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Knowledge and awareness on administration of local anesthesia and its various complications faced by undergraduate and postgraduate dental students - a cross sectional study

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ABSTRACT
Local anaesthetics are an inseparable part of dental practice. Local anesthesia helps in relieving pain of the patient and also makes the comfortable during the dental procedure.also makes it painless as possible. Although they are effective in controlling pain, without proper knowledge of the safe dose and methods of administration inevitable complications arise. This study was done to assess knowledge and awareness of dental students on administration of local anesthesia and its various complications. An online survey was conducted with the help of Google forms was distributed to 103 undergraduate students pursuing dentistry. The questionnaire consisted of 15 questions that were based on dosage, administration and complication of local anesthesia. After obtaining the responses, data was tabulated in excel sheet and was subjected to statistical analysis. Results show that 40.8% agree that 4.4 mg/kg is the maximum dosage of 2% lidocaine with adrenaline, 45.6% students agree the importance of aspiration. 24.3% students know the complication of transient amaurosis to be blindness. 34% students know that ocular complications arise due to local anesthetic administration. No statistically significant difference noticed with the responses based on gender and educational status (p-value > 0.05). The overall knowledge and awareness about local anesthesia and its complications were only moderate among the undergraduate and postgraduate dental students. Postgraduates showed a better knowledge when compared to undergraduates.

Keywords: local anesthesia, complications, lidocaine, ocular, neurological

INTRODUCTION

Dentistry and pain are usually synonymous in the minds of patients, who would require multiple extractions due to caires, surgery due to periodontal disease or endodontic therapy using rotary and hand files due to symptomatic teeth.(1–7) Although the use of fluorides and maintenance of oral hygiene would suppress the need for painful procedures, its use is not widespread due to lack of knowledge.(8–10) Before starting a dental procedure, it is the practitioner who decides a good anesthetic as one that allows them to focus solely on operative procedures without distractions from pain-induced movements by the patient.(11) The discovery of local anesthetics and analgesics are as old as the long history of medicine. Egyptians used opium, beer, juniper & a variety of other extracts from plants to treat ailments related to pain. Father of medicine Hippocrates believed in healing power of nature and Indians use herbal medicine & yoga to overcome pain.(12)

Local anaesthetics are an inseparable part of dental practice. Without which majority of the dental procedures are not possible as the pain induced by them can lead to shock. Local anesthesia helps in relieving pain of the patient and also makes the comfortable during the dental procedure.also makes it painless as possible. They are administered in the form of injections over the nerve branches which supply the site, produce a numbing sensation and provide pain relief. The presence of more than one drug in the dental anesthetic cartridge makes the situation more complicated regarding calculations of the maximum dose for each drug, and it is important to respect local anesthetic as active pharmacological agents that can potentiate dose-related complications.(13) Though local anesthetics is a relatively safe drug, there is still a risk of complications arising due to overdose.

Studies have also shown that it can also cause ocular and auditory problems. Neurological complications of palsy, paresthesia of inferior alveolar nerve & lingual nerve also occur.(14) Ophthalmic complications such as diplopia and blindness have been reported. Hence precautions must be taken while administering local anesthesia.(15) This deems necessity for the assessment of students pursuing dentistry regarding local anesthetic

complications, dose calculation & methods of administration so that they may incorporate them to their day to day clinical practice. So the aim of the current study was to assess knowledge and awareness of dental students on administration of local anesthesia and its various complications

MATERIALS & METHODS

The study was conducted in a university setting. The study was approved by the institutional ethical committee. The study group of this research were dental students, both undergraduate and postgraduate students, in a private dental institute. The sample size of the study is 102 students including both males and females . It was conducted as an online questionnaire survey was uploaded in Google forms and circulated among the students.To eliminate bias, a randomised sampling method was used. Among all the undergraduate and postgraduate students, 103 students were randomly selected to participate in the study. The data was collected over a period of 1 week. The survey consisted of 15 close ended questions. The questions were framed based on the dosage of local anesthetic administration, procedure of local anesthetic administration and complications involved in local anesthetic administration. The validity of the questionnaire was based on logical and content validity. The data were collected from google forms and tabulated in excel sheet. The raw data was transferred to SPSS software. Chi square test was done for statistical analysis.

RESULTS

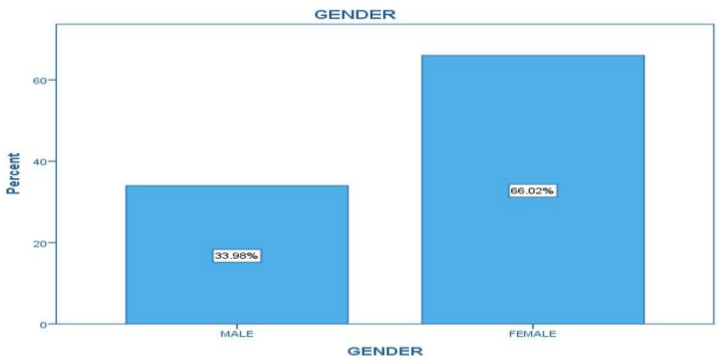
The study sample involves 103 students, out of which 34% were males and 66% were females (graph-1). Among them, 87.5% students were undergraduate students, 12.62% were postgraduate students (graph-2).

