The Oral Health of Children Who Received Dental Treatment Under Dental General Anaesthesia Three Years Previously in Saudi Arabia

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In the Memory of My Dear Father

To My Dear Mother and Beloved Sister

To those I Love Most

And to You

ABSTRACT

The aims of this investigation were to investigate provision of government funded dental general anaesthetic (DGA) services providing comprehensive treatment for children in Riyadh and to determine effectiveness in terms of subsequent treatment experience and attendance, and oral health status in patients who had received treatment three years previously.

Information about services was obtained from ministry sources and from hospital centres. Dental examinations were carried out for children who had DGA and for an independent control group of their siblings. Data about treatment experience was drawn from patient records and information regarding social factors and oral health behaviours was derived from a questionnaire to parents.

There were 6 centres providing DGA in Riyadh of which 4 agreed to take part. Information was provided for 483 patients treated over a two year period, 93% of whom were less than 10 and 50% less than 5 years old at the time of treatment.

Three hundred and forty seven of the children (72%) attended for examination (study group) together with 319 siblings (control group). On average, 4.2 primary teeth were extracted and 7.7 restored per child under DGA, Stainless steel (preformed metal) crowns were placed for 73% of patients. Those having DGA had attended fewer appointments than their siblings in the subsequent three years.

At examination, children in the study group had poorer oral health; mean dmft was 9.2 per child compared to 5.5 in the control group. More (90%) had active caries in primary teeth than did controls (77%) but numbers of decayed teeth were little different. In permanent teeth, more children in the study group had untreated disease and the amount of decay was greater. Plaque and gingivitis were also worse.

Provision of treatment under DGA had been an effective means of providing large amount of treatment for young children.

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CHAPTER ONE

INTRODUCTION AND AIMS

1.1 Introduction

Dental caries remains an unresolved problem affecting children throughout the world. Many industrialised countries have experienced a marked decrease in caries prevalence in children over the past decades (Glass, 1982; Holm, 1990; Marthaler, 1990; Burt, 1994; Downer, 1994; Von der Fehr, 1994). In contrast, in many developing countries, disease prevalence has increased (WHO, 1984; McNulty and Fos, 1989; Stephen, 1997). Although relatively few studies have been carried out in Saudi Arabia, these have shown a high prevalence of caries in both pre-school and school aged children (Salem and Holm, 1985; Al-Khateeb *et al.,* 1990 and 1991; Al-Shammary *et al.,* 1990; Magbool, 1992; Wyne *et al.,* 1996; Al-Mohammadi *et al.,* 1997; Al-Banyan *et al.,* 2000).

Effective prevention of caries represents the first priority but appropriate treatment services for children are also required if needs are to be met. The majority of child patients with caries have relatively simple needs but a minority may require more specialized care. This group include a small proportion of child patients who present with dental disorders that are technically difficult to carry out using conventional methods of management and others who possess only limited ability to co-operate with operative procedures. In Western countries, the reduction of caries prevalence has allowed a greater emphasis to be placed on treatment for these more challenging patients in paediatric dentistry (Persliden and Magnusson, 1980).

Routine use of local anaesthesia and use of sedation techniques, particularly inhalation sedation, has become more wide spread (Murray, 1993). Even when these are available however, occasionally it is not possible to achieve sufficient co-operation for necessary treatment to be carried out. This may be a consequence of the child's immaturity or a result of mental or physical disability. In other cases, needs may be too extensive or traumatic for the child to cope successfully. In these situations, general anaesthesia may be the method of first choice.

Dental general anaesthesia (DGA) is traditionally of particular value in treatment of children. It's major use in industrialised countries has been for multiple extractions, including those required as a result of rampant caries, but it has more recently been used in specialist facilities for more extensive procedures including restorative care and oral surgery. DGA for simple extractions has been widely available in countries such as the UK, although it's use in primary care has declined in recent decades, at a time when disease levels have fallen and safety requirements have become more stringent (DOH, 2001). In contrast, DGA for comprehensive treatment has continued to develop (Mason *et al.*, 1995 a). Specialist DGA services may be more limited in developing countries. In Saudi Arabia, DGA is available only in hospitals (for in-patients) and dental teaching hospitals and in an unknown number of private dental practices and hospitals where treatment costs to the family are very high.

DGA permits treatment at a single visit, allows immediate relief of pain, and requires little or no co-operation from the child (Murray, 1993). These may be beneficial in the short term but broader considerations of effectiveness require a longer term view. Factors including subsequent need for care and oral health behaviours are pertinent in determining the value of the method. DGA for example, may do little to promote oral health or prevent disease in the longer term. Evaluation of other outcomes of the method as well as assessment of the treatment provided is essential if the service is to be used effectively. This is particularly important in countries such as Saudi Arabia, where disease levels are high resources are available and the potential for investment or disinvestments in services is proportionately greater.

1.2 Aims of the Study

The aims of this study are first, to investigate the provision of comprehensive dental treatment under general anaesthesia (DGA) for children at government funded centres in Riyadh City in Saudi Arabia, and secondly, to assess two factors related to effectiveness of the method, first the treatment experience and secondly the oral health status of a group of child patients who had received treatment using this method three years previously. In addition, to compare these outcomes with similar values for an independent control group of their siblings. A further subsidiary aim was to consider attitudes to treatment and oral health behaviours amongst study and control groups.

1.3 Objectives

This study is be made up of two phases;

1.3.1 Phase I:

1. To gain the ethical approval and support for the research from a) The Ministry of Higher Education, b) Ministry of Health.

2. To determine the number of government funded hospitals/centres providing DGA for child patients in Riyadh and seek ethical approval and support from each.

3. From centres agreeing to take part, to identify the number and age of patients who had received DGA during the year of 1995/1996 and the type of care they had received.

1.3.2 Phase II:

1. To contact families of patient included in Phase I and invite attendance of the child who had received treatment under DGA three years previously and one of their siblings.

2. Through examination of patients records to determine the number and items of treatment provided under DGA and the attendance and treatment provided in the subsequent three-year period for children attending for examination. Similarly, from the patient records, to determine treatment experience in terms of attendance and items of treatment for those siblings who attend for examination.

3. To examine patients and their siblings to assess oral health status in terms of DMFT/dmft, DMFS/dmfs (and their components), plaque and gingival indices.

4. Through a questionnaire to parents of children included to determine; a) Social class and educational level of child's parents, b) Current dietary habits and age

at weaning, c) Oral hygiene practices in terms of frequency of brushing, supervision and help during brushing, and type of tooth paste used, and d) The parent's recall of treatment and their children's current attitudes to dental treatment.

1.4 Null Hypothesis:

The two major null hypothesis to be tested are:

1. That there is no difference in treatment experience between children who had been received DGA three years previously and their siblings.

