RESEARCH PAPER

Evaluation of Tramadol versus Lignocaine as a Local Anesthetic for Mental Nerve Block in Extraction of Firm Premolar Teeth - A Comparative Study

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ABSTRACT

Background

This study evaluated the efficacy of tramadol as a local anesthetic compared to lignocaine for mental nerve block during extraction of firm premolar teeth.

Aim

To compare the anesthetic efficacy of tramadol versus lignocaine for mental nerve block in extraction of firm premolar teeth.

Materials and Methods

A comparative study was conducted on patients requiring extraction of firm premolar teeth under mental nerve block. Patients were divided into two groups: Group A received tramadol, and Group B received lignocaine. Parameters such as onset of action, duration of anesthesia, pain scores, and adverse effects were evaluated.

Results

Tramadol demonstrated comparable onset of action with lignocaine but showed prolonged duration of anesthesia. Pain scores were similar in both groups. No significant adverse effects were observed in either group.

Conclusion

Tramadol can be considered an effective alternative to lignocaine for mental nerve block in extraction of firm premolar teeth, with the added advantage of prolonged duration of anesthesia.

Keywords: Tramadol, Lignocaine, Local Anesthetic, Mental Nerve Block, Premolar Extraction.

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Introduction

Local anesthesia is a standard and essential component in most of the dental and oral surgical procedures [1]. The most popular technique for reducing discomfort and pain during oral surgical procedure is intraoral local anesthetic agent injection [2]. Despite the fact that typical local anesthetics (amide and ester based) are thought to be safe, there are some contraindications. Due to the synthesis of para-amino benzoic acid metabolites, allergies to traditional local anesthetics are uncommon and have been linked more to ester based than amide based drugs, if a patient cannot receive a standard local anesthetic, there are other pharmacological options available like tramadol [1]. Tramadol appears to be safer, more effective, and tends to have fewer adverse effects than traditional local anesthetics [3]. Pang and colleagues in 1998, first described the anesthetic property of commercially available tramadol [4]. For the first time, yahiya and al-haidari employed it as an infiltrative anesthetic during tooth extraction. Because of its nerve conduction blocking potency, tramadol hcl may have local anesthesia-like activity. This is similar to the local anesthetic

agent lidocaine. Opioids' nerve conduction blocking effect has been shown to be completely reversible [5].

Materials and methods

Study design

This prospective, double-blinded, split-mouth clinical trial was conducted in the department of oral and maxillofacial surgery at bharati vidyapeeth dental college and hospital, sangli, over a period of two years (may 2023 – may 2025). Ethical clearance was obtained from the institutional review board, and all procedures adhered to the declaration of helsinki (1964), including its 2013 revision.

Inclusion criteria

- Healthy individuals (asa i) aged 18–45 years
- Indicated for bilateral, symmetrical premolar extractions
- No known drug allergies
- Willing to participate and follow postoperative instructions

Exclusion criteria

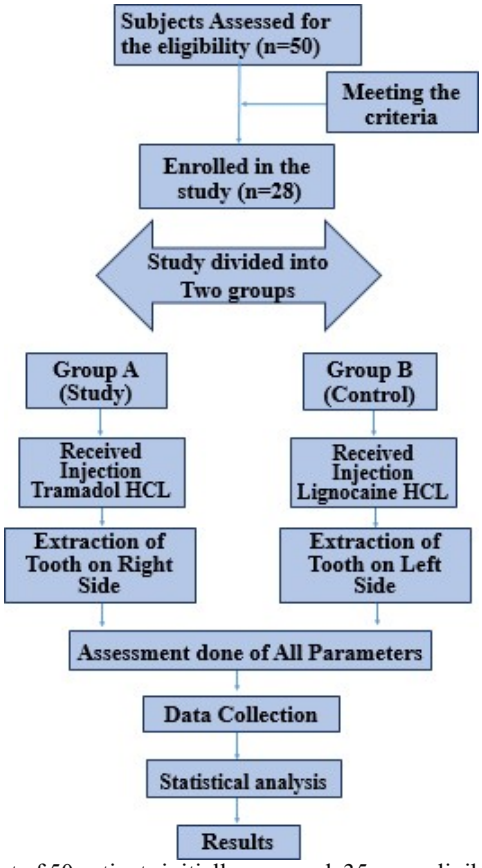
Patients were excluded if they had:

