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DOI: 10.23804/ejpd.2017.18.04.09

## Reasons of repeat dental treatment under general anaesthesia: A retrospective study

### ABSTRACT

**Aim** The purpose of this chart review study was to investigate the common factors that exist in paediatric patients requiring a repeat dental treatment under general anaesthesia (GA2) within four years after the initial dental treatment under general anaesthesia (GA1).

**Materials and methods** The Electronic Health Records of one to 12 year-old children who received dental treatment under general anaesthesia (GA) between April 2004 and October 2009 were identified and analysed by a single examiner. Children who had GA2, within a four year period following GA1 were categorised as cases. Children who had only one dental treatment under GA were considered the control pool. Each case was matched to three controls based on sex and age range at GA1 of  $\pm 6$  months. Other recorded variables included: date of birth, date of GAs (GA1 and GA2 for cases; GA1 for controls), type of payment, dmfs before GA1, dental treatments provided under GA, return of 1-week post-GA1 follow-up, frequency of recare/recall visits following one-year post-GA1 visit and the type and

frequency of post GA1 emergency visits.

**Results** Out of 581 subjects, 29 (4.99%) cases were matched to 87 controls. Medically compromised patients had four times the risk of GA2. At GA1, cases received statistically significant less sealants ( $p=0.026$ ), less extractions ( $p<0.0001$ ), and more composite restorations ( $p=0.0002$ ) compared to controls.

**Conclusion** Medically compromised children and children treated with more composites and fewer sealants and extractions at their initial dental treatment under general anaesthesia were more likely to have a repeat dental treatment under general anaesthesia within 4 years.

**Keywords** General anaesthesia, dental treatment, repeat dental treatment.

### Introduction

Missed opportunities for early dental disease prevention may necessitate dental care performed under general anaesthesia (GA). Behaviour guidance techniques used for young dental patients constitute an important part of paediatric dentistry. Some patients fail to respond to non-pharmacological techniques because of either age, severe anxiety, or a disability, which prevents them from cooperating sufficiently to undergo routine dental care [Nunn et al., 1995]. For many paediatric patients with extensive dental involvement, treatment in the conventional dental setting can be extremely difficult, and comprehensive dental treatment under GA is needed to provide quality dental care [Peretz et al., 2000]. Also, GA may be indicated when a patient requires immediate, comprehensive dental treatment or is medically compromised [Enger and Mourino, 1985].

The treatment under GA has the advantage of providing all the necessary dental procedures during a single visit and under minimal stress to the patient, parent, and dentist [Needleman et al., 2008]. However, GA visits are usually costly, involving specialised hospital facilities, and require time-consuming pre-operative preparation, for the dental team and parent(s) of these patients [Bohaty and Spencer, 1992].

General anaesthesia is a procedure which is never without risks, but it continues to have a remarkable record of safety [Harrison and Nutting, 2000; Jabarifar et al., 2009]. Dentistry has continued to build upon this foundation and has been extremely influential in developing safe and effective sedative and anaesthetic techniques that have enabled millions of people to gain access to dental care. Very few studies reported that sleepiness and pain to be the most common

complications following dental treatment under GA in children [Atan et al., 2004; Needleman et al., 2008].

Unfortunately, there is a small portion of the paediatric dental patients that require further treatment or repeat treatment under GA. In 1972 Legault reported that 10.7% of the children treated under GA required a repeat treatment under GA and the mean relapse time between the initial dental treatment under GA and the repeat treatment under GA was 15.6 months [Leagault et al., 1972]. Furthermore, Almeida [2000] found that of the 42 patients treated for early childhood caries (ECC) under GA, seven patients (17%) required a repeat treatment under GA within two years following their initial full-mouth rehabilitation [Almeida et al., 2000]. Recently, a 2007 study by Schroth and Smith indicated the average length of time between GA1 and GA2 in children was found to be 42 months [Schroth and Smith, 2007].

Children with poor cooperation in the dental setting, as reported by their dentist prior to their initial dental treatment under GA, continued use of the bottle after the initial full mouth rehabilitation under GA. Poor daily oral hygiene habits and caries involvement of the maxillary central incisors at the initial dental treatment under GA are associated with the need of repeat dental treatment under GA in paediatric patients [Sheller et al., 2003]. Parental factors that contributed to repeat dental treatment under GA included adult not brushing the child's teeth, a dysfunctional family social situation, and failure to return for the postoperative dental appointment after the initial dental treatment under GA [Sheller et al., 2003].

