

How does dental anxiety affect the oral health of adolescents? A regression analysis of the Child Dental Health Survey 2013

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Key points

Suggests adolescents with dental phobia feel that their oral health has an impact on their quality of life.

Reports that adolescents with dental phobia perceive that their dental and general health is low.

Finds that dental phobia in adolescents does not predict lower oral health.

Recommends that further work is needed to fully understand the long-term implications of dental phobia on self-esteem and future psychological implications.

Abstract

Introduction Dental phobia has been widely studied but there is limited research on the effect of dental phobia on oral health. This research is an analysis of the 2013 Child Dental Health Survey, to explore the impact of dental anxiety on factors relating to oral health in the adolescents.

Aim To examine if dental anxiety predicts poor oral health in 12- and 15-year-olds.

Design Regression analysis of data from 4,950 children aged 12 years and 15 years who participated in the Child Dental Health Survey 2013.

Setting National epidemiological survey of UK schools.

Materials and methods A series of logistic regressions was carried out to examine if dental anxiety, socio demographic factors and oral health-related behaviour could predict oral health status, the impact of the child's oral health on their own quality of life and the impact of their oral health on the family's quality of life. Additional outcomes examined were self-perceived dental health and general health.

Results Dental anxiety was not a predictor of poor oral health but did predict a greater impact of the child's oral health on everyday life. Adolescents with dental anxiety had negative thoughts regarding their dental and general health.

Conclusions Dental anxiety affects the everyday life and psychological wellbeing of adolescents.

Introduction

Dental anxiety is wide spread, with a reported prevalence ranging from 5.7% to 20.6%.^{1,2} Unlike the adult population,^{3,4} there is little research into the effect dental anxiety has on children's oral health or the impact on their daily life. Dental phobia, is a more severe form of dental anxiety and classed according

to the Diagnostic and statistical manual of mental disorders (fifth edition) as '(i) a severe and out of proportion fear within a certain context to the presence or anticipation of a specific object or situation, (ii) the subject becomes immediately anxious following exposure to the stimuli. This may take the form of a situationally bound or situationally predisposed panic attack, (iii) the person is able to understand that the reaction is out of proportion, (iv) the subject avoids the situation or endures it with intense distress. (v) the subject's reaction to the fearful stimulus interferes significantly with the person's everyday life.'⁵

There is evidence to suggest that individuals with dental phobia suffer from worse health than non-phobics. Epidemiological studies demonstrate a relationship between poor

health and dental phobia,⁶ although this is not as marked as in clinical studies.^{7,8} A recent regression analysis of the adult dental health survey from the UK, showed a significant relationship between poor oral health and dental phobia.⁴ Studies in adults suggest that dental phobics often perceive their oral health to be worse than non-phobics.^{9,10} However, these subjective measures are often inaccurate, with individuals often over rating their dental need.¹¹ This may be due to the anxious participant's negative cognitions.

The psychological impact of poor oral health on daily life has been suggested in other studies including our own simple descriptive analysis of UK epidemiological data.¹² This has been noted previously in the adult population, with dental phobics reporting an effect on their emotional reactions, daily life and socialising.¹³

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Table 1 Predictors for previous decay experience, active decay present, and signs of untreated dental infection

