

**Usage of Dental General Anesthesia and Assessment
of Fear among Special Needs and Non-Special Needs
Children in Kota Bharu, Kelantan**

FATIMA DAWOOD AL-HIDABI

UNIVERSITI SAINS MALAYSIA

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Children in Kota Bharu, Kelantan**

By

FATIMA DAWOOD AL-HIDABI

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LIST OF ABBREVIATIONS

AAPD	American Academy of Pediatric Dentistry
ADA	American Dental Association
ASA	American Society of Anesthesiologist
ACLS	Advanced Cardiac Life Support
CPG	Clinical Practice Guidelines
CFSS-DS	Child Fear Survey Schedule-Dental Subscale
CI	Confidence Interval
DAS	Dental Anxiety Scale
DBS	Dental Belief Survey
DFS	Dental Fear survey
DGA	Dental General Anesthesia
GA	General Anesthesia
GIC	Glass Ionomer Cement
HRPZ II	Hospital Raja Perempuan Zainab II
HUSM	Hospital Universiti Sains Malaysia
ICC	Intraclass Correlation
MOH	Ministry of Health
MDAS	Modified Dental Anxiety Scale
<i>n</i>	Sample size
NIH	National Institutes of Health
RCA	Royal College of Anesthetists
SD	Standard Deviation
SSC	Stainless Steel Crown

UK	United Kingdom
US	United States
USM	Universiti Sains Malaysia

ABSTRAK

Pengenalan: Anestesia Umum Pergigian (AUP) diguna dengan meluas untuk memudahkan rawatan pergigian agar selamat dan berkesan untuk pesakit yang mempunyai masalah fizikal, mental dan berkompromi perubatan lagi takut dan tidak responsif kepada teknik ubahsuai tingkah laku. Kajian ini bertujuan menentukan jenis rawatan yang dilakukan di bawah AUP dan menilai tahap takut dalam kalangan subjek. **Kaedah:** Satu kajian hirisan lintang retrospektif telah dijalankan ke atas 193 subjek sihat dan 193 subjek berkeupayaan khusus yang berumur kurang dari 18 tahun di dua pusat rujukan tertiar di Kota Bharu, Kelantan dari tahun 2001-2006 untuk mengenalpasti penggunaan AUP. Soalselidik Child Fear Survey Schedule-Dental Subscale (CFSS-DS) diguna untuk menerangkan perasaan takut. **Keputusan:** Purata umur subjek adalah 7.4 (4.11) tahun. Masalah perubatan dalam kalangan pesakit berkeupayaan khusus termasuk kardiovaskular, respiratori, sindrom, endokrin, perdarahan, anomali kraniofasial, neurologi, kerosakan pelbagai sistem badan, autisme, miopati, metabolik dan HIV. Rawatan pergigian yang diberi termasuk restorasi dan cabutan. Simen Ionomer Kaca (SIK) paling kerap diguna diikuti kombinasi SIK dan pengapan fisur. Lebih banyak gigi susu dicabut untuk subjek berkeupayaan khusus diikuti dengan restorasi. Lebih banyak restorasi gigi susu dibuat untuk subjek sihat diikuti dengan cabutan. Rawatan surgical paling kerap dibuat untuk subjek berkeupayaan khusus adalah pembetulan rekahan bibir dan lelangit. Rawatan surgical paling kerap dibuat untuk subjek sihat adalah pembuangan gigi terimpak, abses dento-alveolar dan anomali gigi.

Rawatan surgikal subjek berkeupayaan khusus termasuk fistula, jangkitan tulang, selulitis and tumor manakala rawatan surgikal untuk subjek sihat adalah sista kelenjar salivari, fistula, jangkitan tulang, selulitis dan sista odontogenik. Purata masa menunggu untuk AUP dalam kalangan subjek berkeupayaan khusus adalah 2.2 (0.68) bulan dan bagi subjek sihat adalah 1.8 (0.81) bulan ($p < 0.05$). Kadar respon untuk soalselidik CFSS-DS adalah 54.2%. Skor CFSS-DS menunjukkan 5 perkara yang paling ditakuti oleh subjek iaitu 'suntikan', 'alat gerudi doctor gigi', 'bunyi gerudi doktor gigi', 'memasukkan instrumen dalam mulut' dan 'tercekik'. Subjek berkeupayaan khusus lebih takut berbanding subjek sihat ($p < 0.05$). Lebihkurang sesuku dari jumlah ibu/bapa tidak takut kepada doktor gigi, kurang dari tiga-suku jumlah ibu/bapa menyatakan beberapa tahap takut dan 4.3% sangat takut. Skor CFSS-DS mengikut umur subjek menunjukkan peringkat umur yang lebih rendah adalah lebih takut tetapi sambil umur meningkat, subjek menunjukkan kurang rasa takut. Subjek perempuan lebih takut dari lelaki ($p < 0.05$). Apabila umur, jantina, pendapatan keluarga dan jenis keupayaan dikaitkan dengan perasaan takut, jantina didapati lebih signifikan. **Rumusan:** Rawatan bagi kedua-dua kumpulan subjek adalah cabutan dan restorasi gigi susu dan gigi kekal yang baru erup, prosedur oral surgikal dan patologi oral. Tempoh menunggu untuk AUP adalah 1-2 bulan. CFSS-DS menunjukkan skor yang berbeza-beza di antara jantina, umur dan kumpulan subjek. Perasaan takut adalah berkait secara signifikan dengan jantina tetapi tidak signifikan dengan umur dan tahap pendapatan.

