The clinically related predictors of dental fear in Taiwanese children

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Background. Dental fear has been singled out as one of the most troublesome problems facing paediatric dentistry today. Children with dental fear may avoid visiting dentists; therefore, their oral health protection is often compromised. However, the aetiology of dental fear is still not entirely understood.

Objective. This study investigated the dental visiting habit, the previous dental experiences, the conditioning pathway, and the clinically related predictors of dental fear in children.

Design. The dental history of 247 children (2–10 years old) was obtained when they came to a dental clinic for treatment. The level of dental fear in these children was assessed using the Children's Fear Survey Schedule–Dental Subscale (CFSS-DS). Observers rated the clinically anxious responses and uncooperative behaviour towards dental treatment in these children. Three stepwise regression analyses were performed to determine significant

predictors of CFSS-DS score, clinically anxious responses, and uncooperative behaviour of children, respectively.

Results. We found that the CFSS-DS score and clinical anxiety have different predictors, but age \leq 3.99 years old and cooperativeness in the first dental visit were important predictors for both the CFSS-DS score and the clinical anxiety. Furthermore, the other predictors of the CFSS-DS score were maternal dental fear, unbearable pain during the first dental visit, and visiting dentists in a regular dental clinic; the other predictors of clinical anxiety were first-born, regular dentist, and CFSS-DS score. Finally, the only significant predictor for uncooperative behaviour was clinical anxiety.

Conclusion. Children's dental fear and their anxious response during dental treatment were dynamic processes that consisted of many different factors. The direct conditioning of subjective experience of pain was more important than the objective pathway of child dental fear, and the indirect conditioning does not seem influential in this study sample.

Introduction

Children commonly experience anxiety when receiving professional dental treatment; the estimated prevalence rate of child dental anxiety/fear varies considerably from about 3% to 20%¹⁻⁵. Dental fear is characterized by a general apprehension towards stimulation in dental situations. A child's feelings of anxiety during dental treatment can lead to uncooperative behaviour that may obstruct and delay treatment. Dentists in the UK⁶ and the USA⁷ have

singled out dental fear as one of the most troublesome problems facing dentistry today. Children with dental fear may change their dental visit behaviour; indeed, some parents have reported that their children's 'fear' is a barrier to taking their children to visit a dentist^{8–11}. Thus, children's oral health protection is often compromised because of dental fear. Lee *et al.* found that the prevalence of child dental fear in Taiwan is 20.6%⁵. Although the topic clearly deserves close attention as a crucial dental public health issue, little is known about dental fear among children in Taiwan.

The findings of normative datum showed that younger children have higher dental fear^{2,5,10,12-15}, and there was higher dental fear among girls^{2,5,12,16}. Some studies found that previous dental experience is an important

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factor^{17–24}. Rachman¹⁷ has proposed three pathways to fear, directly through conditioning or indirectly via vicarious learning or modelling. Conditioning such as frequent exposure to invasive medical care, past experience of operative dental care¹⁸, and problematic first visit¹⁹ were all influential experiences. Conditioning appeared largely responsible for the children's development of dental fear²⁰⁻²². Children's fear was more strongly associated with subjective experience of pain and trauma than with objective dental pathology^{20,23}. Indirect learning processes were found to be of only minor importance^{20,24}. Otherwise, parents or mothers' dental fear has an important effect on a child's dental fear^{10,19,25,26}. Psychological tendencies such as temperament²⁷, impulsivity²⁸, or general fear¹⁰ were all important predictors. Chapman and Kirby-Turner have proposed a model of child dental fear that includes five interrelated factors: (i) fear of pain or its anticipation; (ii) lack of trust or fear of betrayal; (iii) fear of loss of control; (iv) fear of the unknown; and (v) fear of intrusion²⁹.

The objectives of the present research were to study the relationship between child dental fear and possible effects found in the clinic, and also to study some cause-related factors and their relation to child dental fear using models for stepwise regression analysis.