- Odontogenic infection or pathology
- Required open or dissimilar extractions
- History of systemic illness (gi, cns, bleeding disorders)
- Medical compromise (e.g. Chemotherapy, radiation, pregnancy, lactation)
- Smoking, alcohol use, or contraceptive intake
- Allergy to study drugs
- Inability to provide consent or comply with the study

Methodology

All procedures were performed by a single experienced surgeon to ensure consistency. Before surgery, patients rinsed with 0.2% chlorhexidine, and both intra- and extra-oral antisepsis was maintained.each patient underwent extractions in two separate appointments using a split-mouth design. One side received 0.6–0.9 ml of 2% lignocaine (control), while the contralateral side received the same volume of 5% tramadol via a mental nerve block. A standardized, closed extraction technique was used in all cases. Following extraction, sockets were irrigated with normal saline and 5% povidone-iodine, and sterile gauze was applied for hemostasis. Patients were instructed to avoid forceful spitting or gargling, apply intermittent ice packs, and consume a soft or liquid diet. They were asked to record 1) pain intensity using the visual analogue scale (vas), 2)time and side of first pain occurrence, 3)timing and total number of analgesics taken. A follow-up was scheduled after 72 hours. Data were compiled in microsoft excel and analysed using spss v26.0 (ibm, usa). Continuous variables were expressed as mean ± standard deviation; categorical data as frequencies and percentages. The shapiro–wilk test assessed normality. Intergroup comparisons (tramadol vs lignocaine) for various parameters were made using the mann–whitney u test. A p-value ≤ 0.05 was considered statistically significant.

Observation and results



Out of 50 patients initially screened, 35 were eligible for inclusion, while 15 were excluded due to factors such as associated pathology, asymmetrical tooth positioning, need for additional injections exceeding 2.4 ml of local anaesthetic, differences in surgical duration on both sides, intraoperative complications (e.g., crown or root fracture), or cases requiring open extraction. Seven patients were lost to follow-up as they did not return the next day, resulting in a final study sample of 28 subjects. These 28 patients, requiring bilateral symmetrical mandibular premolar extractions, were treated between february 2022 and march 2024. Of them, 11 (40.7%) were male and 16 (59.3%) female, with a male-to-female ratio of 11:16. The mean age was 21 ± 3.0 years for males and 21.15 ± 3.64 years for females. The key findings of this study were onset of action of tramadol showed a slightly longer onset compared to 2% lignocaine, with statistically significant differences on both subjective and objective assessments (mann-whitney test, p≤0.05). The duration of action of 2% lignocaine provided a significantly longer duration of anaesthesia than tramadol (mann-whitney test). Pain scores showed

that no significant difference in intraoperative pain was observed between the two groups. The effect of post-extraction analgesia were in tramadol group offered a substantially longer duration of postoperative pain relief (mean 415.44 minutes) while lignocaine group (mean 264.81 minutes), with highly significant differences (chi-square test, p≤0.05). The analgesic consumptions of most patients in the tramadol group required no or only one rescue tablet, whereas all patients in the lignocaine group required additional analgesics, usually two or three tablets (fisher's exact test, p≤0.05). The adverse events were observed in 3.7% of the tramadol group and 18.5% of the lignocaine group. The difference was not statistically significant.

Demographic details

Variable	Category	Estimate
Age	--	23.44 ± 4.65
Gender	**Male**	11 (40.7%)
	Female	16 (59.3%)

This table presents the demographic details. The mean of the subjects was 23.44 years. There were 11 males and 16 females.

