

Anesthetization of the Palatal Soft Tissue for the Extraction of the Maxillary Teeth through Buccal Infiltration alone Using Articaine 4%- A Prospective Study

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Abstract

Aims: To evaluate the efficacy of 4% articaine with adrenaline 1:100000 in providing palatal anaesthesia for the extraction of all maxillary teeth by administering a single buccal infiltration

Settings and Design: study was conducted in the Department of Oral and Maxillofacial Surgery, Kannur dental college, Anjarakandy, Kannur, India, and was formulated following STROBE guidelines.

Materials and Methods: Patients reporting to the Department of Oral and Maxillofacial Surgery for the extraction of their maxillary teeth were selected for this study. LA containing 4% articaine with adrenaline 1:100000 was administered as a buccal infiltration using sterile single-use 27 G 0.40 × 21 mm disposable dental needle and a non-aspirating dental syringe. After administration, a leeway of 10 minutes was provided for the anaesthetic to take effect following which an anaesthesia confirmation test was done- "walking of the probe" in the free gingival margin on the buccal and palatal sides

Statistical analysis used: Mann-Whitney U test

Results: 26% of the patients had pain during the elevation of the palatal flap and was given an additional injection for palatal anaesthesia after the stipulated time was over. pain perception based on VAS scale for both males and females was 9.41 (1.09) and 9.14 (1.29), which is not statistically significant (p-value = 0.45). Between the age group of 15-20, overall satisfaction was 8.83 (1.02) and the mean pain score based on VAS was 8.83 (1.52).

Conclusions: Articaine was able to provide palatal anaesthesia with buccal injection alone, even in majority cases with periapical pathology and the patients also exhibited increased satisfaction level with articaine

Keywords: Articaine; Palatal Anaesthesia; Buccal Infiltration; Maxillary Extraction

Abbreviations

LA: Local Anesthetic; VAS: Visual Analogue Scale

Introduction

Palatal anesthesia is one of the most painful maxillary local anesthetic (LA) technique. Various techniques like topical anaesthetic application, computerized injection systems, pressure application, eutectic mixture of anaesthetic solutions- all have been employed to achieve a non-traumatic local anaesthetic administration experience to the patient but failed [1]. This particular enigma paved the way for the concept of this study.

Lignocaine remains the gold standard for the comparison of any newer drugs, and articaine is one of them. It is gaining popularity because of its safety and potency, unique pharmacokinetics and its effectiveness in patients with hypokalemic overstimulation [2,3]. Since the maxillary bone is more cancellous by nature, the superior bone diffusion properties of articaine give an advantage over lignocaine to avoid palatal injection by administering buccal infiltration alone.

Hence, the aim of this study was to evaluate the efficacy of 4% articaine with adrenaline 1:100000 in providing palatal anaesthesia for the extraction of all maxillary teeth by administering a single buccal infiltration, in the treatment population reporting at our institution. Secondly we also evaluated cases with periapical lesion getting articaine having any additional benefits beneficial for the patient.

Subjects and Methods

This study was conducted in the Department of Oral and Maxillofacial Surgery, Kannur dental college, Anjarakandy, Kannur, India. The study design was formulated following STROBE guidelines and commenced after obtaining approval from the institutional ethics committee. Patients reporting to the Department of Oral and Maxillofacial Surgery for the extraction of their maxillary teeth were selected for this study. The procedure and possible complications were explained to the patient and informed consent was obtained from those who were willing to participate in the study.

Inclusion criteria:

- Patient between the age of 20 - 50 years.
- Patient who had indications for the removal of their maxillary teeth.
- Patients with periapical lesions, but with no periodontal diseases or mobility.

Exclusion criteria:

- Medically compromised patients.
- Had a history of allergy to amides and sulfide type of drugs.
- Patients with periodontal diseases.
- Pregnant women.
- Patient under antibiotics and analgesic therapy.
- Whose adjacent tooth to the tooth to be extracted is missing.

Fifty subjects were selected for the study who were willing to sign the written informed consent. Twenty-eight were female and twenty-two were male. The number of teeth to be extracted varied from a minimum of one to a maximum of three teeth.

Study design

Subjects who gave their consent for the study was taken up by a single operating surgeon. After following the aseptic procedures, LA containing 4% articaine with adrenaline 1:100000 was administered as a buccal infiltration using sterile single-use 27 G 0.40 × 21 mm disposable dental needle and a non-aspirating dental syringe. The needle was placed supraperiosteally close to the bone and the penetration was restricted to a depth of one cm from the height of the mucobuccal sulcus. The injection was made into the buccal vestibule along

the long axis of the corresponding tooth to be extracted and if multiple teeth required extraction, the point of injection was along the midpoint of the teeth to be extracted. Once the required depth of penetration was attained, a whole cartridge of articaine (Septonest by Septodont, 25 Wolseley Court, Cambridge, Ontario, Canada- 4% articaine with adrenaline 1:100000 - 1.7 ml cartridges) was injected at a rate of 1 ml/minute.

