Journal for Educators, Teachers and Trainers
The PROFESIOLab electronic, peer-reviewed, open-access Magazine

ISSN 1989 – 9572

DOI: 10.47750/jett.2022.13.06.042

Awareness On Prilocaine Usage In Dental Surgery Among Dental Undergraduates

Bondada Venkata Mani Anirudh[1]

Rakshagan V[2]*

Dhanraj Ganapathy[3]

Revathy Duraiswamy[4]

Journal for Educators,Teachers and Trainers, Vol. 13 (6)

https://jett.labosfor.com/

Date of reception: 12 Oct 2022

Date of revision: 15 Nov 2022

Date of acceptance: 07 Dec 2022

Bondada Venkata Mani Anirudh, Rakshagan V, Dhanraj Ganapathy, Revathy Duraiswamy (2022). Awareness On Prilocaine Usage In Dental Surgery Among Dental Undergraduates*Journal for Educators, Teachers and Trainers*,Vol. 13(6). 443-453.

---

[1]Department of Prosthodontics Saveetha Dental College, Saveetha Institute of Medical and Technical Sciences Saveetha University, Chennai 600077, India
[2]Reader, Department of Prosthodontics, Saveetha Dental College, Saveetha Institute of Medical and Technical Sciences, Saveetha University, Chennai 600077, India
[3]Professor and Head , Department of Prosthodontics, Saveetha Dental College, Saveetha Institute of Medical and Technical Sciences, Saveetha University, Chennai 600077, India
[4]Senior lecturer, Department of Prosthodontics, Saveetha Dental College, Saveetha Institute of Medical and Technical Sciences, Saveetha University, Chennai 600077, India

Journal for Educators, Teachers and Trainers
The LabOSfor electronic, peer-reviewed, open-access Magazine

Journal for Educators, Teachers and Trainers, Vol. 13 (6)
ISSN 1989 – 9572
https://jett.labosfor.com/

Awareness On Prilocaine Usage In Dental Surgery Among Dental Undergraduates

Bondada Venkata Mani Anirudh[1], Rakshagan V[2]*, Dhanraj Ganapathy[3], Revathy Duraiswamy[4]
[1]Department of Prosthodontics Saveetha Dental College, Saveetha Institute of Medical and Technical Sciences Saveetha University, Chennai 600077, India
[2]Reader, Department of Prosthodontics, Saveetha Dental College, Saveetha Institute of Medical and Technical Sciences, Saveetha University, Chennai 600077, India
[3]Professor and Head , Department of Prosthodontics, Saveetha Dental College, Saveetha Institute of Medical and Technical Sciences, Saveetha University, Chennai 600077, India
[4]Senior lecturer, Department of Prosthodontics, Saveetha Dental College, Saveetha Institute of Medical and Technical Sciences, Saveetha University, Chennai 600077, India
*Corresponding Author
Email: 151701034.sdc@saveetha.com[1], rakshagan.sdc@saveetha.com[2], dhanraj@saveetha.com[3]

ABSTRACT
Introduction: A local anesthetic (LA) is a type of medication that prevents pain sensation. A local anesthetic creates an absence of pain or loss of sensation in a specified location of the body without loss of consciousness. The aim of this study was to assess the awareness of prilocaine usage in dental surgery.
Materials and method: A survey was conducted among 100 dental undergraduates, to evaluate their awareness on prilocaine usage in dental surgery. The survey instrument was a questionnaire that was prepared after extensive review of the existing literature. The validated questionnaire consisted a total of 14 questions. The questionnaire was shared to the participants using online survey platform. The responses obtained were tabulated and reliability of the data was checked. The statistics were done using SPSS software and Chi square test was done to check the association with a p value of 0.05 said to be statistically significant.
Results: A total of 100 dental undergraduate students have taken the survey in which 27% were 2nd year students, 71% students were in 3rd year and 2% were in 4th year. 98% were aware about amide and ester based. 79% of the students responded that the maximum dosage of prilocaine is 8mg/kg. 96% of the students responded that prilocaine has less toxicity than lignocaine. 92% of the students believe the main problem caused by overdosage of prilocaine is Methemoglobinemia. Chi-square analysis was done between the year of study and onset of action time of prilocaine where $p<0.05$(p-value-0.019), which was statistically significant.
Conclusion: Most of the students were aware about prilocaine and its uses and side effects and how it differs from lignocaine and this study helps in understanding it.

Keywords: Prilocaine, Anesthesia, Amides, Lignocaine, Innovative technique

INTRODUCTION

A local anesthetic (LA) is a type of medication that prevents pain sensation. A local anesthetic creates an absence of pain or loss of sensation in a specified location of the body without loss of consciousness.A local anesthesia consists of a local anaesthetic agent, Reducing agent(Sodium meta-bisulphite), Preservative(Methylparaben), Diluting agent(Distilled water),Fungicide(Thymol) Isotonic solution(Sodium chloride or Ringer's Solution) Vasoconstrictor(adrenaline), To regulate the pH Sodium hydroxide are often used. Vasoconstrictor can cause decreased blood flow to the site of injection,it can lower the risk of local toxicity, high volume of local anaesthetic agent can remain in and around the nerve for an extended period which can increase the duration of action. Preservative helps in stability of local anesthesia which is maintained by adding agents such as methyl paraben. Reducing agents can act as preservatives for the vasoconstrictor agents such as adrenaline which are usually unstable in solution.[1,2]
LA are classified based on Amides,Esters and Quinolones. The first local anesthetic agent to be widely unutilized in dentistry was cocaine but it had major drawbacks, like high tendency for addiction and a short duration of action.[3]. Amide based anesthetics have advantages compared to ester based agents, like their low rate of allergenicity[4]. Prilocaine is an amide based LA. The most commonly used local anesthetic is lignocaine

which is an amide based When comparing lignocaine and prilocaine, prilocaine is less toxic and a vasodilator than lidocaine [5]. Prilocaine are often a good choice for patients for whom vasoconstrictor is contraindicated in cases such as unstable angina, uncontrolled severe hypertension, uncontrolled congestive heart failure and uncontrolled hyperthyroidism because adrenaline may cause acute hypertensive crisis, angina, arrhythmia or myocardial infarction[4,6–8]

The molecular structure of all local anesthetics usually consists of 3 components which are basically a lipophilic aromatic ring, an ester or amide linkage, and a tertiary amine. Local anesthetics usually act by binding to sodium channels and inhibit the intake of sodium into the cell which prevents cell depolarisation.[9–11]

Our team has extensive knowledge and research experience that has translate into high quality publications[12–20],[21–26],[27–31] Since local anesthetics are widely being used mainly in the field of dentistry, the aim of this study was to assess the awareness of prilocaine usage in dental surgery.