Predictor	Binary groups	Previous decay experience (R ² = 0.068)		Active decay present (R ² = 0.026)		Signs of untreated dental infection (R ² = 0.016)	
		Sig.	Exp(B)	Sig	Exp(B)	Sig	Exp(B)
Age	12 vs 15 years	<0.001	1.189	0.272	0.956	0.003	0.537
Gender	Male vs female	0.096	1.199	0.173	1.189	0.816	0.907
Free school meal eligibility.	Eligible vs not eligible	0.01	0.588	0.003	0.622	0.323	0.612
Used manual toothbrush in last year	No v yes	0.024	1.431	0.702	1.074	0.600	1.481
Used toothpaste in last year.	No vs yes	0.033	0.566	0.051	0.572	0.997	19480190.265
Used mouthwash in last year	No vs yes	0.458	1.089	0.214	1.184	0.242	1.750
Ever had general anaesthetic before dental treatment	No vs yes	<0.001	2.558	0.027	1.467	0.422	0.544
Ever had sedation before dental treatment	No vs yes	0.001	1.587	0.335	1.168	0.693	0.781
Dental anxiety levels	Non phobic vs phobic	0.925	0.984	0.612	1.104	0.493	1.485
Consumes sugary food and drinks 4 times or more in a day	Yes vs no	0.778	0.970	0.160	0.835	0.872	0.934
Frequency of brushing teeth	Twice a day or more vs once a day or less	0.018	1.392	0.011	1.478	0.120	1.990
Self-reported dental attendance	Attended for check-ups vs only attend when in trouble/never	0.871	1.032	0.084	1.423	0.688	1.304

Small-scale studies also suggest that dentally anxious children's quality of life suffers as a result of their oral health.¹⁴

Our previous descriptive analysis highlighted that dentally phobic children were more likely to have dental disease, and their oral health impacted on their quality of life.¹² However, this study failed to control for variables that are known to predict poor oral health. For example, the intake of cariogenic food, socio-economic status, and use of fluoride toothpaste. Therefore, the aim of this study was to conduct a regression analysis to examine if dental phobia was a predictor of poor oral health and the impact the child's oral health on their quality of life.

Materials and methods

Data source

Data were gathered from the CDHS 2013. This epidemiological survey occurs every 10 years in the UK, with children aged 5 years, 8 years, 12 years and 15 years surveyed. The full methodology of the survey can be found in the technical report online here: <https://files.digital.nhs.uk/publicationimport/pub17xxx/pub17137/cdhs2013-technical-report.pdf>.

This study examined data gathered from the 12 - and 15-year-old age groups.

Outcomes

Indicators of oral health status included the decayed, missing and filled teeth index (DMFT), the presence of active decay, previous treatment received and the presence of untreated infection.

The DMFT index was scored 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.

Active decay scoring included both cavitated and non-cavitated carious lesions and grouped into two groups; no decay present and decay present. Other outcomes grouped into present and not present were: restorations in permanent teeth, teeth extracted due to decay and signs of ulceration, fistula or abscess (PUFA). This PUFA index was used as an indicator of the clinical consequences of untreated dental caries.

Also included in the analysis were the participants' report of their oral health-related quality of life using the 'Child Oral Impacts on Daily Performances',¹⁶ which has been validated for use in the UK. This measured

the effect of oral health on eight aspects of daily life over the past three months, including problems eating; problems speaking; problems cleaning teeth; not being able to relax; feeling different; feeling embarrassment when smiling or laughing; trouble completing schoolwork; and difficulty appreciating being with people. These were grouped into two groups; not affected and affected.

The child's self-rated dental health and self-rated general health were also analysed. These were scored on a scale of one to five rating and the variable was divided into two groups; very good/good and fair/worse

The final outcome measure was the parent's 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.¹⁷

Predictors

The predictors used were classified as socio-demographic, self-rated dental anxiety, and oral health-related behaviours.

Socio-demographic predictors were participants' age (grouped into 12 years or 15 years old), gender, and socio-economic status (using free school dinner eligibility as a measure of poor socio-economic status). Children were eligible for free school dinners if the parents claim an income-related support

Table 2 Predictors of a restoration being placed in a permanent molar and tooth extraction due to decay

