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A study to assess the validity of clinical judgement in determining paediatric dental anxiety and related outcomes of management

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Summary. *Objective.* The aim of the present study was to determine the validity of subjective anxiety assessment and the outcomes of management of children receiving operative dental treatment.
Setting. The study was conducted at the Departments of Sedation and Child Dental Health, Newcastle Dental Hospital, Newcastle upon Tyne, UK.
Subjects and methods. One hundred children and adolescents aged between 8 and 15 years participated in the study. Clinicians subjectively allocated 50 children for treatment with local analgesia alone (low anxiety), and identified 50 children who had the potential to benefit from nitrous oxide and oxygen sedation (high anxiety). Participants then completed the State-Trait Anxiety Inventory for Children (STAIC), the Venham Picture Test (VPT) and the Child Fear Survey Schedule – Dental Subscale (CFSS-DS). A global rating scale classified behaviour during dental treatment.
Results. State anxiety and dental fear prior to treatment were significantly higher in children allocated to receive inhalation sedation ($P = 0{\cdot}004$ and $P = 0{\cdot}005$, respectively). There was no significant difference in trait anxiety or post-treatment state anxiety between the two groups ($P = 0{\cdot}69$ and $P = 0{\cdot}06$, respectively). Only 11% displayed 'negative' behaviour during treatment: 82% of this group represented those allocated to receive sedation.
Conclusion. Children receiving inhalation sedation were significantly more anxious prior to treatment than children receiving treatment with local analgesia alone. The findings support the subjective assessment of anxiety in children; however, objective anxiety measures may assist clinicians in identifying specific fears, which may ultimately aid patient management.

Introduction

The issue of dental fear and anxiety has been studied extensively, and presents a significant problem to patients and dentists alike. A sizeable proportion of the population are anxious about dental treatment, and it is recognized that this can act as a barrier to oral health [1]. One study reported that 49% of respondents were 'anxious about visiting the dentist' [2], whilst the incidence in children was reported as between 3% and 21%, depending upon the anxiety measures used [3].

Research has suggested that adults often acquire such fears in childhood [4], and therefore, it is of great importance that the dental health professional is able to identify children who are dentally anxious.

Studies have used a variety of methods to assess anxiety levels. A widely used technique involves quantifying anxiety through psychometric testing using

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self-report measures such as the State-Trait Anxiety Inventory for Children (STAIC, a general anxiety scale) [5] and the Child Fear Survey Schedule – Dental Subscale (CFSS-DS, a dental-specific fear scale) [6]. Others have focused upon observation of behaviour during treatment [7], physiological parameters (e.g. pulse rate) [8] or visual testing (e.g. the Facial Image Scale) [9].

The CFSS-DS has been shown to be valid and reliable in comprehensive reviews of anxiety measures in dentistry [10–14]. Although it is a general anxiety measure, the STAIC has also been applied in the dental context [14–16], and is widely accepted as both valid and reliable.

Several studies have called for the more widespread use of objective anxiety measures in dentistry [17,18] since research has shown that such methods are usually good indicators of how patients feel and will respond to treatment [19]. Despite such calls, a recent survey reported that only 17% of UK dentists used child anxiety assessment questionnaires [20]. It appears that a common method of anxiety assessment is for clinicians to use their clinical judgement and experience in determining anxiety levels. The aim of the present study was to determine the validity of subjective anxiety assessment and record the subsequent management outcomes of children receiving operative dental treatment.

Methods

Sample

One hundred children and adolescents aged between 8 and 15 years who were referred to the Newcastle Dental Hospital over a 6-month period were randomly entered to the present study. The clinicians who assessed anxiety in these children included all grades, from junior house officers up to consultants, to best reflect the normal workings of the departments. Hospital staff were unaware of the purpose of the study, and subjectively assessed the children's anxiety at a routine examination and treatment planning appointment prior to treatment. The clinicians had not seen the participants previously. The hospital staff used their clinical experience in addition to routine factors including the patients' past dental history, the reason for referral, age and parental views to form an overall opinion of each child's anxiety and the likelihood of the proposed treatment being successful. The clinicians subsequently divided the children into two groups each comprised of 50 patients: (1) a 'non-sedation group' for children deemed suitable for treatment with local analgesia alone (low anxiety); and (2) a 'sedation group' for those who appeared more anxious (high anxiety). Children allocated to this second group would receive nitrous oxide and oxygen sedation (relative analgesia) in addition to local analgesia. Both groups were comparable, as outlined in Table 1.

