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ORIGINAL ARTICLE

Efficacy of Buccal Infiltration with or without Palatal Injection for Posterior Maxillary Teeth Extraction – A Split-Mouth Randomized Trial

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ABSTRACT

Objective: To evaluate the feasibility of posterior maxillary teeth extraction buccal infiltration with or without the use of palatal injection. **Material and Methods:** A total of 70 patients underwent extraction of bilateral maxillary posterior teeth under 2% lignocaine hydrochloride with 1:2,00000 adrenaline infiltration in this single-centric split-mouth randomized trial. The test side was administered with a buccal infiltration of 2 mL of anesthetic alone. An extended waiting period of 10 minutes was given before the commencement of the procedure. A standard protocol was followed for the control side. A single operator performed all extractions. **Results:** A total of 140 posterior maxillary teeth were extracted. Patients marked pain perception on a visual analogue scale in three different instances. During the administration of injections for the test side, the pain score was less than that of the control side and was statistically significant. The overall pain during the extraction procedure was comparable and statistically insignificant. The overall success of the method was 90%. **Conclusion:** Extraction of posterior maxillary teeth was feasible with a single buccal infiltration without palatal injection in most cases using an extended waiting period. Dentists can attempt extraction without palatal injections with optimal success. However, the alternate technique could be used when there is a necessity for rescue palatal anesthesia.

Keywords: Lidocaine; Anesthesia, Local; Maxilla; Pain Measurement; Tooth Extraction.

Introduction

Apprehension and fear are common and recognized as barriers to dental attendance [1]. The patient's previous unpleasant experience or a generally acquired mindset regarding the painful nature of dental treatment might delay a dental visit [2]. Administration of local anesthesia (LA) is an integral part of any dental procedure associated with pain. The use of injections and needles may precipitate anxiety and be associated with pain [3,4]. Minimizing perioperative pain and discomfort is crucial to any dental treatment [5,6]. They were many modifications in the agents and techniques in dental research in the recent past [7].

Due to the thin bone and favorable root morphology, maxillary teeth are typically amenable to extraction under LA [8]. The procedure usually involves a nerve block/ infiltration on the buccal side with a supplemental palatal infiltration or a nasopalatine, or a greater palatine nerve block. The palatal infiltration had notoriously been the most painful intraoral LA injection [2,8]. This substantial pain cannot be attributed only to the piercing of oral mucosa by the dental needle. The close adherence of the palatal gingiva to the underlying bone, unyielding to accommodate even a minuscule amount of drug solution, might be a prominent factor for this phenomenon. Therefore, the detachment of the palatal tissues from the bone to accommodate the solution creates considerable tension. This explains the accentuated discomfort, pressure, and pain sensation before and after the palatal LA injection [2,9].

The palate's anatomical innervations suggest a ritualistic use of palatal LA injection for posterior maxillary teeth procedures [8]. Many techniques have been used in the past to decrease the pain during the injection of LA like intra-oral vibration devices [10], iced cotton applicators [11], narrow or thin gauged needles [12], eutectic mixture of local anesthetics [13], needleless jet anesthesia [13], tramadol hydrochloride [14], and refrigerant [15] with variable success rates and limitations. The greater palatine or maxillary nerve can be anesthetized within the pterygopalatine fossa. However, due to increased morbidity, such a technique is not widely accepted [8,16]. A separate palatal LA infiltration or nerve block may be avoided using an alternative extended waiting period followed by buccal infiltration. Studies that evaluated buccal infiltration effectiveness in inducing palatal anesthesia using articaine [17-20] and lignocaine preparations [21,22] were scant. Hence, we aimed to assess buccal infiltration's efficacy with or without palatal LA injection in posterior maxillary teeth extraction.

Material and Methods

Study Design and Ethical Clearance

We conducted a single-center, randomized, outcome assessor-blinded split-mouth trial among patients who required bilateral maxillary dental extraction in the outpatient Department of Oral and Maxillofacial Surgery, Manipal College of Dental Sciences Manipal, India. Kasturba Medical College and Kasturba Hospital Institutional Ethics Committee (IEC 126/2017) approved the protocol and registered with the Clinical trial registry of India (CTRI/2018/10/016180).

Sampling

Seventy subjects satisfied the inclusion criteria. Prior informed consent was sought from all the patients. Sample size calculation was done based on the findings of a previous study's success rates of both types of

treatment protocols (72% versus 100%) [22]. It was found that a minimum of 51 subjects would be required, with a power of 95% and an alpha of 5%. Given possible attrition, an excess of 20% was recruited.

We included patients who required the extraction of bilateral maxillary posterior fully erupted teeth and those aged above 18 years. We have excluded patients with supernumerary or ectopically erupted or teeth with periapical pathology, allergy (LA), pregnancy, and bleeding disorders.

