Do paediatric patient-related factors affect the need for a dental general anaesthetic?

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1) Title: Do Paediatric Patient-Related Factors Affect the Need for a Dental General Anaesthetic?
2) Short Title: Factors That Affect Dental General Anaesthetic Needs
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Abstract

Aims

The aims were to determine the profile of patients referred for treatment with DGA and identify patient-related factors that contributed to a child requiring a DGA.

Design setting

Forty-two patients were recruited from new patient assessment clinics at the Edinburgh Dental Institute, Scotland. Prospective questionnaires were given to the patient's caregivers with questions regarding their child's dental anxiety level, patient's ethnicity, level of English spoken, and languages spoken at home. Height and weight (BMI) measurements were taken and other information (age, gender, medical history status and post code for level of social deprivation) were collected from their medical records.

Results

Compared to the local population, children referred for treatment with DGA had a significantly decreased level of English (P=0.0001) with an increase in non-English languages at home (P=0.0004). Patients from ethnic minority backgrounds (P=0.008) and children from socially deprived areas (P=0.0001) were significantly overrepresented. Self-reported dental anxiety was high and more common in primary than secondary school-age children (P=0.039).

Conclusions

This study highlighted several patient-related variables that may increase the likelihood of DGA treatment. Further work is required to confirm these associations and develop interventions to reduce the number of children requiring DGAs.

Keywords:

Paediatric, risk-factors, dental general anaesthetic, DGA.

Key points

- Children from ethnic minority backgrounds and areas of increased socioeconomic deprivation were significantly overrepresented in requiring treatment under general anaesthetic.

- Children requiring treatment under general anaesthetic had significantly lower levels of self-reported English and significantly higher levels of non-English languages at home compared to the background population.
- Highlights several patient-related factors that may increase the likelihood of dental treatment under general anaesthetic.

Do Paediatric Patient-Related Factors Affect the Need for a Dental General Anaesthetic?

Introduction

Dental General Anaesthetic (DGA) provides dental treatment during a "state of controlled unconsciousness" [1]. Although it is a treatment modality commonly used in Paediatric Dentistry, DGA comes with well-documented risks[1, 2, 3] Additionally, there often is an extended waiting period for paediatric DGA procedures with associated impacts on the child's wellbeing[4].

In the UK all DGAs are undertaken in hospital settings[5] resulting in significant costs. In 2018-2019, NHS Spending Data estimated that £41.5 million was spent funding 44,685 hospital operations for extractions of teeth in children in England[6].

A misconception is that a DGA may prevent children becoming more anxious about dental treatment[3]. Research has shown that dental anxiety may increase following a DGA[4, 7] suggesting "behavioural therapy and desensitisation may be required following a DGA" [8]. However, post-DGA dental anxiety is offset with an improved quality of life following DGAs[8].

Caries risk factors are well-established, and national guidelines have been published on this topic[9, 10]. These risk factors are previous or current clinical signs of caries, dietary habits, socioeconomic status, fluoride usage, level of oral hygiene, low salivary flow and medical history status[10] . However, this guidance recognises that there is no consensus for the best predictors of caries. A systematic review concluded that socio economic and demographic information and baseline caries were good predictors of caries risk[11].

Despite similarities with caries risk factors, the factors that increase the likelihood of treatment under DGA are not identical. One cross-sectional survey concluded that the patient's age and country of residence were associated with treatment under DGA with children living in Wales being significantly more likely to receive DGA treatment than those in England[12].

There is a paucity of information in the literature on patient-related risk factors for children receiving a DGA. This study aims to determine the profile of patients needing treatment with DGA and to identify patient-related

factors that may contribute to a child requiring a DGA. The null hypothesis was there was no association between any patient-related factors and receiving treatment under a DGA.

Materials and Methods

Study Design and Population

This prospective, cross-sectional study was undertaken in the Paediatric Dentistry department at the Edinburgh Dental Institute (EDI). Ethical approval was gained from the Berkshire Research Ethics Committee (19/SC/0494).

Data Collection

Patients, aged between four and the day before their sixteenth birthday, examined in New Patient Assessment clinics between 11th November 2019 and the 1st April 2020 and where DGA had been chosen for treatment were invited to take part in the study. Patient's caregivers with limited English attended with interpreters as is routine within the department. Children without an accompanying adult with parental rights were excluded from the study.

