjustment for age, sex, anesthesia type, American Society of Anesthesiologists physical status classification, and complications, the LB group was prescribed significantly fewer total opioids (adjusted MMEs, 44.9 vs 109.5; rate ratio, 0.41 [95% confidence interval, 0.39–0.44]; $P < .0001$) and had a significantly lower opioid prescription refill rate (3.3% vs 7.7%; odds ratio, 0.38 [95% confidence interval, 0.16–0.90]; $P = .028$) than the non-LB group. Complication rates were comparable between groups.

**Conclusions:** Patients undergoing third molar extraction and receiving LB were prescribed significantly fewer opioids than patients who did not receive LB, with a lower refill rate. Use of LB may reduce opioid prescriptions for postsurgical analgesia.



*J Oral Maxillofac Surg 79:1401-1408, 2021*

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Conflict of Interest Disclosures: S.E.L. and D.M. are paid consultants and on the speakers' bureau for Pacira BioSciences, Inc. J.O. is an employee of Pacira BioSciences, Inc. F.W. is a former employee of Pacira BioSciences, Inc. H.F. has nothing to disclose.

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Received April 14 2020

Accepted February 9 2021



0278-2391/21/00188-9

https://doi.org/10.1016/j.joms.2021.02.012

Third molar extractions are among the most common dental procedures in the United States and are performed in up to 5 million patients every year.[1] Oral surgery, including third molar extraction, is associated with a defined period of pain and discomfort that traditionally leads to written prescriptions for opioid analgesics.[1-3] A large retrospective review of the Medicaid database found that of 2.76 million patients who underwent surgical tooth extraction, 1.16 million (42%) filled a prescription for opioid medications within 7 days after surgery, with a median of 120 (interquartile range, 90–150) morphine milligram equivalents (MMEs) dispensed per patient.[4] Moreover, the number of opioid doses dispensed was found to increase with invasive procedures; the median MMEs dispensed was 113 for surgical extraction of nonimpacted teeth versus 120–150 MMEs for removal of impacted teeth, depending on the type of impaction. The proportion of patients receiving written prescriptions following third molar extraction can be high; a retrospective study assessing opioid prescribing patterns at a single center found that 95% of patients undergoing third molar extraction received a written opioid prescription before institution of an acute postoperative pain opioid prescribing protocol.[5] Ultimately, recent estimates suggest dentists are the second most frequent prescribers of opioids after internal medicine physicians in the United States, accounting for 15.8% of all opioid prescribers.[6] Moreover, a retrospective study using pharmacy claims data for 1.14 million privately insured patients from the Truven Health MarketScan Database suggested that the opioid prescription rate among dentists increased by 17% from 2010 to 2015[7]; however, the implications of these data may be limited as more recent trends since the declaration of the opioid epidemic are unknown and these data do not account for potential changes in the number and clinical profile of patients with dental insurance over this period.

Given that opioid prescriptions for opioid-naive patients after third molar extraction are associated with a risk of persistent opioid use,[8,9] novel opioid-minimizing approaches to postsurgical analgesia are needed. Multimodal pain management strategies, including the use of local anesthetics, nonsteroidal anti-inflammatory drugs (NSAIDs), and other modalities, have been proposed to reduce the need for postsurgical opioids in dental procedures.[10] Liposomal bupivacaine (LB; trade name: EXPAREL) is a long-acting formulation of bupivacaine approved by the US Food and Drug Administration for infiltration in adults to produce postsurgical local analgesia and as an interscalene brachial plexus nerve block to produce postsurgical regional analgesia.[11] The use of LB reduced postsurgical pain scores in the per-protocol population of patients undergoing third molar extraction in a phase 3, randomized, double-blind, placebo-controlled study.[12] In addition, a retrospective pilot study suggested that the use of a multimodal analgesic protocol including LB for third molar extraction resulted in a reduced number of opioid prescriptions compared with historic averages.[13]

The purpose of this retrospective study was to compare opioid prescription volumes in MMEs in patients undergoing third molar extraction with or without the use of LB immediately after the procedure. The specific aims of the study were to compare prescribed MMEs, rate of prescription refills, and complication rates between groups. The investigators hypothesized that LB reduced the need for opioid prescriptions and refills.

## Methods

### STUDY DESIGN

A retrospective cross-sectional analysis was conducted to assess the association between local infiltration with LB after third molar extraction and postsurgical opioid prescription volume. The study protocol was granted exemption status according to 45 CFR 46.101(b) by a central institutional review board (IntegReview) before the start of the study.