Related to administration of local anesthetics, a total of 40.8% of respondents (n=42) agree that 4.4 mg/kg is the maximum dosage of 2% lidocaine with adrenaline (graph-3). Among the respondents, 45.6% (n=47) students agree the aspiration must be done before local anesthetic administration (graph-4). A total of 52.4% (n=54) students know about dose calculation of local anesthetic agents (graph-5). Only 11.7% students (n=12) know the maximum number of local anesthetic injections of 2% lidocaine can be given to an adult's healthy patients (graph-6).

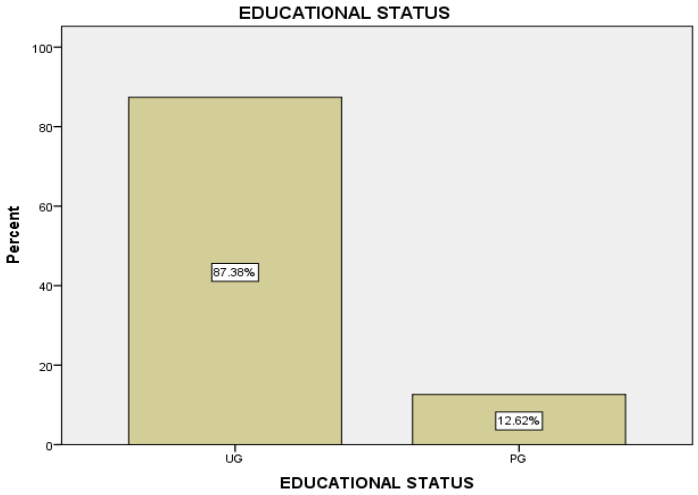
Regarding the neurological complications, among the respondents, 24.3% (n=25) students know the complication of transient amaurosis to be blindness (graph-7). Barbing of the needle causes post injection paresthesia was agreed by 38.8.% (n=40) students (graph-8). Injection of local anesthetic intravenously into carotid causes total body hemiparesis was agreed by 28.2% (n=29) students (graph-9). Recovery time for immediate palsy was about 3 hours was known only by 36.9% (n=38) students (graph10). Majority of 36.9% (n=38) students accepted that neurological complication of inferior alveolar nerve block was facial nerve palsy (graph-11). Total body hemiparesis lasts for 15 minutes was agreed by 26.2% (n=27) students.(graph-12).

About ocular complications, 34% (n=35) students know that ocular complications arise due to local anesthetic administration (graph-13). Majority of 35% (n=36) students agree that infra orbital nerve blocks cause ocular complications (graph-14). About 25.2% (n=26) students agree that ocular complications are both local & systemic (graph-15). Ocular complication of local anesthetic can lead to permanent blindness was agreed by majority of (n=43) (41.7%) students (graph-16). Ocular complication would last for a few minutes as agreed by (n=30) students (29.1%) (graph-17).

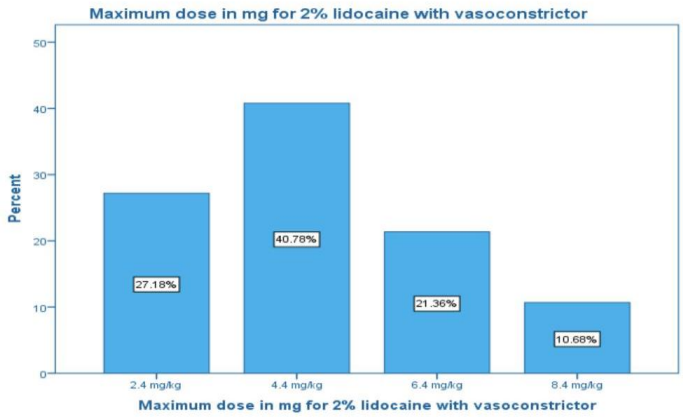
Statistically significant differences were obtained for questions on local anesthetic dose calculation and ocular complications based on gender.(graph 18, 19) Statistically significant differences were obtained for questions on maximum dose with 2% lidocaine with vasoconstrictor based on educational status.(graph 20) However we found better knowledge with undergraduate students when compared to postgraduate students.



