

# Impact of Laughter Therapy on Anxiety and Pain in Pediatric Dentistry: A Double-Blinded Randomized, Controlled Clinical Trial

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## ABSTRACT

**Objective:** To evaluate the effect of laughter therapy on reducing anxiety and pain during dental procedures in children 5–7 years of age. **Material and Methods:** 48 children aged 5–7 years were included in this cross-over double-blinded clinical trial after the parents completed the Screen for Child Anxiety Related Disorder questionnaire (SCARED). After allocation into two groups: laughter intervention (A) and neutral intervention (B), the anxiety as well as pain were determined by Modified Child Dental Anxiety Scale Faces questionnaire (MCDASF) and the Wong-Baker Faces Scale, respectively. Also, the child's behavior during the treatment was recorded using the Sound, Eye, Motor scale (SEM). Data were analyzed by SPSS 21 using Paired t-test, Independent t-test, Chi-square, Mann-Whitney and Wilcoxon's test. **Results:** The mean score of anxiety in the laughter intervention group ( $17.42 \pm 2.74$ ) was significantly less than ( $22.06 \pm 2.16$ ) in the neutral intervention group ( $p=0.000$ ) and lower in boys in both groups ( $p=0.000$ ,  $p=0.047$ ). The mean pain severity reported by the children in the neutral intervention group ( $5.33 \pm 1.81$ ) was higher than in the laughter intervention group ( $2.38 \pm 1.87$ ;  $p=0.00$ ) and higher in girls in both groups ( $p=0.02$ ;  $p=0.03$ ). **Conclusion:** The laughter intervention before dental procedures had a significant effect on reducing anxiety and pain during dental treatment.

**Keywords:** Pediatric Dentistry; Dental Anxiety; Laughter therapy.

## Introduction

The significant and substantial role of behavior management due to the children's anxiety and fear is explicit for dentists who practice in the field of pediatric dentistry [1]. Although conventional behavior control approaches can be successful, the attitudes of parents and dentists toward restraining or physical immobilization of the child have been changed [2].

Management strategies are typically divided into two wide groups. The first includes behavioral techniques such as the tell-show-do technique (TSD), distraction, modeling, positive reinforcement, voice control, parental presence/absence, protective stabilization, non-verbal communication, hand-over-mouth, and hypnotism. Pharmacologic techniques such as sedation and general anesthesia are placed in the second group [3-7].

By investigating physiological parameters, researchers suggest that various parts of the brain are active during laughing, including the left and right sides of the cortex, the frontal lobe, the sensory processing regions in the frontal lobe and motor regions. Close examination of these regions shows that the limbic system plays a major role in human motivation and behavior [8]. In addition, laughing increases the discomfort tolerance threshold and affects the heart rate and respiration depth [9]. Physiological changes that might occur due to laughing include muscle relaxation, improvement in respiration rate and depth, an increase in the blood flow and production of endorphins, and a decrease in the secretion of stress-related hormones such as corticosteroids [10].

A positive emotional state induced by watching funny videos or playing with a clown before dental and medical procedures can increase pain tolerance threshold, improve immunity and neutralize cardiovascular outcomes which are affected by negative conditions [11,12]. According to Felluga et al. [13] and Weisenberg et al. [14], laughter therapy significantly reduces dental anxiety and relieves pain and discomfort during dental procedures. In addition, Vagnoli et al. [12] stated that children's contact with a clown has a strongly positive effect on decreasing anxiety before surgery, which was also confirmed by Demir [10] and Alcântara et al. [15].

Despite the novel behavioral management techniques, less attention has been paid to the impact of direct laughter therapy through watching funny videos on children's pain perception and anxiety during restorative dental treatment. In this context, laughter therapy could be considered a low-cost and available intervention that affects the positive physiological functions of the child. Therefore, the main objective of this investigation was to evaluate the effect of laughter therapy on dental anxiety and pain in children 5-7 years of age who visit the postgraduate pediatric dentistry student for restorative dental treatment.

## Material and Methods

The present paper conforms to guidelines from the Consolidated Standards of Reporting Trials (CONSORT Statement) [16].

### Study Design, Ethical Clearance, and Sample Size

This double-blinded cross-over randomized clinical trial study was carried out on 48 children aged 5-7 years who attended the Department of Pediatric Dentistry of Kerman University of Medical Sciences for dental treatment. The proposal of this study was approved by the Research Ethics Committee of Kerman

University of Medical Sciences under the code of ethics IR.kmu.REC.1394.505 and registered under the Iranian Registry of Clinical Trials (IRCT) registration number, IRCT2017072235212N1.

