ISSN Print: 2394-7489
ISSN Online: 2394-7497
IJADS 2019; 5(1): 13-16

www.oraljournal.com
Received: 07-11-2018
Accepted: 09-12-2018

Dr. Dhanapriya
B.D.S., Department of Oral and Maxillofacial Surgery, Priyadarshini Dental College and Hospital, Tiruvallur, Tamil Nadu, India

Dr. Divya N Kumar
B.D.S., Department of Oral and Maxillofacial Surgery, Priyadarshini Dental College and Hospital, Tiruvallur, Tamil Nadu, India

Dr. Srinivasan
H,M.D.S, Head of the Department, Department of Oral and Maxillofacial Surgery, Priyadarshini Dental College and Hospital, Tiruvallur, Tamil Nadu, India

Dr. Jawahar Babu
M.D.S., Department of Oral and Maxillofacial Surgery, Priyadarshini Dental College and Hospital, Tiruvallur, Tamil Nadu, India

Dr. Loganathan
M.D.S, Senior Lecturer, Department of Oral and Maxillofacial Surgery, Priyadarshini Dental College and Hospital, Tiruvallur, Tamil Nadu, India

Correspondence
Dr. Dhanapriya
B.D.S., Department of Oral and Maxillofacial Surgery
Priyadarshini Dental College and Hospital, Tiruvallur, Tamil Nadu, India

A comparative study on pain encountered with a simulator vibrotactile device assisted la administration, with topical la technique and conventional technique

Dr. Dhanapriya, Dr. Divya N Kumar, Dr. Srinivasan, Dr. Jawahar Babu and Dr. Loganathan

Abstract
Introduction: Majority of the dental procedures involve the administration of local anaesthesia. Patients are invariably afraid of the pain encountered with the LA administration. Hence it is essential for dentists to be aware of the techniques used to mask the pain and help the patient experience a painless treatment.
Background: Several intraoral vibrotactile devices are being marketed at a higher cost. This study is structured to cut down the cost and to increase the availability of intraoral vibrotactile devices so that it would be affordable for every dentist for their regular practice. Thus, an attempt was made to design a vibrotactile device similar to those available in the market. The efficacy of the device in controlling the pain associated with LA administration was studied.
Materials and Methods: This is randomized controlled clinical trial done in 150 patients using Visual Analog Scale (VAS) to assess the effect of a custom made intraoral vibrotactile device to overcome pain during local anaesthesia administration.
Results: The VAS scores for the study group using vibrations were notably lesser than those for the topical LA group and control group. (P-value = 0.05)
Conclusion: Thus, the device is beneficial in masking pain associated with LA administration at an affordable cost.

Keywords: Local anaesthesia, vibrotactile device, painless, affordable

Introduction
Injection pain is often a fearful experience to the general population, with dental injections not being an exception. The pain associated with dental injections is one of the major reasons why patients neglect dental procedures. But local anesthesia in dentistry has become an inevitable procedure to render patients a painless treatment. However, the pain during its administration makes the patients anxious.
Since the discovery of local dental anaesthesia there has been a quest in the field of dentistry to mask the injection pain. There are a huge number of pain control techniques being introduced every now and then. A majority of these techniques usually involve altering the path of injection or the speed of administration or using a buffered LA solution or other adjunctive aids.
There are certain other specified devices or systems available in the market to control injection pain. These include the WAND system, the ANUTRA system, the TENS device and other vibrotactile devices like the DENTALVIBE, the VIBRAJECT, the BUZZ, etc. Invariably all these devices are available at a cost not affordable by every common dentist.
Thus, an attempt to design a vibrotactile device was made by simulating those available in the market and the efficacy of the same in controlling the pain associated with LA administration was studied.

Materials and Methods
In this cross-sectional study, 150 subjects of which 78 males and 72 females aged between 18 and 60 years were selected, from the patients reporting to the Department of Oral and Maxillofacial Surgery, Priyadarshini Dental College and Hospital, Tiruvallur, Tamil Nadu, India. The study was conducted from the month of January 2018 to

March 2018. In the study population 71 patients had a history of previous LA experience.

The study comprised of three groups with 50 subjects in each group. The Group I patients received only LA without any pain control adjunctive techniques, The Group II patients received a topical gel application at the site of injection prior to LA. The Group III patients received mucosal vibrations at the site of injection prior to the LA administration and vibrations parallel to the LA, adjacent to the site of injection.

