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ORIGINAL RESEARCH

A six-year retrospective comparison of dental treatments under general anesthesia in healthy children and those with special health care needs

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Abstract

Background: This study aimed to evaluate the dental procedures and demographic characteristics of healthy children and those with special health care needs (SHCN) who received dental treatment under general anesthesia (GA) between 2018 and 2024. **Methods**: Data were collected from 600 patients treated under GA at the Department of Pediatric Dentistry, Sivas Cumhuriyet University, during the study period, and the patients were categorized into Group M (healthy) and Group N (SHCN). The variables assessed included age, gender, medical condition, dental procedures performed under GA (restorative treatment, pulp treatment, and extraction), and decayed, missing, filled teeth/Decayed, Missing, Filled Teeth (dmft/DMFT) scores. Statistical analyses were conducted using the Mann-Whitney U test and Pearson Chi-Square test. **Results**: The mean ages of Groups M and N were 5.25 ± 1.43 and 7.34 ± 2.43 years, respectively. Among patients aged 7–16 years, the DMFT index was significantly higher in Group N (p = 0.029). Additionally, the frequency of restorative and pulp treatments was significantly higher in Group M compared to Group N ($p < 0.05$). **Conclusions**: The DMFT index was elevated in children with SHCN aged 7–16 years, suggesting the need to strengthen preventive and protective oral health care measures for this patient population.

Keywords

General anesthesia; Dental treatment; Special health care needs patients

1. Introduction

Dental anxiety is a condition that negatively affects both oral and general health, diminishes quality of life, and causes physiological, psychological, and behavioral alterations in affected individuals [1–3]. If it occurs during childhood or adolescence, it may result in uncooperative or treatment-resistant behaviors that complicate dental care delivery [4]. To address this, pediatric dentists often use various behavior management techniques to improve patient cooperation during dental procedures [5, 6].

Behavior management plays a fundamental role in the effective treatment of pediatric dental patients [7]. While many children can be managed using non-pharmacological techniques such as tell-show-do, these methods may be inadequate for patients with severe anxiety or limited capacity to comply with standard care protocols due to their age or condition [8–10]. In such cases, pharmacological approaches, including sedation and general anesthesia (GA), are often required to safely and effectively perform dental treatments [11]. Children with special health care needs (SHCN) are more likely to require dental care under GA [12]. These children commonly present with mental or developmental disorders and require additional support due to underlying medical, cognitive, or psychological conditions [13]. High levels of dental anxiety and behavioral resistance are frequently observed in this population, which poses significant challenges in providing dental care in conventional clinical settings [14]. Moreover, treatments that demand multiple appointments, such as restorative procedures, root canal therapies, and crown placements, are often only feasible under GA [15].

Previous studies have indicated that children with SHCN have poorer oral health than their healthy peers, as evidenced by fewer restored teeth, more missing teeth, and a higher prevalence of untreated dental caries [16–18]. Among the most frequently reported oral diseases in this population are dental caries and periodontal disease [19]. Several functional limitations, including intellectual or physical disabilities, visual impairments, and poor manual dexterity, may also compromise their ability to perform adequate oral hygiene [19, 20]. These challenges are further compounded by additional risk factors, such as limited exposure to fluoride, infrequent use of fluoridated toothpaste, low salivary flow, enamel defects, and irregular tooth alignment [21]. Furthermore, motor, sensory, or cognitive impairments may prevent effective plaque removal, thereby contributing to an increased risk of dental caries in these children [22].

Although some studies have reported that SHCN patients undergo fewer pulp therapies and more extractions under GA than healthy individuals [15, 23], others have found no significant differences in extraction rates between the two groups [24]. In Turkey, however, there is limited research directly comparing the demographic characteristics and dental treatment profiles of healthy and SHCN pediatric patients. Therefore, this present study aimed to evaluate the demographic features (age, gender, medical condition) and dental treatment procedures (extractions, restorative treatments, and pulp therapies) performed under GA in healthy and SHCN children.