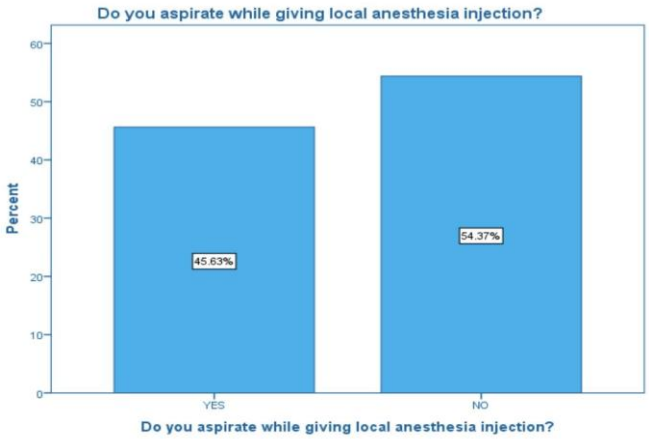
Graph 1: Bar Graph Represents Frequency Distribution Of Participants Based On Gender. (X-Axis Represents Gender; Y-Axis Represents Percentage Of Respondents). Higher Number Of Respondents Were Females.(66%)



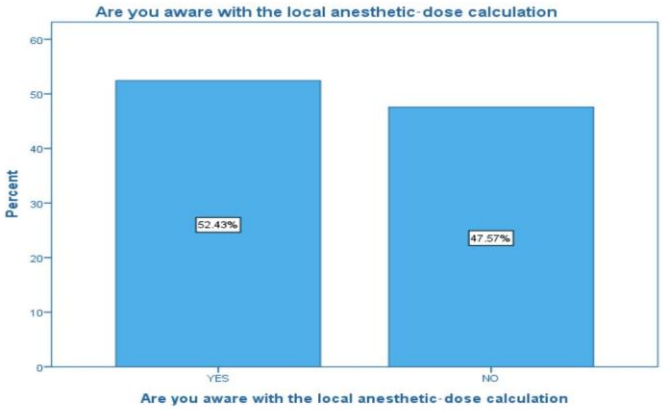
Graph 2: Bar Graph Represents Frequency Distribution Of Participants Based On Educational Status. (X-Axis Represents Educational Status; Y-Axis Represents Percentage Of Respondents). Majority Of Respondents Were Undergraduates(87.38%)



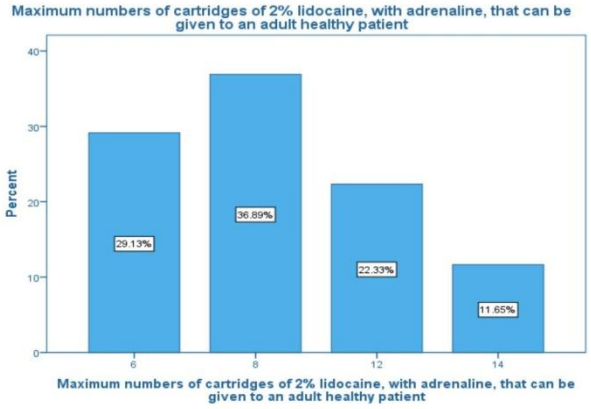
Graph 3 – Bar Graph Showing The Frequency Of Responses For Maximum Dose For 2% Lidocaine With Vasoconstrictor. (X-Axis Represents Responses Of The Question; Y-Axis Represents Percentage Of Respondents) Higher Percentage Of Response Was 4.4 Mg/Kg.(40.78%)



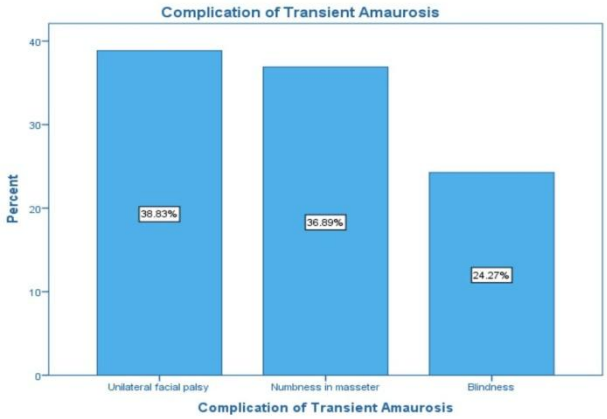
Graph 4 – Bar Graph Showing The Frequency Of Responses For Aspiration While Giving Local Anesthesia Injection.(X-Axis Represents Responses Of The Question; Y-Axis Represents Percentage Of Respondents) Majority Responded As They Don't Aspirate.(54.37%)