In a study by Worthen and Mueller [2000], 20% of patients treated under GA before eruption of primary second molars required further dental treatment under GA. Furthermore, Sheller ([2003] found that children who have undergone initial dental treatment under GA at a very young age are recognised to be at a higher risk for a repeat dental treatment under GA [Sheller et al., 2003]. Landes and Bradnock reported that paediatric patients who have dental extractions under GA before four years of age were found to have a high risk of experiencing a repeat dental treatment under GA within a short period of time [Landes and Bradnock, 1996].

Patients receiving dental treatment under GA are usually recommended to return for a follow-up appointment. While the American Academy of Pediatric Dentistry (AAPD) does not recommend any specific follow-up schedule after dental treatment under GA, other studies recommended a 1-week [Primosch et al., 2001] or 2-week [Leagault et al., 1972; Sheller et al., 2003; Ventura et al., 1981] initial follow-up visit for their patients after dental treatment under GA. All children receiving dental treatment under GA at Tufts Medical Center (TUSDM) in Boston are encouraged to return to the Paediatric Dental Clinic for dental evaluation at 1-week, three-month, and six-month

intervals following their GA visit. The 1-week post initial dental treatment under general anaesthesia follow-up appointment (1-W post-GA1 FU) is believed to be important and includes dental examination, evaluating the dental treatment provided, answering any of the parent's concern regarding the treatment provided, and reinforcing the oral hygiene and the necessity for future recall appointments.

The purpose of this study was to investigate the common factors that exist in paediatric patients requiring a repeated dental treatment under general anaesthesia (GA2) within four years after the initial dental treatment under general anaesthesia (GA1) either at Tufts University School of Dental Medicine (TUSDM) or Franciscan Hospital for Children in Boston, MA between April 2004 and October 2009.

## Materials and methods

This retrospective chart review was approved by the Institutional Review Board at Tufts University Health Sciences Campus. The Electronic Health Records (EHR) of children between the ages of one to 12 year-old children who received dental treatment under GA at TUSDM and Franciscan Hospital for Children in Boston, MA between April 2004 and October 2009 were identified and analyzed in December 2013. The study data was reviewed by a single examiner.

### Study population

Subjects aged 1–12 years, who had at least one dental treatment under GA and who had a minimum of one follow-up appointment within four years after their GA1 were included in the study. Medically compromised subjects were also included in the study. There was no documentation of a third GA in this study. All subjects were patients of Pediatric Dentistry Department, School of Dentistry at Tufts University. They received dental treatments under GA at either TUSDM or Franciscan Hospital for Children in Boston, MA between April 2004 and October 2009. Subjects were treated by different residents from the paediatric dentistry postgraduate program at TUSDM under the supervision of different faculties. The EHRs were recorded by different residents who assisted in the GA.

Children who had GA2, within a four year period following GA1 were categorised as cases. Children who had only one dental treatment under GA were considered the control pool. Each case was matched to three controls based on sex and age range at GA1 of  $\pm$  6 months. Other recorded variables included:

- 1 Date of birth.
- 2 Date of GA (GA1 and GA2 for cases; GA1 for controls).
- 3 Type of payment (Medicaid, private insurance or self-pay).

| Variables             | Mean     | SD       |
|-----------------------|----------|----------|
| Age (months)          | 59.96    | 24.01    |
| Dmfs at GA1           | 30.53    | 12.95    |
| <b>Gender</b>         | <b>n</b> | <b>%</b> |
| Male                  | 274      | 58.42    |
| Female                | 195      | 41.58    |
| <b>Payment Method</b> | <b>n</b> | <b>%</b> |
| MassHealth            | 424      | 92.78    |
| Delta                 | 26       | 5.69     |
| Self-pay              | 7        | 1.53     |
| Medically compromised | 125      | 26.60    |

TABLE 1 Demographic data of subjects in GA1 (N=496).

- 4 dmfs (decayed, missing, filled tooth surfaces) before GA1.
- 5 Dental treatments provided under GA.
- 6 Return of 1-W post-GA1 FU.
- 7 Frequency of recare/recall visits following one-year post-GA1 visit.
- 8 The type and frequency of post-GA emergency visits.

**Statistical methods**

Descriptive statistics were calculated. Mantel-Haenszel and paired t-tests were used to compare

cases and controls. Data were analysed using SAS 9.4 (Cary, NC) and a p-value equal to or less than 0.05 were considered statistically significant.

