Journal of Dentomaxillofacial Radiology, Pathology and Surgery

Autumn 2022, Volume 11, Number 4

Research Paper: Comparison of Audio and Audio-Visual Distraction Techniques in Managing the Pain and Dental Anxiety during Infiltration Anesthesia Injection in Children: Randomized Clinical Trial

Seyedeh Hediyeh Daneshvar[1*], Nazanin Mazloumi[2]

[1]*Assistant Professor, Dental Sciences Research Center, Department of Pediatric Dentistry, School of Dentistry, Guilan University of Medical Sciences, Rasht, Iran*
[2]*Dentist, Private Practice*

Use your device to scan and read the article online

Citation: Daneshvar SH, Mazloumi N. Comparison of Audio and Audio-Visual Distraction Techniques in Managing the Pain and Dental Anxiety during Infiltration Anesthesia Injection in Children: Randomized Clinical Trial. Journal of Dentomaxillofacial Radiology, Pathology and Surgery. 2022; 11(4):24-29. http://dx.doi.org

http://3dj.gums.ac.ir

Article info
Received: 2022/10/21
Accepted: 2022/11/17

Keywords:
Anxiety, Pain, Virtual Reality

ABSTRACT

Introduction: Children's better control methods within the pediatric dentistry focus on avoiding unpleasant behaviors, creating a trusting environment that can facilitate the dental treatment, and developing positive attitudes towards future dental care. This study aimed to compare the effectiveness of using 3D audio-visual glasses and headphones as a distraction technique to reduce pain and anxiety of children during dental injection.

Materials and Methods: This study included 30 healthy children aged 4-10 years. Audio, audio-visual and conventional behavior management strategies were used for each child who needed three dental treatments with infiltration anesthesia injection in the posterior region of maxilla. The subjects' pain severity was assessed using FLACC Scale and anxiety state was measured by Facial Image Scale.

Results: There was a significant decrease in pain perception ($P < 0.001$) and anxiety state scores ($P < 0.001$) with the use of 3D audio-visual glasses compared to the use of headphones and control group.

Conclusion: It was concluded that audiovisual distraction technique was more effective than audio distraction technique in reducing pain and anxiety of dental anesthesia injection.

*** Corresponding Author:**
Seyedeh Hediyeh Daneshvar
Address: Department of Pediatric Dentistry, School of Dentistry, Guilan University of Medical Sciences, Rasht, Iran.
Tel: +98 - 9113851732
E-mail: dr.hediyehdaneshvar@gmail.com

Journal of Dentomaxillofacial Radiology, Pathology and Surgery

Introduction

One of the most challenging aspects of pediatric dentistry is managing the pain during local anesthesia in children. If stress and anxiety associated with needle-related procedures fails to be controlled, it may lead to needle phobia and avoidance of treatment. Pedodontist should be able to detect the children with dental anxiety and apply appropriate behavior management techniques.(1,2)

Management techniques that have been introduced to reduce distress in pediatric dentistry are divided into two categories. The first category consists of behavioral techniques including the distraction, tell-show-do technique, inspiration, modeling and hypnotism. The second category consists of pharmacologic techniques.(3,4) Pain perception has a psychological component and conscious attention is required for feeling the pain.(5) Distraction is a safe and inexpensive method that can be used in children.(3) By distracting the patient's attention away from pain and encouraging a child to focus his/her attention on other thoughts, the level of pain will be reduced.(6,7) Distracting methods includes use of music, massage, breathing exercises, behavioral therapy and combining visual and audio distraction such as virtual reality (VR). (8-11) Virtual reality (VR) is a newer method of distraction which refers to "a human–computer interface that allows the user to interact dynamically with the virtual world. VR applications can be interesting and engaging for children, the child is taken into a different environment which is devoid of the operator's field and its sounds. This type of technology is usually safe and without any side effects. Although, the risk of dizziness, headache, nausea and eye strain increases if the child is in VR for more than 20 min.(11)The aim of this study was to compare the effect of audio and audio-visual distraction techniques on dental anxiety and pain during infiltration anesthesia injection in children.