2. Materials and methods

This retrospective study was approved by the Sivas Cumhuriyet University Health Ethics Committee (Approval No. 2024/05-38). The study population comprised children aged 1–16 years, both healthy and with SHCN, who received dental treatment under GA at the Department of Pediatric Dentistry, Sivas Cumhuriyet University, between 2018 and 2024.

2.1 Eligibility criteria

Patients were included if they met the following criteria: (a) aged 1–16 years and (b) unable to undergo dental treatment under local anesthesia due to a lack of cooperation. Patients who had received GA more than once or had incomplete medical records were excluded. After applying these criteria, a total of 600 patients were found eligible for final data analysis.

2.2 Sample size and data collection

Sample size and power calculations were performed using PASS 2008 (Power Analysis and Sample Size Software, NCSS, LLC, Kaysville, UT, USA). Based on the study design and exclusion of ineligible patients, the statistical power was calculated to be 90% with $\alpha = 0.05$ and $\beta = 0.10$.

Data extracted from patient records confirmed that, before GA, comprehensive dental and medical histories were obtained, and each patient underwent both clinical and radiographic examinations. Demographic information, including age, gender, and medical condition, was documented on the GA assessment form. The suitability of each patient for GA was then evaluated by an anesthesiologist. When patient records were evaluated, it was determined that written informed consent had been obtained from the patients' parents or legal guardians regarding the treatment. All treatments were subsequently performed under GA via nasal or oral intubation by pediatric dentists. Dental procedures were performed on a weekly rotational schedule by three attending pediatric dentists from the Department of Pediatric Dentistry, Faculty of Dentistry, Sivas Cumhuriyet University. Each procedure involved a multidisciplinary team comprising one attending pediatric dentist, two pediatric dentistry residents, one nurse, and one anesthesiologist.

The study population was categorized into two groups based on medical status: systemically healthy patients (Group M) and patients with SHCN (Group N). Additionally, participants were stratified into two age groups: ≤6 years and 7–16 years. Dental procedures performed under GA, including restorative treatments (composite, compomer, and stainless steel crowns), extractions, and pulp therapies (pulpotomy and root canal treatment), were recorded for both primary and permanent dentitions and compared between the two groups. The dental caries experience of each patient was assessed using the dmft/DMFT index, which quantifies the number of decayed (d/D), missing or extracted (m/M), and filled (f/F) teeth (t/T) in the primary and permanent dentitions, respectively.

2.3 Statistical analysis

All statistical analyses were performed using IBM SPSS Statistics for Windows, version 23.0 (IBM Corp., Armonk, NY, USA). Descriptive statistics are presented as arithmetic mean, standard deviation, median, and minimum–maximum values for continuous variables, while categorical variables are expressed as frequencies and percentages. The Kolmogorov-Smirnov test was used to assess the normality of data distribution. As the data did not follow a normal distribution, comparisons between two independent groups were conducted using the Mann-Whitney U test. The Pearson Chi-Square test was applied to analyze associations between categorical variables. A p-value of < 0.05 was considered statistically significant.

3. Results

3.1 Demographic data

A total of 600 children (285 girls and 315 boys), aged between 1 and 16 years, were included in the analysis. Of them, 449 were assigned to Group M, and 151 to Group N. The mean age was 5.25 ± 1.43 years in Group M and 7.34 ± 2.43 years in Group N, with the mean age in Group N being significantly higher than that of Group M ($p < 0.05$). When analyzed by sex, both male and female patients were significantly more prevalent in Group M than in Group N ($p = 0.027$). Age was further categorized based on dentition periods into ≤6 years and 7–16 years. In Group M, the majority of patients (85.6%) were aged ≤6 years, while in Group N, the proportion of patients aged 7–16 years was notably higher (47.4%), with this difference also reaching statistical significance ($p = 0.001$) (Table 1).

