IN BRIEF

- Dentally related anxiety occurs in about 10% of the population of 5-year-old children and is related to irregular attendance, traumatic treatment procedures and the anxiety of the child's parents.
- Children who are sporadic attenders, usually present in pain and therefore often require an extraction and extraction is associated with anxiety. This pattern of attendance and care can set up a vicious cycle leading to long lasting dental anxiety problems.
- To prevent anxiety, we must break this cycle by making the dental visiting experience easier for parents and more pleasant for children, but also by providing effective public health measures to prevent dental caries.
- In measuring the outcomes of dental treatment provided to children, we must measure not only clinical dental factors such as the longevity of restorations, perhaps more important is the need to measure the impact of the treatment on the patient's quality of life.

The relationship between anxiety and dental treatment experience in 5-year-old children

K. M. Milsom,¹ M. Tickle,² G. M. Humphris³ and A. S. Blinkhorn⁴

Objectives To examine the relationship between dental anxiety, dental attendance and past treatment history in 5-year-old children after taking into account confounding influences.

Methods A cross sectional study of all 5-year-old children living in Ellesmere Port and Chester. All children were clinically examined and dmft and its components were recorded. A postal questionnaire was sent to parents of participating children to identify whether children attended the dentist on a regular asymptomatic basis or only when experiencing problems. Additionally parents were asked to judge whether they and their child were anxious about dental treatment. The socio-economic status of the family was measured using the Townsend Material Deprivation Index of the electoral ward in which they resided. The bivariate relationships between anxiety and reported attendance, caries experience, past extraction and restoration history were assessed using chi-square and *t*-tests. Multiple logistic regression analyses were used to identify predictors for dental anxiety.

Results A total of 1,745 children received both a clinical examination and a questionnaire and 1,437 parents responded, a response rate of 82.3%. One in ten parents (10.8%) judged their child to be dentally anxious. Anxious children had significantly ($p < 0.001$) more caries experience (dmft 2.58 vs 1.12). Multiple logistic regression analyses confirmed that anxious children were more likely to be irregular attenders (OR 3.33, 95% CI 2.22, 5.00), have anxious parents (OR 1.60, 95% CI 1.09, 2.36), and to have undergone dental extraction in the past (OR 3.50, 95% CI 2.10, 5.85), after controlling for gender and socio-economic status. A past history of restoration was not a significant predictor of anxiety after controlling for other factors.

Conclusions Dental anxiety is a fairly common condition in 5-year-old children in the North West of England. It is closely associated with a symptomatic, irregular attendance pattern, a history of extraction and having a dentally anxious parent. The cause and effect dynamics of these relationships need to be determined.

INTRODUCTION

A debate about how best to provide dental care for young children with caries in the primary dentition has been initiated by the publication of several recent research papers.^{1,2,3,4} It seems that many general dental practitioners (GDPs) are providing care according to a philosophy which can be described as 'reluctant intervention'. This model of care is very different to that advocated in guidance issued by the British Society of Paediatric Dentists (BSPD).⁵ The reasons why many GDPs hesitate to provide care in accordance with BSPD guidance are probably multiple. One possible reason is that GDPs may be concerned that performing aggressive clinical interventions on young children may cause dental fear and anxiety. Any such concerns are well founded, as dental anxiety is a serious problem that has long term effects because it is stable and difficult to alleviate.⁶

Rachman⁷ proposed three pathways leading to the acquisition of child fears. They include: direct conditioning through some traumatic experience, or two indirect pathways, referred to as vicarious experiences or threatening information. Some reports have claimed that dental anxiety, resistant to casual management, develops from the infrequent experience of major or traumatic dental treatment.⁸ Children who attend irregularly and symptomatically are likely to have more caries than regularly attending children, and crucially are more likely to have extractions.⁹ Given the well-documented traumatic nature of extractions performed under general anaesthesia¹⁰ it is likely that this group of irregular attenders is at greater risk of developing dental anxiety. Frequent asymptomatic visits with no aversive experiences appear to prevent the development of an anxious response to dental attendance. This process is termed 'latent inhibition'.^{8,11} The evidence for this effect has been limited to retrospective reports in the dental field.^{12,13} Indirect evidence can be retrieved from studies that show children with high levels of dental anxiety have received more extensive dental treatment,^{14,15,16} however the literature is equivocal, as the opposite relationship has also been found. Possibly, the most important study in this field is the longitudinal survey of

¹Consultant in Dental Public Health, Department of Dental Research and Development, Halton Primary Care Trust, Moston Lodge, Countess of Chester Health Park, Liverpool Road, Chester, ²Senior Lecturer/Consultant in Dental Public Health, Department of Dental Medicine and Surgery, Manchester University Dental Hospital, ³Reader in Clinical Psychology, Department of Clinical Psychology, School of Psychiatry and Behavioural Sciences, University of Manchester, ⁴Professor of Oral Health, Department of Dental Medicine and Surgery, Manchester University Dental Hospital.

