Community Dent Oral Epidemiol 2006; 34: 455–459

COMMUNITY DENTISTRY AND ORAL EPIDEMIOLOGY

A controlled trial of the impact of exposure to positive images of dentistry on anticipatory dental fear in children

C. Fox[1] and J. T. Newton[2]

[1]Taunton Dental Access Centre, South Somerset Primary Care Trust, Taunton, Somerset, UK, [2]Department of Oral Health Services Research and Dental Public Health, GKT Dental Institute, King's College London, Caldecot Road, London SE5 9RW, UK

Fox C, Newton JT. A controlled trial of the impact of exposure to positive images of dentistry on anticipatory dental fear in children. Community Dent Oral Epidemiol 2006; 34: 455–459. © 2006 The Authors. Journal compilation © Blackwell Munksgaard, 2006

Abstract – *Objectives:* Dental anxiety is common in children. This study sought to determine the impact of viewing positive images of dentistry prior to a dental appointment on the anticipatory dental anxiety levels of children attending for dental treatment. *Methods:* Controlled trial. Assessment of anxiety and analysis of data were conducted blind to experimental condition. Assessment of anxiety was carried out in the waiting room postintervention but before the patient entered the dental surgery for treatment. *Participants:* Thirty-eight children and young adults attending a dental clinic in South West England. *Intervention:* Participants were randomly assigned to one of two conditions. In both conditions the participant was asked to look at photographs for 2 min in the waiting area prior to their appointment. The intervention consisted of viewing positive images of dentistry and dental treatment, the control condition consisted of dentally neutral images. Positive and neutral images were validated independently by four paediatric dentists. The assessment of anticipatory dental anxiety was made blind to experimental condition and statistical analysis was conducted blind to group membership. *Outcome measure:* Anticipatory anxiety assessed by the Venham Picture Test. *Findings:* A significant difference in anticipatory dental anxiety was found between the two groups (median-positive images = 0, median-neutral images = 3; $P < 0.001$). Anticipatory anxiety was not correlated to age (rho = 0.04 $P > 0.05$), there was no difference between male and female participants in their level of anticipatory anxiety (median-males = 0.5, median-females = 1 $P > 0.05$). *Conclusions:* Viewing positive images of dentistry and dentists results in short-term reductions in anticipatory anxiety in children.

Key words: children; dental anxiety; images; Venham Picture Test

Prof. Tim Newton, Oral Health Services Research and Dental Public Health, GKT Dental Institute, King's College London, Denmark Hill Campus, Caldecot Road, London SE5 9RW, UK
Tel.: 0207 346 3481
Fax: 0207 346 3409
e-mail: tim.newton@kcl.ac.uk

Submitted 31 May 2005;
accepted 1 September 2005

Fear of dentistry is common in children. A study of eight European countries found that 35% of 5 years old and 21% of 12 years old were fearful before visiting the dentist (1). Buchanan and Niven (2) suggest that although the majority of children have low levels of fear, a small number show higher levels. Only 7% of their sample of children were shown to be very anxious, a finding which correlates well with previous studies (3, 4). The British national children's dental health survey found that the proportion of children who were dentally anxious steadily increased through the primary years and then levelled off during the secondary years to about 50% of the population (5).

Approaches to the management of children with high levels of dental anxiety are well established. The American Academy of Pediatric Dentistry (6) has outlined ten behaviour management methods for use with children, as follows: voice control, tell-show-do, positive reinforcement, distraction,

nonverbal communication, hand over mouth technique, physical restraint, conscious sedation, nitrous oxide and general anaesthesia.

To the American Academy of Pediatric Dentistry (AAPD) list, Kuhn and Allen (7) added three techniques: (i) contingent distraction; (ii) modelling and (iii) contingent escape. Most of the above approaches have been recommended for the use with children where anxiety is such as to interfere with treatment, there is less information on the routine management of low or moderate levels of dental fear in children. One approach may be to develop positive associations with dentistry through the promotion of positive images of children experiencing dental treatment. Such an approach draws on the principles of social learning, proposing that exposure to positive images will trigger the learning of a association between the positive image and dentistry and is akin to modelling (8). Recently there has been much evidence to demonstrate an effect of observing models in the management of dental anxiety in paediatric dental patients (9, 10), however to date no study has looked at the effects of positive images, shown in the waiting room, on reducing dental anxiety in children. If an association is found between this, it has important implications for alleviating anxiety in both child and adult populations. The results could also provide valuable data for health care professionals in all fields of work to aid in the reduction of anxiety before any consultation or procedure. The use of still images may be akin to a simple version of 'modelling' which has been used with success to reduce dental anxiety in children (11–13), however the use of still images may be easier to implement in everyday practice.

