DOI: 10.1111/j.1365-263X.2010.01100.x

Repeat general anaesthesia, a 6-year follow up

EIRINI KAKAOUNAKI, JINOUS F. TAHMASSEBI & STEPHEN A. FAYLE

Department of Paediatric Dentistry, Leeds Dental Institute, Leeds, UK

International Journal of Paediatric Dentistry 2011; 21: 126–131

Objective. To investigate the number of children who subsequently required further dental general anaesthesia (DGA) following the baseline DGA for exodontia in 1997 over the next 6 year period, and identify any common factors related to these repeat DGAs.

Design. A retrospective longitudinal analysis.

Materials and methods. Records from a UK teaching hospital for patients who had extractions under DGA within the calendar year of 1997 were identified and analysed. The individual's demographic details, reasons for the baseline DGA, teeth extracted, number of subsequent DGAs, the reasons for repeat DGA and finally any episodes of pain and/or infection after 1997 were recorded.

Results. During 1997, a total of 484 children with mean age of 6.35 (ranged between 1 and 16 years) received a DGA for exodontias. The most common reason for the exodontias carried out at this baseline DGA was dental caries and mean number of exodontias was 4.24. Of the total study population 8.9% subsequently had at least one unplanned repeat DGA, with dental caries being a factor in 84% of the cases. Of the subsequently extracted teeth 71.9% were caries free or unerupted at the time of the initial DGA. Of the children who had a repeat DGA, 61% had experienced at least one episode of pain and/or infection subsequent to the first episode of DGA. The pattern of the child's attendance and the recorded experience of oral pain and infection after the baseline DGA in 1997 were variables proved to be strongly associated with the risk of having an unplanned repeat DGA, with the children who were irregular attenders having a four times increased risk.

Conclusions. Two common factors were identified which might predict the potential for a child requiring a repeat DGA; irregular attendance and oral pain and infection.

Introduction

There is still a high prevalence of dental caries in the child population (40% or more of 5-year-olds) in most parts of the UK. Despite improvements in children's dental health and development of alternative treatment modalities[1], many children still require dental treatment under general anaesthesia.

There have been a number of initiatives and changes in regulations, over the past two decades in UK, which have aimed to reduce or eliminate the use of unnecessary DGA. Recently the Department of Health[2] recommended that DGA should be undertaken only when absolutely necessary. Many studies have analysed patient records to identify reasons for referral and the need of DGA[3–7]. In addition, the quality of the treatment provided under DGA has been investigated[8–12]. The outcome for children who received exodontia under DGA, however has been examined in relatively few studies[3,4,13–15].

Few have investigated the reasons for these repeats. In one such study, children who experience extractions under DGA before their fourth birthday were found to have a high risk of having a repeat GA within a short period of time[16].

It has also been reported that the pattern of the child's attendance following the DGA can play a significant role in the risk of a repeat DGA[11,17–19]. Furthermore, the episodes of oral pain and infection a child may experience is a sizable problem and has substantial consequences for the children and their families[20–22]. Previous studies, however do not appear to report on the episodes of pain and infection and the dental treatment received

Correspondence to:
Dr. Jinous Tahmassebi, Department of Paediatric Dentistry, Leeds Dental Institute, Clarendon Way, Leeds LS2 9LU, UK. E-mail: jinoustahmassebi@bramhopedentalclinic.co.uk

© 2010 The Authors
International Journal of Paediatric Dentistry © 2010 BSPD, IAPD and Blackwell Publishing Ltd

INTERNATIONAL JOURNAL OF PAEDIATRIC DENTISTRY

under LA and GA in the years following the administration of a DGA.

Therefore, it seemed appropriate to carry out a study to investigate the number of children who subsequently required a further dental general anaesthesia (DGA) following the baseline DGA for exodontia, the reasons for these repeat DGAs, and identify any common or potentially predictive factors.

Materials and methods

The study was approved by the Research Ethics Committee. Study data was collected using a retrospective longitudinal record analysis.

Study population

The study population consisted of all paediatric dental patients who had received a DGA on the Day Case Unit at Leeds Dental Institute (LDI) during the calendar year of 1997. The criteria for the inclusion of a child in the study group were; aged between 0 and 16 years and having received DGA for extractions only.