MATERIALS AND METHODS

An online questionnaire based survey was conducted among the dental undergraduate students of Saveetha Dental College, to evaluate their awareness on prilocaine usage in dental surgery. The participants did the survey voluntarily. Ethical approval and informed consent were obtained from the participants. The survey instrument which was a validated questionnaire was prepared after extensive review of the existing literature. The questionnaire was reviewed and changes were made to improve clarity of the questions to eliminate responses which are not valid. The questionnaire consisted of 14 questions. The questionnaire was shared to the participants using online survey platform to get maximum responses. Only completed surveys were taken for analysis and the incomplete ones were eliminated. The statistical test used was descriptive statistics. All the responses obtained were tabulated. The statistics were done using SPSS software. The difference in the awareness of prilocaine usage in dental surgery between various years of study were compared using the Chi-square test with a p-value of 0.05 set as statistically significant.

RESULTS AND DISCUSSION

A total of 100 dental undergraduate students have taken the survey in which 27% were 2nd year students, 71% students were in 3rd year and 2% were in 4th year(Fig-1). In a question regarding the types of LA, 98% were aware about amide and ester based LA(Fig-2). A question was asked whether prilocaine was a short acting LA or Intermediate acting LA in which 94% have answered intermediate(Fig-3). The next question was about the type of LA prilocaine and 98% have answered it is amide based(fig-4). 79% of the students responded that the maximum dosage of prilocaine is 8mg/kg(fig-5). 96% of the students responded that prilocaine has less toxicity than lignocaine(fig-6). 92% of the students believe the main problem caused by overdosage of prilocaine is Methemoglobinemia(fig-7). 93% of the students responded that the onset of action of prilocaine is 3 to 5 mins. 67% of students were aware about EMLA which is a eutectic mixture of equal quantities of lidocaine and prilocaine(Fig-8). Chi-square analysis was done between the year of study and onset of action time of prilocaine where $p<0.05$(p-value-0.019), which was statistically significant(Fig-9), Chi- square analysis was also done between year of study and the mixture name of lignocaine and prilocaine where $P<0.05$(p-value-0.00) which was statistically significant(Fig-10).

Studies show that prilocaine and lignocaine are almost similar but differ in a very few aspects[8,32], they have a similar benzene ring and a similar lipid solubility. Generally amide based local anesthetics are metabolized in the liver but in the case of prilocaine it is metabolised in the liver, kidney and lungs which makes it less toxic than lignocaine[33]. Prilocaine is the least vasodilator agent among the amide local anesthetics where the local anesthetic would stay around the nerve for longer duration which increases the depth of anesthesia[32,34] and also prilocaine has slightly less dissociation constant value (pKa-7.7) than compared to lignocaine(pKa-7.8) which can increase the onset time of action[35,36]. EMLA is a eutectic miscute of 2.5% of lignocaine and 2.5% of prilocaine. Use of EMLA as a topical local anesthetic can reduce pain during probing, rubber dam placement, during scaling, administering an injection especially while giving the palatine nerve block. EMLA usually has a melting point below room temperature which will turn into a liquid oil where it can penetrate the mucosa to a depth of 5mm[37,38].

Studies have have shown the comparisons of prilocaine with lignocaine, in one study prilocaine and lignocaine were compared by giving a buccal infiltration for mandibular 1st molar where it showed the success rate for lignocaine was 33% and prilocaine was 32%[39] and another study compared the anesthetic efficacy in maxillary lateral incisors and first molars and have found out that they were equivalent for incidence of pulpal anesthesia[40]. Studies show that patients report that buccal injections are less painful when compared to palatal injections. This can be due to the reason that when giving injections in the palate, it goes below the periosteum(sub-periosteum) which can be painful[34]. Use of topical anesthetic can reduce the pain while inserting the needle.

Prilocaine is almost similar to lignocaine , but is better in providing rapid dental anesthesia due to its faster onset of time and is also less toxic than lignocaine. Limitations of the study include short sample size and single centred study.

CONCLUSION

In conclusion, most of the students were aware about prilocaine and its uses and side effects and how it differs from lignocaine and this study helps in understanding it.

