

<https://doi.org/10.48047/AFJBS.6.8.2024.2822-2833>



African Journal of Biological Sciences



Research Paper

Open Access

Pain Assessment during Pulpotomy using two Injection Techniques in Children : A Split mouth Dual Scale Trial

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Article History

Volume 6, Issue 8, 2024

Received: 09 May 2024

Accepted: 10 Jun 2024

doi: 10.48047/AFJBS.6.8.2024.2822-2833

ABSTRACT:

Introduction

Efficient pain control is essential in pediatric dentistry to guarantee a favorable encounter and compliance during operations. Precise administration of local anesthesia is necessary to minimize discomfort, especially in children between the ages of 3 and 5. The conventional approach of buccal infiltration is compared to the 90-degree infiltration method. The experience of pain during dental procedures include sensory, emotional, and cognitive components, which can impact future visits. Although classic methods such as the inferior alveolar nerve block present difficulties when used on children, infiltration anesthesia is suggested as an alternative to children below 5 years of age.

METHODS:

This study was a randomised clinical trial conducted in Chennai, India from April to July 2023. This study was a split-mouth study conducted on a group of 33 children who exhibited positive Frankel's behaviour and underwent pulpectomy. In this split-mouth trial, the left and right sides were divided into two groups with an allocation ratio of 1:1. Group A received buccal infiltration for anesthesia, while Group B received the 90 degree injection approach for children undergoing pulpectomy on the right side. One week following pulpectomy on the initial side, the children were summoned for a second appointment where the opposite side was treated. Subsequently, pain assessment was conducted using two scales. The study utilized two pain evaluation scales: the Visual Analogue Scale (VAS) and Wong Baker's Facial Pain Scale (WBFPS).

RESULTS:

This study involved a group of 33 children who received pulpectomy in their primary mandibular molars. The Spearman correlation analysis demonstrated a robust positive association between VAS and WBFPS scores within the group. Specifically, the Spearman's rho coefficient was 0.863 in the 90 degree method group and 0.948 in the buccal injection group. Mann Whitney U tests were conducted to evaluate the disparity in pain between the injection procedures. It was discovered that the level of pain experienced was greater when using the 90 degree injection approach compared to the buccal infiltration technique, as measured by both the VAS and WBFPS measures. However, this difference was not found to be statistically significant.

CONCLUSION:

The study assessed the efficacy of 90-degree infiltration and buccal infiltration injection strategies in children aged 3 to 5 undergoing pulpectomy. Although buccal infiltration resulted in lower levels of pain, both procedures yielded comparable outcomes on pain ratings. A significant correlation was observed between pain assessment instruments for both approaches. The results indicate that both approaches are equally efficacious in pain management among young patients, facilitating clinical decision-making in the field of paediatric dentistry to enhance the patient's overall experience.

Keywords: Pain Assessment, Pulpotomy, Injection, A Split mouth Dual Scale Trial, paediatric dentistry

Introduction

In pediatric dentistry, effectively managing pain is of utmost importance as it profoundly influences the overall experience and cooperation of young patients during dental procedures. Local anesthesia stands as a pivotal element in dental care, offering a means to alleviate discomfort [1]. Administering local anesthesia, especially in children aged 3 to 5 years, requires a careful and precise approach to ensure both safety and minimal discomfort. Within the field of pediatric dentistry, significant attention has been directed towards one common injection techniques: buccal infiltration, and we are comparing it to the 90-degree infiltration technique. These techniques aim to minimize the pain and distress associated with dental procedures in this specific age group [2,3].

Pain experienced during dental procedures encompasses various dimensions, including sensory, emotional, and cognitive elements. It can arise from actual or potential tissue damage and ranks among the most distressing sensations individuals, including young children, may face in their lifetime[4]. Effective pain management is pivotal not only in ensuring a positive experience for children during dental treatment but also in establishing a foundation of trust and cooperation that will serve them well in future dental visits [5,6].

The choice of injection technique significantly influences the level of discomfort experienced by pediatric patients during dental procedures [7]. Traditionally, the regional blockade of the inferior alveolar nerve has been considered the preferred technique for mandibular dental procedures due to its ability to provide profound anesthesia. However, this technique comes with several drawbacks, especially for pediatric patients [8].

The inferior alveolar nerve block (IANB) is often regarded as the most painful injection technique, and its successful administration can be challenging for young patients who need to open their mouths widely to enable the clinician to locate the position of the foramen, a location that varies with age[9]. Additionally, the extended duration of soft tissue anesthesia may lead to unintentional self-inflicted injuries when children inadvertently bite the anesthetized lip, tongue, or inner cheek [10,11].

