

# A Retrospective Comparison of Dental Treatment under General Anesthesia Provided for Uncooperative Healthy Patients and Patients with Special Health Care Needs

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**Background/Objective:** This retrospective comparative analysis evaluates the patterns of dental treatment undertaken on uncooperative healthy and special health care needs patients with respect to different age categories. **Study design:** This study reviewed the data from 342 patients (205 male and 137 female), between the ages of 1 and 12 at the time of the treatment, who had received comprehensive dental treatment under general anesthesia in the operating rooms of the Faculty of Medicine, Cukurova University from January 2016 through December 2018. Patient records were divided into two groups according to the patient's medical and mental conditions. SHCN patients (272 patients) with at least one type of mental, medical or physical disability were assigned to Group S and uncooperative healthy patients (70 patients) were assigned to Group H. Treatment modalities of restorative procedures, number of extracted teeth, pulp therapy, and other dental procedures were compared between these groups with respect to eruptional stages in the dentition (<6 years and 6-12 years) **Results:** There was no significant difference between groups H and S in terms of the mean duration of dental treatment among age categories in both groups. The mean number of extracted teeth was significantly greater in Group S. The mean number of teeth treated by restorative procedures in groups H and S were 4.40 and 4.40, respectively, showing no significant difference. **Conclusions:** Comparison of two different groups, with patients who have received comprehensive dental treatment in an operating room, revealed that the number of teeth extracted was significantly higher for the SHCN patients. On the basis of our results, it was concluded that medical and mental conditions affect dental treatment modalities. Preventive treatment strategies are particularly required for patients with SHCN and it is important to educate patients and their parents/caregivers on the importance of home dental care.

**Keywords:** Dental treatment, General anesthesia, Special health care need

## INTRODUCTION

According to the American Academy of Pediatric Dentistry (AAPD), "any physical, developmental, mental, sensory, behavioral, cognitive, or emotional impairment or limiting condition that requires medical management, health care intervention, and/or use of specialized services or programs" is included in the definition of special health care needs (SHCN).<sup>1</sup> Patients with SHCN may be at an increased risk for oral diseases during lifetime.<sup>2</sup> Chronic illness may predispose these patients to poor oral health outcomes, further complicated by the impact of frequent exposure to sugary medications, less than ideal dietary behavior, ineffective oral hygiene practices, behavioral challenges and social disadvantage. Because oral health is an inseparable part of general health, patients with mental, developmental, or physical disabilities who do not have the ability to understand, assume responsibility for, or cooperate with preventive oral health practices are susceptible as well.<sup>3</sup>

Access to regular dental treatment in a conventional environment is frequently impeded for SHCN patients and additional resources

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are required.<sup>4</sup> A number of factors reportedly influence the difficulty or ease with which SHCN are able to access dental services. These include geographic barriers, transportation, complexity of the patient's medical condition, inadequate specific medical services and limited number of specialist dentists. Dental treatment for these patients is commonly performed under GA in hospital-based setting as it is the ideal location to ensure safety for these patients.<sup>5</sup> Dental treatment under general anesthesia (GA) is most commonly used for SHCN patients when behavioral management techniques are attempted and fail.<sup>6-7</sup> The operating room is often the best environment to provide full mouth rehabilitation of the patient with SHCN and uncooperative healthy patients. Special care dentistry constitutes an integral part of the specialty of pediatric dentistry.<sup>8</sup> Dental treatment for SHCN patients is a treatment modality utilized under GA by pediatric dentists.<sup>9</sup> GA is utilized for both healthy and SHCN patients to provide comprehensive, safe and high-quality dental care when conventional dental treatment is not an option.<sup>10,11</sup> Dental treatment in the operating room provides immediate relief of pain and all treatment can be performed during a single visit.<sup>12</sup>

Several studies compared patterns of dental treatment performed under GA between patients with SHCN and uncooperative healthy patients.<sup>13,14</sup> The majority of these studies reported higher frequency of extractions for patients with SHCN compared to those who are healthy.<sup>15-17</sup> Some of these studies reported significantly lower frequency of pulp therapy and stainless-steel crowns<sup>13,17,18</sup> while others reported significantly more restorative treatment for patients with SHCN.<sup>15,16</sup> However, studies comparing dental treatment under GA provided to healthy and SHCN patients with respect to different age categories are limited. The aims of this retrospective study were firstly, to compare the differences in patterns of dental treatment and secondly, to evaluate the characteristics and treatment modalities performed in the operating room for SHCN and healthy patients with respect to eruptional stages in the dentition (primary and mixed dentition stage).

