

ORIGINAL RESEARCH

The impact of medical status on the choice of dental procedures under general anesthesia—a retrospective study

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Abstract

Background: The purpose of this study was to assess the type of dental procedures performed on children under General Anesthesia (GA) and to determine if the pattern differs between healthy children and those with special healthcare needs. **Methods:** In this retrospective study, data were reviewed from the dental records of pediatric patients who underwent dental treatment under GA from 2015 to 2020 at Nantes University Hospital. Patients with mental or physical disabilities were categorized as Disabled (D), while healthy children were assigned to the Healthy group (H). Records from patients with Systemic Diseases were also analyzed with (D + SD) or without (SD) Disabilities. **Results:** The mean age of each group was evaluated and compared to the others. The number and type of dental treatments were compared between each group for both primary and permanent teeth. A total of 655 patients were treated under GA. Patients in groups H and SD were significantly younger than those in the disabled group ($p < 0.001$). Primary teeth were more frequently treated in groups H and SD than in groups D and SD + D, while the opposite was true for permanent teeth. There were more extractions of primary teeth than restorative treatments performed in children with disabilities ($p = 0.0005$). **Conclusions:** The findings of this study suggest that the health conditions of young patients could impact their dental procedures when undergoing GA. Children with systemic diseases don't seem to differ from healthy patients in the acts performed, but patients with disabilities do.

Keywords

Pediatric dentistry; Disabled children; General anesthesia; Systemic diseases

1. Introduction

Dental treatment of pediatric patients can be difficult due to their high levels of anxiety, which may lead to limited cooperation with clinicians [1, 2]. This is a very common situation in pediatric dentistry, and the main challenge for a dentist caring for children. Many situations can be addressed using non-pharmaceutical behavioral techniques, but some young patients may not respond well due to a lack of psychological or emotional maturity, or because of mental, physical or medical disabilities [3–6]. In such cases, they may not be able to tolerate treatment under local anesthesia alone or in combination with inhalation sedation (nitrous oxide/oxygen sedation) [7]. General anesthesia allows access to comprehensive oral rehabilitation in a single session including full mouth prophylaxis treatment, pulp therapy, tooth extraction and dental restoration. It may be indicated by a dentist when regular care has failed, when the patient medical status imposes heavy or urgent therapies, when the planned procedure is going to be complex in relation to the patient's cooperation, or

when local anesthesia is impossible or unsatisfactory following repeated attempts. There are risks associated with the products used to obtain deep sedation and the consequences of doing so. Patients and their parents must be informed.

Oral health is often described as a source of health inequalities in people with disabilities. “Oral health is multi-faceted and includes the ability to speak, smile, smell, taste, touch, chew, swallow and convey a range of emotions through facial expressions with confidence and without pain, discomfort and disease of the craniofacial complex” according to the Federation Dentaire Internationale (FDI). Studies have shown that oral health in these individuals is reported to be worse than healthy children [8–10] due to difficulties in maintaining oral hygiene and coping skills in dental offices [11]. General anesthesia may also be required for children with systemic diseases due to risks or contraindications related to their conditions (diabetes mellitus, cardiovascular diseases, neurological diseases, *etc.*). Moreover, systemic diseases and their associated medications are known to sometimes aggravate dental illnesses [12].

Some studies have suggested that during general anesthesia, the balance between conservative dental treatments and extractions is affected by the child's medical status [3, 13, 14]. More data is required to improve our understanding and management of patients. Therefore, the purpose of this retrospective study was to assess the differences in treatments performed under general anesthesia at Nantes University Hospital between children with special healthcare needs, those who have disabilities or systemic diseases, and their healthy peers.

2. Material and methods

This retrospective monocentric study was conducted at Nantes University Hospital, France, based on an analysis of past medical records (dental and general) available in the hospital database. The research protocol was approved by the Department of Clinical Research and Innovation of the hospital. And as this was a retrospective study, ethical approval and informed consent were waived by the University Hospital of Nantes.

2.1 Study participants

Information was manually reviewed through the different software programs used in the hospital. By cross-checking them, we identified 655 patients under 17-years-old who received dental treatment under General Anesthesia (GA) between 2015 and 2020. Date of birth, medical situation and dental care under GA were required for each patient to be included in this study.