In contrast, infiltration anesthesia has been acknowledged as a less traumatic method for pain control, particularly when compared to nerve blocks, and it is highly recommended in pediatric dentistry[12]. However, its application has been more commonly associated with maxillary dental procedures due to the denser bone structure in the mandibular molar region, which poses challenges for achieving adequate anesthetic diffusion [13].

While some studies have reported positive outcomes with mandibular infiltration for restoring primary teeth, it has proven less effective than nerve blocks in controlling pain during pulpotomy in primary molars [14,15]. Various methods and techniques have been proposed to alleviate discomfort associated with the infiltration of local anesthetic agents. These include transcutaneous electronic nerve stimulation, topical anesthetic application, precooling of the palate, computerized injection systems, pressure administration, and the use of eutectic mixtures of local anesthetics, among others. However, none of these techniques have gained universal acceptance [16–18].

In addition to evaluating the different injection techniques, this study also incorporates two widely recognized pain assessment scales to ascertain the extent of pain experienced by pediatric patients. The Visual Analog Scale (VAS) offers a continuous measure of pain intensity, allowing for detailed evaluation [19]. On the contrary, Wong Baker's Facial Pain Scale relies on visual cues and facial expressions to facilitate pain communication, making it especially suitable for young children who may encounter difficulty with verbal expression [20].

In the light of this, this study aims to fill a critical gap in the existing literature by conducting a meticulous comparative analysis of the 90-degree infiltration and buccal infiltration techniques in pediatric patients aged 3 to 5 years. The secondary aim of the study is to assess the correlation of both the pain scales.

Materials and Methods

Study settings and ethical approval:

This split mouth randomised clinical trial was done in the department of Pedodontics of a private dental college in Chennai during April and July 2023. Children in the age of 3-5 years who needed bilateral pulpotomy of primary mandibular first molars. This study was approved by the Institutional Ethics Committee. This study was done according to rule of 10 which states that Depending on where it is in the dental arch, the primary tooth to be anesthetized is given a number between 1 and 5 (central incisor = 1, second molar = 5). This number is multiplied by the child's age (in years), and if the result is 10 or less, an infiltration is more suitable; if the result is more than 10, an inferior alveolar nerve block is probably more successful [21].

Sample size and allocation ratio:

Considering $\alpha=5\%$ and power of 90%, the sample size of 33 patients was calculated using G power [22]. Given its a split mouth trial, with allocation ratio 1:1, left and right sides were divided into two groups. Left side or Group A was given buccal infiltration[Fig-1] and children undergoing pulpotomy on right side or group B was given 90 degree injection technique[Fig-2].



Figure 1- Demonstrating the technique of Buccal Infiltration



Figure 2- Demonstrating the 90 degree Injection technique

Inclusion and Exclusion criteria:

The study included healthy children aged 4-8 years old who had at least one decayed mandibular molar on each side of the dental arch. Additionally, the children had to be cooperative and exhibit a "positive" or "definitively positive" behavioral rating according to Wright's Modification Of Frankl Behavior Classification Scale. The exclusion criteria consisted of children with systemic disorders and special needs, teeth with proximity to exfoliation and resorption of more than two-thirds of the root beyond its middle point, traumatic dental damage, and developmental anomalies of the tooth. (Figure 1 and 2)

Sampling

After the children were assessed for eligibility, the children were sampled by block randomization method and divided into two groups depending on the side of the mouth they are getting treatment on the day.

Survey instrument

There were two scales which was used in this study for pain assessment. One was visual analog scale (VAS) [24] and another was Wong Baker's facial pain scale (WBFPS) [25].

Visual analog scale is a 5 point likert scale consisting of face emojis from the 0-4 with 0 being no pain and 4 being extreme pain. Similarly, WBFPS scale, which has a 6-point range from "no hurt" (score=0) to "hurts worst" (score=5), is composed of a row of six numbered faces.

Data collection

The children were given appointment and were explained about the procedure using tell show do and euphemisms technique. For the children who were undergoing single visit pulpectomy of primary mandibular left molar, buccal infiltration was used as injection technique and 90 degree infiltration injection technique was used for the right side. Post their appointment, they were assessed for pain using 5 point visual analog scale (VAS) and Wong Baker's facial pain scale (WBFPS). One week after their first appointment, children were called for second appointment and the other side is treated followed by pain assessment using both scales.