Materials and methods

Procedure

This study was conducted in Kaohsiung Medical University's Chung-Ho Memorial Hospital from June 2004 to November 2004. Mothers/Major caregivers (we will refer to them all as 'mothers' because the majority were mothers) of child patients between the ages of 2 and 10 were recruited for the research when they visited the clinic. Three objective observers rated the child's clinical anxiety and uncooperative behaviour on scales from 0 (not at all) to 5 (extremely high), and 0 (fully cooperative) to 5 (completely uncooperative), respectively. The three observers were familiar with child developmental psychology and child behaviour observation, and the kappa statistic among the three observers was 0.8-1.0. Children with

abnormal psychological development, such as mental retardation, developmental retardation, a pervasive developmental disorder, a tic disorder, severe sensory-motor impairment (paralysis, deafness, blindness), or a psychotic disorder were excluded from participating in the study. Furthermore, the children that received an injection during the treatment session were excluded from the research. Because the use of local anaesthesia in Taiwan is a flexible procedure, not every session of treatment uses an injection. In this circumstance, children without dental fear may also express fear and resistance when they see a metal syringe; this could lead the observer to overestimate the child's level of anxiety. There were ten (4%) children who received an injection and were excluded.

The purpose of the study was explained to the mothers, and informed consent was obtained. The questionnaire was divided into two steps. First step, the mothers were asked to complete a semistructured questionnaire, with a research worker helping them to understand the questions. The contents of the questionnaire included demographical characteristics, general medical history, dental visit behaviour, the family members' attitude towards dental treatment, and previous dental experiences. In the part of dental visit behaviour, it is noteworthy that a dentist might not only be employed by one institution at the same time. The parents may choose which clinic they took their child to according to where the dentist is (location) or the reputation of the clinic. So, we divided these into two different variables. In the part of previous dental experiences, the mothers were asked to recall the child's objective and subjective experiences, such as the reason for first dental visit, the response and behaviour during the first dental visit and the first invasive dental treatment (e.g. crying, screaming, resistance, or cooperation), the type of treatment the child received at first dental visit, the dentist's attitude towards the child during dental treatment, and the pain experiences.

The second step, the mothers were asked to help their children to complete the Children's Fear Survey Schedule–Dental Subscale (CFSS-DS). Further, the mothers were asked to fill out the same 15 items of the CFSS-DS to estimate their own dental fear. All the questionnaires were checked and the mothers were asked to fill out the missing answers immediately. A total of 290 mothers were requested, and 247 (85%) agreed to participate in the study.

The Human Experiment and Ethics Committee of the Chung-Ho Memorial Hospital, Kaohsiung Medical University, approved the research protocol for this study.

Instrument

The CFSS-DS consists of 15 items, including 'the dentist drilling' and 'injections'. Each item covers a different aspect of dental and medical situations, and all are used to measure the level of dental fear. The possible response to each item is a score between 1 (not afraid) and 5 (very afraid). The total score ranges from 15 to 75, with a high score indicating a high level of dental fear. The test–retest reliability, reported by Cuthbert and Melamed¹², was 0.86.

The Chinese version of the CFSS-DS⁵ was used in this study. The internal reliability (Cronbach's α) was 0.942, and the CFSS-DS used to estimate maternal dental fear also got a high Cronbach's α of 0.936, which showed that the CFSS-DS is an excellent research instrument whether the subjects are children or their mothers.

Data analysis

Data were analysed using SPSS for Windows release 11.5 (SPSS, Chicago, IL, USA). Descriptive analyses were used to describe children's clinical anxiety, uncooperative behaviour, and dental-related experiences such as invasive dental treatment, the reason for first dental visit, and family members' dental fear. Student's t-test and analysis of variance (ANOVA) were performed to find the related factors of CFSS-DS score, clinical anxiety, and uncooperative behaviour. Independent sample *t*-tests were used to determine the differences between boys and girls, between first-born and not first-born, between only born and not only born, between regular dental clinic and no regular dental clinic, between regular dentist and no regular dentist, and between cooperativeness and uncooperativeness in the first

dental visit in mean total CFSS-DS scores, levels of clinical anxiety, and uncooperative behaviour, respectively. ANOVAs were used to assess differences in mean total CFSS-DS scores, levels of clinical anxiety, and uncooperative behaviour, respectively, between age groups, between ages of first dental visit, between the types of unpleasant experience in the first dental visit, between previous times of dental visit, and between the types of unpleasant dental event that children have experienced. The categories of age groups and ages of first dental visit were transformed consulting developmental stage and the distribution of the sample. We divided the times of previous dental visit into ≤ 5 times', '6~10 times', and ' \geq 11 times' presuming that most mothers could answer an exact number when the child has fewer than five dental visits: an uncertain number when the child has 6-10 dental visits: and an answer such as 'so many times, I can't count' when the child has had more than 11 dental visits. The categories of previous unpleasant dental events the child has encountered and unpleasant experience of first dental visit were transformed referring to the findings of previous studies.

