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Efficacy of Buzzy Bee on Pain Relief during Local Anesthesia Administration for Various Dental Procedures in Children: A Randomized Controlled Trial

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Abstract

Aim: To evaluate pain perception in children on usage of buzzy bee during local anesthesia administration for various dental procedures.

Methodology: 48 children belonging to age group of 6-11 years were equally divided into 2 different groups (group A and group B) of 24 patients each. Children in each of the two groups were treated in 2 different appointments. Children in group A received local anesthesia administration using conventional syringe in the first appointment and buzzy bee along with conventional syringe in the other appointment. Children in group B received local anesthesia administration using buzzy bee along with conventional syringe in the first appointment and only conventional syringe in the other appointment. Wong–Baker pain scale was used as a subjective measure of the child's discomfort and FLACC scale was used to record child's pain as perceived by the dentist. The data obtained was subjected to statistical analysis.

Result: It was observed that pain scale values for the conventional group was statistically significantly higher than the busy bee group for both Wong-Baker and FLACC pain scale ($p < 0.0010$).

When Wong baker and FLACC pain scores were compared between the genders, no statistical significant difference was found between either the test or the control group.

Conclusion: Distraction via buzzy bee had a positive influence on the behavior of the children and buzzy bee

was also effective in reducing pain perception during local anesthesia administration in children.

Keywords: Local anesthesia, Pain perception, Buzzy Bee

Introduction

The single most important pillar upon which modern dentistry stands is effective local anesthesia and injections (intraoral) of local anesthesia is one of the successful methods to reduce pain.[1]

But in pediatric dentistry, most of the patients experience fear and anxiety at the sight of the syringe and the needle. It has been proposed by several studies that pain or the fear of pain is a primary obstacle in seeking dental care. During the administration of local anesthesia injection, an anxious patient might perceive more severe pain for a greater duration than would a less anxious patient.[2]

It is important for the success of the clinical process that the child remains relaxed and keeps calm and quiet during the injection process. Thus, it has been a great challenge for a pediatric dentist to provide an environment that allows technically complex dental treatment, starting with injection of LA to be delivered without inflicting adverse psychological harm to the child.

To overcome the fear of injection, various new technologies have been developed such as vibrajet, computer aided anesthesia and many others. However, as these are quiet expensive, using these devices generally increases the overall cost of the treatment. Thus, an easy to use, inexpensive and rapid method is needed to ameliorate pain associated with injection of local anesthesia.

Temperature (especially cold) has been found to have a profound effect in pain relieving treatment modalities and hence could be applied for dental pain management. Over the past decade, vibrating devices have been shown to be effective in distracting pediatric patients and masking the pain of intramuscular injections and venepuncture. [3]

External vibration and cold via buzzy bee can create a distractive environment, causing the brain cells to relay the vibrations thereby giving room for the delivery of analgesia. The addition of the element of cold, further confuses the perceptions of signals by the pain pathway thereby enabling a “masking effect of pain”.[4, 5]

Since there is very less literature available regarding the effectiveness of buzzy in dentistry this study was thus formulated to check the efficacy of buzzy bee in reducing pain in children during local anesthesia administration.

Methodology

Study design and setting: The randomized controlled trial was approved by the Institutional ethical committee. This study was conducted in the Department of Pediatric and Preventive dentistry, Institute of Dental Sciences, Bareilly in sample size of 48 children for duration of one month (from 12/2/2020 to 14/3/2020).

Sample Size Calculation

$n=⟦(Z⟧\_(\alpha/2)+Z\beta)2 \times 2\sigma 2(\mu 1-\mu 2)2$

Wherein,

$Z\alpha/2$ is 1.96 at 5% level of significance,

$Z\beta$ at 80% is 0.84,

$\mu 1-\mu 2 = 0.5$ - clinical significant difference,

σ = standard deviation = 0.87

The sample size was calculated the be 47.73, which was rounded to 48.

Inclusion criteria

- Children belonging to age group of 6-11 year.
- Patient who have never received dental injection before.
- Patient requiring local anesthesia infiltration on both sides of the same dental arch.
- Patients who belong to frankl positive and definitely positive behavior.

