

Dental anxiety in Hong Kong preschool children: Prevalence and associated factors

Mildred Lok Wun Wong¹, Sarah Hiu Fong Lai¹, Hai Ming Wong^{1*}, Yu Xin Yang¹, Cynthia Kar Yung Yiu¹

¹ Paediatric Dentistry, Faculty of Dentistry, The University of Hong Kong, Hong Kong

Abstract

Background: This study is designed to determine the prevalence of dental anxiety and contributing factors in Hong Kong preschool children.

Methods: All first-time visitors between the ages of three and five to the Prince Philip Dental Hospital, Hong Kong between were recruited between August 2014 and June 2015. Questionnaires on background information, parent's self-reported Modified Dental Anxiety Scale (MDAS), and parental proxy of the Modified Child Dental Anxiety Scale (MCDAS) were completed by parents. An oral examination was carried out to assess and record the caries experience and oral hygiene status of the child. The child's dental anxiety level was rated using the Clinical Anxiety Rating Scale (CARS). Ordered logistic regression analysis was performed to assess the association of parent's and children's characteristics with the CARS scores.

Results: Among 299 children, the mean CARS score reported was 1.16 (SD 1.06) with only 8% of the subjects rating 3 or above, indicating those who were uncooperative and demonstrated real behavioural problems that might interfere with dental procedures. Data analysis showed that the child's age ($p=0.004$, OR=0.659, 95%CI=0.497-0.872), the child's previous dental experience ($p=0.013$, OR=0.518, 95%CI=0.307-0.867), parental proxy MCDAS score ($p=0.002$, OR=2.439, 95%CI=1.376-4.353), and the dental attendance pattern of the parents ($p=0.013$, OR=0.530, 95%CI=0.321-0.870) were associated with the CARS scores.

Conclusion: Dental behavioural management problems are not prevalent in Hong Kong preschool children, but such problems are associated with both the parent's and child's characteristics such as the child's age, previous dental experience, and dental attendance pattern of the parents.

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* Email: wonghmg@hku.hk

Introduction

Dental anxiety/fear remains a challenge in treating children and has major implications on the child, parents, and the dental team. Children often express their dental fear in the form of dental behaviour problems, defined as uncooperative or disruptive behaviour towards dental treatment, which results in a delay of treatment or renders treatment impossible

[1]. The aetiology of dental anxiety and dental behavioural problems is multifactorial and complicated. The relationship between dental fear and behavioural management problems is not fully understood [2], and the distinction between the two has not always been made clear [3]. Behavioural ratings (i.e. observation of the child's behaviour, reaction by the dentist or other person during dental



treatment) have been commonly used as measurement tools for dental anxiety/fear in research.

Children's negative behaviour towards dental treatment not only affects the quality of the treatment provided, which may lead to the need of repeated treatment, but it also induces stress to the child, parents, and the dental staff. Negative behaviour towards dental treatment also correlates to non-attending behaviours, ranging from irregular attendance to total drop out [4]. This impedes the preventive routine, which leads to poor oral health. This is especially important in children, as this may persist into adolescence or even adulthood. About half of dentally anxious adults report the onset of their dental anxiety as occurring during childhood [5]. Dentists must understand the characteristics and contributing factors of anxiety in children in order to prevent its occurrence. Being able to identify at-risk patients would allow dentists to formulate appropriate behaviour management measures or refer children for specialist's care at an early stage.

Many studies on dental behavioural management problems, dental anxiety, and the associated factors in children and adolescents have been carried out. [5-8]. Most of the previous studies were not age specific and covered a wide age range from preschool children to teenagers. Information regarding dental anxiety and dental behaviour management problems specific to preschool children is limited. Most of the previous studies on dental anxiety or dental behavioural management problem were carried out in Western countries, and no similar study has been conducted in the Hong Kong population. Data specific to different populations is important for research into dental fear and dental behaviour management problems, as parenting styles and cultural backgrounds, which can vary among different populations [9-11], have been suggested as contributing factors to the condition. The aim of the study is to determine the prevalence of dental anxiety and contributing factors in Hong Kong preschool children.