Pearson's correlation coefficients were calculated for CFSS-DS score, clinical anxiety, uncooperative behaviour, and maternal dental fear. Then, stepwise regression analyses were employed to find the predictors of the three variables. The discrete variables with more than three categories such as 'unpleasant experience in the first dental visit', 'previous times of dental visit', and 'previous unpleasant dental experience' were transformed into dummy variables. Consulting the high correlation between clinical anxiety and uncooperative behaviour, we hypothesized that the level of dental fear influences the level of anxious response that children express during dental treatment, and the anxious response influences the cooperative behaviour of children. So, we decided to conduct three stepwise regression analyses using CFSS-DS score, clinical anxiety, and uncooperative behaviour as dependent variables, respectively.

In the first regression analysis, the CFSS-DS score was used as the dependent variable, and the other variables that statistically significantly relate to the CFSS-DS score (excluding clinical anxiety and uncooperative behaviour) were

used as the independent variables. In the second regression analysis, clinical anxiety was used as the dependent variable, and the other variables that statistically significantly relate to clinical anxiety (these include CFSS-DS scores, but exclude uncooperative behaviour) were used as the independent variables. In the third regression analysis, uncooperative behaviour was used as the dependent variable, and the other variables that statistically significantly relate to uncooperative behaviour (including clinical anxiety, but excluding CFSS-DS score) were used as the independent variables. The purpose was to discriminate the predictors between CFSS-DS and the anxiety level that children actually expressed during dental treatment, and then use the clinical anxiety to predict the uncooperative behaviour that children expressed during dental treatment.

Results

Sample characteristics

The sample consisted of 135 boys (54.7%) and 112 girls (45.3%), aged from 2 to 10.5 years (mean age was 5.09, SD 1.61 years). The overall mean of clinical anxiety was 2.29 (SD = 1.67), the mean of uncooperative behaviour was 1.76 (SD = 1.75), the mean CFSS-DS score of children was 35.31 (SD = 13.34), and the mean CFSS-DS score of mothers was 29.99 (SD = 11.58).

This study shows that children have anxiety under these dental circumstances (Fig. 1). Overall, there were 97 (39.3%) children who had a low level of clinical anxiety (anxiety = 0~1), 80 (32.4%) children who had a moderate level of clinical anxiety (anxiety = $2 \sim 3$), and 70 (28.3%) children who had a high level of clinical anxiety (anxiety = $4 \sim 5$). As to uncooperative behaviour, there were 132 (53.4%) children having low uncooperativeness (uncooperativeness $= 0 \sim 1$), 61 (24.7%) children having moderate uncooperativeness (uncooperativeness = $2 \sim 3$), and 54 (21.9%) children having high uncooperativeness (uncooperativeness = $4 \sim 5$) as a whole. Furthermore, the proportion of high clinical anxiety and uncooperativeness among different age groups showed an obvious decrease after 4 years old.



Fig. 1. The proportions of high anxiety and uncooperativeness among different age groups.

Dental-related experiences

A total of 94.1% of the children had experience of invasive dental treatment, 62.7% of the children had invasive treatment at their first dental visit, 79.6% of the children had their first dental visit because of caries and/or pain, 12.6% for other reasons, and only 7.7% for examination. In relation to the parents, 31.1% of parents reported that they avoid taking their children to visit a dentist because of their children's fear. Furthermore, 19.2% of the children have one or more siblings that were afraid of visiting a dentist, 18.3% have one or more family members (excluding siblings) that were afraid of visiting a dentist; among those children with siblings or family members that were afraid of a dental visit, 57.3% of their parents reported that their children were ignorant of that.