Table 1. Demographic characteristics.

Variable	Sedation group	Nonsedation group
Sample size	50	50
Sex		
Male	20	25
Female	30	25
Age (years)		
Mean	10·9	11·9
SD	2·4	2
Range	8–14·9	8·1–15

All children were registered with the Newcastle Dental Hospital and the majority had been referred from general dental practitioners in the local area. The Department of Child Dental Health received children deemed suitable for conventional dental treatment (the non-sedation group), whilst the Department of Sedation conducted the treatment of those children who, in the clinician's opinion, needed additional support (the sedation group). In all cases, local analgesia was required and both groups were supplemented with topical analgesia prior to injection. Operating clinicians were limited to four hospital staff: two senior house officer grades, one lecturer and one visiting general dental practitioner with a specialist interest in sedation. Prior to the study, operators were briefed regarding the appropriate levels of verbal reassurance and encouragement to use during each child's treatment. Other management techniques (e.g. distraction through the use of television) were not permitted in either group.

The inclusion criteria stated that males and females should be between 8 and 15 years of age in order that they would be able to complete the various self-assessment anxiety measures. The participants were of mixed ethnicity, and American Society of Anaesthesiologists (ASA) grades I or II.

Ethical approval

Both child and parental consent were required, and approval was granted by the Newcastle and North Tyneside Local Research Ethics Committee.

Table 2. Summary of the anxiety/fear measures used in the present study listed in the order in which they were administered to the participants.

Order of administration	Anxiety/fear measure	Type	Stage
1	State component (State-Trait Anxiety Inventory for Children)	General	Pre-treatment
2	Trait component (State-Trait Anxiety Inventory for Children)	General	″
3	Venham Picture Test	Dental	″
4	Child Fear Survey Schedule Dental Subscale	Dental	″
5	Behaviour Global Rating	Behaviour	Clinical observation
6	State component (State-Trait Anxiety Inventory for Children)	General	Post-treatment
7	Venham Picture Test	Dental	″

Procedure

Participants were randomly selected from the computerized hospital database and were approached in the waiting room on the day of treatment. Children were asked if they would describe how they felt about visiting, and if verbal agreement was forthcoming from child and guardian, a patient information leaflet was given to the adult and written consent gained prior to administering the anxiety measures. The participants were taken to a room adjoining the surgery, and although accompanied, it was ensured that escorts could neither see nor influence responses.

Recognized self-report measures were used to assess general and dental anxiety along with specific dental fears. The behaviour of participants was monitored during treatment at regular intervals and their overall response recorded using a global rating scale. The objective measures used are shown in Table 2.

Both the 'state' and 'trait' components of the STAIC were administered first, immediately prior to dental treatment in a room adjoining the surgery. This measure assesses general anxiety and is not specific to dentistry. Twenty statements are presented in both the state and trait measures. In the state component, each begin with the words 'I feel …', followed by three possible answers, i.e. 'very upset', 'upset' or 'not upset'. In the trait component, the format is different. Each statement stands alone (e.g. 'I feel like crying …'), followed by three possible responses which remain the same throughout, i.e. 'hardly ever', 'sometimes' or 'often'. The child is asked to tick the box that best describes how they are feeling at that specific moment in time. The answers are scored from '1' to '3' for each question, with high scores indicating high anxiety. The investigator was present throughout to assist in the completion of all the self-report measures.

The Venham Picture Test (VPT) was the second test to be administered before treatment. It consists of eight cards with pictures of children in various dental situations. There are two drawings on each card, one in which the child appears happy and one in which they look distressed. Participants simply point to the picture that represents how they are currently feeling. A score is recorded for each card where the 'high fear' picture was selected; the scores are then summed to give a total out of eight. Higher scores indicate greater fear.

