

## Assessment of Intraoperative Pain in Mandibular Third Molar Extractions with Articaine- A Retrospective Study

Research Article

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### Abstract

Pain control through block of the inferior alveolar nerve is one of the loco regional anaesthetic techniques most widely used in oral surgery. Comparative study is made of the anaesthetic efficacy of articaine versus lidocaine during the surgical extraction of mandibular third molars. This is a Retrospective study conducted in the university setting. This study included patients who reported to private dental hospital for the removal of mandibular third molars. Inclusion criteria of this study included patients who required removal of mandibular third molars and exclusion criteria included patients with drug allergies and patients who are pregnant or currently lactating. Data was collected and tabulated in excel. Data was analysed using IBM SPSS Statistical Analyzer(23.0 version). Frequency distribution and descriptive analysis were carried out. The association between the variables was analysed and assessed using Pearson Chi-square test. P value < 0.05 was considered to be statistically significant. Patients experienced less intraoperative pain with the administration of articaine compared to lidocaine. Anaesthetic efficacy and duration of action were found to be superior with articaine over lidocaine

**Keywords:** Intraoperative; Articaine; Lidocaine; Third Molar Extraction; Anaesthetic Efficacy.

### Introduction

Pain control through block of the inferior alveolar nerve is one of the loco regional anaesthetic techniques most widely used in oral surgery. Various medications and analgesic techniques used before the operation can prevent sensitization and postoperative pain. To have an effective pain control in the majority of procedures in dentistry which includes trauma management, osteotomies, extractions and other surgical procedures, a number of local anaesthetics are present and are studied upon for their efficacy in pain control and hence supremacy over the existing local anaesthetics [5, 37, 26, 1, 14]. Local anaesthetic agents are also used in the surgical excision of salivary gland and salivary duct swelling such as ranula [32]. The concept of local anaesthetic action is based on hindering the generation and conduction of nerve impulses. Thus, the impulse is aborted, hindered from reaching the brain and is not interpreted as pain by the patient. The choice of anaesthetic solution should be based on three main clinical considerations: anaesthetic potency, latency and duration of the anaesthetic effects [6, 29, 53]. Lidocaine, synthesised by Lofgren

in 1943, was the first amide anaesthetic prepared for local application [31]. Lidocaine is the local anaesthetic most commonly used for pain control [30]. The emergence of articaine is generating considerable interest because of its considerable faster onset of action and longer duration of action and its comparable safety and potency. Articaine hydrochloride or 4-methyl- 3-propinamido-2-thiophene-carboxylic acid methyl ester hydrochloride, was synthesised by Rusching in 1969 [22, 29]. The pharmacological characteristics of this anaesthetic are responsible for its main advantages with respect to other local anaesthetics and include substitution of the aromatic ring with a thiopenic ring that increases the liposolubility of the drug as well as its potency [23, 40]. Articaine is the only amide local anaesthetic agent containing an ester group in its molecular structure [12]. The clinical advantages of Articaine include the duration of its anaesthetic effort – only surpassed by ultra long acting anaesthetics and its superior diffusion through Bony tissue [54]. The onset of Articaine is reported to be 1-2 minutes. It was reported to be a safe anaesthetic and could be used safely in children was reported by Malamed. Vasodilator activity affects both the anaesthetic potency and the duration.

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Greater vasodilator activity leads to increased blood flow to a region, which leads to a rapid removal of anesthetic molecules from the injection site. This will decrease both the anesthetic potency, and duration. Both articaine and lidocaine as plain solutions without a vasoconstrictor added would be ineffective and more toxic because of their vasodilator activity. In order to improve both the duration and safety, adrenaline is added which acts as a vasoconstrictor. The pH of most of the anesthetic agents is acidic which causes the discomfort during administration. To control the pH of anesthetics, a number of additives are added to make it alkaline such as bicarbonates or carbon dioxide which makes the drug administration comfortable. The pH of plain local anesthetic solution is approximately 5.5; vasoconstrictor containing solution is about 4.5. The alkalized solution has a faster onset of action and relatively higher potency. The pain of tooth extraction varies among individuals, and each extraction of an individual may be quite different. After surgical procedures patients are most commonly administered with antibiotics and analgesics to avoid further complications [24, 16, 49, 44]. The duration of the anaesthetic effect varies according to the amount of vasoconstrictor added to the formulation [28].

Previously our team has a rich experience in working on various research projects across multiple disciplines. (Jain, 2017 [14]); Varghese, Ramesh and Veeraiyan, 2019 [55]; (Ashok and Ganapathy, 2019 [2]); (Padavala and Sukumaran, 2018 [33]); (Ke et al., 2019 [18]); (Ezhilarasan, 2018 [8]); (Krishnan et al., 2018 [35]); (Ezhilarasan, Sokal and Najimi, 2018 [42]); (Pandian, Krishnan and Kumar, 2018 [11]); (Ramamurthy and Mg, 2018 [58]); (Gupta, Ariga and Deogade, 2018 [36]); (Vikram et al., 2017); (Paramasivam, Vijayashree Priyadharsini and Raghunandhakumar, 2020 [34]); (Palati et al., 2020); (Samuel, Acharya and Rao, 2020 [48]). Now the growing trend in this area motivated us to pursue this project.