2.2 Methodology

All patients were either referred by dentist offices (about 80%) or were already followed in the hospital (about 20%). GA was planned after the failure of behavioral techniques and/or conscious sedation. The waiting time between planning and GA ranged from 6 months to 1 year (average 8 months). No distinction was made according to the patient's health, as scheduling was done in order of consultation. The delay depended on the availability of the operating room. Temporary dental care could be performed depending on children's cooperation. Anesthetic preoperative assessment was received by all patients and a pediatric anesthesiologist assessed if their general condition was suitable for GA, using the American Society of Anesthesiologists (ASA) classification. Information was given to parents prior to obtaining their written consent. Dental treatment was performed by three different dentists over the 5 years. Patients were asked to attend a follow-up control 3 to 6 months post-treatment.

Patients were divided into four groups according to medical status. The first group consisted of Healthy children (H); the second group involved children with Systemic Diseases (SD); the third group concerned our patients suffering from at least one mental or physical Disability (D); while the last one involved children suffering from both Disability and Systemic Disease (D + SD). The data regarding patient age, general health, and type of treatment were analyzed. Dental care was classified into restorative procedures, endodontic treatment, and extraction for both permanent or primary teeth.

2.3 Statistical analysis

All data were manually retrieved by the same investigator by cross-checking the two hospital databases: Clinicom® (France) and MacDent® (France). Quantitative data were assessed by descriptive analysis using mean and standard deviation. Qualitative data were expressed by number and frequency. The mean age of every group was evaluated using an analysis of variance (ANOVA) test, followed by a *post-hoc* Tukey test. The Student's *t*-test was used to check variations in the mean number of each type of dental treatment. The ratio between dental extractions and conservative treatment was also calculated and compared using a Fisher test. Validity conditions were confirmed for every test. Statistics were performed using Python® (3.11.2 version, USA) and Jamovi® (2.3.16 version, Netherlands). Figures were created using Canva® (1.62.0 version, Perth, WA, Australia) and Jamovi® (2.3.16 version, Netherlands).

3. Results

3.1 Descriptive analysis

After screening the database, a total of 655 patients were eligible for study inclusion. As shown in Fig. 1, 461 were assigned to group H (70.4%); 77 to group SD (11.8%); 82 to group D (12.5%); and the remaining 35 of them to the group D + SD (5.3%).

The mean age was calculated for each group. For group H, the average age was 5.66 years (± 0.17), while it was 6.22 (± 0.74) in the SD group. Patients in group D were on average 8.57 years old (± 0.61), when they were 8.89 years (± 1.18) old in the D + SD group.

Overall, a total of 5962 teeth were treated, with 5153 (86.4%) of them being primary teeth, and 810 (13.6%) permanent teeth. The distribution of patients between the 4 groups is shown in Fig. 2. Group H shows 3946 (90.3%) primary teeth on 4372 teeth treated; while in group SD 615 (87.1%) of the 706 teeth attended were primary. In group D, these numbers were 413 (66.3%) on 623 teeth treated; and 179 (68.3%) on 262 in group D + SD.

Table 1 illustrates the distribution of dental care (Restorative, Endodontic or Extraction) performed on primary or permanent teeth. It is important to acknowledge that for every endodontic treatment, restorative care is needed on the same tooth. This means that the sum of all treatments is not equal to the number of teeth treated overall.

For primary teeth, the endodontic treatment ratio was similar in each group (ranging from 9.1% of all treatments in the D + SD group to 12.6% in SD group) (Fig. 3). Patients with disabilities with or without systemic disease had more teeth extracted than restored (48.2% extraction vs. 42.7% restorative treatment and 50.7% vs. 39.5%, respectively). Opposite results were observed from patients in group H and SD (respectively 46.3% restorative treatment vs. 41.2% extraction; and 48.2% vs. 39.2%). Regarding permanent teeth, restorative care was above other treatments in all groups (Fig. 4).