*Correspondence to: M. Tickle, Senior Lecturer/Consultant in Dental Public Health, Department of Dental Medicine and Surgery, Manchester University Dental Hospital, Higher Cambridge Street, Manchester M15 6FH
Email: martin.tickle@man.ac.uk

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Murray *et al.*¹⁷ who followed a sample of 9-year-old children for three years. Those children who did not receive invasive treatment were more likely to be dentally anxious. However, an important caveat included in this report was that the anxiety response following dental treatment was attenuated when the child had a record of past regular asymptomatic dental visits. This would support the latent inhibition hypothesis raised earlier.

In attempting to gain an understanding of the initiation and development of dental anxiety, two factors: attendance behaviour and past treatment history seem to be of prime importance. If we are to avoid dental anxiety it is also important to see if the relationships reported by Murray *et al.*¹⁷ in 9-year-old children exist in younger age groups. Against a background of high caries prevalence in young children and the frequent use of extractions to deal with the condition, a study was undertaken in the North West of England, the aim of which was to examine the relationship between dental anxiety, dental attendance and past treatment history in 5-year-old children after taking into account confounding influences.

METHOD

A whole population survey of 5-year-old children in Chester and Ellesmere Port was undertaken. Children were examined according to national criteria developed by the British Association for the Study of Community Dentistry.¹⁸ Three trained and calibrated examiners collected data on dmft and its components. These data were recorded electronically in the field. The Townsend Material Deprivation Score¹⁹ of the electoral ward of residence of each child was attached to each record by reference to the subject's home postcode. This area measure of deprivation was used as a proxy measure of the socio-economic status of each child.

The parents of all children included in the study were sent a questionnaire designed to measure the child's dental anxiety. The questionnaire asked parents to indicate:

- If their child attended the dentist on a regular asymptomatic basis or if they attended only when experiencing symptoms.
- Whether or not their child was frightened or anxious in relation to dental treatment.
- Whether or not they themselves were frightened or anxious in relation to dental treatment.

Both single item questions about anxiety employed a five point rating scale with verbal anchors ranging from very relaxed to very frightened about dental treatment. Children were dichotomised according to their anxiety status, subjects were classified as being anxious about dental treatment if their parents indicated that they were either fairly or very frightened. Those children whose parents described their children as being very or fairly relaxed, or that they were neither relaxed nor frightened, were classified as non-anxious.

Questionnaires were sent out in three stages to increase response. The parents of all subjects were included in the first mailing and non-responders were successively targeted in the second and third stages. Answers to each question were compared from the three stages to detect for possible non-response bias. Each questionnaire was marked with the child's unique study identification number to enable the data collected by questionnaire to be linked to the clinical data.

Bivariate relationships between categorical variables were analysed using cross-tabulations and chi-square tests, *t*-tests were used for continuous variables. A multiple logistic regression model was fitted, for the child assessed as being anxious / not anxious as the dependent variable. This model included: regular asymptomatic attendance / irregular symptomatic attendance, gender, Townsend Index, anxious / non anxious parent and ever / never had an extraction. A second model was constructed replacing the independent variable ever / never had an extraction with ever / never had a filling. In this last analysis children who had previously had an extraction were excluded from the analysis.

RESULTS

A total of 1,745 children received both a clinical examination and a questionnaire to their home address and 1,437 parents responded, an 82.3% response rate. Some 89.8% (N=1,291) of children were reported by their parents as having visited the dentist in the past year. Table 1 examines the prevalence of child anxiety as reported by their parents, and shows that three quarters of all parents asked (76.8%) felt that their children were either very relaxed or fairly relaxed about dental treatment. One in ten parents (10.7%) classified their children as being anxious (fairly or very frightened) and one in nine parents (12.5%) felt that their children were neither anxious nor relaxed about dental treatment.

Table 1 Parentally reported levels of anxiety towards dental treatment of 5-year-old children.

