

**Original Research****A retrospective analysis of demographic and clinical profile of pediatric dental patients treated under general anaesthesia.**

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**ABSTRACT**

**Aim** - To determine the demographic and clinical profile of children treated under general anaesthesia in last 7 years.

**Methodology** - A Medical-record department (MRD) based retrospective study was planned. Dental records all the pediatric patients treated under general anaesthesia in past 7 years (2012-2019) were reviewed and evaluated in the current retrospective analysis. For each patient, detailed clinical and demographic details were extracted and analysed using descriptive statistical analysis and chi-square test.

**Results** - In the current study, dental records of total 93 patients were included. These were divided into 2 groups - based on patient's medical history, wherein group A included healthy children and group B included children with special health care with mean age of  $5.40 \pm 2.1$  years and  $10.3 \pm 6.3$  years respectively. Dental anxiety and un-cooperative behaviour (57%) were the main indication for treating pediatric patient under general anaesthesia and stainless-steel crown cementation was the most frequent procedure performed for both groups. Intra-group analysis showed significant association between age of the patient and need for dental treatment under general anaesthesia in group A ( $P \leq 0.05$ ). However, there was no significant difference and correlation found between gender and need for general anaesthesia. ( $P \geq 0.05$ ).

**Conclusion -**

According to the study, majority of the children treated under general anaesthesia were below 5 years and the major indication was un-cooperative behaviour. Stainless-steel crowns cementation was the most common treatment modality provided. It is important to emphasize more on prevention dental caries and thus avoid unnecessary exposure of children to general anaesthesia.

**Keywords:** Anesthesia; Behavior Therapy; Dental Care; Dental Records; India; Pediatric Dentistry; Retrospective Studies

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## INTRODUCTION

Behaviour management, an integral part of pediatric dentistry aims to improve child's coping skills and to achieve maximum acceptance towards dental care. It is a clinical art form used to establish communication with a child patient, to imbibe positive attitude in a child towards oral health care and thereby alleviate dental anxiety.<sup>1</sup> There is a wide array of behavior management techniques available for dental practitioners to deal with a pediatric patient based on their physical, emotional, social and intellectual development. These are broadly classified into: [a] Pharmacological techniques and [b] Non-pharmacological techniques.<sup>2</sup> Majority of children can be adequately treated with non-pharmacologic behaviour modification techniques such as tell-show-do, modelling, communication, distraction, voice control and many more. However, dental treatment can be a challenge in some children, especially the young children and those with physical or mental disabilities.<sup>3</sup>

The ability of a child to cope with dental procedure is determined by his or her stage of development. They can be either supportive, potentially cooperative, or pre-cooperative. Pre-cooperative stage refers to children at a very young age [below 3 years] and those with special health care needs. At such an early age, a child's brain is still developing and a complex matter like a dental procedure cannot be fully comprehended.<sup>4</sup> Management of these patients on a dental chair is often a challenge for the clinician and requires advanced behaviour management aids such as physical restraints, sedation or general anesthesia.<sup>5</sup> Recent studies aimed at determining the acceptability of various behaviour management approaches among parents revealed that in the late 1980s, parents preferred voice control, physical restraint, and the hand-over-mouth approach over sedation or general anaesthesia. By the end of 2005, however, both sedation and dental general anaesthesia had become more acceptable than negative behaviour control methods, thereby leading to an increased utilization of general anesthesia for pediatric dental treatments, particularly, in individuals with multiple carious lesions. This study notes a trend towards increasing acceptability of GA from 1984 to 2004.<sup>6</sup> Also, with increase in the prevalence of Early childhood caries, exponential increase in the frequency for opting dental general anesthesia is noted. A cross-sectional study by Vinckieret al.<sup>7</sup> and Savanheimo et al.<sup>8</sup> revealed that the primary reason for dental general anesthesia was the presence of rampant caries among young, uncooperative children.

General Anaesthesia is a state of medically induced unconsciousness or coma with the loss of protective reflexes and the absence of pain following administration of one or more general anaesthetic agents.<sup>9</sup> It is particularly opted for pre-cooperative children, children allergic to local anesthesia, children in need of invasive dental procedures or comprehensive dental treatment.<sup>10</sup> With rapid advances in the field of anesthesia, surgical expertise and introduction of modern anesthesia techniques and drugs, dental general anesthesia provides successful treatment of even the most phobic dental patient.<sup>11</sup> However, the potential for anesthetic neurotoxicity in the neonate, young infant, and fetus is still the most pressing and contentious question facing the field of pediatric anaesthesia. According to the guidelines stated by 'U.S. Food and Drug Administration 2017', exposure of anesthetic drugs for more than 3 hours or over multiple procedures may negatively affect brain development in children younger than 3 years. Furthermore, Haworth et al.<sup>13</sup> observed that children with past experience of DGA were over 2.5 times more likely to be anxious by the age 17 years. As a result, understanding the key indications for dental general anaesthesia is crucial in order to minimize or avoid unnecessary exposure of children to general anaesthetic at a young age. To our knowledge, there were no retrospective study conducted and reported to assess the trends of dental general anesthesia on Indian pediatric population. Thus, the aim of this study was to determine the demographic and clinical profile of children treated under general anesthesia in last 7 years.