Predictor	Binary groups	Restoration being placed in a permanent molar (R ² = 0.087)		Tooth extracted due to decay (R ² = 0.056)	
		Sig.	Exp(B)	Sig.	Exp(B)
Age	12 vs 15 years	<0.001	1.384	<0.001	1.384
Gender	Male vs female	0.022	1.315	0.022	1.315
Free school meal eligibility.	Eligible vs not eligible.	0.047	0.723	0.047	0.723
Used manual toothbrush in last year	No v yes	0.251	1.222	0.251	1.222
Used toothpaste in last year.	No vs yes	0.366	0.770	0.366	0.770
Used mouthwash in last year	No vs yes	0.499	1.090	0.499	1.090
Ever had general anaesthetic before dental treatment	No vs yes	<0.001	2.365	<0.001	2.365
Ever had sedation before dental treatment	No vs Yes	<0.001	1.872	<0.001	1.872
Dental anxiety levels	Non phobic vs phobic	0.397	0.850	0.397	0.850
Consumes sugary food and drinks 4 times or more in a day	Yes vs no	0.452	1.093	0.452	1.093
Frequency of brushing teeth	Twice a day or more vs once a day or less	0.352	1.153	0.352	1.153
Self-reported dental attendance	Attended for check-ups vs only attend when in trouble/never	0.0301	0.805	0.301	0.805

allowance, unemployment benefits or due to immigration status.

The participant's self-rated score for dental anxiety was grouped into non-phobic and phobic groups using the Modified Dental Anxiety Scale (MDAS). This scale asked the participants to score how they felt in different scenarios on a five-point scale; eg, having a local anaesthetic. Scores were then summed. Based on previous studies, participants with a total of 19 or above were ranked as phobic (n = 601) while scores below were ranked as non-phobic (n = 4,144).

Predictors related to oral health-related behaviours included the participants' frequency of tooth brushing as reported by each participant and were grouped into those that brushed twice a day or more, and those who brushed less than twice a day.

Also included were the participants' use of oral hygiene products, such as manual toothbrush and mouthwash, and their use of toothpaste in the last year, as reported by the parent. This was grouped into those who used the product and those who did not.

The self-reported dental attendance patterns were grouped into participants who were only brought to the dentist in pain or when in trouble, and those who attended for regular appointments.

Predictors incorporating additional pharmacological measures to aid treatment

included previous experience of general anaesthetic and previous experience of sedation, grouped into children who had experienced these measures and those who had not. These data were gathered from parental reporting.

The intake of cariogenic food and drink was also used as a predictor. This was grouped into those who consumed sugary food and drink more than four times daily and those who did not.

Analysis

A logistic regression was carried out for each stated outcome variable using SPSS (version 25). This type of regression was deemed appropriate as the dependent variable is dichotomous (binary). The statistical significance was assessed at the 5% level. An odds ratio was also calculated, stated as Exp (B) in the results tables. To establish the coefficient of determination, Cox and Snell's R² calculation was used to summarise the proportion of variance in the dependent variable associated with the predictor (independent) variables.

Results

Data from 4,950 participants were analysed, comprising of 2,532 12-year-olds and 2,418 15-year-olds. In terms of gender, the data included, 2,377 males and 2,573 females.

Participants were grouped into a non-phobic group (4,144, 87.3%) and a phobic group (601, 12.1%).

Oral health status

Table 1 shows predictors of children who had previous decay (decay experience), active decay and showed signs of a dental infection (PUFA).

Dental anxiety was not a significant predictor for previous dental decay. (p = 0.925). Children of lower socio-economic status were more likely to have experienced dental decay. In addition, children who had experienced decay were less likely to brush twice daily, did not use toothpaste in the last year and routinely had used a manual toothbrush. They were also more likely to have experienced pharmacological measures to aid dental treatment (sedation/general anaesthetic).

Dental anxiety was not a predictor for active decay (p = 0.612). Variables deemed as significant were social deprivation and brushing infrequently. Having had a general anaesthetic for dental treatment predicted for active decay being present. Dental anxiety did not predict the presence of untreated dental infection (p = 0.493)

Table 2 shows predictors for a child having had a restoration placed in a permanent molar and having had a tooth extracted due to decay.