## MATERIALS AND METHOD

The records were reviewed for all pediatric patients who had received comprehensive dental care under GA in the operating rooms of the Faculty of Medicine, Cukurova University from *January* 2016 through *December* 2018 in Turkey. All dental treatments were provided by the faculty and doctoral students of the Pediatric Dentistry Department, Cukurova University. Patients with incomplete records, or who had received more than one dental operation, and cleft lip/palate patients, were excluded. A total of 342 fully complete pediatric patient records (205 male and 137 female) were considered for this retrospective study. Ethical approval for this retrospective study was obtained from the Ethics Committee of the Faculty of Medicine, Cukurova University (Grant no: 50243401/2019-12).

For this retrospective analysis, the pediatric patients were divided into two groups according to their mental and medical conditions: medically compromised patients with SHCN were categorized as group S (272 patients), uncooperative and more anxious healthy patients who would not allow dental treatment in a dental chair were categorized as group H (70 patients). The study was undertaken on these patient's records. Two weeks after obtaining

complete patient details and before the assessment of all records, 10% of these records were randomly selected to evaluate intra-examiner reliability, which was found to be good.

The data from the patient records were reviewed for general medical history, dental history, gender, age, operation time, dmft and DMFT scores and treatment modality. The pediatric patients were separated into two age categories according to eruptional stages in the dentition: < 6 and 6-12 years. The dental treatment procedures were also classified as simple tooth extractions (permanent and primary), restorative procedures (amalgam restoration, composite restoration, glass-ionomer restoration, and stainless steel crown), pulp therapy (root canal treatment for permanent teeth and pulpotomy or pulpectomy for primary teeth) and surgical procedures (surgical removal of impacted or supernumerary tooth, biopsy, cyst removal, gingivectomy, frenectomy and dentoalveolar trauma).

Records indicated that oral intubation has been used for all patients, and, in general, a detailed dental examination had been carried out following successful intubation of the patient, correlated with the radiographic findings, if available. Periapical radiographs had been taken with a portable radiography device if deemed necessary. Periodontal scaling had been performed on all patients before other dental procedures were commenced. Root canal treatment and pulp therapy were routinely performed under rubber-dam isolation. Tooth extractions were performed after all other dental treatment (restorative procedures, pulp therapy, periodontal procedures) had been completed. For all dental treatment, a local anesthetic solution (Maxicaine Fort 40 mg/ml 0.01 mg/ml) has been used. Throughout the dental procedures, the operator was assisted by a dental nurse. A maxillo-facial surgeon performed the surgical procedures and extracted the permanent teeth. The extraction sites were usually sutured or bleeding had been controlled with a hemostatic agent.

The time taken for the anesthetic procedures was not included in the operating time. After completion of the dental procedures, the patients were transferred to the post-operating room and kept under observation by medical nurses until full recovery from the GA. If there were no complications, the patients were discharged on the operating day. Some patients with severe systemic disease included in this study required intensive care following their dental treatment. Post-operative time, however, was not evaluated in this study.

All data were analysed using the SPSS (Version 20.0, Chicago) software. One-way ANOVA test was used to examine the effect of "age category" on treatment duration and the number of treatment procedures. Post-hoc multiple comparisons were performed using the Tukey test. The results were considered significant when the level of significance was 0.05. Intraclass *correlation coefficient* (ICC) was used to assess the intra-examiner reliability. The results were indicated with the average, standard deviation, and the minimum and maximum values.

## RESULTS

### Patient Characteristics

The mean ages of groups H and S were 5.7±2.4 and 7.9±2.7, respectively. Patients in group S were significantly older than those in group H (p=0.000). The age distribution of all patients for who dental treatment was provided under the GA is shown in Table 1. The gender proportion difference (59.9% male and 40.1%

female) was insignificant between the groups according to the age categories. Medical status of all patients was described according to the International Classification of Functioning, Disability and Health (ICF).<sup>19</sup> In group S, major underlying health problems were Epilepsy (30.1%), various syndromes (14.7%), Autism (14%), Down syndrome (13.6%), and Cerebral Palsy (7.3%). The distribution of group S patients based on their medical conditions is shown in Table 2. All patients were divided into two different age categories according to the eruptional stages in the dentition: < 6 years and 6-12 years. The mean duration of dental treatment was 61.06±28.55 minutes, ranging from 15 to 180 minutes. In group H and group S, there were no significant differences in the duration of dental treatment among age categories (p>0.05) (Table 3).