After administration, a leeway of ten minutes was provided for the anaesthetic to take effect following which an anaesthesia confirmation test was done- "walking of the probe" in the free gingival margin on the buccal and palatal sides. From what is available in the literature the time of onset of palatal anaesthesia has varied from five minutes to more than 15 minutes- after deliberation, it was decided to wait for a period of ten minutes before starting the procedure to mimic routine usage of anaesthetic agent. Although it would have been prudent to analyze the time of onset, there are a plethora of studies regarding the same and the authors believe that repeating it will add additional trauma to the patient without evoking any relevant outcome to the literature.

The anteroposterior extent of anaesthesia, as well as complete or partial anaesthesia, were recorded individually on both buccal and palatal aspects. Complete anaesthesia included those areas where anaesthesia was achieved from papilla to papilla and partial from the papilla mesial/distal to the site of injection not reaching the ipsilateral adjacent papilla anteriorly/posteriorly. Once the extent of soft tissue anaesthesia was confirmed, anaesthesia during flap elevation was noted of the tooth to be extracted. If the articaine administration as a buccal infiltration failed to achieve complete palatal anaesthesia within the stipulated time, rescue palatal anaesthesia was administered. In cases where multiple teeth required extraction, local infiltration was given in the middle third of the teeth to be extracted.

All the procedures were of the forceps extraction criteria and those cases which, during the procedure, required surgical removal were eliminated from the study. Once the procedure was completed, subjects were given a visual analogue scale (VAS) scale from zero to ten- zero denoting the worst experience and ten denoting excellent experience during the procedure. A single surgeon performed all the procedures, assessment and recording of the data. Those who had extractions before in other locations than the study side were able to give an accurate level of assessment of the comfort using this technique and the conventional technique- due to the inherent bias of the data, it was not recorded in the study but was excellently reflected in the VAS scale. All the findings were recorded digitally using a commercially available free online application.

Results

Mann-Whitney U test was used for statistical analysis. A total of 50 patients were selected for the study- 22 males and 28 females. Mean (SD) age of male and female patients was 34.27 (15.75) and 35.88 (17.66) (Table 1) respectively. During the procedure, 26% of the patients had pain during the elevation of the palatal flap and was given an additional injection for palatal anaesthesia after the stipulated time was over (Table 2). The pain perception based on VAS scale for both males and females was 9.41 (1.09) and 9.14 (1.29), which is not statistically significant (p-value = 0.45) (Table 3). The overall satisfaction based on VAS scale for males and females was 9.18 (0.79) and 9.07 (1.46) which is also not statistically significant (p-value = 0.75) (Table 4). Fifty nine tooth were extracted from a total of fifty patients. The extractions from the whole maxillary arch which fulfilled the inclusion criteria was included in the study (Table 5).

Gender	n (%)	Age Mean	SD
Male	22 (44)	34.27	15.75
Female	28 (56)	35.88	17.66

Table 1: Distribution based on gender.

	%
Yes	26.5
No	73.5

Table 2: Description based on pain present: flap elevation on the palate.

	Mean	SD	t value	P value
Male	9.41	1.09	0.75	0.45
Female	9.14	1.29		

Table 3: Pain perception based on VAS scale.

	Mean	SD	t value	P value
Male	9.18	0.79	0.31	0.75
Female	9.07	1.46		

Table 4: Overall satisfaction based on VAS scale.

SI No.	FDI Tooth number	Number of tooth extracted
	18	3
	17	1
	16	7
	15	2
	14	6
	13	0
	12	0
	11	0
	21	2
	22	0
	23	2
	24	10
	25	4
	26	12
	27	4
	28	6
	Total	59

Table 5: Number of extracted tooth according to the tooth.

The study subjects were further categorized based on their age. From the analysis, we could see that in the age group of 15 - 20, overall satisfaction was 8.83 (1.02) and the mean pain score based on VAS was 8.83 (1.52) (Table 6). As the age increased, the overall satisfaction also increased peaking at 9.50 (0.54) in 46 - 50 years age group. The same tendency has been observed in the mean pain score also. The exception being subjects above the age of 50, which had a reduction in both the values. Four cases from 11 cases diagnosed with *periapical abscess* required palatal re-anesthetization and the rest of the cases where palatal re-anesthetization was done were without any periapical pathologies. None of the cases diagnosed with *periapical granuloma*, required palatal re-anesthetization. These advantages of articaine also influenced the final VAS score for overall satisfaction from the patient. The presence of palatal anesthesia was effected more by the presence of the periapical lesions and age than the presence or absence of multiple roots. The number of tooth for extraction at a single time also didn't affect the incidence of palatal anesthesia.