ABSTRACT

Introduction: Dental general anesthesia (DGA) is widely used to facilitate the provision of safe and effective treatment for patients with physical, mental and medically compromising conditions and anxious patients who fail to respond to behavior modification techniques. This study aims to determine types of dental treatment and assess perceived level of fear among study subjects.0 **Materials and methods:** A comparative retrospective record review study of 193 special needs and 193 non-special needs subjects aged less than 18 years was undertaken at two tertiary centers in Kota Bharu, Kelantan from 2001-2006 to explore the utilization of DGA. Postal Child Fear Survey Schedule-Dental Subscale (CFSS-DS) was used to describe dental anxiety and fear. **Results:** Mean age was 7.4 (4.11) years. Medical problems among special needs children were cardiovascular, respiratory, syndromes, endocrine, bleeding, craniofacial anomalies, neurology, multi-system disorders, autism, myopathy, metabolic and HIV. Dental treatment provided was restorations and extractions. GIC was mostly used followed by a combination of GIC and fissure sealants. More extractions of primary teeth were done for special needs patients followed by restorations. More restoration of primary teeth was done for non-special needs patients followed by extractions. Common surgical treatment for special needs was cleft lip and palate repair. The most common surgical dental procedures for non-special needs patients was removal of impacted teeth, treatment of dento-alveolar abscess, and anomalies.

Common surgical procedures for special needs children include treatment of fistula, bone infection, cellulitis and tumors while common surgical procedures for non-special needs children was management of salivary gland cyst, fistula, bone infection, cellulites and odontogenic cysts. The mean waiting time for DGA among special needs children was 2.2 (0.68) and 1.8 (0.81) months respectively ($p < 0.05$). Response rate of postal CFSS-DS was 54.2%. CFSS-DS scores revealed 5 most feared items in both groups including 'injection', 'dentist drilling', 'noise of dentist drilling', 'having somebody put instrument in mouth' and 'choking'. About a quarter of parents claimed of no fear of the dentist, slightly less than three quarters expressed varying degrees of fear and 4.3% were very afraid. CFSS-DS item scores by age groups showed that younger children were more fearful but as age increases, children showed less fear items but this was not significant. Girls were more fearful than boys ($p < 0.05$). When age groups, gender, income level and type of disability were analyzed with perceived levels of fear, gender was significantly related. **Conclusion:** Treatment for both groups was extractions and restorations of primary and newly erupted permanent teeth, oral surgical procedures and oral pathology. The duration of waiting time for DGA was 1-2 months. CFSS-DS showed varied mean scores between gender and age in both groups. Perceived level of anxiety and fear was related with gender but not with age, income level and type of disability.

CHAPTER 1

INTRODUCTION AND LITERATURE REVIEW

1.1 Background of Dental General Anesthesia (DGA)

Dentists from all professional background have provided GA since 1844 when Horace Wells was credited as the discoverer of anesthesia. From that time onwards, general anesthesia (GA) has changed dentistry by being the first reliable method of pain control (Patel, 2004). GA is the induction of a controlled state of unconsciousness with the absence of pain sensation over the entire body, through the administration of anesthetic drugs during certain medical or surgical procedures. The American Academy of Pediatric Dentistry defined DGA as a management technique that uses medications to cause the child to become unconscious and asleep while receiving dental care (ADA, 2007)

In US, since 1980s outpatient dental care facilitated by GA has become more widely available (Nick *et al.*, 2003). However, there has been a fall in the use of GA for dentistry due to the mortality associated with it. Between 1996 and 1999, eight people died in UK as a result of dental anesthesia and five of them were children.

Investigations and inquiries into these deaths showed that the standard of care provided in areas such as preoperative assessment, preoperative monitoring, resuscitation and transfer to a critical care facility were not up to the level (Worthington *et al.*, 1998). However, GA for dental care in children is still necessary to facilitate the provision of safe, efficient, and effective quality of treatment for patients with certain physical, mental or medically compromising conditions.