A number of instruments are available to measure dental anxiety in children (14). The Venham Picture Scale is widely used and easily administered (15). In this test, children are presented with eight pairs of pictures, each depicting cartoon characters in anxious or nonanxious states. They are asked to choose the cartoon from each pair that describes how they feel at that particular time. All cards are shown in their numbered order. If an anxious cartoon is chosen, a score of one is recorded. If a nonanxious cartoon is chosen, a score of zero is recorded. A measure of anxiety is obtained by totalling the number of times the child picks the cartoons depicting the anxious state (minimum score, 0; maximum score, 8).

The aim of this study was to determine the impact of viewing positive images of dentistry on the anticipatory dental anxiety levels of children attending for dental treatment.

Materials and methods

This study was carried out in Taunton Dental Access Centre and was approved by the Somerset Primary Care Trust Ethics Committee (Ref: 04/Q2202/5) and the Research and Development Department of Musgrove Hospital, Taunton (Ref: 10.142).

Participants

Participants were a consecutive series of new and current patients attending the Taunton Dental Access Centre over a 3 month period April to June 2004.

Inclusion criteria

- Age between 5 and 17 years.

Exclusion criteria

- Adults and children aged below 5 years.
- Children with learning difficulties who were judged unable to understand the instructions.
- Visual impairment.
- Children that became upset at viewing the images (In the event no child became upset at viewing the images and therefore no children were excluded as a result of this criterion).

Sample size

The study sample size was based on data on the mean and SD of scores from the original development of the Venham scale. Estimating that a clinically significant difference between two groups would be 1 SD, a sample size of 34 would give 80% power to detect this a difference at a significance level of 0.05. Thirty-eight subjects were actually recruited.

The null hypothesis was stated thus

In the population of children aged 5–17 attending the Taunton Dental Access Centre, there is no difference in the mean anticipatory dental anxiety score of children (as measured by the Venham Picture Test) exposed to positive images of dentistry prior to treatment and the mean anticipatory dental anxiety score of children exposed to neutral images.

Study design

The study consisted of a controlled trial. Positive images in the form of photographs of dental

situations were shown to some children while waiting for treatment and their pretreatment anticipatory anxiety compared with that of children shown neutral images. Assessment of anxiety was carried out in the waiting room postintervention but before the patient entered the dental surgery for treatment. Anxiety was only assessed at one point in the study.

A computer was used to generate a random sequence of 40 numbers between 1 and 10, corresponding to experimental (even numbers) and control conditions (odd numbers). Forty identical envelopes were then created each containing a single code from the random sequence (experimental or control). Envelopes were opened in sequence by a dental nurse not involved in assessing the child's anxiety.

The anxiety assessment of the child was conducted by the principal researcher who was blind to the patient's group allocation. The child's level of anticipatory anxiety was assessed using the Venham Picture Scale. Both the patient's group code and anxiety score were returned to the sealed envelope for analysis at the end of the study.

During any explanation, neither the guardian nor the child were given examples of pictures that might represent positive images, or neutral images, so that it was unclear to them which arm of the trial they were in. Parents were told that the aim of the study was to investigate whether viewing positive images of the dentist reduced anxiety in children. Children were told that the study was to explore whether looking at the pictures made children 'happier when visiting the dentist'.

The patient was allowed 2 min to look at the photographs (in any order and individually for any duration). After this time, the photographs were retrieved from the patient and the nurse withdrew, keeping the envelope.

The principal researcher then entered the waiting room and conducted the Venham Picture Test, recording the age and sex of the patient. The result was then returned (by the nurse) to the sealed envelope and stored until the end of the study. The patient then proceeded to the surgery for treatment.

Intervention

Positive images

Four photographs of A4 size were chosen by the researcher, associating dentistry with familiar and happy images (these were: three children aged between 7 and 15 years smiling whilst sitting in the dental chair; a Teddy bear sat in dental chair; a child aged 10 smiling; child aged 5 holding a large toothbrush), with the aim of showing dentistry in a positive light. These pictures were validated as representing an affective image by four paediatric dentists. These dentists were asked to complete a 10 cm visual analogue scale with markers 'not positive' to 'positive'. The scale was scored from 0 to 10 with higher scores indicating a greater degree of positive attitude to dentistry. The average rating of the four dentists for all four images was 6.42 (SD = 3.12).

Neutral images

Four photographs of A4 size were selected from the most recent issue of a commercially produced magazine related to houses and gardening. These images were believed to be neutral relative to the dentistry. These pictures were validated as representing a neutral image by four dentists working for the PCT using the same method as described for positive images. The average rating of the four dentists for all four images was 0.58 (SD = 0.54).