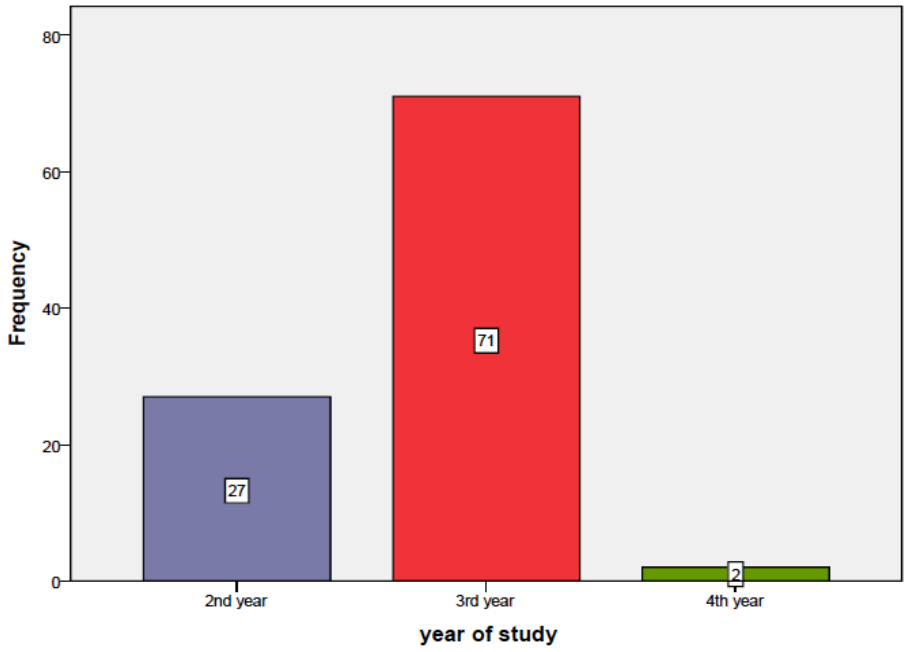

Figure-1: This graph explains the number of students who have taken the survey based on the Year of study. The X-axis represents the Year of study and the Y axis represents the frequency or count. 2nd year students(Purple) were 27%, 3rd year students(Red) were 71%, 4th year students (Green)were 2% .

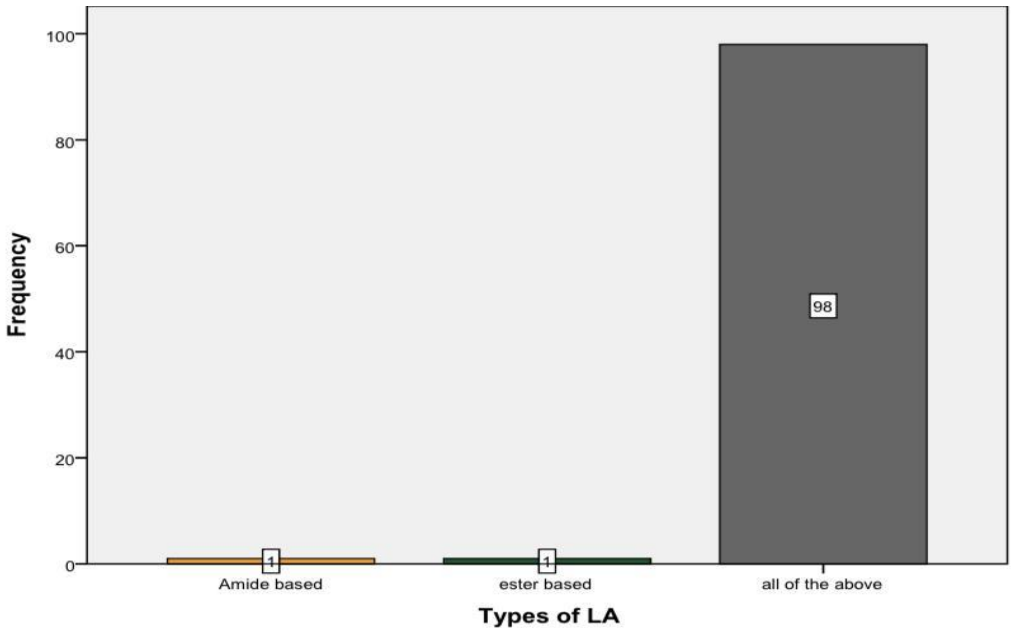

Figure-2: This graph explains the number of students who have responded to the question on types of LA. The X-axis represents the Types of LA and the Y axis represents the frequency or count. Amide based(yellow) were 1%, ester based(green) were 1%, All of the above were 98%(Gray).

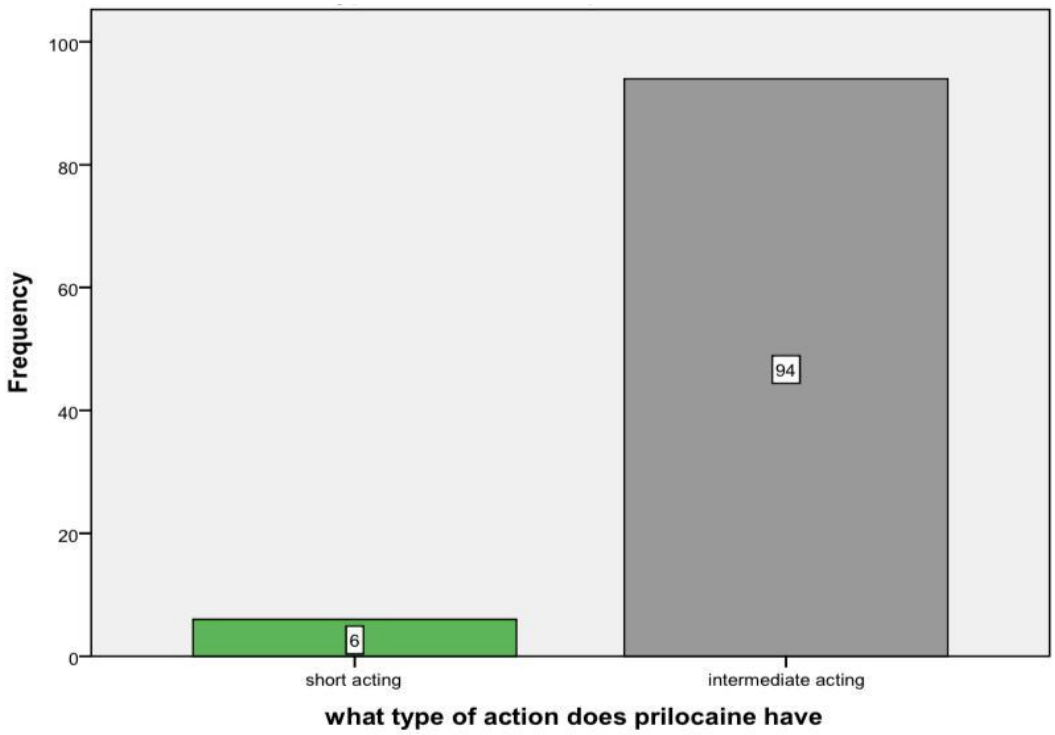

Figure-3: This graph explains the number of students who have responded to the question on what type of action does prilocaine have . The X-axis represents the Types of LA action and the Y axis represents the frequency or count.short acting(green) were 6%, , Intermediate acting were 94%(Gray).

