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CLINICAL RESEARCH:

Effectiveness of Distraction Techniques for Pain Management During Dental Anesthesia in Pediatric Procedures

Efectividad de las técnicas distractoras en el manejo del dolor durante la aplicación de la anestesia dental en procedimientos pediátricos

María José Bardales Martínez[1] https://orcid.org/0009-0001-0569-4553
Galadriel Avril Coronado Caycho[1] https://orcid.org/0000-0002-7898-1836
Rossmary Navarro-Betetta Esp, MSc[2] https://orcid.org/0000-0003-2468-0138

[1]Carrera de Estomatología, Universidad Científica del Sur, Lima Perú.
[2]Especialista en Odontopediatría, Maestro en Odontopediatría, Universidad Científica del Sur, Lima Perú.

Correspondence to: Rossmary Navarro-Betetta - rnavarrob@cientifica.edu.pe

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ABSTRACT: To compare the effectiveness of distraction techniques in pain management during the administration of dental anesthesia in pediatric procedures. This observational, longitudinal, and descriptive study included a sample of 64 pediatric patients: 36 females (56.25%) and 28 males (43.75%), with an average age of 7.3±1.5 years. The participants were divided into two groups: one using audiovisual distraction (32 patients) and the other using audio distraction (32 patients). Pain levels were assessed using the Wong-Baker scale before and after the procedure, and the SEM scale during the procedure. Based on the SEM scale, no statistically significant differences were observed between the two techniques during the procedure ($p>0.05$), indicating equal effectiveness. Similarly, the Wong-Baker scale showed no statistically significant differences ($p>0.05$) in pain perception after the procedure between the two techniques. Both audiovisual and audio distraction techniques are effective for pain management during the administration of dental anesthesia in pediatric patients.

KEYWORDS: Child behavior; Behavior therapies; Dental anesthesia; Audiovisual aids; Visual analog scale.

RESUMEN: Comparar la efectividad entre las técnicas distractoras en el manejo del dolor durante la aplicación de la anestesia dental en procedimientos pediátricos. Estudio observacional, longitudinal y descriptivo en el que se utilizó una muestra de 64 pacientes, estuvo conformado por: 36 pacientes (56.25%) en el sexo femenino y 28 pacientes (43.75%) en el sexo masculino. Se obtuvieron dos grupos: Distracción audiovisual (32 pacientes) y distracción del audio (32 pacientes); con edades promedio de 7.3±1.5 años. Antes y después del procedimiento se utilizó la escala de Wong-Baker y durante el

tratamiento se utilizó la escala de SEM. Según la escala SEM, durante el tratamiento, ambas técnicas no tuvieron diferencias estadísticamente significativas ($p>0.05$), por lo que son igualmente efectivas. Según la escala Wong-Baker, después del tratamiento, no se encontraron diferencias estadísticamente significativas ($p>0.05$) entre las dos técnicas en la percepción del dolor después de la anestesia. La técnica distractora audiovisual y la del audio han demostrado ser efectivas para el manejo del dolor durante la anestesia dental en procedimientos pediátricos.

PALABRAS CLAVE: Comportamiento infantil; Terapias conductuales; Anestesia dental; Ayudas audiovisuales; Escala visual analógica.

INTRODUCTION

The management of fear, anxiety, and pain in pediatric patients undergoing dental procedures remains a critical area of focus in dentistry (1). Research consistently identifies the administration of local anesthetics as the most anxiety-inducing aspect of a dental visit for children, largely due to its association with pain and heightened fear responses (2). To mitigate these reactions and promote a positive experience, dental professionals utilize a variety of behavior management techniques aimed at fostering trust and cooperation (3). Among these, distraction techniques have proven particularly effective in reducing preoperative anxiety and perceived pain during procedures such as local anesthesia administration (4-5).

Distraction is defined as a behavioral or cognitive strategy designed to divert the patient's attention away from painful stimuli (6). Its purpose is to minimize discomfort, prevent negative behaviors, and enhance cooperation during treatment (7). Among the most frequently used distraction methods are audio and audiovisual techniques. Audio distraction, often implemented through music therapy or narrated stories via headphones, has been shown to stimulate neurotransmitter release, thereby alleviating anxiety (8-10). Audiovisual distraction, meanwhile, uses devices such as televisions, interactive games, or two- and three-dimensional video glasses to immerse children in visual content (11-13). These techniques are particularly effective in quiet environments, where they help isolate the patient from external stimuli and enhance calming effects (14-15).