2. That there is no difference in oral health status between children who had received DGA three years previously and their siblings.

CHAPTER TWO

REVIEW OF LITERATURE

2.1 Saudi Arabia and the Provision of Care in the Kingdom

This investigation was concerned with the provision of dental treatment under Dental General Anaesthesia (DGA) for children in Riyadh, Saudi Arabia. The Review of Literature falls into three major parts; the first relates to Saudi Arabia and the provision of health care and oral health care in the kingdom, the second to oral health status in children in the Gulf Area and in Saudi Arabia, and the third to the use of DGA.

2.1.1 The Kingdom of Saudi Arabia

King Abdulaziz Al-Saud established the modern state of Saudi Arabia in 1932 with the unification of the tribes of the Arabian Peninsula. This desert kingdom had seen little development until the discovery of oil in the areas near the Persian Gulf in the 1930s. This initiated a development that was boosted enormously by the rapid rise in oil prices in 1970s. The rapid influx of overseas currency, so called 'petrodollars', provided impetus to development of the country's infrastructure and to the standard of living of the population.

The Kingdom of Saudi Arabia is located in the Middle East between the Old World continents of Asia, Africa and Europe. Jordan, Iraq and Kuwait lie to the north of Saudi Arabia, the Sultanates of Oman and Yemen to the south, the Arabian Gulf, Bahrain, Qatar and the United Arab Emirates to the east and the Red Sea to the west. The Kingdom occupies four-fifths of the Arabian Peninsula, and has an area of 2,250,000 sq. km (868,730 sq miles). The topography of the country varies from fertile plains in the southwest to deserts, rocky hills, high mountains, and deep valleys in other areas.

There are no rivers or lakes in the Kingdom, so that wells are the only source of drinking water, except on the coast where desalination stations are the main source of drinking water (e.g., in Jeddah and Dammam and other cities).

Climate varies according to altitude, distance from the coast and the effect of seasonal high pressure. In general, it is hot and dry in the summer with temperatures of about 35θC, and cold and dry in winter with an average temperature of about 5θC, except for the narrow areas along the coasts where the climate in winter is mild. Temperature rises noticeably inland during the summer months.

There are 13 provinces in the Kingdom. The capital city of Saudi Arabia is Riyadh, which is also the capital of Riyadh province and which is centrally located on the Najed Hill.

2.1.2 The Population of Saudi Arabia

The first census, held in September 1974, showed the total population of the Kingdom to be circa 7 million of which about 47% were urban, 28% settled rural and 25% nomadic Bedouins. More recent estimates were about 15.2 million in the early 1990s and 18,729,576 in 1995, with an estimated annual growth rate of 3.7%. Most recently the Department of General Statistics at the Ministry of Planning has published results of a demographic research study carried out in the first quarter of 1999, when the population of the Kingdom was 19.9 million. The CIA estimation for the year 2000 was 22,023,506 million including 5,360,526 (24%) non-Saudi residents.

The growth in the population is a result of both an increase in the number of expatriates and to the national population living longer as a result of their improved standard of living and health. Currently, about 43% of the population are under 14 years of age and about 80% live in urban areas of the Kingdom. The birth rate for the year 2000 was reported to be approximately 37.5 births/1000, and the death rate about 6.02-deaths/1000 of the populations for the one-year period. Infant mortality remains very high, at 52.9 deaths per1000 live births in 2000 (The Saudi Arabia Information Resource, 1999; CIA, Saudi Arabia, 2000).

2.1.3 Life Style in Saudi Arabia

Life style in Saudi Arabia as elsewhere is determined by a combination of physical factors and ethics, values, habits and customs but religious determinants remain strong. The Saudi Arabian system is Islamic. The country represents the heartland of Islam because of the presence of the two Holy cities of Mecca and Madinah Almonawarah. Islam is both a religion and a way of life; it includes a prescribed order for individuals, societies, and governments and directly codifies every aspect of life including law, family relationships, and matters of business (The Saudi Arabia Information Resource, 1999; CIA, Saudi Arabia, 2000).

Islam lays down social roles for family relations and childcare. For example, under Islamic law, marriage is the only permissible way to have children and the Qura'an includes rules to guide mothers in child rearing practices. Breast-feeding has always been traditional practice in the Arab community. According to Islamic laws, mothers are encouraged to breast-feed infants for a period of two years (Holy Qura'n, Surah of

Al-Bagarah, U 232; Al-Dashti *et al.,* 1995; The Saudi Arabia Information Resource, 1999).

However, the traditional Bedouin mother is now shifting from breastfeeding her baby to use of an infant feeding bottle. Several factors may have contributed to the decline in breast-feeding. These include the rapid urbanisation, changing life styles, social values, and change in women's working patterns. Marketing of baby milks may also have encouraged the change (Sebai, 1983; Ebrahim, 1986).

The age of weaning children is also now earlier than in the past. During the postnatal period, unhygienic conditions and lack of appropriate education have aggravated poor bottle feeding practice and weaning habits with a resultant decline in nutritional status in some groups (El-Hazmi and Sebai, 1981; Sebai, 1985).

2.1.3.1 Social Class in Saudi Arabia

Any population or society may be classified into a series of classes or layers. Systems are most often hierarchical, with some classes being considered as superior and others as inferior. Social classification systems allow for generalisation of lifestyle, behaviour, and attitudes, based on the pattern for the group as a whole. Not everyone from the same social class may share the same lifestyle, but the differences between those from differing classes are sufficient to identify a pattern or trend for each (Beal, 1996). Social class is clearly related to health (Black *et al.*, 1980: Acheson Report, 1998).

Although the concept of class is clear and relationships are seen, there are difficulties in measuring social class. Methods of social classification have most often related to occupation, which is determined to a great extent by education and which strongly influences income and material wealth. Thus, those reaching higher levels of education have higher income, and greater wealth and occupy a higher level of social class. Using this method, a variety of classification systems have been introduced to divide the population into classes. These range from the early classification of Marx and Weber to more generally used systems such as the Registrar General's Classification of Occupations. Although the latter is widely used it has important disadvantages, such as failing to take account of the occupational status of spouses in the case of married couples. Even in countries for which it was designed, the relationship between occupational status, income and educational status may change with time and come to be inconsistent in a proportion of the population. For example, professional sportsmen, who may hold occupations below the centre of the scale, may have an income greatly exceeding many of those at the top. As well there being differences in relationships between education, income and occupation in developing countries, there may be more fundamental differences in the relationship between social class, based on occupation, and lifestyle and behaviour. As an example, in westernised countries attitudes and behaviour amongst mothers in higher social classes favour breast feeding of infants whereas in developing countries attitudes in the most educated and wealthiest mothers favour bottle feeding (Roges *et al.*, 1997).