Oral and maxillofacial surgeons enrolled eligible patients. The same operator performed all the extractions following universal precautions. Lignocaine topical spray (10%) was administered on all selected injection sites as the standard of care. In addition, we used a 27 gauge needle to inject Lignocaine hydrochloride (2%) with 1:200,000 adrenaline as a vasoconstrictor. Subjects requiring bilateral extractions were randomized to either of the protocols using the coin toss method by a trained nurse. Sealed envelopes were used for allocation concealment till the intervention.

Experimental Protocol

Buccal infiltration of 2 mL for 1 minute with a waiting period of 10 minutes.

Conventional Protocol

Buccal infiltration of 1.5 mL and palatal infiltration of 0.5 mL LA with a waiting period of 3 minutes.

Both treatment protocols used were similar, except that the experimental protocol didn't receive palatal infiltration. Readings of the pain "during the administration of LA," "the elevation of the flap," and "during the extraction of teeth" were recorded using the Visual Analogue Scale (VAS) by an evaluator blinded for the treatment protocol. The same protocol was followed for all the participants and there were no changes in the method after the trial commencement.

Statistical Analysis

All the analysis was performed using IBM SPSS version 20 (IBM SPSS Statistics for Windows, Version 20.0. Armonk, NY, USA). A P value of <0.05 was considered statistically significant. The mean VAS scores were compared between the two protocols using the Wilcoxon Sign Rank test.

Results

Patients were recruited from June 2017 to August 2018. Seventy patients were recruited, out of which 13 required rescue injections in the experimental protocol for various reasons. The trial was stopped after reaching the optimal sample size. Therefore, these patients were excluded from the statistical analysis. A total of 57 subjects had completed all the stages of this study, out of which 34 were female (Figure 1). The mean age of the participants was 30.3±14.9 (range: 18-70; Median: 22). The main reasons for extraction are listed in Table 1. There was a significantly higher mean VAS score during injection with the conventional protocol than experimental protocol (55.75 ±27.39 *versus* 37.63±23.01; $p<0.001$). However, there was no significant difference in the mean VAS scores during flap elevation or tooth removal between experimental and conventional protocols ($p=0.627$ and 0.094), respectively (Table 2).

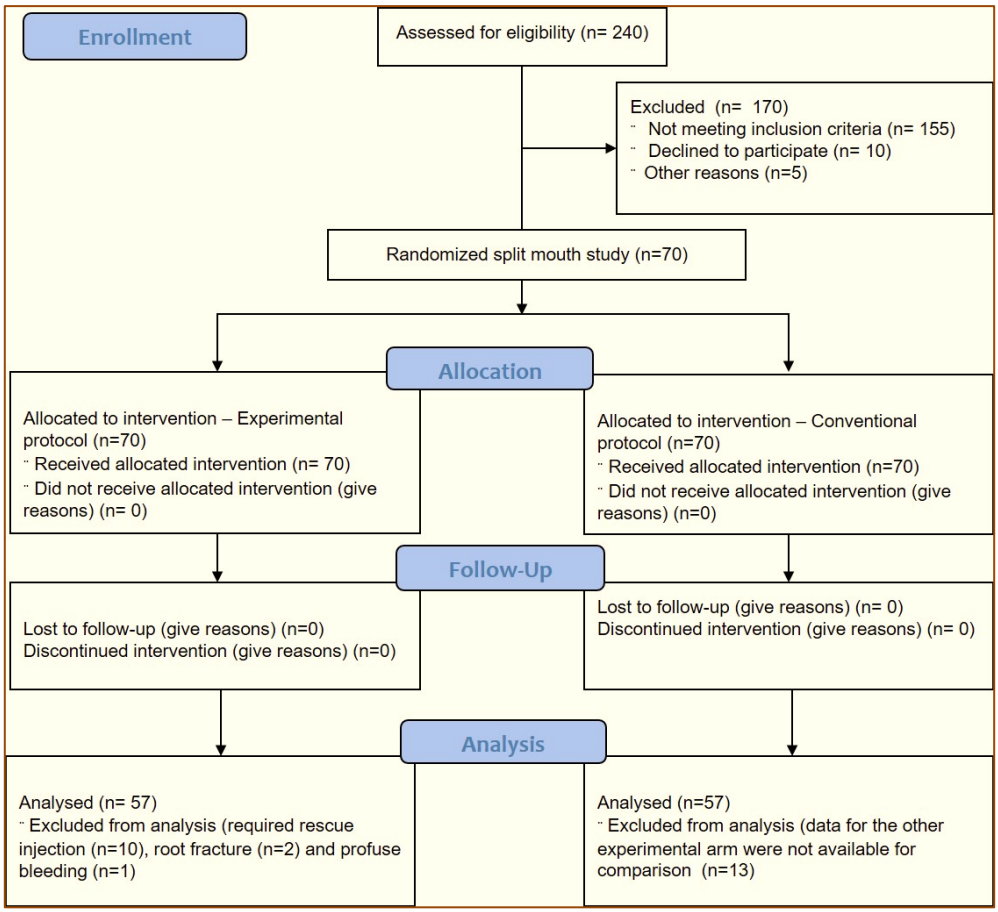

Figure 1. CONSORT flow chart.