## MATERIALS AND METHODS

A Medical-record department [MRD] based retrospective study was planned after necessary ethical approval by the institutional ethical committee. The present analysis was based on dental records of all the patients reported in the Department of Pediatric and Preventive dentistry who were treated under general anesthesia in last 7 years [2012-2019].

The patients evaluated and referred for dental treatment under general anesthesia were admitted in institutional hospital. A standard protocol of assessment was followed by pediatrician and anesthesiologist for each patient. Once the pre-anesthetic clearance was received, dental rehabilitation procedure was scheduled accordingly. Prior to general anesthesia, various pre-requisites that were followed for all the patients were: parent education and counselling, fasting guidelines to be followed and written informed consent was obtained. On the day of procedure, after final pre-operative assessment, child was intubated nasally for general anesthesia and a throat pack was placed in order to prevent accidental aspiration of dental materials during the procedure.

Majority of the patients underwent preoperative radiographic investigations for diagnosis and definitive treatment planning. Treatment was planned with a goal to provide full mouth rehabilitation with definitive and quality dental care. The treatment with fair or questionable prognosis should be avoided so as to avoid further need of pharmacological aids for procedure. It included procedures ranging from preventive [pit and fissure sealants, topical fluoride application] to restorative [Composite restorations and Full coverage restorations] and surgical [Extraction, Cyst enucleation, etc]. Most of the patients were discharged on the next day after thorough post-operative assessment and follow-up. Patient related data is recorded in both OPD and IPD which is maintained in the department and hospital record system. These data sources were utilized for patient data collection.

## DATA COLLECTION

In the current retrospective study, dental records of total 116 patients treated under general anesthesia was collected with the help of medical record system. Data was extracted from paper-based dental records in the department as well as institutional medical record system. For each participant, following data were recorded –

- a) Demographic data - Name, age, gender and socio-economic status
- b) Relevant medical history & physical status – Detailed history about any underlying medical conditions or intellectual impairment disorders such as cerebral palsy, autism, etc were recorded
- c) Indication for treatment
- d) Nature of treatments carried out under general anesthesia

All the data were entered in Excel sheet and for any specific details if required the operating specialist was contacted in person to complete the required information of the patients. Patients with incomplete records were excluded from the study.

## STATISTICAL ANALYSIS

The collected data was entered in Microsoft Excel [2019] spreadsheet and were analysed using SPSS [Version 22, IBM SPSS Inc., Chicago, IL] software. Descriptive and Inferential statistical analysis was carried out in the present study. Quantitative data was presented as Mean values with standard deviation [Mean  $\pm$  SD] and categorical data was represented as frequencies with percentage [%]. Chi-square test was applied for Intergroup comparison, wherein results with  $P \leq 0.05$  was considered as statistically significant.

## RESULTS

Dental records of total 116 patients treated under general anesthesia in past 7 years [2012-2019] were extracted from the institutional medical-record department. After excluding data of patients with incomplete records, 93 patients were included in the current retrospective analysis. These were divided into 2 groups –based on patient's medical history, wherein group A included normal and healthy children and group B included children with special health care needs [SHCN] [Table 1].

Group	Frequency [N]	Percentage [%]
<b>Group A</b> [Healthy children]	73	78.49
<b>Group B</b> [With SHCN]	20	21.5
<b>Total</b>	93	100

Table 1 shows frequency distribution of children based on medical condition treated under general anaesthesia.

Both group A and B were further sub-divided based on age and gender, as represented in table 2. It was observed that majority of the patients in group A [65.7%] were between the age group of 1-5 years. On intergroup comparison, there was highly significant difference observed between age of the patient and need for dental treatment under general anesthesia with  $P < 0.05$ . In contrast, for group B majority of the children were above the age of 6 years with no significant correlation [ $P > 0.05$ ]. The male: female ratio was 0.9:1 and 1.2:1 for healthy and medically compromised children respectively, with no significant co-relation between gender and need for dental general anesthesia in both the groups.