Factors responsible for increasing trends toward GA include recent advances in monitoring patients during GA and recent development of GA-related medications and techniques. The increasing public and professional awareness regarding GA has apparently lowered the incidence of morbidity and mortality in the dental office (Guyton, 1996).

Moreover, patients with dental needs for whom local anesthesia (LA) is ineffective because of acute infection, anatomic variations or allergy, also required DGA. It also applies for extremely uncooperative, fearful, anxious or non-communicative children or adolescents with dental needs and for patients who sustained extensive oro-facial and/or dental trauma (al-Rakaf *et al.*, 2001). Dental care under GA for preschool children is well accepted by parents and has been perceived to have a positive social impact on children in UK and US (Fung *et al.*, 1993; Mason *et al.*, 1995; White *et al.*, 2003).

1.2 Benefits of DGA in Pediatric Dentistry

Dental treatment that utilizes GA can be accomplished safely in most dental hospitals, with major benefits for both patients and dentists. Coplans and Curson (1993) reported that there were favourable mortality ratios when GA was performed in an office setting compared to that of hospital outpatients receiving dental treatment. Properly monitored GA with adequate facilities is thus a salient feature when considering DGA for children.

In many cases, patient anxiety and fear regarding treatment contribute to uncooperative behaviors. GA enables the dentist to complete treatment rather than delay care because of patient anxiety and fear that bring about uncooperative behavior. GA can provide total relaxation, minimize recall of procedures, and allow successful treatment of even the most phobic dental patient. Dental treatment facilitated by GA allows dentists to provide a higher quality of dental care (Nick *et al.*, 2003). Thus, more complex treatment can be carried out with greater comfort, reducing number of appointments and shorten treatment time for both patient and dentist.

Another advantage of oral rehabilitation under GA is that it allows treatment in a single visit, provide immediate relief of pain and require little or no cooperation by the child (Anderson *et al.*, 2004; Jamieson and Roberts-Thomson, 2006). Patients usually opt for DGA to reduce stress and increase comfort. The integral role of pain and anxiety control in dentistry has long been recognized.

Nevertheless, many factors influence the decision to prescribe DGA. These include young age, poor patient cooperation, fear and anxiety, the need for multiple extractions, acute infections, medical conditions and orthodontics (Podesta and Watts, 1996). Also poor cooperation during previous restorative treatment and anticipated difficult extractions can be included as influencing factors (Clayton and Mackie, 2003).

On the other hand, the preparation of children to enable them to accept anesthetic induction is important but is less widely available (Hosey *et al.*, 2006). Thus, DGA permit dentists to treat patients who otherwise could not be treated in a private practice setting (Folayan *et al.*, 2002). GA also facilitated the access to dental care in patients with profound dental fear, phobia and gagging (Nick *et al.*, 2003).

Moreover, DGA services become more efficient, safe, cost effective and will probably remain as the only way of providing dental treatment for patients with special needs (Anderson *et al.*, 2004). Rayner *et al.* (2003) noted that the dental extractions under DGA have been accepted by families as the principal method of treatment for carious primary teeth.

1.3 Risks of DGA in Pediatric Dentistry

GA is still considered relatively safe when administered in a hospital setting. The patient, the dentist and the GA provider must understand the risks of GA. The GA provider usually takes the primary responsibility to explain the risks to both the dentist and the patient as well as ensure a safe working environment for all parties involved. Environmental safety includes the provision of emergency equipment and medication, backup lighting, suction and oxygen.

Although it is generally safe when administered in hospitals, GA is not without risk of complications. One of the most frequent questions asked of a pediatric anesthesiologist is ‘What are the risks of GA for my child?’ Life threatening complications such as allergic reactions and bronchospasms, sore throat and pharyngitis has been identified (Kupietzky, 2004).

According to the American Society of Anesthesiologists (ASA), there are five categories of patients with regard to anesthetic risk. This includes:

- Class 1: Healthy patients
- Class 2: Mild systemic disease e.g. well controlled diabetes, mild asthma, hypertension, pregnancy, epilepsy, anxiety
- Class 3: Severe systemic disease limiting activity but not incapacitating e.g. chronic renal failure, epilepsy with frequent seizures, uncontrolled hypertension, severe asthma, stroke
- Class 4: Incapacitating disease that is a constant threat to life e.g. cancer, unstable angina or recent myocardial infarct, arrhythmia, liver failure

Class 5: Moribund patient not expected to survive more than 24 hours with or without treatment (ASA, 1963)

Generally patients graded as Class 3 ASA or greater are not suitable for day-stay DGA and require preoperative admission (Moore and Hobson, 1989).

