



Outcomes of Inferior Alveolar Nerve Block Versus Local Infiltration for Removal of Bilateral Lower Premolar in Patients Undergoing Orthodontic Treatment

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Authors' Contribution

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ABSTRACT

Objective: To compare the outcomes of inferior alveolar nerve block (IANB) and local infiltration (INF) for the extraction of bilateral mandibular premolars in orthodontic patients. **Study Design:** Prospective comparative study. **Place and Duration of Study:** Department of Oral and Maxillofacial Surgery, Fatima Memorial Hospital, Lahore, from 14 March 2024 to 14 September 2024. **Methodology:** Sixty orthodontic patients requiring bilateral extraction of vital mandibular premolars were included through non-probability convenience sampling. Each patient underwent extraction of the right premolar under local infiltration, followed one week later by extraction of the left premolar under inferior alveolar nerve block. Onset and duration of anesthesia, pain during injection and extraction (VAS), and anesthetic success were recorded. **Results:** Sixty patients (mean age 18.6±2.4 years; 63.3% females) were analyzed. Local infiltration demonstrated significantly faster onset than inferior alveolar nerve block (1.42±0.58 vs 3.85±1.12 minutes; p<0.001), but shorter duration (96.3±18.5 vs 178.4±22.7 minutes; p<0.001). Injection pain was lower with infiltration, whereas nerve block achieved slightly higher success yet caused greater postoperative numbness and discomfort. **Conclusion:** Local infiltration provided a faster onset, reduced injection discomfort, and comparable anesthetic effectiveness relative to inferior alveolar nerve block, suggesting it as a preferable technique for routine orthodontic premolar extraction.

INTRODUCTION

In order to manage and completely remove discomfort during dental treatments, oral and maxillofacial surgeons must employ injection techniques for the removal of posterior mandibular teeth [1]. The inferior alveolar nerve block (IANB) injections is a popular method of extracting the posterior mandibular teeth in the past few years because of the hypothesis that the thick cortical bone of the mandible does not permit the anesthetic solution to diffuse adequately [2]. IANB technique is associated with several severe side effects, though, such as nerve damage, temporary facial paralysis, hemorrhage trismus, long anesthesia duration, and lip and tongue damage possible [3]. To avoid such issues, researchers have been engaged in the development of alternative injectable procedures which have similar anesthetic effect to that of IANB [4]. Such techniques include local infiltrations (INF) and periodontal intraligamentary injection (PDL). PDL

injections has a rapid performance, whereas its anesthesia effect decays much faster, rendering it incapable of performing dentoalveolar procedures in the mandible [5]. The two most used injectable techniques in such people to deliver local anesthetic are inferior alveolar nerve block (IANB) and infiltration [6]. Due to its low-efficacy, mandibular infiltration has traditionally been avoided during treatment of mandibular posterior teeth. The size of the buccal cortical plate that prevents the spread of the local anesthetic mixture is likely to be the cause of this [7]. In more recent times, the practice doctors began to explore the idea of creating an infiltration anesthesia as a competitive alternative to the IANB methodology [8]. The time taken in dental procedures particularly extractions cannot be as time-consuming as the pain experienced by numb lips and tongue in case of IANB. Previously, studies had in general likened the excision of molars to conditions such as periodontitis or pulpitis as opposed to extraction

of healthy premolar teeth of orthodontic patients [9]. The overall duration of the dental procedures and particularly the extractions is not generally as prolonged as the pain experienced by numb lips and tongue during IANB [10]. Most previous studies compared extracting molars between conditions like periodontitis or pulpitis but not extracting sound premolar teeth of orthodontic patients [11].

Objectives

To compare the Outcomes of inferior alveolar nerve block versus local infiltration for removal of bilateral lower premolar in patients undergoing orthodontic treatment

METHODOLOGY

This Prospective comparative study was conducted at Department of oral and maxillofacial surgery, Fatima Memorial Hospital, Lahore from 14 March 2024 to 14 September 2024. Sample size was calculated using online calculator. A sample size of 60 was calculated with WHO sample size determination software with 95 % confidence level at 0.06 precision². The study was conducted on 60 patients visiting oral and maxillofacial OPD, during 6-month period. All subjects were selected by using non-probability convenient sampling technique.