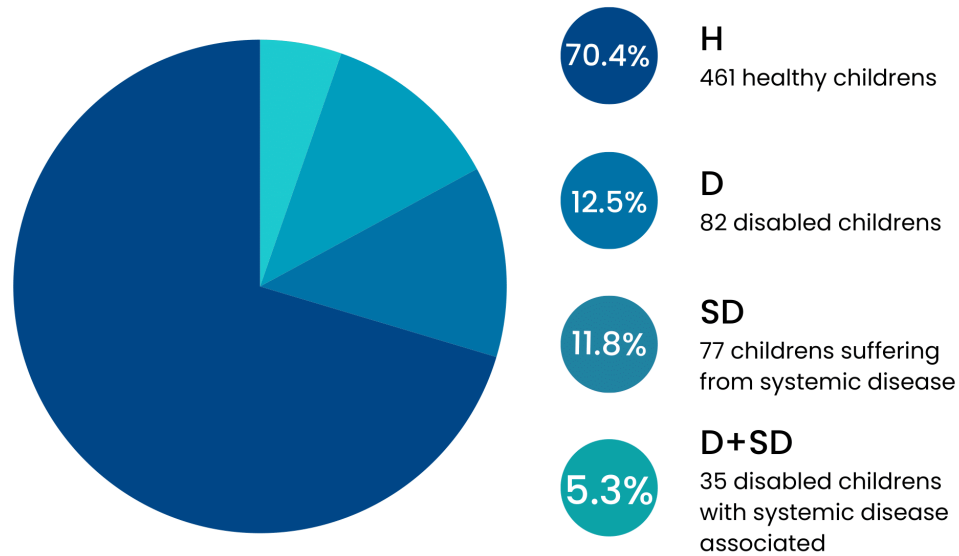


FIGURE 1. Distribution of patients according to their medical status. H: Healthy; D: Disabled; SD: Systemic Diseases.

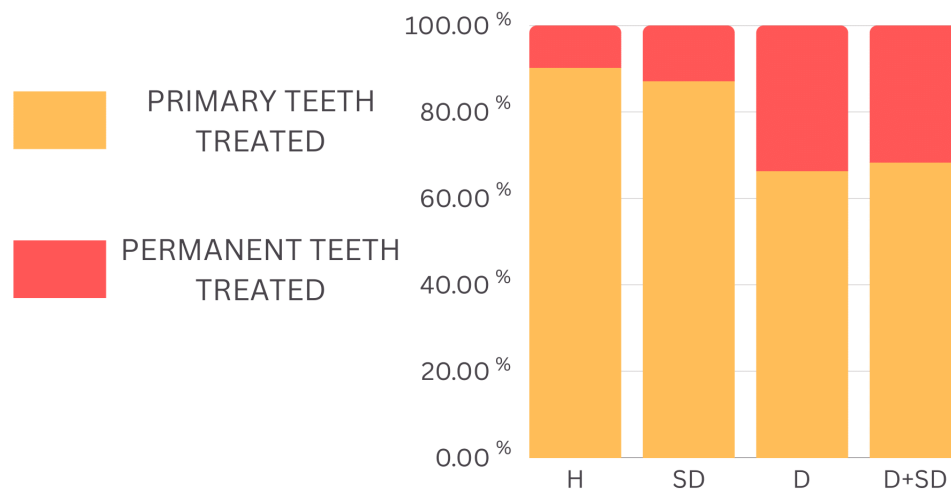


FIGURE 2. Primary and permanent teeth treated. H: Healthy; D: Disabled; SD: Systemic Diseases.

TABLE 1. Type and number of dental cares performed on primary and permanent teeth.

	Restorative Treatment	Endodontic Treatment	Extraction	Pediatric Crown	Total of Treatments	Teeth Treated
Primary Teeth						
H	2087	563	1859	0	4509	3946
SD	339	89	276	0	704	615
D	181	45	232	0	458	413
SD + D	84	18	95	0	197	179
Total	2691	715	2462	0	5868	515
Permanent Teeth						
H	308	5	108	13	431	426
SD	57	4	31	3	95	91
D	157	3	50	3	213	210
SD + D	60	0	23	0	83	83
Total	582	12	212	16	822	810

H: Healthy; D: Disabled; SD: Systemic Diseases.

