

Effect of Acupressure on Dental Anxiety in Children: a Pilot Study for a Randomized Clinical Trial

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Background: Anxiety is an important problem in children in dental clinics. Acupressure may be a useful tool to assist in dental procedures in anxious children.

Objectives: This pilot study was performed to examine the effects of acupressure on dental anxiety in children undergoing restorative procedures.

Methods: Fourteen children aged 7-10 years and with at least one primary molar with caries on the dentine were included in the study. The participants also needed to score at least one point on the modified Venham Picture Test (VPTm) for the determination of anxiety. The children were randomly allocated to two groups: group A — non-documented points for the reduction of anxiety and induction of relaxation; group B — documented points (EX-HN3, *Shen Men* of auricular acupuncture). The anxiety scale was administered on three occasions: prior to the application of acupressure; immediately after sitting in the dental chair to undergo restorative treatment; and after removal of acupressure at the end of the restorative procedure. Heart rate (HR) was measured when each child sat in the dental chair, after the removal of carious tissue, and after the removal of acupressure.

Results: After the procedure, HR (as an indicator of anxiety) was statistically significantly lower in group B than group A ($p = 0.02$). However, there was no significant difference between the groups regarding anxiety before and during the restorative procedure (VPTm and HR: $p > 0.05$).

Conclusion: The children who received acupressure on documented points for the reduction of anxiety had a significantly lower HR after the restorative procedure. No significant between-group difference was found regarding anxiety measured using a psychometric evaluation (VPTm).

Keywords: Acupressure, Children, Dental anxiety

INTRODUCTION

Dental anxiety is an emotional state of anguish or concern prior to and during dental care and may be caused by either specific or unknown factors [1]. The most frequent symptoms are apprehension, nervousness, restlessness, trembling, sweating, and dizziness [2]. These feelings are very common in pediatric patients. In a recent study in children aged 4-13 years and which used an anxiety rating scale of 1 to 5, 43.3% of the children had a score of 3, and 11.9% had scores of 4 and 5. The highest level of anxiety was found among the children aged 4-7 years [3]. Dental anxiety hinders the execution of dental procedures in children in this age group, which leads

to unpleasant experiences for patients, parents, and dentists. Moreover, a higher level of anxiety increases sensitivity to pain [4]. Thus, special attention must be given to psychologic aspects, and several techniques have been proposed to try to reduce dental anxiety and improve well-being in children [5].

Acupuncture can complement conventional therapy by providing patients with a sense of well-being, as this therapeutic modality stimulates the release of opioids, controls the sensation of pain, and induces relaxation [6]. However, the involvement of needles can be a traumatizing factor, which limits the use of acupuncture in children [7]. Acupressure is a non-invasive alternative that activates acupuncture points with a light, pleasant touch [8]. This technique consists of

the mechanical stimulation of cranial nerves and has been successfully used to treat dental and preoperative anxiety [9,10]. Acupressure has important advantages over other complementary practices, as it can be performed with noninvasive materials and has minimal side effects [11].

In a previous search performed in the MEDLINE database via PubMed (www.pubmed.gov), only two were identified [12,13]. In one of these studies, reduced dental anxiety in children with the use of acupressure was evaluated [12]. The researchers used natural seeds on strategic acupuncture points in a sample of children aged 8-12 years. The group who received acupressure had lower levels of anxiety and better behavior during dental treatment [12]. In another study, laser acupuncture effectively reduced dental anxiety in children aged 5-10 years [13]. Therefore, acupressure can be a useful tool to assist with dental procedures in anxious children.

Considering the scarcity of studies, the aim of the present study was to strengthen the evidence base by performing a pilot study for a randomized clinical trial to determine the effects of acupressure on anxiety in children undergoing restorative dental procedures.

MATERIALS AND METHODS

1. Ethical aspects

This project received approval from the institutional review board of X (certificate number: 3.518.228). All parents/guardians signed a statement of informed consent authorizing participation of their children.