The CFSS-DS is a self-report anxiety measure adapted for use in dental environments. This measure was selected for its ability to present a wide range of dental situations in which the child can record their levels of fear. Fifteen situations are presented (e.g. 'Having to open your mouth'), followed by five responses from (score 1) 'not afraid at all' to (score 5) 'very afraid'. Totals of 38 or more out of 75 indicate significant dental fear. Children tick the appropriate box, making administration quick and simple.

During treatment, clinical observation noted the child's behaviour at regular 5-min intervals using a behaviour global rating scale [21]. In addition to these regular intervals, the investigator also recorded each child's response to sitting in the dental chair, the application of a nose-piece (sedation group only) and the administration of local analgesia.

Following treatment, visual analogue scales were completed separately by both the investigator and the operating dentist to rate each child's perceived anxiety level during treatment. The scale was 100 mm in length, and was marked 'low anxiety' and 'high anxiety' at its extremes.

Participants were then taken to the same room as before to complete two state anxiety measures, the state component of the STAIC (general anxiety) and the VPT (dental anxiety).

Data analysis

Data analysis was conducted using Minitab™ and the Mann–Whitney *U*-test assessing state-trait

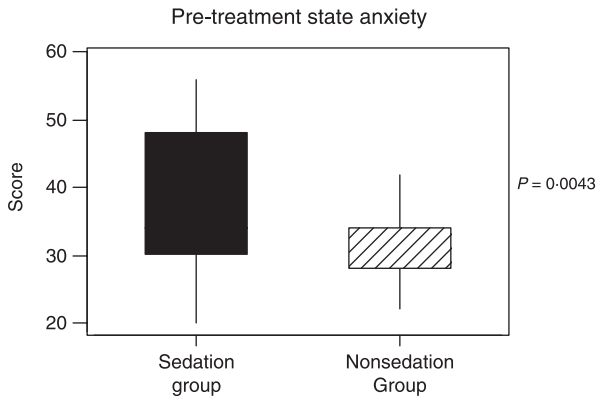

Fig. 1. Box-plots showing the pre-treatment state anxiety scores of the sedation and non-sedation groups, as measured by the State-Trait Anxiety Inventory for Children.

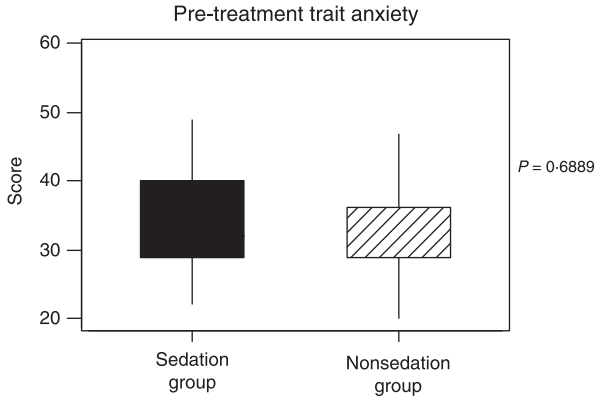

Fig. 2. Box-plots showing the pre-treatment trait anxiety scores of the sedation and non-sedation groups, as measured by the State-Trait Anxiety Inventory for Children.

relationships between the groups. Descriptive statistics were calculated using the Microsoft® Excel 2000 computer program.

Results

The mean age of the sedation group was 10·9 years (SD = 2·4 years), as opposed to 11·9 years (SD = 2 years) in the nonsedation group (Table 1). All defined age groups were represented in both treatment conditions.

State anxiety scores (measured by STAIC) prior to dental treatment were significantly higher in children allocated to the sedation group ($P = 0{\cdot}0043$). Figure 1 illustrates this difference. The mean score in children receiving sedation was 37·3 compared to 32·1 in the nonsedation group. Of participants scoring 50 or more out of 60, three (6%) belonged to the nonsedation group and 11 (22%) received sedation. However, there was no significant difference in trait anxiety (Fig. 2) or post-treatment state anxiety between the two groups ($P = 0{\cdot}69$ and $P = 0{\cdot}59$, respectively).

Interestingly, almost one-quarter of the total sample (24 children) reported higher state anxiety on leaving the surgery than on entering, as measured by STAIC. Both groups reported this fact equally.