CFSS-DS score and related factors

Children visiting dentists in a regular dental clinic (mean = 34.02, SD = 12.46) had significantly lower CFSS-DS scores than non-regular clinic children (mean = 40.82, SD = 15.46), t = -2.847, P = 0.006. Children expressing cooperativeness in the first dental visit (mean = 28.07, SD = 9.79) had significantly lower CFSS-DS scores than uncooperative children (mean = 39.03, SD = 13.26), t = -7.229, P = 0.000. Children aged \leq 3.99 years old have significantly higher

CFSS-DS scores than the other age groups (4.00~4.99, 5.00~5.99, 6.00~6.99, and \geq 7.00 years old) ($F_{4,241} = 6.044$, P = 0.000). Children who had unbearable pain experiences at their first dental visit had significantly higher scores than those without unpleasant experiences ($F_{2,234} = 10.949$, P = 0.000). Children with previous unbearable pain experiences (from the first dental visit up to the present) showed significantly higher scores than those without unpleasant experiences ($F_{3,239} = 3.481$, P = 0.017). Children who have fewer than five dental visits or between six and ten visits both had significantly higher scores than those with more than 11 visits ($F_{2,219} = 6.521$, P = 0.002).

Clinical anxiety and related factors

First-born children (mean = 2.51, SD = 1.67) had a significantly higher clinical anxiety than other birth children (mean = 1.97, SD = 1.65), *t* = 2.451, *P* = 0.015. Only born children (mean = 2.69, SD = 1.68) had significantly higher clinical anxiety than other children (mean = 2.13, SD = 1.65), *t* = 2.346, *P* = 0.020. Children visiting a regular dentist (mean = 2.13, SD = 1.64) had significantly lower anxiety than children without a regular dentist (mean = 2.79, SD = 1.68), t = -2.612, P = 0.009. Children expressing cooperativeness in the first dental visit (mean = 1.57, SD = 1.36) had significantly lower anxiety than uncooperative children (mean = 2.73, SD = 1.70), t = -5.645, P = 0.000. Children aged \leq 3.99 years old had significantly higher anxiety than the other age groups (4.00~4.99, 5.00~5.99, 6.00~6.99, and ≥7.00 years old) $(F_{4,242} = 7.861, P = 0.000)$. Children who had their first dental visit at the age of \leq 2 years old had significantly higher anxiety than the age groups of 2.01-3 years old and \geq 4.01 years old (*F*_{3.236} = 2.843, *P* = 0.039).

Uncooperative behaviour and related factors

Only born children (mean = 2.13, SD = 1.75) had significantly higher uncooperative behaviour than other children (mean = 1.60, SD = 1.73), t = 2.122, P = 0.034. Children visiting a regulardentist (mean = 1.61, SD = 1.69) had significantly lower uncooperative behaviour than children who do not have a regular-dentist (mean = 2.20, SD = 1.88), t = -2.258, P = 0.025. Children expressing cooperativeness in the first dental visit (mean = 1.07, SD = 1.40) had significantly lower uncooperative behaviour than children who were uncooperative in the first dental visit (mean = 2.15, SD = 1.82), t = -5.006, P = 0.000. Children aged ≤ 3.99 years old had significantly higher uncooperative behaviour than the other age groups (4.00~4.99, 5.00~5.99, 6.00~6.99, and ≥ 7.00 years old) ($F_{4,242} = 8.656$, P = 0.000). Children who had their first dental visit at the age of ≤ 2 years old had significantly higher uncooperative behaviour than the other age of ≤ 2 years old had significantly higher uncooperative behaviour than the age of ≤ 2 years old had significantly higher uncooperative behaviour than the age of ≤ 2 years old had significantly higher uncooperative behaviour than the age of ≤ 2 years old had significantly higher uncooperative behaviour than the age groups of 2.01–3.00 years old and ≥ 4.01 years old ($F_{3,236} = 4.135$, P = 0.007).

Correlations

Pearson correlation matrix found that the CFSS-DS score has significantly positive correlations with clinical anxiety (r = 0.556, P = 0.000), uncooperative behaviour (r = 0.557, P = 0.000), and maternal dental fear (r = 0.406, P = 0.000). Furthermore, clinical anxiety was positively correlated to uncooperative behaviour (r = 0.918, P = 0.000) and maternal dental fear (r = 0.162, P = 0.016).