Materials and methods

Samples

All Chinese children between the ages of three and five who were first-time visitors to the Paediatric Dentistry Clinic, the Prince Philip Dental Hospital, Hong Kong between August 2014 and June 2015 were recruited. The Clinic is a primary care clinic. Children's guardians booked their appointments and paid HKD 45 for registration and examination. The exclusion criteria were children who were not accompanied by their parents or parents who could not speak or read Chinese, and those children with a known medical condition, e.g. autism spectrum disorders and congenital heart diseases. The Prince Philip Dental Hospital is the only dental hospital in Hong Kong, hence the data collected in this study can be regarded as representative for the population in Hong Kong.

The study was reviewed and approved by the Institutional Review Board of the University of Hong Kong/Hospital Authority Hong Kong West Cluster (IRB reference number: UW14-010).

Sample size calculation

Sample size determination was based on a width of 95% confidence interval. The minimum sample size of 264 subjects would be needed to achieve the width 95% confidence interval, on the basis that prevalence of dental anxiety in preschool children reported previously was 22% [12]. The final sample size of 278 was then decided with a possible 95% response rate.

Data collection: Questionnaires and clinical examination

Parents were invited to participate in the study while they were in the waiting area. An information sheet regarding this study was given and parental written consent was obtained. Parents were asked to complete a questionnaire, which was designed in Chinese and consisted of two parts, including (i) the parent's and child's demographic backgrounds and their dental histories and (ii) the parent's self-reported Modified

Dental Anxiety Scale (MDAS) and parental proxy of the Modified Child Dental Anxiety Scale (MCDAS)

Parents' self-rated dental anxiety and parent proxy reported dental anxiety for their children were assessed. The MDAS questionnaire consisted of five questions designed to assess how the person felt in 5 different dental situations, on a scale of 1 to 5, from relaxed to highly anxious. It gave a total score that ranged from 5-25 [13]. A cut-off value of 19 and above was recommended to indicate high dental anxiety that might require special attention by dental personnel [14]. The MCDAS [15] is similar to MDAS, except that it consists of seven questions, leading to a total score of 7 to 35. The two additional questions concerned patients' feelings if they had treatment under general anaesthesia or under inhalation sedation. However, the two extra questions in the MCDAS were removed from the questionnaire in this study. This was to make the questionnaire simple and uniform, and also due to the fact that children who had already experienced dental treatment under GA or inhalation sedation at this age group were rare.

The child and the accompanying parent were then invited into the clinic. The parent was asked about the child's previous dental experience and whether he/she presented with pain on the day of the visit. The child was seated in the dental chair and was informed that the examiner would "look at his/her teeth". The child was examined by one of the two trained and calibrated examiners. Their caries experience was assessed by recording the decayed, missing, and filled teeth (dmft) index using the criteria recommended by the World Health Organization [16]. The oral hygiene status was assessed using the full mouth Visible Plaque Index (VPI) [17]. The presence of clearly visible plaque on the buccal surfaces of each tooth was recorded.

The children's dental anxiety level during the examination was rated by one of the two examiners using the Clinical Anxiety Rating Scale (CARS) [18] at the end of the examination but before the child left the dental chair. The CARS is a six-point scale: a point was given from a range of 0 (most relaxed) and 5 (out of contact) according to the child's behaviour during the dental treatment. A score of 0 was given to children with total cooperation, the best possible

working conditions, and no crying or physical protest. A score of 1 was given to children with mild, soft verbal protest or (quiet) crying as a signal of discomfort but who did not obstruct progress; their behaviour was appropriate for procedure. A score of 2 was given to children with protest that was more prominent, with both crying and hand signals. These children sometimes moved their heads around, making it difficult to administer treatment. Their protest was more distracting and troublesome. However, these children still complied with requests to cooperate. A score of 3 was given to children with protest that presented tangible problems to dentist. They complied with demands reluctantly, requiring extra effort by the dentist and with body movement that made providing treatment more difficult. A score of 4 was given to children whose protests disrupted dental procedures, requiring that all the dentist's attention be directed toward the child's behaviour. Compliance with these children was eventually achieved after considerable effort by the dentist, but without much actual physical restraint. These children exhibited more prominent body movement. A score of 5 was given to children with general protests on compliance or cooperation. Physical restraint was required to perform dental procedures.