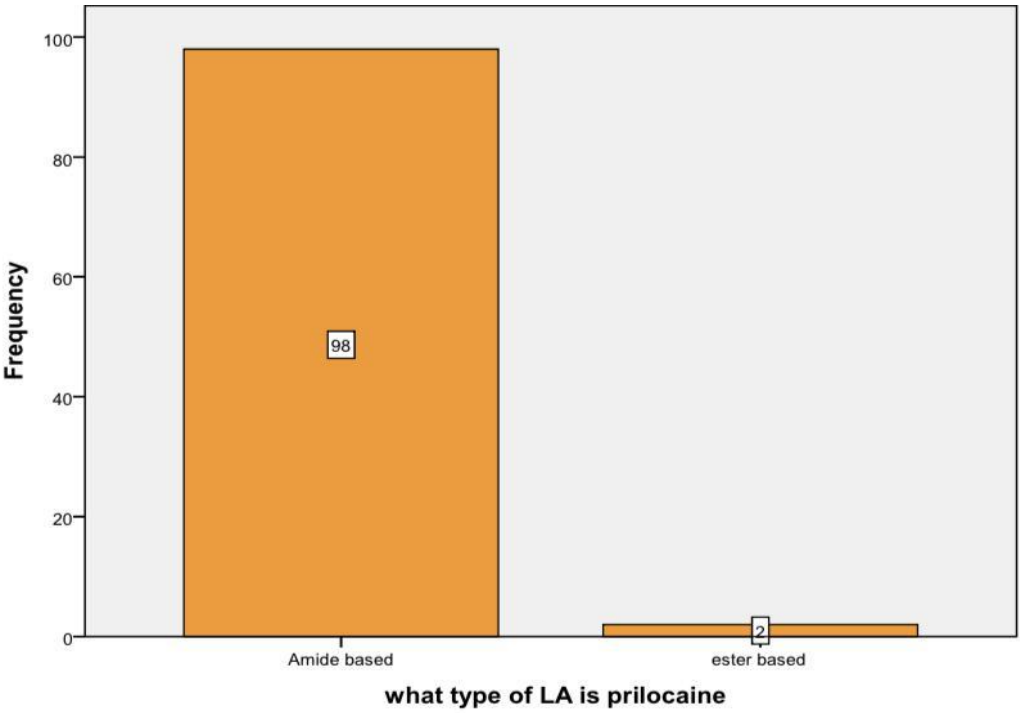

Figure-4: This graph explains the number of students who have responded to the question on what type of LA is prilocaine . The X-axis represents the Types of LA and the Y axis represents the frequency or count. Amide based were 6% and ester based were 94%.

.

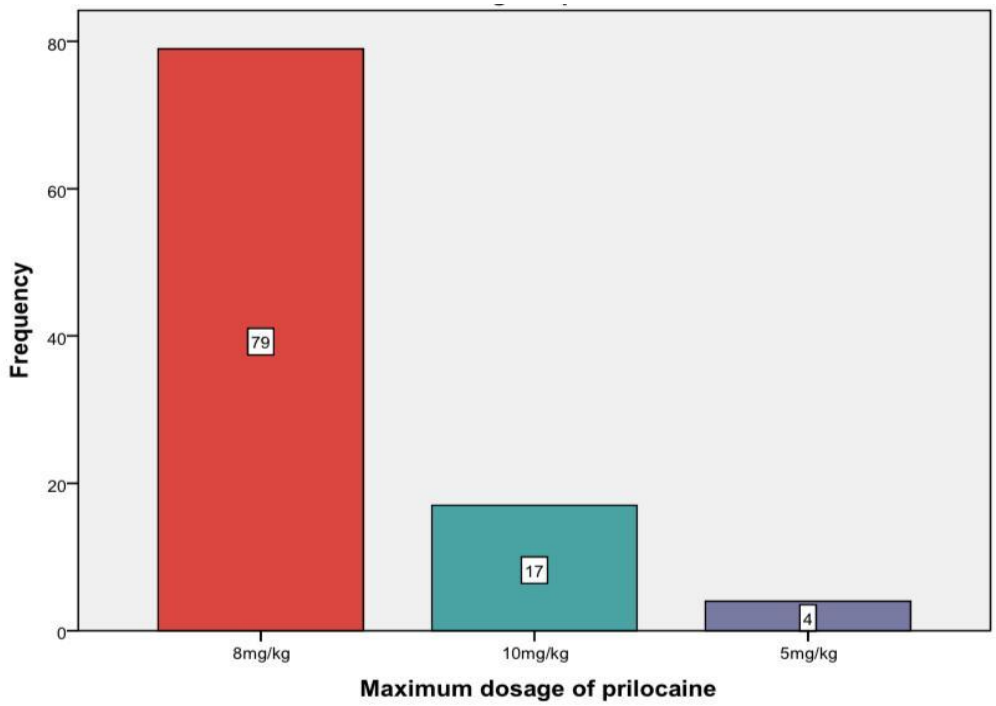

Figure-5: This graph explains the number of students who have responded to the question on the maximum dosage of prilocaine. The X-axis represents the different quantities of dosage and the Y axis represents the frequency or count. 8mg/kg(red) were 79%, , 10mg/kg were 17 %(Turquoise) and 5mg/kg(purple) were 4%.

