

## Comparison of Vibraject with Conventional Syringe during Local Anesthesia Administration

Dr Bhawana, Dr Apoorva, Dr K.S.Gadre, Dr Shahzaib Akhter Nasti

Comparative evaluation of pain perceived on administration of local anesthesia for oral surgery by vibrating needle (Vibraject) and conventional syringe

Corresponding Author: Dr Bhawana

### Abstract

**Aim:** The aim of the study was to evaluate and compare pain experienced during insertion of needle and administration of local anaesthesia on the palate, with VibraJect (a vibrating attachment to the conventional syringe) and conventional syringe. The purpose of the study was to investigate the efficacy of the VibraJect dental syringe attachment in reducing pain and discomfort during administration of palatal block and procedural anxiety in patient undergoing dental treatment.

**Materials and methods:** A total of 50 patients with bilaterally posterior teeth were enrolled in this split mouth randomized controlled clinical study. The pain relief was recorded by the patient on the Facial Visual Analogue Scale at the postoperative hour, 2<sup>nd</sup>, 4<sup>th</sup> and 8<sup>th</sup> hour and on postoperative day 1. The time of when the patient first complains of unbearable pain was noted postoperatively and then the patient was given 20 mg of oral piroxicam as a rescue medication.

**Results:** Patients in both the groups reported no statistically significant decrease in pain score at needle insertion and local anaesthesia deposition

**Conclusion:** Based on result the traditional procedure was preferred to the VibraJect as it does not require accessory attachment to conventional syringe. The clinical efficacy remain controversial.

**Key Word:** Palatal Injection Pain, Vibraject Gate, Control Theory

Date of Submission: 28-01-2019

Date of acceptance: 11-02-2019

### I. Introduction

Pain is: "An unpleasant sensory or emotional experience associated with actual or potential tissue damage, or described in terms of such damage."<sup>[1]</sup> One's pain sensation is a response to the combined effects of physical mechanical, thermal, chemical noxious stimuli and the meaning of such events. Some people may experience pain without any known physical precursor; their pain may be a response to psychosocial disturbance.<sup>[2]</sup> A number of theories have been postulated to describe mechanism underlying pain perception, but the most influential theories focus on, INTENSITY THEORY of pain by Erb (1874), SPECIFICITY THEORY by Von Frey (1895), PATTERN THEORY by Godschneider (1920) and GATE CONTROL theory by Melzack and Wall (1965).

The most common dental complaint is pain. There are several methods for pain control, but effective local anaesthesia is the single most important pillar for pain control upon which modern dentistry stands. Although use of anesthetics can lead to a relatively painless dental procedure, the delivery of local anaesthetic solutions and the needle puncturing the mucosa is known to be uncomfortable and painful<sup>[3]</sup>

The pain induced by injection of local anaesthetic agents for dental / oral purpose can be reduced by number of complementary methods which include application of topical analgesics, conscious sedation and / or deep sedation, distraction technique,<sup>[4]</sup> application of counter irritation, varying the rate of infiltration, buffering and warming the local anaesthetic solution,<sup>[5]</sup> reduced the rate of injection, use of fine needle with improved syringe like metal syringe, precooling the injection site.<sup>[6]</sup> These methods have been reported in many studies, but no conclusive painless injection method has been established. Vibratory stimulation is one of the several non-pharmacological techniques used to reduce the pain. The vibratory stimulation is based on the Gate-Control theory. This theory states that pain and noxious sensation (touch, pressure, and vibrations) was carried to the brain via thin and large diameter nerve fibers through the dorsal horn of spinal cord. This dorsal horn of spinal cord acts a gate which allows large fiber activity to reach the brain if its intensity is relatively high than thin fiber activity. So as result if intensity of the vibration or other noxious stimulus is more than pain intensity, the perception of pain is blocked by the dorsal grey horn of spinal cord.<sup>[7]</sup>

There have been several vibrating devices like Dental vibrate, VibrajectAccupal, Syringe Microvibrator in the market. Recently, a vibrating dental local anesthesia attachment (Vibraject, LLC, California) has been

introduced, which is small battery-powered unit which clips onto the syringe barrel.[Figure 1] It causes the needle to vibrate and this vibration is transmitted to the nerves which sense pressure and vibration. The patient only experiences soft vibration, putting them completely at ease even during the potentially painful palatal injection. It is more economical and a single device attaches to the syringe. This makes it preferred over the other available counterparts.

It is well documented that palatal infiltrations, anterior maxillary infiltrations, and mandibular inferior alveolar nerve blocks are more uncomfortable injections than those delivered to other regions of the mouth (Malamed, 1997). Hence, our aim of the study is to evaluate pain on the universal pain assessment tool during administration of local anaesthetic using VibraJect, a vibrating attachment to the conventional syringe when giving greater palatine block.