The information collected from the Day Case Record Book included the date of the baseline DGA carried out in 1997, the date of birth at the time of baseline DGA, the teeth that were extracted and the total number of exodontias.

The dental records for the 6 years following the baseline DGA episode for each child in the study were reviewed and the following data was collected and recorded in a SPSS® file (Statistical Package for Social Sciences) as shown in Table 1.

In addition to the information presented in Table 1, the following data was collected from the dental records:

- The cause and the timing of oral pain or infection subsequent to the baseline DGA was identified. From this the interval was calculated for each episodes of pain and infection.
- The diagnosis of the cause of oral pain and/or infection was recorded. If the episode was tooth related, the tooth involved was identified and its status at the time of the baseline DGA in 1997 was determined from the dental charting carried out prior to the DGA in 1997.
- The pattern of the patient's attendance at LDI following the baseline DGA, were recorded.

Table 1. Data collected from the dental records.

• Age (in years, according to the child's last birthday at the date of the DGA in 1997), gender and medical history.
• Number of DGAs prior to the baseline DGA in 1997.
• Date, reasons and treatment carried out under the DGA in 1997.
• The nature and timings of any records oral pain and/or infection subsequent to the baseline DGA in 1997.
• Date and nature of follow-up treatment under Local Analgesia (LA) or Sedation (RA) or DGA provided at LDI after the date of the baseline DGA up to 31st of December 2003 and status of the teeth subsequently treated, as charted at the pre-GA assessment in 1997.
• The date of any further DGAs recorded after the baseline DGA until 31st of December 2003.
• Treatment received under any repeat DGA and status of the teeth treated, as charted at the pre-GA assessment appointment in 1997.

Intra-examiner reproducibility

Intra-examiner reproducibility[23] was estimated with Kappa statistics for categorical variables and with Bland-Altman plots for continuous variables. A random selection of 5% of patient's personal identification numbers was performed, with the use of SPSS® package.

Statistical analysis

Descriptive statistics were used. Difference in means was calculated for the variables that were normally distributed. A Confidence Interval of 95% of the medians and difference in the medians was used for the variables that were non parametric[24].

Results

Review of hospital records identified 484 children who had received DGA during 1997, of which 85.1% (412) did not have any record of previous DGA. Out of the total of 484 children 52 subsequently received at least one further DGA following their DGA in 1997. Of these, nine were planned to have a repeat

© 2010 The Authors
International Journal of Paediatric Dentistry © 2010 BSPD, IAPD and Blackwell Publishing Ltd

DGA for restorative treatment under GA and received this within12 months of their baseline DGA in 1997. After exclusion of the planned DGA repeat procedures the unplanned repeat rate for the total group was 8.9%.

The interval between the DGA in 1997 and the repeat DGAs ranged from 1 to 77 months for the 1st repeat DGA and 20 to 78 months for the 2nd repeat DGA. Figure 1 shows the number of children who had a repeat DGA and the interval between the DGA in 1997 and the first repeat.

Treatment provided at the repeat DGAs

Child outcome. A total of 43 children required at least one further DGA which was unplanned. Of these 22 were caries free at the time of their DGA in 1997. Out of the remaining 21 who did have caries at the 1997 DGA, 10 were initially planned for restorative care at LDI under LA, 5 were referred to GDPs and 6 had teeth charted as carious where no plan was recorded for their subsequent management.

Extraction was the most common treatment provided under the unplanned repeat DGAs. Mean number of extractions per child at repeat DGAs was 4.4 (95% CI: 3.7, 5.2) at the first repeat and 4 (95% CI: 2.4, 4.0) at the second repeat DGA. The mean number of teeth restored at the first repeat was 0.4 (95% CI: −0.7, 0.8) and 0.75 (95% CI: −1.6, 3.1) at the second repeat DGA.

The majority of the repeaters had extractions of both primary and permanent teeth at the unplanned repeat DGAs. Twenty children had both primary and permanent teeth extracted, 10 had only permanent teeth and 13 only primary teeth extractions. It is interesting to note that 26 children had at least one-first permanent molar extracted during the repeat DGAs and only five children received restorative treatment.

