RESEARCH PAPER

Use of Posterior Superior Alveolar Nerve Block only for Extraction of Maxillary Third Molars: A Systematic Review & Meta- analysis

Rahul S Bichile[1], Tejraj P Kale[2*], Radhika Pathak[3], Ayushi Srivastava[4], Ojasvee Hiran[5], Kairav Vadher[6]
[1,3]Senior lecturer, [2]Professor,
[1,2,3,4,5,6]Department of Oral and Maxillofacial Surgery, K.V.G. Dental College & Hospital, Sullia, Dakshin Kannada, Karnataka-574327, India
*[*]**Corresponding author:** Tejraj P Kale*

ABSTRACT

Aim: Assessing effectiveness of posterior superior alveolar nerve block (PSANB) or buccal infiltration without application of greater palatine nerve block (GPNB) for maxillary third molars extraction

Methods: Review was adhered to Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) guidelines 2020 and registered in PROSPERO – CRD42024496082. Screening and data extraction was done by two independent reviewers for comparing the effect of posterior superior nerve block with and without application of greater palatine nerve block on maxillary third molars extraction. Quality assessment of studies was evaluated through Cochrane risk of bias (ROB)-2 tool. The standardized mean difference (SMD) and risk ratio (RR) was used as summary statistic measure with random effect model and *p* value <0.05 as statistically significant through Review manager (RevMan) version 5.3.

Results: Five studies were included in for qualitative synthesis and two studies for meta-analysis. Included studies reported presence of low risk of bias overall. Effectiveness between both the injection techniques were evaluated for pain assessed through visual analogue scale (VAS) and facial pain scale (FPS). Meta-analysis revealed that that overall pain assessed through VAS on an average was (0.46 (-2.16 – 3.09) times more in control group (p>0.05) while overall pain assessed through FPS on an average was 0.11 (0.11 (-0.23 – 0.46) times more in control group (p>0.05). Funnel plot did not show presence of publication bias in meta-analysis.

Conclusion: It was found that satisfactory and feasible tooth extraction is possible with only PSANB or buccal infiltration and use of palatal injection or GPNB is not mandatory. However, furthermore clinical trials with larger sample size and follow up duration should be carried out to validate the findings of the study.

Keywords: buccal infiltration, greater palatine nerve block, palatal infiltration, maxillary third molar

How to cite this article: Rahul S Bichile1 Tejraj P Kale2* Radhika Pathak3 Ayushi Srivastava4 Ojasvee Hiran5 Kairav Vadher6. Use of Posterior Superior Alveolar Nerve Block only for Extraction of Maxillary Third Molars: A Systematic Review & Meta- analysis. Int J Drug Deliv Technol. 2026;16(76s):2190-2193. DOI: 10.25258/ijddt.16.76s.216.

Source of support: Nil.

Conflict of interest: None

INTRODUCTION

Extraction of maxillary third molars, is a frequently performed dental procedure that often requires effective local anaesthesia to ensure patient comfort and a smooth surgical process [1]. Achieving adequate anaesthesia in the posterior maxilla presents unique challenges due to the complex innervation of this region, primarily governed by the posterior superior alveolar (PSA) nerve. In clinical scenarios, a combination of PSA and greater palatine nerve (GPN) blocks are employed to ensure complete anaesthesia [2,3-7]. The first amide anaesthetic to be synthesized was lidocaine by Nils Lofgren in 1943 [8-10]. This gained popularity and was started being widely used and was considered the gold standard for usage and comparison [11]. Onset of action of lidocaine varies from 2 to 3 min and the duration of its anaesthesia is 85 minutes at the pulpal level with addition of epinephrine as vasoconstrictor [12]. Various studies have been conducted regarding the use of only buccal bock or to use the combinations of both [13]. By investigating the clinical outcomes of using the PSA nerve block or buccal infiltration without a GPN block, this review seeks to offer evidence-based recommendations for dental practitioners regarding the most efficient and comfortable anaesthetic techniques for maxillary third molar extractions [14,15].

Therefore, this systematic review was performed to assess effectiveness of PSA nerve block or buccal infiltration when used in isolation for maxillary third molar extractions with the hypothesis of study aimed to evaluate whether PSA nerve block only or buccal infiltration could be an effective modality for maxillary third molars extraction.

