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Original Article

A 10-year trend of dental treatments under general anesthesia of children in Taipei Veterans General Hospital

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Abstract

Background: General anesthesia (GA) as a pediatric dental procedure is a well-established method of behavior management. However, studies of pediatric dentistry under GA have mostly focused on handicapped patients, and various retrospective studies in Taiwan have mainly reviewed only a limited number of years. The purpose of the present study was to report trends in pediatric dental treatment performed under GA over the past 10 years.

Methods: A retrospective review of the hospital records of patients receiving dental treatment under GA from 2006 until 2015 was performed. The patients were divided into three age groups: < 3 years, 3–6 years, and > 6 years. A range of information including basic patient characteristics and types of dental treatment was identified and then analyzed.

Results: A total of 791 cases (< 3 years old: 65 cases, 3–6 years old: 492, > 6 years old: 235; 549 male, 242 female) were treated under GA. The case number was found to have increased from 94 during 2006–2007 to 238 during 2014–2015, with the increase being especially pronounced among those aged 3–6 years (2006–2007: 49, 2014–2015: 165). The most common treatments (extraction, restoration, and pulp therapy) were associated with multiple dental caries (684, 86.4%). The < 3-years-old group was characterized by the highest decayed, extracted, and filled surface and decayed, missing, and filled surface indices; the highest mean number of treated teeth; and the highest mean number of treated teeth by composite resin fillings. The 3–6-years-old group had the highest number of primary teeth extractions. The > 6-years-old group had the lowest mean number of treated teeth by stainless-steel crowns (SSCs) and fewest cases treated with pulp therapy. From 2011 onwards, the number of primary tooth extractions significantly increased, while in 2013, there was a crossover whereby the SSC count surpassed the composite resin filling count.

Conclusion: Over the past 10 years, there has been an increased use of GA for pediatric dental treatments, in particular, in cases with multiple dental caries. In addition, there has also been an increasing trend towards extraction of primary teeth and the use of SSCs.

Keywords: dental general anesthesia; rationale for anesthesia; dental treatment type

1. Introduction

When pediatric dentistry is considered, most dentists seem to have a preconception that involves uncooperative and emotional children who strongly resist having dental treatment. This mindset results in dentists being unwilling to spend time treating uncooperative children. The American Academy of Pediatric Dentistry recognizes that dental care is medically necessary for the purpose of preventing and eliminating orofacial disease, eradicating infection, abolishing pain, restoring the form and function of dentition, and correcting facial disfiguration or dysfunction.[1] Behavior guidance techniques, both nonpharmacological and pharmacological, can be used to alleviate anxiety, nurture a positive dental attitude, and

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perform quality oral health care on infants, children, adolescents, and persons with special health care needs; all in a safe and efficient manner.

In order to reduce the anxiety that children may experience, some nonpharmacological approaches to behavior management are available; these include "tell–show–do", positive reinforcement, physical restraint, voice control, and hand-over-mouth.[2] However, these techniques were not completely effective when used with some dental phobia patients due to either age or psychological factors; this is also the case when patients lack the ability to cooperate with the dentist due to physiological factors.[2] Furthermore, in recent years, as the birth rate has become lower and the importance of human rights has increased, many parents show antipathy towards negative approaches to behavior management, and the use of such approaches may even give rise to medical disputes. Investigations targeting the parents of pediatric dental patients have demonstrated that parents were more accepting of voice control, physical restraint, and hand-over-mouth in 1984 than medical sedation or general anesthesia (GA)[3]; but by 1991, parents found medical sedation more acceptable, as well as negative behavior management; however GA still remained unacceptable[4]; by 2005, both medical sedation and GA had become more acceptable than negative behavior management.[5]