Data analysis

Data collected was entered and analysed using SPSS and R version 3.2.3. The children's and parents' demographic backgrounds and dental histories, children's oral health and CARS were presented using descriptive statistics. Ordered logistic regression analysis was performed to assess the association of parent's and child's characteristics with the CARS scores on R version 3.2.3 (R Development Core Team, 2015). To assess the factors associated with the child's CARS scores, all variables of interest were simultaneously entered into the model and the ordered logistic regressions were performed in a stepwise backward manner according to the Akaike Information Criteria (AIC). After each round of regression, the variable whose deletion resulted in the lowest AIC value was removed and the regression was re-performed. The final model comprised the set of variables deletion of any one which led to an increased model AIC value. The ordered logistic

regressions were performed using the polr function from the MASS package version 7.3-45 [19]. The resultant regression coefficients were exponentiated to obtain odds ratios in a higher level of the dependent variable. The backward elimination procedure was implemented through the stepAIC function in MASS package version 7.3-45.

Variables included in the model included child's gender, child's caries status, child's oral hygiene status, parental proxy MCDAS, presence of pain in child, child's previous dental experience, parental MDAS score, parent's education level, parent's age level, parent's employment status, family monthly income, parent's dental experience, and parent's dental attendance pattern.

Intra and inter-examiner reproducibility

Duplication examinations and the CARS rating were performed on 10% of the subjects. The intra-examiner and inter-examiner reproducibility were assessed by the intra-class coefficient (ICC) in psych package version 1.5.8, running on R version 3.2.3 (R Development Core Team, 2015).

Results

Demographic backgrounds and dental histories of the study population

Three hundred children were invited to participate in the study, with only one parent refusing (response rate: 99.7%). Details of the children's and parents' demographic backgrounds and dental histories are shown in Table 1. A total of 299 children were included in the study, with 52% of them boys and 48% girls, with a mean age of 4.7 (SD 0.82). Approximately 60% of children were accompanied by solely the mother, 17% were accompanied by solely the father, and 21% were accompanied by both parents. Around 30% of the children had no previous dental experience, 45% of the children had experienced dental examination, and 23% had previously experienced dental treatment (including filings, pulp treatment, extraction). Most of the parental interviewees in the study were the children's mothers, most commonly in the 30-39 age group. Over 65% of the parents were irregular dental

attendees, though over 70% of the parents had experienced previous dental treatment.

Oral health status

The oral health status of the children is shown in Table 2. The mean dmft reported in this group of children was 9.4 and the mean VPI score was 85%. Among the 299 children, 27% presented with pain at the visit.

Dental behaviour

Over 50% of the children were rated with the CARS score of 1. The mean CARS score reported was 1.16 (SD 1.06). The percentage distribution of children according to the CARS score is shown in Table 3.

Parental MDAS and proxy MCDAS

The parent's MDAS mean score was 12.4 (SD = 4.1), with 8% presenting with an MDAS equal to or over 19. The parental proxy MCDAS mean was 14.7 (SD = 4.4), and 20% of the children were reported with an MCDAS equal to or over 19. Local anaesthesia injection was reported as the highest anxiety-inducing procedure for both parents and children. The frequency distribution of responses to MDAS and parental proxy MCDAS is shown in Table 4.

The association of parent's and child's characteristics with the CARS score

The ordered logistic regression analysis showed that the parent's and child's characteristics were associated with the CARS score (Table 5). The child's age, the child's previous dental experience, parental proxy MCDAS score, and the dental attendance pattern of the parent were shown to be associated with the CARS score.

Regarding the child's age, for every 1-unit increase in the child's age, the odds of the CARS score being in a higher category was 0.66 ($p<0.01$). Regarding the child's previous dental experience, those children who had experienced previous dental examination were 0.52 times as likely to be in a higher CARS category than those who had not ($p<0.05$).

