Journal of Autism and Developmental Disorders
https://doi.org/10.1007/s10803-021-04898-w

BRIEF REPORT

Brief Report: Analysis of Dental Treatment Provided Under General Anaesthesia for Children and Young Adults with Autistic Spectrum Disorder and Identification of Challenges for Dental Services

Jennifer Ann Parry[1,2] · Sinead Brosnan[3] · J. Tim Newton[4] · Conor Linehan[5] · Christian Ryan[5]

Accepted: 22 January 2021

Abstract

Dental treatment provided under general anaesthesia (DGA) is an expectation for many children and young adults (CYA) diagnosed with Autistic Spectrum Disorder (ASD). Planning and delivery of DGA requires consideration of morbidity and mortality risks and implications for families and healthcare services. One hundred patient records of CYA with special healthcare needs were analysed to examine characteristics and experience of DGA revealing that 79% of CYA had a diagnosis of ASD. Forty-seven percent of CYA diagnosed with ASD had at least one previous hospital admission for DGA. For 24% of this repeat DGA group, the previous DGA was within a two-year period. Results highlight a high rate of DGA and need to investigate more effective primary dental care strategies.

Keywords Autistic spectrum disorder · General anaesthesia · Dentistry · Dental services · Dental general anaesthesia

Dental caries (cavities) develop when there is an imbalance between pathological factors and dental protective factors (Featherstone and Chaffee 2018). Admission to hospital for young children requiring dental treatment is recognised as an unfortunate, preventable common occurrence (McAuliffe et al. 2017). For children and young adults (CYA) diagnosed with Autistic Spectrum Disorder (ASD), particularly those with sensory sensitivity and a low level of functioning, dental treatments and repeat treatments under general anaesthesia are often expected. Availability of hospital dental general anaesthetic services (DGA) for CYA diagnosed with ASD are recognised as important and can provide advantages in terms of a single visit with a predictable dental treatment outcome. However, there are risks associated with general anaesthesia provision. The risk of a healthy child dying from a general anaesthetic during non-emergency surgery is estimated to be 1 in 100,000 (van der Griend et al. 2011). Risks may be lower in children over the age of one year, but higher for a child with additional complex medical comorbidity. Severe critical events, such as respiratory or cardiac events, associated with paediatric anaesthesia have been estimated at 5% (Wolf 2017). Representation of CYA with ASD on DGA lists of 12% to 14% have been reported (Arnold et al. 2015; Ciftci and Yazicioglu 2020). Logistical safety requirements such as fasting and monitoring can present challenges, as can post-operative nausea and vomiting and post-operative surgical discomfort. It is acknowledged that there is little research about pain assessment in the ASD population, and that communication challenges associated

✉ Jennifer Ann Parry
jennifer.parry@ucc.ie; jenniferparry@nhs.net

Sinead Brosnan
sinead.brosnan@ucc.ie

J. Tim Newton
tim.newton@kcl.ac.uk

Conor Linehan
conor.linehan@ucc.ie

Christian Ryan
christian.ryan@ucc.ie

1 Present Address: School of Applied Psychology, University College Cork, Cork, Ireland

2 Sussex Community NHS Foundation Trust, Special Care Dental Service, Haywards Heath Health Centre, Haywards Heath RH16 3BB, UK

3 Cork University Dental School and Hospital, University College Cork, Cork T12 E8YV, Ireland

4 Centre for Oral, Clinical and Translational Sciences, King's College London, Floor 18, Guy's Hospital Tower, London SE1 1UL, UK

5 School of Applied Psychology, University College Cork, North Mall, Cork T23 TK30, Ireland

Published online: 08 February 2021

with ASD can make assessing postoperative pain more difficult for health care providers (Arnold et al. 2015). In order to avoid risks of severe critical events, morbidity and mortality associated with general anaesthesia, there is an accepted agreement from many paediatric dental units that following a dental GA, no child should need a repeat DGA within the following two-year period (Kirby et al. 2020). However, it has also been acknowledged that the need for repeat DGA can be significantly affected by a child's medical diagnosis (Amin et al. 2015; Tahmassebi et al. 2014). There is limited research published regarding DGA use and repeat DGA rates specifically for CYA diagnosed with ASD. This brief report describes analysis carried out to investigate the representation, characteristics, experience and treatment of CYA diagnosed with ASD attending for DGA at a hospital aiming to improve preparedness and support for patients diagnosed with ASD. The hospital is a centre of referral serving a population of over 1.1 million in the Republic of Ireland.