Exclusion criteria

Patients with acute signs requiring emergency treatment.

Patients with painful dental experience in the past.

Medically compromised patients

Uncooperative patients.

Apparatus/materials

"BUZZY" was used as the independent variable, which gives a combined effect of cold and vibration. The device is a reusable 8 × 5 × 2.5-cm handheld plastic bee containing a battery-operated vibrating motor and a mechanism to attach an ice pack underneath. (Figure 1)

The dependent variable was pain which was assessed using FLACC [6] (Figure 2) and WONG BAKER faces pain scale.[7] (Figure 3)

Intervention

After obtaining informed consent from the parents/caretakers, the children who fulfilled the inclusion criteria were randomly (using simple randomization: chit system) divided into 2 groups.

GROUP A: 24 patients

GROUP B: 24 patients

The children in both the groups were treated in two different appointments.

For group A, in the 1st appointment local anesthesia infiltration was done using convention syringe. In the 2nd appointment of same patient, local anesthesia infiltration was done on the other side of the same arch with conventional syringe along with buzzy bee. Before starting with the procedure, the child was explained about the working of buzzy and was allowed to play with it so as to get him/her familiar with the device. After the child got comfortable, the wings which were frozen in the refrigerator were attached to the device and the entire assembly was placed extra orally on the cheek above the area where the local anesthesia was injected.

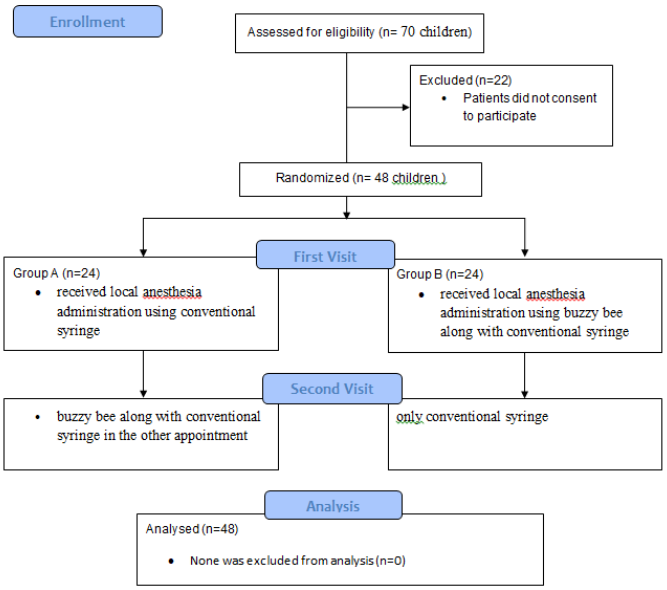
Immediately after administration of local anesthesia, Wong–Baker faces pain scale was used as a subjective measure of the child's discomfort and FLACC scale was used to record child's pain as perceived by the dentist.

For group B, the procedure was same as group A with a difference that in the 1st appointment buzzy bee was used and in the 2nd appointment only conventional syringe was used for local anesthesia administration.

In both the groups, local anesthesia (2% lignocaine) was delivered using 3 ml syringe and prior to infiltration; topical anesthesia spray was applied in the area adjacent to the tooth under treatment.

The data obtained by using pain scales was sent for statistical analysis.

Consort Form



Statistical analysis

The data obtained was entered in excel sheet and analysis was done with SPSS software. Mann Whitney U test was used to compare mean scores of FLACC and Wong Baker faces pain scale of both groups during the administration of local anesthesia using conventional and experimental methods. Any value less than 0.05 was taken as statistically significant.

Results

70 patients screened fulfilled the inclusion criteria, out of which 48 agreed to participate in the study. Among the 48 patients (26 males and 22 females), who completed both the visits, the mean age was 8.21.

Subjective evaluation was recorded using Wong Baker faces pain scale and from the data it was observed that pain scale values for the conventional group was statistically significantly higher than the busy bee group (Table 1) ($U = 407.00$, $p < 0.0010$).