Stepwise multiple regression analyses

After stepwise regression with forward selection, the significant predictors of CFSS-DS score were maternal dental fear, cooperativeness in the first dental visit, age of \leq 3.99 years old, unbearable pain at the first dental visit, and visiting a regular dental clinic (Table 1). The model could explain 36.2% of the total variance in CFSS-DS scores. The significant predictors of clinical anxiety were CFSS-DS scores, age of \leq 3.99 years old, firstborn, regular dentist, and cooperativeness in the first dental visit (Table 2). The model could explain 40.2% of the total variance in clinical anxiety. The significant predictor of uncooperative behaviour was only clinical anxiety (Table 3), which could explain 85.4% of the total variance in uncooperative behaviour.

Discussion

In this research, we found that approximately half of the children aged \leq 3.99 years old were

Variable	В	SE	β	t	P value
Intercept	28.830	2.713		10.627	0.000***
Maternal dental fear	0.350	0.064	0.308	5.514	0.000***
Cooperativeness in the first dental visit	-7.632	1.550	-0.278	-4.923	0.000***
≤ 3.99 years	5.806	1.621	0.198	3.583	0.000***
Unbearable pain during the first dental visit	7.658	2.073	0.206	3.694	0.000***
Regular dental clinic	-4.847	1.768	-0.151	- 2.741	0.007**

Table 1. Predictors for Children's Fear Survey Schedule–Dental Subscale (stepwise regression analysis).

 $R^2 = 0.362; \ *P < 0.05; \ **P < 0.01; \ ***P < 0.001.$

Non-significant factors included: previous pain experience, previous negative experience related to dentist, other previous negative experience, negative experience during the first dental visit except for pain, times of previous dental visit, and age groups (4.00-4.99, 5.00-5.99, 6.00-6.99, and ≥ 7.00 years old).

Table 2. Fredictors for clinical anxiety (stepwise regression analysis)	Table 2.	Predictors f	for cli	nical	anxiety	(stepwise	regression	analysis).
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Variable	В	SE	β	t	P value
Intercept	0.301	0.398		0.757	0.450
CFSS-DS	0.063	0.008	0.473	7.859	0.000***
≤ 3.99 years	0.546	0.217	0.140	2.513	0.013*
First-born	0.516	0.190	0.147	2.715	0.007**
Regular dentist	-0.541	0.209	-0.141	-2.594	0.010**
Cooperativeness in the first dental visit	-0.497	0.212	-0.137	-2.345	0.020*

 $R^2 = 0.402; *P < 0.05; **P < 0.01; ***P < 0.001.$

Non-significant factors included: only born, age groups (4.00-4.99, 5.00-5.99, 6.00-6.99, and ≥ 7.00 years old), age groups of first dental visit, and maternal dental fear.

Table 3. Predictors for uncooperative behaviour (stepwise regression analysis).

Variable	В	SE	β	t	P value
Intercept	-0.482	0.079		-6.080	0.000***
Clinical anxiety	0.982	0.027	0.924	36.636	0.000***

 $R^2 = 0.854$; *P < 0.05; **P < 0.01; ***P < 0.001.

Non-significant factors included: only born, regular dentist, cooperativeness in the first dental visit, age groups, and age groups of first dental visit.

highly dental anxious and uncooperative in the clinical setting. The proportions were obviously higher than the other age groups. Their CFSS-DS scores were also significantly higher than the other age groups. The result was similar to the findings of previous studies that younger children express higher dental fear^{2,5,10,12–15}. The influence of age could be partially explained by the immature psychological development of children³⁰.

The common predictors of CFSS-DS and clinical anxiety were an age of \leq 3.99 years old and cooperativeness in the first dental visit. The importance of age was re-emphasized in

the regression analyses. Four years old seems to be a crucial period, suggesting that most children have insufficient ability to cope with the dental situation until 4 years old; after that, the psychological development gradually matured their ability to cope as age increased. Moreover, the children who have the ability to cooperate during their first dental visit seemed to express more cooperativeness in subsequent dental treatment. It is supposed that the psychological factors such as temperament or personality might play important roles in the emotional status and behavioural expression when facing the first dental visit. Further research is needed to investigate this issue.