**Treatment modalities, dmft and DMF-T scores**

The mean number of extracted teeth in groups H and S were 3.90 and 5.70, respectively. The mean number of extracted teeth was significantly greater in group S (p=0.002). The mean number of teeth treated by restorative procedures in groups H and S were 4.40 and 4.40, respectively, showing no significant difference (p=0.920). The mean number of pulp therapy in groups H and S were 0.10 and 0.10, respectively, showing no significant difference (p=0.959). As

for surgical procedures, however, there was a significant difference between the groups. The greater number of surgical procedures were performed for group S (p=0.000). The mean dmft of the group H and group S were 7.3 and 8.1, respectively and it was not found to be a significant difference between the groups. The mean DMF-T of group H and group S were 1.0 and 2.1, respectively. The DMF-T score of group S was higher than group H statistically (p=0.007). Treatment procedures, the mean number of treated teeth, dmft and DMF-T scores in both groups are summarized in Table 4.

In group H, the mean number of extracted teeth showed significant differences among the age categories. The 6-12 age group received significantly more extractions (p=0.036). Also, there were significant differences in restorative procedures among the age categories (p=0.009). There were no significant differences in pulp therapy and surgical procedures among age categories (p>0.05). DMF-T scores showed significant differences among age categories. The DMF-T index was higher in the 6-12 year age category than the < 6 year age category in group H (p=0.000). As for group S, even if the < 6 year age category received more extractions than the 6-12 year age category, this difference was not found to be significant statistically (p=0.557). The mean number of teeth treated by restorative procedures and surgical procedures showed significant

**Table 1. Age distribution of all patients provided dental treatment under the GA**

Age	Group H		Group S	
	n	%	n	%
1	1	1,4%	0	0,0%
2	3	4,3%	0	0,0%
3	9	12,8%	10	3,7%
4	13	18,6%	13	4,8%
5	9	12,8%	33	12,1%
6	10	14,3%	33	12,1%
7	5	7,3%	31	11,4%
8	8	11,4%	41	15,1%
9	7	10,0%	27	9,9%
10	5	7,1%	32	11,8%
11	0	0,0%	31	11,4%
12	0	0,0%	21	7,7%
	70	100%	272	100%

**Table 2. Distribution of SHCN patients based on their medical conditions**

	N	%
Epilepsy	82	30.1%
Various syndromes	40	14.7%
Autism	38	14%
Down syndrome	37	13.6%
Cerebral palsy	20	7.3%
Hematological diseases	19	7%
Cardiovascular diseases	14	5.2%
Visually impaired	6	2.2%
Hydrocephaly	5	1.8%
Kyphoscoliosis	4	1.5%
Psychological disorder	4	1.5%
Microcephaly	3	1.1%
Total	272	100%

**Table 3. Operating time for the patients with respect to age categories**

		Operating time				
		N	Mean±SD (minutes)	Min (minutes)	Max (minutes)	p
Group H	<6 years	35	58.0±23.0	20	120	0.305
	6-12 years	35	53.4±21.0	15	120	
Group S	< 6 years	56	64.4±29.0	15	120	0.496
	6-12 years	216	61.1±27.4	15	180	

\*p<0.05 (One-way ANOVA and Tukey tests)

differences among age categories ( $p < 0.05$ ). The < 6 year age category received more restorative procedures than the 6-12 year age category. A greater number of surgical procedures was performed on the 6-12 year age category than the younger age category. The mean dmft and DMF-T index showed significant difference among the age categories ( $p < 0.05$ ). The mean number of various treatment procedures, dmft and DMF-T scores for each age category within the study groups is shown in Table 5.