In most cases, GA allows the dentist to complete the treatment rather than delay care because a patient's anxieties and fears about treatment make him or her uncooperative. By reducing the anxiety of patients and their movement through the use of GA, it is possible for dentists to offer significantly improved dental care. GA results in total relaxation, and recall of the procedure is minimized; this allows the successful treatment of even the most dental-phobic patient.[6] In the long run, the use of GA to treat healthy and fearful children results in the best outcome for the patient.[7] Despite the fact that the use of GA and sedation in pediatric dental treatment is common in European countries and North America, Taiwanese parents regard such approaches as not customary, and they find it hard to accept them. Therefore, most cases in which GA and sedation are used for children involve patients with special health care needs, and healthy children in Taiwan are still mostly treated using nonpharmacological approaches to behavior management. Nevertheless, quality of care may be significantly compromised due to uncontrolled movement by children with behavior problems.[8]

Dental treatment under GA at Taipei Veterans General Hospital (VGHTPE) started in the 1980s, and from this point onwards, it was available when treating patients in many districts of Northern Taiwan. While it provides treatment of the highest quality, information on this treatment method and studies on its use remain scarce. Furthermore, such studies of pediatric dentistry under GA in Taiwan that are available have mostly focused on children with special health care needs, and any retrospective studies were limited to only a few years.[9–11] Therefore, the objective of this study was to provide baseline information regarding trends in pediatric dental treatment performed under GA at VGHTPE over the past 10 years. The information collected by this study should be very useful when planning the future use of GA in pediatric dentistry.

2. Methods

This was a retrospective review of hospital records of dental patients who were treated under GA from January 2006 until November 2015. All participants who attended our hospital were first examined to evaluate their behavioral capabilities and their psychological and physical disabilities. Qualified pediatric dentists performed charting and an oral examination. The behavior of patients was then classified according to Wright's Clinical Classification (1975).[12] Indications for the use of GA are based on specific criteria that take into account the risks, benefits, effectiveness, anticipated outcomes, and the use of other behavior management techniques as an alternative. These criteria are listed in Table 1.[13,14] If the guardian of the uncooperative child is hesitant to allow the use of GA, the patient then still undergoes dental treatment; this being arranged on an outpatient department basis initially. Several appointments take place involving behavior guidance, including regulation, tell–show–do, and desensitization, which are combined with oral hygiene instruction and intensive fluoride application for caries control. If the patient still fails to respond, GA may be recommended. Prior to the dental treatment procedures under GA, appropriate pediatric physicians and anesthesiologists are consulted on the systemic condition of each participant in order to ensure there are no absolute contraindications for the GA that is to be performed.

The following dataset was collected for each participant: age (< 3 years, 3–6 years, and > 6 years), sex, medical diagnosis, caries status, types and numbers of treatments, and any complications. Caries status was recorded based on the World Health Organization[15] oral health survey criteria and methods, which use the decayed, extracted, and filled surface (DEFS) index for primary dentition and the decayed, missing,

Table 1
Criteria used to select patients who will undergo dental treatment under GA.

1. Individuals who cannot cooperate due to a lack of psychological or emotional maturity and/or mental physical or medical disability
2. Individuals for whom local anesthesia is ineffective because of acute infection, anatomic variation, or allergy
3. Individuals who are moderately to extremely uncooperative
4. Individuals who are verbally uncommunicative because of psychosocial, medical, or cultural situations
5. Individuals who require complicated restorative and/or surgical procedures
6. Individuals for whom the use of GA may protect the developing psyche and/or reduce medical risk
7. Individuals who require immediate and comprehensive oral/dental care (e.g., dental abscess threat to the patency of the airway or other anatomical structures)
8. Individuals who have demonstrated a failure in behavior management when available behavior guidance techniques were used
9. Individuals who have full-mouth advanced caries and need to be treated invasively over several appointments at the out-patient department
10. Individuals who live in a remote area far from a hospital/dental clinic

GA = general anesthesia.

and filled surface (DMFS) index for permanent dentition. In cases of mixed dentition, the two indices were combined to assess the caries status. The types of dental treatment identified consisted of restoration, pulp therapy, and extraction. The inclusion criterion for patients was that the patient had received comprehensive dental treatment under GA, which resulted in a total of 1126 cases. The exclusion criterion was that the patient had incomplete longitudinal records. Using the records from the hospital database, 792 cases were identified with complete records and these records were then retrieved.