Methodology

Protocol development

This review was carried out according to preferred reporting items for systematic review (PRISMA) 2020 checklist [16] and registered in PROSPERO-CRD42024496082.

Study design

Focused research question in the Participants (P), Intervention (I), Comparison (C) and Outcome (O) format was proposed "Is posterior superior alveolar nerve block (PSANB) or buccal infiltration without application of greater palatine nerve block (GPNB) is effective for maxillary third molars extraction?"

P – patients undergoing maxillary third molars extraction
I – PSANB without GPNB
C – PSANB with GPNB
O – pain assessment

Eligibility Criteria:

a) Inclusion Criteria:

1) Studies published in English language and from open access journal
2) Studies published from January 2000 – December 2024
3) Studies comparing the effect of posterior superior nerve block with and without application of greater palatine nerve block on maxillary third molars extraction
4) Studies reporting study outcomes as pain assessment
5) Only studies that used lignocaine as the local anaesthetic were included
6) Randomized controlled trial (RCT) and prospective studies were selected

b) Exclusion Criteria:

1. reviews, abstracts, letter to the editor, editorials, animal studies were excluded

Search Strategy

Database search was performed till December 2024 for studies published within the last 24 years: PubMed, google scholar and EBSCOhost. Key words and Medical Subject Heading (MeSH) terms were selected and combined with Boolean operators like AND/OR as shown below

Search Strategy according to PICO Format:

	Strategy
Population	"Tooth extraction"[MeSH Terms] AND "maxillary third molars" AND "exodontia" AND ("wound healing"[MeSH Terms] AND "pain" AND "postoperative sequalae".
Intervention	("posterior superior alveolar nerve block"[MeSH Terms] NOT ("greater palatine nerve block" AND "local anaesthesia" AND "wisdom tooth" AND "pain assessment"
Comparator	("posterior superior alveolar nerve block"[MeSH Terms] AND ("greater palatine nerve block" AND "buccal infiltration" AND "local anaesthesia" AND "wisdom tooth" OR "pain assessment"
Outcome assessed	("pain"[MeSH Terms] OR "pain scale" OR ("visual analogue scale"[MeSH Terms] AND ("swelling") AND "facial pain scale" AND " maxillary third molars " AND ("exodontia") AND "randomized controlled trial" AND "prospective study")

Screening Process

The search and screening, according to previously established protocol were conducted by two authors. A two-phase selection of articles was conducted. In phase one, two reviewers reviewed titles and abstracts of all articles. Articles that did meet inclusion criteria were excluded. In phase-two, selected full articles were independently reviewed and screened by same reviewers. Any disagreement was resolved by discussion. When mutual agreement between two reviewers was not reached, a third reviewer was involved to make final decision. The final selection was based on consensus among all three authors. The corresponding authors of study were contacted via email where further information was required.

Data extraction

For included studies, descriptive data was extracted under following heading: author(s), year of study, sample size, age (experimental and control group), study design, modalities evaluated, parameters assessed, follow up duration and conclusion.

Quality assessment of studies

The methodological quality among included studies was executed by using Cochrane collaboration risk of bias (ROB) -2 tool. The tool has various domains like random sequence generation (selection bias), allocation concealment (selection bias), blinding of personnel and equipments (performance bias), blinding of outcome assessment (detection bias), incomplete outcome data (attrition bias), selective reporting (reporting bias) and other biases through their signalling questions in Review Manager (RevMan) 5.3 software. The overall risk for individual studies was assessed as low, moderate or high risk based on domains and criteria. The study was assessed to have a low overall risk only if all domains were found to have low risk. High overall risk was assessed if one or more of the six domains were found to be at high risk. A moderate risk assessment was provided to studies when one or more domains were found to be uncertain, with none at high risk [17].

Statistical analysis

The standardized mean difference (SDM) with 95% CI was calculated for continuous outcomes. A fixed effects model (Mantel-Haenszel method) was used if there was no heterogeneity ($p > 0.05$ or I-squared $\leq 24\%$), otherwise a random effects model (Der Simonian- Laird method) was used. All statistical analyses were performed using the RevMan 5.3 (Cochrane Collaboration, Software Update, Oxford, UK). The significance level was kept at $p<0.05$ [18].