The distribution of systemic conditions among patients in Group N is shown in Fig. 1. The most common diagnosis was autism spectrum disorder (n = 36, 24%), followed by Down syndrome (n = 19, 12.7%), cerebral palsy (n = 17, 11.3%), intellectual disability (n = 17, 11.3%), epilepsy (n = 15, 10%), endocrine disorders (n = 14, 9.3%), cardiovascular diseases (n = 12, 8.0%), genetic disorders (n = 8, 5.3%), musculoskeletal disorders (n = 7, 4.7%), and respiratory system diseases (n = 5, 3.3%).

3.2 Treatment procedures and dmft/DMFT index

The dmft and DMFT index values for Groups M and N, stratified by age (≤6 years and 7–16 years), are presented in Table 2.

TABLE 1. Demographic data of the included cohort.

Variable	Group M (n = 449)		Group N (n = 151)		p-value
	n	%	n	%	
Age (yr)					
≤6	346	85.6	58	14.4	0.001*
7–16	103	52.6	93	47.4	
Mean ± SD	5.25 ± 1.43		7.34 ± 2.43		0.001*
Sex					
Male	224	71.1	91	28.9	0.027*
Female	225	78.9	60	21.1	

*Statistical analysis was performed using the Pearson Chi-Square test. *p < 0.05. SD: standard deviation; n: number of patients; Group M: systemically healthy patients; Group N: patients with special health care needs.*

