

Effect of Preemptive Analgesia on Pain Perception in Children: A Randomized Controlled Trial

Mira Virda¹, Anup Panda², Kanu Kataria³

ABSTRACT

Background: Efforts have been made to minimize pain, prevent the development of needle fear, and promote positive experiences for children. The present study is designed to evaluate the effect of premedication with Ibugesic Plus before the administration of local anesthesia and extraction in children.

Aim: The aim of the study is to assess the efficacy of preemptive analgesia on pain perception during local anesthesia administration and extraction in pediatric patients.

Materials and methods: A total of 104 patients aged 7–10 years were selected who needed primary molar extraction. Group I—Ibugesic Plus syrup was given 30 minutes prior to extraction. Group II—Placebo solution (B-Folcin syrup) was given 30 minutes prior to extraction. Pain level, pulse rate, and SpO₂ were assessed using the Wong–Baker Faces Pain Rating Scale (WBFS) and pulse oximeter after injection, after extraction, and postoperatively.

Results: The highest scores of pain were recorded after the time of injection and extraction. The patients who received preemptive analgesics (group I) reported significantly less pain than the placebo group (group II) at the time immediately after injection, after extraction, and 2 hours after extraction.

Conclusion: The present study showed that preemptive analgesic administration may be considered a routine and rational pain management strategy in primary tooth extraction procedures in children.

Clinical significance: Preemptive analgesia can be given to patients prior to dental procedures to reduce postoperative pain.

Keywords: Ibuprofen, Preemptive analgesia, Postoperative pain.

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INTRODUCTION

Creating a serene environment with minimal pain before and after dental procedures is especially crucial when treating children. In addition to ensuring comfort, such a setting can foster a positive attitude toward dental visits, thereby facilitating future treatments. Conversely, experiencing postoperative pain may cause children to hesitate in returning to the dentist for subsequent appointments.¹

One notable approach to enhancing postoperative pain management is preemptive analgesia. This method involves administering pain-relieving medication prior to tissue injury, effectively before the initiation, transmission, modulation, and perception of the noxious stimulus. The goal is to prevent hyperalgesia and the subsequent amplification of pain.²

Studies examining the advantages of preemptive analgesia in adult dental care have yielded inconsistent findings, as indicated by conflicting results in previous investigations.^{3,4} In the realm of pediatric dental care, there is a significant scarcity of literature on the potential benefits of preemptive analgesia. Moreover, the existing research in this area has been evaluated as having limited quality or significance.

Earlier research has demonstrated the beneficial effects of analgesic administration following tooth extraction in children.⁵ Existing dental literature acknowledges that the use of analgesics prior to surgery can potentially reduce postextraction pain scores in adults.^{6–8} However, when it comes to pediatric populations, the literature presents conflicting reports regarding the effectiveness of preoperative analgesics in providing pain relief following tooth extraction.^{9,10}

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The present research compared the level of pain after surgery, evaluated based on the requirement for pain-relieving medications, among children who underwent tooth extraction. This procedure included the oral administration of a combination of ibuprofen and paracetamol syrup or a placebo. Our hypothesis was that children who received preoperative oral paracetamol or ibuprofen would have a lower likelihood of needing pain medication after the surgery compared to those who received a placebo.

MATERIALS AND METHODS

Study Design

Clinical trial reference number Trial/Ref/2023/11/075526. The study was approved by the ethical committee. All parents of the involved children gave their informed consent.

The study follows the Consolidated Standards of Reporting Trials (CONSORT) guidelines for randomized controlled trials (Flowchart 1).¹¹

Inclusion Criteria

- Positive or definitely positive children, according to Frankel’s behavior rating scale, and healthy children (ASA-1), according to the American Society of Anesthesiologists classification, are involved in the study.
- The children, who are not allergic to analgesics or local anesthetic drugs.
- The children’s ages range from 7 to 10 years, and their weights range from 22 to 30 kg (American Academy of Pediatric Dentistry, 2020).
- The primary molars with abscesses or infections exceeding one-third of the interradicular region that cannot be restored and are indicated for extraction are included in the study.

Exclusion Criteria

- Uncooperative children.
- The children with hypersensitivity or allergic reactions to analgesics, or with a history of prolonged bleeding.
- Molars that are not mobile, have more than one-third of the root length remaining, and can be saved with restoration or pulp therapy.
- Those children, whose parents have not given concern.