Statistical Analysis

Statistical analysis was done in SPSS software version 23.0. Descriptive statistics was done to assess the mean, median and standard deviation of age, VAS scores and WBFPS scores. Frequency and percentage was used to assess the distribution of gender. Normality test was assessed by Shapiro Wilk test. Spearman correlation was done to assess the correlation between the VAS scale and WBFPS scale scores within the group. Mann whitney U test was done to assess the differences in the pain score between the injection techniques within the scales.

Results

This study consisted of 33 children who underwent primary mandibular first molar pulpectomy. The sample was divided into two groups (N=33 each) depending on the injection techniques. The mean age of the 90 degree injection technique group is 3.43 ± 0.83 and buccal injection technique group is 3.82 ± 0.92 . There were more 5 year old's present in both groups than 4 and 3 year old's [Figure 3]. Gender was standardized in both the groups. In each group 17 (51.5%) boys and 16 (48.5%) girls were recruited.

Spearman correlation revealed that within the group, VAS and WBFPS scores had a strong positive correlation to each other with spearman's rho being 0.863 in 90 degree technique group and 0.948 in buccal injection group [Table 1].

Mann Whitney U tests were performed to assess the pain difference between the injection techniques. It was revealed that the pain was higher in 90 degree injection technique than buccal infiltration technique both in VAS and WBFPS scales but it was not statistically significant (Table 2 and 3).

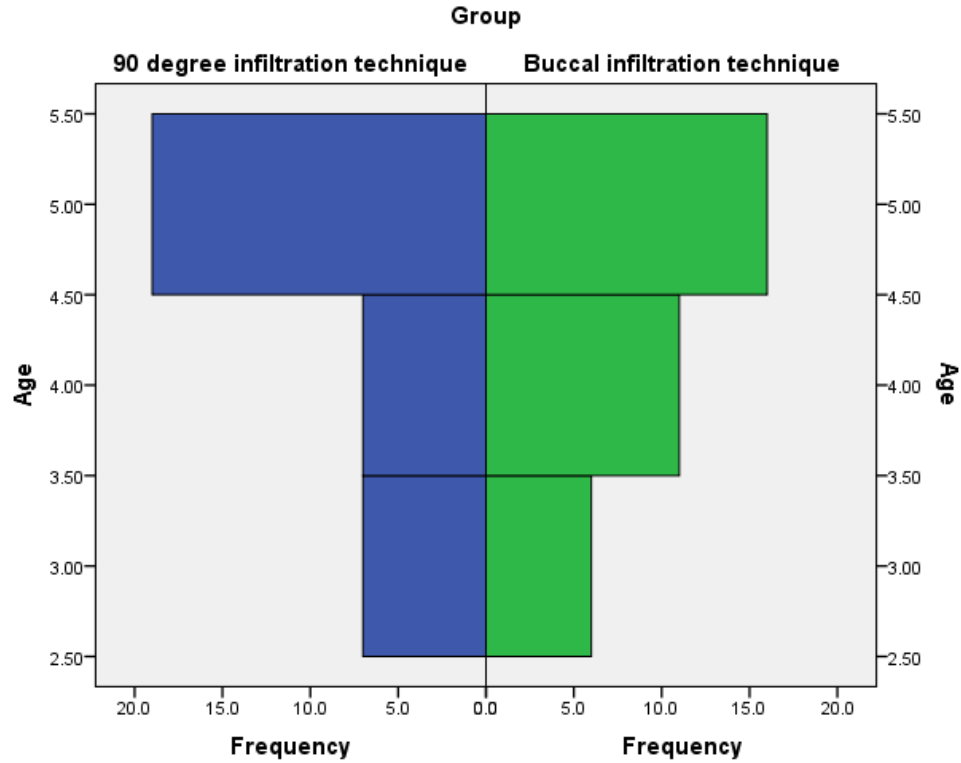


Figure 3 : Age distribution among the study participants between the groups
 Figure 3 shows the Age distribution among the study participants between the groups

		Spearman’s rho value	p value
90 degree infiltration	VAS score	0.863	0.000
	WBFPS score		
Buccal infiltration	VAS score	0.948	0.000
	WBFPS score		

Table 1 : Spearman correlation showing strong positive correlation between the scales within the groups

Table 1 shows the Spearman correlation showing strong positive correlation between the scales within the groups

		Mean \pm SD	Median	Mean rank	Mann whitney U value	p value
VAS scores	90 degree infiltration	2.64 \pm 1.084	3	36.09	459	0.259
	Buccal infiltration	2.27 \pm 1.23	2	30.91		