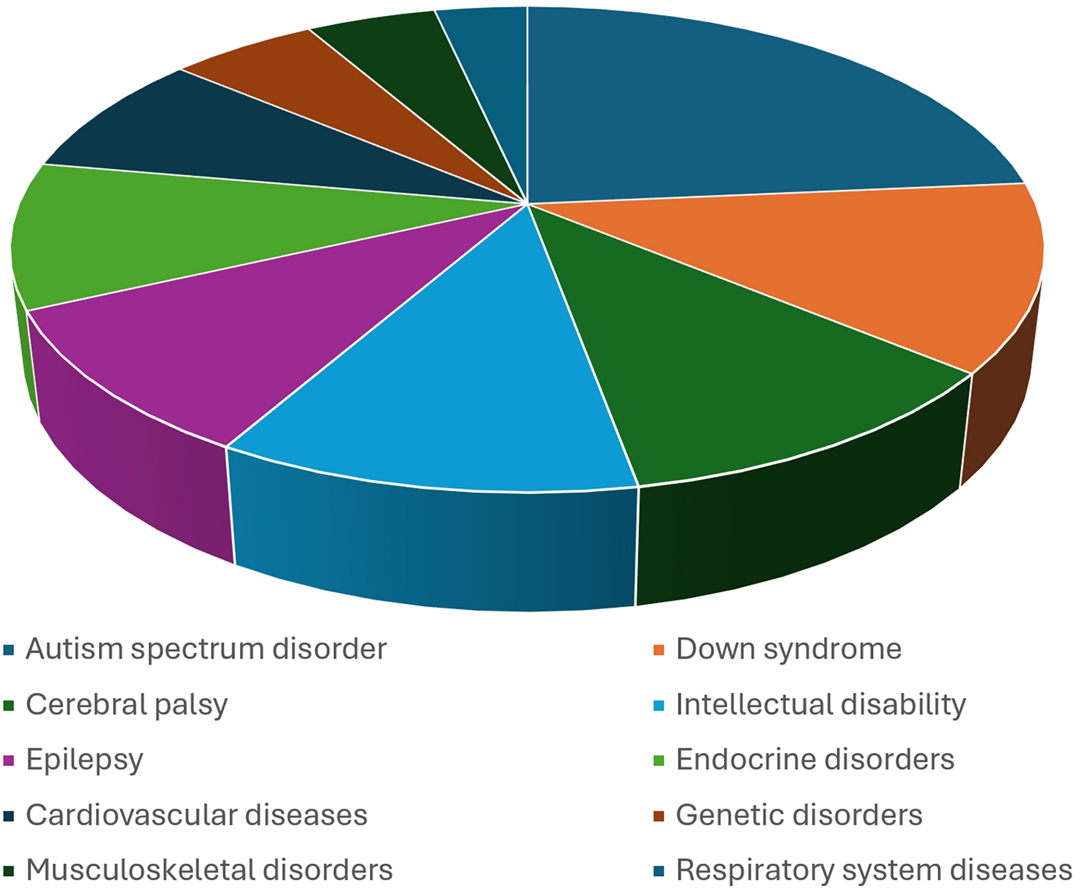

FIGURE 1. Distribution of patients with special health care needs according to systemic conditions.

TABLE 2. dmft/DMFT index values of Groups M and N by age group.

Variables	≤6 yr Group M	≤6 yr Group N	p-value	7–16 yr Group M	7–16 yr Group N	p-value
dmft	10.46 (0.00–20.00)	11.20 (0.00–20.00)	0.215	7.64 (0.00–16.00)	7.86 (0.00–23.00)	0.797
DMFT	0.11 (0.00–8.00)	0.22 (0.00–4.00)	0.941	1.00 (0.00–9.00)	2.71 (0.00–21.00)	0.029*

**Mann-Whitney U test. p < 0.05. dmft: decayed, missing, filled teeth in primary dentition; DMFT: decayed, missing, filled teeth in permanent dentition; Group M: healthy patients; Group N: patients with special health care needs.*

Among children aged ≤6 years, no statistically significant differences were observed between the groups for either the dmft or DMFT indices ($p > 0.05$). Similarly, for children aged 7–16 years, the dmft index did not differ significantly between the groups ($p = 0.797$). However, the DMFT index in Group N was significantly higher than that in Group M among children aged 7–16 years ($p = 0.029$), indicating a greater burden of untreated or previously treated dental caries in the permanent dentition of children with SHCN in this age group.

Table 3 presents the comparison of dental procedures performed under GA between Group M and Group N. The median number of tooth extractions was 2.72 in Group M and 2.82 in Group N, with no statistically significant difference observed between the groups ($p = 0.670$). In contrast, the median number of restorative procedures was significantly higher in Group M (7.53) compared to Group N (6.18) ($p = 0.001$). Similarly, the median number of pulp therapies was significantly greater in Group M (1.09) than in Group N (0.52) ($p = 0.001$), indicating a higher frequency of restorative and pulp treatment interventions in systemically healthy patients.

Table 4 presents the comparison of dental treatments according to age groups (≤6 years and 7–16 years) within Groups M and N. In Group M, children aged ≤6 years had a significantly higher number of extractions than those aged 7–16 years ($p = 0.009$). Similarly, the median numbers of restorative procedures and pulp therapies were significantly greater in the ≤6 years subgroup compared to the 7–16 years subgroup ($p < 0.05$). In contrast, no statistically significant differences in extractions, restorative treatments, or pulp therapies were observed between age groups in Group N ($p > 0.05$).

4. Discussion

This retrospective study compared the demographic characteristics and dental treatment outcomes under GA between systemically healthy children and those with SHCN. In the whole cohort, 74.8% of patients were healthy (Group M), while 25.2% had SHCN (Group N). Among SHCN patients, the most frequent diagnoses were autism spectrum disorder (24%) and Down syndrome (12.7%). In comparison, Sevekar *et al.* [25] reported that among 25 SHCN patients in India treated under GA, the most common conditions were cerebral palsy (n = 13) and intellectual disability (n = 7). Similarly, Lee *et al.* [15] found that in a Taiwanese population, intellectual disability (36.6%) and autism (29.5%) were the leading diagnoses. These discrepancies may reflect differences in ethnic background, regional prevalence, and genetic factors.