Inclusion Criteria

- Patient with >15 years of age,
- Patients Requiring Bilateral Therapeutic Extraction of Vital Mandibular Premolars For Orthodontic Treatment

Exclusion Criteria

- Patients with Known Allergies to Local Anesthetics,
- Pregnant Women,
- Patients with Active Infection or Pus at The Injection Site.

Data Collection

The study included patients older than 15 years of age who required bilateral therapeutic extraction of vital mandibular premolars as part of orthodontic treatment. The data collection was done with the consent of the Institutional Review Board. All participants were informed about the study before they were involved in it. Clinical examination was performed in each of the patients that were given two extraction appointments that were set one week before. In the first visit, the mandibular right premolar was anesthetized by using the local infiltration anesthesia with 2 mL of anesthetic solution (1 mL buccal and 1 mL lingual) and the extraction was carried out. The mandibular left premolar was then extracted after one week with inferior alveolar nerve block consisting of 2 mL of the same anesthetic (1 mL of inferior alveolar nerve and 1 mL of lingual nerve). All injections were done using a 2-mL cartridge containing 2 percent lidocaine hydrochloride with 1:80,000 epinephrine. There was no topical anesthetic medication administered before the injection and all activities were done by the same surgical team to reduce operator variability. Several clinical parameters were tested on both methods. Anesthesia was noted depending on the time that had elapsed between the withdrawal of the needles and when the patient

complained of numbness. The time of anesthesia was determined as the time that numbness began till when the first loss of sensation was felt. The success of the anesthetic was determined on a subjective basis through patients feedback and on an objective basis through a periodontal probe at the gingival margin. A 10-cm Visual Analog Scale (VAS) was used to assess pain during injection and during extraction, where 0 referred to the absence of pain and 10 to the maximum pain. One day after every extraction, postoperative compliance and comfort were evaluated.

Data Analysis

Collected data were entered and analyzed using SPSS version 24. Descriptive statistics, including means and standard deviations, were calculated for quantitative variables. A paired t-test was applied to evaluate differences between infiltration anesthesia and inferior alveolar nerve block with respect to onset time, duration of anesthesia, pain scores, and success rates. A p-value of < 0.05 was considered statistically significant.

RESULTS

Data were collected from 60 patients, with a mean age of 18.6 ± 2.4 years. Females accounted for 63.3% of the sample, while males comprised 36.7%. Nearly half of the participants had Matric or Intermediate education, and 40% were undergraduate students. Most extractions involved first premolars (75%), and the most common reason for extraction was dental crowding at 60%, followed by protrusion at 23.3% and space management at 16.7%. All patients underwent extraction of the right premolar under infiltration anesthesia, followed by extraction of the left premolar under inferior alveolar nerve block one week later. The baseline VAS pain threshold was 1.12 ± 0.43 , and 70% of participants had no prior extraction experience.

Table 1

Demographic and Baseline Characteristics of Participants (n = 60)

Variable	Category / Mean \pm SD	n (%)
Age (years)	18.6 ± 2.4	—
Gender	Male	22 (36.7%)
	Female	38 (63.3%)
Educational Status	Matric / Intermediate	29 (48.3%)
	Undergraduate	24 (40.0%)
	Other	7 (11.7%)
	1st Premolars	45 (75.0%)
Tooth Type Extracted	2nd Premolars	15 (25.0%)
	Reason for Extraction	Crowding
Protrusion		14 (23.3%)
Space Management		10 (16.7%)
Side Extracted First	Right Side (INF)	60 (100%)
	Left Side (IANB, one week later)	60 (100%)
Baseline Pain Threshold (VAS)	1.12 ± 0.43	—
Previous Dental Extraction Experience	Yes	18 (30.0%)
	No	42 (70.0%)