Primary outcome measures

Anticipatory dental anxiety as assessed by the Venham Picture Scale (15). Scores range from 0 to 8 with higher scores indicating higher levels of dental anxiety.

Masking

The researcher assessing the level of anticipatory anxiety of the children was masked to the children's membership of the group. Children and their parents were not informed which arm of the trial they were in. Data analysis was conducted by an independent analyst masked to the coding used to indicate experimental or group membership.

Statistical methods

Data analysis consisted of two parts: the description of the demographic characteristics of the participants, including the comparison of the sex and age of participants in the two arms of the trial, and an analysis of anticipatory dental anxiety scores. Given that the data were not normally distributed, the Mann–Whitney *U*-test was used to compare the anticipatory anxiety scores of the experimental and control groups. Data were analysed on an intention to treat basis.

Results

Figure 1 shows the flow of participants through each stage of the study. Of the 38 participants 20 (53%) were male and 18 (47%) were female. There was no significant difference between the experimental and control groups in the proportion of female participants (chi-square = 0.42, not significant). The overall mean age of the sample was 122.3 months (SD = 41.5 months, range 65–204 months). There was no significant difference between the ages of participants in the experimental and control groups (Table 1).

The mean scores of the participants on the Venham Picture Test are shown in Table 1. The difference between experimental and control groups was significant (Mann–Whitney $U = 29.0$, $P < 0.001$), thus the null hypothesis was rejected.

In order to explore the impact of age and gender on anticipatory anxiety as assessed by the Venham Scale two exploratory data analyses were conducted. The nonparametric correlation between age and Venham Score was calculated, rho = −0.04 (not significant). There was no effect of age on anticipatory dental anxiety. Similarly there was no difference between male and female participants in their score on the Venham scale (Median: males = 0.5, females = 1.0, Mann–Whitney $U = 169$, not significant).

Adverse events

No adverse incidents were reported.

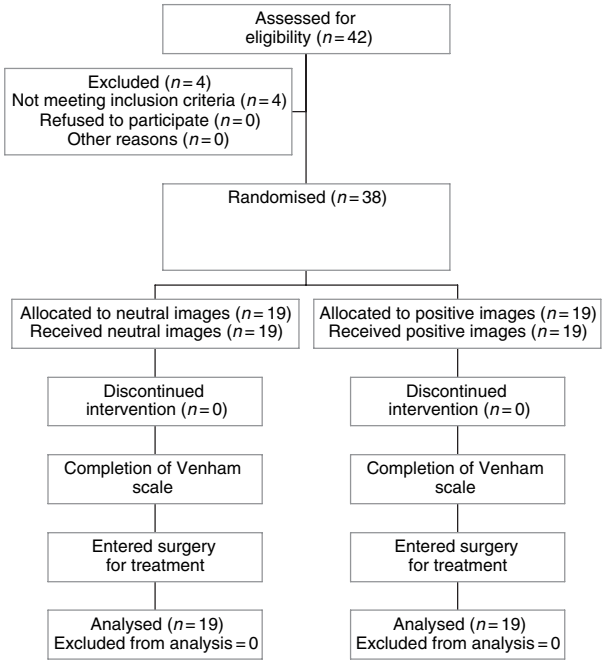

Fig. 1. Participant flow through trial.

Table 1. Sex and age distribution and Venham Picture Test scores of participants defined by experimental group

	Experimental group (positive images)	Control group (neutral images)	Overall
Sex			
Female	9	11	20
Male	10	8	18
Age (months)			
Mean (SD)	125.8 (45.0)	118.8 (38.4)	122.3 (41.5)
Venham Picture Test score			
Median	0	3	1
Mode	0	2	0
Mean (SD)	0.21 (0.42)	3.31 (2.58)	1.76 (2.41)

Discussion

The study provided evidence to disprove the null hypothesis, demonstrating that showing positive images of dentistry to children for a short period before dental treatment reduces anticipatory anxiety as measured by the Venham Picture Test. There was little evidence of potential bias in the findings. The two groups in the trial were well matched in terms of the age and gender distribution of participants, and both assessor and analyst were blind to the allocation of participants. One potential problem is that the dental nurse who administered the intervention was aware of the group membership of each participant. It is possible that the nurse behaved differently when administering the stimuli. Future studies could explore this by assessing the behaviour of the dental nurse whilst administering the intervention through video or direct observation. Further it is possible that participants were aware of which condition they were in and completed the Venham scale accordingly.