	Frequency	Percent
Very relaxed	567	40.4
Fairly relaxed	511	36.4
Neither relaxed or anxious	176	12.5
Fairly anxious	114	8.1
Very anxious	37	2.6
Total	1,405*	100.0

* 32 records missing due to item non-response

A series of bivariate analyses were completed prior to the logistic regression analyses. These demonstrated that children classed as anxious had significantly more dental caries experience than children who were perceived to be relaxed about dental care (dmft=2.58 vs dmft=1.12, $p<0.001$). The association between child anxiety and the child's dental visiting behaviour was also statistically significant. Children judged by their parents to be anxious were more likely to have an irregular, symptomatic visiting pattern than children who were classified as non-anxious ($\chi^2=58.2$, dof 1, $p<0.001$). The relationship between extraction and anxiety was also explored prior to multivariate analysis. The epidemiological examination showed that 115 (8%) of children had one or more extractions in the past. In the questionnaire, parents were asked if their child had received an extraction under local or general anaesthetic, 29 reported that their child had been treated under local anaesthetic and 65 reported that their child had previously undergone a general anaesthetic for extractions. This represents an under-reporting (N=94 vs N=115) of the epidemiological findings. Chi square tests were used to determine the relationship between anxiety and both types of patient management techniques. The tests showed that children who had extractions performed under either a local or general anaesthetic were significantly (local anaesthetic $\chi^2 = 12.71$, dof=1, $p<0.001$, general anaesthetic $\chi^2 = 48.68$, dof=1, $p<0.001$) more likely to be anxious than children who had no history of extraction. The tests also showed that similar proportions of children treated under local (31%) and general anaesthetic (37%) suffered from dental anxiety. Following the results of these analyses children who had a history of extraction were aggregated. The relationship between child anxiety and extraction history (measured epidemiologically) showed that 5-year-old children reported as being anxious by their parents were significantly ($\chi^2=43.6$, dof 1, $p<0.001$) more likely to have had an extraction than non anxious children. In fact, 21.9% (n=33) of anxious 5-year-olds had a history of extraction compared with 6.4% (n=80) of children classified as non-anxious.

A further analysis, excluding the children who had undergone extraction, looked at the relationship between anxiety and whether or not the subject had a restoration in the past. This analysis showed that having a restoration in the past had no significant association with anxiety status of the child ($\chi^2=0.78$, dof 1, $p=0.38$).

Table 2 Results of a logistic regression analysis for the dependent variable anxious/not anxious with independent variables including ever/never had an extraction.

Dependent variable: anxious/not anxious as reported by parent			
95% CI for Odds ratio			
Independent variables	Odds ratio	Lower	Upper
Regular asymptomatic/irregular symptomatic attender	3.33	2.22	5.00
Gender	1.31	0.90	1.90
Townsend Index	0.99	0.94	1.04
Anxious parent/non anxious parent	1.60	1.09	2.36
Ever/never had an extraction	3.50	2.10	5.85

Two multivariate logistic regression analyses were performed to identify which variables predict anxiety in children. The results are presented in Tables 2 and 3. Table 2 shows that children who had anxious parents were one and a half times more likely to be anxious than those whose parents judged themselves not to be anxious about dental treatment. Children who were classed as irregular, symptomatic attenders at the dentist were 3.3 times more likely to be anxious than children who attended regularly. This was after controlling for socio-economic status and gender, both of these variables were shown to have no association with anxiety. The other important predictor of anxiety was a history of extraction. Children who had an extraction in the past were three and a half times more likely to be anxious than children who had not experienced this type of treatment. Interestingly, when this independent variable was replaced with a history (or not) of fillings, no significant association was found between restoration experience and anxiety (Table 3). The significant, independent relationships between the dependent variable and attendance patterns and parental anxiety remained.

DISCUSSION

In this population of 5-year-olds, dental anxiety was relatively common, 10.7% of parents reported that their child was either fairly or very anxious about dental care. The multivariate analyses demonstrated that parents' levels of dental anxiety had a consistent, independent influence on their child's dental anxiety. Some clinical studies have indicated that there is an association between child and maternal dental anxiety, that is modelling or an example of vicarious experience.²⁰ Although when parents are invited to comment on the possible causes, no attribution which focuses on parental transfer of anxiety could be found.²¹ In a community representative survey in Seattle, USA of 5–11-year-old children (N=895), it was found in a multiple logistic regression model that the influence of parental modelling (ie dentally fearful parent) on the child's independently derived dental anxiety score was significant.¹⁴ That is, children who had a dentally anxious parent were twice as likely to be anxious when compared with children who had non-fearful parents. This result held true when controlling for dental health status (a proxy measure of direct conditioning). However, as in the study reported here, direct conditioning was found to be the strongest predictor of child dental anxiety status.

Children who had a history of extraction were three and a half times more likely to be anxious than children who had no experience of this form of treatment. The results of this study and surveys of general anaesthesia provision²² conducted at the time this study was undertaken (1999/2000) show that general anaesthesia was commonly employed to manage young children undergoing extractions. We also know that extraction under general anaesthesia is a traumatic process for young children.¹⁰ Therefore it is not surprising that the results of this study agree with the findings of others in the literature which demonstrate

Table 3 Results of a logistic regression analysis for the dependent variable anxious/not anxious with independent variables including ever/never had a filling.

