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An evaluation of the PALS after treatment modelling intervention to reduce dental anxiety in child dental patients

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Aim. The aim of this study was to assess the effectiveness of the passivity to activity through live symbolic (PALS) after treatment modelling intervention to reduce child dental anxiety.

Methods. A convenience sample of consecutive 5- to 10-year-old dental patients were randomly assigned to intervention or control groups. Self-reported child dental anxiety was assessed at the start of each visit. At the end of each visit, children in the intervention group were introduced to a glove puppet, which acted as the PALS model. The intervention group children re-enacted the treatment they had just received on the puppet's teeth. At the end of each visit, the control children received motivational rewards only. The change in dental anxiety scores was examined by *t*-tests and analysis of covariance.

Results. The final analysis included 27 intervention children and 26 control children. For the intervention group, there were no statistically significant changes in dental anxiety over a course of treatment, between first and second preventive visits, between first and second invasive treatment visits, or between first attendance and subsequent recall attendance. For the control group, a statistically significant decrease in dental anxiety was observed between the first and second invasive dental treatment visits.

Conclusion. The PALS after treatment modelling intervention was ineffective in reducing child dental anxiety.

Introduction

For a child, a visit to a dental clinic involves contact with unfamiliar people and many potentially threatening and invasive situations. Some more vulnerable children may be unable to cope with these new experiences and may become dentally anxious[1]. Dental anxiety may obstruct the delivery of dental care as the child may be unable to accept the treatment being provided by the dentist[2,3]. To ensure that dental care is accepted, effective behavioural management methods are required. Despite the availability of an array of behaviour management techniques, dental anxiety appears to be a widespread problem in children, with a prevalence of up to 19.5% having been reported[4].

All current behaviour management techniques employed in paediatric dentistry are applied before the start of dental care or during the clinical encounter. Behavioural management techniques aim to decrease resistant, disruptive behaviours and facilitate dental treatment[5], reduce the level of child dental anxiety[5–7], assist the child to cope with dental treatment[5,6] and enable the passive child to accept dental treatment. As early as 1936, it was recognized that when a child must lie quietly and passively to accept surgical procedures that this may lead to increased anxiety, whereas conversely activity for the child could be protective against the harmful effects of anxiety[8,9].

The technique of behavioural modelling allows the child to learn about dental treatment and how to eliminate fearful behaviour without having to actually undergo treatment. Two

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Fig. 1. The glove puppet which acted as the PALS model.

types of model are recognized: live and symbolic. In live modelling, the child watches a sibling, parent, or peer receive treatment, whereas in symbolic modelling the model (usually a puppet or video) is shown undergoing treatment. In previous reports of modelling interventions, the model was introduced before or during treatment[10]. Both live and symbolic models may be useful to encourage the child to adopt actively the coping strategies and non-anxious behaviours exhibited by the model[11].

Using this previous work[1,8–11] a novel modelling technique was conceived to enable the child to become active after experiencing the passivity of accepting dental treatment. The underlying premise of the after-treatment modelling intervention was to change passivity to activity, thereby reducing dental anxiety at subsequent dental treatment visits, which was achieved by introducing the child to a glove puppet (Fig. 1) which acted as a live (becoming 'live' through the imitation of the dentist) and symbolic model (the puppet symbolizing the child during treatment). The child could carry out a version of the treatment (s)he had just undergone on the glove puppet. The application of this behaviour management technique immediately after the dental visit was used to enable the child to become active and so reduce anxiety. The technique was termed passivity to activity through live symbolic (PALS) modelling.

The aim of this study was to assess the effectiveness of the PALS after treatment modelling intervention, when used immediately following dental treatment. Change in child dental anxiety was the primary outcome measure. The specific objectives were to assess the changes in child dental anxiety as assessed by the faces version of the Modified Child Dental Anxiety Scale ($MCDAS_f$)[12] (Fig. 2): (i) over a course of dental treatment, from the first visit to the last visit within a course of dental treatment; (ii) between the first visit and the second preventive dental treatment visits; (iii) between the first and the second visits for invasive dental treatment; and (iv) between the first visit in the original course of treatment and the first visit of the recall attendance.

Materials and methods

Sample

A convenience sample of 74 consecutive new child patients and those attending treatment to a single operator (K.E.H.) at the Queen's University of Belfast Department of Paediatric Dentistry, were invited to take part, along with the accompanying adults. Children were included in the study if they were aged between 5 and 10 years, had no disclosed learning disability, had been referred for dental care, and both parent and child had consented to participation in the study.

