

A Retrospective Study of Dental Treatment under General Anesthesia of Children with or without A Chronic Illness and/or A Disability

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Background: The indications for dental treatment under general anesthesia have been described by various authors as extensive decay, behavioral management problems, a medically compromised patient, a handicapped patient, and a combination of these. Few studies have been undertaken to identify the range of treatment provided for chronically sick children. The aim of this study was to identify the characteristics of dental procedures performed under general anesthesia on children with a chronic illness and/or a disability, and compare these findings with other normal children.

Methods: A retrospective, comparative study was designed. Children who received comprehensive dental treatment under general anesthesia at Kaohsiung Chang-Gung Memorial Hospital, Taiwan, in 2002 were enrolled in this study. Patients with a chronic illness and/or a disability were included in group I, and other relatively normal patients were placed in group II.

Results: Group I children were significantly older than those of group II ($p < 0.0001$). Different patterns of dental treatment were noted when the 2 groups were compared. Significantly greater numbers of stainless steel crown build-ups ($p = 0.028$) and pulpal treatments ($p = 0.003$) were found among group II patients. There was no significant between-group difference in restorations ($p = 0.934$); however, group I had a significantly higher ($p = 0.006$) number of extractions.

Conclusions: By comparing the different patient groups receiving comprehensive dental treatment under general anesthesia, it was found that patients with a chronic illness and/or a disability had a significantly higher average surgical age and fewer pulpal treatments, received fewer stainless steel crowns, and underwent more extractions. Providing early treatment for children with a chronic illness and/or a disability may improve their dental health and maintain full dentition so as to reduce the number of subsequent tooth extractions. Thus, it is highly recommended to refer these children at an earlier age to a hospital where tooth restoration under general anesthesia can be performed.

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Behavioral management plays an important role in pediatric dentistry, particularly when treating younger patients. While most young children readily accept dental treatment with the aid of behavior management, some children fail to respond and require general anesthesia.⁽¹⁻⁶⁾

The Department of Pediatric Dentistry at Kaohsiung Chang-Gung Memorial Hospital, Taiwan, provides comprehensive dental treatment for children younger than 18 years and young adults with special needs. Most of the patients are treated at the Pediatric Dental Clinic in a conscious state. When patients are particularly apprehensive with respect to impending dental work, behavioral management is used. However, a certain percentage of very young individuals, or those suffering extreme anxiety, medical impairment, and mental or physical disabilities, can only be treated under general anesthesia. Ultimately, the purpose of general anesthesia in dental treatment is to allow total oral rehabilitation, which consists of amalgam/composite restoration, pulpal treatment, extraction, and/or stainless steel crown reconstruction, in a single session.⁽⁵⁾ There has been a trend toward fewer restorations and pulpotomies, more extractions and stainless steel crowns, and more teeth having fissure sealants placed during comprehensive dental care under general anesthesia.⁽³⁾

Some studies have described differences between the levels of dental disease present in children referred from different pediatric subspecialties.⁽⁷⁾ Harrison and Roberts⁽⁸⁾ concluded that the underlying medical disorder in chronically sick children significantly influences the pattern of dental treatment when this is provided under general anesthesia. Few studies have been undertaken to identify the range of treatment provided for chronically sick children with rampant caries.

The aims of this retrospective study were to determine the characteristics of the comprehensive dental procedures performed on children with rampant caries under general anesthesia and to identify differences between the patterns of dental treatment provided under general anesthesia for children with and without a chronic illness and/or a disability.

METHODS

The records of children who received dental

care under general anesthesia at Kaohsiung Chang-Gung Memorial Hospital over a 1-year period (January~December 2002) were collected. Kaohsiung Chang-Gung Memorial Hospital is a major tertiary referral center. The sources of patients at the pediatric dental department of the hospital were general dental practitioners, other pediatric specialties within the hospital, and self-referrals. The children were treated under general anesthesia because of an inability to accept treatment under local anesthesia.

All of the children were seen for a preoperative assessment. At this appointment, administrative and clinical details related to the patient were recorded. Patients who were classified as ASA III or IV (American Society of Anesthesiologists Physical Status Classification) 9 or living far from the hospital were usually admitted for an overnight stay to allow extensive preanesthetic preparation. These patients were usually discharged on the day of operation or the next day.

All dental procedures were performed by 1 of 3 senior pediatric dentists trained at the same institution. The required preventive, restorative, and surgical treatments for each patient were completed in a single session under general anesthesia with nasal intubation. The children were divided into 2 groups. Group I was comprised of patients who had been issued a major illness/injury certificate (MIC) and/or a disability identification (DI) card. MICs are issued by the city or county government to those who have 1 or more major medical impairments. DI cards are issued by the Department of Social Welfare of the national government to those who are physically and mentally disabled. Patients included in group II had neither an MIS nor a DI.