Objective evaluation was recorded using FLACC scale. It was observed that pain scale values for the conventional group was statistically significantly higher than the busy bee group (Table 2) ($U = 407.00$, $p < 0.0010$).

When Wong baker pain scores were compared between the genders, no statistically significant difference was found between both the test (Table 3) and the control group (Table 4).

Also no statistically significant difference was found between males and females in either test (Table 5) or control group (Table 6) when FLACC scores were compared.

Discussion

The American Academy of Pediatrics et al. (2001) recommends that whenever possible, children should not be exposed to painful procedures. When unavoidable, interventions should be provided to limit the painful experience. [8] In pediatric dentistry, most of the patients experience fear and anxiety concerning the pain occurring while giving injection of local anesthetics.1 Therefore, pharmacologic and non-pharmacologic approaches are recommended to control pain and the resulting future anxiety behaviour.[9]

Distraction using various aids (Hutchins HS 1997, Touyz LZ 2004, Aminabadi NA et al., 2009) is a behaviour management technique which involves distracting the patient away from the stimuli that caused the anxiety and thereby reducing it. The objective of this technique is to relax the patient and reduce anxiety during treatment. It is believed that the anxiety of the patient determines the pain perception.

Local cooling (Ghaderi F et al., 2003; Aminabadi NA et al., 2009, Bhadauria et al., 2017; Hameed NN et al. 2018) and vibration (Hegde KM et al., and Ghorbanzadeh et al., 2019; Nnanitsos E et al, 2009) is believed to slow or eliminate pain signal transmission and thus has shown to reduce pain perceived during local anesthesia administration.

The results of this study suggest that external cold and vibration stimulation via Buzzy is effective for reducing pain during local anesthesia administration in children. Also the motor in the form of bee drives attention of the child and helps in distraction. The Buzzy® device is based on the gate control theory and the descending inhibitory controls. More specifically, the vibration is thought to block the afferent pain-receptive fibers (A-delta and C fibers) by the stimulation of the A-beta non-noxious fibers which will activate an inhibitory interneuron resulting in reduction of the pain information transmitted to the spinal cord. [10] On the other hand, prolonged cold application (30–60 seconds) can stimulate the C nociceptive fibers and further blocks the A-delta pain transmission signal when applied close to the nociception source. [11] The stimulation of C fibers by cold application also transmits slow pain and noxious thermal information to the brain in activating a supraspinal modulation which increases the body's overall pain threshold and therefore produces a generalized hypoalgesia at the insertion site. [12]

Susam et al., conducted a study to evaluate efficacy of Buzzy System in reducing pain during venepuncture and concluded that the Buzzy System was efficacious in

reducing pain when compared to other distractive techniques. [13]

Canbulat N et al., investigated the effect of external cold and vibration stimulation via Buzzy on the pain and anxiety level of children during peripheral intravenous (IV) cannulation. They concluded that Buzzy can be considered to provide an effective combination of coldness and vibrationand it can be used during pediatric peripheral IV cannulation by pediatric nurses. [4]

The FLACC Behavioral Pain Rating Scale comprises behavioral categories and a variety of descriptors that are reliably associated with pain in children, adults with cognitive impairment, and critical illness, supporting the validity of this tool in these groups.[14] Figure 2 provides the criteria for the FLACC Behavioural pain scale. Assessment of Behavioural Score: 0 = Relaxed and comfortable, 1-3 = Mild discomfort, 4-6 = Moderate pain, 7-10 = Severe discomfort/pain.

In this study, Wong Baker pain scale was used for subjective measure of pain as perceived by the child. It is simple and easy method of pain assessment in children.

In the present study, a majority of children showed mild discomfort during anesthesia administration using the device method (Buzzy Bee), whereas a majority of children experienced moderate pain during anesthesia administration using the conventional method. Also no statistically significant difference was found in the pain perception according to gender.

Conclusion

The following conclusions can be drawn from this study:

- Buzzy bee is effective in reducing pain perception during local anesthesia administration in children.
- Distraction via buzzy bee had a positive influence on the behaviour of the children.
- According to the gender there is no difference in the pain perception.