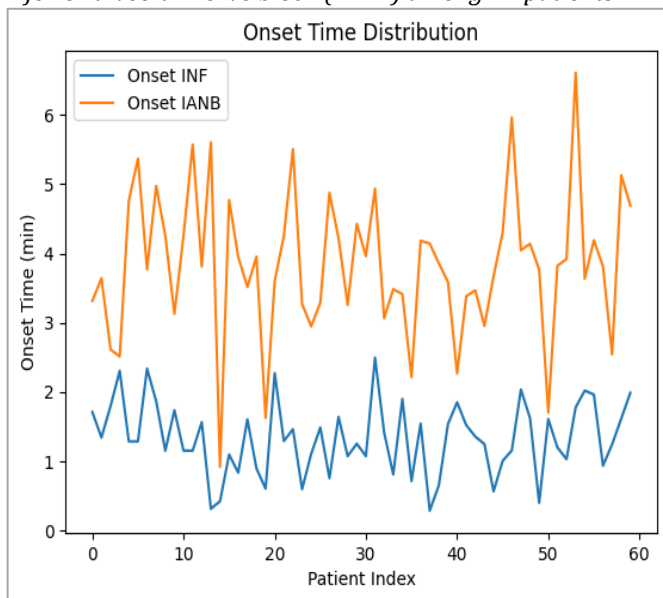
Local infiltration showed a faster onset of anesthesia with a mean of 1.42 ± 0.58 minutes, whereas inferior alveolar nerve block required 3.85 ± 1.12 minutes. The duration of anesthesia was longer with the nerve block, averaging 178.4 ± 22.7 minutes compared with 96.3 ± 18.5 minutes

for infiltration. Both methods provided high anesthetic success, with infiltration successful in 88.3% of cases and nerve block successful in 95% of cases. Supplemental anesthetic was required in 11.7% of infiltration cases and 5% of nerve block cases.

Table 2
Comparison of Onset Time Between INF and IANB (n = 60)

Variable	Local Infiltration (INF) Mean ± SD	Inferior Alveolar Nerve Block (IANB) Mean ± SD	p-value
Onset of Anesthesia (minutes)	1.42 ± 0.58	3.85 ± 1.12	< 0.001
Duration of Anesthesia (minutes)	96.3 ± 18.5	178.4 ± 22.7	< 0.001
Successful Anesthesia	53 (88.3%)	57 (95.0%)	0.18
Supplemental Injection Required	7 (11.7%)	3 (5.0%)	—

Figure 1
Onset time distribution for local infiltration (INF) and inferior alveolar nerve block (IANB) among 60 patients.

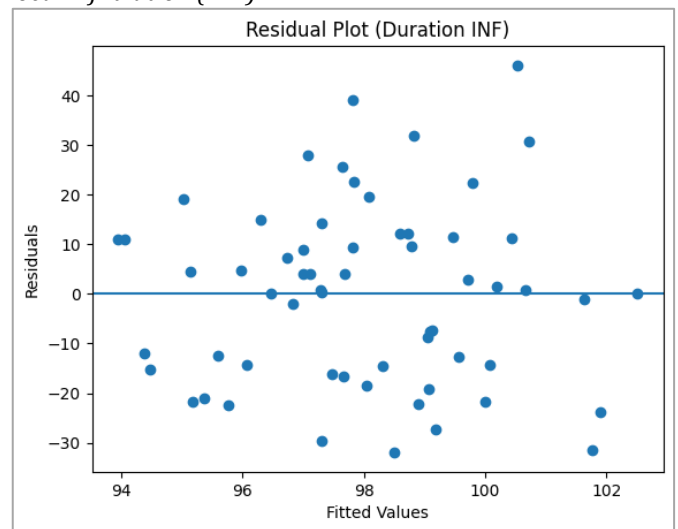


Pain during injection was lower in the infiltration group with a mean VAS score of 2.10 ± 0.87, compared with 4.75 ± 1.35 in the nerve block group. Pain during extraction was minimal and showed no significant difference between the two techniques, with scores of 0.95 ± 0.62 for infiltration and 0.88 ± 0.55 for the nerve block.