Assessment of heterogeneity

The significance of any discrepancies in the estimates of the treatment effects of the different trials was assessed by means of Cochran's test for heterogeneity and the I^2 statistics, which describes the percentage of the total variation across studies that is due to heterogeneity rather than chance. Heterogeneity was considered statistically significant if $P < 0.1$. A rough guide to the interpretation of I^2 given in the Cochrane handbook is as follows: (1) from 0 to 40%, the heterogeneity might not be important; (2) from 30% to 60%, it may represent moderate heterogeneity; (3) from 50% to 90%, it may represent substantial heterogeneity; (4) from 75% to 100%, there is considerable heterogeneity [19].

Investigation of publication bias

To test for the presence of publication bias, the relative symmetry of the individual study estimates was assessed around the overall estimates using Begg's funnel plot. A funnel plot (plot of the effect size versus standard error) was drawn. Asymmetry of the funnel plot may indicate publication bias and other biases related to sample size, although asymmetry may also represent a true relationship between trial size and effect size [20].

Results

Study Selection

Following the database search (n = 250), removal of duplicates, and application of all inclusion and exclusion criteria, five studies were ultimately included in the qualitative synthesis and two studies in the quantitative synthesis, as illustrated in Figure 1.

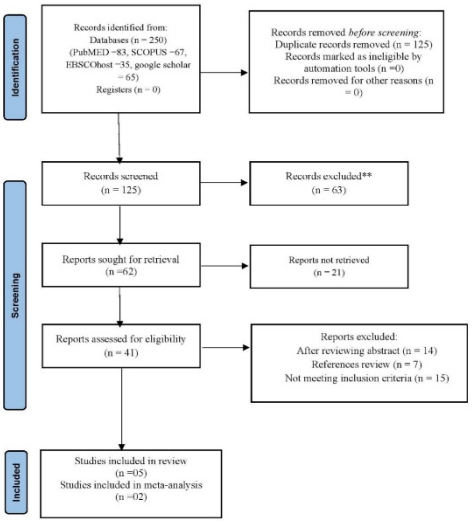

Figure 1. PRISMA 2020 Flow Diagram

Study Characteristics

As shown in Table 1, data were evaluated from five studies [21–25], comprising a total of 545 patients aged 17 to 73 years who underwent maxillary third molar extraction. All included studies assessed the effectiveness of posterior superior alveolar nerve block (PSANB), or buccal infiltration alone compared with PSANB or buccal infiltration combined with a palatal injection or greater palatine nerve block during maxillary third molar extraction. The effectiveness of these techniques was evaluated primarily in terms of pain. Pain was evaluated using the Visual Analogue Scale (VAS) and the Facial Pain Scale (FPS). The study findings indicated that satisfactory and feasible tooth extraction can be achieved with PSANB or buccal infiltration alone, and the use of a palatal injection or GPNB is not mandatory.

Author, years of study	Age (years)	Sample size (experimental / control)	Study design	Modalities evaluated	Parameters assessed	Assessment period	Conclusion
Sekhar et al., 2011 [21]	40.21	75 / 25	RCT	2% lidocaine HCl with 1:80,000 adrenaline + 1.75 mL lidocaine was injected buccally, and 0.25 mL of palatal injection	Pain (VAS Study group = 6.41 +/- 0.1; Control group = 6 +/- 0.01, (FPS Study group = 0.31 +/- 0.1; Control group = 0.28 +/- 0.1)	Waiting period of 8 minutes	Satisfactory tooth extraction is possible with only buccal infiltration
Yadav et al., 2013 [22]	24-31	100/100	RCT	Buccal inj with 2% lidocaine hydrochloride with 1: 200,000 epinephrine + buccal inj. with palatal inj.	Pain (VAS (Group 1 = 5.30 +/- 11.71; Group 2 = FPS Group 1 = 0.98 +/- 1.79; Group 2 = 0.80 +/- 1.50)	Waiting period of 5 minutes	Equal effectiveness was seen with both modalities