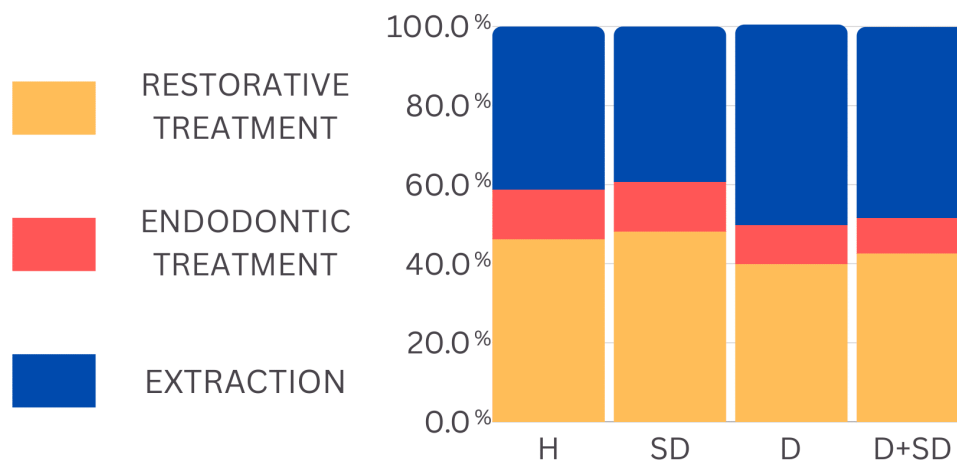


FIGURE 3. Dental treatment performed on primary teeth. H: Healthy; D: Disabled; SD: Systemic Diseases.

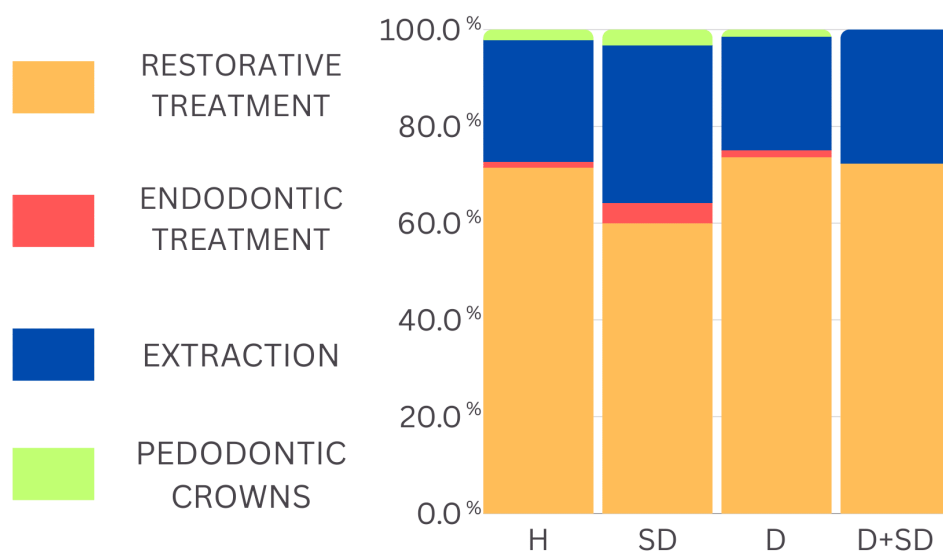


FIGURE 4. Dental treatment performed on permanent teeth. H: Healthy; D: Disabled; SD: Systemic Diseases.

3.2 Comparative analysis

Healthy children and those suffering from systemic disease were significantly younger than their disabled peers (Fig. 5).

Our results show that disabled children, with or without systemic diseases, present a significantly lower number of primary teeth treated compared to patients from group H or SD (Table 2). Focusing on those primary teeth, our study revealed significantly more restorative treatment and pulp therapy in group H or SD compared to their disabled counterparts. Healthy children also exhibit significantly more primary teeth extracted than disabled children (D and D + SD).

Most of those trends reverse when considering permanent teeth, which were significantly more impacted when children were disabled. Restorative treatment and extractions were significantly lower in healthy children than in disabled ones (D and D + SD). The low number of endodontic treatments and pedodontic crowns carried out on permanent teeth did not make it possible to identify a significant trend in this study.