Table 1. Demographic backgrounds and dental histories of the study population

<u>Variable</u>	<u>Number</u> (N=299)	<u>Percentage</u>	30-39	194	64.9%
			>40	75	25.1%
<u><i>Child's demographics</i></u>					
<u><i>Gender</i></u>					
Male	156	52.2%	No schooling/ kindergarten	2	0.7%
Female	143	47.8%	Primary school	13	4.3%
<u><i>Main caregiver</i></u>					
Mother	222	74.2%	Secondary School	201	67.2%
Father	9	3.0%	Post-secondary school	37	12.4%
Grandparents	40	13.4%	Tertiary or above	46	15.4%
Maid	25	8.4%	<u><i>Monthly family income</i></u>		
Other people	3	1.0%	<\$10,000	45	15.0%
<u><i>Child is accompanied by</i></u>			\$10,000-\$19,999	136	45.5%
Mother	184	61.5%	≥\$20,000	118	39.5%
Father	52	17.4%	<u><i>Employment status</i></u>		
Both	63	21.1%	Employed full time	122	40.8%
<u><i>Child's dental history</i></u>			Employed part time	33	11.0%
<u><i>Previous dental experience</i></u>			Unemployed	13	4.3%
No	95	31.8%	Stay at home spouse	131	43.9%
Examination	133	44.5%	<u><i>Dental attendance habit</i></u>		
Filling	51	17.1%	Regular attender	104	34.8%
Pulp treatment	3	1.0%	Non-regular attender	195	65.2%
Extraction	4	1.3%	<u><i>Dental experience</i></u>		
LA	10	3.3%	No dental experience	35	11.7%
GA	3	1.0%	Only dental examination	43	14.4%
<u><i>Parent's demographics</i></u>			Dental treatment	221	73.9%
<u><i>Relationship to the child</i></u>					
Mother	225	75.2%			
Father	74	24.8%			
<u><i>Age</i></u>					
<30	30	10%			

The association between parental proxy MCDAS and the CARS was found to be statistically significant. For those with parental proxy MCDAS ≥ 19 , these children were 2.44 times as likely to be in a higher CARS category than those with a MCDAS score of <19 ($p<0.01$). For children whose accompanying parents were regular dental attendees, they were 0.53 times as likely to be in a higher CARS category than those children whose parents were not regular dental attendees ($p<0.05$).

Table 2. Oral health status of the children

Variable	Number (N=299)	Percentage
<i>Child's oral health</i>		
<i>Caries status</i> (mean dmft = 9.4)		
No caries	16	5.4%
ECC	33	11.0%
severe ECC	250	83.6%
<i>Oral hygiene status</i> (mean VPI = 85%)		
VPI <50%	21	7.0%
VPI 51-75%	63	21.1%
VPI>75%	215	71.9%
<i>Presented with pain?</i>		
With pain	82	27.4%
With no pain	217	72.6%

Table 3. Percentage distribution of children according to the Clinical Anxiety Rating Scale (CARS) (N=299)

CARS score	Number of children (%)
0. Relaxed, smiling and willing to converse	74(24.7%)
1. Uneasy, concerned; willing to interpret as requested	150 (50.2%)
2. Child appears scared; continues to work to cope with the anxiety	51 (17.1%)
3. Shows reluctance to enter the situation; copes with situation with great reluctance	7 (2.3%)
4. Anxiety interferes with ability to assess situation	12 (4.0%)
5. Child out of contact with the reality of the threat	5 (1.7%)

Inter-examiner and intra-examiner reliability were shown to be 'excellent' [20]. The ICC of over 0.99 was reached in assessing dmft and VPI for both inter- and intra-examiner reliability. Intra-examiner reliability on CARS was 0.93, and over 0.96 was achieved for the inter-examiner reliability on CARS.

Discussion

The mean CARS score reported in our study was 1.16. The behaviour of most of the children (87.5%) rated 0 to 2 in the CARS, meaning their behaviour was generally appropriate and did not affect the dental procedures. Only 8% of the subjects were rated 3 or above in the CARS, meaning that they were uncooperative and demonstrated real behavioural problems that might interfere with the dental procedures. This figure is lower when compared to previous studies. A study previously carried out in the United Kingdom reported that 11% of 5-year-old children were dentally anxious [21], and up to 22% of children 3 to 6 years old were found to be dentally anxious in a previous study carried out in Iran [12].