Method

Ethical approval was gained from the Hospital's Clinical Research Ethics Committee in January 2020 to review100 consecutive case notes of CYA aged 1-16 years attending the weekly DGA service for CYA with special healthcare needs. A period of attendance between January 2019 and October 2019 was selected for retrospective review of dental case notes. Patient identifier (ID) numbers allocated to the DGA list during the period under examination were retrieved from the dental electronic patient record system used at the University Dental Hospital. ID numbers assigned to CYA, who subsequently cancelled or were reschedule for the DGA appointment outside the analysis period ($n = 17$), ID numbers of dental case note records which could not be located ($n = 11$), and records lacking details of the operative procedure or anaesthetic within the dental notes ($n = 1$) were excluded. Analysis of the 100 DGA dental case notes retrieved, following exclusions, identified 79 CYA records where the primary medical diagnosis recorded was ASD. The 79 ASD records identified were analysed to examine patient characteristics, treatment and experience of DGA service for this report.

Results

Patient Characteristics

There were 19 females and 60 males. The mean age of attendance for DGA was 9 years-old (range 4-16). Sixteen CYA were recorded as being non-verbal, including one child described with selective mutism.

Medical History

Thirty-five CYA (44%) had at least one other medical diagnosis recorded in addition to their ASD diagnosis. The most common comorbidities recorded alone or with other comorbidities were asthma (11), ADHD (7), and epilepsy (5). Thirty-six CYA (46%) were taking at least one daily medication. Medications for relief of asthma symptoms, regulation of sleep, relief of constipation, stimulant medication and anti-epileptic drugs were the most common medications recorded. Melatonin was noted as a daily medicine in 14 records. Gastrointestinal problems, feeding issues or alteration of diet was recorded for 10 CYA.

Patient Experience and Treatment

Preparation for induction of general anaesthesia involved midazolam premedication prescription for 49 CYA (62%). Two CYA who were prescribed premedication refused or spat out the medicine at administration. The primary dental diagnosis recorded for 91% of CYA was dental caries (dental cavities). Other diagnoses included tooth developmental abnormalities, retained teeth or trauma. Dental treatments provided included extractions, restorations (fillings) and preventive treatments. Figure 1 presents results for dental treatment distribution according to age and stage of dental development (primary / deciduous dentition, mixed dentition, permanent dentition). This age categorisation also reflects planned availability of packages of dental care within the new Irish National Oral Health Policy (Department of Health 2019). The majority of CYA ($n = 61$) were in the 6–12 years age range and therefore in the mixed dentition stage of development with both permanent and primary/deciduous teeth present. Fifty-three CYA had primary teeth extracted and 14 CYA had permanent teeth extracted. All CYA receiving DGA treatment had at least one treatment aiming to help prevent future dental disease (Fig. 1).

Distance travelled to hospital for DGA was calculated. Eight families had a round trip greater that 200 km with one family having a return journey of 386 km. Duration of procedure was recorded in 63 of the dental notes retrieved. The duration of DGA recorded ranged from 40 to 180 min (Fig. 2).

Comments relating to pre- and post-operative behaviour problems such as "crying a lot, refusing monitoring equipment, aggressive and lashing out" or comments stating that completion of post-operative monitoring was prevented by CYA behaviour were recorded (Table 1). The potential impact of age and distance travelled to the hospital as factors that might have affected the occurrence of behaviour problems before the DGA were analysed. Neither of these factors was statistically significant (Table 1). The potential influence