#### *Sample Population*

The study population was composed of patients who underwent third molar extraction at 2 outpatient oral surgery centers in the United States. Eligible patients were required to be ≥ 18 years of age and undergoing elective third molar extraction with ≥1 partial bony—or full bony—impacted tooth in the mandible. The sampling method was nonrandomized and consisted of creating a convenience sample with equal numbers of patients undergoing third molar extraction with versus without LB. Patients were selected in a reverse chronological order, and no patients who otherwise qualified for the study were excluded. Most extractions were performed in 2018, except for the procedures performed without LB at 1 of the centers (n = 150), which were performed in 2012. Data were not used from this center from 2013 and 2017 because the practice was refining the multimodal pain management protocol, and not all patients received the same regimen (including receiving vs not receiving LB).

#### *Treatment Groups*

The study population consisted of patients who received local infiltration with LB (133 mg/10 mL) and patients who did not receive LB. All procedures were performed by oral surgeons, and perioperative protocols were similar between groups other than administration of LB. At one site, patients were

instructed after oral surgery to initiate postsurgical analgesia at home with 600 mg of ibuprofen and to repeat this dose every 6 hours for at least 48 hours. Breakthrough pain was treated with acetaminophen 650 mg. If acetaminophen was insufficient to manage breakthrough pain, patients were advised to use opioids as a rescue analgesic. At the other site, each patient received a prescription for 600 mg of ibuprofen and was instructed to take 1 tablet along with 500 mg of acetaminophen once daily, and opioids were advised only for breakthrough pain.

Third molars were approached via conventional surgical procedures. Bones were removed and teeth were sectioned as necessary using a Hall drill under constant saline irrigation. Lower third molar sites were closed primarily with chromic suture. All procedures were performed by board-certified oral and maxillofacial surgeons. A video demonstrating the administration of LB for third molar extraction can be found online at https://www.pacira.com/third-molar-extraction.

### STUDY VARIABLES

The primary predictor variable was use of LB (yes vs no). The primary outcome variable in this study was the amount of opioid prescriptions, in MMEs, including both the initial prescription and any subsequent refills. The secondary outcome variable was the rate of refills. Variables used to describe the characteristics of the sample population included baseline demographics and clinical characteristics (ie, age, sex, race/ethnicity, American Society of Anesthesiologists [ASA] physical status classification, surgical complications [eg, dry socket, infection]), surgical characteristics (ie, type of anesthesia, infiltration locations, impaction status by location), and surgery-related medications (ie, NSAID prescriptions after surgery, opioid prescriptions before and after surgery including requests for refills for continued pain management). The overall mandibular and maxillary status was categorized as bony (ie, molars on each side classified as either fully or partial bony), other (ie, molars on each side were classified as erupted, soft-tissue impaction, or no procedure was performed because molar was not present, not impacted, or not removed), or mixed (ie, 1 molar on each side was classified as bony, while the other classified as other).

### DATA COLLECTION

Deidentified data, including patient demographics, pain medications (eg, NSAIDs, opioids), infiltration locations, and surgical complications were obtained from electronic medical records. At one site, all patients were scheduled for postoperative visits 7 to 10 days after the procedure with additional or earlier visits conducted as needed on the basis of patient symptoms. At the other site, patients were not scheduled for a routine postoperative appointment but were seen on an as-needed basis. All opioid prescriptions were recorded in electronic medical records to ensure completeness of patient records.

### DATA ANALYSES

Baseline demographics, clinical characteristics, and surgical characteristics, including impaction status, were compared between treatment groups using $\chi^2$ tests for categorical variables. Age was compared nonparametrically using a *t*-test. For univariate analyses, differences in total MMEs between groups were analyzed using a 2-sided *t*-test performed with unequal sample variances, and an F test for comparing total MMEs among overall mandibular status and maxillary status categories. A multivariable analytic model for treatment comparison between the LB group and non-LB group was conducted using a generalized linear regression model with gamma distribution and log link function with adjustment for age, sex, ASA physical status classification, anesthesia type, and surgical complications. Because race data were not collected by one center (ie, for half of the total patient population), race was not included as a covariate in the multivariable analytic model. A significance level of $P < .05$ was considered significant for all analyses performed.