The following relationships, age groups versus caries status, caries status versus number of treated teeth, and age groups versus number of treated teeth, were assessed using one-way analysis of variance. The relationship between year and types of dental treatments was analyzed by two-way analysis of variance. All statistical analyses were performed using SPSS version 12 (SPSS Inc, Chicago, USA) and Microsoft Excel 2010 (Microsoft corporation, Redmon, Washington, USA).

3. Results

Among 791 participants, there were 549 boys and 242 girls enrolled in our study. The mean age of the enrolled patients was 5.77 ± 3.55 years. In terms of age, 65 patients were aged < 3 years old, 235 patients were 3–6 years old, and 235 patients were > 6 years old. The case number was found to have increased from 94 during 2006–2007 to 238 during 2014–2015; this increase was especially pronounced for the 3–6-years-old group, which during 2006–2007 consisted of 49 patients and during 2014–2015 consisted of 165 patients. The mean ages and sex ratios of the three groups remained almost the same over this 10-year period. Details are shown in Table 2.

The most common treatments, including extraction, restoration, and pulp therapy, were for multiple dental caries. This group consisted of 684 of the total of 791 patients (86.4%). The other major indication for pediatric dentistry under GA was a need for surgery, which included surgical odontectomy (12.4%), enucleation (0.7%), surgical exposure (0.4%), and biopsy (0.1%) (Table 3).

The overall mean DEFS/DMFS index was 27.80 ± 20.60. The DEFS/DMFS index was significantly higher among the < 3-years-old patients (39.98 ± 18.10) than among the 3–6-years-old patients (31.46 ± 20.78) and the > 6-years-old patients (17.18 ± 16.38). The overall mean number of treated teeth was 16.79 ± 8.95. The mean number of treated teeth in the three groups was significantly higher in the < 3-years-old group (16.34 ± 40), which was followed by the 3–6-years-old group (13.37 ± 5.39) and then the > 6-years-old group (9.09 ± 6.18). Details are shown in Table 4.

Table 3
Rationale for dental treatment under general anesthesia.

Variable	*n* (%)
Multiple dental caries	684 (86.4)
Surgical need	107 (13.6)
Surgical odontectomy	98 (12.4)
Enucleation	5 (0.7)
Surgical exposure	3 (0.4)
Biopsy	1 (0.1)

The distribution of dental treatments and the number of treated teeth within each age group were also analyzed. The < 3-years-old group was characterized by the highest mean number of treated teeth and the highest mean number of teeth treated by composite resin fillings (CRFs). The 3–6-years-old group had the highest number of extracted primary teeth ($p < 0.05$). The > 6-years-old group had the lowest mean number of teeth treated by stainless-steel crown (SSC) and the lowest number undergoing pulp therapy ($p < 0.05$). Details are shown in Table 5.

The demographic characteristics related to dental treatment and the number of teeth treated each year are shown in Table 6. The extraction of primary teeth showed a significant increase in 2011, and when 2012 and 2014 were compared with 2006, there were also significant differences. The extraction of permanent teeth showed no significant change over the 10-year study period. CRF restoration showed a decline over the 10-year study period and, when compared against 2015,

Table 4
Distribution of DEFS/DMFS indices by age.

Age group (y)	*n* (%)	Mean DEFS/DMFS	Mean no. of treated teeth
< 3	65 (8.2)	39.98 ± 18.10	22.94 ± 6.69
3–6	491 (62.1)	31.46 ± 20.78	18.83 ± 8.42
> 6	235 (29.7)	17.18 ± 16.38	10.82 ± 7.39
Overall	791 (100)	27.80 ± 20.60	16.79 ± 8.95

* $p < 0.05$.
DEFS = decayed, extracted, and filled surfaces of primary dentition; DMFS = decayed, missing, and filled surfaces of permanent dentition.

Table 2
Demographic characteristics of the study population.