**Table 4. Treatment modalities, dmft and DMF-T scores for all patients**

		Mean±ss	p
Extractions	Group H	3.9±3.8	0.002*
	Group S	5.7±4.3	
Primary teeth	Group H	3.7±3.8	0.008*
	Group S	5.2±4.4	
Permanent teeth	Group H	0.3±0.8	0.082
	Group S	0.5±1.1	
Restorative procedures	Group H	4.4±3.6	0.920
	Group S	4.4±3.1	
Primary teeth	Group H	3.4±3.4	0.192
	Group S	2.8±3.0	
Permanent teeth	Group H	0.7±1.9	0.009*
	Group S	1.5±2.5	
Pulp Therapy	Group H	0.1±0.4	0.959
	Group S	0.1±0.4	
Surgical procedures	Group H	0.00±0.05	0.000*
	Group S	0.04±0.20	
dmft	Group H	7.3±5.0	0.297
	Group S	8.1±5.2	
DMF-T	Group H	1.0±2.5	0.007*
	Group S	2.1±3.3	

\* $p < 0,05$  (Paired t-test)

## DISCUSSION

SHCN patients with increased risk medical conditions, congenital heart diseases, and compromised immune systems presenting with signs and symptoms of dental treatment needs should be given priority for emergency dental treatment. AAPD has listed the indications for general anesthesia for children and adolescents who cannot cooperate due to lack of psychological or emotional maturity and/or mental, physical, or medical disability.<sup>20</sup> Comparative studies of dental treatment performed in an operating room on certain groups of patients, such as those who are uncooperative healthy and with SHCN, provide insights for efficacy and safety.<sup>21-23</sup>

In our retrospective comparative study, 79.5% of the patients in the study population were with SHCN and 20.5% were healthy. Major underlying problems among patients with SHCN were Epilepsy (30.1%), various syndromes (14.7%), Autism (14%), Down syndrome (13.6%) and Cerebral palsy (7.3%). Mallineni

**Table 5. The mean number of dental procedures, dmft and DMF-T scores according to the age categories**

		< 6 years	6-12 years	p
		Mean±SD	Mean±SD	
Group H	Extraction	2.97±3.54	4.88±3.88	0.036*
	Primary Teeth	2.97±3.54	4.47±3.88	0.098
	Permanent Teeth	0.00±0.00	0.41±0.70	0.001*
	Restorative procedures	5.29±3.67	3.15±2.91	0.009*
	Primary Teeth	4.66±3.76	2.12±2.48	0.002*
	Permanent Teeth	0.00±0.00	1.03±1.49	0.000*
	Pulp Therapy	0.03±0.17	0.03±0.17	0.984
	Surgical procedures	0.00±0.00	0.00±0.00	0.583
	dmft	8.26±5.04	6.62±4.86	0.174
	DMF-T	0.00±0.61	1.44±1.64	0.000*
Group S	Extraction	6.18±4.87	5.80±4.20	0.557
	Primary Teeth	6.13±4.93	5.27±4.24	0.193
	Permanent Teeth	0.05±0.40	0.52±1.03	0.001*
	Restorative procedures	5.71±2.60	4.03±3.05	0.000*
	Primary Teeth	5.57±2.77	2.33±2.67	0.000*
	Permanent Teeth	0.04±0.27	1.66±2.40	0.000*
	Pulp therapy	0.02±0.13	0.08±0.38	0.242
	Surgical procedures	0.00±0.00	0.02±0.04	0.007*
	dmft	11.80±4.74	7.67±4.81	0.000*
	DMF-T	0.09±0.67	2.24±3.08	0.000*

\* $p < 0,05$  (One-way ANOVA and Tukey tests)

and Yiu<sup>4</sup> recently published a retrospective study of dental treatment provided for patients with SHCN in Hong Kong. In their study population, 60%, 12%, and 11% of the patients presented neurological problems, cardiovascular problems, and various syndromes, respectively. In contrast, in a study carried out in Mexico it was reported that the most commonly treated SHCN patients were those with Cerebral Palsy, intellectual disability and Down syndrome.<sup>6</sup> Several studies selected various study populations and compared dental treatment modalities among various systemic conditions. Our records were based on patient's documents, referrals and systemic conditions, which normally do not include information about ethnicity, immigration status and cultural differences. It has been suggested that ethnic differences, genetic variations, and medical conditions affect the variability in the composition of selected study populations.<sup>24-27</sup>