Materials and Methods

Ethical approval

This randomized clinical study (IRCT20210108049963N1) was approved by the Ethics Committee of Guilan University of Medical Sciences (IR.GUMS.REC.1399.503) in 2021/01/13 and follow CONSORT guidelines. This study was conducted from March 2021 to February 2022.

Sample size calculation

A sample size of 30 was calculated considering a significance level of 5%, power of 80%, and error of 5% and based on previous clinical study of Nuvvula S et al.(12)

Study samples

Thirty children aged between 4-10 years referred to the Department of Pediatric Dentistry, Guilan University of Medical Sciences, who needed three dental treatments with infiltration anesthesia injection in the posterior region of maxilla were selected. A written informed consent was obtained from the parents of the selected children on the first visit along with brief medical and dental history of patient. Children with anxiety disorders, visual and hearing impairment, systemic diseases, children in negative and definitely negative category according to Frankl's behavior rating scale and children with previous history of dental visit or treatment were excluded.

Procedure

Audio, audio-visual and conventional behavior management strategies were used for each child in three dental sessions with at least a one-week interval. Distraction through audio and audiovisual was done using headphones) JLab Studio Wireless(and 3D audio-visual glasses(VR Shinecone G06A) respectively. The injection(infiltration technique) was done in the posterior region of maxilla (first and second primary molar) by the same pedodontist at all sessions. Prior to the injection, topical anesthetic gel (Benzocaine) was applied with a cotton roll for 30 seconds. Local anesthetic solutions (lidocaine) were delivered using a standard aspirating syringe with a 27-gauge needle (Septodent, France).

Daneshvar SH, et al.Comparison of Audio and Audio-Visual Distraction Techniques in Managing the Pain and Dental Anxiety during Infiltration Anesthesia Injection in Children: Randomized Clinical Trial. Journal of Dentomaxillofacial Radiology, Pathology and Surgery. 2022; 11(4):24-29. http://dx.doi.org

Randomization

The randomization method was block that included 6 blocks. Then 5 participants were randomly placed in each block by the same pedodontist using a computer-generated table of random numbers.

1st block: Audio/ Audio-visual/ Conventional Behavior Management

2nd block: Audio / Conventional Behavior Management/ Audio-visual

3rd block: Audio-visual/ Audio/ Conventional Behavior Management

4th block: Audio-visual/ Conventional Behavior Management/ Audio

5th block: Conventional Behavior Management/ Audio-visual/ Audio

6th block: Conventional Behavior Management/ Audio/ Audio-visual

Evaluation of pain and anxiety

Assessment of pain perception was done during injection using FLACC scale (Face, Legs, Activity, Cry, Consolability scale) (Table.1).

Table 1. FLACC scale, behavioural anxiety/pain assessment scale was the sum of the scores of each category, for a ranged score from 0 (completely relaxed) to 10 (severe anxiety/pain).

FLACC behavioral anxiety/pain assessment scale			
	Score		
Categories	0	1	2
Face	No particular expression or smile	Occasional grimace or frown, withdrawn, disinterested	Frequent to constant frown, clenched jaw, quivering chin
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 or sobs; frequent complaints
Consolability	Content, relaxed	Reassured by occasional touching, hugging or being talked to;distractible	Difficult to console or comfort

This score is the sum of the scores of each category, ranged score from 0 (completely relaxed) to 10 (severe anxiety/pain) as follows: 0=relaxed and comfortable; 1-3=mild discomfort; 4-6=moderate discomfort/pain, and 7-10=severe discomfort or pain or both.(13) Each patient was focused on her/his legs, head and body movements, facial expression, crying, and general behavior. Assessment of anxiety was done immediately after completion of the infiltration injection using Facial Image Scale, the each child was asked to select the facial expression that best represented his/her feeling of discomfort during injection. This scale consists of five faces ranging from very happy (1) to very unhappy (5).(14) (FIS, Figure 1).

