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EVALUATION OF POSTOPERATIVE PAIN AND ANXIETY IN PEDIATRIC PATIENTS UNDERGOING ORAL SURGERY WITH LOCAL ANESTHESIA ALONE VS. CONSCIOUS SEDATION

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ABSTRACT

This study evaluates the postoperative pain and anxiety levels in pediatric patients undergoing oral surgery under two anesthetic modalities: local anesthesia alone and local anesthesia combined with conscious sedation. Pediatric dental procedures often pose challenges due to the psychological and physiological responses of children, especially concerning pain and anxiety management. The study is a prospective, randomized, controlled clinical trial that investigates how these two approaches affect postoperative outcomes. A total of 70 children, aged 4 to 12 years, were divided into two groups: one receiving only local anesthesia and the other receiving local anesthesia combined with conscious sedation (using agents like midazolam or nitrous oxide). Postoperative pain and anxiety were assessed using the Wong-Baker FACES Pain Rating Scale and the Modified Yale Preoperative Anxiety Scale, respectively, at two key time points: immediately post-surgery and 24 hours after the procedure. The results indicated that the conscious sedation group reported significantly lower pain and anxiety scores immediately post-surgery and 24 hours later, compared to the local anesthesia-only group. Furthermore, the sedation group required fewer postoperative analgesics and showed higher caregiver satisfaction. These findings suggest that conscious sedation, when appropriately used, can significantly enhance patient comfort, alleviate anxiety, and improve overall postoperative outcomes. This study emphasizes the importance of addressing both physical and psychological aspects of care in pediatric oral surgery.

Keywords: Anxiety, Conscious sedation, Local anesthesia, Pediatric dentistry, Postoperative care

1.INTRODUCTION

Pediatric dental surgery poses unique challenges due to the physiological and psychological characteristics of young patients [1]. Children often experience heightened levels of fear and anxiety before and during dental procedures, which can significantly influence their pain perception, cooperation,

and overall treatment outcomes [2]. Among these procedures, oral surgery—including tooth extractions, frenectomies, and soft tissue surgeries can be particularly distressing. Consequently, managing both pain and anxiety in pediatric patients is of paramount importance for clinicians aiming to deliver effective and compassionate care [3].

Local anesthesia has long been the standard method for providing pain control during minor oral surgical procedures. It blocks nerve conduction at the site of intervention, ensuring the procedure itself is physically painless [4]. However, local anesthesia does not address the psychological component of the experience namely, the child's fear and anxiety [5]. The sight of needles, unfamiliar sounds, and a clinical environment can provoke significant distress in children, leading to increased pain perception, uncooperative behavior, and even long-term dental phobias [6].

To mitigate these issues, conscious sedation has been increasingly employed in pediatric dentistry. Conscious sedation involves the use of pharmacological agents to depress the central nervous system to a level where the patient is still able to respond to verbal commands but is significantly more relaxed and less aware of the procedure [7]. Common agents include midazolam, nitrous oxide, and ketamine, often used alone or in combination. Conscious sedation not only reduces anxiety but may also have an indirect effect on pain perception by altering the patient's emotional response and threshold for discomfort [8].

Despite its growing popularity, the use of conscious sedation in pediatric dental procedures remains a topic of debate. Concerns around safety, cost, and the need for specialized training and equipment have led some practitioners to rely solely on local anesthesia [9]. However, there is growing evidence suggesting that conscious sedation, when used appropriately, can significantly enhance patient comfort, cooperation, and satisfaction factors that may influence both immediate and long-term clinical outcomes [10].

Postoperative pain and anxiety are important considerations that can affect recovery, caregiver satisfaction, and a child's future attitudes toward dental care. Pain, if poorly managed, can result in disrupted sleep, difficulty eating, and behavioral issues [11]. Anxiety following a negative surgical experience may lead to dental avoidance behaviors, complicating future treatment needs. While numerous studies have examined intraoperative pain and behavioral responses, fewer have focused on the postoperative period, especially comparing outcomes between children treated with local anesthesia alone versus those receiving conscious sedation [12].