**Results**

Out of 581 patients who had dental treatment under GA between April 2004 and October 2009, 496 subjects met the inclusion criteria. The demographic data of the subjects included in the study is presented in Table 1. Twenty-nine subjects were categorised as cases (they had two dental treatment under GA) and the pool of controls consisted of 440 subjects. Eighty-seven controls were matched to the cases. The mean difference in age between GA1 and GA2 for cases was 34.40 ± 11.85 months. The demographic characteristics of the subject in cases and control groups are presented in Table 2. Subject cases had higher dmfs prior to GA1 compared to controls with a mean difference of 4.20 ± 20.99 (p=0.076). Having private insurance (Delta) or being a self-paying subject tripled the likelihood of undergoing a GA2 (p=0.0679) when compared with being covered by Medicaid (MassHealth). Medically compromised cases had 4.29 the risk of a GA2 compared to healthy subjects (p=0.0043). Cases in GA1 received less sealants and extractions but more teeth were restored with composites compared to controls and the differences were statistically significant (Table 3). The frequency of

|                       | Case (N = 29) |          | Control (N = 87) |          | Mean difference     | P-value        |
|-----------------------|---------------|----------|------------------|----------|---------------------|----------------|
|                       | Mean          | SD       | Mean             | SD       |                     |                |
| Age (months)          | 45.75         | 24.06    | 46.56            | 23.08    | -                   | NA             |
| dmfs score            | 35.29         | 16.39    | 31.46            | 13.11    | 4.20 ± 20.99        | 0.076 +        |
| <b>Gender</b>         | <b>n</b>      | <b>%</b> | <b>n</b>         | <b>%</b> | <b>OR (CI)</b>      | <b>P-value</b> |
| Male                  | 19            | 65.51    | 57               | 65.52    | -                   |                |
| Female                | 10            | 34.48    | 30               | 34.48    | NA                  |                |
| <b>Payment</b>        | <b>n</b>      | <b>%</b> | <b>n</b>         | <b>%</b> | <b>OR (CI)</b>      | <b>P-value</b> |
| MassHealth            | 23            | 82.14    | 82               | 94.25    | -                   |                |
| Delta or Self-pay     | 5             | 17.85    | 5                | 5.75     | 3.00 (0.87 – 10.36) | 0.0679 ^       |
| Medically compromised | 14            | 48.28    | 19               | 21.84    | 4.29 (1.45 – 12.70) | 0.0043 ^*      |

\*Statistical significance (P<.05); ^Mantel-Haenszel test, + paired t-test.

TABLE 2 Demographic data of subjects in case (n=29) and control (n=87) groups.

| The dental procedure         | GA1           |              | GA2        |             |
|------------------------------|---------------|--------------|------------|-------------|
|                              | Case N=29     | Control N=87 | p-value    | Case N=29   |
|                              | Mean(SD)      | Mean(SD)     |            | Mean(SD)    |
| Sealants                     | 0 (0.00)      | 0.21 (0.86)  | 0.026 +*   | 0.50 (1.23) |
| Composite Restoration        | 16.71 (14.18) | 9.34 (8.87)  | 0.0002 +*  | 6.39 (5.30) |
| Extraction                   | 2.14 (2.63)   | 4.21 (3.48)  | <0.0001 +* | 3.21 (2.28) |
| Stainless steel crown (SSCs) | 3.29 (2.49)   | 4.59 (2.48)  | 0.664 +    | 3.21 (3.02) |
| Pulpotomies                  | 1.39 (1.62)   | 1.20 (1.32)  | 0.279 +    | 0.75 (1.27) |

TABLE 3 Demographic data of subjects in case (n=29) and control (n=87) groups.

|   | Case N (%) | Control N (%) | OR (CI)             | p-value |
|---|------------|---------------|---------------------|---------|
|   | Mean (SD)  | Mean (SD)     |                     |         |
| One-W FU after GA1  | 16 (57.14) | 57 (76.06)    | 0.67 (0.27 – 1.62)  | 0.3711  |
| <b>Frequency of recall appointments</b>                   |            |               |                     |         |
| Twice or more/year  | 11 (39.28) | 35 (32.18)    | -                   | -       |
| Less than twice/year                                      | 17 (60.71) | 49 (57.65)    | 0.95 (0.41 – 2.23)  | 0.9156  |
| <b>Frequency of Emergency appointments</b>                |            |               |                     |         |
| Dental infection  | 8 (27.59)  | 15 (17.24)    | 1.90 (0.69 – 5.26)  | 0.2413  |
| Periodontal infection                                     | 2 (6.90)   | 3 (3.45)      | 2.00 (0.33 – 11.97) | 0.4386  |
| Loose crown   | 6 (20.69)  | 8 (9.20)      | 2.43 (0.78 – 7.57)  | 0.1048  |
| Loose space maintainer                                    | 3 (10.34)  | 5 (5.75)      | 1.80 (0.43 – 7.53)  | 0.4142  |
| *Statistical significance (P<.05); ^Mantel-Haenszel test. |            |               |                     |         |