2. Study design

This was a pilot study (for a randomized, double-blind clinical trial) conducted in the city of Diamantina, Brazil, in accordance with CONSORT guidelines for randomized studies involving non-pharmacologic treatment [14].

The sample size for the main trial was calculated using a standard deviation (SD) of 3.5, referring to the difference in SD between groups (acupuncture vs. control) in a previous study [12]. The population of the main trial will comprise 72 children (36 in each group). In the present pilot study, 14 children (20%) were selected to enable testing of the trial methods.

3. Study population

The study population comprised children aged 7-10 years and screened at public schools in the city. At the initial examination, children with at least one primary tooth with a cavity were invited (through a letter to their parents/guardians) to visit the clinic of the postgraduate program of XXXX. At the clinic, the modified Venham Picture Test (VPTm) was administered to measure anxiety, and children

who scored at least one point were invited (together with a parent/guardian) to participate in the study. The oral clinical examination was then performed in a dental chair, under the light of a reflector and with the aid of a mouth mirror and ball-tip probe. The evaluation of dental caries was performed following World Health Organization criteria, with determination of the decayed, missing, and filled permanent teeth (DMFT)/decayed, missing, and filled primary teeth (dmft) index [15]. Children who met the inclusion criteria were scheduled for the session in the study itself.

4. Dental session

On the scheduled study day, parents/guardians answered a questionnaire addressing sociodemographic characteristics and child health. The questionnaire was designed by the research team and had questions addressing family income, parents'/guardians' schooling, child age and sex, type of housing, present or past toothache reported by the child, and previous visits to the dentist. The respondents also answered a questionnaire about parents'/guardians' anxiety, which comprised four questions, each with five scored response options (total: 1 to 20 points) [16].

5. Randomization

In a reserved room, children were asked by the researcher controlling the acupressure to choose a card from an opaque envelope. The options were A (acupressure on points not reported in the literature to reduce anxiety and induce relaxation), or B (acupressure on points reported in the literature to reduce anxiety and induce relaxation). Only this researcher knew which letter corresponded to which group.

6. Acupressure

After randomization, the children received acupressure in accordance with the group to which they were allocated. Mustard seeds were used over the point selected for the application of constant pressure. In group A, two "fictitious" points were selected — one at the root of the nose, and one on the concha cymba of the ear (Fig. 1). The use of two points (assuming no difference between the two points) was designed to prevent identification of each child's treatment group by the number of points used.

In group B, one of the anxiolytic acupoints selected was the *Yin Tang* point, which is located at the midpoint between the medial extremities of the two eyebrows, and which has been used to induce sedation and provide balance between the sympathetic and parasympathetic nervous systems [17]. The other anxiolytic point selected was the *Shen Men*, which is located at the apex of the triangular fossa of the ear, and which has been used to induce relaxation (Fig. 2) [18]. After application of acupressure, children remained in the waiting

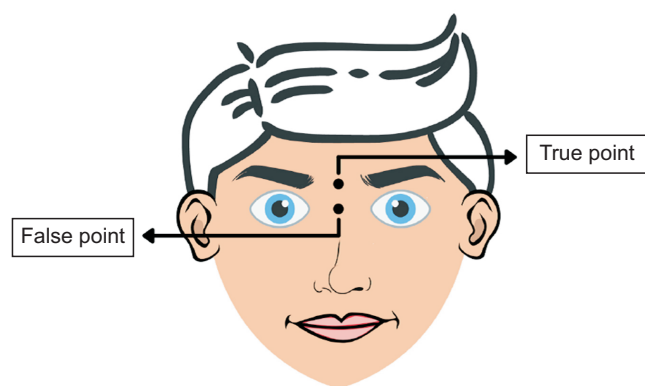


Fig. 1. True point and false point of acupressure located on face.

room for 30 min prior to restorative treatment.

7. Treatment

Thirty minutes after the start of acupressure, children received restorative treatment on a posterior primary tooth with a cavitated carious lesion. The treated tooth could not have a history of spontaneous pain, fistula, or abscess. Restorative treatment was performed with the selective removal of carious tissue based on the principle of minimal intervention [19]. The researcher and assistants in charge of the restorations were unaware of the group to which each child had been allocated. The dentist was prepared to apply local anesthesia if the child complained of pain during the procedure; however, local anesthesia was not necessary for any of the children.