## **II. Material And Method**

The study was conducted by the Department of oral and maxillofacial surgery of bharatvidyapeeth deemed university of dental collage and hospital. 50 Patients requiring extraction of bilateral maxillary posterior teeth were included in the study. The extraction of teeth of both sides was done on the same day. Patients included in the study did not receive any pre-medication. All aseptic precautions were taken during treatment and strict sterilization protocol was followed throughout the study. The patients were explained about possible risks associated with injection of the local anaesthetic and extraction before participating in the study. The severity of the patient's pain perception was assessed via a universal pain assessment tool which was explained prior to injection and deposition of local anaesthesia.

### **METHOD**

The infiltration on buccal side of tooth to be extracted was given with conventional syringe. The palatal block on the right side was given using VibraJect attached to conventional syringe with vibration mode **ON** and left side by VibraJect attached to conventional syringe with vibration mode **OFF** and this was not disclosed to patients.[Figure 2]

In each case, right side from was assigned to the study group (VibraJectgroup ; V) and left side to the control group (Conventional group ; C).

The patients were asked to place a mark on the scale to indicate the pain intensity. These measurements were done after local anaesthesia deposition. Assessment chart was provided to patient on which he / she was asked to rate the pain. After anaesthesia was achieved, the extraction was performed.

Universal pain assessment tool was used to assess the pain for both the appointments during the administration of local anaesthesia<sup>[20]</sup>. The patient was asked to describe his/her pain verbally and it was marked according to his/her own subjective perception of pain on the universal pain rating scale and the results obtained were statistically analyzed and tabulated.[Figure 3]

## **III. Results**

**Results of Wilcoxon signed rank test:** For needle insertion, z-score is greater than  $Z_{critical}$  at confidence level of 99% ( $\alpha=0.01$ ). Thus, we can reject our null hypothesis with 99% confidence based on our data. Use of Vibraject does affect pain levels of patient during needle insertion. This confirms our initial conclusion.

For L.A. deposition, z-score is lesser than  $Z_{critical}$  at confidence level of 95% ( $\alpha=0.05$ ). Thus, we have failed to reject the null hypothesis based on our data. Based on this test we can't conclude if Vibraject has any effect on patient pain levels or not. As from our initial analysis we can conclude that Vibraject has no significant effect on patient pain levels.(table 2)

Wilcoxon signed rank test showed that the comparison between the pain intensity with and without use of Vibraject does affect pain levels of patients during needle insertion and during LA deposition.[ **TABLE 2**]

## **IV. Discussion**

Injection pain in dentistry may be accompanied by fear and anxiety, causing a negative influence on dental treatment. Management of the pain induced by administration of local anesthesia is one of the important aspects of patient care. Palatal injection is painful and may cause patient to avoid future dental care. A number of methods have been suggested to minimize the injection pain of local anaesthesia like prior application of a topical anaesthetic, the use of lidocaine patches, warming and buffering the anaesthetic agents, performing electronic dental anaesthesia, and using a computer controlled local anaesthesia delivery system (CCDS).<sup>[8]</sup> Earlier, Topical anaesthetic like 20% benzocaine gel or 20 % lidocaine patch applied for 60 sec or 5- 15 min respectively prior to local anaesthesia, reduces injection discomfort. Buffering the local anesthetic solution with sodium bicarbonate has been reported to significantly reduce the injection pain. For example LIGNOX 2% + 8.4%NaHCO<sub>3</sub> in a ratio of 1.1ml:10 ml reduces to pH of 7.38<sup>[9]</sup>TENS (transcutaneous electrical nerve stimulation) is another method to reduce pain of injection, in which electric current is used to stimulate nerves

for relief of pain. In the mid-1990s, local anaesthetic delivery systems that incorporated computer technology to control the rate of flow of the anaesthetic solution through the needle were introduced. Based on this concept, various devices were introduced like WAND, Computer control syringe, Jet injection, Syrijet, etc. However none of these techniques have been able to completely eliminate pain due to injection of local anaesthesia.<sup>[10]</sup> Therefore, researches are trying to seek newer and better means of managing pain during injection.

Vibration is one of the newly introduced methods for decreasing injection pain. It is based on gate control theory of pain proposed by Melzack and Wall, which states that pain perception is modulated by the interaction between nociceptive and non-nociceptive afferent neurons.<sup>[11]</sup> This was supported by the study done in Okazahi, Japan<sup>[12]</sup>

Fifty patients were enrolled in this study. Moreover, different areas of the mouth have different anatomical obstacles that may defer pain during local anaesthesia injections. No study has yet compared VibraJect with conventional method during administration local anaesthesia while giving greater palatine nerve block. So, we decided to limit our study to the palatal nerve block.