Age group	Number of participants indicated for GA [Group A]		p-value*	Number of participants indicated for GA [Group B]		p-value*
	n	%		n	%	
1-5 years	48	65.7	0.000 <sup>ns</sup>	3	15	≥0.05
6-10 years	23	31.6		9	45	
11-15 years	2	2.7		2	10	
Above 15 years	0	0		6	30	
<b>Gender</b>						
Males	36	49.3	≥0.05	11	55	≥0.05
Females	37	50.7		9	45	
Total	73	100		20	100	

Table 2 shows the frequency distribution of children based on demographic profile treated under general anaesthesia  
 $p\text{-value} \leq 0.05$   
 Chi-square test

The results of the current analysis indicated that dental anxiety and un-cooperative behaviour [57%] was the main indication for treating pediatric patient under general anesthesia [Table 3]. Approximately, 20% of the patients treated under general anesthesia reported to have an underlying comorbidity. Clinical characteristics of these patients is depicted in Table 4, indicating that 40% in this group were mentally disabled followed by children with ADHD [25%] & Autism [20%].

Sr No.	Indication for general anaesthesia	Frequency [n]	Percentage [%]
1	Un-cooperation	53	57%
2	Extensive treatment	4	4.3%
3	Trauma/Surgical procedure	16	17.2%
4	Special health care needs	20	21.5%
Sr. No.	Medical conditions	Frequency [N]	Percentage [%]
1	Mentally challenged	8	40
2	ADHD	5	25
3	Autism	4	20
4	Down's syndrome	2	10
5	Cerebral palsy	1	5
<b>Total</b>		20	100%

Table 3 shows the distribution of pediatric patients based on indication for dental general anaesthesia

Table 4 shows the clinical characteristics of patients with special health care needs receiving treatment under general anaesthesia.

The results of the current study revealed, stainless steel crown was the most frequent procedure that was performed for both group A [73.9%] and group B [85%]. This was followed by pulpectomy [72.6%] for group A and restorative procedures [65%] for group B [Table 5]. Among various surgical procedures performed under general anesthesia, Enucleation of cyst was the most common followed by fracture management [Table 6].

Sr No.	Procedures Carried Out Under General Anaesthesia	Number of Patients Treated		Number of teeth treated	
		Group A	Group B	Group A	Group B
		N [%]	N [%]	N [%]	N [%]
1	Preventive therapy	39 [53.4]	12[60]	140 [18.3]	48 [22.0]
2	Restorative treatment	41 [56.2]	13 [65]	139 [18.2]	57 [26.1]
3	Vital pulp therapy	3 [4.1]	3 [15]	4 [0.5]	3 [1.3]
4	Pulpectomy	53 [72.6]	11 [55]	200 [26.2]	38 [17.4]
5	Stainless steel crown	54 [73.9]	17 [85]	176 [23.1]	47 [21.6]
6	Strip crowns	14 [19.2]	0 [0]	30 [3.9]	-
7	Extraction	21 [28.8]	10 [50]	63 [8.2]	39 [17.8]
8	Space management	4 [5.5]	2 [10]	5 [0.6]	-
9	Surgical procedure	18 [24.6]	1 [5]	-	-
10	Root canal treatment	2 [2.7]	10 [50]	2 [0.3]	9 [4.1]
11	Zirconia Crown	1 [1.4]	0 [0]	4 [0.5]	0

Table 5 shows the frequency distribution of dental procedures performed and number of teeth treated under general anaesthesia for both the groups.

Sr. No	Surgical procedure carried out under general anaesthesia	Number of patients treated [N]
1	Management of Fracture	4
2	Enucleation of cyst	5
3	Odontoma	3
4	Frenectomy	3
5	Disimpaction	1
6	Excision of fibroma	1

Table 6 shows the frequency distribution of various surgical procedures carried out under general anaesthesia

## DISCUSSION

A retrospective study was designed to analyze the correlation of clinical and demographic profile of pediatric dental patients treated under general anesthesia. General anesthesia, a pharmacological behaviour management technique is an efficient treatment modality, especially in pre-cooperative children. However, though general anesthesia provides better control and efficient dental treatment, it is not recommended as a first-line approach for managing behaviour of an anxious pediatric patient. It is usually opted for children with extremely uncooperative behaviour or those with intellectual disabilities or those requiring extensive dental treatment.<sup>10</sup> According to the present research, 73 healthy children and 20 children with special health care needs were treated under dental general anesthesia with a mean age of  $5.40 \pm 2.1$  years and  $10.3 \pm 6.3$  years respectively.