Padhye et al., 2015 [23]	17-73	150	RCT	Buccal infiltration with 2% lignocaine hydrochloride with 1:80 000 adrenaline and palatal inj. + buccal infiltration with palatal inj.	Pain (VAS experimental group = 156.43; control group = 144.57, FPS experimental group = 150.45; control group = 150.55)	Waiting period of 10 minutes	Palatal injection is not mandatory for maxillary third molar extraction
Chatterjee et al., 2023 [24]	30.3 ± 14.9	35 / 35	RCT (split m	Buccal infiltration of 2 mL +	Pain (VAS) Experimental grou	Waiting period of 10 min	Tooth extraction was feasi
			outh)	Buccal infiltration of 1.5 mL and palatal infiltration of 0.5 mL LA	p = 18.65±20.33; Conventional group = 20.56±20.16	utes + 3 minutes	ble with only buccal infiltration with palatal injection
Tummalapalli et al., 2024 [25]	32.30	100 / 100	RCT	PSA NB alone with 2% lignocaine hydrochloride and adrenaline 1:80,000 + PSA NB with GPNB	Pain (VAS)	Latency period of 10 minutes	Only PSA NB is sufficient for maxillary third molar extraction

FPS: facial pain scale; LA: local anesthetic; GPNB: greater palatine nerve block; PSANB: posterior superior alveolar nerve block; RCT: randomized controlled trial; VAS: visual analogue scale

Table 1: showing descriptive study details of included studies

Quality assessment

The high risk of bias (ROB) was seen for random sequence generation, followed by incomplete outcome data. All the included studies showed a moderate to low overall risk of bias. A moderate to low ROB means that the studies were generally well-designed, but some areas had minor issues that could slightly affect the results. Studies with a low ROB are considered methodologically strong and have very little chance of systematic errors. Studies with a moderate ROB still provide useful evidence but may have small gaps in reporting or methodology, so their results should be interpreted with some caution. The domains of allocation concealment, blinding of participants and personnel, blinding of outcome assessment, selective reporting, and other potential bias showed the lowest ROB, indicating good methodological quality in these areas, as depicted in Figures 2 and 3.

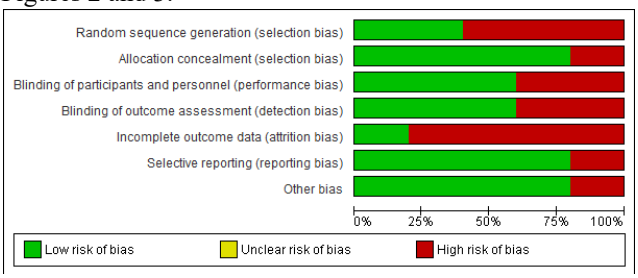

Figure 2: ROB: shown as percentages across all included studies.

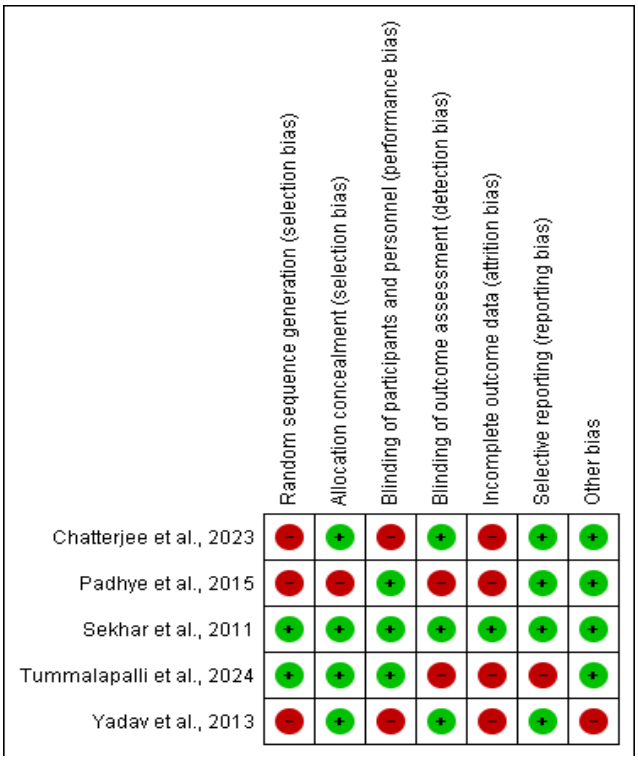

Figure 3: ROB summary: for each study

Synthesis of results/Meta-analysis

The meta-analysis was performed to assess, evaluate and compare the effectiveness between experimental and control group on overall pain assessment with mean difference (MD) as summary outcome measure employing fixed effect model.