Age groups (years)	Overall satisfaction Mean (SD)	Pain score Mean (SD)
15 - 20	8.83 (1.02)	8.83 (1.52)
21 - 25	9.44 (0.52)	9.33 (0.70)
26 - 30	9.50 (0.57)	9.75 (0.50)
31 - 35	9.50 (0.70)	9.50 (0.70)
36 - 40	9.20 (0.83)	9.60 (0.54)
41 - 45	10.00 (0)	10.00 (0)
46 - 50	9.50 (0.54)	9.83 (0.40)
> 50	8.60 (2.17)	9.26 (1.20)

Table 6: Pain perception and satisfaction in each age groups.

Overall, articaine was able to provide palatal anesthesia with buccal injection alone, even in majority cases with periapical pathology and the patients exhibited increased satisfaction level with articaine.

Discussion

Like many reflexes of the body, pain is also a protective mechanism to protect the individual from harm. Minimal injections and maximal effect have been the subject of multiple researches in the field of oral and maxillofacial surgery [4]. Till date, lignocaine is considered as the gold standard in the field of oral and maxillofacial surgery in providing anaesthesia. For attaining anaesthesia for maxillary procedures, it is imperative that the operating surgeon needs to administer both buccal and palatal nerve blocks to attain sufficient anaesthesia. In this, the palatal anaesthesia in itself is more painful during administration. This can be attributed to the firm adherence of the palatal tissues to the underlying bony structure. When local anaesthetic (LA) is injected, this causes hydro-separation of the attached tissues leading to severe pain during administration. Although the very motto in administering local anaesthetics is abolishing pain, the very technique of palatal anaesthesia is in itself painful which negates the whole idea of painless dentistry.

In recent times, there have been many new advents in the field of pharmacology pertaining to local anaesthesia. One such drug is articaine, which has begun to show a promising and effective alternative to lignocaine in attaining anaesthesia. It differs from other anaesthesia drugs due to the presence of a *thiophene ring* which replaces the aromatic ring. It also carries an additional ester ring which increases its intrinsic potency, liposolubility and also has increased plasma protein binding capacity [5]. It is the only amide anaesthetic drug with an ester group. This allows hydrolysis in unspecific blood esterases [6]. Malamed, *et al.* compared the efficacy and safety of 4% articaine with 2% lidocaine, both with epinephrine 1:100000, and observed that articaine was as effective as lignocaine in providing anaesthesia for clinical use [7]. Because of the increased concentration required to achieve anaesthesia, it has been classified under pregnancy category class-C [8].

The aim of this study was to analyze whether the increased penetration properties of articaine can aid in attaining palatal anaesthesia with a single buccal infiltration of a full cartridge (1.7 ml). We concluded that it was effective in providing palatal anaesthesia in 73.5% of cases following buccal infiltration alone. The cases wherein articaine was used, the patients reported an increased overall satisfaction level in the VAS scale which also consented with other studies from the literature. In another study where articaine and lignocaine were compared for maxillary extractions in 71 patients by Fan, *et al.* [9], they concluded that for routine extraction of maxillary teeth, palatal anaesthesia may not be required when articaine hydrochloride is used which corroborates the results of this study. Badcock, *et al.* [10] compare lignocaine and placebo saline palatal infiltration in the extraction of maxillary third molars and concluded that the use of articaine can eliminate the need for palatal infiltration. Concomitantly, one drawback of this study is that we did not differentiate between different teeth so as to assess whether the anatomical thickness of the cortical bone at various locations had any influence on the palatal anaesthesia achieved [6].

From this study, we also noticed that the age changes related to the maxilla also affect the incidence of palatal anaesthesia post buccal infiltration. Hence further studies are required for the identification of the particular age groups where this ability of articaine can be utilized to the maximum and be standardized for general use. We also noticed it was effective in providing anaesthesia even in the presence of periapical lesions except for four cases having a periapical abscess. Although injected at a single site, in case of multiple teeth extractions, the same was enough for attaining buccal anaesthesia for all the teeth to be extracted- up to a maximum of two teeth on average on either side of the site of injection.

From the 50 samples, none of the patients reported any adverse reactions from the same. Although no allergic reactions were noted, it is well documented in the literature that articaine with epinephrine is contraindicated in patients with known sensitivity to sulfide drugs and amide local anaesthetics [11]. Like prilocaine, articaine also has the potential to cause methemoglobinemia along with neuropathies [7].

Although there are studies which corroborate with our findings, Haas, *et al.* [12] reported a study where he wasn't able to observe palatal anaesthesia post maxillary infiltration with articaine, even after a delay of 25 minutes before starting the procedure. But there are also certain claims that palatal anaesthesia can be less painful after the use of articaine on the buccal side [13].

Conclusion

From the data available in this study, it can be said that articaine can be used alone as buccal infiltration to obtain both buccal and palatal anaesthesia. Even in cases where it was not effective, literature shows that it can reduce the trauma caused to the patient during the procedure. Further studies with a large sample size with categorization based on age and tooth to be extracted needs to be conducted to attain a more conclusive data.

Acknowledgement

Nil.

Conflict of Interest

Nil.

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