This present study compares the efficacy of Articaine versus lidocaine in application to inferior alveolar nerve blocks for the surgical extraction of mandibular third molars by assessing the duration of action of local anaesthetic agents used and intra operative pain experienced by the patients.

## Materials And Methods

This retrospective study was conducted in the university setting. Data chosen for evaluation were patients who reported to a pri-

vate dental college for the removal of mandibular third molars. The details of the patients were obtained from analysis of 86,000 patients from June 2019 to March 2020 from patient dental records. The study was conducted after getting ethical approval from the Institutional Ethical Committee (Ethical Approval Number: SDC/SIHEC/2020/DIASDATA/0619-0320). Cross verification was done with the help of patient dental records data. To minimize sampling bias all data were included.

### Inclusion criteria:

- Subjects above 18 years age.
- Subjects who required removal of impacted mandibular third molars, prophylactic removal of mandibular third molars.
- Subjects with acute pericoronitis.
- Patient records with complete data and photographs during follow up.

### Exclusion criteria:

- Subjects with drug allergies.
- Subjects who are pregnant or currently lactating.
- Patient records with incomplete data.

A total of 128 records which satisfied the inclusion and exclusion criteria were included in the study. The age range of patients included for this study was 18-80 years. From the preoperative and postoperative records of the study population, data such as age, gender, postoperative findings and observations were obtained. Data was downloaded from the patient dental records and imported to Excel. Data which was not required were excluded. Data was analysed using IBM SPSS Statistical Analyzer (23.0 version). Frequency distribution and descriptive analysis were carried out. The correlation and association between the variables were analysed and assessed using Pearson Chi-square test. p value less than 0.05 was considered to be statistically significant. Results were obtained in the form of graphs.

## Results & Discussion

This study included 128 participants. Among these 69.53% of patients belonged to the age group 18-40 years, 20.31% of patients belonged to the age group 41-60 years and remaining 10.16% of patients belonged to the age group 61-80 years (Figure-1). Among

**Figure 1: This bar graph represents the age distribution of the study population. Majority of the study population belonged to the age group 18-40 years i.e; 69.53%, 20.31% of patients belonged to the age group 41-60 years and remaining 10.16% of patients belonged to the age group 61-80**

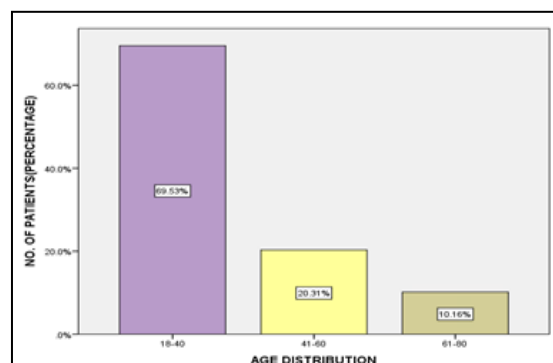


Figure 2: This bar graph depicts the gender distribution of the study population.53.91% of patients were males and 46.09% of patients were females who underwent extraction of mandibular third molars

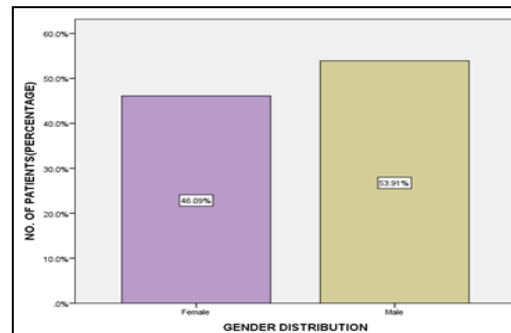


Figure 3: This bar graph represents the usage of local anaesthetic agents among the study population.About 92.97% of patients were administered with lignocaine of adrenaline and only 7.03% of patients were administered with articaine for the extraction of mandibular third molars.

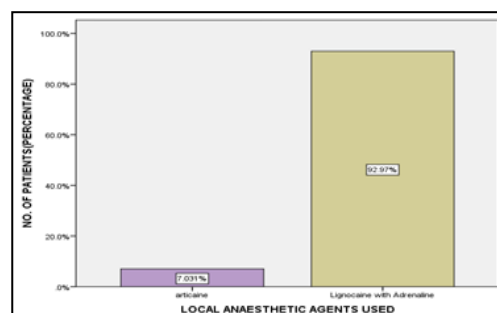


Figure 4: This bar graph represents the association between local anaesthetic agent used and duration of action of the local anaesthetic agents.X-axis represents the local anaesthetic agent used and Y-axis>represents the number of patients who underwent mandibular third molar extraction. Pearson Chi square test was done,p value = 0.000>0.05 hence the association is statistically significant proving that local anaesthetic agent used influences duration of action in patients during mandibular third molar extraction.