The CFSS-DS identified a significant difference between the sedation and nonsedation groups ($P = 0{\cdot}0052$). The median score for the sedation group using the CFSS-DS was 32·5 compared to 25 in the nonsedation group. However, there was no significant difference between the mean scores of males (30·5) and females (31·3) with this measure ($P > 0{\cdot}05$). A score of 38 or more out of 75 is widely accepted to indicate high dental fear. Only five children (10%) allocated to the nonsedation group could be classified this way, whilst 16 children (32%) scored more than 38 points in the sedation group.

Children receiving sedation reported higher levels of fear in 14 out of 15 dental situations posed by the CFSS-DS. The most feared items were invasive procedures, including 'the dentist drilling' (mean ± SD = 3·7 ± 1·5) and 'injections' (3·5 ± 1·6). The least feared were seemingly non-threatening encounters such as 'having to open your mouth' (1·2 ± 0·7) and 'people in white uniforms' (1 ± 0·2).

Of all the children who participated, 16 (16%) cried once or more during treatment, and 14 of these subjects (88%) had been allocated to the sedation group (high anxiety) by clinicians. Twelve of these children (75%) had scored 38 with the objective CFSS-DS measure and could be identified as experiencing high dental fear prior to treatment. The mean CFSS-DS score of those who cried was 45 (range = 38–64) compared to the overall sample mean of 31·4.

Unsurprisingly, the few isolated cases of crying occurred at the 'critical' points identified prior to treatment, i.e. the administration of local anaesthetic (12 cases), and the application of a bur or forceps to teeth (four cases). There was no crying or negative behaviour observed when the subjects initially sat in the dental chair, or for those in the sedation group when the nose-mask for inhalation sedation was applied.

The VPT showed a significant difference between the sedation and nonsedation groups both before and

Table 3. Pre- and post-treatment Venham Picture Test scores (mean ± SD). Higher scores indicate increased anxiety.

Sedation group (n = 50)		Non-sedation group (n = 50)	
Pre-treatment	Post-treatment	Pre-treatment	Post-treatment
2·5 ± 3·1	1·0 ± 1·9	1·1 ± 1·7	0·3 ± 0·8

after treatment (P = 0·04 and P = 0·04, respectively). Table 3 shows the mean scores and standard deviations associated with the VPT. The higher the score, the greater the level of anxiety.

Clinical observation revealed that the vast majority of children's behaviour in both groups could be classed as 'good' or 'excellent' according to the global rating scale used [21]. Only three children (6%) in the sedation group received a 'poor' or 'aborted' coding. These children all scored greater than 38 points on the CFSS-DS, indicating high dental fear, and were in the upper quartile of state anxiety scores prior to treatment according to STAIC.

Visual analogue scores were used to assess the level of agreement between the operator and investigator relating to the anxiety levels of children receiving treatment. The results indicated that both parties agreed strongly. The correlation coefficient of dentist versus investigator scores were 0·88 (sedation group) and 0·84 (nonsedation group).

Discussion

The present study aimed to determine the validity of subjective anxiety assessment and record the subsequent management outcomes of children receiving operative dental treatment. Hospital staff used clinical experience alone to form two groups: a low-anxiety 'nonsedation' group and a high-anxiety 'sedation group'. Objective self-report fear and anxiety measures were then applied in addition to observation of behaviour during treatment.

General anxiety prior to treatment (measured by the STAIC) was significantly higher in children allocated subjectively for inhalation sedation. However, there were exceptions, and it is noted that several participants in the sedation group reported very low anxiety, indicating that they may have coped without pharmacological anxiolysis. Similarly, some children in the non-sedation group reported high anxiety and may have benefited from additional support.

State anxiety in the majority of children reduced significantly following dental treatment, as expected, and has been found elsewhere [14]. This was particularly the case for children allocated to the inhalation sedation group since they had also reported higher pre-treatment anxiety. In contrast, one-quarter of children reported higher state-anxiety on leaving rather than entering the dental surgery. Both groups reported this fact equally, and it may be that the decision to apply anxiety measures without delay following treatment meant that immediate factors such as pain experience and environment may have been more relevant to children at the time than their response several hours later, when a lower anxiety score would be expected. It is evident that the time at which anxiety is measured is an important consideration and this has been discussed elsewhere in anxiety research in children [22].