## Results

### BASELINE PATIENT CHARACTERISTICS

A total of 600 patients who underwent third molar extraction were included in the analysis, with 300 patients each from 2 participating outpatient oral surgery centers in the United States. Data from each site included 150 patients who received LB and 150 patients who did not receive LB. Patient baseline characteristics were generally comparable across treatment groups, although some statistical differences were observed between groups (Table 1). Notably, almost all patients in both groups received intravenous anesthesia for the procedure, with a small number of patients receiving other types of anesthesia (ie, local anesthetics with or without nitrous oxide); however, a higher proportion of patients in the LB group received intravenous anesthesia. No patients in either treatment group received opioids before third molar extraction.

### POSTSURGICAL OUTCOMES

All patients were discharged to home after surgery. After extraction, the number of patients who received initial written opioid prescriptions was similar between the LB group and non-LB group (98.3 [295/300] and 98.7% [296/300], respectively). The most common

**Table 1. BASELINE CHARACTERISTICS**

| | LB Group (n = 300) | Non-LB Group (n = 300) | *P* |
|---|---|---|---|
| Age, mean, y* | 22.4 | 23.5 | 0.07 |
| Age category, n (%)* | | | 0.35 |
| ≥21 y | 142 (47.3) | 153 (51.7) | |
| <21 y | 158 (52.7) | 156 (48.3) | |
| Sex, n (%)† | | | 0.48 |
| Female | 174 (58.0) | 166 (55.3) | |
| Male | 125 (41.7) | 134 (44.7) | |
| Race/ethnicity, n (%)‡ | | | 0.02 |
| White | 99 (33.0) | 71 (23.7) | |
| Black | 36 (12.0) | 53 (17.7) | |
| Asian | 1 (0.3) | 4 (1.3) | |
| Other/unknown | 14 (4.7) | 22 (7.3) | |
| ASA physical status classification, n (%) | | | 0.40 |
| 1 | 240 (80.0) | 248 (82.7) | |
| 2 or 3 | 60 (20.0) | 52 (17.3) | |
| Anesthesia type, n (%) | | | 0.02 |
| IV anesthesia | 298 (99.3) | 290 (96.7) | |
| Other | 2 (0.7) | 10 (3.3) | |
| Overall mandibular status, n (%) | | | 0.08 |
| Bony§ | 226 (75.3) | 231 (77.0) | |
| Mixed‖ | 69 (23.0) | 56 (18.7) | |
| Other¶ | 5 (1.7) | 13 (4.3) | |
| Overall maxillary status, n (%) | | | 0.87 |
| Bony§ | 115 (38.3) | 159 (53.0) | |
| Mixed‖ | 45 (15.0) | 35 (11.7) | |
| Other¶ | 140 (46.7) | 106 (35.3) | |
| Surgical complications, n (%) | | | 0.89 |
| Yes | 27 (9.0) | 28 (9.3) | |
| No | 273 (91.0) | 272 (90.7) | |

Abbreviations: ASA, American Society of Anesthesiologists; IV, intravenous; LB, liposomal bupivacaine.

* One patient did not provide a year of birth.

† One patient did not identify as female or male.

‡ One center (n = 300) did not collect data on race/ethnicity.

§ Includes cases in which mandibular/maxillary molars on both sides were classified as bony (ie, full or partial bony).

‖ Includes cases where patient had bony status for one mandible/maxilla and other status (ie, erupted, soft-tissue impaction, not present, not impacted, or not removed) for the contralateral mandible/maxilla.

¶ Includes cases in which mandibular/maxillary molars on both sides were classified as other.

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type of opioid prescribed in both groups was hydrocodone/acetaminophen (Supplementary Table 1). The rates of written NSAID prescriptions were also similar between the LB group (50.0% [150/300]) and the non-LB group (49.3% [148/300]).

### *Primary Outcome: Total Prescribed Opioids in MMEs*

Total prescribed MMEs, including refills, across baseline characteristics and subgroups are shown in Table 2. Notably, patients who experienced complications had significantly greater total prescribed MMEs than patients who did not experience complications. In the univariate analysis, significant differences in total prescribed opioids in MMEs, including refills, were observed between groups, with the LB group being prescribed 59% fewer total opioids in MMEs (Table 3). This reduction in MMEs in the LB group was also observed in multivariable analysis after adjustment for age, sex, anesthesia type, ASA physical status classification, and surgical complications; the LB group was found to have a 59% reduction in total prescribed opioids in MMEs compared with the non-LB group (Table 4).