The risk of death in children undergoing hospital GA varies in many parts of the world. When considering the risks associated with GA, mortality is usually the first concern. However, death following DGA in healthy children is relatively unlikely but morbidity is a much more common problem (Atan *et al.*, 2004). Worthington *et al.* (1998) reported between 2 and 6 per 100,000 in the UK. The mortality risk of GA appears to be somewhere between 1:1,000 and 1:100,000 with infants younger than one year and patients older than 70 years at greater risk (Ersin *et al.*, 2005).

However, the overall risk of mortality from GA is difficult to evaluate. Many different factors are involved ranging from the overall patient health and the circumstances preceding surgery to the type of procedure and the skill of the physicians involved. The risk of death of DGA is 3:1 000 000 in healthy persons. Although this ratio seem to be small, is still higher than for conscious intravenous sedation that is 1:2 000 000 (ADA, 2007).

Complications are more likely with GA compared with conscious sedation both during and after procedure. GA is most likely to depress the cardiovascular and respiratory systems such that in some groups of medically compromised patients, it is not indicated for elective procedures (Royal College of Anesthetist, 1999).

More often, several laboratory tests, chest x-rays and electrocardiograms are required before GA is instituted to minimize risks. A very well-trained anesthetic team as well as facilities and equipments are essential because GA introduces technical problems whereby when a breathing tube is in use, the tongue is brought forward. In GA, muscles are paralyzed, the posture of the dentist maybe compromised such that he can tire easily in one session. The preparation of the child for GA is also tedious such as hospital admission, pre-assessments, various tests and standard fasting before the procedure. All these involve time and cost (AAPD, 2005).

Where time is concern, treatment under GA usually has a waiting list and waiting time before DGA varies for many reasons such as availability of equipments and manpower. As DGA is not done on an outpatient basis, treatment needs to be properly planned such that the child is fit and the environment is conducive to enable safe treatment. However, it is also important to note that sometimes special needs children may have to wait for a longer time before DGA to stabilize their medical conditions in order to receive GA safely (AAPD Clinical Guidelines, 2004).

On the other hand, the risks of serious complications from GA are low. These include heart attack, stroke, brain damage and death. The risk of complications depends in part on the patient's age, sex, weight, allergies, general health, history of smoking, alcohol or drug use (Ersin *et al*, 2005). Anderson *et al*. (2004) concluded that GA procedures has been considered to be the last resort for providing dental treatment and that relates to cost and parental acceptability.

Bridgman (1999) reported that morbidity following GA can have adverse effects and can manifest itself in varying degrees of severity across a range of physiological, pathological, psychological and social effects. Moreover, GA carries a degree of anesthetic risk and is therefore deemed not suitable for all patients or for very long treatment procedures (Ersin *et al*, 2005).

The controversy surrounding deaths due to DGA is frequently associated with criticisms of the quality of practice such that current concerns about standards of medical practice and clinical governance demand a response (UK Department of Health, 1991). In the UK, starting from December 2001, DGA is only allowed to be performed in a hospital setting by a qualified trained anesthetist (GDC, 1999). The Poswillo Report (1990) gave clear advice on the clinical setting in which DGA should be administered and the minimum training of practitioners. It has been strongly emphasized that GA should be strictly limited to those patients and clinical situations in which LA is not an option (RCS, 1978).

In Scotland, since 1998 after the tragic death of Darren Denholm, 10 who went into a coma and died while having tooth extraction under DGA, dentists are no longer allowed to perform DGA in their own surgeries unless they have a specialist anesthetist present as well as have immediate access to emergency care facilities (Bryan, 2000). In the US, dentists can perform DGA with the State Dental Boards having the responsibility to ensure that only qualified dentists use sedation and GA.

State Boards set acceptable standards for the safe and appropriate delivery of sedation and anesthesia care as outlined by the ADA Guidelines for the Use of Sedation and GA for Dentists (ADA, 2007). Thus in the US, to administer deep sedation or GA, the dentist must have completed an advanced education program accredited by the ADA Commission of Dental Accreditation, have a current certification in Basic Life Support for Health Care Providers and Advanced Cardiac Life Support (ACLS) or an appropriate dental sedation /anesthesia emergency management course (AAPD Guidelines, 2004).