Table 3 Predictors of the child's oral health impacting on their quality of life

Predictor	Binary groups	Child's oral health impacting on their quality of life (R ² = 0.026)		Child's oral health impacting on family quality of life (R ² = 0.035)	
		Sig.	Exp(B)	Sig	Exp(B)
Age	12 vs 15 years	0.156	0.942	0.813	1.009
Gender	Male vs female	0.156	1.202	0.658	1.052
Free school meal eligibility.	Eligible vs not eligible.	0.130	0.773	0.349	1.161
Used manual toothbrush in last year	No v yes	0.255	0.814	0.953	1.010
Used toothpaste in last year.	No vs yes	0.499	1.246	0.652	0.880
Used mouthwash in last year	No vs yes	0.898	0.983	0.005	1.416
Ever had general anaesthetic before dental treatment	No vs yes	0.200	0.929	0.023	1.451
Ever had sedation before dental treatment	No vs yes	0.014	1.477	<0.001	2.005
Dental anxiety levels	Non phobic vs phobic	0.020	1.554	0.746	1.060
Consumes sugary food and drinks 4 times or more in a day	Yes vs no	0.673	0.947	0.017	0.759
Frequency of brushing teeth	Twice a day or more vs once a day or less	0.019	1.446	0.238	0.838
Self-reported dental attendance	Attended for check-ups vs only attend when in trouble/never	0.001	1.936	0.042	1.486

Again, dental anxiety was not a significant predictor ($p = 0.397$). Female, 15 -year-old participants who were eligible for free school meals were more likely to have had a tooth filled. Adolescents were more likely to have teeth filled if they had experienced sedation or a general anaesthetic for dental treatment.

Dental anxiety was not a predictor of an individual having a tooth extracted due to decay ($p = 0.316$). The analysis suggests that this was more likely to occur if the child is aged 15 years, attend infrequently and have had experienced general anaesthetic and sedation.

Impact of the adolescent's self-rated oral health on their quality of life and effect on quality of family life

Dental anxiety served as a significant predictor for the child's oral health effecting their quality of life ($p = 0.020$). Table 3 shows other significant predictors were children who brushed infrequently, attended infrequently, and who had received sedation for dental treatment before.

In contrast to the negative effect dental anxiety has on an individual's quality of life, dental anxiety does not seem to impact on the quality of family life, as reported by the parent ($p = 0.981$). Variables that were deemed significant were using mouthwash, not attending frequently, consuming cariogenic food and drink frequently, and attending for a general anaesthetic and sedation.

Predictors of self-rated dental health and general health

Table 4 shows predictors of self-perceived dental and general health. Dental anxiety was a significant predictor of poor self-rated dental health ($p=0.012$). Lower ratings were associated with being younger, being male, and infrequently brushing teeth. Adolescents attending infrequently were three times more likely to report poor dental health.

Dentally anxious children were nearly twice as likely to rate themselves as having poor general health ($p = 0.004$). Brushing less than twice a day was also deemed as significant.

Discussion

This analysis shows that higher levels of reported dental anxiety predicted that the oral health of the child impacted on their quality of life and predicted lower self-perceived dental health and general health. Dental anxiety did not predict poorer oral health on any of the variables measured here.

This study does have limitations, most notably related to the MDAS measure used to rate dental anxiety levels. This measure is well supported for use with adults but has not been validated on children and adolescents. In particular, the threshold value of 19 or above which is used to classify an individual as phobic has only been validated in the adult population.^{18,19}

Epidemiological surveys often tend to underreport the true effect of dental anxiety on oral health compared to clinical studies.²⁰ The CDHS required positive consent from individuals and their caregivers to participate. Therefore, participants may not have consented to take part in this dental survey if they suffered with extreme dental anxiety, which led to data not being captured from this group.