Delgado *et al*. reported that patients exposed to audiovisual distraction demonstrated "definitely positive" behavior on the Frankl Behavior Rating Scale (16). Krishnan *et al*. Similarly found that audiovisual distraction was associated with a slight rise in heart rate, suggesting reduced anxiety levels (17). Studies by Mahmoud *et al*. and Zaidman *et al*. further support these findings, noting significant reductions in pain during anesthetic procedures when audiovisual methods were used (18-19).

This study aimed to compare the effectiveness of distraction techniques in managing pain during the administration of dental anesthesia in pediatric patients.

MATERIALS AND METHODS

This was a longitudinal, observational, and descriptive study involving 90 patients from the Pediatrics Dentistry II and Comprehensive Stomatological Clinic V programs at Científica del Sur University. The required sample size was estimated through statistical calculations, considering a 95% confidence level and a 5% margin of error. However, due to logistical limitations and patient availability during the data collection period, a total of 64 patients were selected using convenience sampling (41).

Inclusion criteria included:

- Children aged 4 to 11 years of both sexes.
- Children needing pulp therapy.
- Children with positive or definitely positive behavior as per the Frankl Scale.
- .Children with prior experience with dental anesthesia.
- .Signed informed consent from parents, assent from the child.

Exclusion criteria included:

- Patients with a known allergy or contraindication to the anesthetic agent used.
- Cases in which the operator required assistance from a faculty member during the procedure.
- Patients with systemic conditions or special healthcare needs that could affect pain perception or behavior.
- Patients who had received sedative or anxiolytic medication prior to the appointment.
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Ethical approval was obtained from the university and Institutional Ethics Committee (N°633-CIEI-CIENTÍFICA-2024). Before initiating treatment, student operators were required to present each clinical cases to a supervising faculty member for approval. This included confirmation of the diagnosis, caries risk assessment, treatment plan and behavioral evaluation.

Patient behavior was evaluated using the Frankl Behavior Rating Scale, a widely employed tool in both clinical dentistry and research for assessing pediatric patient behavior. This scale classifies observed behaviors into four categories: 1- Definitely negative, 2- negative, 3- Positive, and 4- Definitely positive (39). Those meeting inclusion criteria were managed with Tell-Show-Do, positive reinforcement, and either audio or audiovisual distraction. Audiovisual distraction consisted of child-appropriate programming via glasses or mobile devices, while audio distraction involved music or stories through headphones (40).

Before anesthesia, patients identified their pain level using the Wong-Baker Faces Pain Rating Scale (39), by selecting the face that best represented how they felt. This scale measures pain intensity through a series of facial illustrations ranging from a smiling face (score 0, no pain) to a crying face (score 10, worst pain), allowing children to communicate their pain experience easily. In addition, pain-related behavior during the Sound, Eye and Motor (SEM) Scale, which evaluates the patient's response based on vocalizations, eye signs, and body movements, with scores ranging from "comfortable" to "painful" (21). All Data were recorded using a standardized collection form.

Training for accurate SEM and Wong-Baker scale application was led by the research advisor (R.N.B.). During calibration, intra-observer reliability was established with a Kappa value above 0.7. A pilot study (10% of the sample) was conducted to validate the methodology.

Data were analyzed using SPSS v25. Univariate analysis described frequency and percentages. The Chi-Square test assessed associations between categorical variables. Wilcoxon test evaluated within-group changes.

RESULTS

Of the initial 90 patients, 64 met the inclusion criteria (Appendix 11). The sample consisted of 36 females (56.25%) and 28 males (43.75%), with a mean age of 7.3±1.5 years. Participants were equally divided into audiovisual (n=32) and audio (n=32) distraction groups.

Table 1 shows the outcomes obtained using the SEM Scale, analyzed according to outcomes distraction technique, sex and age. The

SEM Scale includes four categories: Comfortable, Mild Discomfort, Moderate Discomfort, and Sever Discomfort. At the "Comfortable" level, audio distraction was more prevalent (31.2%) than audiovisual (25%). Both techniques were most frequently associated with "Mild Discomfort" (audio: 68.8%, audiovisual: 59.45). "Moderate Discomfort" was recorded only in the audiovisual group (15.6%). Importantly, no cases of "Severe Discomfort" were recorded in either group.

Participants were equally divided into two groups: Group 1 (audiovisual distraction) and Group 2 (audio distraction). Each group was further subdivided by gender (males and females) and by age to assess the effect of the distraction technique across these variables. By gender, in males, 15.6% in the audiovisual group and 12.5% in the audio group were rated as "Comfortable", with mild discomfort similarly distributed across both groups. In females, a higher proportion of "Comfortable" and "Mild Discomfort" responses was observed in the audio group.