Period	2006–2007 (%)	2008–2009 (%)	2010–2011 (%)	2012–2013 (%)	2014–2015 (%)	Total (%)
Sex						
Male	70 (74.5)	100 (75.2)	94 (63.0)	119 (67.2)	167 (70.2)	549 (69.4)
Female	24 (25.5)	33 (24.8)	55 (37.0)	58 (32.8)	71 (29.8)	242 (30.6)
Mean age (y)	5.47 ± 3.18	5.80 ± 3.47	5.87 ± 3.52	5.82 ± 3.74	5.77 ± 3.60	5.77 ± 3.55
Age group (y)						
< 3	15 (16.0)	15 (11.3)	15 (10.1)	11 (6.2)	9 (3.8)	65 (8.2)
3–6	49 (52.1)	72 (54.1)	87 (58.4)	118 (66.7)	165 (69.3)	491 (62.1)
> 6	30 (31.9)	46 (34.6)	47 (31.5)	48 (27.1)	64 (26.9)	235 (29.7)
Total	94	133	149	177	238	791

Table 5
Distribution of dental treatment and numbers of treated teeth by age group.

	< 3 y	3–6 y	> 6 y
Ext-primary	1.35 ± 1.78	2.08 ± 2.24*	1.58 ± 2.17
Ext-permanent	0.11 ± 0.87	0.09 ± 0.35	0.55 ± 1.11*
CRF	9.08 ± 4.12*	5.19 ± 3.78	5.28 ± 4.85
SSC	5.80 ± 3.12	6.04 ± 3.70	1.68 ± 2.42*
Pulpotomy	2.51 ± 2.26	2.18 ± 2.51	1.08 ± 1.76*
Pulpectomy	4.23 ± 2.71	3.27 ± 3.51	0.59 ± 1.19*
Total	22.94 ± 6.69	18.83 ± 8.42	10.82 ± 7.39

* $p < 0.05$.
CRF = composite resin filling; Ext-primary = primary tooth extraction; Ext-permanent = permanent tooth extraction; SSC = stainless steel crown.

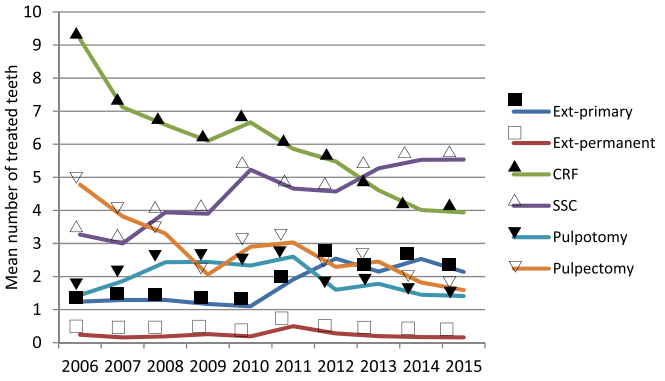

Fig. 1. Trends over time for each type of treatment. CRF = composite resin filling; Ext-primary = primary tooth extraction; Ext-permanent = permanent tooth extraction; SSC = stainless steel crown.

there were significant differences with the period before 2011. In particular, there was a crossover wherein the number of SSC restorations surpassed the number of CRF restorations in 2013. SSC restoration showed an opposite pattern to CRF restoration and had increased over the study period; specifically, when compared against 2015, there were significant differences before 2009. When we examined pulp therapy, pulpectomy was seen to be significantly higher in 2006, and pulpectomy showed a decreasing trend over the study period. Generally the rate of pulpectomy was higher than that of pulpotomy over the study period, with 2009 being the exception. The trends over time for each treatment are presented in Figure 1. Finally, when postoperative complications were reviewed, it was found that there had been no major complications noted in the hospital records and no patients had suffered mortality, laryngospasm, aspiration pneumonia or postintubation croup over the study period.

4. Discussion

Out of a sample of 791 individuals, the number of patients treated using GA showed an increasing pattern using 2-year intervals, and by the end of the study period, the number of GA patients had doubled. It is believed that early in the study period, many patients who needed treatment did not attend due to their parents or guardians not accepting the management of caries under GA. However, as the awareness of the need for child health care has increased over time, there has been a parallel decrease in the acceptance of negative behavior management techniques in recent years. Therefore, it is believed that the number of patients receiving dental treatment under GA is likely to continue to increase. The number of patients treated under GA has shown an upward trend since 2006, and the total number of patients treated during 2014 and 2015 was more than twice that treated during 2006 and 2007. The need for GA has significantly increased in the last 2-year period based on this study, and it can be speculated that more parents in Northern Taiwan are becoming willing to try pharmacological behavior management techniques for dental treatment. Furthermore, this could represent an increasing trend towards GA or dental sedation as part of pediatric dental treatment in the future.