Age, anesthesia type, ASA physical classification status, and surgical complications were significantly associated with MMEs in the multivariable analytic model (Table 4). However, when analyzing MMEs between the LB and non-LB group within each of the subgroups

**Table 2. TOTAL MMES (INCLUDING REFILLS) ACROSS BASELINE CHARACTERISTICS**

| | MMEs (95% CI) | P* |
|---|---|---|
| Age, mean, y† | | 0.07 |
| ≥21 y (n = 295) | 76.5 (70.5–82.5) | |
| <21 y (n = 304) | 84.2 (78.6–89.8) | |
| Sex‡ | | 0.45 |
| Female (n = 340) | 82.3 (76.1–88.5) | |
| Male (n = 259) | 79.1 (73.6–84.6) | |
| ASA physical status classification | | 0.0061 |
| 1 (n = 488) | 77.4 (73.0–81.7) | |
| 2 or 3 (n = 112) | 94.0 (83.0–105.0) | |
| Anesthesia type | | 0.01 |
| IV anesthesia (n = 588) | 81.2 (77.0–85.3) | |
| Other (n = 12) | 46.2 (20.5–72.0) | |
| Overall mandibular status | | 0.052 |
| Bony (n = 457)§ | 83.3 (78.4–88.1) | |
| Mixed (n = 125)‖ | 72.1 (63.8–80.3) | |
| Other (n = 18)¶ | 67.5 (44.7–90.3) | |
| Overall maxillary status | | 0.063 |
| Bony (n = 274)§ | 85.7 (79.5–91.9) | |
| Mixed (n = 80)‖ | 78.7 (67.7–89.6) | |
| Other (n = 246)¶ | 75.2 (68.9–81.6) | |
| Surgical complications | | 0.011 |
| Yes (n = 55) | 99.5 (84.0–115.0) | |
| No (n = 545) | 78.5 (74.3–82.8) | |

Abbreviations: ASA, American Society of Anesthesiologists; CI, confidence interval; IV, intravenous; MME, morphine milligram equivalent.

* Based on F test for overall mandibular and maxillary status and *t*-test for all other comparisons.

† One patient did not provide a year of birth.

‡ One patient did not identify as female or male.

§ Includes cases in which mandibular/maxillary molars on both sides were classified as bony (ie, full or partial bony).

‖ Includes cases where patient had bony status for 1 mandible/maxilla and other status (ie, erupted, soft-tissue impaction, or no procedure performed because molar not present, not impacted, or not removed) for the contralateral mandible/maxilla.

¶ Includes cases in which mandibular/maxillary molars on both sides were classified as other.

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in Table 4, the LB group received significantly fewer MMEs than the non-LB group in all strata ($P < .0001$ for all; data not shown).

*Secondary Outcome: Opioid Prescription Refill Rates*

There were a lower proportion of patients who received another opioid prescription after the initial prescription in the LB group (3.3%) than in the non-LB group (7.7%). After adjustment for age, sex, anesthesia type, ASA physical status classification, and surgical complications, the proportion of patients requiring opioid prescription refills was significantly lower in the LB group compared with the non-LB group (odds ratio, 0.38 [95% confidence interval, 0.16–0.90]; $P = .028$).

*Comparison of Complications Between the LB and Non-LB Groups*

The overall rate of surgical complications was similar between the LB and non-LB groups (Table 1). The incidence of infections in the LB group (4.0% [12/300]) was comparable with the incidence in the non-LB group (2.7% [8/300]). Similarly, the incidence of dry socket in the LB group (4.7% [14/300]) was comparable with that in the non-LB group (6.0% [18/300]). A low incidence of nerve injury or numbness was observed in both treatment groups (LB group, 0.3% [1/300]; non-LB group, 0.7% [2/300]). At follow-up appointments, none of these cases were reported as permanent in nature.

## Discussion

The purpose of this study was to evaluate the relationship between use of local infiltration with LB for elective third molar extraction and the amount of postsurgical opioid prescriptions. It was hypothesized that the use of LB would reduce the need for opioid prescriptions after third molar extraction of at least 1 partial or full bony mandibular molar. This study demonstrated that patients who received local LB infiltration received significantly fewer total prescribed MMEs compared with patients who did not receive LB infiltration. A significant reduction was also observed in the proportion of patients requiring opioid prescription refills among patients who received LB, suggesting that the duration of postsurgical pain control with LB may have decreased the need for postsurgical opioids. The complication rate after third molar extraction was comparable between groups.