Patients' data was transferred to a Microsoft Excel™ (Microsoft, USA V14.2.0, Santa Rosa, CA, ISA) spreadsheet. Data collection forms were populated from the completed questionnaires and the patient's dental records. Data collected included the patient's age, gender, any significant medical history, post code, height, weight, their ethnicity and languages spoken at home. This data was compared with Scottish data obtained from the most recent Scottish Census[13] (2011), Scottish Index of Multiple Deprivation[14] (SIMD 2020) and Scottish Information Services Division (ISD 2019) [15]. The format of the questions regarding the patient's ethnicity, languages spoken at home and how well they spoke English were derived from the most recent Scottish Census[13] (2011).

Dental anxiety was measured by one of two questionnaires depending on the patient's age; if aged between four and twelve years, the Modified Child Dental Anxiety Scale with Faces (MCDASf) was used. The MCDASf questionnaire has been validated for this age group[16, 17, 18]. Patients above thirteen used the Modified Dental Anxiety Scale (MDAS). There are no validated dental anxiety scales available for this cohort. However, the MDAS was validated from 18 to 60-years-of-age hence provided the nearest age-match[19].

For children of age eight and under, the clinician would ask the children the questions from the MCDASf questionnaire. Children over nine years of age would self-complete the questionnaires. The clinicians were available to assist the child if this was required. We recommended against parents completing the questionnaire to minimise bias.

Statistical Analysis

Data was transferred from Microsoft Excel™ spreadsheets to SPSS V24 (IBM, Armonk, NY, USA) for processing and statistical analysis. T-tests compared self-reported dental anxiety scores against other variables. Chi-Squared tests compared our data sets against the most recent City of Edinburgh Scottish Census[13] (2011) (ethnicity, languages spoken at home, how well English is spoken) data. Chi-squared tests compared against the City of Edinburgh SIMD 2020[14] (socioeconomic status) and the National Scottish Government P1 age statistics[15] (BMI).

Residence from relative deprivation was selected as the primary outcome measure. Based on the local population it would be expected that 20% of patients would be from SIMD 1 or 2 (most deprived). In order to detect a doubling of this deprivation rate to 40% amongst our DGA sample, the minimum number of children required was 36 (P=0.05) which would show a significant difference in SIMD deciles 1 and 2 membership.

Results

Patient gender and age

The demographics of the children in our study compared with the overall data from the Scottish Census (2011) [13], SIMD (2020) [14] and P1 children (2019)[15] is presented in Table 1. The study sample included 22 (52%) male patients and 20 (48%) female patients. The mean age of the patients was 7.17 years (SD = 3.34). Of the 42 children, 22 (52.4%) were six years or younger and 28 (88.1%) were below nine years of age.

Ethnicity

Study participants reported a non-White British ethnicity in 23.8% of cases, which contrasts with 12.6% in the census data, a 1.89 times increase (P=0.008). Asian ethnicity was reported 3.8 times higher in the study group (14.2%) compared to the census (3.7%).

Level of spoken English

Six times more study participants reported speaking English either not well or not at all compared to census data (9.6% v 1.6%, P=0.0001).

Languages spoken at home

A language other than English was spoken at home 4.04 times more in the study group compared to the census data (19.0% v 4.7%, P=0.0004).

SIMD

Study participants resided in areas of high relative deprivation (SIMD 1 and 2) at a rate 3.20 times greater than the background population (38.1% v 11.9%, P=0.0001). Conversely, there was a 0.43 times reduction in study participants from areas of low relative deprivation (SIMD 9 and 10) compared to the background population (19.0% v 44.1%, P=0.0001).

BMI

19.5% of our patients were above a healthy weight, (BMI 91st centile or greater). Two participants (4.9%) were above the 98th centile which placed them in the obese/severely obese category. The remaining participants (80.5%) were all within the healthy weight categories (healthy weight BMI ranged from 0.4th to <91st centile). One participant was excluded from BMI measurements as the child was wheelchair bound.