Resin-modified glass ionomer cement (Riva Light Cure[®]; SDI Ltd, Bayswater, Victoria, Australia) was the material of choice for all restorations. In deep cavities, indirect capping was performed using calcium hydroxide as the capping agent.

The evaluations in the present study were performed in this first session. Other necessary treatment was performed in subsequent sessions without the use of acupressure.

8. Data collection — patient-reported pain and anxiety

1) Heart rate

Heart rate (HR) was measured prior to the start of the restorative procedure using a pulse meter (Multilaser Industrial SA, Sao Paulo, Brazil), which remained attached until the end of the procedure. HR was measured to investigate possible fluctuations related to anxiety level. Three readings were recorded: when the child sat in the dental chair (H1); after removal of the carious tissue (H2); and at the end of the procedure (H3).

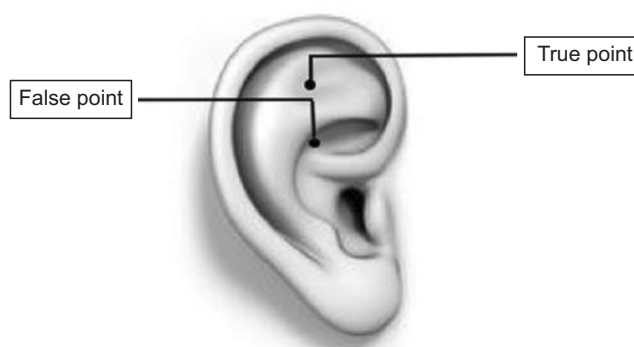


Fig. 2. True point and false point of acupressure located on ear.

2) Modified Venham Picture Test

Anxiety was measured using the VPTm scale [20]. Each child was shown color figures of a child with similar features (sex and ethnicity) exhibiting different expressions. Without the interference of others, each child selected the image that best represented her/him at the time. The instrument is easy to administer, as it requires little time to obtain a response, and it is easy for children to understand. The aim is to evaluate the degree of anxiety of children related to dental treatment. The VPTm scale was administered before the clinical examination for inclusion in the study (VPT1), when each child sat in the dental chair to undergo the restorative procedure (VPT2), and after the removal of acupressure (VPT3).

9. Statistical analyses

The data were entered into a databank and organized using IBM SPSS Statistics for Windows, version 22.0 (IBM Corp., Armonk, NY, USA). Descriptive statistics were used for the variables of interest, and bivariate analysis was performed to determine between-group differences in the variables. Categorical variables were evaluated using the chi-squared test and Fisher's exact test. For quantitative variables, the Shapiro-Wilk test and Levene's test were used to determine the data distribution. The t-test for independent samples was used to compare variables with normal distribution and homogeneity, and the Mann-Whitney test was used to compare variables without normal distribution and homogeneity. A *p*-value < 0.05 was considered statistically significant.

RESULTS

Fourteen children participated in this pilot study. Boys (*n* = 8) accounted for 57.2% of the sample, and 50% (*n* = 7) of the children were aged 7-8 years. Table 1 shows the distribution between groups of data referring to sociodemographic variables, past toothache, previous visits to the dentist, as