The results in this study show that the association between parental dental fear (MDAS) and CARS score was not significant. However, for the children that were rated as highly anxious ($MCDAS \geq 19$) according to the parent proxy reported MCDAS, they had higher CARS scores when compared to those reported with $MCDAS < 19$. This suggests that parents were able to assess the child's dental anxiety level or behaviour during the dental treatment. This supports the findings by Xia et al [8] that the parent's expectation of a negative reaction from the child in the dental situation was a reliable predictor of the dental behavioural problem. However, the agreement between the child's self-reported and parent proxy reported dental anxiety has been shown to be weak in 7-16 years old children [22]. This could be attributed to the difference in the age of the study populations. Preschool children rely more heavily on and spend most of their time with their parents. For younger children, the parents are the people who know their children's behaviour best, though this relationship may be expected to weaken later in life as the children are exposed to more people and different environments.



Table 4. Frequency distribution of responses to Modified Dental Anxiety Scale (MDAS) and Modified Child Dental Anxiety Scale (MCDAS)

	N (%)				
	Not Anxious	Slightly Anxious	Fairly Anxious	Very Anxious	Extremely Anxious
MDAS					
Q1. If you went to your dentist for treatment tomorrow, how would you feel?	74 (24.7%)	109 (36.5%)	91 (30.4%)	23 (7.7%)	2 (0.7%)
Q2. If you were sitting in the waiting room (waiting for treatment), how would you feel?	83 (27.8%)	108 (36.1%)	82 (27.4%)	22 (7.4%)	4 (1.3%)
Q3. If you were about to have a tooth drilled, how would you feel?	32 (10.7%)	73 (24.4%)	98 (32.8%)	79 (26.4%)	17 (5.7%)
Q4. If you were about to have your teeth scaled and polished, how would you feel?	94 (31.4%)	102 (34.1%)	84 (28.1%)	16 (5.4%)	3 (1.0%)
Q5. If you were about to have a local anaesthetic injection in your gum, above upper back tooth, how would you feel?	30 (10%)	73 (24.4%)	111 (37.1%)	58 (19.4%)	27 (9%)
MCDAS					
Q6. If your child were going to visit a dentist, how do you think your child would feel?	59 (19.7%)	92 (30.8%)	101 (33.8%)	32 (10.7%)	15 (5.0%)
Q7. If your child were going to have his or her teeth examined, how do you think your child would feel?	58 (19.4%)	123 (41.1%)	75 (25.1%)	33 (11.0%)	10 (3.3%)
Q8. If your child were going to have his or her teeth scaled and polished how do you think your child would feel?	28 (9.4%)	86 (28.8%)	108 (36.1%)	59 (19.7%)	18 (6%)
Q9. If your child were going to have his or her teeth filled, how do you think your child would feel?	19 (6.4%)	51 (17.1%)	116 (38.8%)	82 (27.4%)	31 (10.4%)
Q10. If your child were going to have a local anaesthetic injection in his or her gum, how do you think your child would feel?	7 (2.3%)	30 (10.0%)	72 (24.1%)	113 (37.8%)	77 (25.8%)

The association between age and dental anxiety has been reported in many previous studies, however the results were conflicting. Rud and Kisling [23] stated that the chronological age did not always correspond to the level of mental development. However, we have demonstrated a negative correlation between the age of the child and dental anxiety in this study. This correlation was also demonstrated in the study by Winer [24], whose study showed that positive behaviour increases between 3 to 6 years old. Winer suggested that anxiety in the dental setting reflected a more general and basic type of anxiety, and that the

child's emerging personality might lead to a decline in fear in older pre-schoolers.

The results in this study show that for children who had a previous experience of dental examination were found to have a lower CARS than those who had no dental experience. This relationship was also shown in a study carried out previously by Soares et al [25], which showed that children and adolescents who had never visited a dentist showed a level of anxiety 5.6 times higher than those who had. Previous studies have demonstrated that the first dental visit



experience has significant effects on the behaviour and attitudes about dental treatment in subsequent visits [26]. A positive first dental experience may contribute to the prevention of negative dental behaviour. Uncertainty contributes to anxiety as it diminishes the efficiency and effectiveness of our preparation for the future [27]. Children with a previous dental experience would have a better understanding of the dental setting and examination procedure, and they would have an idea of what they were going to experience and therefore be less anxious. Obtaining a detailed dental history regarding children's previous dental visits from their accompanying parents is crucial in predicting children's behaviour in order to avoid specific triggers towards negative behaviour. When a child is referred to a paediatric dental clinic for specialist care, communication between the specialist and referring dentist may be necessary.