Overall, during an intervention under general anesthesia, significantly more teeth (permanent and primary) were treated in healthy children compared to disabled ones with ($p =$

0.0024) or without ($p = 0.00002$) systemic diseases. Similarly, more teeth were treated in group SD than in group D ($p = 0.0077$) and D + SD ($p = 0.04$). When it came to evaluating the proportion of extraction in comparison to restorative care on primary teeth, this study highlights a significantly higher ratio of dental extraction in disabled children than in group H and SD ($p = 0.0005$).

4. Discussion

The use of general anesthesia for dental care can be essential for providing safety and efficacy to certain groups of patients. Individuals with mental or physical disabilities, and very young children with low cooperation skills are known to be a major part of this group [14–16]. In this study conducted at the Nantes University Hospital, we aimed to determine whether the medical condition of pediatric patients undergoing general anesthesia was a factor in the type of dental care they received. We analyzed dental records from 655 young patients.

Our results indicate an increased number of primary teeth treated in children without disabilities, whether we focus on

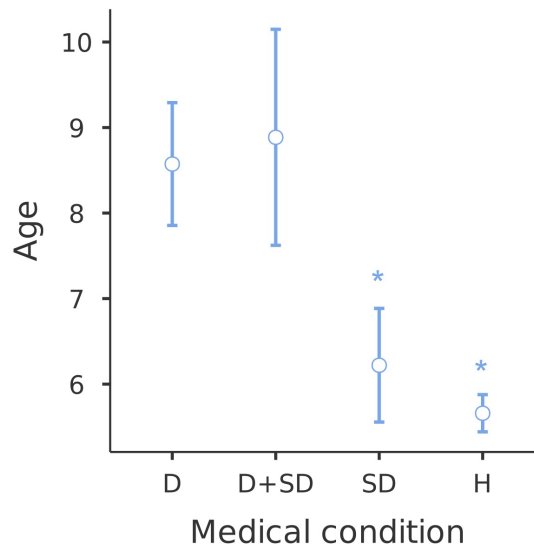


FIGURE 5. Age distribution of children suffering from at least one mental or physical Disability (D), children suffering from both Disability and Systemic Disease (D + SD), children with Systemic Diseases (SD) and Healthy children (H) expressed in mean \pm standard deviation. *Significantly different from D and D + SD ($p < 0.001$).

restorative and pulp therapy, extraction or all treatments on primary dentition. These results are consistent with other findings showing that treatment of primary dentition was more frequently performed in healthy children compared to medically compromised ones [3]. This might be explained by a difference in age distribution. In this study, disabled patients were significantly older than healthy children, in agreement with findings by Haubek *et al.* [17]. In healthy and systemic disease groups, the major issue for dental office treatment was the lack of cooperation and reluctance due to the patients' young age. As they age, these patients are more likely to understand and tolerate dental treatment under local anesthesia. This could explain the age discrepancy between them.

However, for primary teeth, the proportion of extractions to restorative care in our patients was significantly higher when they suffered from a handicap. An underlying medical condition may influence the choice of treatment by the pedi-

atric dentist, leading them towards more invasive procedures for disabled children; as discussed by Harrison and Roberts [18]. According to them, the dentist may prefer to opt for tooth extraction over restorative care in these groups because the risk of harm is higher in disabled children in case of restoration failure. Moreover, several studies report that oral health in children with disabilities is poorer than in healthy patients, and this situation worsens with age [8–10, 14]. As a result, the number of teeth with poor prognosis is increased in our medically compromised patients, subsequently increasing radical treatments.

In mixed dentition, this study highlights that children with disabilities have a higher number of permanent teeth treated under GA, whether restorative care or extractions, which is compatible with Koberova Ivancakova *et al.* [3] findings.

The comparison of means for the total number of teeth treated, both primary and permanent, also shows that the

TABLE 2. Difference in numbers of treatment performed under general anesthesia and their p -value.