The children's records were reviewed to determine the following: (1) age at the time of dental treatment; (2) gender; (3) requirement for hospitalization and further admission; (4) number of decayed teeth; (5) type of dental procedure completed; (6) procedure duration; and (7) ASA classification. The dental procedures were classified into: (1) operative restorations, including amalgam and composite resin; (2) stainless steel crowns; (3) pulpal treatments; and (4) extractions.

All numerical and categorical data were entered into a Microsoft Access database. Reports generated in Microsoft Excel format were exported for verifica-

tion and subsequently imported into the Statistical Package for Social Science program for Windows (SPSS, Chicago, IL, USA) for cross-tabulation and summarization of the data. All data were subjected to the Kolmogorov-Sminov test for normality. The data were not normally distributed, so the Mann-Whitney U-test for independent groups was used for the statistical comparisons.

Two-sample t-tests and Chi-square tests were respectively used to compare numerical and categorical variables between the 2 groups. In cases in which more than 20% of the expected cell sizes were less than 5, the Chi-square test for trends was used instead of the Chi-square tests.

RESULTS

There were 222 records in the database. Those patients who were over 18 years old, whose records were incomplete, or who had been treated for reasons other than caries, for example impacted supernumer-

ary tooth extraction, were excluded from the study. The final number of patient was 184. There were 56 children in group I and 128 in group II. Results of comparisons of the patients' characteristics between groups I and II are summarized in Table 1.

Patient characteristics

The age distributions of the 2 groups of children differed; those in group I had an age range of 2 years 6 months to 15 years 4 months, while those in group II had an age range of 2 years 2 months to 11 years 4 months. The average ages at the time of the operation were 6 years 3 months for group I and 4 years 1 month for group II. Thus, group I children were significantly older than those of group II ($p < 0.0001$). There were 101 males and 83 females altogether, with no statistically significant difference detected between the 2 groups in terms of gender.

Distribution of medical conditions

In group I, 21.4% of patients had MICs and

Table 1. Comparisons of Patients' Characteristics between Groups I and II.

	Total		Major illness/injury certificate or disability identification				p-value
			Yes (group I)		No (group II)		
	N = 184		N = 56		N = 128		
	n	%	n	%	n	%	
Age (year)							
< 3	33	17.9%	5	8.9%	28	21.9%	< 0.0001 [‡]
≥ 3 to < 6	119	64.7%	26	46.5%	93	72.7%	
≥ 6 to < 12	28	15.2%	21	37.5%	7	5.4%	
≥ 12 to < 18	4	2.2%	4	7.1%	0	0%	
mean ±SD	4.75 ±2.32		6.25 ±3.18		4.09 ±1.39		< 0.0001 [‡]
ASA							
I	133	72.3%	16	28.6%	117	91.4%	< 0.0001 [‡]
II	46	25.0%	35	62.5%	11	8.6%	
III	5	2.7%	5	8.9%	0	0%	
Further admission after the operation							
Yes	22	12.0%	12	21.4%	10	7.8%	0.0089*
no	162	88.0%	44	78.6%	118	92.2%	
No. of teeth with caries							
fewer than 5	0	0%	0	0%	0	0%	0.3378*
6~10	8	4.3%	4	7.1%	4	3.1%	
11~15	76	41.3%	20	35.7%	56	43.8%	
more than 15	100	54.5%	32	57.2%	68	53.1%	
mean ±SD	15.17 ±3.38		15.21 ±3.97		15.16 ±3.10		0.9228 [‡]

* By Chi-square tests;

† by 2-sample t-test;

‡ by Chi-squared t-test for trend.

these medical impairments included epilepsy, bleeding disorders, blood dyscrasia, and cardiovascular disease as well as liver transplant children; 60.7% of them had DIs and the reasons included mental retardation as well as physical impairments such as cerebral palsy, muscular dystrophy, cleft lip and palate, deafness, and hearing impairment. Overall, 17.9% of them had both an MIC and a DI.

Of the 184 cases, 133 (72.3%), 46 (25%), and 5 patients (2.7%) belonged to ASA I, II, and III, respectively. A significant difference was found overall between the 2 groups in terms of ASA classification ($p < 0.0001$).

Hospitalization

In total, 80 (43.5%) children were admitted for inpatient care with dental treatment being performed under general anesthesia. In contrast, 104 (56.5%) patients were treated on an outpatient basis under general anesthesia. Among those subjects in the inpatient care group, 72.5% (58/80) of them were discharged on the same day. In other words, 88.0% (162/184) of all patients were able to leave the hospital on the same day, and we categorized them as having no need of hospitalization. Of groups I and II, 21.4% (12/56) and 7.8% (10/128), respectively, needed further admission after the operation. There was a significant difference between the 2 groups (2 test, $p = 0.009$) with regard to the need for hospitalization.