Tooth outcome. In total 207 teeth were extracted and 26 teeth were restored during the unplanned repeats. The majority of the teeth (174 of 233 teeth) treated during the unplanned repeats were recorded as caries free or unerupted at the time of the DGA in 1997. The dental status of the teeth at the time of the initial DGA in 1997 subsequently treated under GA is presented in the Fig. 2. The most commonly recorded dental condition related to the repeat DGAs was dental caries (Fig. 3).

Characteristics of the unplanned repeaters

In total 43 children had unplanned repeats. Of these repeaters 16 were 4-years-old or

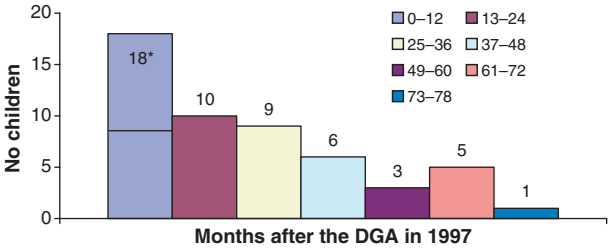

Fig. 1. Number of children who received a repeat DGA and the interval between the DGA in 1997 and the 1st repeat DGA. *Of these 18 repeats during the first year following the DGA in 1997, 9 were planned repeat DGAs.

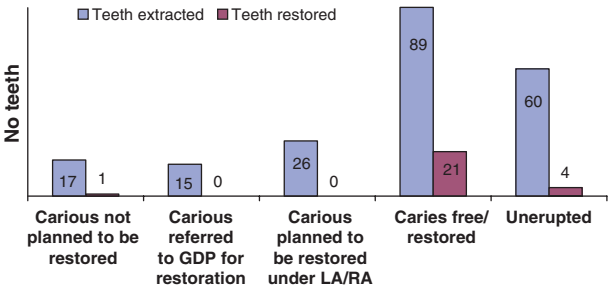

Fig. 2. Status at the time of the DGA in 1997 of the teeth subsequently restored and extracted under the repeat DGAs.

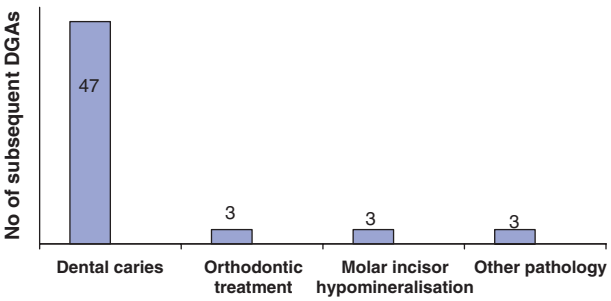

Fig. 3. Dental conditions related to the provision of subsequent DGAs.

© 2010 The Authors
International Journal of Paediatric Dentistry © 2010 BSPD, IAPD and Blackwell Publishing Ltd

younger at the time of the DGA in 1997. With regards to the previous DGA experience, five children had one previous DGA prior to the initial DGA in 1997 and one child had two previous DGAs. Four of the unplanned repeaters had a single tooth extraction during the DGA in 1997. Five of the unplanned repeaters had subsequently attended at LDI regularly for further dental treatment.

Thirty two of the unplanned repeaters were recorded as having experienced oral pain and infection subsequent to the completion of the initial DGA in 1997. In 18 cases the tooth, which caused the pain and infection had been charted as carious at the time of the DGA in 1997. Treatment had been planned for 10 of these children. For the remaining eight cases minimal occlusal caries was the common feature. Finally, for three of the unplanned repeaters treatment had been attempted under LA with use of inhalation sedation (IHS).

The relative risk (RR) of an individual child requiring a repeat DGA was assessed as shown in Table 2. The independent variables tested were the following: gender, age younger than 4 years at the DGA in 1997, previous DGA experience, single tooth extractions, extractions of anterior primary teeth only, extractions of posterior primary teeth only and experience of pain and infection after the DGA in 1997. It was demonstrated that a child who received a DGA when he/she was 4 years-old or younger had a 64% increased risk of an unplanned repeat DGA compared with an older child and having only one tooth extracted under GA increased the risk of a repeat by 73%.