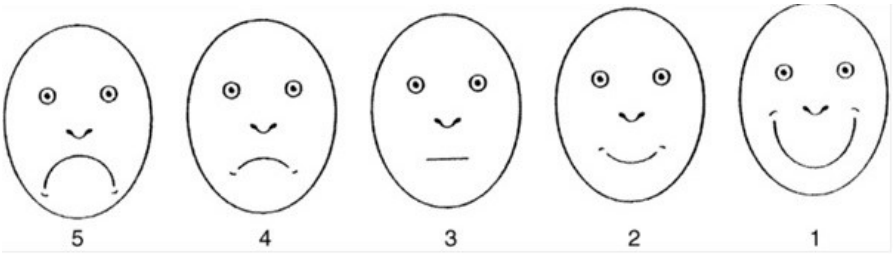

Fig. 1 Facial Image Scale

Statistical Analysis

Descriptive and inferential statistics were applied. The results were expressed in mean and standard deviation, Repeated test was used in the present study to compare the parameters. The statistical significance was set at 0.05

Results

Four patients were unable to complete the three treatment sessions due to the economic issues and they were replaced. 30children (15 boys and 15 girls) participated in this study. The overall mean age of patients was 7±2.1 years (range 4-10). 40% (n=24) of participants were 4-6 years old, 23.3% (n=14) were 6-8 years old and 36.7% (n=22) were 8-10 years old.

The mean pain score (FLACC) and anxiety score (FIS) in audio, audio-visual and control group have been shown in Table 2. The mean pain score (FLACC) and anxiety score (FIS) was significantly lower in audio-visual group compared to audio and control group ($P<0.05$, Repeated Test). No significant difference was seen between the audio and control groups in terms of FLACC ($P=0.897$) and FIS ($P=0.847$) (Table 3).

The mean FLACC and FIS score of girls was higher than boys (Table 4).

The mean FLACC and FIS score of participants decreased with increasing age (Table5).

Table 2. Mean FLACC and FIS score in three groups

Variable	Audio	Audio-visual	Control
FLACC	4.07±2.69	2.7±2.17	4.03±2.25
FIS	2.9±0.72	2.5±0.52	3±1.26

Table 3. Comparison of FLACC pain rating score and FIS anxiety score

Technique	P-value	
	FLACC	FIS
Audio&Audio-visual	0.000	0.000
Audio-visual&Control	0.000	0.000
Audio&Control	0.897	0.847

Table 4. Mean FLACC and FIS score in two genders

Variable	Audio		Audio-visual		Control	
	FLACC	FIS	FLACC	FIS	FLACC	FIS
Girl	4.6	3.06	3.53	2.66	4.66	3
Boy	3.53	2.86	1.86	2.4	3.4	3

Table 5. Mean FLACC and FIS score by age group

Variable	Audio		Audio-visual		Control	
	FLACC	FIS	FLACC	FIS	FLACC	FIS
4-6 Y	6.08	3.33	4.25	2.75	5.58	3.5
6-8 Y	3.86	2.86	2.43	2.43	3.86	2.43
8-10Y	2	2.64	1.18	2.36	2.45	2.82

Discussion

Injection of local anesthesia is one of the most feared or anxiety-producing stimuli in the pediatric dentistry. Distraction is a common technique used to divert the patient's attention to decrease the likelihood of unpleasantness perception, indicated for any child of any age. The use of topical anesthetic agent along with distraction has been considered as the best method in reducing needle insertion pain and child anxiety during dental anesthesi.(15) This study tested the effectiveness of a headphone and video eyeglass as a distracting device in reducing pain and anxiety during infiltration injection. There was a significant decrease in pain perception and anxiety scores with the use of video eyeglass compared to the head-phone and control group. By applying video eyeglasses, the child is taken into a different environment and distracted from the reatment process. Several studies have evaluated the efficacy of video eyeglasses in the different fields of medicine and dentistry and showed

contradictory results. In the study by Asvanund Y et al. (2015) [16], AV eyeglasses significantly reduced FLACC scores and heart rate when compared with not wearing the eyeglasses during local anesthesia injections in 5-8 year old children. No subject reported a maximum score on the FLACC scores when wearing AV eyeglasses, while 14% of the control group reported. In the study by CustÓdio NB et al. (2021) [17], 6-9 year old children who used the AV eyeglasses did not exhibit better behavior (Venham Behavioral Scale) and less perception of pain (FLACC Scale) than those of children in the control group during restorative treatment or extraction of the primary molars. This difference can be related to the type of procedure in which pain and behavior evaluation was done. In the present study, pain and anxiety were assessed during injection of local anesthesia.