Our study group consisted of approximately 70% males and 30% females. Another study, conducted by National Taiwan University Hospital analyzed 200 patients who underwent dental treatment under GA, and the sex ratio (male: 65% and female: 35%) was similar to that of our study.[9] However, another study conducted in Australia, which involved the use of day stay GA for the provision of dental treatment to children, showed no significant difference in the sex ratio of the patients.[16]

Our study found that the mean age of our pediatric dental patients who had undergone dental treatment under GA was

Table 6
Characteristics of dental treatment and numbers of treated teeth during each year.

Year	Ext-primary	Ext-permanent	CRF	SSC	Pulpotomy	Pulpectomy
2006	1.24 ± 1.52	0.24 ± 0.65	9.18 ± 4.85	3.27 ± 3.28	1.44 ± 1.73	4.78 ± 4.51
2007	1.29 ± 1.53	0.16 ± 0.59	7.12 ± 4.57	3.00 ± 2.54	1.86 ± 1.73	3.82 ± 3.49
2008	1.29 ± 1.50	0.19 ± 0.44	6.59 ± 4.66	3.94 ± 3.11	2.43 ± 2.43	3.30 ± 3.63
2009	1.17 ± 2.04	0.26 ± 0.67	6.10 ± 3.44	3.90 ± 3.31	2.44 ± 2.17	2.06 ± 2.61
2010	1.10 ± 1.61	0.19 ± 0.55	6.66 ± 4.03	5.23 ± 4.10	2.33 ± 2.23	2.90 ± 3.44
2011	1.91 ± 1.88	0.50 ± 1.47	5.86 ± 4.80	4.66 ± 3.59	2.60 ± 2.52	3.03 ± 4.06
2012	2.54 ± 2.15	0.28 ± 0.77	5.48 ± 3.94	4.57 ± 3.93	1.60 ± 2.18	2.29 ± 2.88
2013	2.15 ± 2.18	0.20 ± 0.54	4.61 ± 4.00	5.27 ± 4.04	1.78 ± 2.39	2.45 ± 3.10
2014	2.53 ± 2.71	0.17 ± 0.63	4.01 ± 3.58	5.53 ± 3.38	1.45 ± 2.41	1.82 ± 2.42
2015	2.14 ± 2.12	0.16 ± 0.56	3.94 ± 3.33	5.54 ± 4.36	1.41 ± 2.61	1.59 ± 2.35
Total	1.87 ± 2.20	0.23 ± 0.74	5.52 ± 4.27	4.74 ± 3.86	1.88 ± 2.35	2.55 ± 3.22

CRF = composite resin filling; Ext-primary = primary tooth extraction; Ext-permanent = permanent tooth extraction; SSC = stainless steel crown.

5.77 ± 3.55 years. A study was conducted at National Cheng Kung University Hospital (Tainan, Taiwan, ROC) during 2014; this consisted of 118 patients of all ages, including adults. The patients were divided into two groups, namely < 6 years old and ≥ 6 years old. There were 69 patients in the < 6-years-old group with a mean age of 3.3 years, and a sex ratio, male to female, of 1.6:1. By contrast, there were 49 patients in the ≥ 6-years-old group, with a mean age of 20.0 years and a sex ratio of 1.04:1.[17] Our study in 2014 consisted of 127 patients and included 90 patients aged < 6 years and a higher ratio for all patients of males to females (2.6:1, VGHTPE study and 1.83:1, National Cheng Kung University Hospital study). Furthermore, the lower mean age for our ≥ 6 years (9.9 years) group reflects that our service group was pediatric only and did not include adults. The 3–6-years-old group in our study formed the highest proportion of patients, and these groups showed an annual increase during our study. We believe that the concept of early intervention to treat caries is becoming more widespread and thus more parents are willing to allow their children to undergo caries treatment under GA at a young age.