It was also shown that children whose parents are irregular dental attendees have higher CARS compared to those with parents who are regular attendees. There is a lack of previous data regarding the relationship between the two. Children with parents who are regular attendees might have visited a dental clinic with their parents before. Direct observation of another person undergoing dental treatment is a behavioural guidance technique commonly used in paediatric dentistry. By having the experience of visiting a dental clinic and observing some dental procedures, a child may be more familiar with the dental setting and therefore less anxious.

Behavioural ratings play an important role in dental clinics and research. They provide aid in measuring and recording children's behaviour and cooperation in a standardised way. The Clinical Anxiety Rating Scale was used in the study because it is one of very few scales that assesses dental anxiety based on the observation of clinical behaviour. This is especially important in studies on dental anxiety involving young children as they are not able to self-report their own anxiety level. CARS is a clear and practical scale, and it demonstrates the ease of recording with good inter-examiner reliability. The 6-point CARS shows advantage over other behavioural scales (e.g. Frankl's scale) as it gives clear, detailed, and mutually exclusive description of the behaviour in under each score category.

Table 5. Ordered logistic regression analyses: the association of parent's and children's characteristics with the CARS scores (N=299)

Variable	β (SE)	OR (95% CI)	p-value
Child's age	-0.417 (0.143)	0.659 (0.497, 0.872)	0.004 **
Parent's dental attendance pattern	-0.635 (0.254)	0.530 (0.321, 0.870)	0.013 *
Child's previous dental experience: history of examination	-0.658 (0.264)	0.518 (0.307, 0.867)	0.013 *
Child's previous dental experience: history of dental treatment	-0.616 (0.319)	0.540 (0.288, 1.007)	0.053
VPI: ≥ 0.9	0.432 (0.238)	1.540 (0.968, 2.460)	0.069
Parental proxy MCDAS score ≥ 19	0.892 (0.293)	2.439 (1.376, 4.353)	0.002 **
Family monthly income: $\geq 20,000$	0.369 (0.259)	1.446 (0.871, 2.407)	0.154

*p<0.05; **p<0.01.

β : regression coefficient; OR: odds ratio; CI: confidence interval. Nagelkerke's R²=0.148.

Excluded variables: Child's gender, interviewee (relationship with child), child's caries status (dmft), presence of pain in child, CARS score, parent's MDAS score, parent's education level, parent's age level, parent's employment status, parent's dental experience, identity of child's main caregiver

However, there is no recommended cut off point of the scale to differentiate subjects that are or are not dentally anxious, meaning that results from different studies may not be directly comparable.

While interpreting the results, it is important to be aware that CARS rates anxiety based on children's behaviour toward dental examination and treatment. Behaviour is what dentists see and fear/anxiety is what the children feel. Dental anxiety has been identified as an important contributing factor to dental behaviour management problems, but the two do not

necessarily correlate on all occasions. Dental fear may only explain part of the problem of uncooperative behaviour. Fear was expressed by uncooperativeness in just over 60% of the children with dental fear [28]. Some children do experience psychological stress despite being cooperative during dental procedures [29]. Therefore, dentists should always be careful with their approach to children.

Several limitations of this study must be addressed. It is important to note that the study was carried out in the Paediatric Dentistry Clinic of a teaching hospital, which is in a secondary care setting. Some of the patients attending the clinic were referred by general dental practitioners for various reasons, including dental behavioural problems in their previous visits or complication of treatment required. Therefore, the study could be carried out in other settings, e.g. randomly selected primary care dental clinics. However, the consistency of the examiners, in this case, would be difficult to control. Children's behaviour was assessed during the first examination appointment in which no active treatment procedure was carried out. Behaviour management problems may be encountered in subsequent visits when certain treatment procedures (e.g. local anaesthesia) are introduced. Changes in dental behaviour management problem in subsequent visits and the correlation with certain types of invasive procedures (e.g. local anaesthesia, extraction) can further be investigated.

Conclusions

Dental anxiety remains a challenge in paediatric dentistry. Detailed assessment of the child's previous dental history and experiences should be made together with the parent's contributions in order to identify children who are at risk for dental anxiety at an early stage.

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