None of the above results were however statistically significant. There were only two independent variables, which gave a statistically significant result, which were: the pattern of the child's attendance at LDI; the recorded experience of oral pain and infection after the DGA in 1997. These two variables proved to be strongly associated with the risk of having an unplanned repeat DGA, with the children who were irregular attenders having a four times increased risk.

Table 2. Relative risk (RR) of having an unplanned repeat DGA.

		95% CI	
Independent variables	**RR**	**Lower**	**Upper**
Male/female	0.98	0.56	1.73
4-years-old or younger at the DGA in 1997	1.64	0.85	3.15
Other than fit and well i.e., mild asthma	1.33	0.72	2.43
Previous DGA experience at the initial DGA in 1997	0.93	0.40	2.12
Single tooth extractions	1.73	0.67	4.48
Extractions of the anterior primary teeth only	1.05	0.34	3.24
Extractions of posterior primary teeth only	0.95	0.30	2.93
Irregular attendance at LDI	4.43	**1.63**	**12.03**
Experience of pain and/or infection subsequent to DGA in 1997	17.20	**9.10**	**32.51**

Discussion

This paper has focused on identifying any common factors amongst the children who had a repeat DGA within the following 6 years of a baseline DGA procedure at a UK teaching hospital. This study showed an overall unplanned repeat rate of DGA of 8.9%.

The results of this study on DGA repeat rate over 6 years appears to be similar to most of the previous studies[15,25–27]. There are only two studies, which reported a repeat rate higher than 11.5% both showing a 17% repeat rate over a relatively short period. The first is the study by Almeida *et al.*[28], who investigated the outcome of comprehensive treatment under GA of children with Early Childhood Caries in USA with a mean age of 3 years. Children receiving a first DGA when very young are recognised to be at a higher risk for repeat DGA[29]. The second study is by Keniry[13] which was carried out much before the recent guidance, when a more liberal approach to the administration of DGA existed.

A better outcome over 5–6 years has been reported by two other studies. First of all, Rule *et al.* reported a repeat rate of 3.5% over 6 years[30], however, the authors reviewed only 36% of their study group, therefore this

© 2010 The Authors
International Journal of Paediatric Dentistry © 2010 BSPD, IAPD and Blackwell Publishing Ltd

outcome should be carefully interpreted. Secondly, Thompson[31] reported in New Zealand a repeat rate of 4.2% over 5 years, for children with a mean age of 5 years, who received extractions and restorations under GA. The authors attributed this outcome to the universality of access to School Dental Service, which is able to provide follow-up dental treatment, rather than any differences in incidence of caries, when compared with the UK child populations. We cannot, however overlook the fact that in New Zealand water fluoridation is widespread[31].

In this study the median interval between the initial DGA in 1997 and first repeat was 22 months, which is in agreement with the study by Harrison and Nutting[15]. The results of another study in USA[29] showed a slightly longer mean interval of 2.1 years between repeat DGAs. This study, however reported the outcome of full mouth rehabilitation under GA.

In the current study treatment provided during the repeats was mainly extractions. The majority of repeats was to treat new disease and was probably unavoidable at the planning stage, since 72% of the teeth extracted were recorded as caries free, restored or unerupted at the time of the DGA in 1997.

Of the unplanned repeaters (43), just over half (22) probably could not have been anticipated at the planning stage, as these children developed new dental disease subsequent to their first DGA. In some instances this was new caries, which might potentially have been prevented by more effective post GA preventive follow-up and support. For others the new disease was related to disease in teeth that were unerupted at the time of planning their first DGA. Examples included several children presenting at a later stage with conditions such as MIH affecting their previously unerupted first permanent molars. For these, the subsequent need for repeat DGA may have been impossible to predict.