1.4 Conditions Requiring DGA

The National Institutes of Health (NIH) Consensus Statement reported that high levels of preoperative anxiety, lengthy and complex procedures and the need for a pain-free operative period may be indications for DGA in very young children (NIH Consensus Statement, 1985). Preparation for GA includes taking a complete medical history especially family history of allergic responses to anesthetics that might influence patient response to specific anesthetic agents. Patients should not eat or drink before GA because of the risk of regurgitating food and liquid or aspirating vomitus into the lungs. In addition, three professionals are required when GA is used during dental procedures: one is the operating dentist; the second is a professional responsible for observing and monitoring the patient; the third person assists the operating dentist (NIH Consensus Statement, 1985).

Reasons for DGA referral include dental pain, facial swelling, and extraction of teeth in multiple quadrants, young age and history of poor cooperation (MacCormac and Kinirons, 1998). Other reasons include increased dental diseases, need for complex procedures, medical complications or poor cooperation in the dental chair (Alcaino *et al.*, 2000; Sheller *et al.*, 2003). Thus, uncooperative behavior and medical and/or physical disabilities were the two broad categories that require DGA.

In Malaysia, DGA is typically performed by an anesthetist in a hospital setting while the operating dentist will perform dental treatment once anesthesia is successfully achieved.

According to the local Clinical Practice Guidelines (CPG): Management of Severe Early Childhood Caries (MOH Malaysia, 2005), indications for GA include:

- Children with learning disabilities to the degree that the dentist cannot communicate effectively
- Children with severe dental anxiety or the very young child with whom adequate cooperation cannot be achieved using the usual behavioral guidance procedures or supplemented by pre-medication, and/or acceptable degree of physical restraint
- Children with systemic disturbances and congenital anomalies that require GA

1.4.1 Behavior management of children and role of dental team

The Dental Anesthesia Committee of the Royal College of Anesthetists strongly recommends that the use of GA in Dentistry should be limited to:

- Clinical situations in which it would be impossible to achieve adequate LA and so complete treatment without pain. This would usually relate to the management of acute infections where drug therapy or drainage procedures with other methods of pain relief are inappropriate or have been unsuccessful.

- Patients who, because of problems related to age/maturity or physical/mental disability are unlikely to allow safe completion of treatment.

The RCA recommends that only the specialist pediatric anesthetist should administer GA to very young children.

- Patients in whom, long-term dental phobia will be induced or prolonged.

The long term aim in such patients should be the graduated introduction of treatment under LA using, if necessary, an intermediate stage employing conscious sedation techniques (Standards and Guidelines for GA in Dentistry, 1999).

Behavior problems and inability to cooperate partly due to fear are some common reasons for treatment under GA (Nick *et al.*, 2003). 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 DGA (Tsai *et al.*, 2006).

Special methods of behavior management including GA may be required in order to provide dental treatment for intellectually and/or physically disabled children (Ersin *et al.*, 2005).

Amin *et al.* (2006) noted that all referrals to the specialty practice by general dental practitioners were because of child behavior management issues and the need for extensive dental rehabilitation which include extraction of teeth and restorative dentistry. More often, children with pain present to the dentists with problems concerning their behavioral management as well as for dental treatment. Children in pain are frightened children and may refuse to open their mouths, making normal dental treatment impossible (Freeman and Carson, 2003).

Behavior guidance techniques have allowed most pediatric dental patients to receive treatment in the office with minimal discomfort and without fear. Along with that, minimal or moderate sedation has provided the ability to accept dental treatment.

However, a subset of children and special needs patients that shows extensive treatment needs, acute situational anxiety, uncooperative age-appropriate behavior, immature cognitive functioning, disabilities, or medical conditions may still require deep sedation or GA in order to receive dental treatment in a safe and humane fashion (Council on Clinical Affairs, 2005). By reducing patient apprehension and movements, dentists can offer significantly improved dental care.

The role of the dental team is also of major importance (Skaret *et al.*, 1998). Effective communication is the key to successful and safe GA-facilitated dental care.

The dentist should have a clear treatment plan for each patient, and when unable to do so, may introduce parents or caregivers to the concept of GA, answer initial questions and provide medical history and preoperative instructions required by the anesthesiologist.

The anesthesiologist needs to communicate to parents or caregivers regarding patient history, potential risks of GA, standard fasting requirements etc. In other words all parties involved must be well informed of every step of the pre and post procedure (Nick *et al.*, 2003). Pre-anesthetic assessment of every patient is crucial to ensure suitability and fitness of the child for DGA. A thorough medical history and physical examination is necessary to exclude any possible complications (Mason *et al.*, 1995).

1.4.2 Medical and physical disabilities

DGA has been considered as the most appropriate way of providing dental treatment for patients with special needs (Savanheimo *et al.*, 2005). Anderson *et al.* (2004) reported that GA is an efficient, cost-effective and probably the only way of providing dental treatment for patients with special needs.