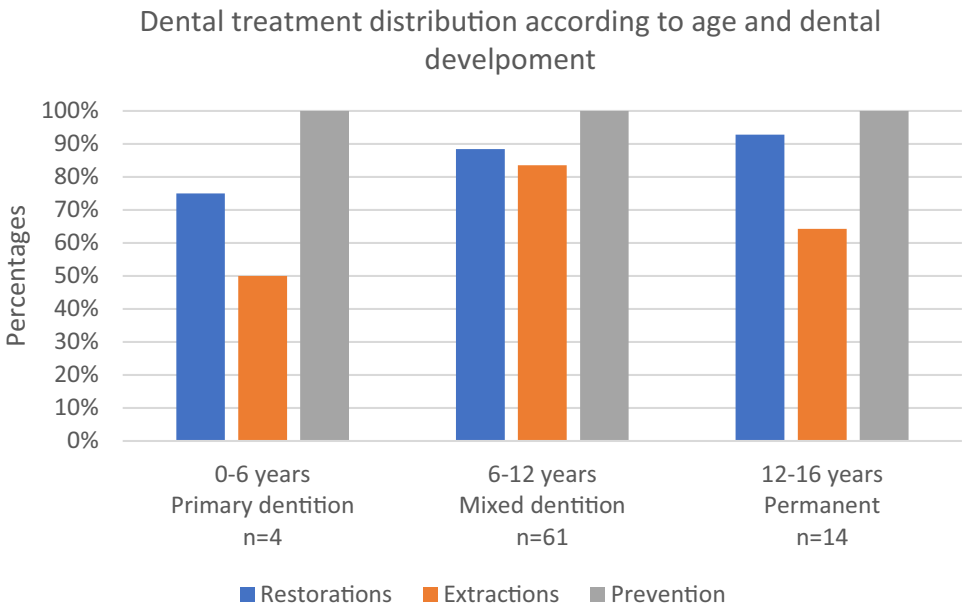

Fig. 1 Dental treatment distribution according to age and dental development

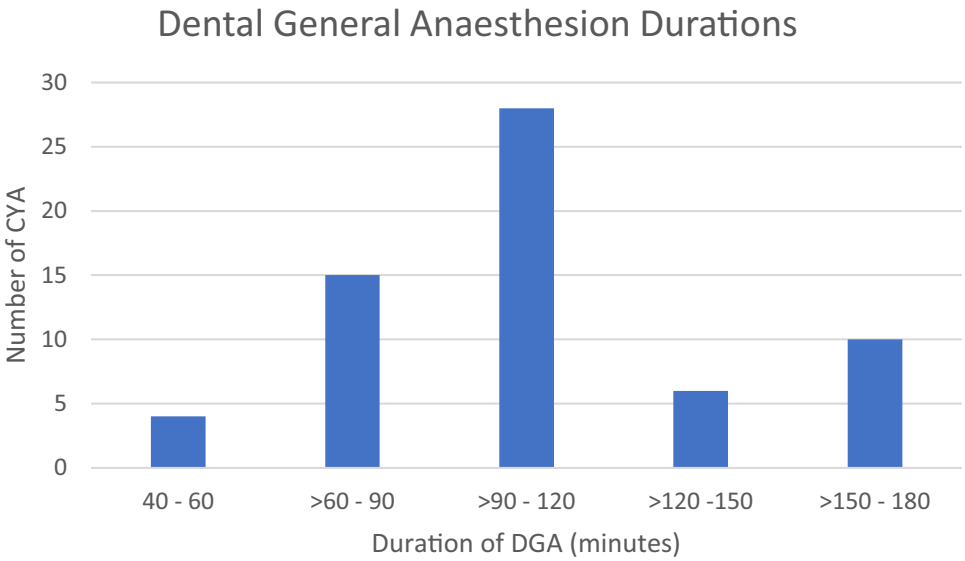

Fig. 2 Duration of dental general anaesthesia recorded for CYA

Table 1 Exploration of factors associated with negative behaviour problems pre- and post-treatment

		No behaviour problems ($n=65$) Mean (sd)	Behaviour problems ($n=14$) Mean (sd)	*t* test	*p* value
Pre-treatment	Age	9.38 (2.48)	9.00 (3.09)	0.44	.67
	Distance travelled	35.83 (33.8)	47.02 (56.4)	− 0.72	.49
Post-treatment[a]	Number of teeth extracted	2.53 (2.31)	2.60 (2.82)	− 0.09	.93
	Age	9.42 (2.54)	8.87 (2.80)	0.70	.49
	Distance travelled (Km.)	36.36 (38.82)	44.03 (38.01)	− 0.70	.49
	Treatment duration (mins.)[b]	108.42 (32.17)	114.62 (32.82)	− 0.61	.55

