Comparative evaluation of pain perception by vibrating needle (Vibraject™) and conventional syringe anesthesia during various dental procedures in pediatric patients: A short study

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Keywords
Gate control theory, pain rating scales, vibraject

Abstract
Background: One of the most important and challenging aspects of behavior management in children during dental treatment is pain control. Fear related behavior has long been recognized as the most difficult aspect of patient management and can be a barrier to good care. Administration of local anesthesia may evoke anxiety not only in the patients but also in the clinicians. Although local anesthesia is most commonly used for pain control in dentistry, researches are going to seek new and better means of managing pain. In this study, we have used a newer vibration device named Vibraject™ to give painless anesthesia.

Materials and Methods: 20 children aged between 8 and 14 years, visited the Department of Pedodontics, K.D. Dental College and Hospital, Mathura, for some dental treatment were selected. In the first appointment, local anesthesia using a conventional syringe was administered. The procedure was repeated with Vibraject™ on the opposite side of the same dental arch on the subsequent visit. The child side of the same dental was assessed through visual analog scale (VAS) and faces pain rating scale (FRS) for both the techniques. Various physiological parameters were also assessed and compared between conventional and vibrating injection techniques.

Results: A statistically significant difference in VAS and FRS was found between the two techniques whereas when physiological parameters (heart rate, blood pressure, and temperature) were compared at various intervals, the difference was not statistically significant.

Conclusion: Vibraject provides less pain while giving local anesthetic injections in comparison to the conventional injection technique in clinical dental procedures.

Introduction
Most of the pediatric patients experience fear and anxiety concerning the pain occurring while giving injection of local anesthetics.\(^1\) Although local anesthesia is considered as the backbone of pain control in dentistry, researches are going to seek newer and better means of managing the pain.\(^2\) Vibration of soft tissue has been employed for relief of pain in other areas of the body, but a search of the literature revealed very few attempts to use vibration to relieve the pain of oral injections.\(^3,4\)

Recently, a vibrating dental local anesthesia attachment (Vibraject, LLC, California) has been introduced. This device was based on the gate-control theory, which states that if nerve impulses evoked by tactile sensation are simultaneously transmitted through A-beta tactile fibers, it depresses pain transmission through A delta and C nociceptive fibers at the secondary neuronal cell bodies in the dorsal horn. It is therefore hypothesized that vibrating a needle with Vibraject™ can result in a reduction of injection pain.

Hence, this study was undertaken to evaluate the pain perception through Vibraject™ and comparing it with traditional injection technique during dental procedures in clinical pediatric dentistry.

Materials and Methods
A total of 20 children visited the Department of Pedodontics and Preventive Dentistry, KD Dental College Mathura, for...
dental treatment were randomly selected. Ethical committee clearance was taken from the ethical committee to start the study. A detailed informed written consent was also taken by the patient, parents or guardian.

**Inclusion criteria**

- Patients aged between 8 and 14 years
- Patients require local anesthesia on both the sides of same dental arch for dental treatment procedures.

**Exclusion criteria**

- Patients having significant behavioral management problem
- Patients with underlying medical history and developmental anomalies
- Patients with a known history of allergy to local anesthetic agents.

The visual analog scale (VAS),\(^5\) Wong-Baker faces pain rating scale (FRS),\(^7\) and local anesthesia procedure were explained to the child before starting the procedure [Figure 1].

The VAS is as a 10 cm line, anchored by verbal descriptors, usually indicating “no pain” and “worst imaginable pain.” The patient is asked to mark a 100 mm line to indicate pain intensity on the scale. The score is measured from the zero anchor to the patient line VAS has been tested in clinical research principally to measure the pain intensity.

The FRS Wong-Baker pain rating scale was in clinical use mainly in pediatrics since 1984. The face rating scale consists of six drawings with different expressions ranging from a child smiling (no pain) to a child crying (hurt worst). The patient is asked to mark the face according to his pain perception.

In the first appointment, local anesthesia was administered using conventional syringe technique [Figure 2]. Heart rate, blood pressure, and temperature was recorded using a pulse oximeter and digital thermometer before, during, and after the injection [Figure 3].

Immediately after the injection the child’s intensity of pain was assessed using VAS and FRS.

On subsequent visit of same patient, the local anesthesia was administered using Vibraject™ (ITL Dental, 31 Peters Canyon, Irvine, CA) on the other side of the same dental arch [Figure 4]. Physiologic parameters were recorded, and pain scores were assessed as in conventional syringe technique.

Vibraject is a battery operated detachable device attached to the body of the syringe to produce high-frequency vibration of the needle while giving injection [Figures 5 and 6].

**Statistical analysis**

The data was collected and put forward for statistical analysis using SPSS 16.0 for Windows. Paired \(t\)-test was used to compare...
the VAS, FRS, heart rate, blood pressure, and temperature between Vibraject® and the conventional technique.