Part from those based on occupation, other systems of classification used in developed countries use methods of deprivation most often based on area of residence. These include Jarman, ACORN and Townsend indices. Designed for specific areas or countries these are also likely to be unsuitable for direct application elsewhere.

In Saudi Arabia, the effects of very rapid modernisation have included increases in education as well as improvements in housing and health care. There have also been major changes in socio-economic status, with much more occupational opportunity for much of the population and exemplified by a greatly increased income per capita, such that the Saudi population now possesses one of the highest mean personal incomes in the world. Such changes are likely to have profound effects on both the interrelationship between education and income and the relationships between occupation, lifestyle, and behaviour.

In general terms, the population of Saudi Arabia includes urban, rural and Bedouin groups, with lifestyles that differ in relation to traditions, cultures, and social patterns. Although the country has become increasingly urbanised, there are still some rural migrants (people who have more recently moved to urban areas) who have much lower living standards.

In terms of general health in the UK, women from poorer social backgrounds are more likely to suffer a prenatal or a post neonatal death (Donaldson and Donaldson, 2000).

Systems of social classification used in previous Saudi studies of oral health have included area of residence (rural or urban) and housing density as well as parental income and level of education (Al-Shammary *et al.,* 1991; Al-Mohammadi, 1995). This system incorporates elements of both occupation based and deprivation based systems of social classification but is complex and requires very detailed information. Differences in classification also made it difficult to draw comparisons with other countries (Al-Mohammadi, 1995). An alternative, based on occupation and analogous to the Registrar General's Classification of Occupations, has been used in at least two studies (Al-Ghanim, 1996; Al-Malik, 2000). Results suggest that when appropriate classification systems are used, findings are similar to those seen in developed countries and that, for example, lower levels of disease and more favourable oral health behaviours are found in children of more educated and wealthy families.

In Saudi Arabia also, child health and survival has been related to parents' level of education and income and to such factors as breast feeding, nutrition, birth spacing, and housing quality (Sebai, 1983; Al-Obaid, 1995).

Whilst these results suggest poor health in those from lower classes and amongst those from more deprived families, there would appear to be no published information from Saudi Arabia regarding health or oral health in relation to deprivation measured more directly using systems analogous to those from the UK.

2.1.4 Health Care in Saudi Arabia

From being very limited, the health sector has expanded greatly during the period between 1973 and the present. Until relatively recently the incidence of infectious diseases was high and people died from acute and infectious diseases associated with environmental and systemic problems in a way characteristic of an underdeveloped country. Today, in contrast, the main causes of death are chronic diseases, for example cancer, heart disease, stroke, and diabetes (Sebai, 1983; Al-Obaid, 1995).

In the past, traditional medicine was the main health provider, involving herbal medicines and religious methods of treating people with illness, but dramatic changes have occurred in health services in Saudi, particularly over the last two decades. The Ministry of Health (MOH) has taken prime responsibility for health care programmes in the Kingdom since it was established in 1951. Organisation is through a series of Health Authorities, which are responsible for all health administration in the regional hospitals, clinics, and primary health centres. A total of 18 health authorities manage all facilities of the Ministry of Health throughout the Kingdom (Sebai, 1983; Health Through the Century, 1999).

During the Development Plan of 1980-1985, the Ministry of Health spent more than eight billion dollars on the construction of modern facilities and the execution of development projects in all areas of health. During this and the subsequent Five-Year Development Plan (1985-1990), attention was focused on expansion of health services to cover all areas of the Kingdom and to applying the principles of primary health care through health centres to ensure provision of comprehensive health services to all. The Ministry of Health (MOH) now provides approximately 70 per cent of health services (for both Saudi and non-Saudi people). A further 18 per cent are provided by other government agencies such as the Ministry of Defence and Aviation, National Guard, Ministry of Interior, and Ministry of Education, each sector providing health services for their own personnel. The remaining twelve per cent of health care is provided by the private sector, which includes private hospitals and private clinics (Guile and Al-Shammary, 1987, Annual Health Report, 1998/99).

The principles of primary health care govern health care philosophy. It is the policy of the Saudi Arabian government to provide good health care to its citizens at no charge or, for those with the ability to pay, only a nominal charge. By 1987 the Ministry of Health had established more than 750 health centres and dispensaries across the country, this number increasing to 1751 health centres and 182 hospitals in 1999 (Annual Health Report, 1998/99; Health Through the Century, 1999).

The total budget allocated for health care in Saudi Arabia is approximately 6.2% of the total budget for the country and in 1996 the dental health sector was reported to form about 5% of the nation's health budget (Annual Health Report, 1996). Specialised hospitals have been established to accept referrals from primary health care centres. Research is also considered important and programmes have been established to study the levels of endemic diseases and progress towards their resolution. University hospitals have been strongly supported by the government during the last two

Development Plans to train and educate personnel and staff who form the infrastructure of the health care system.

Although developments have improved access, community based services are still more readily available in towns where there is generally better access to medical and dental care.

2.1.5 Oral Health Care Services in Saudi Arabia

Few organised dental services were provided in Saudi Arabia before 1959, when registration for dentists became compulsory (Guile and Al-Shammary, 1987). More than twenty years later, Zaki and Tamimi (1984) reported an acute shortage of dental personnel in the Kingdom. They pointed out that in 1974 there had been 224 dentists practising in Saudi Arabia and by 1980 there were 280 dentists (dentist-to-population ratio of 1: 28,000). The situation improved in the next 6 years. In 1986, the population of Saudi Arabia was eight million, with more than 850 dentists but the dentist-to-population ratio was still low relative to many other countries, at 1: 9,411. However, rapid population expansion exacerbated the shortage and by 1998, the dentist-to-population ratio was reported to be 1: 15,609 although the number of dentists working around the Kingdom had increased and was now greater than 4500. In the UK there are currently 28104 dentists on the register to serve a population of approximately 59,511,464 (Guile and Al-Shammary, 1987; Annual Health Report, 1998/99; Chaudhry and Scully, 1998; CIA, UK, 2000).

There are now two dental schools in Saudi Arabia. King Saud University College of Dentistry in Riyadh -Central Province- was established by a royal decree in 1975. The women's branch of the college began two years later in 1977. Government policy is based on a strict interpretation of Islamic values and keeps the sexes separate throughout the educational system. For this reason the physical facilities are in two different locations in Riyadh. In 1986, there was enrolment capacity for 90 men and 60 women students per year, and by 1996 there were 251 men and 194 women in training. The second dental college, King Abdulaziz University College of Dentistry, was established in 1986/1987 in Jeddah, Western Province. By 1996 this second school had capacity to train 112 men and 95 women per year. It has been policy to increase the number of dentists to cover the dental health needs in the Kingdom and there has been little or no development of auxiliary manpower (Guile and Al-Shammary, 1987; Annual Health Report, 1998/99).