Pattern of dental treatment

The average surgical time was 3.1 h, and no significant between-group difference was found ($p = 0.646$). The mean numbers of treated teeth and dental procedures per patient were 15.2 and 21.7, respectively. No significant between-group differences were demonstrated in the number of total treatment procedures ($p = 0.167$) and operative restorations ($p = 0.934$). However, group I children received significantly fewer stainless steel-crown build-ups ($p = 0.028$), fewer pulpal treatments ($p = 0.003$), and more extractions ($p = 0.006$) than did group II children (Table 2).

Level of dental caries

The average numbers of teeth with caries were 15.21 for group I and 15.16 for group II. There was no significant difference ($p = 0.9228$) in the number

Table 2. Mean Number of Treatment Procedures for Each Item between the 2 Groups (mean \pm SD)

	Group I N = 56	Group II N = 128	Two-sample t-testp value
Operative dentistry	8.7 \pm 3.6	8.9 \pm 3.1	0.934
Pulp therapy	4.9 \pm 4.3	6.3 \pm 2.9	0.003*
Stainless steel crowns	3.9 \pm 2.8	4.9 \pm 2.3	0.028*
Extractions	2.8 \pm 4.2	1.4 \pm 2.2	0.006*
Total procedures	20.18 \pm 6.68	21.43 \pm 5.12	0.167

* Statistically significant difference.

of teeth with caries between groups I and II.

DISCUSSION

In this study, we demonstrated that there was a trend towards conducting dental procedures under general anesthesia where 95% of the children were between the ages of 3 years 6 months and 4 years 1 month in group II. To determine the optimal timing for comprehensive dental treatment for children at high risk of caries, Worthen and Mueller (2000) suggested that treatment be delayed until the eruption of the primary second molars to reduce the need for a second such procedure.⁽¹⁰⁾ As children mature, most of them are better able to cope with dental treatment, and the number of patients requiring surgical intervention and general anesthesia decreased between 6 and 12 years of age. The results of the present study confirmed this tendency in group II. For group I, however, the distribution was more even across the different age groups relative to group II. It is, therefore, inferred that the need for dental treatment under general anesthesia exists for disabled or chronically ill patients in every age group. In this investigation, group I patients were found to be older than the relatively normal group II patients. Harrison et al. suggested that parents of chronically sick children are usually aware of the need for dental treatment, but preoccupation with immediate medical needs frequently causes considerable delays in seeking dental treatment.⁽¹¹⁾

In this study, 69.6% of patients were not in group II, but they were treated under general anesthesia just because of dentistry-related fear or lack of cooperation at a younger age. This prevalence was higher than analogous rates determined by Wang et al. (40%),⁽¹²⁾ Vermeulen et al. (42%),⁽⁵⁾ and Tarjan et

al. (49%).⁽¹³⁾ However, O'Sullivan and Curzon reported that general anesthesia was used for 76% of their cases due to behavioral problems alone.⁽¹⁴⁾

Outpatient general anesthesia offers a distinct advantage in dental care for special patients. The guidelines proposed by the Royal College of Surgeons in England for day-care surgery suggest that the anesthetic duration should not exceed 30~40 min for children undergoing day-care surgery.^(15,16) In a 1983~1993 review, however, it was demonstrated that approximately half of the patients undergoing day-stay anesthesia exceeded the recommended time.⁽¹⁾ Ventura et al. also observed that such cases required between 40 min and 3 h to complete the full-mouth rehabilitation in specialized outpatient clinics.⁽¹⁷⁾ In this study, the mean number of dental procedures per patient was 21.7, with the surgical duration requiring 2.4~3.8 h. Most of the patients (88%; n = 162) left the hospital on the same day; all were free of severe complications, such as uncontrolled fever, or respiratory or cardiovascular complications, which would typically require further hospitalization. However, 21.4% (12/56) of group I children and 7.8% (10/128) of group II children required further admission. Group I children had a significantly higher necessity of hospitalization than did group II children. According to Ferretti's recommendation, with a thorough evaluation of systemic disorders such as asthma, diabetes, and congenital heart disease, ASA class I or II cases are candidates for outpatient general anesthesia, while those classified as ASA III or higher are usually not.^(18,19) Wong et al. showed a low rate of perioperative admissions for children with medical complications and/or mental disabilities.⁽¹²⁾ Enever et al. also concluded that in disabled patients, postoperative morbidity after outpatient general anesthesia for dental procedures appeared to be low, and parent/caretaker satisfaction was high.⁽²⁰⁾ Further, Ennger and Mourino failed to demonstrate a statistically significant relationship between the preoperative physical status (ASA category) and postoperative complications.⁽²⁾ To determine if an inpatient or outpatient modality is indicated, individual assessment of each patient, such as physical status and parents' compliance with instructions, is most important.⁽¹⁶⁾

The mean number of decayed teeth per patient in our study was 15.2, which is comparable to Su and Chen's study at Chang Gung Memorial Hospital,

Taipei.⁽²¹⁾ Although our average treatment duration was longer (3.1 vs. 2.6 h, respectively), this may have been due to the relatively greater number of procedures performed (average 21.7 vs. 17.4, respectively). The present study also showed that more pulp therapies were conducted in 2002 than in 1992.