Ethical approval was obtained from the Research Ethics Committee of Queen's University of Belfast. Before entering the study, each parent and child received written information explaining the study design and affirming that participation was voluntary. Written consent from both parent and child was obtained prior to inclusion in the study.

Sample size

The changes in child dental anxiety were assessed using the faces version of the $MCDAS_f$[12]. It was considered that a change in score of 5 units on the scale would be required to detect a clinically significant effect of the intervention. The standard deviation of the $MCDAS_f$ at the first visit for the first ten children

For the next eight questions I would like you to show me how relaxed or worried you get about the dentist and what happens at the dentist. To show me how relaxed or worried you feel, please use the simple scale below. The scale is just like a ruler going from 1 which would show that you are relaxed, to 5 which would show that you are very worried.

1 would mean : relaxed / not worried
2 would mean : very slightly worried
3 would mean : fairly worried
4 would mean : worried a lot
5 would mean : very worried.

How do you feel about …					
… going to the dentist generally?	1	2	3	4	5
… having your teeth looked at?	1	2	3	4	5
… having your teeth scraped and polished?	1	2	3	4	5
… having an injection in the gum?	1	2	3	4	5
… having a filling?	1	2	3	4	5
… having a tooth taken out?	1	2	3	4	5
… being put to sleep to have treatment?	1	2	3	4	5
… having a mixture of 'gas and air' which will help you feel comfortable for treatment but cannot put you to sleep?	1	2	3	4	5

Fig. 2. Faces version of the Modified Child Dental Anxiety Scale.

enrolled in the study was calculated and found to be 5.67. Twenty-seven participants were required in each group, for 90% power to detect a difference of 5 points on the $MCDAS_f$ scale at a significance level of 0.05.

Study design

A randomized controlled trial methodology was used. The participants on their initial presentation to the clinic were randomly assigned to the intervention and control groups.

Intervention

Intervention group. The participants in the intervention group were introduced to the PALS model at the end of each dental visit immediately after the completion of treatment. The PALS model was a glove puppet with a set of 32 plastic teeth (Paragon International, Inc., Gainsville, FL, USA). The participant was invited to play at being dentist in a role-play during which they completed their own version of the treatment which they had just received in the clinic on the puppet (Fig. 3). The child sat on the operator's seat and the puppet was placed on the dental chair, and the dentist (K.E.H.) sat on the dental nurse's seat and assisted the participant and guided play through the role-play encounter. Where the child had had a fissure sealant placed the corresponding tooth in the puppet's mouth was isolated using the means which had been applied to the patient including cotton wool rolls and

Fig. 3. Child completing a treatment on the PALS model.

low volume aspiration. Disclosing solution was applied to the puppet by the child to mimic acid etch, which was rinsed by the child with the water syringe accompanied by high-volume aspiration; imaginary fissure sealant was applied by the child and then the dental curing light applied and occlusion checked using articulating paper. Each dental intervention was adapted for use on the puppet. The participant then received motivational rewards prior to leaving the clinic. At initial visits, each patient received a sticker of a children's cartoon character whereas at subsequent visits, a sticker was given along with a selection by the dentist from an eraser, a toothbrush, or colouring page.

Control group. At the end of each visit, participants in the control group received the same motivational rewards as were awarded to the intervention group, then left the clinic.

Measures

Demographic profile of the child. The participant's age, gender, and source of referral were recorded. The multiple deprivation measure (MDM) was derived from the postal code[13]. This describes the socioeconomic status of an electoral district by combining information on income, employment, health, education, access, social environment, and housing to give an overall measure of deprivation.

Assessment of the child's obvious decay experience. Obvious decay experience [decayed, missing, or filled permanent teeth (DMFT): decayed, missing, or filled primary teeth (dmft)] was assessed by clinical examination, conducted under standardized conditions observing normal infection control protocols.

Assessment of child dental anxiety: the primary outcome measure. Before the dental examination, all participants completed the $MCDAS_f$[12]. The $MCDAS_f$ includes eight questions to assess dental anxiety about specific dental procedures. The scale includes a question about local anaesthetic and other dental procedures that may distress children, such as extraction, dental general anaesthesia, and inhalation sedation. A 5-point Likert scale is used to assess dental anxiety with scores ranging from 'relaxed/not worried' (scoring 1) to 'very worried' (scoring 5). In the faces version, the numerical scale has been modified by the addition of a faces rating scale anchored above the original numeric form. Total scores for the $MCDAS_f$ range from 5 (little or no dental anxiety) to 40 (extreme dental anxiety). The mean normative score for the $MCDAS_f$ is 19.81 [95% CI: 19.20, 20.43][12].