Half of all dental practitioners in Saudi Arabia work for government dental programs in the public sector. In principle, the government's philosophy is that high quality dental care should be available for the entire population, rural and urban, regardless of social standing or of educational level. The urbanization of Saudi Arabia has resulted in the transformation of a desert nomadic culture into a sedentary one residing mainly in the three major cities of Riyadh, Jeddah, and Dammam. There is also a strong localisation of dental services in Riyadh and Jeddah where the dental schools are located. As a consequence there continues to be a shortage of dental services in the other parts of the Kingdom and comprehensive services are often not available (Guile and Al-Shammary, 1987; Annual Health Reports, 1998/99).

2.1.5.1 Dental Resources

The Ministry of Health has equipped more than 1500 dental clinics around the Kingdom and the aim of the most recent plan was to have 2000 dental clinics in operation by the year 2000 (Personal communication with Development Centre in MOH).

In the Kingdom there are now 1751 MOH health centres, 735 of which have a dental clinic, 19 dental health centres, and 180 hospitals. In addition the Ministry of Defence and Aviation, the National Guard, and the Security Forces have a total of 39 hospitals and clinics in various parts of the kingdom. Their staff include dentists whose primary task is to provide dental services to armed services personnel and their dependants. The facilities have also been made available to civilian sectors of the population in areas where there is a shortage of dental personnel (Annual Health Report, 1998/99).

Private sector services, which often provide a wide range of dental services, are growing rapidly. These include private clinics and polyclinics located mainly in the metropolitan regions and their surroundings. According to the last Annual Health Report for 1998/99, there were 622 private health care centres, 87 hospitals, and 785 special clinics (Annual Health Report, 1998/99).

In recent years dental expenditure has begun to change from spending on mainly curative treatment to preventive care. The first priority for preventive dentistry is children. Water fluoridation is planned for cities with piped water supplies (Guile and Al-Shammary, 1987; Health Through the Century, 1999).

2.1.5.2 Resources in the City of Riyadh

Riyadh is the administrative and economic centre of the Kingdom. It is the biggest city in Saudi and has the highest population (about 4.0 million). The MOH has 30 hospitals distributed in different areas in Riyadh and which provide dental care. There are also 287 health care centres; 121 of which have dental clinics, and a single dental centre providing specialist care in all dental specialities. In 1998/99 there were more than 240 dentists working in Riyadh with the MOH, 119 worked in the health centres which included dental services, 97 in the hospitals, and the remainder working in the dental centres (Annual Health Report, 1998/99).

The armed services government agency, which provides health care for all armed service personnel and their dependants, has it's own hospital with many different polyclinics located around Riyadh. As at other government funded centres treatment provided is free of direct charge to the patients (Annual Health Report, 1998/99).

In the private sector, Riyadh is considered to have the largest number of private clinics in all specialities of anywhere in the Kingdom. There are 10 private hospitals, 195 health centres, and 283 private clinics. Fifty-three of the private clinics include dental centres. In 1998/99, there were estimated to be 383 dentists (30 of whom were Saudi) working full time and a small number working part time in the private sector (Annual Health Report, 1998/99).

2.1.6 Oral Health Care in Saudi Arabia

Oral health care provided for children in Saudi Arabia has included both preventive and operative measures.

2.1.6.1 Preventive Measures

Prevention now has a high priority in health care planning in Saudi Arabia. This is true for both rural and urban areas of the country and irrespective of social and educational levels of the community. In relation to dental care also, preventive dentistry is the aim of the system, combined with curative care for existing dental disease (Younes and El-Angbawi, 1982; Mosadomi, 1994). Throughout the world recommended preventive care includes both community based approaches such as water fluoridation, educational approaches directed at changes in individual behaviour such as encouraging regular dental visits and tooth brushing and professionally applied prevention in the form of fissure sealants.

The Ministry of Health (MOH) in Saudi Arabia plans to introduce the adjustment of water fluoride levels to optimal levels in cities, to benefit particularly school-aged children. Most cities have centralised water supplies making this a feasible option but this is not the case in all parts of the kingdom. Some parts of the country currently have water supplies with greater than optimal levels. For example, a high level of fluoride is seen in water supplies in Qassim region with an average value of 2.7ppm. Other supplies contain naturally optimal, or near optimal, levels. Riyadh, for example, has water supplies containing 0.8 ppm. On the coast, most supplies are of desalinated water, which contains 0.7-1.2 ppm fluoride (Al-Mohammadi, 1995).

The benefits of fluoride dentifrice in caries prevention are well known (Murray, 1996) and use of fluoride toothpaste has increased amongst the higher social classes in the population who can afford to buy this. The majority of toothpastes sold now contain 1000-1500 mg F/kg. Several different types are currently available in the Saudi market and some companies now manufacture toothpaste within the Kingdom. To encourage their more widespread use, prices are subsidised by the government (Al-Mohammadi, 1995).

Government strategy works towards increasing the level of dental health education among the population but education for oral health may come from a variety of differing sources. Schemes are provided by the MOH, Ministry of Defence and Aviation, and through the University Dental Schools. In order to stimulate interest in dentistry, the MOH with the help of the Ministry of Information produces programmes of basic oral health care. These are disseminated through mass media such as television, radio, and newspapers, in order to try to reach most of the population in the country. The aim of these programmes is both to educate and to motivate the population. Children are often specific targets.

Other agencies, such as the Ministry of Defence and Aviation also provide educational programmes for school age children in their own ministry schools. Responsibility for teaching the programme is shared with the schoolteachers. Supervised daily tooth brushing at school has been introduced in the ministry schools during the programme period, as has weekly fluoride mouth rinsing (Personal communication, RKH).

The Dental Schools at King Saud University and King Abdulaziz University have also played a major role in educational schemes in Riyadh and Jeddah area over the years. Students in their final semester prepare an educational programme as a part of their study curriculum. Sponsorship may be sought from large Saudi Companies (Personal communication, King Saud University and King Abdulaziz University). The private sector may contribute further to oral health promotion in Saudi Arabia by offering free dental examinations and free consultation (Personal communication, MOH).

The aims of education are to promote good oral health behaviour, including regular dental visits and use of fluoride toothpaste. Dental visits for check-ups are seen as an important way to promote good oral health and are one of the major aims of current educational efforts. However, these are still not common practice. In developed countries such as the UK, attendance at least once a year is recommended for everyone, with more frequent attendance being recommended for children and for some individuals (The Scientific Basis of DHE, 1996). In 1993, 90% of 5-year-old children had visited the dentist at least once in their lives and over half were reported to be regular attenders (O'Brien, 1994).