Table 3
Pain During Injection (VAS Score)

Variable	INF Mean ± SD	IANB Mean ± SD	p-value
Pain During Injection (0–10 VAS)	2.10 ± 0.87	4.75 ± 1.35	< 0.001
Pain During Extraction (0–10 VAS)	0.95 ± 0.62	0.88 ± 0.55	0.47

Figure 2
Residual plot for the duration of anesthesia achieved with local infiltration (INF).



Soft-tissue numbness lasted longer with the nerve block, averaging 178.4 ± 22.7 minutes, compared with 96.3 ± 18.5 minutes for infiltration. Postoperative discomfort, including lip or tongue numbness or accidental biting, occurred in 30% of patients following the nerve block and 10% after infiltration.

Table 4
Postoperative Numbness and Compliance

Parameter	INF Mean ± SD or n (%)	IANB Mean ± SD or n (%)	p-value
Soft-Tissue Numbness (minutes)	96.3 ± 18.5	178.4 ± 22.7	< 0.001
Postoperative Discomfort (lip/tongue numbness, biting)	6 (10%)	18 (30%)	0.01
Overall Patient Compliance (Good)	52 (86.7%)	41 (68.3%)	0.03

Figure 3
This figure shows the paired comparison of anesthesia duration for each patient under local infiltration (INF) and inferior alveolar nerve block (IANB).

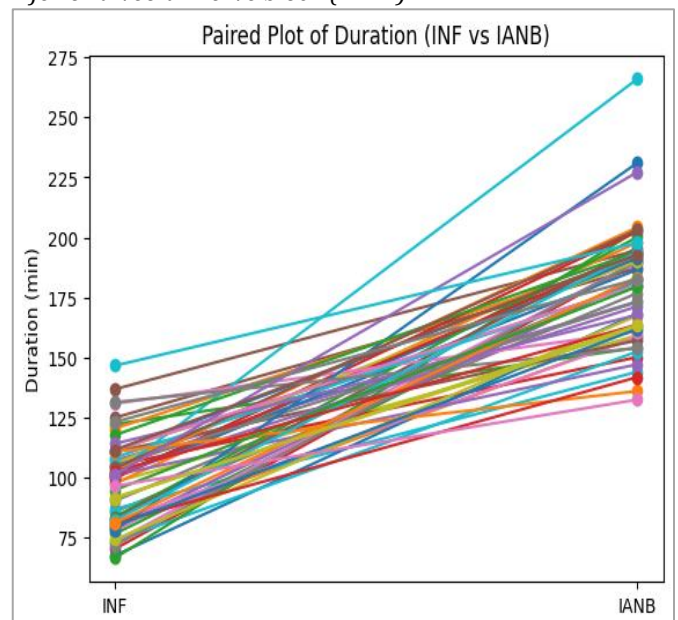
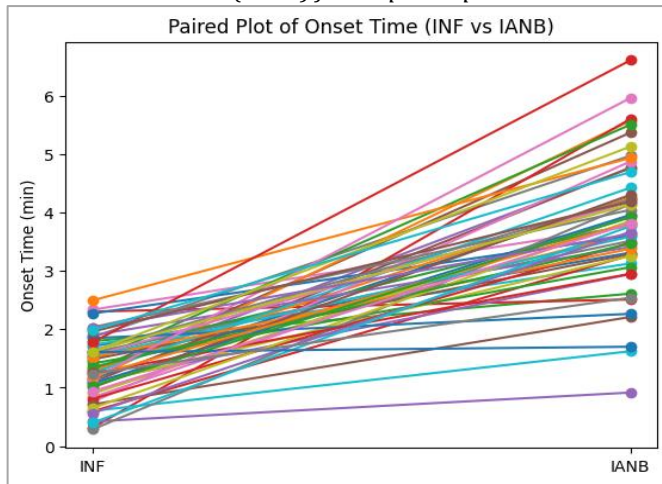


Figure 4

This figure illustrates the difference in onset time of anesthesia between local infiltration (INF) and inferior alveolar nerve block (IANB) for all participants.