Of the remaining unplanned repeats (21/43) caries was left untreated at the first DGA. For the majority of these children, (15) subsequent treatment had been planned, but, it seems, was not successful in avoiding further DGA. In many cases this was possibly related to unreliable post-DGA attendance for follow-up care; however, six of the repeaters included in their extractions teeth which were recorded as carious at the time of the DGA in 1997 but no plan for restoring them had been recorded. Harrison and Nutting[15] reported that new caries accounted for only 15% of children attending for repeat DGA. This implies that 85% of their repeaters had caries left untreated at the first DGA, which is a far higher proportion than in the current study. This could reflect the aggressive approach to treatment planning (i.e., usually planning extraction or treatment of ALL carious teeth under the one GA) adopted in Leeds, which Harrison and Nutting[15] advocated in their paper.

Nearly half of the unplanned repeaters in the current study subsequently had records supporting irregular attendance. Irregular attenders had a four times increased risk of having a repeat DGA. Landes and Bradnock reported that 25% of the children who were referred for exodontia under DGA had attended their dentist only when they were in pain[16]. Furthermore, Sheller *et al.* reported that only 7% of the repeaters returned for a follow-up visit *versus* 43% of those children who received only one DGA for dental treatment[29]. This suggests parental motivation may be a factor in influencing repeat DGA, and that these patients require proactive dental follow-up and support following DGA.

Conclusion

Two common factors were identified which might predict the potential for a child requiring a repeat DGA; the pattern of the child's attendance at LDI and the recorded experience of oral pain and infection. Finding effective strategies to encourage regular attendance and targeting resources to educate at risk patients and their parents in prevention of dental disease still remains the key issue in addressing the circumstances leading to repeat DGA.

© 2010 The Authors
International Journal of Paediatric Dentistry © 2010 BSPD, IAPD and Blackwell Publishing Ltd

What this paper adds

- The unplanned repeat rate in the current study (8.9%) was similar to that reported by previous studies.
- The majority of the repeat DGAs were probably unavoidable at the planning stage, since they were to treat newly developed dental disease.

Why this paper is important to paediatric dentist

- More aggressive planning of extractions at the diagnostic stage is important in reducing the proportion of DGA repeats.
- This paper highlights the importance of active follow-up and education of the parents and children regarding dental disease prevention to reduce the number of children requiring repeat DGA.

References

1 Pitts NB, Evans DJ, Nugent ZJ. The dental caries experience of 5-year-old children in Great Britain. Surveys coordinated by the British Association for the Study of Community Dentistry in 1999/2000. *Com Dent Health* 2001; **18**: 49–55.

2 Department of Health. *A Conscious Decision. A Review of the use of General Anaesthesia and Conscious Sedation in Primary Dental Care*. London: Department of Health, 2000.

3 Smallridge JA, Al-Ghanim N, Holt RD. The use of general anaesthesia for tooth extraction for child out-patients at a London dental hospital. *Br Dent J* 1990; **168**: 438–440.

4 Holt RD, Rule DC, Davenport ES, Fung DE. The use of general anaesthesia for tooth extraction in children in London: a multi-centre study. *Br Dent J* 1992; **173**: 333–339.

5 Podesta JR, Watt RG. A quality assurance review of the patient referral process and user satisfaction of outpatient general anaesthesia services for dental treatment. *Com Dent Health* 1996; **13**: 228–231.

6 Grant SMB, Davidson LE, Livesey S. Trends in exodontia under general anaesthesia at a dental teaching hospital. *Br Dent J* 1998; **185**: 347–352.

7 Clayton M, Mackie IC. The development of referral guidelines for dentists referring children for extractions under general anaesthesia. *Br Dent J* 2003; **194**: 561–565.

8 O'Sullivan EA, Curzon ME. The efficacy of comprehensive dental care for children under general anaesthesia. *Br Dent J* 1991; **171**: 56–58.

9 Eidelman E, Faibis S, Peretz B. A comparison of restorations for children with early childhood caries treated under general anaesthesia or conscious sedation. *Ped Dent* 2000; **22**: 33–37.

10 Ng MW, Tate AR, Needleman HL, Acs G. The influence of medical history on restorative procedure failure rates following dental rehabilitation. *Ped Dent* 2001; **23**: 487–490.