In contrast, in Saudi Arabia, only 9% of 4-6 year olds were reported to visit a dentist regularly with 91% visiting only when they had a problem (Wyne and Khan, 1995). In a second study in Saudi Arabia relatively few children (14%) had made their first dental visit to the dentist for a routine check up, and few (13%) had made their first visit at the age of 12 months or younger. The majority, 65% had made their first dental visit after the age of 36 months (Wyne *et al.,* 1995). That many children in Saudi Arabia attended the dentist only in response to problems would seem to have been confirmed in findings reported by Al-Ghanim (1996). In a study of 446 Saudi pre-school children in Riyadh region, it was found that a high percentage (70%) of 215 children with a high dmft $\geq$ 8.0 had visited a dentist as compared with only (30%) of 215 children who were caries free. The main reason for visiting a dentist in the caries free group had been for a check up whereas in the high dmft group the visit was mainly in response to pain or other dental problems (Al-Ghanim, 1996).

A second aim of education may be to encourage regular tooth brushing with fluoride toothpaste. This represents a major means of preventing caries but as with dental attendance, levels of brushing have not yet reached those seen in more developed countries. Amongst 5 year olds in the UK 98% are reported to brush their teeth at least once a day and 78% to brush twice a day or more (O'Brien 1994). In Saudi Arabia in the region of 60% of 4-6 year olds were reported to brush once or twice a day whilst the remainder were reported not to brush their teeth at all or to do so only occasionally (Wyne and Khan, 1995; Wyne *et al.,* 1995). In the study reported by Al-Ghanim, 62% of the caries free group of children brushed their teeth compared to 49% with a dmft $\geq$ 8.0. In comparison with those with high dmft a higher proportion of children without caries had started brushing at an earlier age and had assistance in brushing (Al-Ghanim, 1996).

Unfavourable eating habits are often established very early in life. For that reason, it has been suggested that dental health and nutrition programmes should be targeted to pregnant and nursing mothers so that good practice may be introduced from the start (Wahid and Fathi, 1987; Ashley and Allen, 1996).

As elsewhere in the world, it may be very difficult to change or control dietary habits in Saudi Arabia, because many of these habits relate directly to social and cultural factors. Programmes may not have a strong effect on dietary practices and if they do so, this success is likely to be only temporary (Kay and Locker, 1998). However, it has been suggested that the evaluation of oral health education is complex and that simple schemes of education alone are unlikely to be effective. Changing diet also requires political and policy changes to provide supportive environments and make healthy choices easier (Watt and Fuller, 1999).

Fissure sealants have been introduced in Saudi Arabia as an individual preventive measure. The technique is advocated for use in permanent teeth in children attending government funded clinics. Fissure sealants are of proven efficacy and it is therefore pertinent to emphasise them in public health as well as individual approaches to prevention. However there is currently no information as to how widely they are taken up either in government or private sector care in Saudi Arabia (Guile and Al-Shammary, 1987).

2.1.6.2 Operative Treatment

Operative intervention is often the only option once caries is well established. In the past, when services were scarce, this may have been limited to extraction of painful teeth. Before 1959 unqualified practitioners often carried out extractions but a Royal Decree issued that year required all dental practitioners to be fully qualified.

Restorative procedures now available for child patients in Saudi Arabia include all techniques necessary to restore the dentition to form and function, ranging from simple restorations to pulp and root canal treatment and placement of preformed metal crowns (SSC). The curriculum of training in Saudi Arabian Dental Schools is based on that used in North American schools. Emphasis is placed on full mouth rehabilitation whenever this is possible (Seraj *et al.*, 1983; Guile and Al-Shammary, 1987).

Whatever the treatment plans, optimal management is needed to ensure its successful completion. The aim of management is to ensure that treatment is painless and does not produce fear or anxiety. For most procedures for the majority of child patients this is achieved through good child behavioural management technique, routine use of local anaesthesia and a high standard of technical skill. However, for some child patients and procedures, these cannot be used successfully. In some cases, sedation may be of value. There are now a variety of techniques for dental sedation including intravenous, rectal and inhalation methods, although not all of these are suitable for all patients. There remain some child parents for whom sedation and/or local anaesthesia are not suitable. For these, general anaesthesia either as an outpatient or with hospital admission may be the method of first choice (Holt *et al.,* 1991; Harrison and Roberts, 1998).

Methods of sedation for children are now beginning to be introduced in Saudi Arabia (Al-Rakaf *et al.,* 2001). General Anaesthesia is also used. A limited number of government funded hospitals in the country provide general anaesthetic services for dentistry. These hospitals follow international recommendations for dental treatment under general anaesthesia (Annual Health Report, 1998/99).

2.1.7 Summary

The Kingdom of Saudi Arabia was established in 1932. It is located in the middle of the Arabian Gulf. Saudi Arabia is a large country which consists of 19 regions, which vary in population, topography, and weather. The population now numbers more than 22 million people. Health care has changed, with government support, away from primitive health providers to well-equipped medical centres and hospitals. Oral health care for children includes community based preventive schemes and treatment of caries. Available facilities include services offering treatment under general anaesthesia.

Among the Saudi population, chronic diseases are now the major main problem. In respect of oral health dental caries represents the most important dental problem especially amongst children. Prevention and treatment of this disease is a major priority.

2.2 Oral Health Status in Children in the Arabian Gulf Area and in Saudi Arabia

Oral health status in children has been concerned principally with caries. Currently considered one of the most prevalent diseases in the world, dental caries was of a little significance before the 17th century. Caries has existed in man for thousands of years, as is evident in human skulls from archaeological material. However, only one or a few teeth were affected in very few individuals in these early remains. Beginning in the 1600s in Europe, dental caries progressively affected more individuals, more teeth, and more tooth surfaces (Heloe and Haugejorden, 1981; Walker *et al.,* 1981). This increase in caries probably came about at least partly because of change to a modern diet and dietary habits dominated by refined carbohydrates and more recently, industrial sugar containing products (Marthaler, 1971).

Changes in caries prevalence, severity, distribution and pattern in many developed countries have been recorded during the past 2-3 decades (Heloe and Haugejorden, 1981; Glass, 1982; Mandel, 1985). Throughout this period, dramatic reductions in caries levels have occurred in developed countries, despite the fact that sugar consumption has remained relatively static. It is widely accepted that the reduction of dental caries in these countries was due at least partly to more widespread introduction of fluoride. Some authors have also attributed the decline to development of dental health educational programs (Burt, 1985; Holm, 1990).

In developing countries the situation is more equivocal. Data have indicated that in some parts of developing countries where there is a high sugar intake, children have high caries prevalence in their primary dentition, in contrast to the situation in the permanent dentition where caries may be less severe. Prevalence may remain low in other parts of the same countries because of the poor economic status and more restricted sugar intake (Amaratunge *et al.,* 1986; Ibrahim *et al.,* 1986; Holm *et al.,* 1989; Holm, 1990).