However a number of limitations of the findings can be identified. Data were only collected at one point in the trial, after the intervention (that is after children had examined the images). It is possible that differences between the two groups were present prior to intervention, an analysis of change in anxiety would exclude this possibility. However such a possibility is unlikely given the randomization of participants to conditions. Future research should seek to ascertain appropriate baseline data, perhaps by postal survey of potential participants prior to their attendance at the surgery, as it would

be anticipated that anxiety levels would increase as soon as the patients enter the practice environment.

It is reasonable to expect a similar outcome amongst children in the remainder of the U.K. as they belong to a similar culture and environment, and have had a similar education. Anticipatory anxiety in this instance was assessed immediately prior to the child entering the dental surgery, so it is possible that any effect may not generalize to the dental chair. An assessment of children's anxiety levels whilst undergoing examination or treatment would identify the durability and generalizability of the anxiety reduction found. Further research is required, it would be important in such research to ensure that the nature of the treatment undertaken prior to the assessment of dental anxiety is standardized.

The age range of the participants was wide, and it is possible that some stimuli (for example the teddy bear) were not appropriate for older children. Although important this is unlikely to have influenced the study findings comparing control and experimental groups as there was no difference in the ages of participants in the two groups. However if the technique is to be used clinically it would be important to ensure that all materials are age appropriate. One way to achieve this would be to ask children to validate the images, rather than (as in this study) asking paediatric dentists.

It was interesting to note that no significant difference was found in the anticipatory anxiety level of different age groups, or across male and female participants. Such differences are commonly reported in the literature. This is most likely because of the small sample size, which while sufficient to detect the difference between the experimental groups would be too small to detect differences in age and gender.

This is the first study in which images have been used with the goal of reducing dental anxiety in children. No attempt was made in the present study to identify the mechanism through which this reduction occurred, although this would be a fruitful area for future research. One putative mechanism for the effect noted would be a form of social learning through modelling. By observing individuals experiencing oral healthcare with positive outcomes, children may learn vicariously positive associations with dentistry (8–13). Alternatively the opportunity to view images of the dental surgery may serve to familiarize the child with the dental setting and serve as a form of preparatory information, such an approach has been shown to be effective in reducing anxiety in children undergoing dental surgery (16).

Acknowledgements

This paper, being a clinical trial, was prepared according to CONSORT guidelines.

References

1. Bolin AK. Children's dental health in Europe: an epidemiological investigation of 5- and 12-year old children from eight EU countries. Swed Dent J 1997;21:1–33.
2. Buchanan H, Niven N. Validation of a facial image scale to assess child dental anxiety. Int J Paediatr Dent 2002;12:47–52.
3. Alwin NP, Murray JJ, Britton PG. An assessment of dental anxiety in children. Br Dent J 1991;171:201–7.
4. Wogelius P, Poulsen S, Sorensen H. Prevalence of dental anxiety and behaviour management problems among six to eight year old Danish children. Acta Odontol Scand 2003;61:178–83.
5. Todd JE, Lader D. Children's dental health in the United Kingdom 1988. London: HMSO, 1991.
6. American Academy of Pediatric Dentistry. Guidelines 2001–2002. Iowa IA: AAPD, 2002.
7. Kuhn BR, Allen KD. Expanding child behavior management technology in pediatric dentistry: A behavioral science perspective. Pediatr Dent 1994;16:13–7.
8. Bandura A. Social learning theory. Morristown, NJ: General Learning Press, 1971.
9. Wilson S, Cody WE. An analysis of behavior management papers published in the pediatric dental literature. Pediatr Dent 2005;27:331–8.
10. Adair SM. Behavior management conference panel I report – rationale for behavior management techniques in pediatric dentistry. Pediatr Dent 2004;26:167–70.
11. Stokes TF, Kennedy SH. Reducing child uncooperative behaviour during dental treatment through modelling and reinforcement. J Appl Behav Anal 1980;13:41–9.
12. Melamed BG, Weinstein D, Hawes R, Katin-Borlan M. Reduction of fear-related dental management problems with use of filmed modelling. J Am Dent Assoc 1975;90:822–6.
13. Melamed BG, Yurcheson R, Fleece E. Effects of filmed modelling on the reduction of anxiety related behaviour in individuals varying in level off previous experience of the stress situation. J Consult Clin Psychol 1978;46:1357–67.
14. Newton T, Buck D. Anxiety and pain measures in dentistry: a guide to their quality and application. J Am Dent Assoc 2000;131:1449–57.
15. Venham LL, Gaulin-Kremer E. A self-report measure of situational anxiety for young children. Pediatr Dent 1979;1:91–6.
16. Herbert RM, Innes JM. Familiarisation and preparatory information in the reduction of anxiety in child dental patients. J Dent Child 1979;46:319–23.