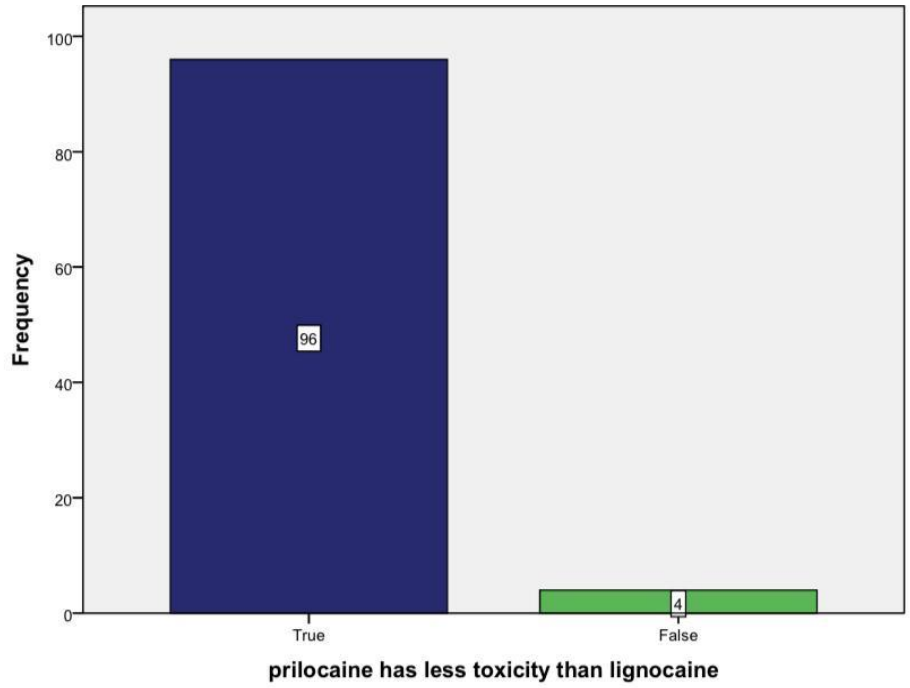

Figure-6: This graph explains the number of students who have responded to the question on whether prilocaine has less toxicity than lignocaine. The X-axis represents true(blue)-96%, false(green)-4% and the Y axis represents the frequency or count.

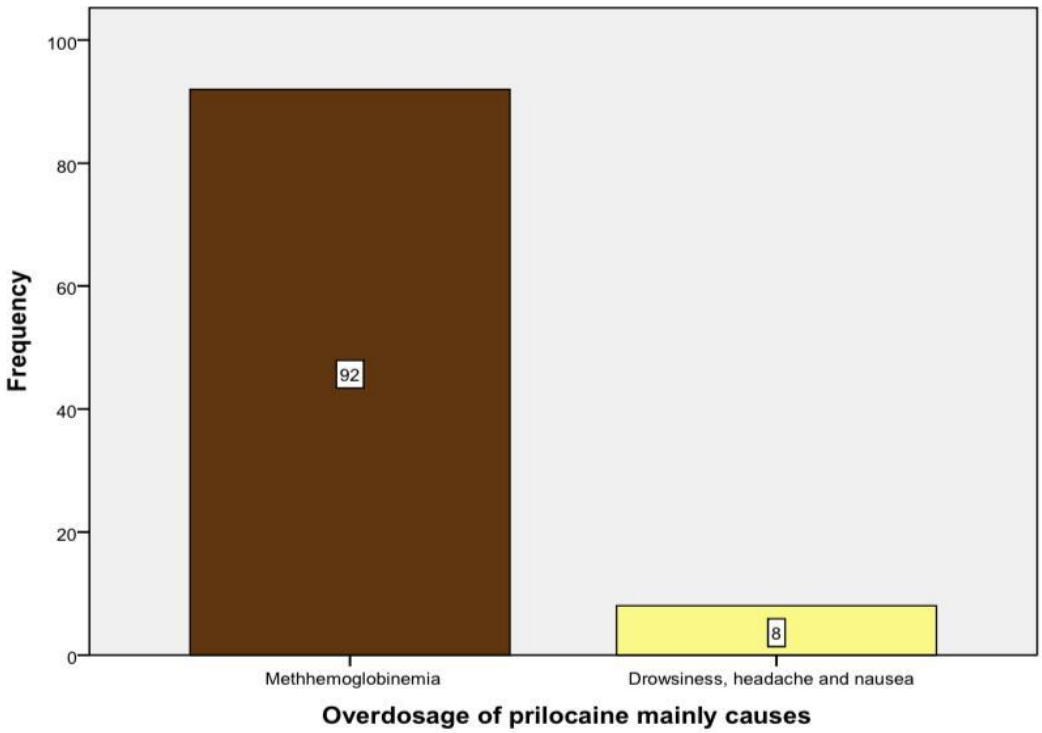

Figure-7: This graph explains the number of students who have responded to the question on what is caused by overdose of Prilocaine. The X-axis represents the signs and symptoms and the Y axis represents the frequency or count. 92%(brown) responded to Methemoglobinemia and 8% responded to drowsiness,headache and nausea(yellow).

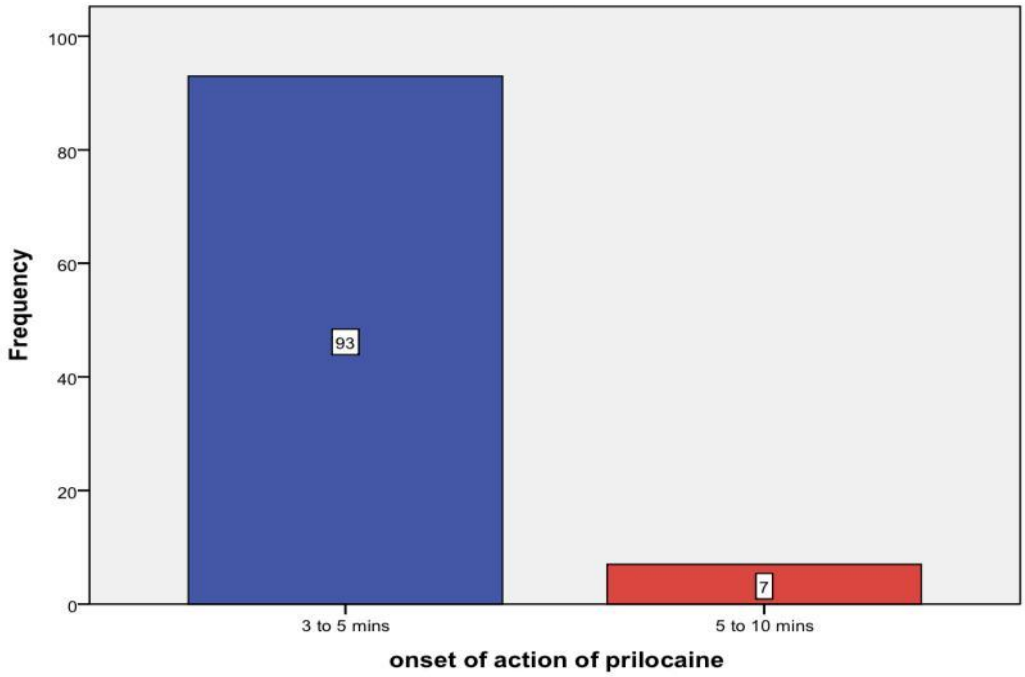

Figure-8: This graph explains the number of students who have responded to the question on the onset of action of prilocaine. The X-axis represents the different onset of action and the Y axis represents the frequency or count. 93% responded 3 to 5 mins (blue) and 7% responded to 5 to 10 mins(red).