Our study had 3.9% fewer patients in the above-healthy weight (BMI ≥91st centile) compared with the P1 statistics (2018/2019)[15] . However, this difference between the data sets was not significant {X^2(1, N=42) 0.644, P=.725)}.

Medical history

88.1% of participants were healthy (n=38) with only four having significant medical issues {autism (n=2), motor neurone disease (n = 1) and challenging behaviour with fine motor difficulties (n=1)}.

Dental anxiety level

60.4% (n=27) of participants had a self-reported dental anxiety (score of 19 or more)[16, 17, 18]. Only one was aged 12 or older. Chi-squared tests comparing our findings with those reported by Haworth et al (2016)[20] showed the differences in the numbers of dentally anxious patients that had DGAs were statistically significant {X^2(1, N=42) 44.935, P=.0001)}.

Table 2 compares the patient-related variables between children with self-reported dental anxiety (MCDASf and MDAS scores ≥19) against those without self-reported dental anxiety (MCDASf and MDAS scores <19). Dental anxiety was higher in the primary school-aged children compared with secondary school-aged children. The mean dental anxiety score of primary school children was 20.3 (SD = 5.01) while that of secondary school children was 15.0 (SD = 4.94). This difference was statistically significant (P=0.039). For all the other patient-related variables, there were no statistically significant relationships found with self-reported dental anxiety.

Reasons for DGA

73.9% (n=31) of the patients were treated for caries. 11.9% (n=5) were treated under general anaesthetic for Molar Incisor Hypomineralisation (removal of first permanent molars). 11.9% (n=5) surgical exposure/removal of canines. 2.39% (n=1) were treated for trauma (removal of a primary incisor).

Table 1 - DGA use by demographic and socioeconomic characteristics of participants (N=42)

Patient-Related Variables	N	(%)	Census Data(2011)[13] (%)	BMI P1 Data (ISD 2019)[15]	SIMD (2020)[14]	P-value*
Age	42 (Mean 7.17 years)					
P School Age (4-11 years)	37	88.1				
S School Age (12-16 years)	5	11.9				
Gender						0.597
Male	22	52.0	48.6	N/A	N/A	
Female	20	48.0	51.4	N/A	N/A	
BMI**						0.725
Below Healthy Weight	0	0.0	N/A	1.0	N/A	
Healthy Weight	33	80.5	N/A	76.6	N/A	
Above Healthy Weight	8	19.5	N/A	22.4	N/A	
Ethnicity						0.008
White (British)	32	76.2	87.4	N/A	N/A	
White (European)	2	4.8	3.4	N/A	N/A	
White (Other)	1	2.4	3.6	N/A	N/A	
Asian	6	14.2	3.7	N/A	N/A	
Other	1	2.4	1.9	N/A	N/A	

Level English is spoken						0.0001
Very Well/Well	38	90.4	98.4	N/A	N/A	
Not Well	2	4.8	1.4	N/A	N/A	
Not At All	2	4.8	0.2	N/A	N/A	
Language at home						0.0004
English	34	81.0	95.3	N/A	N/A	
Other	8	19.0	4.7	N/A	N/A	
Socioeconomic Classification						0.0001
SIMD 1-2 (Most deprived 20%)	16	38.1	N/A	N/A	11.9	
SIMD 3-8	18	42.9	N/A	N/A	44.0	
SIMD 9-10 (Least deprived 20%)	8	19.0	N/A	N/A	44.1	
Self-Reported Dental Anxiety						0.0001
Dentally Anxious	27	64.3	20.3 ***	N/A	N/A	
Not Dentally Anxious	15	35.7	79.7 ***	N/A	N/A	

* – Chi-squared tests used for gender, BMI, ethnicity, level of English spoken, languages spoken at home, socioeconomic classification and dental anxiety.