Contrary to the present study, Sullivan et al. (2000) [18] reported that AV eyeglasses failed to improve the behaviors of the 6-9 year old children. According to the authors, the eyeglass blocks the real world and the children's vision and may cause discomfort for some children.

In the study by Mitrakul K et al. (2015) [19], AV eyeglasses reduced physical distress and heart rate during pre-operation and the first use of high speed hand piece in 5-8 year-old children. This may be attributed to the elimination of unpleasant dental sounds such as the sound of handpiece. Similar to the present study, FLACC score was used which is related to the child's anxiety and distress level in over 3-year-old children regardless of their cooperation level.

In the study by Prabhakar et al. (2007) [3], use of AV distraction during dental treatment was more effective than using audio distraction solely. It was reported that AV eyeglasses not only reduce the children's anxiety towards dental treatment by involvement of visual and auditory scenes, but in turn also, enhance the children's cooperation and induces a positive emotional reaction resulting in a relaxed experience.

Khandelwal et al. (2018) [20] reported that AV distraction was more effective than Tell show do (TSD) during restorative treatment in the first dental visit of 5-8 years old children. Combination of TSD and AVD had an additive effect in reduction of anxiety level. Analysis of Facial Image Scale (FIS) and Venham Picture Test (VPT) revealed that decline in anxiety was significantly when AVD technique was applied. The TSD increase the basic knowledge of patient about the dental procedures while AVD diverts attention from unpleasant dental environment. Distraction methods divert patient's attention away from dental environment, whereas in TSD the child is exposed directly to dental procedures, which might make the child more afraid. The limitation of this study is that the pedodontist who assessed the children's behavior was not blinded to whether audio-visual glass or headphone was used. One of the advantages of this study is that each participant would be compared with themselves in three different situations and therefore the differences in pain threshold would not result in bias in reporting the results. This study excluded children with previous dental experience which might have affected the results. This was chosen in order to have a homogeneous group and achieve more reliable results.

Studies with different aged subjects, larger samples and different treatment procedures should be conducted in order to identify the effectiveness of these devices.

Conclusion

The use of 3D audio-visual glasses can be an effective tool for reducing anxiety and pain perception during the dental injection in children.

Acknowledgments

We would like to thank Department of Pediatric Dentistry of Guilan University of Medical Sciences for their great support.

Authors' contributions

Seyedeh Hediyeh Daneshvar: Conceptualization, Methodology, Writing - Review & Editing **Nazanin Mazloumi:** Writing - Original Draft, Data Curation, Supervision

Conflict of Interests

The authors declare no conflict of interest.

Ethical declarations

IR.GUMS.REC.1399.503

Financial support

None

Availability of data and material

The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

References

1. Cohen LA, Harris SL, Bonito AJ, et al. Coping with toothache pain: a qualitative study of low-income persons and minorities. J Public Health Dent 2007; 67:28-35.https://doi.org/10.1111/j.1752-7325.2007.00005.x

2. Wiederhold MD, Gao K, Wiederhold BK. Clinical use of virtual reality distraction system to reduce anxiety and pain in dental procedures. Cyberpsychol Behavand Soc Netw 2014;17:359-65.https://doi.org/10.1089/cyber.2014.0203

3. Prabhaker AR, Marwah N, Raju OS. A comparison between audio and audiovisual distraction techniques in managing anxious pediatric dental patients. J Indian Soc Pedod Prev Dent 2007;25:177-82.https://doi.org/10.4103/0970-4388.37014

4. Ram D, Peretz B. Administering Local anaesthesia to paediatric dental patients -current status and prospects for the future. Int J Paediatr Dent 2002;12:80-9.https://doi.org/10.1046/j.1365-263X.2002.00343.x

5. Baghdadi ZD. Evaluation of audio analgesia for restorative care in children treated using electronic dental anaesthesia. J Clin Pediatr Dent 2000;25:9-12.

