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**Dental general anaesthetic pre-assessments completed by a specialist - does it change patient outcomes? A UK based study.**


## Summary

### Background

In the UK, assessments for dental general anaesthetics (DGA), completed by a Specialist in Paediatric Dentistry are purported to be the gold standard.

### Aim

To evaluate the outcome of dental assessments completed by a Specialist in Paediatric Dentistry after a referral for an exodontia DGA by the patients' General Dental Practitioner (GDP).

### Design

Six hundred and forty-two sets of notes were reviewed from patients referred for exodontia DGA at a community dental service in the UK. Information was gathered regarding patients' oral health and the treatment they had received at three key points; at initial assessment by the Specialist in Paediatric dentistry, hypothetically if the GDPs treatment plan had been followed, and following specialist assessment and treatment.

### Results

Statistically significant differences were found in the dental assessment and the subsequent treatment children received between GDP plans and specialist plans. Proposed exodontia plans were changed by the specialist in 85% of cases, with more than 12% of the sample avoiding the need for a DGA.

### Conclusions

An assessment by a Specialist in Paediatric Dentistry prior to an exodontia GA significantly changed the outcome for patients. Further work is required to investigate whether there is any long-term effect of specialist DGA assessment on oral health.



### Key words

General anaesthesia; Treatment planning; Extraction; Care Index


### Running Head

Dental general anaesthetic pre-assessments completed by a specialist

**Introduction**

The number of children receiving a general anaesthetic for dental extractions in the UK is reported to be increasing [1, 2], with one child reported to be having teeth extracted every 10 minutes [3]. Previous studies have considered the impact dental caries has on daily life including pain, reduced eating and sleeping [4] and a wider impact on the family with lost work time and increased family stress [5]. General anaesthetics to manage dental caries have been shown to further affect childrens' lives including anxiety, days off school and post- operative morbidity [6-8]. Those waiting for DGA appointments suffer on-going pain and have reduced school attendance [9].

Other studies have focused on aspects of the dental general anaesthetic pathway including the need for repeat DGAs [10-12]. Studies report multiple factors that affect the need for repeat DGAs. The number of teeth extracted at the initial DGA is reported to affect the likelihood of a need for a further DGA [11-13]. Incomplete diagnosis of caries or failure to manage caries at initial GA is also cited as a cause for repeat DGA [11, 14]. A further study [13] found that irregular attendance and the presence of pain or infection were significant predictors of repeat DGA. Bitewing radiographs have been shown to yield an increase in caries detection[15] . Within the context of DGA planning the introduction of pre-operative radiographs have been shown to increase caries diagnosis and subsequently increase the number of teeth extracted, and reduce the rate of repeat DGA [10] . Repeat dental general anaesthetics have a cost financially to the service provider as well as creating a burden of care for the patient and their families.

Guidelines [16, 17] which aimed to improve the quality of treatment for children undergoing dental general anaesthetics were developed following review of the evidence by an expert panel. Together these guidelines represent the accepted 'best practice' for children receiving a general anaesthetic for dental treatment in the U.K. The guidelines focus on appropriate assessment (including radiographs), treatment planning, and pre-operative care which should be completed by a specialist or someone with equivalent skills.

However, since publication of these guidelines there has been little published evidence as to the effect that they have had on specific dental general anaesthetic pathways. This study aimed to evaluate the impact a pre-operative dental assessment by a specialist in Paediatric Dentistry has on the care a child referred for a dental general anaesthetic receives.

**Material and methods**

Study design & population

The study was a retrospective record analysis of paediatric patients assessed by the specialist Paediatric Dentistry service at City Health Care Partnership, Hull prior to an exodontia GA in the year 2015. All patients had been referred to the service by their GDP for dental extractions under general anaesthestic. Ethical approval was gained from the Welsh Research Ethics committee in November 2015 (15/WA/0407).

Data Collection

All data was collected by the first author. All paediatric patients aged 1-18 years seen by the general anaesthetic assessment service between 1st January to 31st December 2015 for extraction of primary or permanent teeth under GA were potentially eligible for inclusion. Patients were excluded if they had been seen prior to 2015, if their treatment plans weren't finalised by April 2016 or if their records weren't available. Seven hundred and ninety five records were hand searched by a single examiner and 153 records were excluded. Over 50% of those excluded were patients who were on the GA pathway before 2015. A further 35% were excluded because their treatment plans weren't finalised by April 2016. The remainder were excluded, as patient notes were not available for analysis.