A total of 104 patients aged 7–10 years were selected who needed primary molar extraction.

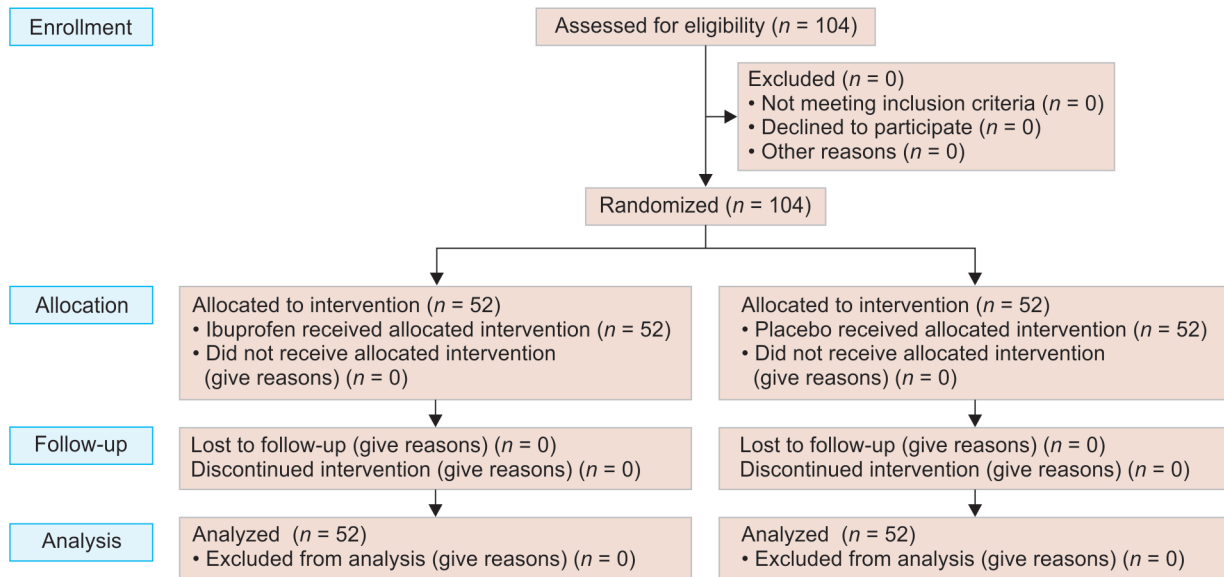
- Group I: Ibugesic syrup (strawberry flavor), in which each 5 mL of syrup contains ibuprofen (100 mg) and paracetamol (162.5 mg), was given 30 minutes prior to the administration of local anesthesia.
- Group II: B-Folcin syrup, which contains folic acid (1.5 mg) and vitamin B12 (12–15 µg), was given 30 minutes prior to the administration of local anesthesia.

The dosages of the drugs were decided according to the age and weight of the child, as recommended by the American Academy of Pediatric Dentistry.

Children were asked to select the faces according to the Wong–Baker Faces Pain Rating Scale (WBFS) that most accurately represented the pain they were feeling in order to evaluate subjective pain scores (Fig. 1). The researcher had properly described this scale to the children and their parents. The faces were scored at various time points. Based on this method, children were presented with six different faces representing various emotions (ranging from 0, which represented a happy face, to 10, indicating a distressed face), and they were asked to select the face that best reflected their own feelings. Pain scores were documented at specific time intervals: after local anesthesia administration, after tooth extraction, and 2 hours after the dental procedure.

Parents were given both written and verbal instructions regarding posttreatment care. They were advised to document