Trait anxiety did not differ significantly between the two groups, despite state anxiety being higher in those children receiving inhalation sedation. There was no association between trait anxiety and dental anxiety, as reported elsewhere [23]. However, this could be a result of the small sample size obtained, confounding variables or the type of anxiety measure used here. The relevance of general anxiety rather than a learned specific fear has been suggested as the most important factor in determining dental anxiety [24]. This is supported by other studies where personality trait characteristics have be used as predictors of how a child will respond to stressful situations [25].

The findings of the CFSS-DS outlined in the results section above broadly support those of earlier research [5,26–28]. In addition, the present study showed that the measure did, on the whole, identify children who displayed 'negative' behaviour during treatment, correctly classifying the three children for whom treatment had to be abandoned as 'highly fearful'. Of the children who cried during treatment, 75% were identified by the CFSS-DS as experiencing high dental fear. However, it was clinicians' subjective anxiety assessments which identified 88% of children who cried by originally placing them in the 'high anxiety' sedation group. Interestingly, only three children (3% of all participants) had their treatment abandoned and referred for general anaesthesia, which is a similar finding to that of a larger study based within the Community Dental Service [29].

Past studies have used different criteria for classifying 'highly dentally anxious' children [14,30,31], some requiring scores from 38 to 45 out of 75, but it should be remembered that any child scoring more

than 15 out of 75 is reporting fear and this should not be ignored. The CFSS-DS yielded relevant information since it is specific to the dental environment and quick to interpret. It is simple to administer, and therefore, may assist dentists in identifying fearful children.

The VPT results show that children allocated to the sedation group initially reported higher levels of anxiety than children in the non-sedation group, and both groups showing significant anxiety reduction immediately following treatment. The findings are similar to a study conducted earlier at the same location by Alwin *et al*. [32]. Recent research has highlighted the value of a Facial Image Scale (FIS), which has been shown to be valid and to overcome some disadvantages of the ambiguous situations presented on the VPT flash cards [9,33]. The VPT correctly identified 'high anxiety' in the three children for whom treatment was subsequently abandoned. However, most children and adolescents commented that some of the figures were unclear in meaning and the score does not provide the dentist with information to highlight which dental procedures are anxiety-provoking, unlike the CFSS-DS.

The present study found that dentists using clinical judgement alone identified the vast majority of those who subsequently reported high pre-treatment state anxiety and dental fear according to recognized measures. These findings provide support to clinicians who use their subjective clinical judgement in the assessment of anxiety. As discussed above, this is the method used by the majority of UK dental practitioners, and therefore, is highly relevant. However, self-report fear and anxiety measures (e.g. the CFSS-DS) may highlight specific concerns, thereby assisting dentists to achieve anxiolysis and ultimately a successful outcome for their patients.

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Résumé. *Objectif*. Déterminer la validité de l'évaluation subjective de l'anxiété et les résultats de la prise en charge des enfants bénéficiant d'un soin dentaire.
Mise en place. Departments of Sedation & Child Dental Health, Hôpital dentaire de Newcastle.
Sujets et méthodes. 100 enfants et adolescents ages de 8 à 15 ans ont participé. Les cliniciens ont subjectivement adressé 50 enfants pour traitement sous anesthésie locale (faible anxiété) et identifié 50 enfants comme pouvant bénéficier de sédation au protoxyde d'azote/oxygène (forte anxiété). Les participants ont rempli l'évaluation des signes d'anxiété (STAIC) pour enfants, le test d'image de Venham (VPT) et l'échelle dentaire de l'évaluation de la peur de l'enfant (CFSS-DS). Une échelle d'évaluation globale a classé le comportement durant les soins dentaires.
Résultats. L'état d'anxiété et la peur dentaire préalable au traitement étaient significativement plus importantes chez les enfants du groupe sédation ($p = 0{,}004$ et $p = 0{,}005$, respectivement). Il n'y avait pas de différence entre les 2 groupes pour ces variables après le traitement ($p = 0{,}69$ et $p = 0{,}06$, respectivement). Seulement 11% ont montré un comportement négatif durant le traitement – 82% de ce groupe étaient dans le groupe sédation.
Conclusion. Les enfants bénéficiant de la sédation par inhalation étaient significativement plus anxieux avant les soins que les enfants recevant un traitement sous anesthésie locale seule. Les données confortent l'évaluation subjective de l'anxiété de l'enfant. Cependant, les mesures d'anxiété objectives peuvent aider les cliniciens à identifier des peurs spécifiques, améliorant la prise en charge ultérieure du patient.