**TABLE 4** Number and percentage of subjects attending the one-W FU after GA1 and the post-GA1 FU recare/recall appointment with in one year after GA1.

attending the 1-W post-GA1 FU visit was higher among controls compared to cases. Although cases were less likely to regularly attend the recommended recare/recall visits and more likely to need emergency dental visits, no statistical differences existed in the frequency of recall and emergency visits between cases and controls (Table 4). Dental infection was the main reason for emergency visit among case (27.59%) followed by loose stainless steel crowns (SSCs) (20.69%).

## Discussion

The aim of the study was to investigate the common factors that exist in paediatric patients requiring a repeat dental treatment under general anaesthesia within four years after the initial dental treatment under general anaesthesia at TUSDM in Boston.

The results of the current study show that medically compromised paediatric patients, and children who were treated with more composites and less extractions were more likely to have a repeat dental treatment under general anaesthesia within four years. Failing to attend the 1-W post-GA1 FU was also more prevalent among patients who needed a repeat GA, but the results were not statistically significant. Although some variability existed between cases and controls regarding attending the recommended recare/recall visits following post GA1 visits, cases needed more emergency visits compared to controls. The results of the study emphasizes the fact that more definitive treatments like extractions and SSCs are preferable toward treatments that are more prone to failure like composite restoration especially when treatment under GA is provided to medically compromised paediatric patients. The study also reaffirms the importance of regular recare/recall visits to the dental office to monitor and prevent dental diseases.

The study showed that 29 of the 581 (4.99%) children treated under GA needed GA2 within four years. Other

studies reported a repeat rate between 1% and 20% [Almeida et al., 2000; Leagault et al., 1972; O'Sullivan and Curzon, 1991]. Behaviour management problems in children were the second most common cause of dental treatment under GA after extensive decay [Leagault et al., 1972; O'Sullivan and Curzon, 1991]. One of the limitations of our current study is that the children's behaviour toward dental examination before their GA1 was not included in the analysis. Sheller [2003] reported that children requiring GA2 within two years were found to show worse behaviour during their initial dental examination and radiograph taking before their GA1 [Sheller et al., 2003]. We have to take in consideration that none of the previous studies gave a clear definition, standardisation or classification of what behaviour management problem is.

Once the child was treated under GA his/her behaviour was found to be improved with subsequent visits. Their dentist was able to provide the required dental treatment including local anaesthesia in the dental clinic [O'Sullivan and Curzon, 1991]. Further studies based on a clear definition and classification of the behaviour management in children that require dental treatment under GA and its subsequent effect on their need for GA2 is warranted.

Dental caries is a commonly transmissible chronic infection [Loesche, 1986]. The percentage of US preschool children affected with ECC is increasing especially among poor or near poor [Tinanoff and Reisine, 2009], which increase their risk of getting new caries lesions in both their permanent and primary teeth [O'Sullivan and Curzon, 1991]. We have to keep in consideration that the dental treatment only treats the sign and symptom of ECC and does not deal with the actual cause of the diseases. On the other hand, maintaining proper oral hygiene practice and routine preventive dentistry can significantly reduce the costs/health risks and repeat GA exposure [Schroth and Smith, 2007]. Therefore, the AAPD emphasises the importance of providing these children with preventive

and therapeutic measures including more frequent professional visits and the applications of topical fluoride [American Academy of Pediatric Dentistry Council on Clinical Affairs, 2005]. Also, parents needed to take more responsibility for becoming more proactive in following proper oral hygiene and dietary protocol provided, in order to decrease the likelihood of a GA2. TUSDM has a large and diverse patient pool of cultural/ethnic backgrounds, with some families having limited English-speaking skills. We must now ask, therefore, if we are adequately instructing our caregiver(s) of the importance of the disease of caries and its continuance if strong measures are not taken. Further research regarding parental knowledge of proper preventive care is warranted.