[a]N for behaviour problems was slightly higher for post-treatment ($n=15$)

[b]Due to some missing data, the Ns for duration were 47 and 13 respectively

of number of teeth extracted, age of the child, distance travelled and the duration of the procedure as predictors of post-operative negative behaviour were also examined. As can be seen in Table 1, none of these factors was significantly associated with the occurrence of post-operative negative behaviour recorded. Five of the 15 CYA with comments relating to negative post-operative behaviour had restorative dental filling treatment and did not have any teeth extracted. A four-year-old child who had 12 primary teeth extracted had no record of post-operative negative behaviour.

Analysis established that 37 CYA (47%) had at least one DGA recorded previously. The average time between the first and second DGA was 3 years 1 month (range 28 days – 8 years). Twenty-four percent of those CYA attending for repeat DGA had a previous DGA within 2 years of the most recent DGA. In addition to the attendance being analysed, 10 CYA were recorded as having two previous DGAs, three children had three previous DGAs.

Discussion

CYA diagnosed with ASD comprised the largest category (79%) attending for treatment on the DGA list dedicated to CYA with special health care needs in this analysis from a regional referral hospital in Ireland. Direct comparison with other studies is difficult as ASD is not always classified as a single special health care category within reports of DGA services. Where specific categorisation of ASD can be found within DGA analyses, figures for ASD attendance rates of 12% to 14% have been reported (Arnold et al. 2015; Ciftci and Yazicioglu 2020). Difficulties establishing good oral health practices were highlighted in a Public Health England survey which revealed that 24% of 5-year-olds and 12% of 12-year-olds with ASD were resistant or refused a dental examination even within their familiar special school setting environment (Public Health England 2015).

The data from our analysis reveals reliance on DGA services for provision of dental treatment for many CYA diagnosed with ASD. When CYA are identified who cannot accept routine dental care and prevention, the implications for families and carers need to be identified and understood so that values and care delivered by the health system match the values and expectations of parents and carers for their CYAs. Daily medication, taken by 46% of CYA in this analysis, can be an important caries risk factor if medication is not sugar free or contributes to salivary dysfunction. Evidence based guidelines for prevention of dental caries exist (Public Health England 2014) but tailored oral health support is required to ensure realistic guidance is available for families who may be burdened with lack of sleep, coping with food aversions and restricted intake (Cermak et al. 2010), and unable to change timing or content of medication (to sugar free) because of sensory and change sensitivities (Chistol et al. 2018).

Midazolam premedication was prescribed for 62% of CYA. Studies have identified challenging negative experiences for patients, parents and staff associated with administration of premedication for CYA with ASD (Taghizadeh et al. 2019). Although not reflected in the current data, there is a growing pattern of tailored use of non-standard premedication and combination premedication for children diagnosed with ASD (Arnold et al. 2015; Taghizadeh et al. 2015).

It is recognised that CYA with ASD attend for frequent interventional use of health care services (Cummings et al. 2016). This analysis highlights areas of particular attention for pre-operative discussion and planning with parents prior to hospitalisation for DGA. These include information regarding premedication, duration of DGA and behaviour problems pre- and post-operatively. There was no evidence from our analysis that peri-operative behaviour could be predicted by distance travelled, age, duration of procedure or complexity of surgery.

The high percentage of extractions (84%) in the 6 -12 years age group has been reported previously (Savanheimo et al. 2012) and reflects the length of time the primary/baby teeth have been in the mouth with failure of professional or homecare strategies to prevent the dental caries process. DGA is a costly service requiring high numbers of staff, specialist facilities and equipment for safe provision. Duration of DGA, including delays associated with behaviour issues, have resource implications in terms of financial and opportunity costs and length of waiting lists (Jameson et al. 2007). In this analysis the duration of DGA recorded ranged from 40 to 180 min. There is limited research published regarding cost of DGA services for CYA with special health care needs. The most recent DGA cost per patient, for adults with disabilities in Ireland was estimated at €2242.87 (McGeown et al. 2018). Some public funded DGA services in Ireland and UK concentrate resources on short duration DGAs and a more aggressive approach, providing dental extractions only. The more comprehensive approach with provision of dental restorations and preventive treatments as well as extractions requires longer duration of DGA, increased costs and decreased number of patients treated per DGA session. Appropriate treatment planning and care is required to ensure responsible stewardship of health care and family time and resources.