Data collection sheets were developed and then piloted to assess for content and ease of use. All patients' data was pseudo-anonymised on the data collection Excel™ spreadsheets (Microsoft, USA V14.2.0). Data collection forms were populated using information gained from the printed electronic patient record (R4™) and paper notes. Questions were answered according to the data collection framework [Figure 1]. Data collected included patient demographics such as age and gender. Information regarding GDP assessment and treatment before referral including number of carious or non-carious teeth planned for extraction was recorded from the referral and dental chart. The number of primary teeth with pulpal involvement, an associated ulceration, fistula or abscess was recorded to calculate the pufa score [18]. The number, type and effect of radiographs taken prior to and during specialist assessment was recorded. Specialist assessment was recorded including the number of teeth planned for extraction and types of restorations placed. Differences in the number of carious teeth identified, teeth planned for extraction, dmft/DMFT and care indices were calculated and compared GDP assessments and specialist assessments. The treatment modality and outcome was recorded for

all patients. A repeat sample of 10% was randomly chosen and data collection repeated, to assess intra-examiner reliability.

### Statistical Analysis

All data was transferred from Excel spread-sheets (Microsoft, USA V14.2.0) into SPSS V24 (IBM, USA) for data processing and statistical analysis.

Descriptive statistics and standard deviations were used for non-paired variables. For paired data that was not normally distributed, such as number of teeth, dmft, and the care index, the Wilcoxson signed rank test was performed. For paired binary data (radiographs taken), McNemar's test was performed. Significance was set at $p<0.05$.

To assess reproducibility of the data Cohen's Kappa was used for categorical data with nearly 90% of variables showing moderate strength of agreement or more. Intra Class Correlation Coefficient was used to assess continuous variables and found that 75% of variables showed good strength of agreement or more. Variables associated with the permanent dentition showed poorer agreement.

## Results

### Patient demographics

The sample comprised 352 males and 290 females. The mean age was 6.29 (SD=2.52). Half of the study sample were between 4-6 years of age and nearly 90% were aged nine or under.

### PUFA

The pufa score represents the "prevalence and severity of oral conditions related to untreated dental decay " [18] . Within the study population the mean was 3.05 (SD 2.26) in the primary dentition. The mean PUFA score was 0.1 (SD=0.372), significantly lower than that associated with the primary dentition. At referral, 25% of patients in the primary or mixed dentition had at least one fistula present and nearly 5% had an abscess present.

Number of carious teeth identified

In the primary dentition the mean number of carious teeth identified by the specialist service was 5.68 in comparison to 3.71 by GDPs. Data showed that GDPs both under and over diagnosed caries (417 and 23 cases respectively) in comparison to the specialist service but the dominant trend was for under diagnosis. In all the dentitions there was an increase in the number of carious teeth identified by the specialist service compared to GDPs ($P<0.001$).

The increase in the number of carious teeth identified is likely to be directly associated with the increase in the number of radiographs taken at specialist assessment ($p<0.001$). The risk of false positive diagnoses from radiographs must be considered. However in contrast to GDP assessment, bitewing radiographs were the mostly frequently taken image, facilitating the most accurate radiographic assessment of caries. A dental nurse with radiography qualifications took over 95% of the radiographs.

Care Index

In the primary, mixed and permanent dentitions there was an increase in the care index following specialist treatment ($P<0.001$). The mean change in the care index was higher in the permanent dentition (9.77 SD=28.16) compared to the primary dentition (7.59 SD=17.32). In some cases the care index reduced as teeth that were restored prior to assessment were extracted. This may be influenced by material type; at assessment the majority of restorations were glass ionomer cement, in comparison, following specialist and assessment and treatment, composite was the most commonly used material. The mean number of primary and permanent teeth restored as a result of specialist assessment by the specialist service was 0.7 (SD=1.082) and 0.33 (SD=1.121) respectively. Twenty-five per cent of patients received restorative care following specialist assessment. A dental therapist provided most of this treatment, and most patients had either one or two teeth restored.

Number of teeth planned for extraction

The difference in the number of primary and permanent teeth planned for extraction by the GDP compared to the specialist service was statistically significant ($P<0.001$). This reflects the increase in the number of carious teeth that were identified at specialist assessment. The mean number of

primary teeth planned for extraction by the referring dentist was 3.89 (SD=2.92) compared to 5.21 (SD=3.52) following specialist assessment. The mean number of permanent teeth planned for extraction by the referring dentist was 0.68 (SD=1.10) compared to 0.94 (SD=1.34) following specialist assessment.