To assess oral health status, the present study used the dmft/DMFT indices, which are widely recognized indicators for evaluating dental caries in primary and permanent dentition, respectively [26]. Our findings revealed that children aged 7–16 years in Group N exhibited significantly higher DMFT scores compared to those in Group M. This result aligns with the study by Gümüş *et al.* [27], which similarly reported higher DMFT values in SHCN children over six years of age. The increased caries burden in SHCN patients may be attributed to a combination of factors, including frequent sugar intake, poor cooperation during tooth brushing, and difficulties in maintaining oral hygiene due to neuromuscular limitations [28, 29]. These factors likely contributed to the elevated DMFT scores observed in Group N.

In terms of restorative treatment, the median number of procedures was significantly higher in Group M (7.53) than in Group N (6.18). This finding contrasts with that of Sevekar *et al.* [25], who reported more restorations in SHCN patients. Limited access to oral health services, due to socioeconomic constraints, transportation barriers, cultural factors, and the behavioral challenges of SHCN children, may reduce the frequency of routine dental care and preventive treatments in this population [30, 31]. Additionally, caregivers' apprehension about the risks of treatment under GA may lead to reduced acceptance or avoidance of dental care [32, 33], potentially explaining the lower number of restorations in SHCN children in our study. Within Group M, children aged ≤6 years received significantly more restorative treatments than those aged 7–16 years (8.10 *vs.* 5.26); consistent with the findings of Ciftci and Yazicioglu [34], who reported more restorations in healthy children under six years of age compared to those aged 6–12 years (5.29 *vs.* 3.15). This difference may be explained by the emphasis on preserving primary teeth in younger children to maintain oral function and guide the eruption of permanent dentition.

In the present study, the median number of pulp therapies was significantly higher in Group M (1.09) compared to Group N (0.52) ($p < 0.05$). This result is consistent with previous studies, which have similarly reported a greater frequency of pulp therapy in systemically healthy children [23, 24]. When analyzed by age, the median number of pulp therapies in Group M was significantly lower in children aged 7–16 years than in those aged ≤6 years (0.47 *vs.* 1.44, respectively). This difference may be attributed to the dentition stage, as the majority of patients in Group M (n = 346) were within the primary dentition period. The anatomical characteristics of primary teeth—including wider dentinal tubules and greater permeability of the intertubular matrix—render them more susceptible to external stimuli and pulpal inflammation compared to permanent teeth [35]. Therefore, the higher number of pulp therapies observed in younger children in our study likely reflects the increased vulnerability of the primary teeth to carious lesions and subsequent pulpal involvement.

The current findings showed no statistically significant difference in the number of tooth extractions between Groups M and N ($p > 0.05$). While several studies have reported a higher number of extractions in SHCN patients [27, 34], our results are consistent with those of Ibricevic *et al.* [24], who also found that the average number of extractions was 2.8 in healthy children and 2.2 in SHCN children, with no statistically significant difference. This similarity could be attributed to the comparable number of unrestorable teeth in both groups. Additionally, within Group M, the median number of extractions in children aged ≤6 years was significantly higher than in those aged 7–16 years (3.03 *vs.* 1.73, respectively). This result contrasts with the findings of Ciftci and Yazicioglu [34], who reported more extractions in the 6–12-year age group. Although exfoliation of primary teeth typically begins around 6 to 7 years of age with the loss of the incisors [36], early extractions may be necessary due to dental caries, premature root resorption, periodontal disease, or trauma [37]. These

TABLE 3. Comparison of dental procedures performed between Groups M and N.