** – 1 missing BMI reading due to patient being wheelchair bound.

*** - Chi-squared test used against a previous study[20]

Table 2 - Comparison of patient-related variables who received treatment under DGA in dentally anxious and non-anxious children

Patient-Related Variable	Total	Non-Dentally Anxious (MCDASf and MDAS <19)	Dentally Anxious (MCDASf and MDAS ≥19)	P-value
n	42	16	26	
Age Categories		16 (38.1%)	26 (61.9%)	0.039
P School Age (4-11 years)	37(88.1%)	11 (26.2%)	26 (61.9%)	
S School Age (12-16 years)	5 (11.9%)	5 (11.9%)	0	
Gender		16 (38.1%)	26 (61.9%)	0.597
Male	20 (47.6%)	8 (19.0%)	12 (28.6%)	
Female	22 (52.4%)	8 (19.0%)	14 (33.3%)	
Social Deprivation		16 (38.1%)	26 (61.9%)	
SIMD 1-2 (Most deprived 20%)	16 (38.1%)	6 (14.3%)	10 (23.8%)	0.848
SIMD 3-8 (From the 3rd to 8th Decile)	18 (42.9%)	5 (11.9%)	13 (31.0%)	0.815
SIMD 9-10 (Least deprived 20%)	8 (19.0%)	5 (11.9%)	3 (7.1%)	0.568
BMI*				
Above healthy weight (≥91st centile)	8 (19.5%)	6 (14.6%)	2 (4.9%)	0.069
Healthy Weight (3rd to 90th centile)	33 (80.5%)	14 (34.1%)	19 (46.3%)	0.071
Under Heathy Weight (≤2nd centile)	0	0	0	

Ethnicity				0.662
White (British)	32 (76.2%)	13 (31.0%)	19 (45.2%)	
Arab	2 (4.8%)	0	2 (4.8%)	
White (European)	2 (4.8%)	0	2 (4.8%)	
Arab/Hungarian	1 (2.4%)	1 (2.4%)	0	
Bangladeshi	1 (2.4%)	0	1 (2.4%)	
Indian	1 (2.4%)	1 (2.4%)	0	
Iraq	1 (2.4%)	1 (2.4%)	0	
Pakistani/Latvian	1 (2.4%)	0	1 (2.4%)	
Pakistani	1 (2.4%)	0	1 (2.4%)	
Medical History				0.570
Healthy	37 (88.1%)	14 (33.3%)	23 (54.8%)	
Significant Medical History	5 (11.9%)	2 (4.8%)	3 (7.1%)	
Languages				0.614
English	34 (81.0%)	13 (31.0%)	21 (50.0%)	
Other	8 (19.0%)	4 (9.5%)	4 (9.5%)	
How well English is spoken				0.317
Very well	35 (83.3%)	12 (28.6%)	23 (54.8%)	
Well	3 (7.1%)	3 (7.1%)	0	
Not well	2 (4.8%)	1 (2.4%)	1 (2.4%)	
Not at all	2 (4.8%)	0	2 (4.8%)	

* - 1 missing BMI reading due to patient being wheelchair bound.

Discussion

Language would appear to impact on children requiring a DGA. In our study, whether English was spoken well/very well or another language beyond English was spoken at home were significant factors when compared with the background population. These findings are novel as we are unaware of previous studies which reported any associations between spoken language and the risks of receiving a DGA.

The reason for the association between language and children requiring a DGA is likely to be multifactorial. Preventative advice and oral hygiene instructions (OHI) by dental professionals may be challenging if children and their caregivers have communication difficulties. Behaviour management techniques rely heavily on good communication between the clinician and the child. A study of a similar cohort of children in Lothian (Scotland) found that only 39 out of the 80 children (48.8%) had OHI and diet advice given by their GDP in the 12 months preceding their DGA[21] . This suggests that if less than half of all children needing a DGA had the recommended preventative advice[9, 10] then those with difficulty communicating in English would be further disadvantaged, increasing the risk of requiring a DGA.

There were fewer children in our study from a White British background and an overrepresentation of other ethnic backgrounds compared with the Scottish Census[13] (2011) data which was statistically significant. While no previous studies have shown a correlation between ethnicity and the likelihood of receiving a GA, two studies concluded that children from "non-British" or "other ethnic" backgrounds had significantly more teeth extracted under DGA compared to White British[23, 24]. Ethnic diversity could lead to differences in oral health behaviours, perceived importance of oral health or barriers to oral healthcare access. Further research is required to investigate the differences between ethnicities and cultures so individualised oral health promotion can be delivered. We are mindful that, while it is the most up-to-date data set currently available, the Scottish Census data is over a decade old.