To avoid the bias, we used a split mouth technique in our study, in which the side of injection was pre-decided by operator and not disclosed to the patient. In the present study of 50 subjects, 74% had reported lesser or equal pain during needle insertion when using VibraJect as compared to the conventional injection technique. However, during local anaesthesia deposition, 66% subject reported marked pain with VibraJect compare to the conventional group.

Hence, the result of this study showed no statistically significant difference in pain intensity between two techniques during local anaesthesia deposition. Our result was similar to **Saijo et al.**<sup>[13]</sup> who concluded that no difference was found in the degree of pain during needle insertion and aesthetic deposition with and without VibraJect. Similarly, **Yoshikawa et al** and **Roeber et al**<sup>[14]</sup> found no significant pain reduction when VibraJect was applied with a conventional dental syringe. These authors suggested that the possible reason was that the vibrations were extremely small and did not activate the larger nerve fibres in that area in many individuals.<sup>[8]</sup>

Our result not in agreement inconsistent with studies conducted by **E.Nanitsos et al**,<sup>[15]</sup> **Chandrashekar et al**,<sup>[16]</sup> **Kalpachoudhary et al**<sup>[17]</sup> and **Mangalampally s et al**<sup>[18]</sup> who reported lower pain intensity with the use of VibraJect. Their studies, however, utilised different local anaesthesia techniques i.e. using vibration on giving during inferior alveolar block or in buccal mucosa infiltration, while we used greater palatine block. So, comparison of the results from the above studies with those of our study may not be appropriate. Based on the results of our study, the reason for VibraJect not being effective during deposition of local anaesthetic solution for the palatine block may be because of tough adherent of the palatal mucosa to the underlying periosteum and its abundant nervous complement.<sup>[19]</sup> So, while administrating local anaesthetic solution in the palatal mucosa, cause tissue tension which leads to more pain and discomfort than the needle puncture.

## V. Conclusion

The literature review is inconclusive and certain studies promote VibraJect while other do not promote due to lack of efficacy of vibration.

Based on observations of this study, the patients experienced similar levels of pain during anaesthesia administered with a conventional syringe and with the VibraJect while giving palatal block. The traditional procedure was preferred to the VibraJect as it does not require accessory attachment to conventional syringe. As this study was conducted on 50 participants, further studies with larger sample size are suggested for the better outcome of results.

## Bibliography

- [1]. International Association for the Study of Pain: Sub-committee on taxonomy, Pain Terms: a list with definitions and notes on usage. Pain, 1979;6:249-252
- [2]. Clare C. O'Callaghan, MMus, BSW, RMT. Pain, music creativity and music therapy in palliative care., The American Journal of Hospice & Palliative Care 43 March/April 1996 the pain.
- [3]. Feck AS, Goodchild JH. The use of anxiolytic medications to supplement local anesthesia in anxious patient. CompendContinEduc Dent 2005;26(3): 183-6,188,190
- [4]. Touyz LZ, Lamontagne P, Smith BE. Pain and anxiety reduction using a manual stimulation distraction device when administering local analgesia oro-dental injections: A multi-center clinical investigation. J Clin Dent 2004;15:88-92
- [5]. Dilip Kothari DENTALANAESTHESIA:AN OVERVIEW Review article Annals and Essences of Dentistry Vol. V Issue 3 jul – Sep 2013
- [6]. Aminabadi NA, Farahani RM. The effect of pre-cooling the injection site on pediatric pain perception during the administration of local anesthesia. J Contemp DentPract2009;10:43-50
- [7]. Melzack R, Katz J. The Gate Control Theory: Reaching for the Brain. In Craig KD, Hadjistavropoulos T. Pain: psychological perspectives. Mahwah, NJ: Lawrence Erlbaum Associates, Publishers; 2004 ISBN 0-8058-4299-3.
- [8]. M. Elbay\*, Ü. ŞermetElbay\*, S. Yıldırım\*, C. Uğurluel\*, C. Kaya\*, C. Baydemir\*\* Cemungor et al Comparison of injection pain caused by the DentalVibe Injection System versus a traditional syringe for inferior alveolar nerve block anaesthesia in paediatric patients. European Journal of paediatric dentistry vol. 16/2-2015