Treatment Procedure	Group M, (n = 449) Median (Min–Max)	Group N, (n = 151) Median (Min–Max)	*p*-value
Extractions	2.72 (0.00–12.00)	2.82 (0.00–20.00)	0.670
Primary tooth extraction	3.40 (0.00–12.00)	2.68 (0.00–20.00)	0.171
Permanent tooth extraction	0.02 (0.00–2.00)	0.07 (0.00–2.00)	0.004*
Restorative Treatment	7.53 (0.00–20.00)	6.18 (0.00–20.00)	0.001*
Primary tooth restoration	7.06 (0.00–20.00)	3.80 (0.00–14.00)	0.001*
Permanent tooth restoration	0.25 (0.00–7.00)	0.71 (0.00–20.00)	0.001*
Pulp Therapy	1.09 (0.00–11.00)	0.52 (0.00–6.00)	0.001*

**Mann-Whitney U test. $p < 0.05$. Min: minimum; Max: maximum; Group M: healthy patients; Group N: patients with special health care needs.*

TABLE 4. Comparison of dental treatments according to age groups within each study group.

Treatment Procedure	Group M ≤6 yr Median (Min–Max)	Group M 7–16 yr Median (Min–Max)	*p*-value	Group N ≤6 yr Median (Min–Max)	Group N 7–16 yr Median (Min–Max)	*p*-value
Extraction	3.03 (0.00–12.00)	1.73 (0.00–10.00)	0.009*	2.09 (0.00–15.00)	3.18 (0.00–20.00)	0.168
Primary tooth extraction	3.42 (0.00–12.00)	3.36 (0.00–10.00)	0.669	2.09 (0.00–15.00)	3.00 (0.00–20.00)	0.343
Permanent tooth extraction	0.00 (0.00–2.00)	0.08 (0.00–2.00)	0.001*	0.00 (0.00–0.00)	0.12 (0.00–2.00)	0.007*
Restorative Treatment	8.10 (0.00–20.00)	5.26 (0.00–14.00)	0.001*	6.11 (0.00–14.00)	6.25 (0.00–20.00)	0.396
Primary tooth restoration	7.84 (0.00–20.00)	4.04 (0.00–13.00)	0.001*	4.05 (0.00–14.00)	3.00 (0.00–14.00)	0.022*
Permanent tooth restoration	0.11 (0.00–7.00)	1.29 (0.00–6.00)	0.001*	0.09 (0.00–4.00)	2.07 (0.00–20.00)	0.001*
Pulp therapy	1.44 (0.00–11.00)	0.47 (0.00–9.00)	0.001*	0.66 (0.00–6.00)	0.46 (0.00–6.00)	0.160

**Mann-Whitney U test. $p < 0.05$. Min: minimum; Max: maximum; Group M: healthy patients; Group N: patients with special health care needs.*

clinical factors likely contributed to the higher number of extractions observed in younger children in Group M.

This study has certain limitations. First, it was conducted at a single center, which may limit the generalizability of the findings. Second, the dental procedures under GA were performed by different clinicians, potentially introducing variability in treatment approaches. Therefore, future studies using larger sample sizes and multicenter designs are needed to enhance the external validity of the findings.

5. Conclusions

In conclusion, the present study demonstrated that systemically healthy children had a higher number of root canal treatments and restorative procedures performed under GA compared to children with SHCN. In contrast, SHCN children presented with a higher average age and DMFT scores. To reduce the risk of dental caries, it is essential to educate parents on the importance of maintaining oral health in children. Regular dental check-ups from an early age are particularly important for children with SHCN, and coordinated efforts between parents and dental professionals are necessary to improve oral health outcomes in this population.

AVAILABILITY OF DATA AND MATERIALS

The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

AUTHOR CONTRIBUTIONS

FO—conceived the ideas. TY—designed the study and collected the data. FO, TY and AK—analysed the data. TŞU and ADB—interpreted the data. All authors wrote some part of the manuscript. All authors read and approved the final manuscript.

ETHICS APPROVAL AND CONSENT TO PARTICIPATE

Ethical approval for the study was obtained from Sivas Cumhuriyet University Health Ethics Committee (2024/05-38). When patient records were evaluated, it was determined that written informed consent had been obtained from the patients' parents or legal guardians regarding the treatment.

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CONFLICT OF INTEREST

The authors declare no conflict of interest.

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