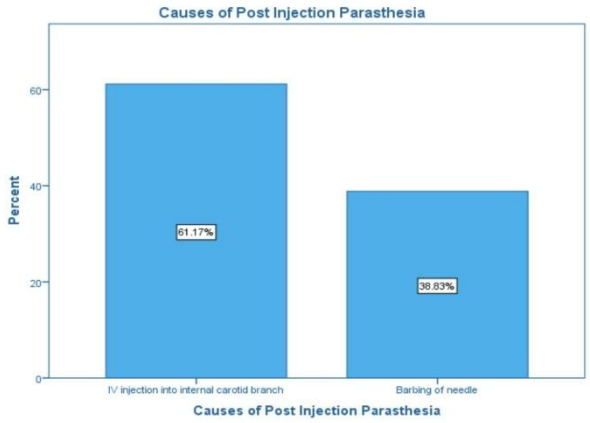
Graph 5 – Bar Graph Showing The Frequency Of Responses For Awareness With The Local Anesthetic-Dose Calculation.(X-Axis Represents Responses Of The Question; Y-Axis Represents Percentage Of Respondents) Majority Of The Respondents Were Aware Of The Local Anesthetic Dose Calculation.(52.43%)



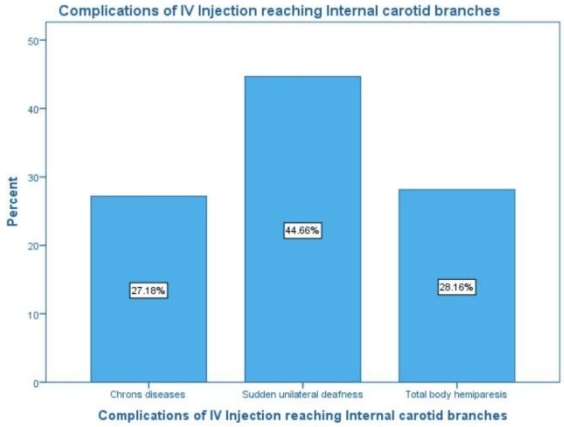
Graph 6 – Bar Graph Showing The Frequency Of Responses For Knowledge On Maximum Numbers Of Cartridges Of 2% Lidocaine, With Adrenaline, That Can Be Given To An Adult Healthy Patient.(X-Axis Represents Responses Of The Question; Y-Axis Represents Percentage Of Respondents) Majority Of Response Was 8 Cartridges.(36.9%)



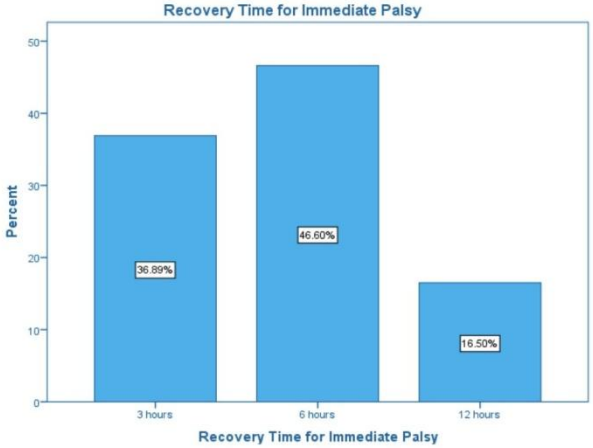
Graph 7 – Bar Graph Showing The Frequency Of Responses Regarding Complication Of Transient Amaurosis.(X-Axis Represents Responses Of The Question; Y-Axis Represents Percentage Of Respondents) Majority Of The Responses Was Regarding Unilateral Palsy And Numbness In Masseter.(38.83% And 36.89% Respectively)



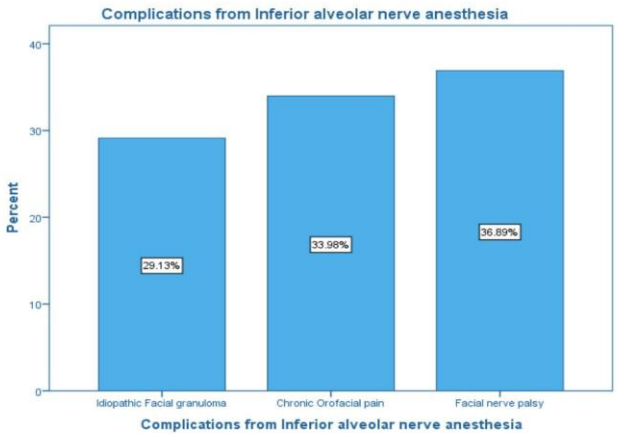
Graph 8 – Bar Graph Showing The Frequency Of Responses For The Causes Of Post Injection Paresthesia.(X-Axis Represents Responses Of The Question; Y-Axis Represents Percentage Of Respondents) Majority Of The Response Was Intravenous Injection Into The Internal Carotid Branch. (61.17%)