Table 1. Distribution of categorical variables in Groups A and B

Variables	Group A n = 7 (50%)	Group B n = 7 (50%)	p-value*
Sex			
Female	3 (42.9%)	3 (42.9%)	0.704
Male	4 (57.1%)	4 (57.1%)	
Age			
7 and 8 years	3 (42.9%)	4 (57.1%)	0.500
9 and 10 years	4 (57.1%)	3 (42.9%)	
Family income			
≥ 2 x monthly min. wage	3 (42.9%)	2 (28.6%)	0.500
< 2 x monthly min. wage	4 (57.1%)	5 (71.4%)	
Type of housing			
Own	6 (85.7%)	3 (42.9%)	0.133
Rented	1 (14.3%)	4 (57.1%)	
Mother's schooling			
≥ 8 years of study	6 (85.7%)	6 (85.7%)	0.769
< 8 years of study	1 (14.3%)	1 (14.3%)	
Mother's marital status			
Married	5 (71.4%)	3 (37.5%)	0.296
Other	2 (28.65%)	4 (57.1%)	
Visit to dentist			
Yes	6 (85.7%)	7 (100%)	0.500
No	1 (14.3%)	0 (0 %)	
Toothache			
No	4 (57.1%)	2 (28.6%)	0.296
Yes	3 (42.9 %)	5 (71.4%)	
Do you consider your child to be anxious			
No	3 (42.9%)	3 (42.9%)	0.704
Yes	4 (57.1%)	4 (57.1%)	

Group A: acupressure on false points; Group B: acupressure on true points; *chi-square test

well as the child's anxiety report by the mother. It can be seen that the groups were homogeneous in relation to this information. there were no statistically significant between-group differences regarding gender ($p = 0.704$), age ($p = 0.500$), monthly family income ($p = 0.500$), maternal education ($p = 0.769$), type of housing ($p = 0.133$), marital status ($p = 0.296$), previous visits to the dentist ($p = 0.500$), toothache ($p = 0.296$), and reporting of a child's anxiety by a mother ($p = 0.704$).

Table 2 presents the data distribution between groups for quantitative variables. There were no statistically significant differences between groups regarding maternal anxiety ($p = 0.777$); mean number of missing and filled decayed teeth ($p = 0.590$); and anxiety assessed before treatment, both by the VPTm scale ($p = 0.869$) and HR ($p = 0.528$). Regarding dental anxiety during and after treatment, there was a statistically significant difference between groups, but only for HR after treatment, which was lower in group B than group A ($p = 0.02$).

Table 2. Distribution of quantitative variables in Groups A and B

Variables	Group A Mean (SD)	Group B Mean (SD)	p-value*
Mother's anxiety	4.43 (±1.23)	4.43 (±1.25)	0.777
dmft	3.43 (±0.64)	3.00 (±0.48)	0.126
DMFT	2.00 (±0.78)	1.71 (±0.52)	0.590
VPT 1	3.14 (±0.85)	2.57 (±0.99)	0.869
VPT 2	0.14 (±0.14)	0.86 (±0.85)	0.072
VPT3	0.71 (±0.42)	0.29 (±0.18)	0.154
HR 1	85.71 (±4.65)	84.43 (±5.60)	0.528
HR 2	85.57 (±5.06)	81.43 (±4.11)	0.451
HR 3	92.14 (±2.70)	70.86 (±7.80)	0.027

Group A = acupressure on false points; Group B = acupressure on true points; *t-test for independent samples; VPT 1 = anxiety before acupressure; VPT 2 = anxiety upon sitting in dental chair; VPT 3 = anxiety after removal of acupressure; HR 1 = heart rate before treatment; HR 2 = heart rate during treatment; HR 3 = after treatment.

DISCUSSION

This pilot study shows that children who received acupressure at points (documented in the literature as reducing anxiety) had a lower HR after restorative dental treatment. HR was similar between the groups during treatment, although a gradual decrease was found at the end of the procedure in group B, but not in group A. This finding agrees with other studies in children, in which HR decreased significantly after the procedure in the group that received acupressure or acupuncture at documented points [12,13]. The gradual reduction in anxiety due to the use of acupuncture contributed positively to future dental appointments for these children [12].

HR is a useful tool for measuring acute stress and has been increasingly used in studies on behavior in the pediatric dental setting. The body releases adrenaline in situations of excitement or stress, leading to increased HR [21]. Indeed, anxiety triggers physical reactions that alter electrical and neurochemical conduction in the autonomic (sympathetic) nervous system, thereby promoting changes at cardiac receptors and increasing HR [22]. Acupressure at documented points, as performed in the present study, promotes dominance of the parasympathetic nervous system over sympathetic stimulation, causing relaxation, reduced HR, and an anxiolytic effect [13].