Policies regarding acceptance of referrals for DGA and availability of DGA vary between regions and countries but should always reflect the best interest of the CYA weighing up associated risks and benefits. There is expert agreement regarding safety concerns and goals to avoid repeat DGA within a two-year period (Kirby et al. 2020). There are also resource implications associated with high repeat DGA rates.

The high (47%) repeat DGA rate in this ASD population compares unfavourably with population repeat DGA rates available for CYA from the UK which range from 0.36% to 37% (Kirby et al. 2020). To assist data comparison, service planning and staff training hospital statistics for DGA should be readily accessible with clear categorisation by medical diagnoses and repeat DGA episodes. Service evaluation exercises should encourage team reflection to ensure that wherever possible dental treatment strategies reduce avoidable repeat DGA. Attendance and rates of repeat DGA (47%) identified in the current dataset may reflect dentists' lack of training, skills and confidence in treating CYA with ASD in a primary care setting or may reflect parent and carer concerns and preference for the DGA treatment modality. This analysis highlights the need for more research to clarify which of these factors may be driving higher rates of DGA in CYA with ASD. The burden associated with dental care and attendance within a health care plan following ASD diagnosis is often overlooked. Collaboration between dental health professionals and the wider team of paediatricians, clinical psychologists, feeding disorder specialists, speech and language and occupation therapists at the post-diagnostic stage should be considered to provide opportunities to implement oral health advice and therapies within other personal health strategies.

This analysis demonstrates dental clinical need with dependency on access to DGA services for many CYA diagnosed with ASD. The importance of planning for access to appropriate and timely DGA services is acknowledged. However, this analysis also highlights a need to further investigate effective strategies in primary dental care which could help reduce the identified reliance on DGA services.

Conclusion

This study revealed that for CYA identified with special healthcare needs, the rate of DGA attendance for those diagnosed with ASD is higher than for their non-ASD peers. It is recognised that DGA is unlikely to be avoidable, when ASD traits interfere with daily dental preventive oral hygiene and dietary guidance and affect coping strategies required to deal with the highly sensory and invasive challenges of dental treatment. This report highlights the burden of dental care for families and dental healthcare resources and begins to investigate some of the factors that may affect the occurrence of behaviour problems for CYA with ASD pre- or post-operatively when DGA is unavoidable. Further work is necessary to explore the mediating factors for pre- and post-operative behavioural difficulties encountered during DGA attendance, with a view to developing suitable intervention techniques. Research is also required to investigate if treatment need and DGA attendance could be reduced with education and training for dental health care professionals and through development of more collaborative strategies with families and other healthcare professionals.

Acknowledgments This paper will contribute to the preparation of a doctoral dissertation for J Parry.

Author Contributions JP, CR and JTN contributed to the analysis and interpretation of data. JP and SB organised the acquisition of the data with assistance on design from JTN. All authors contributed to the drafting the work, revising it critically and approving it for publication.

Compliance with Ethical Standards

Conflict of interest The authors have no conflicts of interest to declare that are relevant to the content of this article.

References

Amin, M., Nouri, R., ElSalhy, M., Shah, P., & Azarpazhooh, A. (2015). Caries recurrence after treatment under general anaesthesia for early childhood caries: A retrospective cohort study. *European Archives of Paediatric Dentistry, 16*(4), 325–331. https://doi.org/10.1007/s40368-014-0166-4.

Arnold, B., Elliott, A., Laohamroonvorapongse, D., Hanna, J., Norvell, D., & Koh, J. (2015). Autistic children and anesthesia: Is their perioperative experience different? *Pediatric Anesthesia, 25*(11), 1103–1110. https://doi.org/10.1111/pan.12739.

Cermak, S. A., Curtin, C., & Bandini, L. G. (2010). Food selectivity and sensory sensitivity in children with autism spectrum disorders. *Journal of the American Dietetic Association, 110*(2), 238–246.