The other predictors of CFSS-DS were maternal dental fear, unbearable pain at the first dental visit, and regular dental clinic. Although the mean of maternal dental fear was lower than the children's CFSS-DS scores, maternal dental fear still exerted an influence on children's dental fear^{10,19,25,26}. The statistical significance of unbearable pain proved that the subjective dental experience was influential to child dental fear^{20,23}; furthermore, unbearable pain 'in the first dental visit' was more important in our

study sample¹⁹. Moreover, in this study, we found that children who visit a dentist in a regular clinic have a lower level of dental fear. It is supposed that receiving dental treatment in a familiar environment could decrease children's fear of unfamiliarity (or fear of the unknown).

In addition, the other predictors of clinical anxiety were CFSS-DS score, first-born, and regular dentist. CFSS-DS score was certainly an important predictor of the anxious response in the dental setting. Moreover, we found that children visiting the same dentist regularly significantly decrease the anxious response towards dental treatment. It is supposed that regular visits to the same dentist decrease the anxiety caused by strangers, and improve the trust and sense of security towards dental treatment²⁹. The influence of first-born was a new finding, suggesting that child rearing practice might be a new indicator that needs further investigation.

The last regression analysis showed that the uncooperative behaviour that children expressed in the dental setting could be mostly predicted by clinical anxiety. It suggested that uncooperative behaviour was mostly because of clinical anxiety and the simple uncooperative behaviour because behavioural deviation was very rare in this study sample.

The stepwise regression analyses found that the CFSS-DS and clinical anxiety have different predictors, suggesting that children's dental fear and the response actually expressed during dental treatment were dynamic processes that consisted of many different factors.

In the viewpoint of the three-pathway theory¹⁷, in this study the objective pathway such as invasive dental experience did not seem to be influential, but the subjective pain experience (reported by mothers) contributed to the development of dental fear through direct conditioning. The dental pain experience of Taiwanese children needs more investigation, because the use of local anaesthesia in Taiwan is a flexible procedure and some children probably suffered pain during dental treatment. We have no way of knowing if the injection might have improved the situation or if pain was related to the behaviours observed. Issue about how the injection influences the child's

behaviours in the dental setting needs to be clarified. Otherwise, it is worth noting that most of the parents with family members fearful of a dental visit reported that they are not likely to mention it in front of the children. This suggested that the importance of indirect conditioning was minor in this sample^{20,24}. In addition, the interaction between maternal dental fear and child dental fear (via parent–child interaction or heredity?) needs further research.

One shortcoming of this study is that we used a cross-sectional study design, and in a clinical sample from a dental clinic of medical centre, it was insufficient to represent the whole population, the differences between age groups were observed indirectly, and a possible sample bias might exist.

Finally, the study found that most of the children begin visiting dentists because of pain and/or caries, and more than half of the children received invasive dental treatment during their first visit, showing that the oral health knowledge was insufficient and the promotion of oral health education in Taiwan should be a top priority of dental health professionals. If adults take a child to visit a regular dentist and/or in a regular dental clinic, to avoid facing dental pain in the first dental visit and in very early childhood (especially under 4 years of age), the child dental fear might decrease and the oral health of Taiwanese children would be improved.

What this paper adds

- Provides verification of the three-pathway theory and other clues about the aetiology of child dental fear, and a profile of the relevant factors of child dental fear/ anxiety in the clinic.
- Found that there is some difference between predictors of child dental fear and their anxious response in the dental setting.
- Provides a new clue of the representation of anxious response in children (first-born expresses higher anxiety).

Why this paper is important to paediatric dentists

- Child dental fear/anxiety is closely linked to oral health and dental visit behaviour in children.
- A child's anxiety during dental treatment can lead to uncooperative behaviour that may obstruct and delay treatment. It is often a problem that obsesses paediatric dentists.
- The findings of this paper provide many clues that help decrease dental fear/anxiety in children. We hope to see more and more children visiting dentists with good oral health and a positive attitude.

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