In the permanent dentition, nearly 8% of the sample had a previously restored tooth extracted, compared to nearly 25% of the sample in the primary dentition.

Single tooth extractions

In the primary dentition, single tooth extractions requested by GDPs comprised 17.3% of the sample, this reduced to 5.6% following specialist assessment. In the permanent dentition, less single tooth extractions were requested by GDPs (15.9%) and specialist assessment had less effect on the reduction of the number of single tooth extractions (10.3%).

DMFT/dmft

In the primary and permanent dentitions the difference between the DMFT/dmft scores at assessment, if the GDP plan was followed compared to when the specialist assessment and treatment was followed, was shown to be statistically significant ($P<0.001$). This was also found for the individual components as seen in Table 1 with exception of the f/F score (number of filled teeth). The mean number of decayed teeth decreased at each interval. If the GDP exodontia plan was followed the mean number of decayed primary teeth remaining after DGA would have been 2.09 (SD=2.260). A mean of 0.49 (SD=1.417), decayed permanent teeth would have been left in situ.

Changes to treatment planning

The specialist paediatric dental GA assessment service changed the initial plan, as requested by the GDP, in 84.9% of cases. An orthodontic opinion was requested in 3.7% of the total cases seen. This increased in the mixed or permanent dentition, with an orthodontic opinion requested in 7.5% of cases. Following assessment by the specialist GA assessment service, treatment in the dental surgery was planned for certain cases. This was used either as an adjunct to GA extractions or as an alternative to DGA. In total 179 (27.88%) patients managed an aspect of their care in the dental surgery, with 8%

managing all of their care. Over 12% of the sample avoided the need for a DGA altogether. Twenty patients were discharged without the need for any active dental treatment.

Repeat GA

Within the current sample, 5% had had a previous DGA. Of these, only 0.8% had previously been planned by the specialist GA assessment service for a general dental anaesthetic.

**Discussion**

The mean age of the study population was 6.29 (SD=2.527) and was similar to the mean age found in other DGA studies [19].

In the study nearly 5% of children in the primary or mixed dentition had an abscess present, with 25% having a fistula. These figures are higher than reported by Pine et al. [20] and Tsakos [21] who found nearly 5% of children to have signs of sepsis. Although a higher rate would be expected in a cohort with an older mean age as in this study, this level of untreated dental decay and sepsis is concerning.

Previous studies haven't directly analysed the increase in the number of carious teeth identified at Paediatric Dentistry specialist assessments. However evidence regarding the increase in the number of teeth planned for extraction following specialist assessment, hints at the diagnosis of further carious teeth [22] as shown in this study. The increase in the number of carious teeth diagnosed at specialist assessment is directly linked to patients having radiographic assessment, which identified additional carious lesions.

In this study nearly twice as many radiographs were enclosed with referrals by GDPs than previous studies [23] have suggested. However dental pantomograms (DPTs) accounted for over two thirds of these. DPTs would not be considered gold standard for aiding caries diagnosis. Study findings agree with the report by Hosey et al. [10] that radiographs taken prior to DGA affect treatment planning; use of radiographs altered the treatment plan in nearly 40% of cases.

Within the study population, the mostly commonly recorded restorative material used by GDPs was glass ionomer cement. This has been reported in the literature previously [24]. Almost 25% of the primary teeth previously restored by GDPs were eventually extracted. Within the specialist service the

wider dental team delivered care. Dental nurses took over 90% of the radiographs and a wide range of pre-GA treatments were routinely completed by a dental therapist, including preventative advice, fluoride varnish application, fissure sealants, composites and stainless steel crowns. Most frequently, simple restorations such as buccal composites on primary canines were completed. Restorative treatment such as this, prior to DGA allowed the specialist service to save teeth if co-operation allowed.

The average number of teeth extracted under GA for paediatric patients in the UK is not known. Findings showed that the average number of planned extractions was higher in the primary compared to the permanent dentition and agreed with previous studies [25]. This study is the first to report that the number of teeth planned for extraction increases following specialist assessment.

Single tooth extractions are reported to be a risk factor for repeat GA [11, 13], so a low percentage of single tooth extractions is therefore advantageous. The proportion of patients in both the primary and permanent dentitions referred for a single tooth extraction decreased following assessment by the specialist service.

Previous studies have not investigated the effect GA services have on childrens' dmft. The statistically significant difference in dmft score and each individual component between intervals highlights a number of factors. The statistically significant difference between GDP-proposed plans and the specialist plan shows that further decayed teeth were identified both clinically and radiographically. The specialist treatment plan then made a statistically significant difference to the number of teeth that were restored and were extracted.