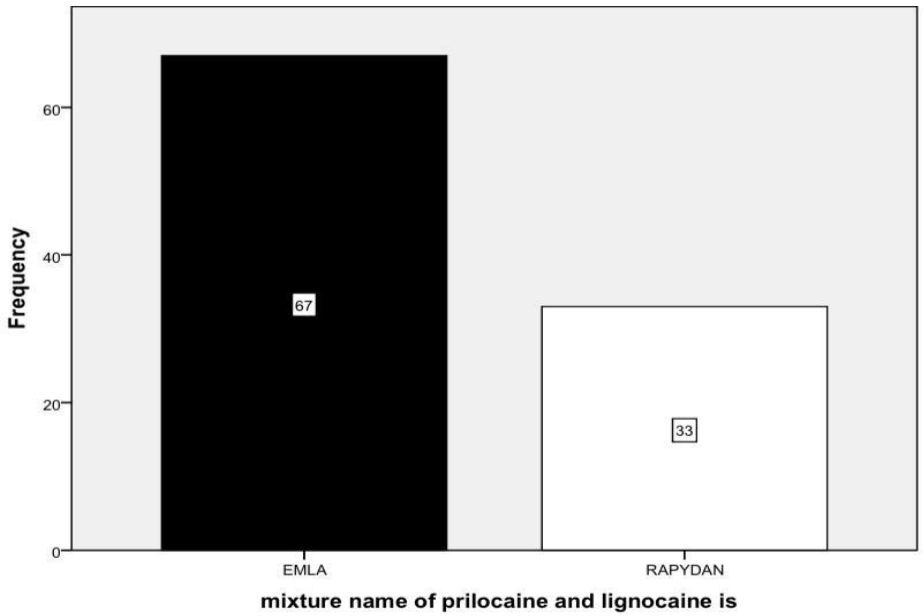

Figure-9: This graph explains the number of students who have responded to the question on the mixture name of prilocaine and lignocaine. The X-axis represents the different types of mixtures and the Y axis represents the frequency or count. 67% responded EMLA(Black) and 33% responded to RAPYDAN(white).

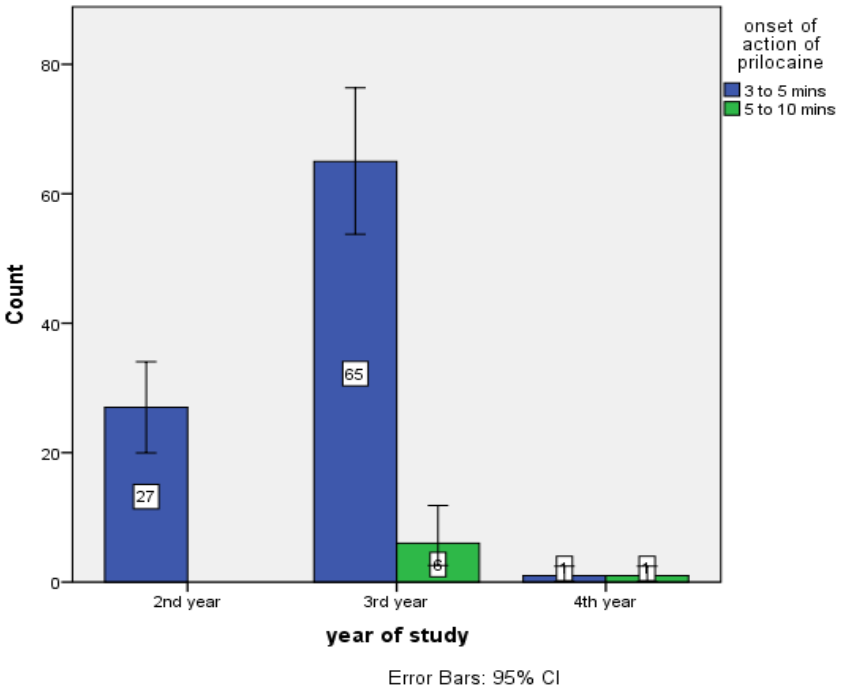

Figure-10: This error graph explains the correlation between the year of study of the students and the onset of action of prilocaine . The X-axis represents the different year of study and the Y axis represents the frequency or count. 3 to 5 mins is shown as blue and 5 to 10 mins is shown as green. 27% of the 2nd year students have answered 3 to 5 mins and 65% of the 3rd year students have answered 3 to 5 mins and 6% of 3rd year students have answered 5 to 10 mins. Chi- square analysis was done between the year of study of the students and the onset of action of prilocaine and p<0.05(p value-0.19) which is statistically significant.