In some areas, the results confirm the literature regarding children in other cultures¹⁴ and in the adult population that says that dental phobics state that their oral health impacts their daily life, affecting their function and social interactions. In addition, the relationship between dental anxiety and lower self-perceived dental health shown here, echoes the findings in the literature on the adult population.¹¹ As per the adult population, the socio-economic status of these adolescents also predicts the oral health status, with poorer children suffering from worse oral health.

The findings of this study, in relation to dental anxiety and oral health, contrast with previous studies in adult populations, which suggests poor oral health is associated with dental anxiety and phobia. This has been demonstrated in a wide range of studies. No measures of oral health analysed here demonstrated this relationship and also contrasts with similar studies in the paediatric population.^{2,21} Indeed, the findings of this regression analysis, with regards to oral

Table 4 Predictors of self-rated poor dental health and general health

Predictor	Binary groups	Self-rated poor dental health (R ² =0.078)		Self-rated poor general health (R ² = 0.031)	
		Sig.	Exp(B)	Sig.	Exp(B)
Age	12 vs 15 years	0.015	0.902	0.433	0.957
Gender	Male vs female	<0.001	0.620	0.676	0.929
Free school meal eligibility.	Eligible vs not eligible.	0.205	0.803	0.176	0.741
Used manual toothbrush in last year	No v yes	0.144	0.772	0.404	0.815
Used toothpaste in last year.	No vs yes	0.416	1.288	0.462	1.401
Used mouthwash in last year	No vs yes	0.093	0.801	0.921	0.982
Ever had general anaesthetic before dental treatment	No vs yes	0.448	1.150	0.536	1.160
Ever had sedation before dental treatment	No vs yes	0.155	1.265	0.855	1.042
Dental anxiety levels	Non phobic vs phobic	0.012	1.629	0.004	1.975
Consumes sugary food and drinks 4 times or more in a day	Yes vs no	0.888	0.982	0.687	0.932
Frequency of brushing teeth	Twice a day or more vs once a day or less	<0.001	2.506	<0.001	2.721
Self-reported dental attendance	Attended for check-ups vs only attend when in trouble/never	<0.001	3.077	0.123	1.494

health, contradict our own results from the secondary analysis of the data.¹² This highlights the importance of this regression analysis, where the effects of known predictors of poor oral health, like socio-economic status, are mediated.

Possible explanations for this finding may be:

1. There has been insufficient time for the manifestations of dental phobia, such as avoiding the dentist, to show. Signs of poor oral health such as dental caries and infection associated with teeth occur over a relatively long period of time
2. Parents and caregivers are, to a large extent, in control of their children's access to dental care. While there is qualitative evidence that suggests dentally anxious children place considerable pressure on their parents to not take them to the dentist,²² we may not see the vastly different attendance patterns of phobic and non-phobic population groups compared to adults
3. As mentioned previously, the likely selection bias of an epidemiological study requiring positive consent may lead to an under-reporting of dental phobia and poor oral health.

The dissonance between an individual's actual oral health and perceived dental health is in keeping with the negative thoughts, feelings and resultant physical symptoms of dentally anxious children found in qualitative research.²²

The overall picture this research paints is that dentally phobic children's everyday life is impacted by their perception of poor dental health. This may well lead to actual poor oral health in adulthood. The 'Vicious cycle model' is well supported, with an individual's fear and anxiety leading to avoidance of dental treatment, leading to poor oral health, leading to feelings of shame and embarrassment. This continues in a downwards spiral.⁷ The results shown here demonstrate the start of this cycle, where perceived poor dental health is leading to a negative impact on self-esteem.^{23,24}

As such, this study shows the importance of interventions to treat dental anxiety prior to the detrimental effect this causes on oral health in adulthood. Interventions can vary from simple techniques such as habituation via 'tell-show-do', enhancing perceived control via stop signals and positive reinforcement of desirable behaviour.²⁵ For more severe cases of dental phobia, cognitive behavioural therapy has a good evidence base in the adult population and has increasing scientific support for its utilisation with children.^{26,27}

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