Knowledge of operation duration allows for optimal utilization of treatment time.<sup>28</sup> Ventura *et al.*<sup>29</sup> observed that SHCN patients required between 40 and 180 minutes to receive a complete full-mouth rehabilitation. In our study, there was no significant difference in the operating time between the two study groups. The mean duration of dental treatment was 61.06±28.5 minutes for all patients, ranging from 15 to 180 minutes. No significant differences in the



duration of treatment were observed among different age categories in group H and group S ( $p \geq 0.05$ ). Mallineni and Yiu reported that the < 6 year age category within the SHCN patient group required relatively more operating time.<sup>4</sup> The mean duration of treatment according to their study was  $115 \pm 55$  minutes. O'Brien and Suthers demonstrated similar findings in their study, where only 4.5% of the cases were completed in under 30 minutes.<sup>30</sup> Our data, however, were in contrast to these studies, recording shorter duration of treatment times. This is due to the fact that the majority of procedures our study population had received were primary teeth extractions, and hence, the shorter operating time in our study population.

Roeters and Burgersdijk<sup>5</sup> reported an average of 5.2 restorations performed per patient in a study population of 215 patients with intellectual disabilities. Mallineni and Yiu found<sup>4</sup> an average of 5.48 restorative treatments received by SHCN patients. Peretz *et al.* in their study<sup>31</sup> of 121 patients with systemic diseases and developmental disorders, found the average number of restorative treatments was 7.6. In our study, the total number of restored teeth was similar for both groups and there was no significant difference between them (4.40 and 4.40 for group H and S, respectively). However, in group H and group S, < 6 year age categories had received a greater number of restorative procedures (5.29 and 5.71, respectively) compared to the 6-12 year age categories. Our results were similar to those of a study by Kwok-Tung and King that included both healthy and SHCN patients in their study population.<sup>32</sup>

The Royal College of Surgeon's guideline recommended that if a GA is indicated for pediatric patients, unrestorable teeth with excessive caries should be extracted in addition to those causing pain or sepsis in the future.<sup>33</sup> Harrison and Roberts<sup>37</sup> found that a greater number of extractions were performed on chronically sick patients compared to healthy ones under the GA. Tsai *et al.*<sup>18</sup> observed similar findings. In our study, the number of extractions performed on SHCN patients were higher than all other dental procedures in the GA. Additionally, more teeth had been extracted in Group S than Group H (5.70 and 3.90, respectively). It was found that there were significant differences among age categories and the number of extracted teeth was greater in the 6-12 year (4.88) than the < 6 year age categories (2.97) in group H. In contrast, the < 6 year age category received more extractions than the other age category in group S. SHCN patients in the < 6 year and 6-12 year age

categories received an average of 6.18 and 5.80 teeth extractions, respectively. These numbers are lower than those of a recent study<sup>34</sup>, which reported an average of 7.5 extractions for 281 patients who were <6 years of age. This is due to a greater number of primary teeth extractions during the primary or mixed dentition period. Dentists avoid complex treatments for SHCN patients in order to reduce complications and the need for re-treatment. Tooth extraction is particularly preferred, instead of pulp therapy or root canal treatment, for teeth with periapical pathologies or deep caries.<sup>17</sup> In our study the number of teeth extractions was also observed to be higher for SHCN patients than for the healthy ones, possibly as a result of poor oral hygiene. Harrison and Roberts<sup>37</sup> mentioned that all dental restorations have a potential for failure. In healthy patients, a failed restoration can be re-treated with little effect on their general health. However, for SHCN patients, a failed restoration itself can be life-threatening and may involve additional medical intervention. For this reason, in our study it was probably decided to extract the teeth with poor prognosis, particularly for SHCN patients. These findings are compatible with similar studies.<sup>32,35,36</sup> In this study, the number of pulp therapies showed insignificant difference between study groups. As for surgical procedures, a significant difference was found, where group S had received more surgical removals of impacted or supernumerary teeth, biopsies, cyst removals, gingivectomies, frenectomies and dentoalveolar trauma procedures than group H. The 6-12 year age category patients had received more dental surgical operations than the other age category in group S ( $p=0.007$ ).

### CONCLUSIONS

Medical and mental conditions may affect the comprehensive dental treatment modalities provided under GA. The dentists may prefer a dental treatment approach for patients with SHCN that is less complex or has a lower risk of complication, such as tooth extraction. The data from this study showed that a greater number of extractions under GA were performed on SHCN patients compared to healthy patients. Based on our data, it was concluded that oral health education and preventive strategies would improve dental hygiene for SHCN patients in their primary or mixed dentition stage and reduce the number of tooth loss as well as the need for any treatment under GA in the future.

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