Age-specific analysis was conducted using two categories: children aged 4-7 years and children older than 7 up to 11 years (>7–11 years), ensuring comprehensive coverage without excluding transitional ages. In the 4-7 age group, audiovisual distraction resulted in a higher proportion of "Comfortable" ratings, while audio distraction was more frequently associated with "Mild Discomfort". Among children aged >7-11 years, audio distraction was slightly more prevalent in the "Mild Discomfort" category, while the audiovisual group continued to show more favorable comfort responses.

No statistically significant differences were observed between distraction techniques across any variable ($p>0.05$).

SEM Scale	**Group 1 (Audiovisual) n=32**				**Group 2 (Audio) n=32**			
	Subgroup I (males)	**Subgroup II (females)**	**Subgroup III (age 4-7)**	**Subgroup IV (age >7-11)**	**Subgroup I (males)**	**Subgroup II (females)**	**Subgroup III (age 4-7)**	**Subgroup IV (age >7-11)**
Comfortable	5	3	5	3	4	6	3	7
Mild Discomfort	7	12	14	5	8	14	11	11
Moderate Discomfort	4	1	2	3	0	0	0	0
Severe Discomfort	0	0	0	0	0	0	0	0
Total number	16	16	21	11	12	20	14	18

Table 1. Effectiveness of audiovisual and audio distraction techniques in pain management during dental anesthesia administration in pediatric procedures according to the SEM scale.

	n (%)		
SEM Escale	**Audiovisual Distraction**	**Audio Distraction**	**p- value**
Comfortable	8 (25,0)	10 (31,2)	
Mild Discomfort	19 (59,4)	22 (68,8)	0,066
Moderate Discomfort	5 (15,6)	0 (0,0)	
Gender			
Male			
Comfortable	5 (15,62)	4 (12,5)	
Mild Discomfort	7 (21,89)	8 (25,0)	0,159
Moderate Discomfort	4 (12,5)	0 (0,0)	
Female			
Comfortable	3 (9,37)	6 (18,75)	
Mild Discomfort	12 (37,5)	14 (43,75)	0,421
Moderate Discomfort	1 (3,12)	0 (0,0)	
4-7 years			
Comfortable	5 (15,62)	3 (9,37)	
Mild Discomfort	14 (43,75)	11 (34,37)	0,467
Moderate Discomfort	2 (6,27)	0 (0,0)	
8-11 years			
Comfortable	3 (9,37)	7 (21,89)	
Mild Discomfort	5 (15,62)	11 (34,37)	0,065
Moderate Discomfort	3 (9,37)	0 (0,0)	

Chi-square; non-significant p-value.; p>0,05.
SEM: Sound, eye and motor scale.

Table 2 shows mean pain scores before and after anesthesia. Pre-procedure, both groups reported identical mean pain scores (0.62), with no significant difference (p>0.05). After anesthesia, pain increased in both groups (audiovisual: 2.31, audio: 1.75), but differences remained statistically insignificant.

However, Wilcoxon test results confirmed significant increases in perceived pain within each group after the procedure (audiovisual: p=0.004; audio: p=0.013), suggesting both techniques reduced baseline discomfort and facilitated better tolerance.

Table 3 shows that 50% of both males and females used audiovisual distraction. Audio distraction was more prevalent among females (62.5%) compared to males (37.5%). No significant sex-based preference was detected (p>0.05).

Table 4 presents the distribution by age. Audiovisual distraction was more common in the 4-7 group (65.6%), while the 8-11 group showed greater use of audio distraction (56.3%). These differences were not statistically significant (p>0.05), though trends suggest age-based preference patterns.

Table 2. Effectiveness of audiovisual and audio distraction techniques in pain management before and after dental anesthesia application in pediatric procedures based on the WONG-BAKER scale.

	Wong-Baker Scale	Audiovisual Distraction	Audio Distraction	p- value**
	Mean	0,62	0,62	
	Mean ± SD	1,39	1,07	
Before				0,626
	Min.	0	0	
	Max.	6	4	
	Mean	2,31	1,75	
	Mean ± SD	2,83	2,26	
After				0,643
	Min.	0	0	
	Max.	10	8	
p-value*		0,004	0,013	

S.D:Standard deviation* Wilcoxon p-value, significant
Min.- Max.: Minimum and maximum values.
**U de Mann-Whitney, p-value not significant

Tabla 3. Effectiveness of audiovisual and audio distraction techniques in pain management during dental anesthesia application in pediatric procedures by gender.

	n(%)		
Gender	Audiovisual Distraction	Audio Distraction	p- value
Female	16 (50.0)	20 (62.5)	>.05
Male	16 (50.0)	12 (37.5)	

Chi-square test; non-significant p-value.