Initially the study was explained to the patients in a language understood by the patient following which their consent to participate in the study was obtained. A brief case history was taken for every patient which included the history, diagnosis, treatment and the LA technique to be administered. A thorough past medical history was taken and patients under drugs or alcohol or with any other neurological or psychological disturbances were excluded. The past dental history was taken to record the previous LA experience of the patients for comparison. The LA was administered prior to the dental procedure.

The different LA techniques tried included, supraperiosteal infiltrations for maxilla viz. buccal and palatal infiltrations and nerve blocks for mandible viz. inferior alveolar, lingual and long buccal nerve blocks. Patients received either single or multiple injections but in a similar method according to their group. Following the LA administration, the VAS was displayed and explained to the patients of all three groups. The patients were then asked to score the pain experienced during the LA administration.

Mechanism of Action

The pain sensation is transmitted to the central nervous system through specialized sensory receptors called the nociceptors. These nociceptors are responsible for recognition of any stimulus and converting them into electric signals which will be carried to the brain [1]. The primary afferent fibres such as A-beta, A-delta, C fibres are the nociceptors for pain conduction. The A-beta fibres are myelinated and are of large diameter. They allow rapid signal conduction responsible for non-noxious stimuli such as touch, temperature and pressure or vibrations. The A-delta fibres are myelinated but are of small diameter. They conduct mechanical and thermal stimuli and allow the conduction of rapid, sharp pain and intial reflexes of acute pain. In the spinal gating mechanism, the signal transmission is arrested by the activity of large fibres (gate closed) and is conducted by the activity of small fibres (gate opened) [12].

Statistical Analysis

The results were statistically analyzed using SPSS-16th version. The normality was checked using Kolmogorov-Smirnov and Shapiro-Wilk test. But it doesn't follow normality. So non-parametric tests were done. To describe about the data, descriptive statistical analysis was done. Percentage analysis was done for categorical variables and the mean and S.D were used for continuous variables. Kruskal Walli's test was used to compare the groups.

Table 1: Age distribution and VAS scores for various injection techniques in Group A.

Parameters	Group A		
	Mean	Median (interquartile range)	Standard deviation
Age	38.58	38.50 (28.75 – 48.00)	12.940
Inferior alveolar	8.00	8.00 (7.00 – 9.00)	1.017
Long Buccal	8.30	9.00 (7.75 – 9.00)	0.837
Lingual	7.77	8.00 (7.00 – 9.00)	1.223
Supraperiosteal	6.26	6.00 (6.00 – 7.00)	1.163
Palatal	7.56	8.00 (7.00 – 8.00)	0.892

Table 2: Age distribution and VAS scores for various injection techniques in Group B.

Parameters	Group B		
	Mean	Median	Standard deviation
Age	40.68	39.50 (30.75 – 52.75)	12.727
Inferior alveolar	6.52	6.00 (6.00 – 7.00)	0.738
Long Buccal	7.48	7.00 (7.00 – 8.00)	1.022
Lingual	6.64	7.00 (6.00 – 7.00)	0.780
Supraperiosteal	4.96	5.00 (4.00 – 6.00)	0.999
Palatal	7.04	7.00 (6.25 – 7.75)	0.922

Table 3: Age distribution and VAS scores for various injection techniques in Group C.

Parameters	Group C		
	Mean	Median	Standard deviation
Age	37.26	35.50 (22.00 – 49.75)	14.744
Inferior alveolar	3.76	4.00 (3.00 – 4.00)	1.075
Long Buccal	2.65	3.00 (2.00 – 3.00)	1.368
Lingual	2.86	3.00 (2.00 – 3.00)	0.789
Supraperiosteal	2.67	3.00 (2.00 – 4.00)	1.404
Palatal	3.76	3.00 (3.00 – 4.00)	1.091

Results

Test results for various injection techniques across the groups – Kruskal-Wallis Test (Pair wise comparison)

Table 4: Long Buccal Nerve Block

Group Sample1-Sample2	Test statistic	Std. Error	Std. Test Statistic	Sig.	Adj. Sig.
3.00-2.00	38.359	6.724	5.705	.000	.000
3.00-1.00	51.634	6.663	7.749	.000	.000
2.00-1.00	13.275	6.927	1.916	.055	.166