The types of medical and developmental disabilities included physical disability, cerebral palsy, mental disability, Down syndrome, heart disease, bleeding disorders, autism, and diabetes (Al-Malik and Al-Sarheed, 2006).

On the other hand, the complex nature of medical conditions and histories can place these children at risk when treated by a dental health care provider who has no access to accurate medical history (Schwarz *et al.*, 2004). Sometimes, it becomes difficult to treat these patients in the dental chair using physical restraint and behavioral control techniques. In these cases, treatment under GA becomes a valuable option, especially for those procedures requiring an important level of cooperation (Limeres-Posse *et al.*, 2003)

Improving oral health for people with special needs is possible mainly through effective community-based dental care systems. Education of patients and parents with regard to prevention and treatment of oral diseases must be planned from an early stage. These efforts could minimize disease and operative interventions since extractions and surgical procedures in particular, may produce major problems or complications (Allen and Davies, 2007).

Advances in pediatric medicine and surgery have led to a dramatic reduction in morbidity and mortality among medically compromised children, resulting in a growing population of special needs pediatric patients. Moreover the use of GA is declining, with a higher percentage mostly administered to children who are medically compromised (Camilleri *et al.*, 2004).

Special care dentistry is the appropriate delivery of dental care in accordance to the individual needs of patients who have disabling medical conditions or mental or psychological limitations that require consideration beyond routine approaches (Lawton, 2002).

The special needs population have a variety of disabilities, and evidence exists that they are at high risk for developing oral diseases and conditions and experience significant barriers to accessing dental care (Ettinger *et al.*, 2004). The medical condition of the child is a salient factor that determines which anesthesia type is to be used (Al-Malik and Al-Sarheed, 2006). Therefore, GA has a special place in the treatment of patients with disabilities.

Lawton (2002) reported that nearly 20% of the US population had some type of disability, with approximately 12% of the population considered severely disabled and nearly 38% of those were aged 65 years and above.

Indeed, it is not surprising, severe disability becomes more common with increasing age. Therefore, in the coming years an increase in the number of special needs dental patients may also be seen (Lawton, 2002).

1.5 Dental treatment under GA

Dental caries or dental decay is the most common chronic disease of childhood. It is five times more common than asthma and seven times more common than hay fever and it causes children to miss 1.6 million days of school each year (Adams *et al.*, 1999).

The American Academy of Pediatric Dentists (2002) highlighted that dental caries is common among pediatric patients and because pediatricians are considered experts in child health and see young children before and more frequently than their dental colleagues, it is important for pediatricians to be familiar with dental caries.

According to the Surgeon General report titled “Oral Health in America”, great efforts have been made to make Americans aware of the ‘silent epidemic’ of dental and oral disease that affects certain populations in the US. It is important to note that 80% of dental caries in the permanent teeth among US children occurs in 25% of children. The greatest disease burden is disproportionately found in low-income and minority children. More than a third (36.8%) of poor children aged 2-9 years has one or more teeth with untreated caries (Wathen, 2000). This high figure is also supported by other epidemiological studies in various Head Start programs throughout the US and data from other countries such as Netherlands (Truin *et al.*, 1991) and the UK where it was reported that 40% of 5-year-old children in the UK have active caries (Milsom *et al.*, 2002). While in Malaysia, caries prevalence among 5-year-olds is 76.2% (MOH, Malaysia, 2005).

Children with special health care needs are at increased risk of developing dental caries. Dental needs are the most unmet health needs in children even in developed countries, when compared with other medical problems (Nunn *et al.*, 1997). Newacheck *et al.* (2000) reported that despite the nation’s great wealth, unmet health needs remain prevalent among US children and dental care was the most prevalent unmet need.

The consequence of untreated oral disease can be either short term or long term. In the short term, untreated dental caries has been associated with failure to thrive and in the long term can cause abscesses, cellulitis and systemic spread of disease and bring premature loss of primary molars causing malocclusion (Acs *et al.*, 1999).

Substantial numbers of children with untreated caries are seen in emergency departments and for many; it is their first dental visit. Other than restorative care, advanced disease required extractions, intravenous antibiotics and treatment under GA (Sheller *et al.*, 1997). An analysis of an emergency dental service provided at a children's hospital in Belfast indicated that dental emergencies accounted for 4% of all attendances at the accident and emergency department whereby toothache was the most frequent complaint (49%) and abscesses were most frequently associated with primary molars (Fleming *et al.*, 1991). The reason for treating carious primary teeth is that such procedures are likely to reduce the risk of the children developing toothache (Fayle *et al.*, 2001). It is clear that the scope for such restorative care is great.