Tabla 4. Effectiveness of audiovisual and audio distraction techniques in pain management during dental anesthesia application in pediatric procedures by age.

	n(%)		
Age	Audiovisual Distraction	Audio Distraction	p- value
4-7 years	21 (65.6)	14 (43.8)	>.05
8-11 years	11 (34.4)	18 (56.3)	

DISCUSSION

Children require special consideration during dental procedures, as early negative experiences may influence long-term attitudes toward dental care (3, 23, 31). Distraction techniques are widely used in pediatric dentistry due to their effectiveness in reducing stress and anxiety, thereby improving cooperation and treatment outcomes (10, 13).

Although the sample was selected through convenience sampling due to limited patient availability during the data collection period, a prior sample size calculation was performed to estimate the minimum number of participants required to ensure statistical validity. In addition, while random assignment would have strengthened the methodological rigor, the choice of distraction technique was based on the operator's clinical judgment, considering each child's familiarity with audiovisual or audio device. This approach was intended to promote patient cooperation and comfort, in line with ethical standards in pediatric care.

The study aimed to compare audiovisual and audio distraction techniques in managing pain during dental anesthesia. Both approaches were found effective, with no statistically significant differences between them, confirming previous findings by Cuya *et al*. (5) in children aged 7-10 years. Although the comparisons in Table 3 and 4 did not yield statistically significant differences, they were retained to illustrate potential clinical trends in pain response based on age and gender. These patterns, while preliminary, may inform future studies seeking to tailor distraction techniques more effectively to specific pediatric subgroups.

Younger children (4-7 years) tended to prefer audiovisual distraction, likely due to the immersive and engaging nature of visual stimuli. Studies by Padminee *et al*. (24) and Rath *et al*. (22) also support the superiority of audiovisual methods over audio alone. Similarly, Gurav *et al*. (27) and Prabhakar *et al*. (28) concluded that audiovisual tools produce greater reductions in anxiety and pain.

Other studies have emphasized alternative distraction methods such as animated films (30) and virtual reality, which enhance patient immersion even further. Music therapy remains a viable alternative, with evidence from Navit *et al*. (12) and Abdelmoniem *et al*. (21) showing anxiety and heart rate reduction.

While some authors report differences in anxiety by gender and age (4,11), others -including Sadeghi *et al*. (2) and this study- found no significant correlations.

Additional non-pharmacological strategies such as biofeedback, aromatherapy, and combined sensory methods (e.g., music and aromatherapy) have shown promise in anxiety reduction (17, 32). Lavender aromatherapy has proven effective in lowering both pain and anxiety levels (36).

Comparative studies also highlight the added value of distraction techniques over traditional behavioral methods like Tell-Show-Do (13). Nevertheless, individual characteristics such as temperament, anxiety history, and personal preferences significantly influence outcomes, underlining the importance of personalized management strategies.

Limitations of this study include the relatively small sample size, which restricts the generalizability of the findings. Moreover, as an observational study, it was not possible to manipulate the sample or fully control for confounding variables. Furthermore, procedures were performed by undergraduate students, whose varying technical skills and confidence levels may have influenced results.

Despite these limitations, this study reinforces the value of distraction techniques as simple, accessible, and cost-effective tools for managing pain and anxiety in pediatric dentistry. These

methods are applicable to both students and experienced professionals, supporting a positive dental experience for young patients.

CONCLUSIONS

Both audiovisual and audio distraction techniques were effective in managing pain during the administration of dental anesthesia in pediatric patients. Findings based on the SEM and Wong-Baker Scales indicate that these methods significantly reduced perceived discomfort, making them valuable tools for behavior and pain management in clinical pediatric dentistry.

AUTHOR CONTRIBUTION STATEMENT

Conceptualization and design: R.N.B.
Literature review: M.J.B.M. and G.A.C.C.
Methodology and validation: R.N.B.
Investigation and data collection: M.J.B.M. and G.A.C.C.
Data analysis and interpretation: M.J.B.M., G.A.C.C. and R.N.B.
Writing-original draft preparation: M.J.B.M., G.A.C.C. and R.N.B.
Writing-review & editing: M.J.B.M., G.A.C.C. and R.N.B.

All authors gave their final approval and agreed to be responsible for all aspects of the work.

CONFLICT OF INTEREST

The authors declare that they have no conflicts of interest.

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