Flowchart 1: Consolidated Standards of Reporting Trials flowchart



Wong–Baker faces® pain rating scale

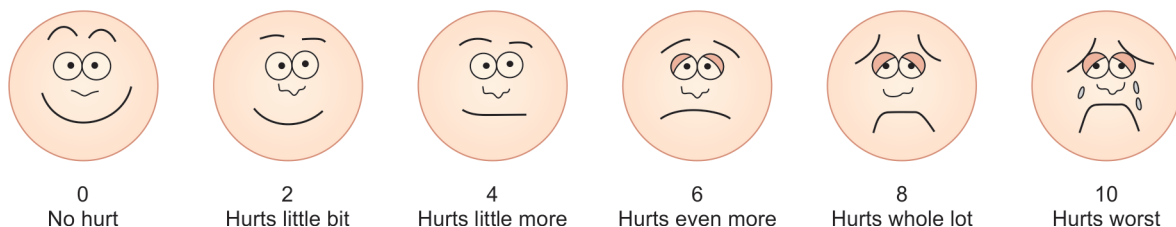


Fig. 1: Wong–Baker pain scale



their children's self-reported pain intensity at 4 and 24 hours after the procedure and to administer pain medication if necessary. To obtain this information, parents were contacted via telephone and asked to provide the children's self-reported pain scores using the WBFS. The pulse rate and oxygen saturation level were assessed after administering local anesthesia, after extraction, and 2 hours postoperatively using a pulse oximeter.

RESULTS

The collected data were subjected to statistical analysis using Statistical Package for the Social Sciences (SPSS) 15.0 software (SPSS Inc., Chicago, Illinois, United States of America), a statistical package commonly used in social sciences. The *t*-test was employed to examine the relationships between children's behavior and age with different factors, including pain behavior and the WBFS score. Additionally, the Pearson Chi-squared test was utilized to evaluate the associations between the administered treatments and parameters such as extraction history, anesthesia type, and the requirement for additional pain relief medication.

The study comprised 104 children—52 in group I and 52 in group II. There were no significant differences between the groups; however, the placebo group demonstrated higher pain scores after extraction. In addition, the overall "pain issue" expressed by the children even prior to treatment was high. A comparison of median ranks showed that differences in pain score reduction between the two groups were significant at the time points immediately after

injection, immediately after extraction, and 2 hours after extraction (Table 1). The patients who received preemptive analgesics (group I) reported significantly less pain than the placebo group (group II) immediately after injection, after extraction, and 2 hours postoperatively (Fig. 2).

Statistically, no significant difference was observed in pulse rate among all groups after local anesthesia, after extraction, and 2 hours postoperatively (Table 2).

Statistically, no significant difference was observed in oxygen saturation among all groups after local anesthesia, after extraction, and 2 hours postoperatively (Table 3).

DISCUSSION

In this research, preemptive pain-relieving medications were examined to determine their effectiveness in reducing pain from injections to after primary molar extraction in children

Table 1: Median pain score in two different groups at various time periods

	Group I	Group II	<i>p</i> -value
After injection	4 (0–10)	6 (0–10)	0.001*
After extraction	6 (0–10)	8 (0–10)	0.0001*
After 2 hours	2 (0–2)	4 (0–8)	1

Level of significance *p* ≤ 0.05; *, significant; **, nonsignificant

Table 2: Pulse rates in groups I and II at different time period

Groups	Time periods	Number	Pulse rate		<i>p</i> -value
			Mean	SD	
Group I	After injection	52	85.79	8.23	0.342**
	After extraction	52	89.93	8.91	
	2 hours postoperatively	52	91.96	8.14	
Group II	After injection	52	98.11	8.91	<0.001*
	After extraction	52	81.61	6.87	
	2 hours postoperatively	52	82.96	6.66	

Level of significance *p* ≤ 0.05; *, significant; **, nonsignificant

Table 3: Oxygen saturation in groups I and II at different time period

Groups	Time periods	Number	Oxygen saturation		<i>p</i> -value
			Mean	SD	
Group I	After injection	52	98.14	1.11	0.511*
	After extraction	52	97.75	0.96	
	2 hours postoperatively	52	97.89	1.03	
Group II	After injection	52	96.71	1.11	<0.001*
	After extraction	52	98.75	0.75	
	2 hours postoperatively	52	98.54	0.69	