Table 5: Inferior Alveolar Nerve Block

Group Sample1-Sample2	Test statistic	Std. Error	Std. Test Statistic	Sig.	Adj. Sig.
3.00-2.00	34.402	6.735	5.108	.000	.000
3.00-1.00	56.234	6.674	8.426	.000	.000
2.00-1.00	21.832	6.938	3.147	.002	.005

Table 6: Lingual Nerve Block

Group Sample1-Sample2	Test statistic	Std. Error	Std. Test Statistic	Sig.	Adj. Sig.
3.00-2.00	34.718	6.601	5.260	.000	.000
3.00-1.00	51.397	6.488	7.922	.000	.000
2.00-1.00	16.679	6.547	2.548	.011	.033

Table 7: Palatal Supraperiosteal Infiltrations

Group Sample1-Sample2	Test statistic	Std. Error	Std. Test Statistic	Sig.	Adj. Sig.
3.00-2.00	34.657	6.261	5.536	.000	.000
3.00-1.00	43.467	6.315	6.883	.000	.000
2.00-1.00	8.810	6.137	1.435	.151	.453

Table 8: Buccal Supraperiosteal Infiltrations

Group Sample1-Sample2	Test statistic	Std. Error	Std. Test Statistic	Sig.	Adj. Sig.
3.00-2.00	26.262	6.270	4.188	.000	.000
3.00-1.00	43.597	6.324	6.894	.000	.000
2.00-1.00	17.335	6.080	2.851	.004	.013

Each row tests the null hypothesis that the Sample 1 and Sample 2 distributions are the same. The significance level is. 05. Sample 1 – study group (3) compared with control group (2), Sample 2 – study group (3) compared with control group (1).

Discussion

Local anaesthesia in dentistry has become a routine chair side procedure.150 years ago, it was Cook who invented the modern dental syringe. However we are using the conventional aspirating syringes and there were no advancements until recent decades, in anaesthesia delivery devices [9]. There has always been a need for masking the injection pain to provide patients a painless dental procedure.

Lignocaine is considered to be the 'Gold Standard' local anaesthetic agent across the globe. There are some new drugs evolving that are proved to be equally efficient as lignocaine. Some of them include Articaine and Centbucridine. [11] However there must be an effective method for the delivery of the local anaesthetic agent. They may be topically delivered or deep in to the tissues using syringes or other modalities.

The topically delivered local anaesthetic agents are usually higher in concentration compared to the solutions delivered through syringes. They are either applied as gels or patches over the mucosa. These drugs will penetrate few millimetres down the non-keratinized tissues. Although their action is quite short. Therefore they may not alone be sufficient for dental extractions as they cannot achieve pulpal anaesthesia [8].

Nerve blocks can achieve pulpal anaesthesia but are painful upon injections. There many modalities coming up in the field of dentistry to mask this pain upon injection. One such device is the vibrotactile device. They are proven to reduce the pain on local anaesthesia administration but at a cost that could not be afforded by every patient or dentist. Therefore a custom made vibrotactile device simulating those conventional ones was fabricated using a powered tooth brush. The device was then compared for its efficacy with topical LA gels in masking injection pain.

There are numerous studies on vibrotactile devices like Dental Vibe, Vibraject, etc. Gholam Hossain *et al* (2017) claims that the average injection pain levels were significantly lesser with Dental Vibe than with the control group [2].

Rahaf Dak-Albab *et al* (2016) compared the effectiveness of vibrations with Dental Vibe and benzocaine gel in relieving pain associated with mandibular injections. The study proved that vibrations were better than the gels in reducing the injection pain [5].

Cem Ungor *et al* (2014) conducted a split mouth study in which various infiltrations and nerve blocks were tried along with their vibrotactile device and concluded that the vibrations were useful in reducing the pain without causing anxiety upon injection [4].

However in one study conducted by Ozgur erdon *et al* (2018), it was proved that the vibratory devices did not provide any reduction in the pain perception levels associated with local anaesthetic injections [3].

Therefore in our study we compared the efficacy of the vibrations and local aneasthetic gels with convetional local anesthesia administration in reducing pain upon injections using the Visual Analog Scale. The VAS was chosen as it has a higher reliability in assessing acute pain [13].

Initially the pain scores with the conventional method of local anaesthesia administration without any assisting aids were recorded in 50 subjects over different LA techniques. This constituted the control group 1 or group I.

The pain scores associated with local anaesthesia administration assisted by topical LA gels were recorded in another 50 subjects over different LA techniques. This constituted the control group 2 or group II.