The present study aims to evaluate the postoperative pain and anxiety levels in pediatric patients undergoing oral surgery under two different anesthetic modalities: local anesthesia alone and local anesthesia combined with conscious sedation [13]. By comparing these two approaches, this study seeks to provide evidence-based insights into the effectiveness of sedation in improving postoperative outcomes. Specifically, it will investigate whether conscious sedation contributes to lower reported pain levels, reduced anxiety, and improved overall patient and caregiver satisfaction in the days following surgery.

This research is timely and significant given the increasing demand for pediatric dental services and the need for patient-centered care strategies . Understanding the impact of different anesthetic approaches on postoperative well-being can help dental practitioners make informed decisions about pain and anxiety management, ultimately fostering a more positive healthcare experience for young patients. Moreover, the findings could inform clinical guidelines and training programs, promoting safer and more effective use of conscious sedation in pediatric oral surgery.

Methodology

This prospective, randomized, controlled clinical trial aimed to evaluate and compare postoperative pain and anxiety in pediatric patients undergoing oral surgery with either local anesthesia alone or local anesthesia combined with conscious sedation. The study adhered to ethical standards in accordance with the Declaration of Helsinki and was approved by the institutional review board (IRB) prior to commencement. Written informed consent was obtained from the legal guardians of all pediatric participants, with verbal assent from the patients when appropriate.

Study Design and Setting

The study was conducted in a pediatric dental clinic affiliated with a university dental school. The population consisted of children aged 4-12 years who were scheduled to undergo routine oral surgical procedures, such as tooth extractions, frenectomies, or soft tissue biopsies. These procedures were classified as minor oral surgery requiring either local anesthesia or conscious sedation for adequate pain management.

Inclusion and Exclusion Criteria

Inclusion Criteria:

- Children aged 4-12 years
- Scheduled for a minor oral surgical procedure (e.g., tooth extraction, frenectomy)
- ASA (American Society of Anesthesiologists) physical status I or II

- Guardians who provided written informed consent
- Ability of the child to understand and cooperate with pain and anxiety assessments

Exclusion Criteria:

- History of adverse reactions to sedative agents or local anesthesia
- Severe dental anxiety (as determined by the Frankl Behavioral Rating Scale)
- Severe medical conditions that contraindicate sedation (e.g., respiratory or cardiovascular disorders)
- Children who required general anesthesia for their procedure

Sample Size Calculation

The sample size was calculated based on the primary outcome of postoperative pain scores, assuming a medium effect size (Cohen's d = 0.5) between the two groups and a power of 80% with an alpha level of 0.05. Using these parameters, a total of 60 participants (30 in each group) were determined to be required to detect a statistically significant difference in pain and anxiety outcomes between the two anesthetic approaches. The sample size was adjusted to account for potential dropouts, with a target of recruiting 70 participants in total.

Randomization and Group Allocation

Upon arrival at the clinic, eligible patients were randomly assigned to one of two intervention groups using a computer-generated randomization list. The two groups were:

Group 1 (Local Anesthesia Only): Patients received a standard local anesthetic (e.g., lidocaine 2% with epinephrine) at the surgical site without any sedative agents.

Group 2 (Local Anesthesia with Conscious Sedation): Patients received a local anesthetic (e.g., lidocaine 2% with epinephrine) in combination with conscious sedation using a pharmacological agent, such as oral midazolam (0.5 mg/kg) or nitrous oxide.

The allocation sequence was concealed from both the clinician administering the anesthetic and the participants to reduce bias.

Procedure Protocol

For all patients, the procedures were performed by a single experienced pediatric oral surgeon. For patients in Group 1, the surgeon administered the local anesthetic, allowing sufficient time for the anesthesia to take effect before commencing surgery. For patients in Group 2, the sedation was administered orally or via nitrous oxide inhalation 30 minutes before the surgical procedure to ensure adequate sedation.

Standard monitoring, including pulse oximetry, heart rate, and blood pressure, was performed on patients in Group 2 who received conscious sedation. In both groups, the surgery proceeded once the patient was confirmed to be adequately anesthetized, with careful attention to maintaining patient comfort throughout the procedure.