Groups compared	Primary Teeth				Permanent Teeth		
	Teeth treated	Restorative care	Pulp therapy	Extraction	Teeth treated	Restorative care	Extraction
H and D	H > D $p = 0.000001$	H > D $p = 0.000001$	H > D $p = 0.000200$	H > D $p = 0.001700$	H < D $p = 0.000001$	H < D $p = 0.000001$	H < D $p = 0.000100$
H and D + SD	H > D + SD $p = 0.000007$	H > D + SD $p = 0.000100$	H > D + SD $p = 0.008700$	H > D + SD $p = 0.020400$	H < D + SD $p = 0.000020$	H < D + SD $p = 0.000100$	H < D + SD $p = 0.002400$
SD and D	SD > D $p = 0.001000$	SD > D $p = 0.000020$	SD > D $p = 0.009000$		SD < D $p = 0.000600$	SD < D $p = 0.000400$	
SD and D + SD	SD > D + SD $p = 0.004500$	SD > D + SD $p = 0.005500$			SD < D + SD $p = 0.015300$	SD < D + SD $p = 0.009800$	

H: Healthy; D: Disabled; SD: Systemic Diseases.

Healthy and SD groups had the highest number of teeth treated under general anesthesia. These results are in line with a study from Loyola-Rodriguez *et al.* [19] where patient with special medical needs had fewer teeth treated than healthy patients. Findings by Camilleri *et al.* [20] have also concluded that healthy children needed more dental procedures than Medically Compromised/Developmentally Disabled children under GA.

It should be noted that few preformed pediatric crowns were used in our study, despite their indications in high-risk caries patients. This seems to be due in part to the clinical situations of the patients treated and in part to the habits of the treating practitioners. In the same vein, it was noted that around a quarter of permanent teeth treated in healthy patients were extracted. This is probably due to the increasingly frequent management of Molar Incisor Hypomineralisation (MIH) patients, who may have sensitivities that are difficult to anaesthetize, heightened anxiety about dental care severely compromised teeth affected by the pathology.

The waiting time required before general anesthesia also influence the care that needs to be provided. In order to improve our practices, but also to increase patient quality of life and parental satisfaction, we must seek to shorten the waiting time before general anesthesia [21, 22]. Good support between the time of diagnosis and the time of general anesthesia is also very important, and helps minimize the care required in the event of successful temporary restoration. Preventive measures for patients and their families will minimize the risk of new decay developing, and the need for repeat care, possibly under general anesthesia [21].

Our study was a single center retrospective study. Multi-centric studies are recommended to better understand those variations in dental care based on health status. On large populations, it would be possible to investigate possible differences between specific health conditions, for example between different disability types. This would also avoid an impact linked to the operators. Yet, with 5 years limited duration and a total of 655 medical records included, this survey still manages to give a trend for care habits at a local level. The follow-up of these patients would also be particularly interesting to observe.

5. Conclusions

Considering any limitations of the present study it has been shown that our disabled patients were older than those in other groups, resulting in a smaller number of treatments performed on their primary teeth, but a greater number on their permanent teeth. However, we also found a trend towards more radical treatments in disabled children. Therefore, it seems necessary to develop prevention methods to better raise awareness and care for this population. Children with systemic diseases don't seem to differ from healthy patients for the age at which they are treated or in the acts performed.

6. Bullet point

- Disabled children seem to have more radical dental treatments during GA.
- Children with systemic diseases don't seem to differ from

healthy patients in dental treatment during GA.

AVAILABILITY OF DATA AND MATERIALS

The data that support the findings of this study are available from the corresponding author, TP, upon reasonable request.

AUTHOR CONTRIBUTIONS

TP and AB—designed the research study. TR and AB—performed the research. RC and CB—provided help and advice on the research. TR and CB—analyzed the data. TR, AG and TP—wrote the manuscript. All authors contributed to editorial changes in the manuscript. All authors read and approved the final manuscript.

ETHICS APPROVAL AND CONSENT TO PARTICIPATE

The study protocol was approved by the Department of Clinical Research and Innovation of the University Hospital of Nantes, and as this was a retrospective study, ethical approval and informed consent were waived by the University Hospital of Nantes.

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CONFLICT OF INTEREST

The authors declare no conflict of interest.

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