Dependent variable: anxious/not anxious as reported by parent			
95% CI for Odds ratio			
Independent variables	Odds ratio	Lower	Upper
Regular asymptomatic/irregular symptomatic attender	4.50	2.70	7.50
Gender	1.27	0.80	2.02
Townsend Index	0.99	0.94	1.06
Anxious parent/non anxious parent	1.78	1.1	2.88
Ever/never had a filling	1.16	0.57	2.34

the strong association between major or traumatic treatment interventions and dental anxiety.^{8,14,15,16} In light of these observations perhaps extraction should be considered very much as a treatment of last resort. For very young children or the child who is already dentally anxious, a wait and watch approach by the dentist may have much to recommend it.

It is more difficult to explain why no relationship was found between dental anxiety and a history of restorative treatment. One explanation could be that the restorative approach adopted by the majority of GDPs is atraumatic for children. At present we have no in-depth understanding of the processes employed by GDPs for the restoration of carious primary teeth. For example, how often is local anaesthesia used and how is the mechanical preparation of teeth approached; is hand instrumentation rather than use of an air rotor the norm? If local anaesthetic (and therefore an injection) and use of an air rotor are avoided (through the application of hand instrumentation) the restorative procedure may well be less traumatic for the child than the procedures required to undertake an extraction either under local or general anaesthetic. This possible regimen may reflect a holistic approach by GDPs keen to reduce levels of anxiety at the expense of fastidious cavity preparation. The BSPD recommends the use of a vital pulpotomy followed by fitting a preformed crown for the treatment of primary teeth with two surface caries,⁵ procedures which require an injection and use of the air rotor. And yet in England and Wales in 2001, NHS fees for only 4,255 preformed crowns for the treatment of primary teeth were claimed by GDPs.²³ These statistics suggest that the majority of GDPs are providing dental care according to a less invasive philosophy than that recommended by BSPD, which may account for the findings of no association between anxiety and restorative history.

The data from this study demonstrate that there is a very strong link between irregular attendance and dental anxiety in young children, even after controlling for past treatment experience. These results add support to the notion of latent inhibition;^{8,11} that regular asymptomatic dental visits have a cumulative effect and prevent development of dental anxiety. In this way children learn to associate positive or neutral effects with asymptomatic dental visits. Against a background of unremarkable dental visits, an occasional unavoidable aversive experience is psychologically less negative.

The link between extraction and reported dental anxiety amongst 5-year-old children has been demonstrated in this study, as has the link between reported irregular symptomatic dental attendance and anxiety, but the nature of these relationships is unclear. Does extraction lead to the creation of dental anxiety in children, or is it the case that inherently anxious children undergo extraction under general anaesthesia because their anxiety prevents alternative treatment options? Are anxious children less likely to be regular attenders because they have an intrinsic anxiety (irrespective of whether they have attended a

dentist in the past) which acts as a barrier to attendance, or does a past history of symptomatic attendance associated with unpleasant treatment experiences have the effect of creating anxious children? Cross-sectional studies cannot answer these questions. Longitudinal studies are required to provide us with a more complete understanding of the causal relationship between dental care and dental anxiety if we are to prevent this distressing psychological condition in the future.

The basis of non-threatening dental care should be prevention, which ought to form the cornerstone of any long-term care strategy for the dental care of children. The preventive messages are well understood²⁴ and the fact that 60% of 5-year-olds are caries free²⁵ suggests that dental decay can be prevented. However, for prevention to work in practice, regular attendance by children is necessary and dentists should be adequately remunerated for undertaking this time consuming work. Dietary advice and preventive interventions such as the topical application of fluorides are advocated for children with active caries⁵ and such non-invasive approaches can do much to build confidence in anxious children and their parents.

It is important that the value of primary teeth is recognised, but we must not lose sight of the fact that they are temporary structures and as a consequence may need to be managed somewhat differently to the permanent dentition. Most of all, the dental profession needs to remember that the patient's long term well-being should be our overriding concern. Anxious children have greater dental disease levels than their non-anxious peers. If we wish to convert these dentally needy children into preventively-minded, asymptomatic adult dental attenders, we have to be able to offer them positive dental experiences. With this in mind, the dental care of the young child should be approached holistically and the desire to eradicate dental caries should be carefully considered against the possible psychological consequences of invasive dental treatment.

CONCLUSIONS

Dental anxiety is a fairly common condition in 5-year-old children in the North West of England. It is closely associated with a symptomatic, irregular attendance pattern, a history of extraction and having a dentally anxious parent. The cause and effect dynamics of these relationships need to be determined through longitudinal studies if we are to have a firm evidence base for preventing and alleviating this distressing psychological condition.

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