A majority of our cases underwent comprehensive dental restoration followed by odontectomy, which agrees with other studies.[9,18,19] This seems to be correlated with the current level of caries experienced in Taiwan. When children aged < 6 years were examined, a 2011 Taiwanese oral health survey showed that the prevalence of dental caries among those aged 5–6 years was 79.32%.[20] This prevalence is high compared with the goal of the World Health Organization in 2000; namely, a dental caries prevalence among children 5 years of age of ≤ 50%.[21] Young patients with multiple dental caries are the group most commonly treated under GA. In some cases, the presence of rampant caries was combined with a high level of anxiety, and this often resulted in severe management problems.[22] The other indication for pediatric patients under GA was the need for surgical intervention. Surgery conducted under GA is without doubt beneficial when pediatric patients are being treated because they are often afraid of the needle used for local analgesia and are unable to bear long surgical procedures under local analgesia.

In our survey, the mean DEFS/DMFS index was higher for the < 3-years-old group (39.98) compared with the 3–6-years-old group (31.46) and the > 6-years-old group (17.18). During early development, younger children often have difficulty carrying out proper oral care due to their physical limitations. After 6 years of age, the exfoliation of primary teeth and the eruption of permanent teeth seem to decrease the DEFS/DMFS index until children reach 12 years.[10] In addition, this reduction could be due to case selection associated with the hospital setting, namely that patients in the > 6 years age group may visit the hospital not for dental caries itself but rather because there is a need for surgery or because they suffer from severe dental phobia. The overall mean number of treated teeth was 16.79 ± 8.95, with the highest number being 22.94 ± 6.69 in the < 3-years-old age. If a patient is treated in an outpatient department, each 1-hour appointment is only able to treat one or two teeth. Moreover, if the teeth need pulp therapy, there is a great deal of discomfort and the need for more advanced treatments. In such circumstances, most children would have difficulty cooperating with these treatments. In addition to this, if the patient lives in a remote area far away from the hospital or a dental clinic, finishing all the treatment requires more time. In such circumstances, GA is a good option, as it allows all the treatments to be finished in one morning.

The management of patients with rampant caries that require treatment under GA may involve the extraction of all teeth affected by caries,[23] followed by restoration of the remaining teeth using CRFs or SSCs, together with pulp therapy for teeth with deep caries. Restoration of primary teeth with stainless steel crown has shown the highest rate of success compared with other types of restorative material,[24] and such an approach is useful when treating primary teeth. Recently, Almeida et al[25] reported that a group of children with early childhood caries who were treated under GA had a significantly higher subsequent caries rate than a control group who were initially caries free. They concluded that a more aggressive approach may be warranted when children have early childhood caries and require treatment under GA.[25] O'Sullivan and Curzon,[26] in their investigation of restorations done under GA, also found that amalgam and composite resin restorations had higher failure rates than SSC restoration. Only 3% of SSC restorations failed in O'Sullivan and Curzon's study, while 29% of amalgam and composite restorations failed. Another study conducted by Tate et al[27] reported that the failure rates for SSC, amalgam, CRF, and composite strip crown restorations were 8%, 21%, 31%, and 51%, respectively. SSC restoration was the most reliable and surpassed amalgam, while composite restoration was the least durable for patients treated under GA, especially the use of composite strip crowns.[27]

In our study, the < 3-years-old group had a significant higher number of CRFs. It has been suggested that caries in these patients shows severe progression because the teeth do not remain long enough in the mouth, therefore, the cavities are small enough to undergo preventive resin restoration. If the caries is deeper or shows a greater progression, SSCs may be needed.