A) Overall pain assessment (VAS)

Two studies [21,22] containing data on 300 patients undergoing maxillary third molar extraction, of which (n=175) patients were evaluated by experimental group and (n=125) patients by control group for pain assessment through visual analogue scale (VAS). As shown in Figure 4. a difference of (MD = 0.46 (-2.16 – 3.09) was seen and pooled estimate signifies that overall pain assessed through VAS on an average was 0.46 times more in control group (p>0.05).

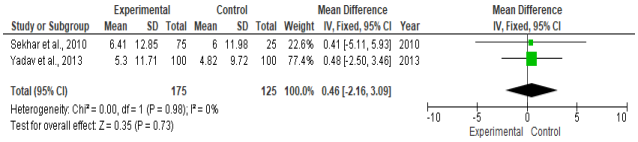

Fig 4: overall pain assessment between experimental and control group

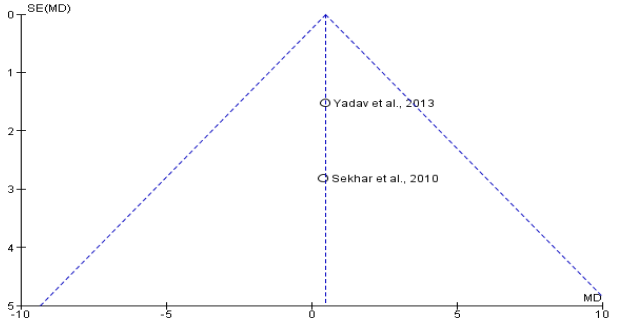

Fig 5: funnel plot showing absence of possible publication bias in meta-analysis

B) Overall pain assessment (FPS)

Two studies [21,22] containing data on 300 patients undergoing maxillary third molar extraction, of which (n=175) patients were evaluated by experimental group and (n=125) patients by control group for pain assessment through facial pain scale (FPS). As shown in Figure 6. a difference of (MD = 0.11 (-0.23 – 0.46) was seen and pooled estimate signifies that overall pain assessed through FPS on an average was 0.11 times more in control group (p>0.05).

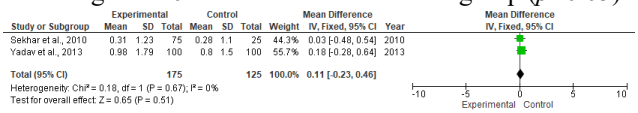

Fig 6: overall pain assessment between experimental and control group

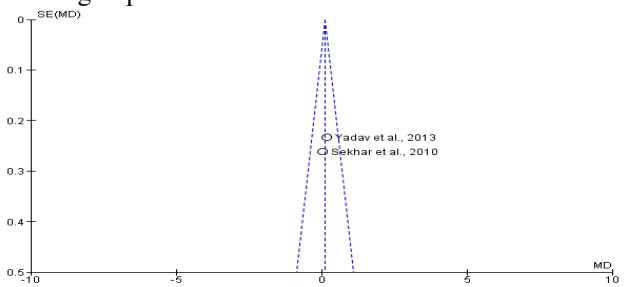

Fig 7: funnel plot showing absence of possible publication bias in meta-analysis

Discussion

Pain associated during administration of palatal injection is high because of adherent mucosa and underlying periosteum [5]. However, performing nerve blocks increases the number of injections, potentially leading to increased patient discomfort and a higher risk of complications, such as hematoma [6,7]. As a result, clinicians often question whether the PSA nerve block alone could provide sufficient anaesthesia for maxillary third molar extractions, particularly when limited or no palatal tissue manipulation is anticipated [8,9].

Padhye et al. [26] performed a clinical trial to evaluate the anaesthetic ability of posterior superior alveolar nerve block (PSANB) for maxillary molars. 100 patients requiring extraction of maxillary second molars extraction were included. One group received infiltration received infiltration for anaesthesia while other group received PSANB with lignocaine and adrenaline. Outcome was assessed in terms of pain assessed through visual analogue scale (VAS). It was found that pain effect was same in both the techniques used (p<0.05).

Halim et al. [27] performed single blind randomized controlled trial (RCT) to evaluate effect of PSA nerve block with infiltration technique for local anaesthesia during surgical extraction of bilateral maxillary third molar in 50 patients. It was found that overall pain score was equivocal in PSA side (p<0.05). Although the pain score was equal in both groups, the PSA nerve block has slight advantage over infiltration technique depending on the number of repeated injections.