**Results**

Comparison between conventional syringe and Vibraject in VAS and FRS showed a significant difference ($P < 0.05$) between the two techniques as shown in Table 1. Graphical representation of VAS and FRS score is shown in Graphs 1 and 2, respectively.

Significant differences in the physiological parameters were observed between the two techniques at various time intervals [Table 2].

**Discussion**

One of the most important and challenging aspect of behavior management in children during dental treatment is pain control. Various advancements have been made in anesthetic agents and techniques to get a pain free and comfortable anesthesia. Newer vibrotactile devices for pain control have been introduced such as Vibraject and Accupal. This is a newer concept used in dentistry for pain control. Vibraject is a battery operated detachable device based on vibration and can be easily applied in routine local anesthesia procedures. Vibration provides interference stimulation and relieves pain. The concept is based on the gate-control theory. Limited data are available pertaining to the use of vibraject in dentistry so keeping this in mind, we have compared Vibraject and conventional injection technique for pain control during anesthetic injection in pediatric dental patients.

Various agents like eutectic mixture of local anesthetics an oil in water emulsion is effective as a Pediatric local anesthesia in minor soft tissue surgical procedures. Oraqix is needle-free subgingival anesthetic agent and is proved to be effective.
Table 2: Comparison of heart rate, blood pressure and temperature, before, during, and after between the Vibraject® and the conventional techniques

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Technique</th>
<th>N</th>
<th>Mean</th>
<th>SD</th>
<th>t-test</th>
<th>P value</th>
<th>NS/S</th>
</tr>
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<tr>
<td>Heart rate (beats/min)</td>
<td></td>
<td></td>
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<td>Before</td>
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<td>13.39</td>
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<td>0.448</td>
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SD: Standard deviation

in controlling pain during scaling and root planning, with fewer side-effects and a good acceptance by patients and clinicians. Techniques like jet injections (Syrijet, Med-Jet) are based on the principle of using mechanical energy to create a pressure sufficient to push a dose of liquid medication through a very small orifice and have also been proved to be effective. Another technique studied was cooling the injection site for infiltration of local anesthesia in the buccal mucosa for 1 min, reduced pain perceived by pediatric patients. Electronic dental anesthesia in which electric current is used to stimulate nerves for relief of pain. It has an advantage of absence of unpleasant residual anesthetic effect and is effective technique for children with needle phobia. Devices like single tooth anesthesia/compudent (WAND) and comfort control syringe were also discussed which are based on the computer program that controls the anesthetic flow and provide low-pressure injections resulting in pain-free and precise anesthetic delivery.

In our study, statistically significant difference was seen in VAS and FRS scores in both the techniques. We observed that the use of Vibraject for anesthetic injections results in significantly less pain perception. Physiologic parameters did not show any statistically significant difference before, during, and after anesthetic injection in both the techniques. Our results coincide with Meghali et al. who concluded in their study no significant difference in physiologic parameters before, during and after various anesthetic injections.

Similarly, Marie et al. investigated the effectiveness of vibratory stimulation as a means of managing orthodontic pain and found a significant difference in overall pain scores among the various time intervals. Nanitsos et al. performed a study to investigate the effects of extraoral vibration stimuli on pain experienced during inferior alveolar nerve block and buccal infiltration local anesthetic injections. They suggested that vibration can be used to decrease pain during dental local anesthetic administration. Shahidi Bonjar put forward a hypothesis of using syringe micro vibrator a promising breakthrough device in pain and anxiety management mounted on a conventional dental anesthesia injection syringe. That device was more useful for pediatric patients and those who had a phobia of intraoral injection or pain.

In contrast, Saijo et al. had done a pilot study to compare the effectiveness of Vibraject with an electrical injection device and found no significant decrease in pain score at needle insertion and anesthetic injection between two techniques. Hutchins Jr et al. 1997 concluded in their study that the topical anesthetic agent caused a statistically significant decrease in pain values when compared with vibration.

Results obtained from this study may have marked importance in pediatric dental practice as a compact battery operated vibrating device has been proved helpful in reducing pain perceived during local anesthetic injections. Therefore, the Vibraject seemed to be an effective alternative to the traditional syringe technique. However, to the best of our knowledge, no study has been carried out on the children with Vibraject for giving local anesthesia during dental treatment. As this was a short study, further studies with larger sample size are suggested for the outcome of results.

Conclusion

- Based on observations of this study, Vibraject provides less pain while giving local anesthetic injections in comparison to the conventional injection technique in clinical dental procedures in children of 8-14 years of age.
- The role of physiologic parameters in pain perception was inconclusive.
Vibraject may be a promising method of delivering local anesthesia in children.

References