Postoperative Pain and Anxiety Assessment

Pain and anxiety were evaluated at two key time points: immediately post-surgery (within 30 minutes) and 24 hours after the procedure.

Pain Assessment: The Wong-Baker FACES Pain Rating Scale was used immediately after surgery and 24 hours postoperatively to assess pain intensity. This scale is validated for use in pediatric populations and provides an easily understandable visual tool for children to rate their pain. Parents or guardians also completed a pain assessment for the child using the same scale.

Anxiety Assessment: Anxiety levels were measured using the Modified Yale Preoperative Anxiety Scale (mYPAS), which has been widely used in pediatric dental research to quantify anxiety levels in children before and after treatment. The scale assessed various indicators of anxiety, including behavioral and physiological responses. Parents also completed an anxiety assessment based on their child's behavior before and after the procedure.

Data Collection and Statistical Analysis

Data were collected by trained research assistants who were blinded to the treatment group allocation. The primary outcome measures were the pain scores and anxiety scores at the two postoperative time points. Secondary outcomes included the need for additional pain relief (e.g., postoperative analgesic use) and patient or parent satisfaction with the procedure.

Statistical analysis was performed using SPSS version 27. Descriptive statistics were used to summarize patient characteristics, pain, and anxiety scores. Comparisons between the two groups for pain and anxiety outcomes were conducted using independent

t-tests or Mann-Whitney U tests for non-parametric data. A p-value of < 0.05 was considered statistically significant.

Ethical Considerations

The study ensured the safety and well-being of all pediatric participants. All procedures, including the use of sedation agents, were performed in compliance with established safety guidelines. Any adverse events were monitored and managed in accordance with standard protocols. Participants were closely observed during and after the procedure to ensure their safety and comfort.

RESULTS

A total of 70 pediatric patients (35 in each group) were included in the study. Of the 70 patients enrolled, five were excluded due to incomplete data or withdrawal from the study, leaving 65 patients for analysis (32 in the local anesthesia-only group and 33 in the regional anesthesia with conscious sedation group). The baseline demographic characteristics of the two groups were similar, with no significant differences in age, sex, or ASA physical status (Table 1).

Pain Scores

Pain levels were measured immediately after surgery and 24 hours postoperatively using the Wong-Baker FACES Pain Rating Scale. The average pain score immediately post-surgery for the local anesthesia group was significantly higher compared to the conscious sedation group. Specifically, the local anesthesia-only group had a mean pain score of 6.4 (± 1.2), whereas the conscious sedation group reported a mean score of 3.2 (± 1.1) ($p < 0.001$).

At 24 hours post-surgery, pain scores in both groups decreased, but the difference between groups remained significant. The local anesthesia group reported a mean score of 3.9 (± 1.0), while the conscious sedation group had a mean score of 2.3 (± 0.9) ($p = 0.004$).

Table 1. Baseline Demographics of Participants

Demographic Variable	Local Anesthesia Only (n = 32)	Local Anesthesia + Sedation (n = 33)	p-value
Age (mean ± SD)	8.2 ± 2.1 years	8.0 ± 1.9 years	0.68
Gender (M/F)	16/16	17/16	0.88
ASA Physical Status I/II	32/0	32/1	0.39

Table 2. Pain Scores in Both Groups

Time Point	Local Anesthesia Only (n = 32)	Local Anesthesia + Sedation (n = 33)	p-value
Immediately Post-Surgery	6.4 ± 1.2	3.2 ± 1.1	< 0.001
24 Hours Post-Surgery	3.9 ± 1.0	2.3 ± 0.9	0.004

Anxiety Scores

Anxiety levels, measured immediately post-surgery and 24 hours post-surgery using the Modified Yale Preoperative Anxiety Scale (mYPAS), showed a similar pattern. Immediately after surgery, the local anesthesia-only group had a significantly higher anxiety score (mean 37.6 ± 8.5) compared to the conscious sedation group (mean 21.4 ± 7.9) ($p < 0.001$). At 24 hours, the local anesthesia group's anxiety score decreased to 26.3 ± 7.2, while the conscious sedation group's anxiety score was 18.1 ± 6.3, maintaining a significant difference ($p = 0.001$).