The majority of the study sample resided in the most relatively deprived areas (SIMD 1 or 2). This is statistically significant when compared with the SIMD (2020)[14] data sets. Children from the least relatively deprived areas (SIMD 9 or 10) were underrepresented compared with the SIMD (2020)[14] data sets which were also significant. These findings indicate that a child's socioeconomic status is a potential determinant on the

receipt of dental treatment under DGA. It is possible that children from the least deprived areas may have accessed private care due to longer waiting time for treatment within the NHS. However, there are no private general anaesthetic treatment centres within the Lothian area.

As previously mentioned, socioeconomic status is a known risk factor for caries[9, 10] . Caries prevalence in children maps to socioeconomic status, so the prevalence of children in the study from the different SIMD groups may be a reflection on the disease burden in society[25]. This may be reflective of the access to oral health care service within these different socioeconomic groups. Families with greater resources may be able to access services earlier and support the child attending multiple appointments to avoid DGA whereas, more disadvantaged families may not attend services until disease reaches a "crisis" point and may only be able to support the treatment modality that resolves the issues as quickly as possible. These findings correlate with the previously reported evidence linking DGA use and social deprivation[26].

Most of the children in our study had self-reported dental anxiety, which is correlates with previous studies[12, 20, 26] . However, our study had a higher proportion of children that had dental anxiety when compared with previous studies which was statistically significant[12, 20, 26]. This provides further evidence that dental anxiety is a risk factor for children receiving dental treatment under DGA.

Our study found that primary school aged children (4-to-11-year-olds) had a significantly higher level of self-reported dental anxiety than secondary school aged children (12-to-16-year-olds). This contradicted a previous finding where dental anxiety in 12-to-16-year-olds was twice that of the 7-to-11-year-old children[27]. However, these comparisons are of limited benefit as study populations differ. It would seem logical that primary-school aged children were pre-cooperative and unlikely to manage chairside comprehensive caries management plans. Secondary-school-aged children in our study did not have self-reported dental anxiety. The absence of dental anxiety in the older cohort was likely due to differences in the nature of their treatment under DGA, with younger children more likely to need DGA for caries management whilst older children requiring DGA for provision of invasive procedure such as surgical removal of ectopic teeth.

In this study gender, BMI and a significant medical history status were not associated with an increased risk of treatment under DGA. Currently, there is no evidence that gender is associated with an increased risk of receiving dental treatment under the DGA. Studies investigating links between BMI and effects on caries

incidence reported conflicting findings[28, 29]. A systematic review, investigating a potential link between caries and obesity, only found three studies with children to provide high enough evidence on the topic which had conflicting results[30] . There is currently no clear evidence that the medical history status of paediatric patients affects the caries risk[, 31, 32].

The majority of the patients were treated for caries. This was expected as caries management is the commonest reason for referrals to our paediatric services. Surprisingly, only one child was treated for a traumatic dental injury. This is most likely due to children having treatment done chairside with or without inhalation sedation.

One limitation of this study is the cross-sectional design which does not allow analysis of patient-related factors over a period of time. Dental anxiety may be different on the day of surgery and following DGA. The study design does not allow for a control group or random sampling, potentially increasing the risk of selection bias.

In terms of future directions for clinical practice, we would consider which patient-related risk factors have shown an increased risk of children undergoing DGAs. The lack of adequate spoken English from the children and their caregivers may create barriers to routine healthcare and health education. Thus, these families may seek care once the disease had progressed to a crisis point necessitating a DGA. To gain a further understanding of this, qualitative studies with patients who do not speak English well or who speak a different primary language would be helpful.

Socioeconomic deprivation is recognised as a caries risk factor and forms the basis of the targeted elements of the Childsmile community oral health programme[33]. The study data demonstrates the health inequality of children from areas of socioeconomic deprivation being more likely to be seen for treatment under DGA. The basis for this inequality is likely to be multifactorial. However, a fuller understanding of what health experiences drive children from these backgrounds towards DGA may help inform interventions to reduce the need for DGA by this group. Again, qualitative studies would likely be helpful in investigating this.

In conclusion, within its limitations, our study showed that level of spoken English, languages spoken at home, ethnicity (other than White British), self-reported dental anxiety and socioeconomic deprivation may be factors that increase the likelihood of receiving dental treatment under DGA.

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