The $MCDAS_f$ has been shown to have good reliability and validity[12], and is a two-factor construct consisting of: (i) an 'examination factor' composed of the questions, 'How do you feel about': '... going to the dentist generally?', '... having your teeth looked at?', and '... having your teeth scraped and polished?'; and (ii) a 'treatment factor' consisting of all other questions which are those related to invasive dental treatment such as, 'How do you feel about having an injection in the gum?'[12].

Procedures

At each visit, all child participants completed the $MCDAS_f$ while seated in the dental chair prior to any treatment being undertaken. The questionnaire was administered by a trained dental nurse. The clinician (K.E.H.) was blinded to the child participant's dental anxiety scores at all visits. Following the dental examination, a treatment plan was formulated for each participant including prophylaxis,

preventive treatment, restorative and extraction phases as indicated.

Statistical methods

Data were analysed in two parts. First, the demographic characteristics of the participants in the two arms of the trial were compared. Second, the dental anxiety scores were computed and analysed. The $MCDAS_f$ score at the first dental visit for each participant was subtracted from the $MCDAS_f$ score at subsequent visits to determine the change in child dental anxiety over the course of treatment, between the first visit and the second preventive dental treatment visit, between the first and second visit for invasive dental treatment and between the first visit in the original course of treatment to the first visit of the recall attendance. The changes in the score of the examination and treatment factors were also calculated for the intervals under study.

The data were entered onto spreadsheets and analysed using SPSS v. 12.0.1 (Chicago, IL, USA). Mean differences in the child dental anxiety between the intervention and control groups were examined by Student's *t*-tests for unpaired data. Analysis of covariance (ANCOVA) was used to explore the relationship between child dental anxiety at the first and second invasive dental treatment visits while controlling for $MCDAS_f$ score at the first invasive dental treatment visit.

Results

Sample

Thirty-seven participants were enrolled in each group. One participant was excluded from randomization as they refused to participate in the study. Thirty-six participants were allocated to the intervention group, and 37 to the control. The flow of participants through the study is shown in Fig. 4. Twenty-seven participants were included in the final analysis from the intervention group, and 26 participants were included in the final analysis from the control group.

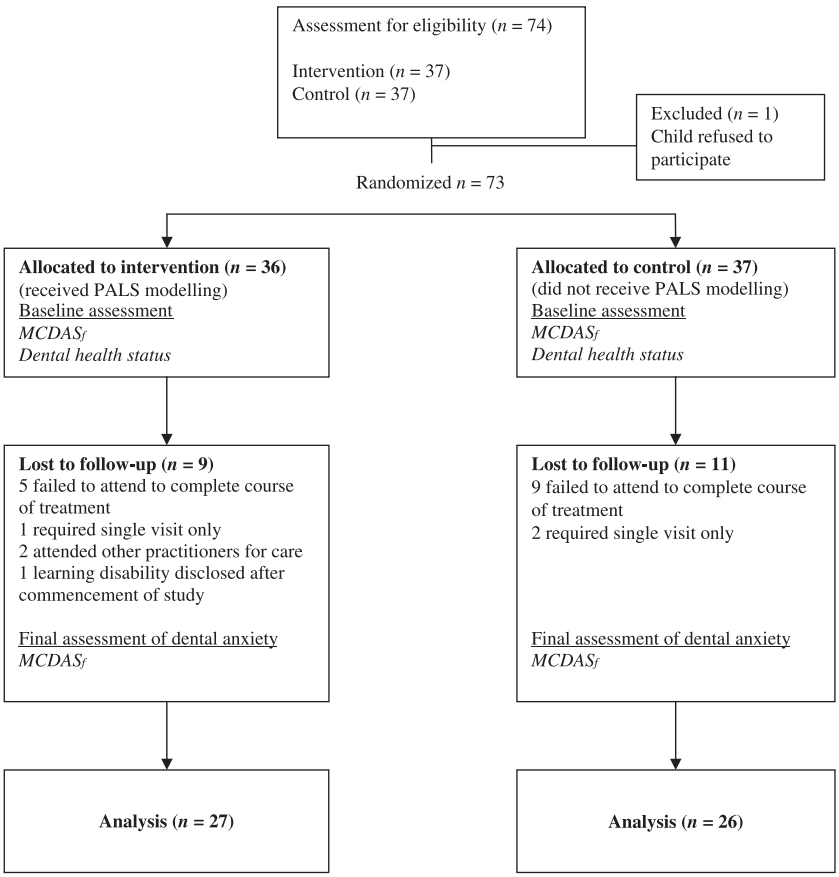

Fig. 4. Participant flow through trial.