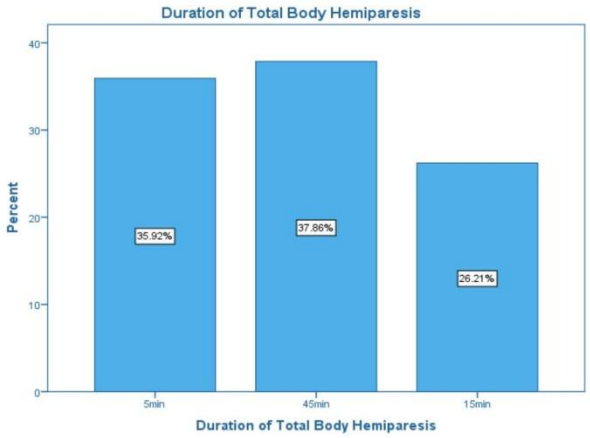
Graph 9 – Bar Graph Showing The Frequency Of Responses For The Complications Of Iv Injection Reaching Internal Carotid Branches.(X-Axis Represents Responses Of The Question; Y-Axis Represents Percentage Of Respondents) Majority Of The Response Was Sudden Unilateral Deafness.(44.66%)



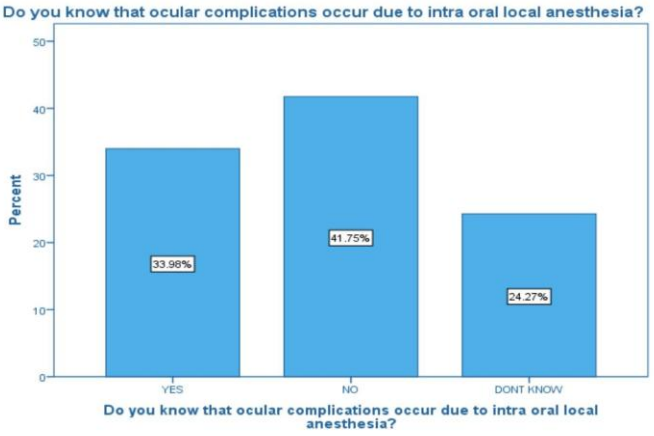
Graph 10 – Bar Graph Showing The Frequency Of Responses For Recovery Time For Immediate Palsy.(X-Axis Represents Responses Of The Question; Y-Axis Represents Percentage Of Respondents) Duration Of 6HOURS Was The Highest Response.(46.6%)



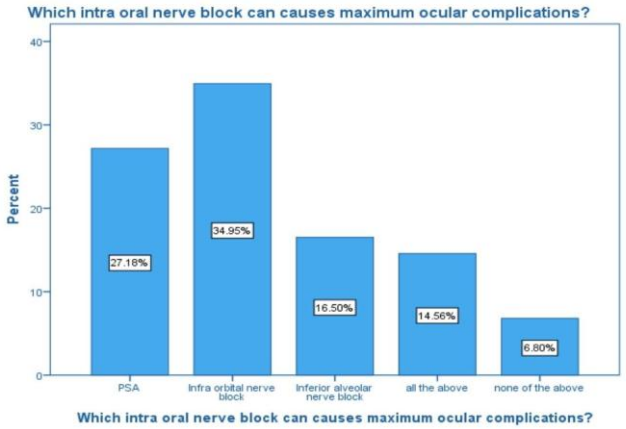
Graph 11 – Bar Graph Showing The Frequency Of Responses For Complications From Inferior Alveolar Nerve Anesthesia.(X-Axis Represents Responses Of The Question; Y-Axis Represents Percentage Of Respondents) Majority Of Response Was Facial Nerve Palsy (36.9%)



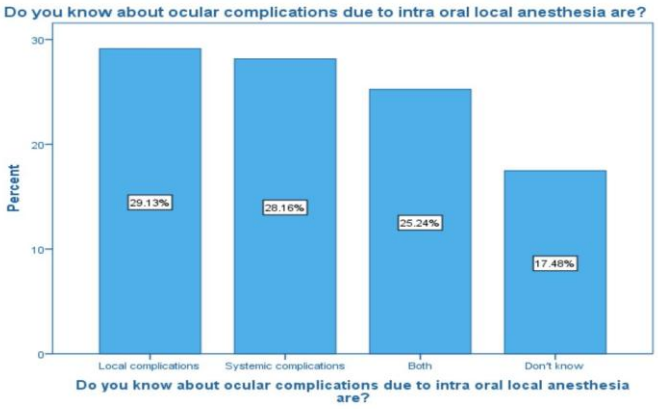
Graph 12 – Bar Graph Showing The Frequency Of Responses For Duration Of Total Body Hemiparesis.(X-Axis Represents Responses Of The Question; Y-Axis Represents Percentage Of Respondents) Only 26.21% Were Aware About Duration Of Total Body Hemiparesis Of 15MIN Duration.