It is anticipated that as the economic status of developing countries improves, traditional habits such as feeding practices for infants and young children will continue to be lost or modified. One consequence is likely to be a greater consumption of sugar containing foods, a change that may contribute to increasing caries prevalence in the future (Heloe and Haugejorden, 1981; McNulty and Fos, 1989; Holm, 1990).

In the past, because a high proportion of susceptible tooth surfaces had been attacked by early adult life, caries was considered to be essentially a disease of children (Blinkhorn and Davies, 1996). Despite the improvements seen, with the exception of root surface caries, this remains true. This has important implications for both the prevention and treatment of caries.

Dental caries has been widely studied in many parts of the world. Investigations have included studies in the Arabian Gulf area and more specifically in Saudi Arabia. Studies of the disease have included those focused on pre-school children and those of primary and secondary school age.

2.2.1 Dental Caries in the Arabian Gulf Area

The area of the Arabian Gulf includes Saudi Arabia, Kuwait, Qatar, Bahrain, Sultanate of Oman, and the United Arab Emirates. As have some other parts of the Middle East, these have been considered as developing countries. Rapid modernisation in the area, associated with a shift in the population from rural to urban living and changes in traditions and life styles (Saparamadu, 1984; Mandal, 1985; Ernest, 1992) has been accompanied by an increased prevalence of caries in children. It has been concluded that the future prevalence of dental caries in these and other developing countries is unpredictable, partly because of the limited data available and lack of dental information (Blinkhorn and Davies, 1996).

2.2.1.1 Prevalence in Pre-school Children (< 5 years)

At least 6 studies have investigated caries in pre-school children in the area of the Arabian Gulf. All have been relatively recent. In one large study, Babeely *et al.* (1989) reported 12% of group of 5473 Kuwaiti pre-school children to show some form of nursing caries. More recently, in the same age group (18-48 months) in a group of 227 children from different social classes, Al-Dashti (1995) concluded that caries prevalence in early childhood is relatively high in Kuwait. Prevalence was recorded as 21% at 18-23 months, 54% at 24-35 months, and 67% at 36-48 months. Nineteen percent of the children had rampant caries. The authors noted that the problem of rampant caries among young children in Kuwait was increasing, a conclusion drawn from a comparison of their results with estimates reported by Babeely *et al.* (1989) six years earlier (Babeely *et al.*, 1989; Al-Dashti *et al.*, 1995).

Two other recent studies in Kuwait have shown contrasting results. In one, which included 450 children aged between 3 and 7 years from higher socio-economic groups, caries prevalence was 37% at the age of 4 year and mean dmft was 1.4. In the second and most recent Kuwaiti study, in which a sample of 3500 children were drawn more widely from Kuwaiti kindergartens, caries prevalence was 81% and mean deft -where 'e' denoted a tooth indicated for extraction- was higher at 4.6 (Vigild *et al.,* 1996). The reason suggested for the low dmft in the first of the two studies was the selection of the sample, which was confined to children of higher socio-economic status (Murtomaa *et al.,* 1995).

The most recent study to be reported from an Arabian Gulf country was conducted by Al-Hosani and Rugg-Gunn (1998). It involved children aged 2 and 4 years old living in the three administrative regions of the United Arab Emirate, which are the Emirates of Abu Dhabi city and surrounding area, Al-Ain and surrounding area and the Western region which includes rural areas. The caries prevalence for the sample of 421 children included was 36%-47% at age 2 years and 71%-86% at age 4 years. The mean dmft recorded for the each area was 1.7 and 6.2 in Abu Dhabi, 3.2 and 5.2 in Al-Ain, and 2.8 and 5.1 in the Western region for 2 and 4 year-old children respectively in each area. The authors considered the high caries prevalence to be related to the low parental level of education coupled with a high parental income (Al-Hosani and Rugg-Gunn, 1998).

Information about pre-school children from other parts of the Gulf has not been documented to the same extent as for primary school children. This is probably because as in many developing countries, primary teeth are considered as less important and valuable than permanent teeth. Because younger children do not attend school they are also harder to identify and to study (Winter *et al.,* 1971 a and b).

2.2.1.2 Prevalence in School Children (5–8 years)

More studies have been carried out on school children at the age of 6 years and over than amongst younger age groups. Baghdady and Ghose (1982), in the First National Oral Health Survey of primary school children in Iraq, estimated caries prevalence of 6 year-old children from mixed socio-economic levels to be high, with a mean dmft of 5.2 and a prevalence of 89% in primary teeth. Mean DMFT for the same children was 0.6 and caries prevalence was 33% in permanent teeth (Baghdady and Ghose, 1982).

Results of further large study, carried out in 1210 5 year-old children in Abu Dhabi, supported these findings of a high caries prevalence in the Gulf area. In this investigation children were selected and gathered into three groups according to school type (public or private) and for those at public schools, whether these were city or rural. The results show a prevalence of 72% in 5 year-olds, with dmft values being similar in children from city and rural schools. Those from private schools had lower values than did children in the two other groups. Mean dmft for each group was 5.1, 5.02, and 3.1 for children in the city, rural, and private schools respectively (Al-Mughery *et al.,* 1991).

In Kuwait, mean dmft was higher at the age of 6 than at 4 years (Murtomaa *et al.,* 1995). Mean dmft of 6 year-olds children was 4.1 with a prevalence of caries of 80%.

A lower value was recorded for 7 year-old children, in whom mean dmft was 3.8 and caries prevalence 75%. The sample included in this investigation did not represent the entire country, and the study population was thought likely to over represent higher socio-economic levels (Murtomaa *et al.,* 1995). In a further study carried out in Kuwait amongst children in public schools, mean dmft was 6.2 at age 6 and DMFT was 0.2. It was reported that only 9% of children were caries free in the primary dentition and 14% of children at this age already had caries in their permanent teeth (Vigild *et al.,* 1996).

Similar results were recorded in the Sultanate of Oman in 1994 when the first Omani National Oral Health Survey of 6 year-old children was carried out in a sample of 3114 children. Mean dmft was 4.6 with only 16% of children caries free. The authors attributed the high prevalence of caries to change in diet resulting in increased sugar consumption (Al-Ismaily *et al.,* 1997).

A total of 80 five-year-old children were included as a part of the more recent study conducted by Al-Hosani and Rugg-Gunn (1998). The caries prevalence ranged between 82% and 94% at this age. Mean dmft was 8.4 in Abu Dhabi, 8.6 in Al-Ain, and 5.7 in the Western region (Al-Hosani and Rugg-Gunn, 1998).