Measures

Demographic characteristics of the participants. There was no statistically significant difference in the mean age of participants in the intervention group [7.99 years (95% CI: 7.46, 8.51)] and the control group [7.62 years (95% CI: 7.03, 8.21)] ($t = 0.97$, $P = 0.34$), nor was there a statistically significant difference in the proportion of girls in the intervention (67%) and control groups (69%) ($\chi^2 = 0.05$, $P = 0.83$). In the intervention group, 24 children had been referred regarding the management of dental anxiety and three had been referred for other reasons. In the control group, 23 participants had been referred regarding the management of dental anxiety and three had been referred for other reasons. There was no statistically significant difference between the mean MDM score for the parents of participants in the intervention group [17.55 (95% CI: 9.94, 25.16)] and the parents of participants in the control group [16.20 (95% CI: 9.94, 22.45)] ($t = 0.28$, $P = 0.78$).

Assessment of the child's obvious decay experience. The DMFT (as a measure of obvious decay experience) was recorded for 23 of the participants in the intervention group, and 22 of the participants in the control group. Where the DMFT was not recorded, this was because of no permanent teeth having erupted. There was no statistically significant difference in the mean DMFT between the intervention [2.43 (95% CI: 1.69, 3.18)] and control groups [2.00 (95% CI: 1.15, 2.85)] ($t = 1.57$, $P = 0.12$).

The dmft was recorded for 26 participants in the intervention group and all 26 of the participants in the control group (where it was not recorded; this was because of the exfoliation of all primary teeth). There was no statistically significant difference in the mean dmft between the participants in the intervention [6.50: (95% CI 5.64, 7.36)] and control groups [7.04 (95% CI: 4.64, 8.36)] ($t = 0.18$, $P = 0.86$).

Assessment of child dental anxiety: the primary outcome measure. The mean overall score for both the intervention [24.85 (95% CI: 22.10, 27.60)] ($t = -3.73$, $P < 0.001$) and control groups [25.00 (95% CI: 22.31, 27.69)] ($t = -4.11$, $P = 0.001$) was significantly greater than for the normative population [19.81 (95% CI: 19.20, 20.43)]. There was no statistically significantly difference in the mean overall scores on the $MCDAS_f$ between the participants in the intervention [24.85 (95% CI: 22.10, 27.60)] and control group at the first visit [25.00 (95% CI: 22.31, 27.69)] ($t = -0.08$, $P = 0.94$).

Over a course of dental treatment. There was no statistically significant difference in the mean number of dental appointments between participants in the intervention [6.70 (95% CI: 5.86, 7.55)] and control groups [5.50 (95% CI: 4.50, 6.50)] ($t = 1.90$, $P = 0.06$). There was no statistically significant difference in the mean change of the $MCDAS_f$ total score from the first examination visit to the last treatment visit, between the participants in the intervention and control groups. There was no statistically significant difference in the mean change in scores for the 'examination' and 'treatment' factors from the first to the last dental visits between the intervention and control groups (Table 1).

Between the first visit and the second preventive dental treatment visits. There was no statistically significant difference in the mean change of the $MCDAS_f$ total score or in the individual factors, from the first to the second preventive dental treatment visits in the course of dental treatment between the participants in the intervention and control groups (Table 2).

Between the first and second visits for invasive dental treatment. Only 26 participants in the intervention group and only 20 participants in the control group required two episodes of invasive dental treatment. There was no statistically significant difference in the mean change of the $MCDAS_f$ total score between the first and second for invasive dental treatment visits between the participants in the intervention and control groups. Participants in the control group [–0.85 (95% CI: –0.85, –1.55)] had significantly greater decreases in the 'examination' factor from the first to the second invasive dental treatment visit than the intervention group of participants [0.27 (95% CI:

Table 1. Mean change in mean overall $MCDAS_f$ score and in factors between first and last visits.