## *Comparison of Vibraject with Conventional Syringe during Local Anesthesia Administration*

- [9]. Aminash M, Priya N., Parul S, Monali B comparison of topical anesthesia gel, pre-cooling,vibration and burffered local anesthesia on the pain perception of pediatric patients during the administration of local anesthesia in routine dental procedure. Internal journal of contemporary medical research.Vol 4, issue 2. Feb 2017.
- [10]. MungaraJayanthi,. Effectiveness of new vibration delivery system on pain associated with injection of local anesthesia in children. Journal of Indian Society of Pedodontics and Preventive Dentistry, Vol. 33, No. 3, July-September, 2015, pp. 173-176 .
- [11]. Melzack R, Wall PD. Pain mechanisms: a new theory. Science. 1965;19:971–979
- [12]. Kakigi R, Shibasaki H. mechanism of pain relief by vibration and movement . J Neurosurg Psychiatry 1992;55:282-286 .
- [13]. Saijo M, Ito E, Ichinohe T, Kaneko Y. Lack of pain reduction by a vibrating local anesthetic attachment: a pilot study. AnesthProg 2005;52:62–64
- [14]. Roeber B, Wallace DP, Rothe V, Salama F, Allen KD. Evaluation of the effects of the VibraJect attachment on pain in children receiving local anesthesia.Pediatr Dent 2011;33(1):46–50
- [15]. Nanitsos E, Vartuli R, Forte A, Dennison PJ, Peck CC. The effect of vibration on pain during local anaesthesia injections.Aust Dent J 2009;54:94-100
- [16]. Chandrasekaran J , Prabu D, Silviya,Sunayana M, Ahemed A, Kumarasamy B. Efficacy of painless injection technique – Vibraject . Int J Med and Dent Sci 2014; 3(1):250-256.
- [17]. KalpnaChaudhry, ManishaShishodia, Chanchal Singh, Avantikatuli. Comparative evaluation of pain perception by vibrating needle and conventional syringe anesthesia during various dental procedures in pediatric patients: A short study. International Dental & Medical Journal of Advanced Research (2015), 1, 1–5
- [18]. MangalampallyShilpapriya, MungaraJayanthi, VenumbakaNilaya Reddy, RajendranSakthivel, GirijaSelvaraju, PoornimaVijayakumar. Effectiveness of new vibration delivery system on pain associated with injection of local anesthesia in children. Journal of Indian Society of Pedodontics and Preventive Dentistry | Jul-Sep 2015.
- [19]. Barry F. Mcardle .Dm.D Jada 1997.
- [20]. Dalton JA, McNaull F. A call for standardizing the clinical rating of pain intensity using a 0 to 10 rating scale. Cancer Nurs 1998;21:46-9

### **VI. Figure And Tables**

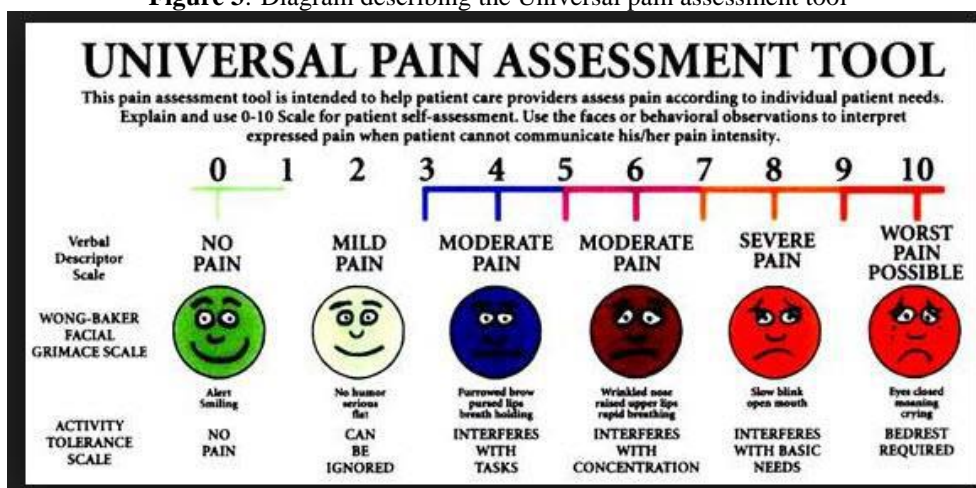
**Figure1** :Vibraject and Vibraject attached to conventional syringe



**Figure 2**:- Administrating local anaesthesia with VibraJect attached on conventional syringe



Figure 3:-Diagram describing the Universal pain assessment tool



**TABLES**

Categorical pain distribution for both groups for both procedures have been mined of raw data and summarized in Table

**Table.1 Pain level comparison for control and Vibraject group**

Pain	Needle insertion	%	LA Deposition	%
V<C	13	26	22	44
V=C	9	18	11	22
V>C	28	56	17	34

**Table.2 Results of Wilcoxon signed rank test for needle insertion and L.A. deposition**

Pain reduction (w.r.t. pre-op)	Z-score ( z )	Z <sub>critical</sub> (α=0.01)	Z <sub>critical</sub> (α=0.05)	Verdict on hypothesis
Needle insertion	2.53	2.326	1.645	Reject
L.A. deposition	0.86			Failed to reject

Dr Bhawana. "Comparison of Vibraject with Conventional Syringe during Local Anesthesia Administration." IOSR Journal of Dental and Medical Sciences (IOSR-JDMS), vol. 18, no. 2, 2019, pp 08-12.