The impact of dental anxiety on the oral health of children aged 5 and 8 years: a regression analysis of the Child Dental Health Survey 2013

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Key points

Higher levels of dental anxiety are associated with poorer oral health.	Higher levels of dental anxiety are associated with a greater impact on the quality of life of the family of which the child is a member.	The research highlights the importance of the profession in managing dental anxiety.

Abstract

Introduction Dental anxiety and fear is widely prevalent in the population, including children. This research is a further analysis of the Child Dental Health Survey 2013, to explore the impact of dental anxiety on factors relating to oral health.

Aim To explore the relationship between dental anxiety and oral health and the impact dental anxiety has on the quality of family life.

Design Regression analysis of data of 4,916 children aged 5 years and 8 years who participated in the Child Dental Health Survey 2013.

Setting National Epidemiological Survey in schools in the UK.

Materials and methods A series of logistic regression analyses was carried out for markers of oral health and impact of the child's oral health on the family's quality of life. The variables entered as predictors in the models included dental anxiety, socio demographic status and oral health-related behaviours.

Results Dental anxiety was associated with poorer oral health on nearly all measures (decay experience $p = <0.001$, active decay $p = <0.001$, primary tooth being restored $p = 0.010$, signs of oral infection $p = 0.007$) and had a greater impact on their family's quality of life ($p = <0.001$).

Conclusions Dentally anxious children have more dental disease and this has a greater impact on their family's quality of life.

Introduction

Dental anxiety, dental fear and dental phobia in children is well documented in the literature,[1] with a reported prevalence of dental fear ranging from 5.7% to 20.6%[2] in children and adolescents. The management of this population group represents a sizeable challenge for the profession. However, unlike the adult population,[3,4] only a few studies have

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been completed into the effect dental anxiety has on children's oral health and the impact this has on their families' day-to-day life.[5]

Dental fear and anxiety is defined as a feeling of dread and anticipation that something will happen, combined with a sense of losing control in relation to dentistry.[6] Dental phobia is described as a more severe form that leads to an out of proportion reaction. This phobia interferes with daily life.[7] For the purposes of this paper, the single term of dental anxiety will be used throughout to describe dental fear, anxiety or phobia.

Previous research has described the negative effect dental anxiety can have on the oral health of children[8,9,10] and the effect it can have on family life.[11] The resultant poor oral health can often lead to distressing consequences such as frequent pain from untreated dental decay[12] and inevitable tooth removal.[10]

The data collected from the Child Dental Health Survey 2013 (CDHS) present a unique chance to further research the relationship between dental anxiety and factors relating to oral health. The CDHS takes place every ten years in the UK and has well established methodology and features a large sample size.

A previous study, by the present authors, performed a secondary analysis on the dataset.[13] This study suggested that children with high levels of dental anxiety were more likely to experience dental decay and have had treatment that carries more risk, such as a general anaesthetic. In terms of oral health-related behaviour, dentally anxious children were more likely to attend irregularly and are less likely to brush their teeth twice a day. It was also noted that the dentally anxious child's oral health seemed to impact more on the quality of family life, compared to non-anxious children.

However, this study didn't take other variables, which are known to predict poor oral health, into account. For example, numerous studies have linked poor socio-economic status with poor oral health[14] and failing to follow a recommended oral hygiene regime, brushing twice a day with fluoridated toothpaste, were also not controlled for.

The aim of this study was to explore the relationship between dental anxiety and oral health, and the impact that dental anxiety has on the quality of family life.

Materials and methods

Data source

Data were gathered from the CDHS 2013. This survey is commissioned by the Health and Social Care Information Centre and occurs every 10 years. The children surveyed were 5 years, 8 years, 12 years and 15 years of age. The full methodology of the survey can be found in the technical report available online here: https://files.digital.nhs.uk/publicationimport/pub17xxx/pub17137/cdhs2013-technical-report.pdf.

For the purpose of this study, data analysis took place on information gathered from the 5-year-old and 8-year-old age groups.

Outcomes

A number of variables were considered as indicators of oral health status for this analysis.

The first outcome measure was the decayed missing filled index teeth (DMFT). This was scored according to the 2003 criteria which states 'All teeth with cavitated or visual dentine caries, restorations with cavitated or visual dentine caries, teeth with filled decay (otherwise sound) and teeth extracted due to caries. Excludes teeth with enamel caries present. The term obvious decay experience relates to teeth with dentinal cavities, missing teeth and filled teeth in the DMFT dental decay index.'[15] This was grouped into no decay experience and decay experience.