With regard to the number of teeth with caries, the minimal and maximal numbers were 6 and 25 in group I, and 7 and 20 in group II, respectively. All of the patients corresponded to the definition of rampant caries, which indicates more than 6 active lesions.

Group I children received significantly fewer pulpal treatments and stainless steel crowns than did group II. The findings are in line with the results by Harrison and Roberts⁽¹¹⁾ and Ibricevic et al.⁽²²⁾ Those workers reported more extractions in chronically sick children compared to healthy controls. There was no difference in the number of teeth with caries between the 2 groups. The amount of dental disease present was similar. It appears reasonable to conclude that pediatric dentists in the present study modified the treatment protocol and adopted a more-aggressive dental treatment strategy, such as extraction of teeth rather than preserving them for chronically sick children because of their preexisting medical conditions. As Harrison and Roberts⁽¹¹⁾ mentioned, 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. Extraction is preferred in such cases if there is any doubt about the likelihood of the success of a particular treatment.⁽¹¹⁾

Camilleri et al. (2004)⁽²³⁾ mentioned that ASA III and IV children have significantly lower levels of dental caries than ASA I and II children, and received a higher level of preventive and restorative care. Hence, they suggested that it is not true that medically compromised children receiving dental treatment under general anesthesia have more extractions and fewer restorations than ASA I and II children undergoing similar procedures. In the present study, most of the children with a chronic illness and/or disabilities were also grouped into ASA I or II. Only 8.2% of them were classified as ASA III. Thus, there were no contradictions between the earlier conclusions and results of the present study.

By comparing the different patient groups who received comprehensive dental treatment under general anesthesia, it was concluded that patients with a chronic illness and/or disability had a significantly higher average surgical age, received fewer pulpal treatments, received fewer stainless steel crowns, and underwent more extractions. Therefore, more efforts should be made at encouraging these patients to visit the dentist earlier and receive primary preventive care. Pediatric dentists should cooperate and communicate with pediatric specialists. Our study suggests that early treatment of children with a chronic illness and disability may improve their dental health and help maintain their full dentition so as to reduce the number of teeth extracted. Thus, it is highly recommended to refer these children at an earlier age to a hospital where tooth restoration under general anesthesia can be performed.

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重大傷病及 / 或身心障礙兒童與一般兒童在全身麻醉下 進行全面性牙科治療的回溯研究

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背景：對於患有猛暴性齲齒又缺乏合作能力或極度害怕的兒童，或患有重大或特殊疾病及身心障礙的患者，不適合在牙科治療椅上治療者，以「全身麻醉下進行全面性牙科治療」的全口復健方式，可說是相當合適。本研究即比較在此種治療方式下的慢性疾病及 / 或身心障礙兒童與一般兒童之特性及治療方針上的異同。

方法：收集 2002 年所有在高雄長庚醫院 18 歲以下於全身麻醉下進行全口齲齒治療之 184 位兒童，患有慢性疾病及 / 或身心障礙的 56 位兒童為第一組，其他 128 位一般兒童為第二組。以回溯研究分析患者之性別、年齡、住院與否、齲齒數、牙科處置項目、手術時間及 ASA 分級特性。

結果：兩組兒童齲齒數目沒有顯著差異 ($p = 0.9228$)，平均 15 顆以上。第一組兒童平均治療時的年齡為 6.25 歲，較第二組兒童 (平均 4.09 歲) 大 ($p < 0.0001$)；第一組兒童齒髓治療 ($p = 0.003$) 及不鏽鋼牙冠 ($p = 0.028$) 的數目較少；拔牙數目較多 ($p = 0.006$)；但在填補數目及總治療數目沒有顯著差異 ($p = 0.934$ 及 $p = 0.167$)。

結論：慢性疾病及 / 或身心障礙的兒童的平均實施年齡一般兒童高，平均齒髓治療及不鏽鋼牙冠數目較少，平均拔牙數較多。推論患有慢性疾病及 / 或身心障礙兒童的牙科處置因為疾病拖延較久而較嚴重，所以拔牙顆數較多，齒髓治療較少。建議應建立早期轉介慢性病及身心障礙兒童至牙科的系統，以提早預防及治療。
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關鍵字：全身麻醉，全面性牙科治療，身心障礙兒童。

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