Once caries have progressed to a large cavity, simple restorations may be inadequate. Badly decayed primary teeth may well require more extensive treatment including pulp therapy followed by the placement of preformed crowns (Fayle *et al.*, 2001). This more extensive treatment may be somewhat scary for young children. However, these treatments are highly effective (Einwag and Dunninger, 1996).

On the other hand, behavioral management techniques exist to ensure young children can comply with dental treatment and that any pain and/or discomfort associated with the dental procedure can be controlled (Shaw *et al.*, 1996). However, when behavioral management techniques are not successful, an alternative method of choice for treating unmanageable children is GA.

Thus, dental treatment under GA is a logical alternative method of choice for treating very young children who require extensive conservative dentistry and are unable to accept ordinary dental treatment in the dental chair.

In addition, children who are medically compromised or who require oral surgical procedures, DGA becomes a method of choice (Smallridge *et al.*, 1990). Moreover treatment of dental caries under GA for young children allows rehabilitation to be completed in a single session (Anderson *et al.*, 2004). This is usually preferred by both parents and dentists for the benefit of the child patient.

1.5.1 Types of dental treatment carried out under DGA

It is a known fact that dental treatment under GA is an expensive alternative but in certain occasions, it becomes the most reasonable method for treating unmanageable children. DGA is indicated for very young children who require extensive conservative dentistry and are unable to accept treatment in the dental chair, for children who are medically compromised, or for children who require oral surgical procedures (Al-Malik and Al-Sarheed, 2006).

Moreover, DGA allow total oral rehabilitation which may consists of several treatment modalities such as amalgam or composite restorations, pulpal treatment, extractions, and/or stainless steel crown reconstruction in a single visit or session.

Currently, there has been a trend toward fewer restorations and pulpotomy procedures but more extractions and stainless steel crowns, more teeth having fissure sealants placed during comprehensive dental care under GA (Tsai, 2006). However, many studies in the literature confirmed that restorative procedures and simple extractions are the most common types of treatment modality in children. For example, Al-Malik and Al-Sarheed (2006) reported that glass ionomer cement (GIC) restorations, amalgam restorations, and extractions were the most frequent dental procedures provided for children under DGA for both primary and permanent teeth. Extractions involving many teeth under GA were reported to be a very common practice in some countries like UK (Bridgman *et al.*, 1999). Jamjoom *et al.* (2001) in their study concluded that the main indication for use of DGA in children was management for rampant caries.

In the UK, 79% of GA was administered in the general dental service and 96% of those in the community service are for the non-surgical extraction of teeth (MacCormac and Kinirons, 1998). While the number of GA administered for dental treatment in the UK has reduced dramatically, Scotland continues to have the highest rate of DGA in the world and in Scotland also, larger numbers of teeth are extracted rather than restored compared to demographically similar areas in Europe that have matching levels of decayed teeth in 6-year-olds (Bolin, 1997).

A culture of extractions under DGA has become established over many years and accepted by Scottish families and dentists as the principal method of dental treatment of carious primary teeth even though it is increasingly acknowledged to be a treatment of last resort (Bolin, 1997).

As of 1999, Bridgman *et al.* reported that the use of GA for extraction of teeth in young people is still common in the UK, with nearly 70% of the total number of administrations being given to patients under the age of 15 years and nearly 80% of these treatments were given in the primary dental care sector. Likewise, Machuca *et al.* (1996) in their study reported that exodontia was the most frequently performed treatment under DGA.

Tate *et al.* (2002) found that stainless steel crowns were the most reliable restorations while composite restorations were the least durable under DGA. On the other hand, few studies have included pulpectomy in their treatment options as pulpotomy is not usually recommended for patients with cardiac problems (Harrison and Roberts, 1998). In California, GA is commonly utilized for restorative dentistry, endodontics, pediatric dentistry and periodontology (Nick *et al.*, 2003).

1.5.2 Quality of dental treatment under GA

The general concept of dental treatment under GA is based on the belief that all of the operative and/or surgical procedures have to be completed in one visit with good outcome (Roberts, 1990).

GA provides optimum conditions for restorative treatment such as minimum contamination and effective moisture control, immobilization of patient, efficiency and effectiveness, and elimination of reflexes.

However, treatment outcomes and the frequencies of retreatment under DGA still vary. For instance, Eidelman *et al.* (2000) found that the quality of restorative treatment performed under GA was better than the quality of treatment performed under conscious sedation. This observation is contradictory with the findings of Tate *et al.* (2002) who reported that high restorative failure rates were noted for treatments provided under GA.