6. Hodes RL, Howland EW, Lightfoot N, et al. The effects of distraction on responses to cold pressor pain. Pain 1990; 41:109-14.https://doi.org/10.1016/0304-3959(90)91115-Y

7. Miron D, Duncan GH, Bushnell MC. Effects of attention on the intensity and unpleasantness of thermal pain. Pain 1989; 39: 345-52.https://doi.org/10.1016/0304-3959(89)90048-1

8. Nguyen TN, Nilsson S, Hellstrom AL, Bengtson A. Music therapy to reduce pain and anxiety in children with cancer undergoing lumbar puncture: A randomized clinical trial. J Pediatr Oncol Nurs 2010; 27: 146-55. https://doi.org/10.1177/1043454209355983

9. Post-White J, Fitzgerald M, Savik K, Hooke MC, Hannahan AB, Sencer SF. Massage therapy for children with cancer. J Pediatr Oncol Nurs 2009; 26: 16-28.https://doi.org/10.1177/1043454208323295

10. McKenna K, Gallagher KA, Forbes PW, Ibeziako P. Ready, set, relax: Biofeedback-assisted relaxation training (BART) in a pediatric psychiatry consultation service. Psychosomatics 2015; 56: 381-9.https://doi.org/10.1016/j.psym.2014.06.003

11. Lee DW, Chan AC, Wong SK, Fung TM, Li AC, Chan SK et al. Can visual distraction decrease the dose of patient-controlled sedation required during colonoscopy? A prospective randomized controlled trial. Endoscopy 2004; 36:197-201.https://doi.org/10.1055/s-2004-814247

12. Nuvvula S, Alahari S, Kamatham R, Challa RR. Effect of audiovisual distraction with 3D video glasses on dental anxiety of children experiencing administration of local analgesia: a randomised clinical trial. Eur Arch Paediatr Dent. 2015;16:43-50.https://doi.org/10.1007/s40368-014-0145-9

13. Garrocho-Rangel A, Ibarra-Gutiérrez E, Rosales-Bérber M, Esquivel-Hernández R, Esparza-Villalpando V, Pozos-Guillén A. A video eyeglasses/earphones system as distracting method during dental treatment in children: A crossover randomised and controlled clinical trial. Eur J Paediatr Dent 2018;19:74-79.

14. Buchanan H ,Niven N . Validation of a Facial Image Scale to assess child dental anxiety. Int J Paediatr Dent 2002; 12: 47-52.https://doi.org/10.1046/j.0960-7439.2001.00322.x

15. Fakhruddin KS, Gorduysus MO. Effectiveness of audiovisual distraction eyewear and computerized delivery of anesthesia during pulp therapy of primary molars in phobic child patients. Eur J Dent 2015;9:470-5.https://doi.org/10.4103/1305-7456.172637

16. Asvanund Y, Mitrakul K, Juhong RO, Arunakul M. Effect of audiovisual eyeglasses during local anesthesia injections in 5-to 8-year-old children. Quintessence Int 2015;46:513-21.

17. CustÓdio NB, Cademartori MG, Azevedo MS, Mendes MD, Schardozim LR, Costa LR et al. Efficacy of audiovisual distraction using eyeglasses during dental care: a randomized clinical trial. Braz Oral Res 2021;35:26.https://doi.org/10.1590/1807-3107bor-2021.vol35.0026

18. Sullivan C, Schneider PE, Musselman RJ, Dummett Jr, CO, Gardiner D. The effect of virtual reality during dental treatment on child anxiety and behavior. ASDC J Dent Child 2000;67:193-6.

19. Mitrakul K, Asvanund Y, Arunakul M, Paka-Akekaphat S. Effect of audiovisual eyeglasses during dental treatment in 5-8 year-old children. Eur J Paediatr Dent 2015;16:239-45.

20. Khandelwal D, Kalra N, Tyagi R, Khatri A, Gupta K. Control of Anxiety in Pediatric Patients using"Tell Show Do" Method and Audiovisual Distraction. J Contemp Dent Pract 2018;19(9):1058-1064.https://doi.org/10.5005/jp-journals-10024-2381