Comparison of onset of action (in minutes)

Variable	Group	Mean	SD	Difference	p-value
Subjective	**Inj Tramadol 50**	2.30	0.16	0.12	0.002*
	Inj 2% Lignocaine	2.18	0.09		
Objective	**Inj Tramadol 50**	2.03	0.30	0.15	0.034*
	Inj 2% Lignocaine	1.88	0.32		

Mann-Whitney test; * indicates a significant difference at p≤0.05

Comparison of duration of action

Variable	Group	Mean	SD	Difference	p-value
Subjective#	**Inj Tramadol 50**	130.81	5.54	-25.63	<0.001*
	Inj 2% Lignocaine	156.44	6.58		
Objective¥	**Inj Tramadol 50**	141.11	7.51	-23.89	<0.001*
	Inj 2% Lignocaine	165.00	7.21		

#Independent t test; ¥Mann-Whitney test; * indicates a significant difference at p≤0.05

Comparison of pain during procedure

Group	Mean	SD	Difference	p-value
Inj Tramadol 50	1.59	0.57	-0.26	0.178
Inj 2% Lignocaine	1.85	0.91		

Mann-Whitney test ,This table presents a comparison of the pain for injected Tramadol 50 and injected 2% Lignocaine. There was a non-significant difference in the pain score between the two groups.

Comparison of post-extraction analgesia

Group	Mean	SD	Difference	p-value
Inj Tramadol 50	415.44	17.91	150.63	<0.001*
Inj 2% Lignocaine	264.81	11.58		

Mann-Whitney test; * indicates a significant difference at p≤0.05

Comparison of the numbers of analgesics taken

No of tablets	Inj Tramadol 50	Inj 2% Lignocaine	p-value
0	14 (51.9%)	0	<0.001*
1	13 (48.1%)	1 (3.7%)	
2	0	11 (40.7%)	
3	0	15 (55.6%)	

Chi-square test; * indicates a significant difference at p≤0.05

Discussion

Local anaesthesia (la) refers to the temporary loss of sensation in a specific area of the body without affecting consciousness. This effect is produced by either suppressing nerve excitation at the endings or blocking the conduction of impulses along peripheral nerves. Based on their chemical structure, local anaesthetic agents are commonly classified into three groups: esters, amides, and quinolones.
Lignocaine (lidocaine) is an amide-type local anaesthetic that acts through both receptor-mediated and receptor-independent mechanisms. Its primary mode of action is the reversible blockade of sodium

channels in nerve fibres, which prevents the propagation of action potentials and thereby interrupts pain transmission. Although widely used for its safety and effectiveness, lignocaine may cause side effects such as local irritation, allergic reactions, or systemic toxicity, particularly when administered in excessive doses or inadvertently injected intravascularly.[6]

Tramadol is a centrally acting analgesic drug with a low affinity for μ opioid receptors. [7] it acts centrally through a dual mechanism—by weakly stimulating mu-opioid receptors and by inhibiting the reuptake of serotonin and norepinephrine, thereby enhancing pain control. [7] the local anaesthetic effects of tramadol can be described as anaesthetic and opioid/analgesic.[8] tramadol provides pain relief through different mechanisms depending on its route of administration. Systemically, it acts on both opioid and non-opioid receptors in the central nervous system to alter pain perception. Locally, it blocks sodium channels in nerves, producing anaesthetic-like effects and offering targeted pain relief without the systemic side effects seen with oral use.[8] tramadol has a dual mode of action, functioning as both a systemic analgesic and a local anaesthetic. In adults, its average half-life is about 6 hours.

In this study, tramadol infiltration was prepared by diluting 50 mg of tramadol hydrochloride in 2 ml of distilled water. According to kakagia et al., the maximum safe dose for local infiltration is 2 mg/kg. The dosage used here was well below this recommended limit, ensuring patient safety. [9] we have worked in accordance with all of the earlier research.

This study used a split-mouth design, where each patient served as their own control, minimizing variability. Extractions of bilaterally symmetrical mandibular premolars were performed by the same surgeon under comparable conditions. This design allowed direct comparison of local anaesthetic agents in terms of efficacy, dosage, and postoperative analgesia.