Table 1. Distribution of reasons for extraction.

Reasons for Extraction	N (%)
Caries	25 (43.9)
Orthodontic premolar extraction	29 (50.9)
Pre-orthodontic third molar extraction	3 (5.2)
Total	57 (100.0)

Table 2. Comparison of mean VAS scores between experimental and conventional protocols at various time points.

Time Point	Experimental Protocol Mean ± SD (95% CI)	Median (Min-Max)	Conventional Protocol Mean ± SD (95% CI)	Median (Min-Max)	p-value
During Injection	37.63±23.01 (31.52-43.74)	30 (5-100)	55.75±27.39 (48.49-63.02)	54 (0-100)	<0.001
Elevation of the Flap	23.79±22.46 (17.83-29.75)	20 (0-100)	24.70±21.29 (19.05-30.35)	20 (0-100)	0.627
Removal of the Tooth	18.65±20.33 (13.25-24.04)	10 (0-90)	20.56±20.16 (15.21-25.91)	15 (0-90)	0.094

Wilcoxon Signed-Rank test.

Discussion

Pain perception is a complex phenomenon that may be a function of an individual's physiological and emotional state. Therefore, it may differ for the same patient at different time intervals and may be more pronounced in patients who bear an apprehension about it. Owing to its subjective peculiarity, valid and universal assessment is difficult [23].

Assessment of pain in the surgical field has traditionally used VAS (Visual Analogue Scale) or VRS (Verbal Response Scale) [24,25]. VAS and VRS have demonstrated strengths besides limitations [23]. The VAS is considered more sensitive than the VRS; more diverse and higher responsiveness is possible [23,26]. In addition, VAS has demonstrated excellent reliability and construct validity for self-reported pain [24,25,27].

In the present study, the use of experimental protocol was adequate for extracting posterior maxillary teeth. Also, it was noted that the pain on injecting the LA was significantly lower in the experimental protocol compared to a conventional protocol. These findings were similar to earlier studies [21,22] but with variable success rates. Kumaresan et al. [22] reported an overall success rate of 81.3% in achieving palatal anesthesia with buccal infiltration, with the time taken to accomplish the palatal anesthesia as 7-9 min. The success rate of buccal infiltration to achieve palatal anesthesia decreases from the anterior maxillary region (92%) to the posterior maxillary region (52%), which could be attributed to widely spaced cortical plates posterior region as compared to the anterior region [22]. Our study's overall success rate (81.4%) was slightly higher than that reported in a previous study (72%) [22]. Pawar et al. [28] reported no significant difference in pain among patients who received buccal infiltration with or without lignocaine palatal injection for extraction of maxillary third molars. An extended waiting period coupled with the cancellous nature of the palatal alveolus could be the factors that facilitated adequate palatal anesthesia using the experimental protocol [29].

A study that compared 4% articaine versus 2% lignocaine reported only five individuals requiring a palatal block with articaine [18]. A comparative study using 0.9% saline as a placebo injection on the palatal gingiva concluded palatal injection was extremely painful [8]. Bataineh et al. [30] reported a success rate of 90.6% using 4% articaine buccal infiltration and a 5 min waiting period. They also reported no significant difference in pain perception when extracting anterior and posterior teeth [30]. Majid and Ahmed [31] reported that the anesthetic effect of buccal injections of articaine (4%) and lidocaine (2%) was comparable. However, the adequacy of anesthesia with lignocaine was significantly less than that achieved by articaine (4%) given by the standard technique [31]. Another trial reported a success rate of 82.7% for articaine and 1.3% for lignocaine [32].

The pain due to buccal injections was found to be significantly lower than the pain due to palatal injections. Similarly, pain due to extraction of the tooth following atraumatic technique, minimal manipulation of palatal gingiva, and an extended waiting period before the commencement of the procedure were comparable to the standard methods. Other potential factors like pre-existing anxiety, monitoring of hemodynamic parameters, and stress could be compared between these two protocols.

Conclusion

Extraction of posterior maxillary teeth was feasible with a single buccal infiltration without palatal injection in most cases using an extended waiting period. Therefore, dentists can attempt extraction without palatal injections with optimal success. However, the alternate technique could be used when there is a necessity for rescue palatal anesthesia.

Authors' Contributions

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All authors declare that they contributed to critical review of intellectual content and approval of the final version to be published.

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Conflict of Interest

The authors declare no conflicts of interest.

Data Availability

The data used to support the findings of this study can be made available upon request to the corresponding author.

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