The allocation ratio was 1:1. Sample size was estimated on G-power software version 3 [17] with an effect size of 0.50 and 80% power at a significance level of 5%. To compensate for the possible losses of follow-up, a 10% addition was made, resulting in the minimum recruitment of 24 participants per group.

#### Participants

Children aged 5-7 years who did not have any anxiety disorders based on the Screen for Child Anxiety Related Disorder questionnaire (SCARED) were included in the study. The SCARED questionnaire consists of 41 questions and a score of  $\geq 25$  indicated an anxiety disorder [18]. Other eligibility criteria were the first dental visit of the child and the presence of two contralateral primary molars in one jaw, which could be restored under local anesthesia.

The following inclusion criteria were adopted: Inclusion Criteria: 1) Children with no anxiety disorders (SCARED questionnaire score  $< 25$ ); 2) First-time dental visit; and 3) Presence of two contralateral carious primary molars in one jaw. As for the exclusion criteria, the following were established: 1) Systemic medical problems; 2) History of hospitalization; 3) Family problems; 4) Using sedatives or tranquilizers before the dental procedure; 5) History of toothache caused by inflammation; and 6) Speaking with unintelligible language.

#### Interventions, Randomization, and Allocation Concealment

Parents completed the SCARED questionnaire and their informed consent was obtained prior to the investigation. Then 48 children were selected and numbered on a list. All the subjects underwent fluoride therapy in one session to become acquainted with the dentist and the dental environment, and after that, the names of the children were all placed in separate envelopes and the gender of each child was registered on the back of the envelope. Then the assistant randomly divides 24 children by equal distribution between males and females into the intervention and neutral groups of groups A and B. Throughout the treatment, the dentist is blind to the child's group. The researcher, the postgraduate pediatric dentistry student, the dental assistant and the statistician were blinded to the groups of children and subjects' group allocation. Encoding and decoding of the questionnaires were carried out by a dental assistant. The subjects in group A watched a cartoon with selected funny scenes (Cat & Dog, Nickelodeon Co, 1998) (translated in Iran) for 10 minutes in a quiet environment similar to the waiting room before they entered the Pediatric Department. The room was darkened, and the cartoon, selected by a pediatric psychologist specifically for that age group, was played by a video projector on a wall. From the beginning of the child's arrival at the room until the end of the film, a dental assistant was present in the room to monitor the process of watching the film and interfere when necessary to make the child laugh.

#### Outcomes and Confounding Factors

Subsequently, after watching the cartoon, each child was guided to the operatory and after being seated on the dental unit, the Modified Child Dental Anxiety Scale Faces questionnaire of Iranian Version (MCDASF) was read by the dentist and the child was asked to tick the answers on the 'faces'. The validity and reliability of MCDASF have been confirmed in the Iranian population [19].

Then the dentist injected the local anesthetic agent and restored one of the decayed molar teeth. During the procedure, another dentist who was blinded to the study assessed and recorded the child's behavior, including sounds, eye and hand movements. Based on the Sound, Eye, Motor scale (SEM), the child's feedback during treatment is described in Table 1 [18].

**Table 1. Sound, Eye, and Motor (SEM) Scale description.**

Score	Designation	Sounds	Eye	Motor
0	Comfort	No sound indicating pain	No eye signs of discomfort	Hands, relaxed, no apparent body tenseness
1	Mild Discomfort	Nonspecific possible pain indication	Eyes wide show of concern, no tears	Hands show some tension
2	Moderately Painful	Specific verbal complaint, e.g., voice raised	Watery eyes	Random movement of arms/body grimace, twitch
3	Painful	Verbal complaint indicates intense pain	Crying; tears running down the face	Movement of hands to make aggressive physical contact, pulling head away punching

At the end of the treatment, the Wong-Baker faces questionnaire (Figure 1) was filled up by the child to check the severity of pain he/she had experienced by choosing a 'face' that best described his/her feelings [20].