Then the custom made vibrotactile device was tested for its efficacy in reducing the injection pain, in other 50 subjects. The pain scores associated with this method were recorded. This constituted the study group or group III.

In 150 patients, 80 buccal and palatal supraperiosteal infiltrations, 93 inferior alveolar nerve blocks, lingual nerve block and long buccal nerve block injections were tried.

The vibrotactile device acts on the principle of Gate Control Theory given by Ronald Melzack and Patrick Wall. Vibrations from the device hinder the pain signals from reaching the cerebral cortex by closing the gate [7].

The study results (tables 4- 8) show that there is a significant pain reduction during the local anaesthesia administration with the cutom made virotactile device in all the injection techniques (p-value <.01; the significance level being. 05) when compared with the control groups 1 and 2.

For the long buccal nerve blocks (table 4), the adjusted significance value between the group 2 and group 1 is not significant (p-value = 1.66). Whereas the adjusted significance value between the group 3 and group 1 as well as between the group 3 and group 2 is significant (p-value <.01). This implies there is no considerable difference in the pain reduction with the topical gel for long buccal nerve block injection but the vibrotactile device was proved to be efficient in masking the injection pain for the same block.

Similarly for the supraperiosteal palatal infiltrations (table 7), the adjusted significance value between the group 2 and group 1 is not significant (p-value =.453). Whereas the adjusted significance value between the group 3 and group 1 as well as between the group 3 and group 2 is significant (p-value <.01). This implies there is no considerable difference in the pain reduction with the topical gel for supraperiosteal palatal infiltration injection but the vibrotactile device was proved to be efficient in masking the injection pain for the same technique.

Conclusion

We conclude our study that this custom made vibrotactile device could be a cost effective measure to reduce the intraoral injection pain during local anaesthesia administration. The device could be modified further better clinical handling properties. Future studies could be performed to evaluate the device for reducing anxiety in patients undergoing local anaesthesia.

References

1. Hand Book of Local Anesthesi, 6th edition by Stanley F. Malamed.
2. Gholam Hossain Ramezani, Mohammed Tajjedin *et al*. Effect of vibration on pain during injection of local anaesthesia. Biosci. Biotech. Res. Comm. 2017; 10(4):728-731.
3. Ozgur Erdogan, Anatachai Sinsawat *et al*. Utility of vibratory stimulation for reducing intraoral injection pain. Anesth Prog. 2018; 65:95-99
4. Cem Ungor, Emre Tosun *et al*. The effects of vibration on pain and anxiety during local anaesthesia administration. – JSM Dent. 2014; 2(1):1022
5. Rahaf Dak-Albab, Mohammad Bashier Al-Monaqel, *et al*. A comparison between the effectiveness of vibration with Dentalvibe and Benzocaine gel in relieving pain associated with with mandibular injections: a randomized clinical trial. – Anaesth Pain and Intensive Care. 2016; 20(1)43-49.
6. Amin Nasehi, Savita Bhardwaj *et al*. Clinical pain evaluation with intraoral vibration device during local anesthetic injections. – J Clin Exp Dent. 2015; 7(1):e23-7.

7. Nitin Sing, Sugandha Agarwal *et al*. Painless anaesthesia a new approach. Jounal of dentofacial sciences. 2013; 2(2):49-55.
8. Deepti V. Recent advances in local anaesthesia – overview.
9. Payal Saxena, Saurabh K Gupta *et al*. Advances in dental local anaesthesia techniques and devices: an update. Natl J Maxillofac Surg. 2013; 4(1):19-24.
10. Oktay Dugler, Meltem Koray *et al*. Evaluating Anxiety and Pain in Patients Receiving a Local Anaesthetic injection: Traditional syringe versus a Computer – Controlled Local Anaesthetic delivery system. Balk J Stom. 2007; 11:100-104.
11. Dr. Sharma SS, Dr. Qruna Sharma SA *et al*. Newer local anbaesthetic drugs and delivery systems in dentistry – an update. – IOSR Journal of Dental and Medical Sciences (JDMS) ISSN: 2279-0853, ISBN: 2279-0861. 2012; 1(4):10-16.
12. Ronald Melzack. Gate control theory – on the evolution of pain concepts. - FOCUS. Pain Forum. 1996; 5(1):128-138
13. Polly E Bijur, Wendy Silver *et al*. Reliability of the visual analog scale for measurement of acute pain. Academic emergency Medicine. 2001; 8:1153-1157.