Chistol, L. T., Bandini, L. G., Must, A., Phillips, S., Cermak, S. A., & Curtin, C. (2018). Sensory sensitivity and food selectivity in children with autism spectrum disorder. *Journal of Autism and Developmental Disorders, 48*(2), 583–591.

Ciftci, V., & Yazicioglu, I. (2020). A retrospective comparison of dental treatment under general anesthesia provided for uncooperative healthy patients and patients with special health care needs. *Journal of Clinical Pediatric Dentistry, 44*(3), 196–201. https://doi.org/10.17796/1053-4625-44.3.11.

Cummings, J. R., Lynch, F. L., Rust, K. C., Coleman, K. J., Madden, J. M., Owen-Smith, A. A., et al. (2016). Health services utilization among children with and without autism Spectrum disorders. *Journal of Autism and Developmental Disorders, 46*(3), 910–920. https://doi.org/10.1007/s10803-015-2634-z.

Department of Health, (2019). *Smile Agus Sláinte: National Oral Health Policy*. Retrieved from https://health.gov.ie/wp-content/uploads/2019/04/NOHP-Main-FINAL.pdf

Featherstone, J., & Chaffee, B. (2018). The evidence for caries management by risk assessment (CAMBRA®). *Advances in Dental Research, 29*(1), 9–14.

Jameson, K., Averley, P., Shackley, P., & Steele, J. (2007). A comparison of the'cost per child treated'at a primary care-based sedation referral service, compared to a general anaesthetic in hospital. *British Dental Journal, 203*(6), E13–E13.

Kirby, J., Walshaw, E. G., Yesudian, G., & Deery, C. (2020). Repeat paediatric dental general anaesthesia at Sheffield Children's NHS foundation trust: A service evaluation. *British Dental Journal, 228*(4), 255–258. https://doi.org/10.1038/s41415-020-1256-9.

McAuliffe, Ú., Kinirons, M., & Harding, M. (2017). *A retrospective investigation of the oral health records of a cohort of preschool children who received extractions under general anaesthesia including cost analysis of treatment*.

McGeown, D., Stapleton, S., & Nunn, J. (2018). A cost analysis estimation of a single episode of comprehensive dental treatment under general anaesthesia for adults with disabilities. *British Dental Journal, 224*(6), 442–446.

Public Health England. (2014). *Delivering better oral health: An evidence-based toolkit for prevention*. In: Public Health England London.

Public Health England. (2015). *Oral health survey of children attending special support schools*. Retrieved from https://www.gov.uk/government/statistics/oral-health-of-5-and-12-year-old-children-attending-special-support-schools-in-england-2014

Savanheimo, N., Sundberg, S. A., Virtanen, J. I., & Vehkalahti, M. M. (2012). Dental care and treatments provided under general anaesthesia in the Helsinki public dental service. *BMC Oral Health, 12*(1), 45.

Taghizadeh, N., Davidson, A., Williams, K., & Story, D. (2015). Autism spectrum disorder (ASD) and its perioperative management. *Pediatric Anesthesia, 25*(11), 1076–1084. https://doi.org/10.1111/pan.12732.

Taghizadeh, N., Heard, G., Davidson, A., Williams, K., & Story, D. (2019). The experiences of children with autism spectrum disorder, their caregivers and health care providers during day procedure: A mixed methods study. *Pediatric Anesthesia, 29*(9), 927–937. https://doi.org/10.1111/pan.13689.

Tahmassebi, J. F., Achol, L. T., & Fayle, S. A. (2014). Analysis of dental care of children receiving comprehensive care under general anaesthesia at a teaching hospital in England. *European Archives of Paediatric Dentistry, 15*(5), 353–360. https://doi.org/10.1007/s40368-014-0123-2.

van der Griend, B. F., Lister, N. A., McKenzie, I. M., Martin, N., Ragg, P. G., Sheppard, S. J., & Davidson, A. J. (2011). Postoperative mortality in children after 101,885 anesthetics at a tertiary pediatric hospital. *Anesthesia and Analgesia, 112*(6), 1440–1447. https://doi.org/10.1213/ANE.0b013e318213be52.

Wolf, A. (2017). Reducing risk in pediatric anesthesia: What are the implications from the APRICOT study? *Pediatric Anesthesia, 27*(7), 674–675. https://doi.org/10.1111/pan.13177.