2.2.1.3 Prevalence in School Children (9–12 years)

Children of 9 and 12 years provide evidence of caries in both primary and permanent dentitions. In the National Oral Health Survey carried out in conjunction with the WHO in Iraqi children, the mean dift for 9 and 12 year olds was 3.7 and 1.8 for primary teeth and the DIFT was 1.4 and 2.7 for the permanent teeth for the two ages respectively. Caries prevalence was 60% and 79% for the two respective ages (Baghdady and Ghose, 1982).

More recently, Kuwaiti 12 year-old children showed a moderate caries prevalence similar to that seen in Iraq in the early 1980's. The prevalence was 79% and mean DMFT 2.6 (Vigild *et al.*, 1996).

In a study of 3435 Omani children it was reported that the DMFT for 12 year-old children had been relatively low at 1.5 and prevalence of dental caries was also lower at 58% (Al-Ismaily *et al.*, 1996).

Generally, dmft values for 12 year olds are often lower compared with estimates for other age groups. This is likely to be a consequence of exfoliation of the primary teeth (and the eruption of sound permanent teeth). In all studies from countries in the Arabian Gulf, and in all age groups, the 'f' component was very low with most of the caries experience in the form of untreated decayed teeth whilst high disease experience may partly reflect the underlying socio-economic conditions, lack of oral health promotion and infrequent use of fluorides and other measures. Lack of treatment may also be a consequence of poor access to care through factors such as shortages of dental manpower and cost to the families (Baghdady and Ghose, 1982; Al-Mughery *et al.*, 1991; Al-Dashti *et al.*, 1995; Vigild *et al.*, 1996; Al-Ismaily *et al.*, 1996 and 1997; Al-Hosani and Rugg-Gunn, 1998).

2.2.2 Caries Prevalence in Saudi Arabia

As amongst studies in other countries, investigations in Saudi Arabia may be considered in those concerned with children of preschool age and those which related to children of primary or secondary school age. In several cases, investigations have included children from more than one of these groups. The aims of these studies and their methodology (particularly the sampling methods and criteria used) have differed widely. Nevertheless, some broad trends can be identified.

2.2.2.1 Prevalence in Pre-school Children (0-5 years)

At least six studies have been conducted in different areas in Saudi Arabia to estimate caries prevalence in children of preschool age (Salem and Holm, 1985; Wyne *et al.,* 1996; Al-Mohammadi *et al.,* 1997; Paul and Maktabi, 1997; Al-Banyan *et al.,* 2000; Al-Malik, 2000), details of these studies are summarised in Table 2.1. Three further studies have been carried out in this age group but are not included in the table; in two the sample of children studied were selected on the basis of having high or low caries experience (Al-Ghanim *et al.,* 1998; Nainar and Wyne, 1998); and in the third, only the prevalence of nursing caries was considered (Al-Amoudi *et al.,* 1996).

In the earliest of the studies included in Table 2.1 carried out in the south of Saudi Arabia, in Gizan, mean dmft in a sample of 296 children, 3-5 years old was 1.2 per child suggesting a moderate level of disease. It was noted that none of the children included had received any restorative care and that 33% had active disease (Salem and Holm, 1985). Relatively low levels of disease were also reported by Al-Mohammadi *et al.*

from a study in Riyadh (Al-Mohammadi *et al.*, 1997). In this study of 390 2 and 4-year-old children caries was shown to vary with age, with social class and with where the children lived. In the study dmft values ranged from 0.2 per child amongst 2-year-olds from rural areas to 3.0 per child amongst 4-year-old children from urban areas and from lower social classes. Prevalence ranged from 6% to 55% in these two subgroups. Higher dmft values have been reported more often during the last ten years. Average dmft values of 6.9 per child were reported in a study of 1016 children in Riyadh (Wyne *et al.*, 1996) and 7.1 per child from a much smaller investigation of 103 five-year-old children in Alkharj (Paul and Maktabi, 1997). In the second of these two studies a prevalence of 84% was reported. Most recently, Al-Banyan *et al.* reported a mean dmft of 4.5 per child for the 49 5-year-olds in Riyadh included in their investigation (Al-Banyan *et al.*, 2000) and Al-Malik a very similar value of 4.8 per child amongst a much larger representative sample of 2-5-year-olds kindergarten children from the city of Jeddah, in the Western Province (Al-Malik, 2000). Al-Malik found 73% of her sample to have some caries experience.

It can be seen from details given in Table 2.1 that where separate estimates were given, dmft values were very largely made up of decayed teeth. More than 80% of the mean dmft value reported by Al-Malik for example was made up of decayed teeth.

Prevalence of either rampant or nursing caries has been considered in three studies in cities in Saudi Arabia (Wyne *et al.*, 1996; Al-Amoudi *et al.*, 1996; Al-Malik, 2000). Twenty per cent of a group of 633 3-6-year-old children from Jeddah were reported to have nursing caries (Al-Amoudi *et al.*, 1996). In the same city, Al-Malik later reported

32% of a larger sample of 2-5-year-olds to be affected by rampant caries. These estimates are much higher than the 6% with rampant caries and 9.2% with nursing caries that had been reported by Wyne et al amongst children with an average age of 4 years from Riyadh (Wyne *et al.,* 1996).

Table 2.1: **Summary of studies of caries in 0-4 year old children in Saudi Arabia**

Authors	**Number**	**Age**	**dmft**	**dt**	**mt**	**ft**	**Prevalence (%)**
Salem and Holm, 1985	296 Gizan	3-5 years	1.2 ± 0.08	1.05	0.15	-	-
Wyne *et al.*, 1996	1016 Riyadh	54.2 ± 10.5 months	6.9 ± 4.3	5.8 ± 4.1	0.4 ± 1.0	0.7 ± 1.7	7.4
Al-Mohammadi *et al.*, 1997	390 Riyadh	2 Years 4 Years — High Social	0.4 ±1.1 0.7 ± 2.7	-	-	-	17 45
		2 Years 4 Years — Low Social	1.7 ± 3.7 3.0 ± 5.0	-	-	-	30 55
		2 Years 4 Years — Rural	0.2 ± 0.7 2.1 ± 3.9	-	-	-	6 46
Paul and Maktabi, 1997	103 Alkharj	5 years	7.1 ± 5.7	5.8	0.51	0.82	84
Al-Banyan *et al.*, 2000	49 Riyadh	5 years	4.5 ± 3.8	-	-	-	-
Al-Malik, 2000	987 Jeddah	2-5 years	4.8 ± 4.9	3.9 ± 4.4	0.3 ± 0.9	0.51 ± 1.5	73

2.2.2.2 Prevalence in Primary School Age Children (6-8 years)

Information about eight studies carried out in primary school children in Saudi Arabia is summarised in Table 2.2. Three were concerned only with disease in primary teeth (Al-Khateeb *et al.,* 1990; Al-Amoudi *et al.,* 1995; Al-Mohammadi *et al.,* 1997), but five included estimates for caries in permanent teeth (Al-Shammary *et al.,* 1990; Magbool, 1992; Al-Amoudi *et al.,* 1996; Al-Tamimi and Petersen, 1998; Al-Banyan *et al.,* 2000). In 6-year-old children mean dmft values (for primary teeth) have ranged from 2.1 per child, seen in 160 children from Rabagh, which has optimal water fluoride levels (Al-Khateeb *et al.,* 1990) to 6.8 per child for a group of children of the same age from Jeddah (Al-Amoudi *et al.,* 1995).