**Figure 1. The Wong-Baker faces pain rating scale.**

The child returned to the Department of Pediatric Dentistry two weeks later, and this time, in the waiting room, the same cartoon with neutral scenes was played for 10 minutes. Then he/she was guided to the dental operatory. After seating the child on the unit, the MCDASF anxiety questionnaire was completed. Then the dentist injected the local anesthetic agent and started to restore the decayed molar teeth on the contralateral side. During the treatment, the SEM scale was completed by the second dentist, and eventually, the Wong-Bakers faces questionnaire was completed to determine the pain that the child had experienced. The same procedural steps were carried out for the subjects in group B; however, first, the neutral video was played, followed by the treatment and evaluations used for group A (Figure 2). In order to eliminate the confounding factors, the injections were carried out using Septo Ject 27-G needles with a length of 21 mm (septodont.com.uk) with an anesthetic cartridge containing 2% lidocaine with 1:80000 epinephrine (Persocaine, Daroopaksh Company, Tehran, Iran). An anesthetic gel containing 2% benzocaine (Master-Dent Co.) was also used as a local topical anesthetic agent before the injection. The injection syringe (Jooya Company, Iran) was the same for all the subjects and the injection was carried out in one minute. The operatory was isolated so that the effect of the surrounding stresses and noises would not interfere with the procedures. In addition, all the children were treated at a specific hour of the day. The children were asked to have enough nocturnal sleep before the two treatment sessions and were accompanied by one of the parents selected by the child; otherwise, the procedure was postponed to another session. During the treatment, behavioral control was performed with

routine techniques in the presence of one of the parents; if the child was uncooperative during the treatment or needed pulp treatment during the procedure, he/she was excluded from the study.

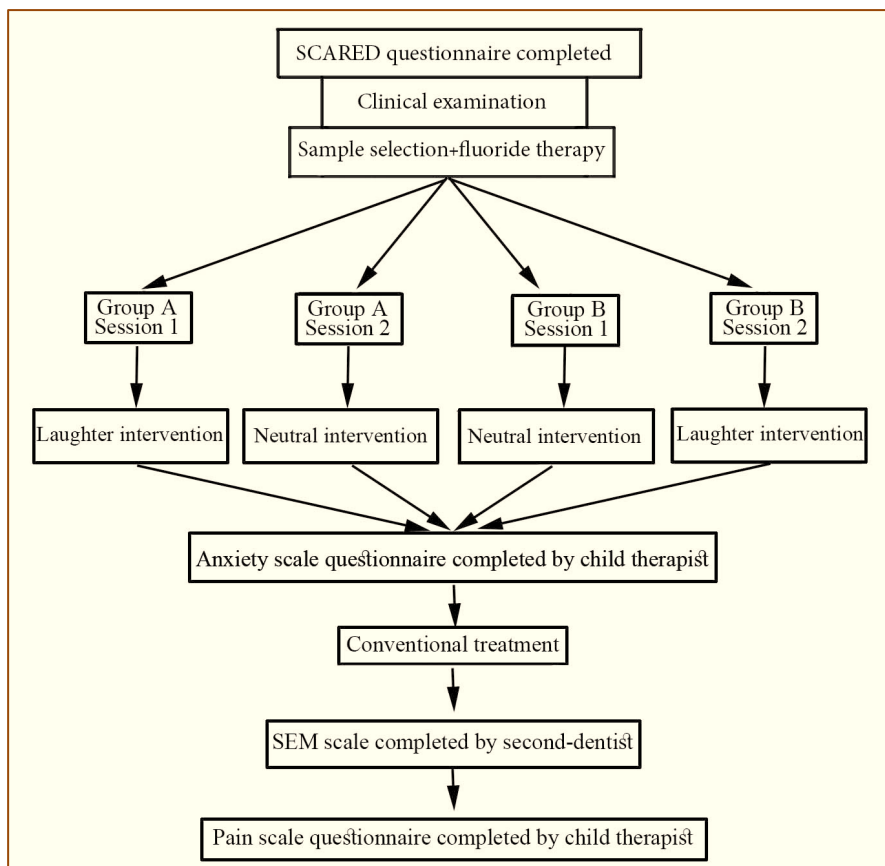


Figure 2. An algorithm showing the study protocol.

### Statistical Analysis

After collecting the questionnaires, the data were coded and entered into SPSS statistical software version 21 (IBM Corp. Released 2012. IBM SPSS Statistics for Windows, Version 21.0. Armonk, NY: IBM Corp.), using mean, standard deviation for quantitative variables, frequency and percentage of frequency for stratified qualitative ones. Paired t-test, Independent t-test, Chi-square, and Mann-Whitney were used to compare quantitative variables and Wilcoxon’s test was performed in the absence of normal distribution of data at a significant level of 0.05.

### Results

The results of the study conducted on 48 children aged between 5-7 with the mean age of 6.094 and equally distribution between males and females are shown in Table 2.

Table 2. Distribution according to demographic information.