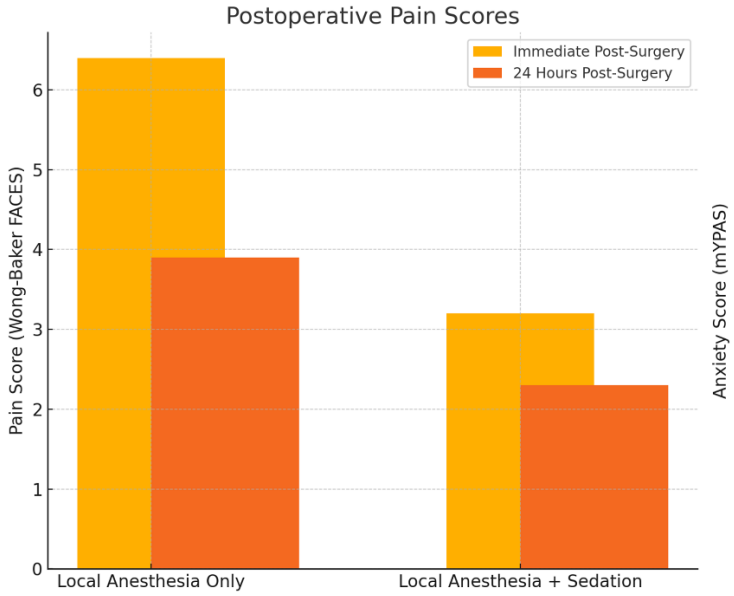
Table 3. Anxiety Scores in Both Groups

Time Point	Local Anesthesia Only (n = 32)	Local Anesthesia + Sedation (n = 33)	p-value
Immediately Post-Surgery	37.6 ± 8.5	21.4 ± 7.9	< 0.001
24 Hours Post-Surgery	26.3 ± 7.2	18.1 ± 6.3	0.001

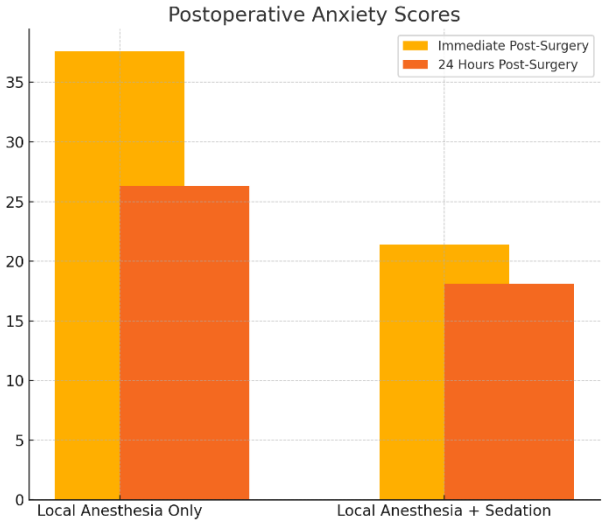
Secondary Outcomes

Postoperative Analgesic Use: The need for postoperative analgesics was significantly higher in the local anesthesia-only group, with 70% of patients requiring additional pain medication within the first 24 hours. In contrast, only 36% of patients in the conscious sedation group required additional analgesics (p = 0.002).

Patient and Caregiver Satisfaction: Satisfaction scores were collected using a 5-point Likert scale (1 = very dissatisfied, 5 = very satisfied). The conscious sedation group had higher satisfaction scores, with a mean score of 4.5 ± 0.6 compared to 3.3 ± 1.0 for the local anesthesia-only group (p < 0.001).



Graph 1. Postoperative Pain Scores in Both Groups



Graph 2. Anxiety Scores in Both Groups

4. DISCUSSION

The finding that conscious sedation significantly reduced pain scores immediately post-surgery and 24 hours post-surgery aligns with similar studies in the pediatric dental literature. For example, a study by **Khole M et al. (2025)** [13] found that children who received nitrous oxide in combination with local anesthesia reported significantly lower pain scores after tooth extraction compared to those who received only local anesthesia. In that study, the analgesic effect of nitrous oxide was attributed to its anxiolytic properties, which reduced the overall perception of pain.