Zusammenfassung. *Ziele*. Bestimmen der Validität einer subjektiven Angstmessung und die Ergebnisse der Behandlungsführung bei Kindern, welche restaurativ zahnärztlich versorgt wurden.
Setting. Departments of Sedation & Child Dental Health, Newcastle Dental Hospital.
Stichprobe und Methoden. Einhundert Kinder und Jugendliche im Alter von 8–15 Jahren nahmen teil. Durch Behandler wurde subjektiv eine Zuordnung von 50 Kindern zu einer Behandlung ausschlieβlich unter Lokalanästhesie (geringe Angst) sowie 50 zu einer Gruppe, die von einer Lachgas/Sauerstoff-Inhalation profitieren sollte (hohe Angst). Die Teilnehmer wurden dann folgenden Tests unterzogen: State-Trait-Inventar für Kinder (STAIC), Venham Picture Test (VPT) und Child Fear Survey Schedule – Dental Subscale (CFSS-DS). Ein globales Rating wurde zur Beurteilung des Verhaltens bei der Behandlung herangezogen.

Ergebnisse. Die mit STAIC und CFSS-DS gemessene Angst war statistisch signifikant höher bei Kindern, welche der Sedierungsgruppe zugeordnet worden waren ($p < 0.004$ bzw. 0.005).

Zwischen den beiden Messwerten existierte kein signifikanter Unterschied. Nur 11% der Kinder zeigte negatives Verhalten während der Behandlung – 82% davon waren der Sedierungsgruppe zugeordnet.
Schlussfolgerung. Kinder, die eine inhalationssedierung erhielten, waren vor der Behandlung ängstlicher als Kinder, welche ausschlieβlich unter Lokalanästhesie behandelt wurden. Das subjektive Einschätzen der Behandlungsangst durch die Behandler erscheint durch die Daten dieser Untersuchung bestätigt zu werden. Dennoch sollte objektive Angstmessung für bestimmte Fragestellungen zur Optimierung der Behandlungsführung eingesetzt werden.

Resumen. *Objetivo*. Determinar la validez de la valoración de la ansiedad subjetiva y los resultados del manejo de niños que reciben tratamiento en operatoria dental.
Lugar. Departamentos de Sedación & Salud Dental del Niño, Hospital Dental de Newcastle.
Sujetos y métodos. Participaron 100 niños y adolescentes entre 8–15 años de edad. Los clínicos asignaron subjetivamente 50 niños para el tratamiento con sólo analgesia local (ansiedad baja) e identificaron 50 niños que podían beneficiarse de la sedación con óxido nitroso y oxígeno (ansiedad alta). Los participantes completaron el Inventario para Niños sobre la Ansiedad Estado-Rasgo (INAER), el Test de Dibujos de Venham (TDV) y el Examen Cuestionario sobre Miedo Infantil – Subescala Dental (ECMI-SD). Durante el tratamiento dental una escala de valoración global clasificó el comportamiento.
Resultados. La ansiedad estado y el miedo dental antes del tratamiento fueron significativamente más altos en los niños asignados para recibir sedación por inhalación (p = 0,004 y p = 0,005, respectivamente). No hubo diferencia significativa en la ansiedad rasgo o en la ansiedad estado post-tratamiento entre los dos grupos (p = 0,69 y p = 0,06, respectivamente). Sólo el 11% mostró comportamiento 'negativo' durante el tratamiento – el 82% de este grupo representaba a aquellos asignados a recibir sedación.
Conclusión. Los niños que recibieron sedación por inhalación fueron significativamente más ansiosos antes del tratamiento que los niños que recibieron tratamiento sólo con analgesia local. Los hallazgos apoyan la valoración subjetiva de la ansiedad en niños; sin embargo, las mediciones objetivas de la ansiedad pueden ayudar a los clínicos a identificar miedos específicos, que pueden al final ayudar en el tratamiento del paciente.

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