The second indicator of oral health was the presence of active decay. This included both cavitated and non-cavitated carious lesions and was grouped into two groups; no decay present and decay present.

The third outcome measure was the presence of soft tissue lesions. This was taken as an indicator of the clinical consequences of untreated dental caries, where there is a visible pulpal lesion, ulceration, fistula or abscess (PUFA index). This variable was grouped into a binary value: no PUFA lesion seen vs. any PUFA lesion seen

Also included as outcome measures were restorations present in primary teeth and teeth extracted due to decay. These were again grouped into binary variables: restorations present or not present and teeth extracted due to decay or no teeth extracted due to decay

The final outcome variable examined involved the parental report of the impact of the child's oral health on family life. This information was gathered via seven questions taken from the Family Impact Scale,[16] and grouped into two groups; not affected or affected.

Predictors

Predictors of the above outcome measures were divided into socio-demographic variables, dental anxiety, and variables concerning oral health related behaviours. These variables were chosen following a bivariate descriptive analysis of the CDHS to establish factors which may have a relationship with dental anxiety.[13]

Socio-demographic variables examined included the child's age (5 or 8 years old), their gender and their socio-economic status. The CDHS 2013 survey used free school dinner eligibility as a measure of poor socio-economic status. Children are eligible for free school dinners if the parents claim unemployment benefits, an income related support allowance or have immigration status.

In these age groups the CDHS scored dental anxiety via the completion of a visual analogue scale (VAS), which was filled in by the parent and asked them to rate their child's dental anxiety, on a scale ranging from 1 (not at all anxious) to 10 (extremely anxious). The participants were grouped into two categories: VAS scores below the median value and VAS scores above the median value.

The oral health-related behaviours were reported by the parent. Included were the participant's frequency of tooth brushing, grouped into children that brushed twice a day or more, and children who brushed less than twice a day. Also included were the participant's use of oral hygiene products such as a manual toothbrush, toothpaste and mouthwash, grouped into children who used the product and those who did not.

The participant's dental attendance patterns were also examined and grouped into children who were only brought to the dentist in pain or when in trouble, and those who attended for regular appointments.

The final predictors looked at additional pharmacological methods such as the use of

sedation and previous experience of general anaesthetic for dental treatment. These were grouped into children with previous experience of these measures and those without.

Analysis

Using SPSS (version 25) a series of logistic regression analyses was carried out for each stated outcome variable. The statistical significance was assessed at the five percent level. An odds ratio was also calculated, stated as Exp (B) in the results tables. Cox and Snell's R^2 calculation was used to establish the coefficient of determination and used to summarise the proportion of variance in the dependent variable associated with the predictor (independent) variables.[17]

Results

Data from 4,916 participants was analysed, comprising of 2,549 5-year-olds and 2,367 8-year-olds. In terms of gender, the data included, 2,435 males and 2,481 females. Participants' anxiety scores, reported by their parents, ranged from 1–10 (none to extreme anxiety), with a median score of 1 with 1,304 (57%) below or equal to the median and 985 (43%) above it.

Oral health status

Predictors of previous decay experience, active decay being present and signs of oral infection being present are shown in Table 1.

Dental anxiety served as a predictor for the child having decay experience (p <0.001), active decay present (p <0.0001) and signs of untreated oral infection (p = 0.007). In addition, 8-year-old children or children of poor socio-economic status were more likely to have previous or current decay and oral infection. In terms of oral health related behaviours, children who brushed infrequently, those who did not use toothpaste, and children who only attended when in trouble were also more likely to have previous or current dental decay. Irregular attendance also predicted oral infection being present. A history of being treated with additional pharmacological measures (under general anaesthetic or with the aid of sedation) served as a predictor of the child having decay experience and active decay.