Besides analysis of the physiologic response (HR), dental anxiety can be measured through a psychometric assessment, in which the child or parent/guardian indicates the level of anxiety using a scale [23]. The VPTm is a scale on which the child selects the image that best corresponds to her/his feeling at that specific moment [20].

Reduced anxiety, measured by the VPTm, was found in the overall sample, with no statistically significant difference between groups. However, fluctuations were found in group A, in which a reduction occurred during the procedure, and a slight increase occurred after the removal of acupressure. In group B, the reduction in anxiety continued after the removal of acupressure. Like the analysis of HR, this finding suggests that the state of relaxation may be maintained after removal of the stimulus and may result in less anxiety during subsequent appointments. A previous study also found that self-reported anxiety levels were durably reduced in the group that received acupressure at documented points [12].

Dental anxiety is associated with compromised oral health due to delays in seeking dental care and can therefore be considered a public health problem [24]. Consequently, dental anxiety may generate malaise, shame, feelings of guilt, depression, and social isolation, and may have a negative impact on quality of life (QoL) [5]. A recent study found that anxious patients reported a negative impact on QoL

twofold more than non-anxious patients [25]. Although the present data are preliminary, the results are encouraging for acupressure use to reduce dental anxiety. Acupressure has the benefit of involving a light, pleasant touch that stimulates acupuncture points without the use of needles. Thus, it is a noninvasive technique that is easy to learn and has no side effects [11]. Acupressure is well tolerated and accepted by children due to its simplicity and the fact that it causes no discomfort [12]. Therefore, this technique could be used to complement other methods of anxiety alleviation during pediatric dentistry [12].

In this study, factors that could confound the effects of acupressure on anxiety were controlled through randomization, and the results show that potential confounding factors were similar between the groups. Children with a higher DMFT/dmft index are at greater risk of developing dental anxiety [26], and toothache is also associated with dental anxiety in this population [27]. However, no differences between groups were found regarding these aspects.

Other controlled variables were parent/guardian anxiety, and child age and sex, for which no differences were found between groups. Parents/guardians may verbalize feelings of anxiety in the presence of their children, thereby sending a negative message about treatment [28]. However, recent studies reported conflicting findings regarding the prevalence of dental anxiety in boys and girls, and among different age groups [29,30].

The literature also describes an association between socioeconomic status and dental anxiety. Lower levels of anxiety are generally associated with a higher family income [31]. Greater access to information, and a lower frequency of caries and traumatic past experiences, may mediate this association. In the present study, no significant differences were found between groups regarding family income, parental schooling, or type of housing.

The children who received acupressure at documented points for the reduction of anxiety had a lower HR after the end of the restorative procedure. However, as this was a pilot study, the small sample size is the main limitation. Pilot studies are important for testing proposed methods [32], and for enabling the correction of limitations in future studies. As a gradual reduction in anxiety was found in the present study, based on the VPTm scale and HR, it is pertinent to assess anxiety levels at subsequent appointments. Such assessments will enable the identification of whether reduced anxiety is momentary or remains after stimulus removal. As anxiety can exert a negative influence on behavior [12], reduced anxiety may enhance the behavior of children during treatment. Therefore, assessing the level of anxiety could assist in clarifying this association.

Anxiety can compromise the success of dental treatment

in children [4]. Thus, several (generally complementary) management techniques are used to minimize the symptoms of dental anxiety [5]. Moreover, anxiety can have a negative impact on the frequency of visits to the dentist, increasing the risk of compromised oral health [23]. Thus, acupressure may be an effective, complementary method for reducing dental anxiety and contributing to better QoL for children and their families [25].

CONCLUSIONS

In this study, the children who received acupressure at documented points for the reduction of anxiety had a lower HR after the end of the restorative dental procedure. No significant difference between groups was found regarding anxiety measured using the psychometric evaluation (VPTm), although the reduction was greater in the group that received acupressure.

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CONFLICT OF INTEREST

The authors declare no conflict of interest.

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