He mean age of the 28 participants in this study was 23.44 ± 4.65 years (range 18–30 years). This is comparable to the findings of bilal et al., who reported a mean age of 22.68 ± 1.3 years in their study evaluating the local anaesthetic efficacy of tramadol and lidocaine in bilateral maxillary infiltration.[10]

The onset of anaesthesia is the point in time at which the local anaesthetic solution begins to block nerve transmission and produce a loss of sensation in the targeted area. [6] In this study, the subjective onset of mental nerve block anaesthesia was recorded as the time from injection to the patient's perception of numbness at the site. The objective onset was confirmed by gently probing the buccal gingival crevice of the same tooth with a moon's probe every 15 seconds until sensation was lost.

The findings of present study demonstrated a significant difference at $p \leq 0.05$ between both the groups for subjective as well as objective onset of anaesthesia, p=0.002 and p=0.034 respectively. This observation was consistent with that of reported subjective and objective onset of anaesthesia by shoeb kasim jendi et al. [11] and a.a. Qureshi et al. [12], who studied the efficacy of tramadol and lignocaine on the extraction of the teeth for orthodontic reasons and the maxillary third molar, p=0.881 and $p > 0.05$ respectively. Similarly, bilal ege et al. [10] and pallavi khan et al. [13], who carried out split-mouth study to assess the efficacy of tramadol and lignocaine for maxillary teeth extraction found no significant difference between both the groups for onset of anaesthesia, p=0.013 and p=0.457 respectively.

The duration of the procedure refers to the total time from administration of local anaesthesia to completion of tooth extraction. In this study, procedure time did not differ significantly between the two groups ($p = 0.396$).

The duration of anaesthesia is defined as the time from onset of numbness until normal sensation returns. Results showed that 2% lignocaine provided a significantly longer duration of anaesthesia than tramadol , both subjectively ($p < 0.001$) and objectively ($p = 0.001$).this observation was in accordance with the previous studies [13,14,15] who noticed a statistically significant difference in the mean duration of anaesthesia between both the groups, p=<0.001, p=<0.001, p=0.001 respectively. While, in contrast to present study, few earlier researchers [11,12,16] have reported no statistically significant difference in the mean duration of anaesthesia between both the groups, p=0.432, p=0.388, p=0.432, respectively.

Present study found no statistically significant difference in pain during procedure between both the groups, p=0.178. This finding was in harmony with the study conducted by madhumita srivastava et al. [14] and sumera gul et al. [15] on the efficacy of tramadol and lignocaine in non-complicated extractions under supra-periosteal infiltrations, which too observed no statistically significant difference, p=0.495 and p=0.509 respectively.

The interval between tooth extraction and the first administration of analgesic medication was quantified based on the patient's self-report and the individual's specific circumstances. [11] patients have been instructed to record time they took first analgesic tablet and total number of tablets taken on reporting back after 3 days on a data sheet provided. There was a statistically significant difference recorded between both the groups for subjective as well as objective post-extraction analgesia. It was noticed that majority of patients experienced post-extraction pain first on the control side. This observation was in accordance with the previous studies [11,12,14,15] who noticed a statistically

significant difference in the mean duration of post-extraction analgesia between both the groups, p=<0.001. The study demonstrated a highly significant difference in post-extraction analgesia between the two groups. Tramadol 50 provided a much longer duration of pain relief (mean 415.44 minutes) compared to 2% lignocaine (mean 264.81 minutes).

There was also a significant difference in the number of analgesic tablets consumed (p = 0.022). Most patients in the tramadol group required no or only one additional analgesic, whereas all patients in the lignocaine group needed extra tablets, with many taking two or three. This indicates that tramadol 50 offers superior and longer-lasting postoperative pain control, reducing the need for supplemental oral analgesics.

No previous studies were found that objectively recorded both post-extraction analgesia and analgesic consumption for comparison. Additionally, there was no significant difference in intraoperative or postoperative complications between the two groups, indicating both agents are safe.

Conclusion

The use of anaesthesia is as old as the history of surgery itself, and so is usage of local anaesthetic agents. Lignocaine remains the gold standard drug providing safe and successful local anaesthesia for surgical procedures in dentistry. It is postulated that tramadol can confer multifaceted benefits in surgical operations due to its potential postoperative analgesic and intraoperative anaesthetic effects. Therefore, tramadol can be safely employed as an alternative to conventional local anaesthetic agents as nerve block for certain specific minor oral surgical procedures.

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