In terms of reported dental treatment received, dentally anxious children are more likely to have primary tooth restored (p = 0.010, Table 2), as were 8-year-olds, those who did not adhere to recommended oral hygiene regimes and those who received their

Table 1 Predictors of a child having decay experience

Predictor	Binary groups	Decay experience (R² = 0.094)		Active decay present (R² = 0.065)		Signs of oral infection present (R² = 0.025)	
		Sig.	Exp(B)	Sig.	Exp(B)	Sig.	Exp(B)
Age	5 vs 8 years	<0.001	1.259	<0.001	1.169	<0.001	1.442
Gender	Male vs female	0.054	0.837	0.241	0.894	0.764	0.940
Free school meal eligibility.	Eligible vs not eligible.	<0.001	0.691	0.004	0.685	0.011	0.527
Dental anxiety	Below average vs above average	<0.001	1.649	<0.001	1.518	0.007	1.773
Frequency of brushing teeth	Twice a day or more vs once a day or less	0.001	1.489	0.002	1.466	0.547	1.170
Used manual toothbrush in last year	No vs yes	0.132	1.265	0.066	1.354	0.280	1.514
Used toothpaste in last year	No vs yes	0.012	0.469	0.008	0.458	0.745	0.834
Used mouthwash in last year	No vs yes	0.148	1.154	0.195	1.141	0.730	1.079
Dental attendance of child	For check ups vs only when in trouble/never	0.011	2.068	0.001	2.524	0.003	3.212
Ever had general anaesthetic before dental treatment	No vs yes	<0.001	2.257	<0.001	2.083	0.156	0.532
Ever had sedation before dental treatment	No vs yes	<0.001.	3.086	0.004	1.977	0.511	1.323

Table 2 Predictors of a primary tooth being restored, and a tooth extracted due to decay

Predictor	Binary groups	Primary tooth restored (R² = 0.050)		Tooth extracted due to decay (R² = 0.028)	
		Sig.	Exp(B)	Sig.	Exp(B)
Age	5 vs 8 years	<0.001	1.294	0.566	0.924
Gender	Male vs female	0.197	0.853	0.913	1.043
Free school meal eligibility	Eligible vs not eligible	0.309	0.843	0.635	0.798
Dental anxiety	Below average vs above average	0.010	1.380	0.962	1.019
Frequency of brushing teeth	Twice a day or more vs once a day or less	0.009	1.500	0.517	0.687
Used manual toothbrush in last year	No vs yes	0.631	0.910	0.995	1.004
Used toothpaste in last year	No vs yes	0.007	0.419	0.006	0.136
Used mouthwash in last year	No vs yes	0.010	1.403	0.764	0.881
Dental attendance of child	For check ups vs only when in trouble/never	0.451	1.281	0.894	1.123
Ever had general anaesthetic before dental treatment	No vs yes	0.471	1.172	<0.001	22.263
Ever had sedation before dental treatment	No vs yes	<0.001	2.612	0.539	1.471

dental care under sedation. Dental anxiety was not a significant predictor of having a tooth extracted. Aside from the use of general anaesthetic to aid dental treatment, only the non-use of toothpaste served as a predictor.

Impact of child's oral health on the quality of family life

Table 3 shows predictors of the impact of the child's oral health on the quality of family life. As well as dental anxiety (p <0.001), predictors

were an 8-year-old child, not using toothpaste, infrequently attending the dentist, and the child requiring additional pharmacological measures to aid dental treatment (GA and sedation).

Discussion

In these age groups, dental anxiety predicted poorer oral health in measures such as decay experience, the presence of active decay and the presence of untreated dental infection. The

only exceptions were oral health outcomes related to having a permanent tooth restored or having teeth extracted due to decay. This exception is probably due to the newly erupted permanent teeth having relatively little time exposed to the oral environment. Higher levels of dental anxiety also predicted that the child's oral health had a greater effect on the quality of family life.

These findings are in accordance with the broader themes found in the literature related

to adult populations; people with dental anxiety are more likely to have worse oral health that impacts on their quality of life.[4] However, there are subtle differences that require explanation. For example, 5- and 8-year-old children with dental anxiety were not more likely to have had a tooth removed due to decay. This is understandable given that the teeth have not been erupted in the mouth for a long period of time. Although anxious children are more likely to have untreated decay, it has not resulted in pulpitis or pulp necrosis. However, our data analysis suggests dental anxiety is related to an increase chance of a child having a soft tissue lesion as a result of untreated dental decay (PUFA index). This may be due to the anxious child's caregiver being less likely to present the child for examination and treatment at a dental surgery, or the practitioner may have decided to not extract the tooth due to likely poor cooperation.