The specialist paediatric dental GA assessment service changed the initial plan, as requested by the GDP in 84.9% of cases. This was higher than the 35% found by Landes et al. [26], but mirrors previous findings [27].

The number of patients within the study population (5%), who have had a previous DGA, was significantly lower than previous studies have stated [13, 28-30]. Those having repeat DGAs who originally were planned by a specialist or consultant in Paediatric Dentistry accounted for less than 1% of the cohort. This suggests that the aim of the service, in ensuring that each child discharged from hospital has no untreated caries, is being met. This study highlights the trend of GDPs failing to diagnose and

plan for all carious teeth. This factor is likely to increase repeat GA rates. Although not previously studied directly, the effect of specialist treatment planning is supported by others in reducing the risk of repeat DGA [11-14, 26].

The findings of the study support current literature as well as the national guidelines [16, 17] on DGA that advise all pre-operative assessment are completed by specialists in Paediatric Dentistry or someone with equivalent skills. It is hoped that this study will add to the available evidence base and inform those commissioning DGA services for paediatric populations. The study has given further insight into the effect pre-assessment by a specialist Paediatric Dentist has on the outcome of DGA for paediatric patients. In comparison to previous research, this study had a large sample size, assessed the whole pre-assessment process and considered multiple outcomes for patients.

The clinical implications of the study must however be considered within the context of the study methodology. The study was a retrospective review of patient records and so there is no comparison group. The methodology of this study may lead to difficulties with reproducibility due to the difficulties associated with extracting data from notes. However, variables for which statistical significance was calculated (except F of DMFT) showed good strength of agreement. Further research is required to assess the impact that assessments by specialists in Paediatric Dentistry may have on children, especially those undergoing a 'mixed management' approach with restorative care prior to an exodontia GA. The acceptability of this for both patients and their parents must be evaluated. Cost benefit analysis research will also be crucial to investigate the cost savings associated with a reduction in the number of DGA and repeat treatments against the increased cost of employing specialists.

Accepting the limitations of the retrospective design, the study provides further evidence to suggest that DGA pre-assessment completed by specialists in Paediatric Dentistry significantly improves the outcome for paediatric patients and 'adds value' to the care they receive.

**Why this paper is important to paediatric dentists.**

- Provides confirmation that improved outcomes are found if dental general anaesthetic assessment is specialist led.
- These findings have implications for commissioners and policy makers.

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The authors declare no conflict of interest.

**Author contributions**

LB and EO'S conceived the idea, LB collected and analysed the data. KK and EO'S supervised the research. LB wrote the manuscript, EO'S and KK edited it.

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| | At specialist assessment | If GDP exodontia plan was followed | Following specialist led treatment |
|---|---|---|---|
| Mean dmft | 5.93 | 6.09 | 6.29 |
| dmft (standard deviation) | 3.56 | 3.55 | 3.57 |
| Mean DMFT | 1.35 | 1.37 | 1.49 |
| DMFT (standard deviation) | 1.97 | 1.99 | 2.06 |

Table 1. The mean (and standard deviation) of the dmft/DMFT score at each recorded interval.

**Data Collection Framework**

I. **Collection number**
*Number used to identify patients for the study.*

II. **R4™ number**
*Each patient was identified using their R4™ number from their electronic patient record.*

III. **Age at referral**
*Age recorded in years to previous birthday at the time of referral.*

IV. **Gender**
*Male/female*

V. **General Dental Practitioner (GDP) Assessment**
a. Number of carious teeth planned for extraction
*Number of carious teeth referred by GDP for extraction. Primary and permanent.*
b. Number of non-carious teeth planned for extraction
*Number of non-carious teeth referred by GDP for extraction e.g. for orthodontic reasons. Must be stated in referral that tooth is requested for extraction for reasons other than caries. Primary and permanent.*

VI. **General Dental Practitioner (GDP) treatment prior to referral**
a. Total number of teeth restored by GDP prior to referral
b. Number of carious teeth restored using; amalgam, composite, glass ionomer cement (GIC), stainless steel crown (SSC), Hall technique stainless steel crown (HTSSC), unknown.
*Number of teeth restored by GDP prior to referral. Material used recorded as amalgam, composite, GIC, SSC or SSC placed using the Hall Technique(HTSSC). If unidentified or material not noted, unknown recorded.*

Figure 1. Sample of the data collection framework used.