As children mature, they learn to understand, relate and cope up with the dental environment, thus decreasing the need for pharmacological behaviour management techniques in an older age group child. Furthermore, increase prevalence of S-ECC has exponentially increased the need for extensive dental treatment under general anesthesia. The results of the present study confirmed this tendency. Approximately, 67.12% healthy children treated were under the age of 5 years indicating a strong correlation between child's age and necessity for dental treatment under general anesthesia [ $P < 0.05$ ]. Similar results were observed in the study by Tsai et al., wherein about 80% children were below the age of 6 years. This can be attributed to dental anxiety, lack of cognitive development and coping skills in a child of younger age group.

Whereas, group B included children between the age of 3-26 years with no significant correlation between age and need for dental general anesthesia. The male: female ratio was 0.9:1 and 1.2:1 for healthy and medically compromised children respectively with no statistically significant difference [ $P > 0.05$ ]. In contrast, Lee et al.<sup>14</sup> observed boys to be highly uncooperative compared to girls, with a ratio of 1.7:1 and 1.9:1 for healthy and disabled children respectively.

It was also observed that un-cooperative behaviour [57.8%] was the main indication for performing dental treatment under general anesthesia followed by 20% cases with intellectual impairment or any other medical comorbidities. This was in accordance to the findings reported by Bader R et al<sup>11</sup>, Nsour H et al<sup>15</sup> and Brailo V et al.<sup>16</sup>, wherein non-compliance was major factor for opting dental treatment under general anesthesia. On contradictory, Sari M et al.<sup>3</sup> and Rajavaara P et al.<sup>17</sup> reported that dental general anesthesia was more common among the medically compromised children compared to the healthy children, owing to their poor oral hygiene and relatively higher DMF-T scores.

Dental general anesthesia is relatively safe and efficient approach that allows for a wide range of dental procedures, from preventive to surgical. Based on the current retrospective analysis, Stainless steel crown cementation was the common procedure performed followed by Pulpotomy [For group A] and Restorative treatment [For group B]. Contrastingly, Zirconia crown was opted in only 1.4% of the cases. The reason for the same could be the hospital set-up being in the remote area, majority of the patients reported were from low-socioeconomic status. Thus, stainless steel crown or strip crowns were most preferred compared to zirconia crowns considering its high cost. Similar findings were reported by Ibricevic et al.,<sup>5</sup> wherein number of pulpotomies and stainless-steel crowns placed for healthy patients was significantly higher [3.5] than for special needs patients [1.3] with  $P < 0.001$ . According to Zhou et al.,<sup>18</sup> extractions were the dominant procedure accounting for approximately 39.3%. A study by Savanheimo et al.,<sup>8</sup> and Nsour et al.<sup>15</sup>, restorations and extractions were the most frequently performed procedure under general anesthesia.

According to Harrison and Roberts<sup>19</sup> all dental restorations have a potential for failure. In healthy children, a failed restoration can be re-treated with little effect on their general health. However, for a chronically sick child, a failed restoration itself can be life-threatening and may involve additional medical intervention. In such cases with questionable prognosis along with underlying medical conditions clinician should choose an appropriate and definitive treatment to avoid complications or the necessity for re-treatment. Extraction is preferred in such cases if there is any doubt about the likelihood of the success of a particular treatment. In our study, children with special health care needs had considerably higher frequency of extractions compared to that of healthy children. This was in accordance to that reported by Tsai et al.,<sup>20</sup> and Lee et al.,<sup>14</sup> wherein, extraction was preferred as a treatment modality in order to provide definitive treatment.

In our study the most frequently performed preventive procedure included application of 5% sodium fluoride varnish application and pit and fissure sealants. Approximately, 53.4% children in group A & 60% in group B underwent sealant application & fluoride therapy. Also, researchers determined the frequency of surgical procedures performed dental general anesthesia; wherein it was noted that enucleation of cyst was the most frequently performed. On contrary, in an analysis by Bader et al; only one case was surgically operated under general anesthesia.

As per the literature, Early childhood caries [ECC] is regarded as the most prevalent disease globally and affects more than 40-60% of the pre-school population in India.<sup>21</sup> It was observed in the present study that majority of the children treated under general anesthesia were below the age of 5 years diagnosed with S-ECC and 20% with special health care needs. General anesthesia, although considered safe, is associated with potential risks and consequences. Hence, it is important to emphasis more on prevention of dental caries and thus avoid unnecessary exposure of children to general anesthesia.

## **CONCLUSION**

It is important to note that with increased incidence of dental caries and need for comprehensive dental treatment the global demand for dental general anesthesia is steadily increasing. In accordance to the results, it can be concluded that need for extensive treatment in a young, non-compliant child is one of the main indications for opting general anesthesia for pediatric patients. With respect to the treatment modality, stainless steel crown cementation was the most frequent procedure performed under general anesthesia.

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