Age	N	%
5.0	8	16.7
5.5	6	12.5
6.0	17	35.4
6.5	3	6.3
7.0	14	29.2
Total	48	100.0

At first 54 children assessed for eligibility from which, five children were excluded because of their parents' withdrawal, and a child was excluded by the dentist due to hospitalization between the two treatment sessions. Treatment of the subjects who were excluded continued routinely at usual work hours of the Department of Pediatric Dentistry. Subsequently, 48 children were included in the study after initial examinations and becoming eligible. According to the results of this study, the mean of anxiety scores in the laughter and neutral intervention groups were  $17.42 \pm 2.74$  and  $22.06 \pm 2.16$ , which showed that children in the laughter intervention group had less anxiety before the dental procedures ( $p=0.000$ ). Moreover, in both groups, boys experienced less anxiety than girls before the procedures, and the difference was statistically significant (Table 3).

**Table 3. Mean anxiety, child's behavior and pain score in terms of age and gender.**

Variables	Laughter Intervention				Neutral Intervention			
	Gender		Age Group		Gender		Age Group	
	Males	Females	5-6	6-7	Males	Females	5-6	6-7
Mean Anxiety Score	$15.88 \pm 1.87$	$18.96 \pm 2.62$	$17.13 \pm 2.79$	$17.94 \pm 2.65$	$21.38 \pm 2.14$	$22.75 \pm 2.00$	$21.74 \pm 2.17$	$22.65 \pm 2.09$
p-value	0.000		0.333		0.047		0.207	
Child's Behavior Score	$0.96 \pm 0.75$	$1.54 \pm 0.93$	$0.90 \pm 0.70$	$1.88 \pm 0.85$	$2.2 \pm 1.31$	$3.08 \pm 1.13$	$2.26 \pm 0.21$	$3.35 \pm 0.16$
p-value	0.025		0.000		0.043		0.013	
Mean Pain Score	$1.75 \pm 1.59$	$3.00 \pm 1.95$	$1.81 \pm 1.740$	$3.41 \pm 1.698$	$4.67 \pm 1.834$	$6.00 \pm 1.560$	$5.16 \pm 1.917$	$5.65 \pm 1.618$
p-value	0.027		0.038		0.034		0.260	

The mean score of child's behavior in the SEM scale under neutral and laughter interventions were  $2.65 \pm 1.29$  and  $1.25 \pm 0.88$ , respectively. This shows that the children in the laughter intervention group significantly exhibited totally positive or positive behavior during treatment ( $p=0.00$ ). However, in both neutral and laughter intervention group, the mean score of the child's behavior was significantly lower in males ( $p=0.043$  and  $p=0.025$ ). Therefore, in both groups, boys exhibited more positive behavior than girls during dental treatment (Table 3). Nevertheless, the mean score of pain reported by the children in the Wong-Baker scale was  $5.33 \pm 1.81$  and  $2.38 \pm 1.87$  in the neutral and laughter intervention groups, respectively, with a significant difference between the two groups ( $p=0.00$ ). Also, the pain severity reported by the boys was significantly lower than the girls in both the laughter and neutral intervention groups ( $p=0.02$  and  $p=0.03$ , respectively) (Table 3). The mean anxiety score in the neutral and laughter intervention group was different at various levels of pain ( $p=0.002$  and  $p=0.00$ ). The Pearson's correlation coefficient test in both groups shows a significant relationship between anxiety and pain ( $p=0.036$  and  $p=0.00$ ); thus, an increase in the child's anxiety before the treatment results in more severe pain during and after the treatment.

## Discussion

The following discussion concerns the impact of laughter therapy before dental treatment through watching a funny film on children's anxiety and pain during the treatment, as below:

### Effect on Anxiety

The level of anxiety in children in the laughter intervention group was less than in the neutral intervention group. Felluga et al. [13] investigated the effect of clown therapy on children's anxiety in an emergency department and showed that the level of anxiety in the clown therapy group was significantly lower

than in the control group, which was confirmed by Alcântara et al. [15], Demir [10], Vagnoli et al. [12] and Al-Khotani et al. [21]. Also, Rao et al. [22] concluded that distraction with virtual reality eyeglasses significantly reduces anxiety during and after the restorative treatment procedure. This agrees with Rajeswari et al. [23] that cognitive behavioral play therapy and audiovisual distraction reduce the subjective and objective anxiety scores, although the rate of anxiety reduction was significantly higher in cognitive behavioral play therapy.