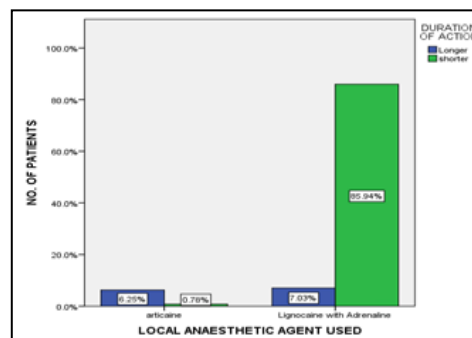
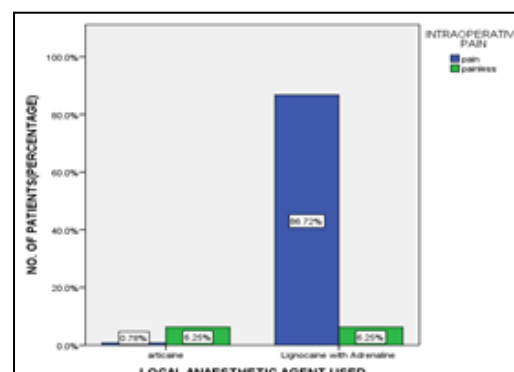


Figure 5: This bar graph represents the association between local anaesthetic agent used and intraoperative pain experienced by patients during extraction of mandibular third molar.X-axis represents the local anaesthetic agent used and Y-axis represents the number of patients who underwent mandibular third molar extraction.Pearson Chi square test was done, p value = 0.000>0.05 hence the association is statistically significant proving that local anaesthetic agent used influences the intraoperative pain experienced by patients during mandibular third molar extraction.



these 46.09% were female participants and the remaining 53.91% were male participants who underwent extraction of mandibular third molars (Figure-2). In regard to the usage of local anaesthetic agents among the study population, about 92.97% of patients were administered with lignocaine with adrenaline while only 7.03% of patients were administered with articaine for the extraction of mandibular third molars (Figure-3). In terms of local anaesthetic agents used for the extraction, duration of action of local anaesthetic agents was found to be shorter in 85.94% of patients administered with lignocaine with adrenaline while only 0.78% of patients administered with articaine showed shorter duration of action (Figure-4). About 86.72% of patients administered with lignocaine with adrenaline showed higher incidence of intraoperative pain while only 0.78% of patients administered with articaine showed incidence of intraoperative pain during extraction of mandibular third molar (Figure-5).

In this study, we compared the anaesthetic efficacy of articaine and lignocaine. Results from this study showed that the duration of action of articaine was found to be longer compared to lignocaine and intra operative pain experienced by patients was less with articaine than lignocaine and no complications were observed in patients administered with articaine. The duration of the effect of the local anesthetic is dependent on the injection site or concentration of vasoconstrictor present in the anesthetic solution, among other factors.

These results are in line with the results in a study conducted by Deepashri H et al which also showed articaine to be more comfortable to the patients which exhibits more profoundness, less onset of action, less bleeding and larger duration of anaesthesia [7]. Kashyap et al also stated that 4% articaine hydrochloride has more efficacious local anaesthetic ability, mild injection pain and reasonable duration of anaesthesia, low intraoperative pain and reasonable duration of anaesthesia [17]. Silva Junior et al concluded in their study that articaine has improved anaesthetic efficacy in third molar extractions [51]. Alejandro Sierra Rebolledo et al conducted a randomised controlled trial with the conclusion of 4% articaine having better pharmacological performance compared to 2% lidocaine in terms of its latency and duration of the anaesthetic effect [50].

The duration of the anaesthetic effect of an agent is proportional to the degree of protein binding. However, the duration of the effect of the local anaesthetic is also dependent on the injection site or concentration of vasoconstrictor present in the anaesthetic solution, among other factors. Articaine presents one of the greatest protein binding percentages of all amide local anaesthetics, comparable only to ultra long action agents such as bupivacaine, ropivacaine and etidocaine. This in turn implies a longer duration of the anaesthetic effect [3]. In contrast, Ruprecht S et al in their study concluded that there were no statistically significant differences between the two solutions i.e., articaine and lignocaine in their anaesthetic efficacy [46]. Gagnon S et al stated that there was an increased incidence in nerve alterations leading to paresthesia with the administration of 4% articaine [25]. Haas and Lennon in a review of 143 paresthesias, found the latter to be more frequent when articaine was used [13]. Therefore, dentists should have sound knowledge regarding the properties usage and disposal of local anaesthesia and its complications [38, 20].

Our institution is passionate about high quality evidence based

research and has excelled in various fields [39, 43, 57, 9, 41, 52, 56, 4, 27, 45, 47]. We hope this study adds to this rich legacy.

## Conclusion

Within the limitations of this study, it can be concluded intraoperative pain was higher in patients with the administration of lignocaine with adrenaline. Duration of action and anaesthetic efficacy of articaine was found to be superior compared to lidocaine. Less intraoperative pain was experienced by patients with the administration of articaine in extraction of mandibular third molars. However, owing to the small study population, it is necessary to conduct multicentre studies with large population to further study the anaesthetic efficacy of articaine.

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