These data support results from a phase 3 randomized controlled study of patients undergoing extraction of all 4 third molars, in which reported pain intensity was significantly lower in the per-protocol population of patients who received LB compared with that in a per-protocol population of patients who received placebo.[12] The most frequently reported adverse events after LB administration for third molar extraction in that study were oral hypoesthesia, dysgeusia, and nausea. The addition of LB to a standard opioid-sparing regimen may also provide benefits in other major oral procedures, given that this has been previously demonstrated to reduce postsurgical pain after full-arch implant surgery in a randomized, open-label study.[14] The results from the present study and these past studies demonstrate

**Table 3. UNIVARIATE COMPARISON OF PRIMARY OUTCOME (TOTAL PRESCRIBED* MMES, INCLUDING REFILLS) BETWEEN LB AND NON-LB GROUPS**

| | MMEs (95% CI) | Rate Ratio (95% CI) | *P* |
|---|---|---|---|
| LB (n = 300) | 47.1 (44.2–50.0) | 0.41 (0.39–0.44)† | <0.0001 |
| Non-LB (n = 300) | 113.8 (108.3–119.4) | | |

Abbreviations: CI, confidence interval; LB, liposomal bupivacaine; MME, morphine milligram equivalent.
* The total MMEs prescribed were likely much greater than the total MMEs consumed for each group.
† Interpretation: the LB group consumed 59% fewer MMEs than the non-LB group.

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that the addition of a long-acting nonopioid analgesic such as LB to a multimodal pain management protocol could provide an opportunity to significantly reduce the need for opioid use after major oral procedures. Reduction of postsurgical opioids while providing effective postsurgical analgesia remains an important aim for dental procedures, and policies released by the American Dental Association and American Association of Oral and Maxillofacial Surgeons have placed a strong emphasis on reducing the amount of opioids prescribed; it has been recognized that dentists play vital roles in helping control the opioid crisis.[15-17] Notably, high opioid prescription rates for dental procedures persist despite these guidelines, and there is evidence that other analgesic regimens can provide similar or superior pain control to opioids.[18] Education regarding the overprescribing of opioids has been demonstrated to be effective in reducing the amount of opioid prescriptions following various surgical procedures,[19] and a similar educational effort among oral maxillofacial surgeons, in addition to education regarding local anesthesia alternatives, could help reduce prescription of opioids.[3,5,20]

**Table 4. MULTIVARIABLE COMPARISON OF THE PRIMARY OUTCOME (TOTAL PRESCRIBED* MMES)**

| | Adjusted MMEs (95% CI)† | Rate Ratio (95% CI) | *P* |
|---|---|---|---|
| Treatment | | | |
| LB (n = 299) | 44.9 (38.9–51.8) | 0.41 (0.39–0.44) | <0.0001 |
| Non-LB (n = 299) | 109.5 (95.2–125.9) | 1.00 | |
| Age, y‡ | | | |
| ≥21 y (n = 294) | | 0.91 (0.85–0.97) | 0.004 |
| <21 y (n = 304) | | 1.00 | |
| Sex§ | | | |
| Female (n = 340) | | 1.00 | 0.26 |
| Male (n = 258) | | 1.04 (0.97–1.11) | |
| ASA physical status classification | | | |
| 1 (n = 486) | | 1.00 | <0.0001 |
| 2 or 3 (n = 112) | | 1.24 (1.14–1.35) | |
| Anesthesia type | | | |
| IV anesthesia (n = 586) | | 1.00 | <0.0001 |
| Other (n = 12) | | 0.61 (0.48–0.78) | |
| Surgical complications | | | |
| Yes (n = 55) | | 1.35 (1.21–1.51) | <0.0001 |
| No (n = 543) | | 1.00 | |

Abbreviations: ASA, American Society of Anesthesiologists; CI, confidence interval; IV, intravenous; LB, liposomal bupivacaine.
* The total MMEs prescribed were likely much greater than the total MMEs consumed for each group.
† The multivariable analytic model for treatment comparison was conducted using a generalized linear regression model with gamma distribution and log link function. The model was adjusted for age, sex, ASA physical status classification, anesthesia type, surgical complications, and treatment; most of these variables demonstrated nominal significance ($P < .05$) in association with total MMEs (see Table 2). Only patients without missing variable data were included in the analysis (n = 598).
‡ One patient did not provide a year of birth.
§ One patient did not identify as female or male.