The 3–6-years-old group had a significant higher number of primary teeth extractions. First, this may have been due to the fact that patients at 6 years of age were at a stage at which there was early mixed dentition, and under such circumstances, many primary teeth, such as the central and lateral incisors, showed some degree of root resorption and mobility. As a result of such instability, extraction of the affected teeth was the first choice. Second, many of these children had rampant caries that involved the upper anterior primary teeth and an advanced caries extension, and in such circumstances, the tooth structure was seriously damaged. Tate et al[27] showed that the failure rate of composite strip crowns was high, which were highly prone to fracture, especially after pulpectomy. In such circumstances, any severely damaged upper anterior primary teeth need to be removed and replaced with a kiddy denture. In the > 6-years-old group, there was a significantly

higher number of permanent teeth that had been extracted, and this was associated with a lower number of SSCs, fewer pulpotomies, and fewer pulpectomies. This greater number of extractions of permanent teeth may have been related to some young permanent molars having advanced decay and poor restorability. If the tooth germ of the third molar was seen in a panoramic film, extraction of a first permanent molar and replacement with a second molar may have been performed. The lower number of SSCs, pulpotomies, and pulpectomies was likely due to the fact that most primary teeth among this age group were at a late stage and would exfoliated in a few years. In such circumstances, the need for endodontic treatment and SSC restoration may have been converted to tooth extraction or composite resin restoration.

The extraction of primary teeth has shown a significant upward trend since 2011, and after 2012, these numbers showed a significant difference compared with 2006. One possible explanation for this was the high failure rate of upper anterior composite resin strip crowns placed over teeth after pulpectomy when the child was younger. When upper anterior primary teeth are severely decayed, the preferred mode of treatment in recent years has become extraction and restoration using a kiddy denture. By way of contrast, the extraction of permanent teeth has shown no significant trend up or down over the past 10 years. Nevertheless, CRF restoration has shown a significant downward trend since 2006, and the number of teeth involved has even dropped below that of SSC restoration. Specifically, restoration using SSCs has shown an opposite trend to that of CRFs, with the crossover in tooth numbers occurring in 2013 and the number of SSC restorations now significantly higher than that of CRF restorations. These trends are in accordance with the studies previously mentioned, which indicated that SSCs were the most reliable mode of restoration.[26,27]

Trends in pulp therapy were found to be different in our study. The number of teeth receiving pulpotomy was usually lower than the number receiving pulpectomy, and pulpotomy only surpassed pulpectomy in 2009. Pulpectomy has shown a downward trend and has reached a low point in recent years. The results from a systemic review of different kinds of pulp treatment show that the evidence available is insufficient to assess which of indirect pulp capping (IPC), stepwise excavation, direct excavation and pulp capping/partial pulpotomy, pulpotomy, or pulpectomy is the most effective treatment approach for teeth with deep caries.[28] The number of teeth receiving SSC restoration has exceeded that undergoing pulpotomy and pulpectomy since 2007. According to Al-Zayer et al,[29] this may be due to the use of SSC restoration after an IPC having a high success rate. This study concluded that IPC is a successful technique and should be considered as an alternative to pulp therapy procedures when treating deeply carious primary posterior teeth.[29]

There were no major postoperative complications in our patients. For both the dentist and the patient's parents, the major consideration when carrying out a GA is the possibility of postoperative complications. In such circumstances, a strict preoperative assessment and good preparation of the patient are crucial. A study conducted by Lee et al[30] reported that when dental comprehensive treatment was compared with general surgery, the former was simpler and the general condition of the patient population was more stable; therefore, the risk of postoperative complications was lower. A study investigating postoperative complications associated with comprehensive dental treatment under GA at VGHTPE from August 2011 to August 2012 found that the most common postoperative complications were lip swelling (69.2%), followed by nausea (59.6%) and oral ulceration (46.1%). Despite this high prevalence of postoperative complications, most of the above complications gradually self-eliminated postoperatively under proper medical care.[31]

In conclusion, there has been an increasing use of GA for pediatric dental treatment in Taiwan. Experience at VGHTPE has indicated that children who need comprehensive dental treatment or surgical procedures under GA show major benefits with regard to better treatment conditions. Using GA results in a higher quality of care, especially when children experience extreme dental fear and have multiple dental caries. Finally, two major trends were obvious, these were an increase in the extraction of primary teeth together with an increased use of SSC restoration rather than CRF restoration.

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