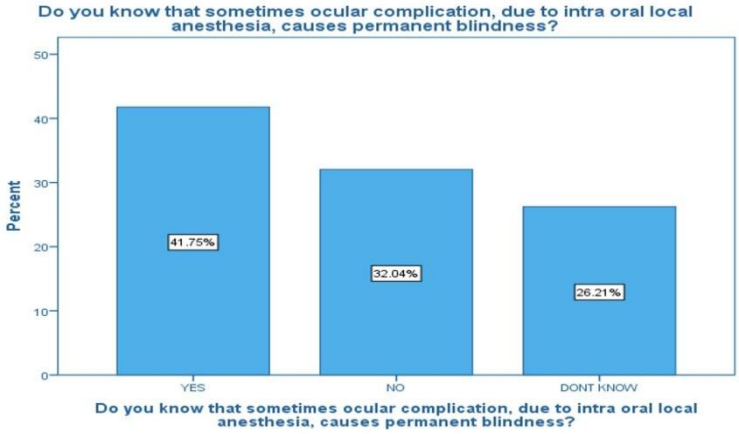
Graph 13 – Bar Graph Showing The Frequency Of Responses For Knowledge On Ocular Complications Occur Due To Intra Oral Local Anesthesia.(X-Axis Represents Responses Of The Question; Y-Axis Represents Percentage Of Respondents) Majority Weren't Aware On Ocular Complications. (41.75%)



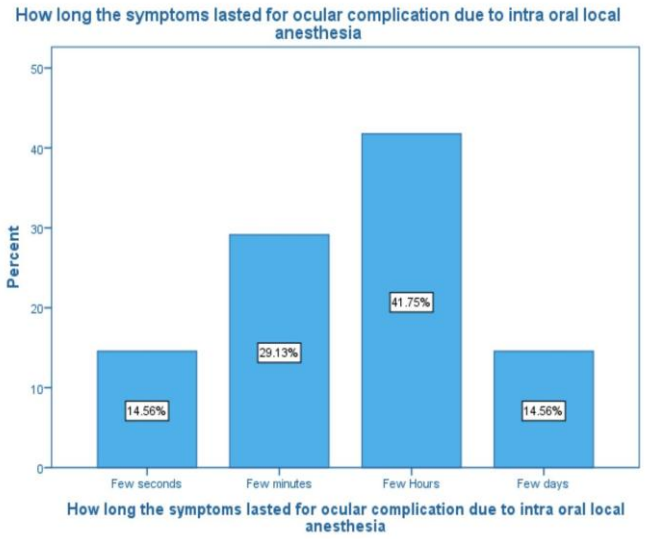
Graph 14 – Bar Graph Showing The Frequency Of Responses For The Type Of Intra Oral Nerve Block Can Causing Maximum Ocular Complications.(X-Axis Represents Responses Of The Question; Y-Axis Represents Percentage Of Respondents) Majority Responded About Maximum Ocular Complications With Infra Orbital Nerve Block.(35%)



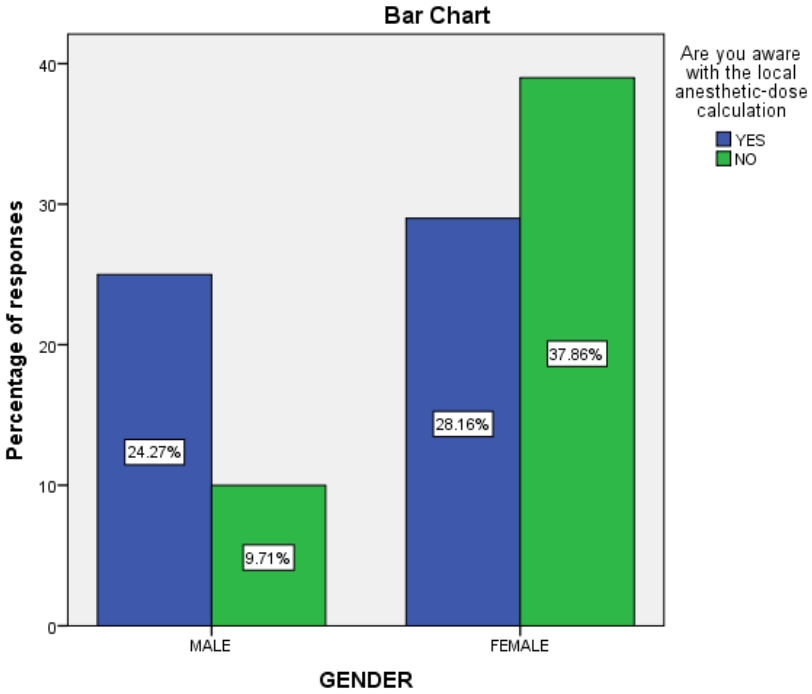
Graph 15 – Bar Graph Showing The Frequency Of Responses For Awareness On Ocular Complications Due To Intra Oral Local Anesthesia.(X-Axis Represents Responses Of The Question; Y-Axis Represents Percentage Of Respondents) Higher Percentage Of Respondents Had Awareness On Local And Systemic Ocular Complications. (29.13% And 28.16% Respectively)