There is surprisingly scant research in the impact of dental fear on the oral health of children and the impact the child's oral health has on their quality of life and the quality of family life. What limited research there is suggests a relationship between dental anxiety and poor oral health[18] and has a negative effect on the quality of the life of the individual and family.[19]

This study has limitations, most notably in the measures used to assess the child's dental anxiety. As mentioned in our previous study,[13] parental reports of the child's dental anxiety are fraught with inaccuracies. These relate to over reporting of a child's anxiety,[20] failing to differentiate between 'normal' fear of a novel situation, or proper dental anxiety,[21] or the parent's report on the child's anxiety mirroring their own anxiety.[22] In addition, as opposed to adult dental anxiety measures such as MDAS[23,24] a visual analogue scale of dental anxiety has no validated cut-off to identify whether or not an individual is phobic.

The use of a by proxy VAS scale is therefore not ideal in the measurement of child anxiety. However, previous research suggests there is no ideal measure currently in use.[25] As such, efforts should centre on the development and validation of an adequate dental anxiety measure before the 2023 Child Dental Health survey. It should also be noted that some of the questions asked in the survey may also lead to inaccurate reporting. For example, does the parent understand if the child has experienced sedation or a general anaesthetic?

It is noticeable that in this regression model, deprivation, as scored by free school

Table 3 Predictors of the impact of child's oral health on the quality of family life			
Predictor	Binary groups	Sig.	Exp(B)
Age	5 vs 8 years	0.002	1.127
Gender	Male vs female	0.236	1.136
Free school meal eligibility	Eligible vs not eligible.	0.401	1.139
Dental anxiety	Below average vs above average	<0.001	2.278
Frequency of brushing teeth	Twice a day or more vs once a day or less	0.423	1.121
Used manual toothbrush in last year	No vs yes	0.516	0.893
Used toothpaste in last year	No vs yes	0.005	0.431
Used mouthwash in last year	No vs yes	0.571	1.067
Dental attendance of child	For check ups vs only when in trouble/never	0.011	2.091
Ever had general anaesthetic before dental treatment	No vs yes	<0.001	2.599
Ever had sedation before dental treatment	No vs yes	0.009	1.898
$R^2 = 0.069$			

meal eligibility, mirrored dental anxiety in predictors of poor oral health. Both had a significant relationship with previous decay experience, the presence of active decay and signs of oral infection. This finding would indicate the importance of ensuring areas of social deprivation should be able to access dental services to build rapport with the child and parent from an early age, by schemes such as 'Baby Teeth Do Matter'.[26]

The family has a central role in a child's health and any illness is likely to impact on family life. The results of this analysis suggest a child's dental anxiety results in a detrimental effect on the quality of family life.

It can also be hypothesised that this impact on the everyday life of the family will affect the treatment planning process, with parents opting for a general anaesthetic. This concept does not seem too farfetched, especially when considering poor dental attendance is also a significant predictor. A child who is dentally anxious and attends infrequently is more likely to have oral infection that affects family life. In such a scenario, a parent may be more likely to choose extractions over more complex work.

Indeed, the parent's own dental anxiety and beliefs about dentistry may alter their decision making. Further work is needed to look at the relationship between the quality of family life, the parent's decision making regarding the child's treatment, and the decision making of the dentist. For example, is the dentist advising treatment that is in the best interest of the child or the caregivers?

Although this regression is modelled on variables found to be of significance in our descriptive analysis of dental anxiety,[13] it is notable that preventative regimes such as infrequent brushing and not using toothpaste are still significant predictors of poor oral health and a consequential detrimental effect on family life. Although not related to the primary aim of this study, this finding highlights the importance of preventative measures and schemes for young children such as 'Designed to Smile'.[27]

This study highlights that children's dental anxiety, even at aged 5 and 8 years old, is linked with clear health problems and there is a clear effect on the family unit. As such this study highlights the importance to the profession in preventing dental anxiety, even in these age groups, by using prophylactic measures such as the use of latent inhibition, where previously pleasurable experiences of the dental environment can prevent long-term anxiety when exposed to a negative experience. This is possible by ensuring any trip to the dentist is as rewarding as possible.

Equally this study stresses the importance of attempting to resolve dental anxiety when it presents in the child, even at a young age. Although radical treatment such as the use of general anaesthetic can improve a child's quality of life, it does little to resolve dental fear.[28] Simple behavioural management techniques such as positive reinforcement of desirable behaviour may help resolve dental anxiety before it impacts on an individual and

their family. Although challenging to the dental team, dental anxiety and other associated factors related to poor oral health should be viewed by the profession as an opportunity to re-engage with the individual and their caregivers to ensure a positive outcome.

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