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There are several limitations to this study. First, this was a retrospective study; that is, the data analyzed in this study were limited to those recorded in the electronic medical records. The potential for selection bias was reduced at 1 center by selecting patients in a backward, consecutive manner from the arbitrary study date, with all patients receiving the same perioperative protocol. Procedures conducted without LB at the other center were all performed in 2012, while the procedures conducted with LB at the same center were performed in 2018. As a result, changes in the surgical protocol over time could have affected the results, particularly because opioid prescribing patterns may have been affected by the increased visibility and sensitivity to opioid prescriptions highlighted by the opioid crisis. In addition, federal regulations instituted in October 2014 altered the ability to call in refills for hydrocodone,[21] which could have impacted opioid refill prescribing patterns at the center with a bimodal distribution. For example, it is possible that the patient population who underwent third molar extraction without LB in 2012 in the present study may have been prescribed a lower initial volume of hydrocodone pills, given that surgeons would have had a greater opportunity to call in refills; however, this possibility would have likely skewed results toward reduced overall prescribed opioids in the non-LB group, whereas the opposite trend was observed in the present study. Second, this study was unable to directly assess opioid consumption (ie, patients did not confirm number of pills consumed) and instead measured the number of written opioid prescriptions and refills. These measurements assume that calls for prescription refills imply the patient had consumed the opioid pills from the original prescription and therefore continued to experience pain. However, it is worth noting that the total MMEs prescribed were likely much higher than the total MMEs consumed. Third, reduction in the number of opioid prescriptions was subject to observer bias because the volume of initial opioid prescriptions was a subjective decision made by the investigators. Fourth, this study did not directly compare use of LB to another local anesthetic (eg, bupivacaine hydrochloride). Therefore, the opioid-reducing benefits of LB compared with local infiltration using other local anesthetics cannot be addressed by this study design. Fifth, this study did not assess overall costs associated with use versus nonuse of LB. The benefit of LB in reducing postsurgical opioid prescriptions should be considered in the context of the cost of LB, and studies formally investigating the economic implications of use of LB in third molar extraction have not been conducted. Finally, the study was conducted at 2 outpatient oral surgery centers. Because regional variations in opioid prescribing patterns have been reported, a larger study across a greater number of outpatient oral surgery centers is warranted to assess whether LB reduces the number of opioids prescribed in a larger cross-section of settings.[22]

This study contributes to the dental and oral maxillofacial community by demonstrating that use of LB is a therapeutic option to help mitigate opioid misuse by reducing overall exposure to opioids after third molar extractions. Further studies including larger sample sizes and different geographical regions, as well as direct comparisons of LB versus other local anesthetics, such as bupivacaine hydrochloride, are warranted.

*Acknowledgments*

This study was supported by Pacira BioSciences, Inc. Writing and editorial assistance was provided under the direction of the authors by Nathan Rodeberg, PhD, and David Boffa, ELS, of MedThink SciCom with support from Pacira BioSciences, Inc.

## Supplementary Data

Supplementary data associated with this article can be found in the online version, at https://doi.org/10.1016/j.joms.2021.02.012.

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**Supplementary Table 1. TYPES OF OPIOID PRESCRIPTIONS AFTER SURGERY**

| Prescriptions | LB Group (n = 300) | Non-LB Group (n = 300) |
|---|---|---|
| First opioid prescription, n (%) | 295 (98.3) | 296 (98.7) |
| Hydrocodone/acetaminophen | 292 (97.3) | 264 (88.0) |
| Hydrocodone/Ibuprofen | 0 (0.0) | 28 (9.3) |
| Oxycodone/acetaminophen | 1 (0.3) | 4 (1.3) |
| Hydrocodone/acetaminophen oral solution | 2 (0.7) | 0 (0.0) |
| Additional opioid prescriptions, n (%) | 10 (3.3) | 23 (7.7) |
| Hydrocodone/acetaminophen | 10 (3.3) | 21 (7.0) |
| Hydrocodone/Ibuprofen | 0 (0.0) | 1 (1.3) |
| Oxycodone/acetaminophen | 0 (0.0) | 1 (1.3) |

Abbreviation: LB, liposomal bupivacaine.

*Lieblich et al. Postsurgical Analgesia for Third Molar Extraction. J Oral Maxillofac Surg 2021.*