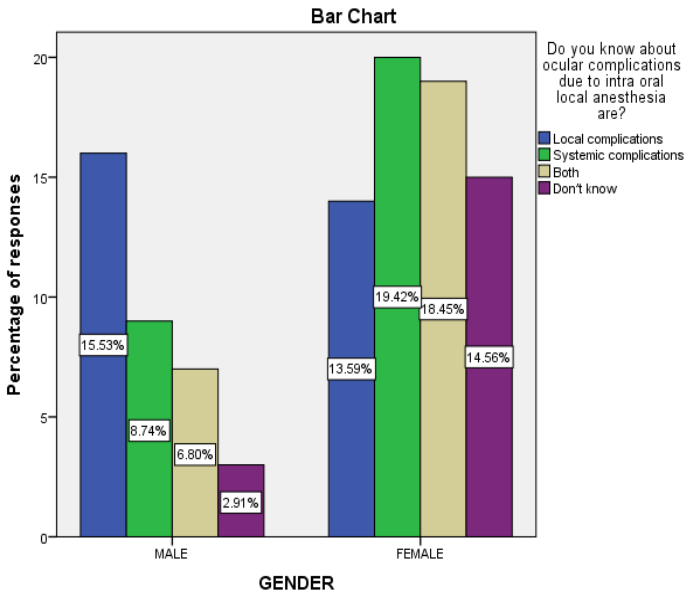
Graph 16 – Bar Graph Showing The Frequency Of Responses For Blindness As A Complication Due To Intra Oral Local Anesthesia.(X-Axis Represents Responses Of The Question; Y-Axis Represents Percentage Of Respondents) Majority Of The Respondents Were Aware Of Permanent Blindness As A Complication.(41.75%).



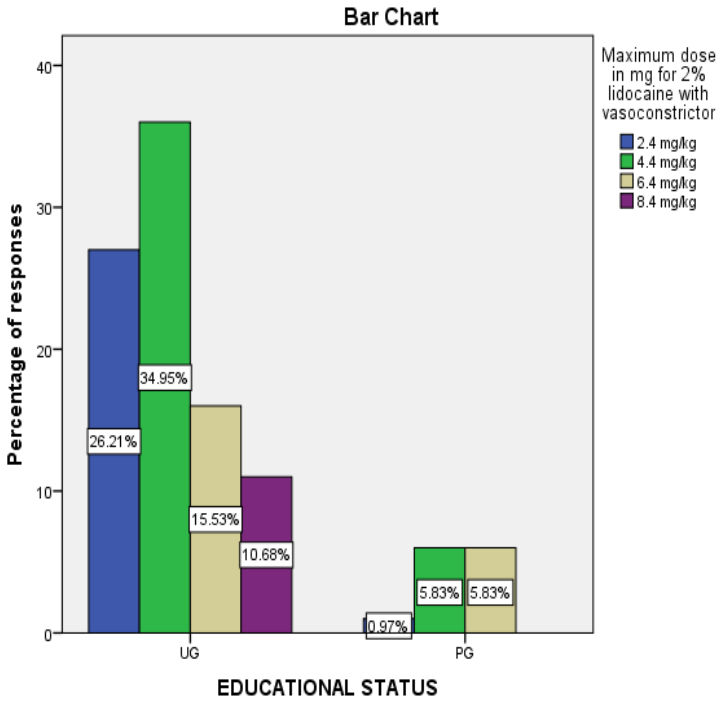
Graph 17 – Bar Graph Showing The Frequency Of Responses For Duration Of Ocular Complication. (X-Axis Represents Responses Of The Question; Y-Axis Represents Percentage Of Respondents) Majority Responded That It Lasted For Few Hours (41.75%).



Graph 18: Bar Graph Showing Comparison Of Responses Based On Gender To The Question On Awareness On Local Anesthesia - Dose Calculation. (X-Axis Represents Gender; Y-Axis Represents The Number Of Responses; Blue Color Represents Yes; Green Color Represents No) Majority Of The Females Were Not Aware Of The Dose Calculation Of Local Anesthesia(37.9%).(Chi-Square Test; P-Value = 0.006, Statistically Significant)



Graph 19: Bar Graph Showing Comparison Of Responses Based On Gender To The Question On Knowledge Of Ocular Complications. (X-Axis Represents Gender; Y-Axis Represents The Percentage Of Responses; Blue Color Represents Local Complications; Green Color Represents Systemic Complications, Yellow Represents Both, Violet Represents Do Not Know) Majority Of The Females Were Not Aware Of Systemic Complications (19.4%) And Majority Of Males Were Not Aware Of Local Complications (15.5%).(Chi-Square Test; P-Value = 0.044, Statistically Significant)