Limitations

The major limitation of this study is the verification of the efficacy of Buzzy bee in reducing pain was done only in children with frankl positive behaviour. Its efficacy was not evaluated in children with altered behaviour.

Another limitation while using Buzzy bee was that of its size while using it in maxillary anterior region.

Future prospects

Buzzy bee would be useful to compare child's perception of pain with parental satisfaction and look after possible correlation as family-centered care and partnership with parents are the key elements in managing the behaviour of the child.

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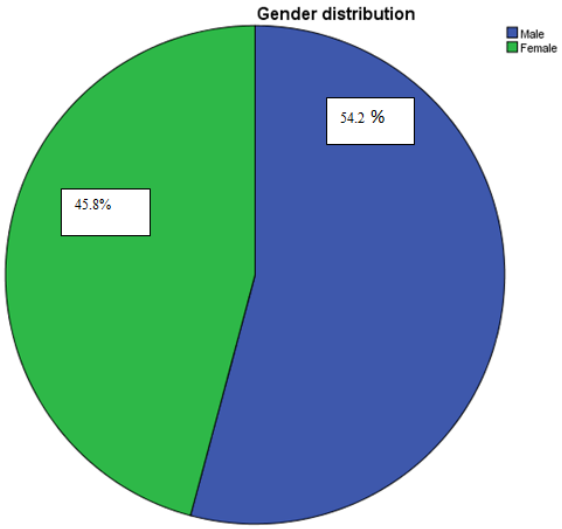
Legend Figure

Fig. 1: Buzzy Bee

Behaviour	0	1	2
Face	No particular expression or smile	Occasional grimace or frown, withdrawn, disinterested	Frequent to constant quivering chin, clenched jow
Legs	Normal position or relaxed	Uneasy, restless, tense	Kicking or legs drawn up
Activity	Lying quietly, normal position, moves easily	Squirming, shifting, back and forth, tense	Arched, rigid or jerking
Cry	No cry (awake or asleep)	Moans or whimpers; occasional complaint	Crying steadily, screams, sobs, frequent complaints
Consolability	Content, relaxed	Reassured by touching, hugging or being talked to, distractible	Difficult to console or comfort

Fig. 2: FLACC scale

Fig. 3: Wong Baker Faces pain rating



Fig, 4: Pie chart depicting gender distribution of study population

Groups	Sample	Mean Rank	Sum of ranks	Mann Whitney and Z^d statistic	P value
Busy bee	48	28.93	1388.50	212.500 and -7.027	0.000**
Conventional	48	68.07	3267.50		

** - Statistically significant differences

Table 1: Comparative response for pain on the Wong baker scale between test and control visits

Groups	Sample	Mean Rank	Sum of ranks	Mann Whitney and Z^d statistic	P value
Busy bee	48	32.98	1583.00	407.00 and -5.679	0.000**
Conventional	48	64.02	3073.00		

** - Statistically significant differences

Table 2: Comparative response for pain on the FLACC scale between test and control visits

Gender		N	Mean Rank	Sum of Ranks	Mann Whitney U statistic and p value
	Male	26	23.85	620.00	269.000 and
	Female	22	25.27	556.00	.713
	Total	48			

Table 3: Comparison of pain response between genders for visit (Wong baker)

Gender		N	Mean Rank	Sum of Ranks	Mann Whitney U statistic and p value
	Male	26	23.48	610.50	
	Female	22	25.70	565.50	259.500 and .567
	Total	48			

Table 4: Comparison of pain response between genders for test visit (wong baker)

Gender	N	Mean Rank	Sum of Ranks	Mann Whitney U statistic and p value
Males	26	21.88	569.00	
Females	22	27.59	607.00	218.000 and
Total	48			.122

Table 5: Comparison of pain response between genders for test visit (flacc)

Gender		N	Mean Rank	Sum of Ranks	Mann Whitney U statistic and p value
	Male	26	24.92	648.00	275.000 and
	Female	22	24.00	528.00	.812
	Total	48			

Table 6: Comparison of pain response between genders for control visit (flacc)