Moin et al. [28] performed randomized clinical study to determine anaesthetic efficacy of conventional posterior

superior alveolar nerve block (PSANB) and greater palatine nerve block (GPNB) compared to buccal and palatal technique for pain during and after extraction and after 15 minutes of procedure with pain evaluated through visual analogue scale (VAS). They reported that buccal infiltration was less painful than compared to PSA nerve block with infiltration technique being more advantageous and successful than PSA nerve block.

There have been few clinical studies [26- 28] published in past but due to presence of data heterogeneity, none of them actually could provide a comprehensive qualitative and quantitative analysis in providing a comparative analysis of effectiveness of posterior superior alveolar nerve block (PSANB) or buccal infiltration without application of greater palatine nerve block (GPNB) for maxillary third molars extraction. According to our knowledge, this is the first systematic review and meta-analysis which assessed and evaluated the better effectiveness between the two injection techniques for maxillary third molar extraction.

Databases were searched from January 2000 to December 2024 for RCTs and prospective studies evaluating effectiveness of posterior superior alveolar nerve block or buccal infiltration compared to posterior superior alveolar nerve block or buccal infiltration with palatal injection or greater palatine nerve block during maxillary third molar extraction. Five studies [21-25] were included in for qualitative synthesis and two studies [21,22] for meta-analysis. Included studies reported presence of low risk of bias overall. Effectiveness between both the injection techniques were evaluated for pain assessed through visual analogue scale (VAS) and facial pain scale (FPS). Meta-analysis revealed that that overall pain assessed through VAS on an average was (0.46 (-2.16 – 3.09) times more in control group (p>0.05) while overall pain assessed through FPS on an average was 0.11 (0.11 (-0.23 – 0.46) times more in control group (p>0.05). Funnel plot did not show presence of publication bias in meta-analysis.

The systematic review adhered to PRISMA guidelines, employing a comprehensive literature search and rigorous methodology, including Cochrane tool ROB assessment. This resulted in high-quality studies with minimal bias, providing a robust evidence base for therapeutic recommendations on optimizing the usage of PSA nerve block without palatal injection.

Systematic reviews and meta-analyses are considered the highest level of evidence, offering transparency and reproducibility in addressing specific research questions. However, the quality of included studies impacts the strength of evidence. This review included sufficient studies with brief observation periods and known risk of bias.

Conclusion

It was found that satisfactory and feasible tooth extraction is possible with only PSANB or buccal infiltration and use of palatal injection or GPNB is not mandatory. However, furthermore clinical trials with larger sample size and follow up duration should be carried out to validate the findings of the study.

Conflict of interest

NIL

Ethical approval statement

As this systematic review and meta-analysis is a secondary analysis of published literature, ethical approval was not required.

Funding

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

Patient consent

Consent was not required, as this study is a systematic review and meta-analysis based on previously published research studies.

References

1. Aslin WR. Reduced discomfort during palatal injection (2001) J Am Dent Assoc 132:1277-89.
2. McArdle BF (1997) Painless palatal anesthesia. J Am Dent Assoc 28:647-59.
3. Meechan JG. (2002) Effective topical anesthetic agents and techniques. Dent Clin North AM 46:759-766.
4. Uckan S, Dayangac E, Araz K (2006) Is permanent maxillary tooth removal without palatal injection possible? Oral Surg Oral Med Oral Pathol Oral Radiol Endod 102:733-735.
5. Duncan JD, Reeves GW, Fitchie JG (1992) 'Technique to diminish discomfort from the palatal injection'. J Prosthet Dent 67:901-902.
6. Badcock ME, Gordon I, McCullough MJ (2007) A blinded randomized controlled trial comparing lignocaine and placebo administration to the palate for removal of maxillary third molars. Int J Oral Maxillofac Surg 36:1177-1182.
7. Raja Sekhar G, Nagaraju T (2011) Is palatal injection mandatory prior to extraction of permanent maxillary tooth: a preliminary study. Int J Oral Maxillofac Surg 22:100-102.
8. Fan S, Chen WL, Yang ZH, Huang ZQ (2009) Comparison of the efficiencies of permanent maxillary tooth removal performed with single buccal infi ltration versus routine buccal and palatal injection. Oral Surg Oral Med Oral Pathol Oral Radiol Endodont 107:359-363.
9. Lima-Júnior JL, Dias-Ribeiro E, de Araújo TN, Ferreira-Rocha J (2009) Evaluation of the buccal vestibule-palatal diffusion of 4% articaine hydrochloride in impacted maxillary third molar extractions. Med Oral Patol Oral Cir Bucal 14:129-132.
10. Ozeç I, Tasdemir U, Gumus C, Solak O (2010) Is it possible to anesthetize palatal tissues with buccal 4% articaine injection? J Oral Maxillofac Surg 68:1032-1037.
11. Tortamano IP, Siviero M, Costa CG, Buscariolo IA, Armonia PL (2009) A comparison of the anesthetic effi cacy of articaine and lidocaine in patients with irreversible pulpitis. J Endod 35:165-168.
12. Bernardi M, Secco F, Benech A (1999) Anesthetic efficacy of a eutectic mixture of lidocaine and prilocaine on the oral mucosa: prospective double