		Mean	95% CI	*t*	*P*
Mean change in	Intervention (*n* = 27)	–0.59	–2.94, 1.76	0.86	0.39
$MCDAS_f$	Control (*n* = 26)	–2.19	–5.22, 0.83		
Mean change in	Intervention (*n* = 27)	1.19	0.22, 2.15	–0.90	0.37
'examination' factor	Control (*n* = 26)	1.81	0.75, 2.87		
Mean change in	Intervention (*n* = 27)	–1.72	–3.67, 0.23	1.34	0.19
'treatment' factor	Control (*n* = 26)	–3.73	–6.15, –1.31		

$MCDAS_f$, Modified Child Dental Anxiety Scale.

Table 2. Mean change in mean overall $MCDAS_f$ score and in factors between the first and second preventive dental treatment visits.

		Mean	95% CI	*t*	*P*
Mean change in	Intervention (*n* = 27)	–0.26	–1.99, 1.47	–0.60	0.55
$MCDAS_f$	Control (*n* = 26)	0.42	–1.14, 1.98		
Mean change in	Intervention (*n* = 27)	–1.04	–1.94, –0.14	–0.94	0.35
'examination' factor	Control (*n* = 26)	–0.46	–1.34, 0.42		
Mean change in	Intervention (*n* = 27)	0.78	–0.51, 2.07	–0.13	0.90
'treatment' factor	Control (*n* = 26)	0.88	–0.26, 2.03		

Table 3. Mean change in mean overall $MCDAS_f$ score and in factors between the first and second invasive dental treatment visits.

		Mean	95% CI	*t*	*P*
Mean change in	Intervention (*n* = 26)*	0.94	–0.42, 2.30	1.84	0.07
$MCDAS_f$	Control (*n* = 20)	–1.00	–2.76, 0.76		
Mean change in	Intervention (*n* = 26)	0.27	–0.33, 0.87	2.53	0.02
'examination' factor	Control (*n* = 20)	–0.85	–0.85, –1.55		
Mean change in	Intervention (*n* = 26)	–0.25	–2.26, 1.74	–0.28	0.78
'treatment' factor	Control (*n* = 20)	0.10	–1.27, 1.47		

*Only children who required a second invasive dental treatment are included in this analysis.

–0.33, 0.87)] ($t = 2.53$, $P = 0.02$). There were no other statistically significant differences (Table 3).

ANCOVA was undertaken to examine these findings. The ANCOVA demonstrated a significant difference in the mean overall $MCDAS_f$ scores at the second invasive dental treatment visit between intervention [24.19 (95% CI: 21.79, 26.59)] and control [22.10 (95% CI: 19.68, 24.52)] groups, independent of the first invasive visit $MCDAS_f$ score ($F[1,44] = 4.22$: $P = 0.046$).

Between the first visit in the original course of treatment to the first visit of the recall attendance. Twenty-seven participants in the intervention group attended a recall following their course of dental treatment and were included in the final data set. Of the 26 participants in the control group, 22 were included in the final data set. One control participant was excluded following their initial course of treatment as he moved abroad, two control participants had no clinical indication for a recall attendance, and one control participant did not receive a recall appointment within the time frame in which the study was conducted. There was no statistically significant difference in the mean change between the total $MCDAS_f$ score or the individual factors, from the first visit in the original course of treatment to the first visit of the recall attendance, between the participants in the intervention and the control groups (Table 4).

Table 4. Mean change in mean overall $MCDAS_f$ score and in factors between the first and recall attendance visits.

		Mean	95% CI	t	P
Mean change in	Intervention (n = 27)	–1.67	–4.05, 0.71	0.21	0.83
$MCDAS_f$	Control (n = 22)	–2.10	–5.58, 1.40		
Mean change in	Intervention (n = 27)	–1.89	–3.23, –0.55	–0.28	0.78
'examination' factor	Control (n = 22)	–1.64	–2.89, –0.38		
Mean change in	Intervention (n = 27)	–0.22	–1.37, 1.82	0.46	0.65
'treatment' factor	Control (n = 22)	–0.45	–3.19, 2.28		

Discussion

The results of this study indicate that the PALS modelling intervention was ineffective in reducing dental anxiety over a course of dental treatment, or between courses of dental treatment. The effect of the intervention was examined over both preventive and invasive dental treatment visits to determine if the effect varied according to the invasiveness and difficulty of treatment. It was considered that the PALS intervention would increase in effect as the invasiveness of the dental procedures increased, as by facilitating the child to play out and dissipate their dental anxiety by becoming active after the period of passivity required for the acceptance of invasive dental treatment. It was disappointing that only one significant difference in child dental anxiety was shown between intervention and control groups. The finding that control group children had greater falls in dental anxiety related to the 'examination' factor between their first and second invasive dental treatment visits compared with intervention children suggested that factors previously unaccounted for had influenced child dental anxiety. Thinking in this way allows possible explanations to be formulated:

1) The previous dental treatment experiences of the children may have influenced the effectiveness of the PALS intervention: The children in the intervention and control groups were similar in terms of their demographic profile and their obvious decay experience. In both groups, the children had equivalent mean scores for dental anxiety, but were significantly more dentally anxious than a normative child population[12]. The groups were also remarkable in that the majority had been referred for the management of dental anxiety. The efficacy of different modelling interventions is influenced by the previous dental treatment experiences of the child[14]. Dentally experienced children were shown to be resistant to the effects of both a mastery or coping symbolic model, whereas dentally naïve children were positively influenced by both[15]. These findings were confirmed by Carson and Freeman who found tell–show–do (TSD) to be an effective means of anxiety reduction prior to dental general anaesthesia in those with no previous dental general anaesthesia experience. Children with previous dental general anaesthesia experience were resistant to the anxiolytic effects of TSD[16]. The previous dental experience of this group may have acted as a barrier to the effect of the PALS intervention. Despite the lack of effect of the PALS model in reducing dental anxiety in this group of children, it would be desirable to examine the effectiveness of the PALS modelling intervention in children with no previous dental experience to determine if the intervention would act prophylactically against the development of dental anxiety in the dentally naïve child.

2) Coping styles adopted by the children: Miller[17] considers that two types of coping style may be adopted for medical interventions. She describes 'monitors' as those who actively seek out and prefer information about their treatment, whereas 'blunters' prefer to avoid information and choose to distract themselves from treatment[17]. Monitors would therefore have been aided by the additional information provided by the PALS modelling intervention; however,

it would not have been suitable for those who cope by 'blunting'.

A possible limitation was therefore that the children had previous dental experience, and the majority had been referred for dental anxiety which may have weighted against the effectiveness of the PALS intervention to reduce dental anxiety in subsequent treatment visits. Furthermore, this study did not assess whether the child used monitoring or blunting as a means of coping. Both these factors may have influenced the outcome of the PALS intervention and while being limitations of this RCT they remain areas for future research.

Despite the lack of effect of the PALS intervention on self-reported dental anxiety, the response of the children and their parents to the PALS model puppet was positive for the majority of participants. On arrival for treatment, the children eagerly anticipated their encounter with the puppet, and when the puppet was presented to the children she often received hugs. The lower drop-out numbers observed for the experimental group may have been caused by positive perceptions engendered by the PALS model puppet. These perceptions may have strengthened the relationship between the dentist, child patient and parent, thereby motivating towards completion of the course of treatment. Although there was no reduction in dental anxiety for those children in the intervention group, nevertheless, there did appear to be some clinical benefits of using the intervention. The intervention did seem to help the children accept their treatment more readily. An independent assessment of child behaviour or the dentist–child patient interaction in the dental clinic may be a more appropriate assessment tool for this intervention.

It is apparent that there is a need for an experience management technique which is acceptable to parents and the profession, and which is effective in allaying the child's dental anxiety and equipping the child to cope with further treatment. The chair-side time required for this intervention may make it an unattractive method for adoption in general dental practice. It may be possible to reduce the cost associated with the time taken to complete the intervention by using a dental care professional to guide the PALS intervention. The presence of the dental care professional may create a more open environment for the child to express their feelings pertaining to the dental treatment which they have just received, whereas the presence of the dentist may inhibit the child's re-enactment of their treatment experience as they may not wish to offend the dentist with whom they have formed a treatment alliance. The efficacy of the intervention when applied by a dental care professional merits further investigation.

The PALS modelling intervention applied immediately following the dental visit was ineffective in reducing child dental anxiety in a group of dentally anxious children with previous dental experience. Child factors may affect the impact of this intervention, and the effect of coping style and efficacy for children with no previous dental experience warrants further research.

What this paper adds

- It describes a new behavioural intervention – the post-treatment modelling (PALS) intervention.
- It illustrates that child dental anxiety and personality factors may affect the efficacy of this behavioural intervention to reduce dental anxiety in a group of child patients.

Why this paper is important to paediatric dentists

- Child dental anxiety can lead to difficulty in completing treatment; additional methods which may facilitate the provision of treatment are required.
- Child factors may impact the efficacy of behaviour management interventions.

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