Six year follow-up after dental treatment under GA showed that irregular post-GA1 clinic attenders had a four times increased risk of having a GA2 [Kakaounaki et al., 2011]. The importance of the initial follow-up [Leagault et al., 1972; Primosch et al., 2001; Sheller et al., 2003; Worthen and Mueller, 2000] and subsequent recare/recall appointments within one year [Leagault et al., 1972; Sheller et al., 2003; O'Sullivan and Curzon, 1991] after dental treatment under GA was evaluated by similar studies. We initially felt that attending the recommended 1-W FU after GA1 played a crucial role in reducing the need of a GA2 in paediatric patients. Although, only 307 (68.68%) of subjects returned for the 1-week post-GA1 FU appointment, this finding is higher than what was reported by Worthen (37%) [Worthen and Mueller, 2000] and Sheller (26.1%) [Sheller et al., 2003]. Surprisingly, when the association between the attendance of the 1-W post GA1 FU and the need for a GA2 was investigated in the current study, the attendance of 1-W post-GA1 FU was found not to influence the need of GA2. Sheller in 2003 reported that returning for a postoperative visit within two weeks of GA1 was statistically significant lower (7%) among subjects requiring repeat dental treatment under GA within two years after their initial GA1 compared to (43%) of control group subjects [Sheller et al., 2003]. Our study showed that by the end of the first year post-GA1, 49.21% of the subjects returned for at least once a year for recare/recall appointment within one year following their GA1. Similar percentages (75%) were reported by Leagault et al. [1972] and O'Sullivan and Curzon [1991] respectively.

Medicaid children represented (92.78%) of the subjects included in our study, which is higher than what was reported by Sheller et al. [2003]. We also found that significantly higher number of Medicaid subjects required a GA2. This data could suggest that non-Medicaid subjects possibly delayed routine, preventive or needed dental treatment in the clinic, because it afforded out-of-pocket expenses, which Medicaid recipients do not incur.

Full coverage crown provides superior durability

and longevity [Seale, 2002] and is the most successful restoration for children in the GA [Sheller et al., 2003]. In our study, the mean number of SSCs provided was  $3.5 \pm 2.4$  in GA1 and  $3.4 \pm 2.5$  in GA2. The mean (SD) number of teeth received SSCs in the case group subjects 3.29 (2.49) was less than the control group subjects 4.59 (2.48) This agrees with the study done by Seale in 2002 and reported that less children receiving SSCs during their dental treatment under general anaesthesia require repeat GA [Seale, 2002].

According to a study by Tate [2002] composite resin restorations (30%) and composite strip crowns (51%) completed under GA had the highest failure rates of any other restoration [Tate et al., 2002]. O'Sullivan and Curzon [1991] found that amalgam and composite restorations (29%) placed under GA had extremely higher failure rates compared to SSCs (3%). In the current study, composite restoration was the most common dental procedure provided for the patients during their GA1 and GA2. This can be a contributing factor that played a role in the need for a GA2 in some of the patients. Further evaluation in the success rate of the type of treatment provided during GA1 and its influence on the need for further dental treatment under GA is warranted.

The need for a third dental treatment under GA for the subjects was not recorded for the current study. The dental treatment under GA was provided by postgraduate students under the supervision of faculty members at TUSDM in Boston. Also, the dental records were written by different undergraduate and postgraduate students. It is reasonable to assume that the quality of the treatments provided were not the same and that not all of the data were similarly recorded. Parents who received dental education using visual aid following their child's dental treatment under GA were more likely to bring their children in for the follow-up visits recommended [Picard et al., 2014]. Therefore, prospective studies on larger number of children together with providing proper education and dental prevention program for these children and their caregivers will help to provide a better understanding of the risk factors associated with the need of a repeat dental treatment under GA in children.

## Conclusion

Within the limitations of our study, the frequency of repeat dental treatment under general anaesthesia within four years of the initial treatment is relatively low. Medically compromised children and children treated with more composites and fewer sealant and extractions at their initial dental treatment under general anaesthesia were more likely to have a repeat dental treatment under general anaesthesia within four years. Less children required repeat dental treatment

under general anaesthesia attended the recommended 1-W post GA1FU and were less likely to regularly attend the recommended recare/recall visits and more likely to need emergency dental visits.

### Acknowledgements

We would like to give special thanks to Angel Park from the Department of Academic Affairs, Tufts University School of Dental Medicine, for the help in the statistical analysis. This study was supported by U.S. Department of Health and Human Services Health Resources and Services Administration grant D84HP19955.

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