Alternatively, the type of restorative materials used could affect the quality or outcome of restoration under GA. O'Sullivan and Curzon (1991) reported that under GA, different types of restorative materials have different success rates. For example, while 33% of composite resins and glass ionomer restorations failed, the success rates of amalgam restorations and sealants were over 80%, and stainless steel crowns were the most successful restorations with only 3% needing replacement.

Apart from the type of restorative materials used, other researchers indicated that the duration and extent of caries were other factors that may determine the quality of the restoration under GA. For instance, Gizani (1998) reported that about 30% of the restorations fail after one year and the cause of failure varies from loss of filling to failed restorations because of recurrent caries.

Almeida *et al.* (2000) reported that after two years of restorative treatment under GA, 79% of the patients require subsequent restorative treatment or extraction at recall visits and 17% of patients treated for extensive childhood caries required retreatment.

Nevertheless, for the best treatment outcomes following dental rehabilitation under GA, many authors suggested that the pediatric dentists should have specific treatment plans of caries management, active follow-up and education of parents (Sheller *et al.*, 2003; Harrison and Nutting, 2000).

1.6 Waiting time before DGA

The waiting time before DGA accounts for the duration of time from initial examination to the actual treatment under DGA. Waiting times have increased substantially with many children waiting over 3 months before receiving treatment (Anderson *et al.*, 2004). Evidence suggests that there are an increasing numbers of children waiting to receive dental care under GA in Australia with waiting lists of up to 2 years in some locations (Alcaino *et al.*, 2000).

Similarly it was found that the waiting time for referrals differed between centers. In New Zealand the mean waiting time at the University of Otago, School of Dentistry was 7.9 months (SD=2.0) with a range of 1–12 months, and that for the Christchurch Oral Health Centre was 5.5 months (SD=2.0) with a range of 3–12 months (Anderson *et al.*, 2004).

Al-Malik and Al-Sarheed (2006) showed that the waiting time for treatment under DGA ranged from one to 28 weeks and medically compromised children had shorter waiting time compared to healthy children. North *et al.* (2007) reported that the longer the child waits for DGA, more dental pain, less amount of sleep and more problems during eating can take place.

1.7 Dental Fear or Anxiety

1.7.1 Overview

Fear of dentistry in general and especially some aspects of dental treatment afflict a significant proportion of people of all ages and social classes. For many years this fear has been recognized as a problem area in clinical dentistry (Bergius *et al.*, 1997).

Fear is a learned reaction characterized by physiological symptoms such as faster heart rate, nausea, sweating, muscular tension, and increased respiration. The response is initiated by a real or imagined threat to one's safety. When questioned, the patient will readily identify the specific source of fear. Anxiety is a different type of disturbed emotional state, usually associated with dangerous or unpredictable situations. The physiological symptoms are similar to fear symptoms but may include pounding chest, dry mouth, diarrhea, hyperventilation and a sense of impending doom. When questioned about the stimulus, the source is not easily identifiable (Milgrom *et al.*, 1992).

1.7.2 Factors causing fear or anxiety on the dental chair

The terms 'fear and anxiety' are often interchanged or grouped together. Anxiety is the anticipation of the possibility of danger. Fear on the other hand, is a physiological process that occur in the body when threatened by danger (Chanpong *et al.*, 2005).

Dental anxiety has been reported in up to 50% of subjects and often results in irregular dental attendance or poor cooperation with care providers (Moore *et al.*, 1993).

Even though GA facilitates operative dental treatment but it does little to manage dental anxiety (Hosey *et al.*, 2006). Therefore, dental anxiety may still cause management problems during dental treatment leading to partial or total avoidance of treatment. These behavioral problems obviously lead to compromised dental health. Accordingly, early fear acquisition also affects adolescents (Skaret *et al.*, 1998). Milgrom *et al.* (1992) examined the prevalence of dental fear among adolescents 18 years of age and between the ages of 13-15 years respectively and found that the presence of previous painful events and direct conditioning plays a major role in the etiology of severe clinical fear (Firat *et al.*, 2006). Furthermore, the effects of this anxiety have been shown to persist into adulthood, which can often lead to dental avoidance (Buchanan and Niven, 2002). The origin of dental anxiety is frequently associated with direct traumatic dental experiences in early childhood particularly if painful events during dental treatment are combined with the feeling of loss of control (Bergius *et al.*, 1997; Milgrom *et al.*, 1992).

Other factor that has been highlighted as important in the development of dental anxiety is general anxiety, the behavior of the dental team, dental anxiety in the family and socioeconomic factors (Weinstein *et al.*, 1990; Klingberg *et al.*, 1994; Bergius *et al.*, 1997; Kinirons and McCabe, 1995). If any of these factors lead to avoidance of dental appointments, phobic anxiety may be established (Skaret *et al.*, 1998).