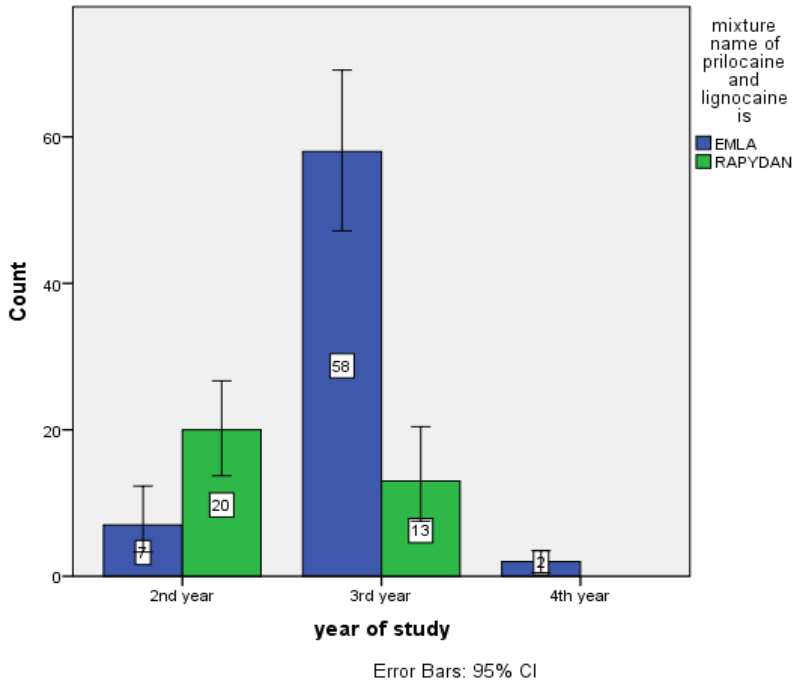

Figure-11: This error graph explains the correlation between the year of study of the students and the mixture name of prilocaine and lignocaine . The X-axis represents the different year of study and the Y axis represents the frequency or count. EMLA is shown as blue and RAPYDAN is shown as green. 7% of the 2nd year students have answered EMLA and 20% have answered RAPYDAN, 58% of the 3rd year students have answered EMLA and 13% have answered RAPYDAN and 2% of 4th years have answered EMLA. Chi- square analysis was done between the year of study of the students and the mixture name of prilocaine and lignocaine and p<0.05(p value-0.00) which is statistically significant.

Funding
The present project is supported/funded/sponsored by Saveetha Institute of Medical and Technical Sciences, Saveetha Dental College and Hospitals, Saveetha University.

Conflict Of Interest
None

REFERENCES

1. Malamed SF. Handbook of Local Anesthesia. Mosby Incorporated; 2004. 399 p.
2. David D, Ganapathy D. Knowledge and Awareness of Articaine Use among Dental Students - A Survey. Journal of Pharmaceutical Research International. 2020 Aug 25;55–63.
3. Halsted Ws. Pracital Comments On The Use And Abuse Of Cocaine; Suggested By Its Invariably Successful Emplogyment In More Than A Thousand Minor Surgical Operations [Internet]. Vol. 28, Survey of Anesthesiology. 1984. p. 156. Available from: http://dx.doi.org/10.1097/00132586-198404000-00072
4. Shafaifard S, Khan RH. The Use of Lidocaine and Prilocaine in Dental Surgery. A Review. Archives of Anesthesiology and Critical Care. 2016 Jun 13;2(2):197–9.
5. Kumaran GV, Jeevanandan G, Ganapathy D. USAGE OF LOCAL ANAESTHESIA IN PAEDIATRIC DENTISTRY-A REVIEW. PalArch's Journal of Archaeology of Egypt/Egyptology. 2020;17(7):1912–21.
6. Little JW, Falace D, Miller C, Rhodus NL. Dental Management of the Medically Compromised Patient - Pageburst on VitalSource. Elsevier Health Sciences; 2007. 704 p.
7. Hashemi SHJ, Ladez SR, Moghadam SA. Comparative Assessment of the Effects of Three Local Anesthetics: Lidocaine, Prilocaine, and Mepivacaine on Blood Pressure Changes in Patients with Controlled Hypertension. Glob J Health Sci. 2016 Oct 1;8(10):54157.
8. Gazal G. Is prilocaine safe and potent enough for use in the oral surgery of medically compromised patients. Saudi Med J. 2019 Jan;40(1):97–100.