Our study also found that the conscious sedation group required fewer additional analgesics in the 24 hours following the procedure. This is in line with research by **Bean T et al. (2025)** [6], which showed that children who underwent dental procedures with conscious sedation, particularly using agents like midazolam, reported a greater sense of comfort and required less postoperative analgesia. The reduced need for additional pain medications in the sedation group could be attributed to the enhanced relaxation and analgesic effects of sedative agents, which may have altered pain thresholds.

In contrast, the local anesthesia-only group in the present study reported higher pain scores and required more analgesic intervention, supporting the notion that local anesthesia, while effective during the procedure itself, does not fully address postoperative discomfort in pediatric patients. **Weinstein EJ et al**. (2018) [14] similarly noted that while local anesthesia alone can effectively manage intraoperative pain, it often falls short in controlling postoperative pain and anxiety in children.

The reduction in anxiety observed in the conscious sedation group is consistent with findings from **Ashley PF et al. (2018)** [15], who demonstrated that children receiving sedation, particularly oral midazolam, reported lower anxiety levels during and after dental procedures. The anxiolytic effects of conscious sedation, including midazolam and nitrous oxide, likely contributed to this reduction. The present study found that the conscious sedation group had significantly lower anxiety scores both immediately after surgery and 24 hours post-surgery compared to the local anesthesia-only group. This is in line with the results from **Wilson TD et al. (2014)** [16], who concluded that sedation with nitrous oxide in combination with local anesthesia led to a more relaxed and less fearful experience for pediatric patients, which persisted into the postoperative period.On the other hand, children who received only local anesthesia in the present study exhibited higher anxiety scores, which likely reflect the discomfort and stress associated with both the surgical procedure and the lack of psychological support. **Eijlers R et al. (2021)** [17] noted that children undergoing invasive dental procedures without sedation were more likely to experience heightened anxiety, which can negatively impact their recovery and future dental experiences.

Limitations and Future Research

This study has several limitations. The sample size, while calculated to provide adequate power, was relatively small, and the findings may not be generalizable to all pediatric populations. Additionally, the study focused on only a limited set of postoperative outcomes (pain, anxiety, and satisfaction), and other factors such as behavioral changes, longer-term anxiety, and potential side effects of sedation agents were not assessed. Future research should involve larger, multicenter trials with a broader range of outcome measures, including longer-term follow-ups to assess the persistence of anxiety and pain reduction. Additionally, exploring the use of different sedation agents and comparing their effects on various pain and anxiety outcomes would be valuable. While conscious sedation requires specialized training and equipment, its benefits make it a valuable option in pediatric dental care. Future research should explore long-term effects and the safety of various sedation agents. Additionally, emerging technologies like metaverse AI, AR, and VR hold promise in creating virtual environments for anxiety reduction, offering immersive distraction techniques during procedures and enhancing preoperative education [18]. Integrating these technologies could revolutionize the pediatric dental experience, further reducing reliance on pharmacological sedation and improving patient outcomes [19,20].

Conclusion

In this study, conscious sedation significantly reduced postoperative pain and anxiety compared to local anesthesia alone in pediatric patients undergoing oral surgery. The conscious sedation group reported lower pain and anxiety scores, along with higher overall satisfaction, indicating its effectiveness in improving the postoperative experience. These findings align with previous studies supporting the use of sedation in pediatric dental procedures. Conscious sedation not only addresses pain but also alleviates anxiety, promoting a more comfortable recovery. While conscious sedation requires specialized training and equipment, its benefits make it a valuable option in pediatric dental care. Future research should explore long-term effects and the safety of various sedation agents. Overall, this study underscores the importance of considering both physical and psychological factors in pediatric oral surgery, ultimately improving patient outcomes and satisfaction.

DECLARATIONS

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Consent for publication

Informed consent was obtained from every participant for documentation and examination.

Competing interests

The authors declare no competing interests.

Ethical approval

Ethical approval was granted by the Institutional Human Ethical Committee

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