11 Tate AR, Ng MW, Needleman HL, Acs G. Failure rates of restorative procedures following dental rehabilitation under general anesthesia. *Ped Dent* 2002; **24**: 69–71.

12 Al-Eheideb AA, Herman NG. Outcomes of dental procedures performed on children under general anesthesia. *J Cl Ped Dent* 2003; **27**: 181–183.

13 Keniry AJ. An assessment of child patients requiring general anesthesia. *J Dent Child* 1974; **41**: 194–200.

14 Holt RD, Al Lamki S, Bedi R, Dowey JA, Gilthorpe M. Provision of dental general anaesthesia for extractions in child patients at two centres. *Br Dent J* 1999; **187**: 498–501.

15 Harrison M, Nutting L. Repeat general anaesthesia for paediatric dentistry. *Br Dent J* 2000; **189**: 37–39.

16 Landes DP, Bradnock G. Demand for dental extractions performed under general anaesthesia for children by Leicestershire Community Dental Service. *Com Dent Health* 1996; **13**: 105–110.

17 Carson P, Freeman R. Characteristics of children attending for dental general anaesthesia in 1993 and 1997. *Prim Dent Care* 2000; **7**: 163–167.

18 Ibricevic H, Al-Jame Q, Honkala S. Pediatric dental procedures under general anesthesia at the Amiri Hospital in Kuwait. *J Clin Ped Dent* 2001; **25**: 337–342.

19 Jamjoom MM, al-Malik MI, Holt RD, el-Nassry A. Dental treatment under general anaesthesia at a hospital in Jeddah, Saudi Arabia. *Int J Paed Dent* 2001; **11**: 110–116.

20 Shepherd MA, Nadanovsky P, Sheiham A. The prevalence and impact of dental pain in 8-year-old school children in Harrow, England. *Br Dent J* 1999; **187**: 38–41.

21 Milsom KM, Tickle M, Blinkhorn AS. Dental pain and dental treatment of young children attending the general dental service. *Br Dent J* 2002; **192**: 280–284.

22 Levine RS, Nugent ZJ, Pitts NB. Pain prediction for preventive non-operative management of dentinal caries in primary teeth in general dental practice. *Br Dent J* 2003; **195**: 202–206.

23 Altman DG. *Practical Statistics for Medical Research*. London: Chapman and Hall, 1991.

24 Gardner MJ, Altman DG. *Statistics With Confidence*. Belfast: The University Press, 1986.

25 Legault JV, Dinner MH, Auger R. Dental treatment of children in a general anaesthesia clinic: review of 300 cases. *J Can Dent Assoc* 1972; **38**: 221–224.

26 Roeters J, Burgersdijk R. The need for general anesthesia for the dental treatment of mentally handicapped patients: a follow-up study. *J Dent Child* 1985; **52**: 344–346.

27 Mitchell L, Murray JJ, Ryder W. Management of the handicapped and the anxious child: a retrospective study of dental treatment carried out under general anaesthesia. *J Paed Dent* 1985; **1**: 9–4.

28 Almeida AG, Roseman MM, Sheff M, Huntington N, Hughes CV. Future caries susceptibility in children with Early Childhood Caries following treatment under general anaesthesia. *Ped Dent* 2000; **22**: 302–306.

29 Sheller B, Williams BJ, Hays K, Mancl L. Reasons for repeat dental treatment under general anesthesia for the healthy child. *Pediatr Dent* 2003; **25**: 546–552.

30 Rule DC, Winter GB, Goldman V, Brookes RC. Restorative treatment for children under general anesthesia. The treatment of apprehensive and handicapped children as clinical out-patients. *Br Dent J* 1967; **123**: 480–484.

31 Thomson WM. Day-stay treatment for dental caries at a New Zealand hospital dental unit: a 5-year retrospective audit. *N Z Dent J* 1994; **90**: 139–142.

© 2010 The Authors
International Journal of Paediatric Dentistry © 2010 BSPD, IAPD and Blackwell Publishing Ltd

Copyright of International Journal of Paediatric Dentistry is the property of Wiley-Blackwell and its content may not be copied or emailed to multiple sites or posted to a listserv without the copyright holder's express written permission. However, users may print, download, or email articles for individual use.