blind study with a placebo. Minerva Stomatal 48:39-43.
13. Badcock ME, McCullough MJ (2007) Palatal anaesthesia for the removal of maxillary third molars as practised by oral and maxillofacial surgeons in Australia and New Zealand. Aust Dent J 52:329-332.
14. Munshi AK, Hedge AM, Latha R. Use of EMLA: Is it an injection free alternative? J Clin Pedatr Dent 2001;25:215-219.
15. Kandasamy S, Elangovan R, John RR, Nantha Kumar C (2015) Removal of maxillary teeth with buccal 4% articaine without using palatal anesthesia—A Comparative double blind study. J Oral Maxillofac Surg Med Pathol 27:154-8.
16. Page MJ, McKenzie JE, Bossuyt PM, Boutron I, Hoffmann TC, Mulrow CD (2021) The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. BMJ 29;372-382.
17. Corbett MS, Higgins JP, Woolacott NF (2014) Assessing baseline imbalance in randomised trials: implications for the Cochrane risk of bias tool. Res Synth Meth 5:79-85.
18. DerSimonian R, Laird N (2015) Meta-analysis in clinical trials revisited. Contemp Clin Trials 45:139-45.
19. Higgins JP, Thompson SG (2002) Quantifying heterogeneity in a meta-analysis. Stats Med 21:1539-58.
20. Sterne JA, Egger M (2005) Regression methods to detect publication and other bias in meta-analysis. Publication bias in meta-analysis: Prevention, assessment and adjustments 7:99-110.
21. Sekhar GR, Nagaraju T, Nandagopal V, Sudheer R (2011) Is palatal injection mandatory prior to extraction of permanent maxillary tooth: a preliminary study. Ind J Dent Res 22:100-2.
22. Yadav S, Verma A, Sachdeva A (2013) Buccal injection of 2% lidocaine with epinephrine for the removal of maxillary third molars. Anaes prog 60:95-106.
23. Padhye M, Shah V, Shevale V, Pawar S, Desai RA (2015) Palatal injection: a myth or a reality in maxillary third molar extraction. World J Dent 5:28-32.
24. Chatterjee A, Gadicherla S, Roy S, Pentapati KC (2023) Efficacy of Buccal Infiltration with or without Palatal Injection for Posterior Maxillary Teeth Extraction-A Split-Mouth Randomized Trial. Pesquisa Brasileira em Odontopediatria e Clínica Integrada 23:21-35.
25. Tummalapalli S, Inturi NM, Suvvari RK, Polamarasetty LP (2023) Posterior superior alveolar nerve block alone in the extraction of upper third molars: a prospective clinical study. J Dent Anaes Pain Med 23:213-224.
26. Padhye M, Gupta S, Chandiramani G, Bali R (2011) PSA block for maxillary molar's anesthesia-an obsolete technique? Oral Surg Oral Med Oral Pathol Oral Radiol Endodont 112:39-43.
27. Halim SH (2017) Assessment of efficacy of PSA nerve block technique and local infiltration technique in patients undergoing surgical removal of maxillary third molars: A comparative study. J Adv Med Dent Sci Res 5:101-112.
28. Moin A, Shafath A, Kale S (2023) Comparison of posterior superior alveolar and greater palatine nerve block with local infiltration for extraction of maxillary molars in oral surgery–A randomized controlled trial. Int J Maxillofac Imag 9:70-5.