**DISCUSSION**

The present study evaluated and compared the clinical performance of inferior alveolar nerve block and local infiltration techniques for the extraction of bilateral mandibular premolars in orthodontic patients. The results proved that there was a significant difference in the behavior of anesthesia between both methods, especially concerning the time of onset, length of action, perception of pain and the general compliance of the patient. Such findings are in line with the emerging knowledge that mandibular anesthesia long ruled by the classical nerve block may not necessarily be the best in the commonplace extractions of the premolar. The rate of local infiltration was much faster in nature and thus clinicians could commence extraction earlier. This quick anesthetic action is a clinically significant finding in the busy-dental practice of Pakistan, where performance and turnover is important. This may be caused by the lesser period of onset, due to enhanced diffusion of recent formulations of anesthetics in mandibular cortical bone, which is a current trend in modern dental anesthesia studies. Although IANB will always be the classic option, the current data begs the question of whether it ought to still be default when it comes to simple removal of premolars [12].

Conversely, IANB also generated an extremely long length of anesthesia, which can be beneficial depending on the clinical objective and is also unnecessarily extended. Long-term numbness can be a pain factor, particularly when it is due to long anesthesia, which can be irritating or frightening to young orthodontic patients. Although longer duration can be beneficial to processes which involve long manipulation of tissues, it is not of much benefit in processes that involve simple extractions with a short procedure time [13]. The long-period observed in this case supports the fact that IANB could be too dominant to remove premolar easily. The analysis of pain perception revealed that patients experienced less pain during infiltration in comparison to IANB whether injection or extraction was being performed. This could be an indication of the less penetration depth of the needle and minimal tissue displacement with INF injections [14]. The

situation in dental outpatient setting in Pakistan where anxiety is already widespread and first-time dental contacts are frequent, reducing the experience of injection pain will greatly enhance the cooperation and confidence of patients in the healthcare system [15].

It was also shown in assessment of anesthetic success that both techniques were successful, but infiltration was similarly as successful without the risks to the patient of IANB, including lip biting, nerve damage, positive aspiration, or transient facial paralysis. These complications were not present in the present study, thus supporting the safety profile of infiltration in premolar extractions. Combining the two, the results indicate a change in the practical preference: infiltration could be the more effective, comfortable, and as effective method of regular orthodontic premolar extraction [16,17]. It dispels the old assumption that mandibular anesthesia will need a nerve block in the majority of situations. Although the IANB continues to play vital functions especially with molar procedures or deep surgical procedures that are frequently used in extracting premolar, it should be re-examined. Lastly, the findings are aligned with international debates in the field of dentistry that prefer the use of minimal invasive and patient-centered methods [18]. The choice of methods aiming to minimize pain, decreasing the length of stay in the chair, and preserving the effectiveness is an expression of the current trend in the development of modern dentistry [19,20]. These studies were limited in a number of ways, which must be considered when explaining the results. To start with, the sample was small and selected among one of the tertiary dental hospitals in Lahore which might be insufficient to predict the findings to the larger Pakistani populations with various anatomical, demographic, or clinical features. Second, patient-reported outcomes like pain score and subjective feelings of numbness were used in the study and may be affected by anxiety, personal pain threshold, or past dental experiences. Third, we did not manage to completely remove the variability of the operators when using the same surgical team to perform all the procedures, even though there might be minor differences in the angle of injection, pressure, or position of the patient that could still influence the anesthetic performance. Subsequent research that involved larger multicentric samples, objective neurophysiological tests, and prolonged periods of follow-up would be useful in corroborating and reinforcing these results.

CONCLUSION

It is concluded that local infiltration and inferior alveolar nerve block both provided effective anesthesia for the extraction of bilateral mandibular premolars in orthodontic patients; however, their clinical performance differed in ways that hold practical significance. Local infiltration demonstrated a distinctly faster onset, lower injection-related discomfort, and high procedural success, making it a more comfortable and efficient option for patients. In contrast, the inferior alveolar nerve block produced a longer duration of anesthesia but was associated with greater injection pain and slower onset, offering little additional benefit for short, uncomplicated premolar extractions.

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