Graph 20: Bar Graph Showing Comparison Of Responses Based On Educational Status (X-Axis Represents Educational Status; Y-Axis Represents The Percentage Of Responses; Blue Color Represents 2.4MG/Kg; Green Color Represents 4.4MG/Kg, Yellow Represents 6.4MG/Kg, Violet Represents 8.4MG/Kg) Majority Of The Undergraduates Were Aware Of That 4.4MG/Kg Was The Maximum Dose For 2% Lignocaine With Vasoconstrictor When Compared To Postgraduates (35%). (Chi-Square Test; P-Value = 0.045, Statistically Significant)

DISCUSSION

Local anesthetic administration is a daily routine for most dental practitioners involved in extractions, trauma management, surgeries and rotary endodontics.(16–20) Normally, the effect is achieved with no adverse effects seen. However, sometimes certain complications, even very serious ones, can occur in daily practice. Complications associated with local anesthetics are commonly noticed in two ways: systemically and locally. Common systemic reactions due to local anesthesia are reported as psychogenic reactions, systemic toxicity, allergy, and methemoglobinemia. Common local complications associated with local anesthesia are reported as pain at injection, needle fracture, prolongation of anesthesia and various sensory disorders, lack of effect, trismus, infection, edema, hematoma, gingival lesions, soft tissue injury, and ophthalmologic complications.(21,22)

The maximum dosage of 2% lidocaine with adrenaline is 4.4 mg/kg. Aspiration must be done before local anesthetic administration so as to avoid accidental injection into the blood vessels which would complicate the condition. Maximum number of local anesthetic injections of 2% lidocaine can be given to an adult's healthy patients is eight. Complication of transient amaurosis would lead to temporary blindness. Barbing of the needle as well as injecting into internal carotid branches would lead post injection paresthesia. Injection of local anesthetic intravenously into the internal carotid branch would cause total body hemiparesis. Recovery time for immediate palsy would be about 3 hours. Most common neurological complication of inferior alveolar nerve block was facial nerve palsy. Total body hemiparesis would last for 15 minutes. Infra orbital nerve block is the major cause of ocular complications after local anesthetic administration. Ocular complications would last for a few minutes to few hours only. Sometimes ocular complication of local anesthetic can lead to permanent blindness.(11,23,24)

The pain control in patients is a major subject of interest, as in dentistry there are many procedures that cause discomfort and along with the psychological and emotional factors would enhance the perception of pain. However, observing the results of this study and other similar studies(25–27), it is very important to note that knowledge related to dosage, administration and complications of local anesthesia would need improvements. Most dentists use local anesthetic routinely to perform their various dental procedures without giving attention to the importance of the dosage used. A number of complications can arise from the improper administration of intra oral local anesthetic injections, which sometimes are permanent and can damage patients or even be life threatening.(28–30) The maximum numbers of cartridges of 2% lidocaine with adrenaline that can be given to an adult healthy patient is calculated according to the percentage and the maximum recommended dose of the drug. Only 11.7% of the respondents correctly answered the question regarding the maximum numbers of syringes that can be given to an adult healthy patient.

Local complications of local anesthetic injection include burning sensation during injection (hyperesthesia), post-injection paresthesia, hematoma, and trismus. (31) Structures far from the oral cavity including the middle ear and eye can also be affected by intra oral local anesthesia.(15,32) Knowledge on ocular complications due to intra-oral local anesthesia was low, suggesting an incorrect understanding of the local complications of local anesthesia. Although the prevalence of ocular complications is low in dentistry, sometimes they may cause permanent damage to the eye. Learning through journals and continuing dental education programs would make it more feasible options to stay updated.(23)

A below average of all respondents had some idea about the ophthalmic and neurologic complications related to local anesthesia. Misdirected needle placement can lead to consequences like inferior alveolar, lingual nerve paresthesia (transient or permanent), muscle trismus and even facial paralysis.(14) Local anesthetic related ophthalmic complications have been reported which include symptoms including diplopia, palpebral ptosis and blindness.(15) Keeping all these in mind, more knowledge had to be imparted to students in the future so as to avoid the complications.

This study was formulated to test the knowledge and awareness about the various complications arising from administration of local anesthesia. The study has a very important clinical significance as lidocaine is the most common drug used in clinical practice as local anesthetic. Though it is relatively very safe there still exists a chance of complication due improper administration of local anesthetic or by overdose.

Hence from this study we can infer that there is a significant lack of knowledge among students. This lack of knowledge was more noticed with undergraduate students when compared to students pursuing post-graduation. This could be because of enhanced clinical and theoretical knowledge and higher experience of post graduate students while the undergraduate students were still in their learning curve. The major limitation of the survey is the very small sample size and unicentric model of the study. Larger number of participants from multiple centres would have been more helpful to assess the overall knowledge and also validate the study in a higher population.

CONCLUSION

The overall knowledge and awareness about local anesthesia and its complications were only moderate among the undergraduate and postgraduate dental students. Postgraduates showed a better knowledge when compared

to undergraduates. There is a need to emphasize the basics on local anesthesia as this forms the baseline in day-to-day practice of a dental practitioner.

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