Table 2 : Mann Whitney U test to assess the VAS pain scores between the groups
Table 2 shows the Mann Whitney U test to assess the VAS pain scores between the groups

		Mean \pm SD	Median	Mean rank	Mann whitney U value	p value
WBFPS scores	90 degree infiltration	2.91 \pm 1.25	3	34.73	504	0.594
	Buccal infiltration	2.73 \pm 1.37	3	32.27		

Table 3 : Mann Whitney U test to assess the WBFPS pain scores between the groups
Table 3 shows the Mann Whitney U test to assess the WBFPS pain scores between the groups

Discussion

The present study explored the pain levels of two injection techniques during primary mandibular first molar pulpotomy. Though buccal infiltration had lower pain levels both the scales did not have much difference which makes them equally effective. Also during each injection two pain assessment scales were taken which were highly correlated to each other. This also proves both the scales are equally effective in assessing pain and can be used interchangeably.

In the present study, infiltration was used for mandibular molar pulpectomy which is contrary to the alveolar nerve block. This is in accordance with the rule of 10 and a study done by Wright et al who assessed 66 subjects from 3 - 6 years old who were undergoing pulpotomy of mandibular

molars which revealed that more than 65% of the children did not experience pain at all with just infiltration anesthesia [26].

In the current study VAS scale and Wong Baker's facial pain scale were used. While self-report measures are a highly recommended method that provides accurate information in children, it demands a certain degree of cognitive development. to enable the child to accurately comprehend the questions posed and make appropriate use of the scale [27]. Both the scales used in the present study are rapid, easy-to-use measures that the children prefer over other verbal, numerical, scales because they require less explanation from the participants [28].

In the present study, age had no significant role in the pain scale. The mean age of the study population is less than 5 years and the pain scales are very subjective in nature. It's possible that some of the participants misunderstood their feelings because they were unable to distinguish between various pain thresholds [22]. Also there were some studies which resulted in having associations with age and pain level during treating primary teeth [27]. In the present study gender also had no role in pain scale. But in a study which assessed the perceived pain while treating primary molars, females showed lesser pain scores than males [29].

In the current study, 90 degree and buccal infiltration were both effective in reducing the pain though buccal group had more reduction in the pain. In a study conducted by Halenur Altan et al, when conventional infiltration was compared with needless injection technique for pulpotomy and filling in primary molars, there were no difference in the pain assessment scores between both the techniques [30]. This proves that a simple infiltration is the easy but as effective way as the comparatively newer technology of needless injections.

On the contrary, in a study conducted by Passant H Hassanein et al, which assessed the pain among 60 children from 5-7 years old who were undergoing primary mandibular molar pulpotomy, the author concluded that dental vibe which produces vibration generated less pain than conventional nerve block [31].

Therefore, there are some limitations in this study. Firstly the study only assessed two injection techniques. With growing technology and the with the introduction of injectionless needles, various injection techniques should have been compared. Secondly the study only assessed the pain for a single procedure. Thirdly it was a split mouth trial with less sample size. Future studies with higher sample size should be conducted to compare multiple injection techniques and materials for different procedures on primary teeth.

Conclusion

In conclusion, this study sought to evaluate and compare the effectiveness of two distinct injection techniques, namely the 90-degree infiltration and buccal infiltration, in pediatric patients aged 3 to 5 years.

The findings of this investigation indicated that the buccal infiltration technique demonstrated a lower level of pain compared to the 90-degree infiltration approach. However, it is noteworthy to mention that no statistically significant difference was observed between the two techniques when assessed using both the VAS and Wong Baker's Facial Pain Scale. This suggests that while the buccal infiltration technique may yield a perceptible reduction in pain, it is on par with the 90-degree infiltration in terms of pain management.

Moreover, it is worth highlighting the high positive correlation observed between the VAS and Wong Baker's Facial Pain Scale across both injection techniques. These findings collectively contribute valuable insights into the selection of injection techniques for pediatric patients aged 3 to 5 years. While the buccal infiltration technique exhibits a potential advantage in terms of pain reduction, practitioners can confidently utilize either the 90-degree infiltration or buccal infiltration technique, as both are equally effective in managing pain during dental procedures in this age group. This study thus enhances our understanding of pain management strategies in pediatric dentistry, providing a basis for informed clinical decision-making and ultimately ensuring a more comfortable and positive dental experience for young patients.

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