Level of significance *p* ≤ 0.05; *, significant; **, nonsignificant

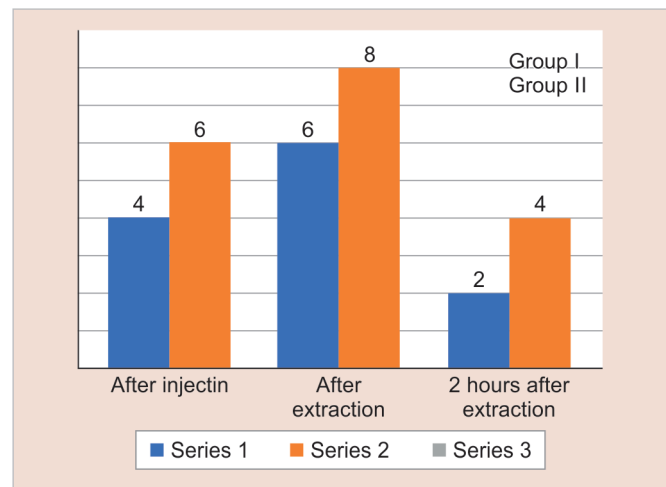


Fig. 2: Faces scores at the various time points

during the initial 2-hour period. To evaluate pain subjectively, the study employed the WBFS, which is easily usable and preferred by children, parents, and clinicians over other self-assessment scales. The study focused on children aged 7–10 years because this age-group possesses adequate verbal and cognitive abilities for accurate pain assessment using the chosen scale. The study adhered to recommended dosing guidelines for ibuprofen and paracetamol to ensure uniformity. Topical anesthesia was excluded from the study as it has limited effectiveness in deeper tissue. Previous research indicated that topical anesthesia and placebo have similar impacts on pain perception during local anesthesia injections. The pulse oximeter is a major technological advance in monitoring pulse rate and SpO₂ during dental procedures.

Pulse rate and oxygen saturation levels can vary in anxious patients or under painful conditions. Any major fluctuations in these variables may alert us to prevent potential medical emergencies during routine dental procedures.¹²

The results indicated that ibuprofen with paracetamol effectively reduced pain from injections compared to the placebo. This might be attributed to ibuprofen's potency in pain management for children, offering advantages over paracetamol. Ibuprofen works by decreasing peripheral pain sensation through inhibiting prostaglandin E2 (PGE2) synthesis, while paracetamol functions centrally without affecting peripheral prostaglandin production. Ibuprofen with paracetamol also offers faster relief compared to the placebo group. Notably, prior studies did not focus on preemptive analgesics' impact on injection pain.

Pain results from inflammation caused by tissue damage, with tooth extraction being a prime source of pediatric dental pain and inflammation.¹³ Pretreatment with ibuprofen and paracetamol led to a significant reduction in pain scores, with ibuprofen demonstrating superior efficacy.¹⁴ Ibuprofen produced lower pain scores compared to the placebo group, especially immediately and 2 hours after extraction, due to its potent analgesic and anti-inflammatory properties. Ibuprofen inhibits pain signal initiation by blocking cyclooxygenase, thereby preventing prostaglandin synthesis following tissue injury. In contrast, paracetamol's anti-inflammatory effects are less pronounced.¹⁵ Analgesics inhibiting peripheral prostaglandin synthesis are more effective in suppressing pain during extraction and post-extraction.⁸ Prior studies also showed preemptive analgesia's effectiveness in reducing pain scores.¹⁶

Results aligned with previous findings, except for one study, potentially due to inadequate blood levels before tissue trauma initiation. Pain levels were statistically comparable among groups at 2 hours postextraction, likely because the effects of local anesthesia persisted in most patients.⁸

Gender and the number of teeth extracted did not influence pain scores, consistent with other research. Ibuprofen's pretreatment demonstrated its effectiveness in postoperative pain reduction and in reducing injection pain, potentially elevating pain thresholds for subsequent dental procedures like extraction.¹⁷ The study's narrow age range, standardized dosing, inclusion of maxillary and mandibular extractions, and use of internet-based hourly pain assessments enhance its validity.¹⁸

Overall, this study underscores the efficacy of ibuprofen with paracetamol in reducing pain from injections to tooth extraction in children, offering a straightforward, cost-effective, and safe strategy for pain management in pediatric dental procedures.

CONCLUSION

The findings from this investigation lead to the following conclusions:

- Preemptive administration of analgesics could be a regular and logical approach for managing pain during primary tooth extraction in children.
- The combination of ibuprofen and paracetamol proves to be more effective in alleviating pain in children following local anesthesia-induced tooth extractions.
- Prior treatment with ibuprofen lessens the severity of injection-induced pain.
- Local anesthesia administration causes only minor changes in vital parameters.

Clinical Significance

Preemptive analgesia can be used prior to a dental procedure to reduce postoperative pain.

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