9. Becker DE, Reed KL. Local anesthetics: review of pharmacological considerations. Anesth Prog. 2012 Summer;59(2):90–101; quiz 102–3.
10. Becker DE, Reed KL. Essentials of local anesthetic pharmacology. Anesth Prog. 2006 Autumn;53(3):98–108; quiz 109–10.
11. Decloux D, Ouanounou A. Local anaesthesia in dentistry: a review. Int Dent J [Internet]. 2020 Sep 17; Available from: http://dx.doi.org/10.1111/idj.12615
12. Duraisamy R, Krishnan CS, Ramasubramanian H, Sampathkumar J, Mariappan S, Navarasampatti Sivaprakasam A. Compatibility of Nonoriginal Abutments With Implants: Evaluation of Microgap at the Implant-Abutment Interface, With Original and Nonoriginal Abutments. Implant Dent. 2019 Jun;28(3):289–95.
13. Anbu RT, Suresh V, Gounder R, Kannan A. Comparison of the Efficacy of Three Different Bone Regeneration Materials: An Animal Study. Eur J Dent. 2019 Feb;13(1):22–8.
14. Sekar D, Mani P, Biruntha M, Sivagurunathan P, Karthigeyan M. Dissecting the functional role of microRNA 21 in osteosarcoma. Cancer Gene Ther. 2019 Jul;26(7-8):179–82.
15. Sekar D. Circular RNA: a new biomarker for different types of hypertension. Hypertens Res. 2019 Nov;42(11):1824–5.
16. Bai L, Li J, Panagal M, M B, Sekar D. Methylation dependent microRNA 1285-5p and sterol carrier proteins 2 in type 2 diabetes mellitus. Artif Cells Nanomed Biotechnol. 2019 Dec;47(1):3417–22.
17. Sivasamy R, Venugopal P, Mosquera E. Synthesis of Gd2O3/CdO composite by sol-gel method: Structural, morphological, optical, electrochemical and magnetic studies. Vacuum. 2020 May 1;175:109255.
18. Sekar D, Nallaswamy D, Lakshmanan G. Decoding the functional role of long noncoding RNAs (lncRNAs) in hypertension progression. Hypertens Res. 2020 Jul;43(7):724–5.
19. Preethi KA, Lakshmanan G, Sekar D. Antagomir technology in the treatment of different types of cancer. Epigenomics. 2021 Apr;13(7):481–4.
20. Preethi KA, Sekar D. Dietary microRNAs: Current status and perspective in food science. J Food Biochem. 2021 Jul;45(7):e13827.
21. Bakshi HA, Mishra V, Satija S, Mehta M, Hakkim FL, Kesharwani P, et al. Dynamics of Prolyl Hydroxylases Levels During Disease Progression in Experimental Colitis. Inflammation. 2019 Dec;42(6):2032–6.
22. Ezhilarasan D. Dapsone-induced hepatic complications: it's time to think beyond methemoglobinemia. Drug Chem Toxicol. 2021 May;44(3):330–3.
23. Thakur RS, Devaraj E. Lagerstroemia speciosa(L.) Pers. triggers oxidative stress mediated apoptosis via intrinsic mitochondrial pathway inHepG2cells [Internet]. Vol. 35, Environmental Toxicology. 2020. p. 1225–33. Available from: http://dx.doi.org/10.1002/tox.22987
24. Ezhilarasan D, Shebi S, Thomas J, Chandrasekaran N, Mukherjee A. Gracilaria foliifera (Forssk.) Børgesen ethanolic extract triggers apoptosis via activation of p53 expression in HepG2 cells [Internet]. Vol. 15, Pharmacognosy Magazine. 2019. p. 259. Available from: http://dx.doi.org/10.4103/pm.pm_379_18
25. P. K, M. P, Samuel Rajendran R, Annadurai G, Rajeshkumar S. Characterization and toxicology evaluation of zirconium oxide nanoparticles on the embryonic development of zebrafish, Danio rerio [Internet]. Vol. 42, Drug and Chemical Toxicology. 2019. p. 104–11. Available from: http://dx.doi.org/10.1080/01480545.2018.1523186
26. Balusamy SR, Perumalsamy H, Veerappan K, Huq MA, Rajeshkumar S, Lakshmi T, et al. Citral Induced Apoptosis through Modulation of Key Genes Involved in Fatty Acid Biosynthesis in Human Prostate Cancer Cells: In Silico and In Vitro Study. Biomed Res Int. 2020 Mar 18;2020:6040727.
27. Arvind P TR, Jain RK. Skeletally anchored forsus fatigue resistant device for correction of Class II malocclusions-A systematic review and meta-analysis. Orthod Craniofac Res. 2021 Feb;24(1):52–61.
28. Venugopal A, Vaid N, Bowman SJ. Outstanding, yet redundant? After all, you may be another Choluteca Bridge! Semin Orthod. 2021 Mar 1;27(1):53–6.
29. Ramadurai N, Gurunathan D, Samuel AV, Subramanian E, Rodrigues SJL. Effectiveness of 2% Articaine as an anesthetic agent in children: randomized controlled trial. Clin Oral Investig. 2019 Sep;23(9):3543–50.

30. Varghese SS, Ramesh A, Veeraiyan DN. Blended Module-Based Teaching in Biostatistics and Research Methodology: A Retrospective Study with Postgraduate Dental Students. J Dent Educ. 2019 Apr;83(4):445–50.
31. Mathew MG, Samuel SR, Soni AJ, Roopa KB. Evaluation of adhesion of Streptococcus mutans, plaque accumulation on zirconia and stainless steel crowns, and surrounding gingival inflammation in primary molars: randomized controlled trial [Internet]. Vol. 24, Clinical Oral Investigations. 2020. p. 3275–80. Available from: http://dx.doi.org/10.1007/s00784-020-03204-9
32. Alsharif A, Omar E, Alolayan A-BB, Bahabri R, Gazal G. 2% lidocaine versus 3% prilocaine for oral and maxillofacial surgery. Saudi J Anaesth. 2018 Oct;12(4):571–7.
33. Karm M-H, Kim M, Park FD, Seo K-S, Kim HJ. Comparative evaluation of the efficacy, safety, and hemostatic effect of 2% lidocaine with various concentrations of epinephrine. J Dent Anesth Pain Med. 2018 Jun;18(3):143–9.
34. Meechan JG. Local anaesthesia: risks and controversies. Dent Update. 2009 Jun;36(5):278–80, 282–3.
35. Gazal G, Alharbi R, Fareed WM, Omar E, Alolayan AB, Al-Zoubi H, et al. Comparison of onset anesthesia time and injection discomfort of 4% articaine and 2% mepivacaine during teeth extractions. Saudi J Anaesth. 2017 Apr;11(2):152–7.
36. Gazal G, Alharbi AM, Al-Samadani KH, Kanaa MD. Articaine and mepivacaine buccal infiltration in securing mandibular first molar pulp anesthesia following mepivacaine inferior alveolar nerve block: A randomized, double-blind crossover study. Saudi J Anaesth. 2015 Oct;9(4):397–403.
37. Milani AS, Zand V, Abdollahi AA, Froughreyhani M, Zakeri-Milani P, Jafarabadi MA. Effect of Topical Anesthesia with Lidocaine-prilocaine (EMLA) Cream and Local Pressure on Pain during Infiltration Injection for Maxillary Canines: A Randomized Double-blind clinical trial. J Contemp Dent Pract. 2016 Jul 1;17(7):592–6.
38. Antoniazzi RP, Cargnelutti B, Freitas DN, Guimarães MB, Zanatta FB, Feldens CA. Topical intrapocket anesthesia during scaling and root planing: a randomized clinical trial. Braz Dent J. 2015 Jan;26(1):26–32.
39. Nydegger B, Nusstein J, Reader A, Drum M, Beck M. Anesthetic comparisons of 4% concentrations of articaine, lidocaine, and prilocaine as primary buccal infiltrations of the mandibular first molar: a prospective randomized, double-blind study. J Endod. 2014 Dec;40(12):1912–6.
40. Katz S, Drum M, Reader A, Nusstein J, Beck M. A prospective, randomized, double-blind comparison of 2% lidocaine with 1:100,000 epinephrine, 4% prilocaine with 1:200,000 epinephrine, and 4% prilocaine for maxillary infiltrations. Anesth Prog. 2010 Summer;57(2):45–51.