This is consistent with Sekhavatpour et al. [24], that reading animated illustrated books for children before surgical procedures could significantly decrease physical and total anxiety as well as behavioral disorders in children after the procedure.

By contrast, Ramos-Jorge et al. [25] concluded that children's confrontation with positive scenes before dental procedures did not affect the children's anxiety significantly in the ages of 4–11. This might be due to the fact that positive scenes could not exactly stimulate the physiologic responses induced by laughter therapy and the irrelevancy between the scenes and dental treatment. Also, Koticha et al. [26] suggested that distraction by virtual reality sunglasses reduces the mean pulse rate during extraction procedure but does not significantly affect child's anxiety responses.

#### Effect on Pain

This investigation suggests that the mean score of pain reported by children in the laughter intervention group was significantly lower than the neutral intervention group. In this regard, Aminabadi et al. [18] used Wong-Baker criterion on 80 children aged 6–7 in Tabriz and showed that listening to illustrated stories about visiting a dental office decreases anxiety and improves behavioral feedback during treatment. Abolghasemi et al. [27] also concluded that behavioral-cognitive interventions decrease children's anxiety, heart rate and pain during dental procedures, supporting the results of Rao et al. [22]. Alcântara et al. [15], based on a visual analog scale (VAS) suggested that clown therapy significantly increases systolic and diastolic blood pressures and decreases pain severity. Additionally, Weisenberg et al. [14] compared the effect of watching comic/disgusting/neutral films to not watching films on pain tolerance and concluded that in the group watching a comedy, there was a significant increase in pain tolerance. Nonetheless, Felluga et al. [13] found that despite the positive effect of meeting a clown on children's anxiety, this effect was not observed on children's pain. Since such studies only used the techniques of play therapy and distraction without measuring the effect of laughing on the child, it seems that the effect of laughter on pain cannot be expected through laughter's physiological pathways.

#### Effect on Anxiety and Pain in Terms of Gender

The level of anxiety in the boys in both groups before treatment was significantly lower than in the girls. Also, the level of anxiety in the boys decreased further after intervention and they reported less pain in both groups compared to the girls. Kiliç et al. [28] suggested that despite the effect of inducing a happy environment on decreasing children's anxiety, there was no significant difference between the two genders. The difference is because of the larger sample size, age group and different measurement tools in the above-mentioned study. It has been found [29,30] that dental anxiety in children under 5 is not related to the child's gender, and female subjects exhibit more anxiety, especially after the early years of school. Yet, researchers believe this might be due to females' greater willingness to express their fears verbally [30].

### The Relationship Between Children's Self-Reports of Pain with the Dentist's Records of Non-Verbal Behavior

In our investigation, the children's self-reports of pain were consistent with the dentist's records of their behavior. This was also confirmed by Alcântara et al. [15], in which by the clown intervention, vital signs changes indicated a decrease in pain severity conforming to the results of non-verbal measurements. However, in this study, the criterion for this measurement was SEM scale with a non-verbal table and without scales and scores. McGrath et al. [31] also claimed that in the absence of the child's self-report of pain or if he/she is not able to report the pain at the age of 3–6, behavioral criteria are very important for measuring the pain.

### The Relationship Between Dental Anxiety and Pain in the Two Groups







Our study showed that anxiety reduction leads to a decrease in pain severity and is consistent with the specificity theory of pain; if the cause of anxiety and pain is the same, anxiety can increase pain [32]. Also, Bronzo and Powers [33] reported that the pain threshold in stressful situations decreases, which was substantiated by measuring the pulse and blood pressure, although animal studies have shown that induction of relatively severe shocks can activate the opioid system, reducing the effect of pain [32].

The main advantages of our study are related to the sufficient sample size and new methodology for the distraction of the children, even though further studies are needed to evaluate the impact of laughter therapy during pulp treatment, extraction procedures on children anxiety and pain perception in different age groups.

## Conclusion

This study highlights that laughter intervention before dental procedures have a significant impact on reducing anxiety before the procedure and on decreasing the pain during the procedure, which was more evident in boys. It is recommended that this intervention should be repeated with larger sample sizes of different age intervals. Further studies are merited to investigate the relationship between the duration of laughter before treatment and the level of anxiety and severity of pain during the treatment.

## Authors' Contributions

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All authors declare that they contributed to critical review of intellectual content and approval of the final version to be published.

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## Conflict of Interest

The authors declare no conflicts of interest.

## Data Availability

The data used to support the findings of this study can be made available upon request to the corresponding author.



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