Prevalence estimates for disease in primary teeth have ranged from 60% for 6-year-old children in Rabagh, (Al-Khateeb *et al.,* 1990) to 89% for those from lower social classes in the more recent study in Riyadh (Al-Mohammadi *et al.,* 1997). Values for dmft and prevalence for older children in this age group have generally been slightly lower, reflecting the exfoliation of primary teeth occurring between 6 and 8 years of age.

Differences in relation to socio-economic factors have been reported in primary school age children. In the study of Al-Mohammadi *et al.* differences in dmft were seen with social class and with area of residence in 6-year-olds in the same way as in younger children with values being highest in children from lower classes and urban areas and lowest in those from rural areas (Al-Mohammadi *et al.,* 1997). As well as the study published in 1990 and shown in the table, Al-Khateeb *et al.* made a second report from the same investigation demonstrating that caries differed significantly between children attending private and publicly funded schools in two of the three areas included. No difference was seen in Mecca; where water fluoride levels were in excess of 2.5 ppm but in Rabagh, mean values were 1.5 per child for children attending private schools compared to 2.8 per child for those at public schools. In Jeddah values were 2.9 and 6.3 per child for those at private and public schools respectively (Al-Khateeb *et al.,* 1991).

In the permanent dentition, DMFT values were relatively low, at 0.2 per child for 6-year-old children in the study of Al-Shammary *et al.* from Riyadh and reported in 1990, but more recent estimates suggest higher levels of disease. Caries in permanent teeth has also been shown to increase markedly with age. In the most recent estimate, from Riyadh, a DMFT of 2.6 was reported for 8-year-old children, compared to 0.9 per child for 6-year-olds in the same investigation (Al-Banyan *et al.,* 2000). Not all studies provide prevalence estimates but in one study from Jeddah; a prevalence of 62% was reported for caries in permanent teeth in 8-year-olds (Al-Amoudi *et al.,* 1996).

As in younger children, a high proportion of disease has been made up of decayed teeth. As can be seen from information given in Table 2.2, this has been true for both primary and permanent teeth and in all studies where the breakdown was given.

Table 2.2: **Summary of studies of caries in 6-8 year old children in Saudi Arabia**

Authors	Number	Age	Dentition	dmft/DMFT	dt/DT	mt/MT	ft/FT	Prevalence (%)
Al-Shammary *et al.*, 1990	2321 Riyadh	6 years	Primary	3.8*	3.4*	0.3*	0.1*	77
			Permanent	0.2*	0.2*	0*	0.01*	11
Al-Khateeb *et al.*, 1990	160 Jeddah	6 years	Primary	4.6 ± 3.9**	-	-	-	79
	160 Rabagh			2.1 ± 2.3**	-	-	-	60
	160 Mecca			2.7 ± 2.0**	-	-	-	79
Magbool, 1992	279 Alkhobar	6-7 years	Primary	5.11	3.60	1.11	0.4	88
			Permanent	0.78	0.48	0.27	0.03	-
Al-Amoudi *et al.*, 1995	742 Jeddah	6 years	Primary	6.8 ± 0.7	5.6 ± 0.6	0.9 ± 0.07	0.4 ± 0.05	-
		7 years		6.1 ± 0.31	4.7 ± 0.24	1.0 ± 0.5	0.4 ± 0.02	-
		8 years		5.64 ± 0.23	4.3 ± 0.18	0.8 ± 0.04	0.5 ± 0.02	-
Al-Amoudi *et al.*, 1996	1522 Jeddah	6 years	Primary	5.5 ± 4.2	4.5 ± 3.8	0.7 ± 1.2	0.2 ± 0.7	74
		7 years		5.6 ± 3.8	4.3 ± 3.3	0.9 ± 1.4	0.3 ± 0.9	87
		8 years		4.4	3.4 ± 3.1	0.6 ± 1.2	0.3 ± 0.9	74
		6 years	Permanent	1.2 ± 1.4	1.2 ± 1.4	-	0.02 ± 0.2	12
		7 years		1.6 ± 1.6	1.5 ± 1.6	-	0.03 ± 0.2	60
		8 years		1.8 ± 1.7	1.8 ± 1.7	-	0.03 ± 0.3	62

* Values represent an average of mean values for boys and girls.

** Values represent an average of mean values for private and public school.

Authors	Number	Age	Dentition	dmft/DMFT	dt/DT	mt/MT	ft/FT	Prevalence (%)
Al-Mohammadi *Et al.*, 1997	390 Riyadh	6 years	Primary (High social)	3.7 ± 3.9	-	-	-	62
			Primary (Low social)	5.0 ± 3.6	-	-	-	89
			Primary (Rural)	2.9 ± 3.9	-	-	-	61
Al-Tamimi and Petersen, 1998	480 Madinah	6 years	Primary	6.4 ± 0.3	5.6 ± 0.3	0.5 ± 0.0	0.2 ± 0.0	-
			Permanent	0.4 ± 0.1	0.4 ± 0.1	0	0	-
Al-Banyan *Et al.*, 2000	272 Riyadh	6 years	Primary	4.3 ± 3.2	-	-	-	-
			Permanent	0.9 ± 1.3	-	-	-	-
		7 years	Primary	4.2 ± 4.0	-	-	-	-
			Permanent	1.5 ± 1.6	-	-	-	-
		8 years	Primary	4.1 ± 2.8	-	-	-	-
			Permanent	2.6 ± 1.5	-	-	-	-

2.2.2.3 Prevalence in Secondary School Age Children (9-12 years)

At least 9 investigations have been carried out into caries in children aged 9 to12 years in Saudi Arabia. Details of these are shown in Table 2.3. Many have also considered younger children. All have considered caries in permanent teeth and five have included estimates of disease in primary teeth (Magbool, 1992; Al-Amoudi *et al.*, 1995; Al-Amoudi *et al.*, 1996; Al-Tamimi and Petersen, 1998; Al-Banyan *et al.*, 2000).

Information shown for primary teeth again shows dmft values falling with increasing age with a value of 0.2 per child for 12-year-old children in one recent study. In permanent teeth in 12-year-old children DMFT values range from 1.6 per child amongst a sample from Riyadh (Al-Shammary *et al.*, 1990) to 6.0 per child reported more recently in a selected very small group of children of this age from the same city (Al-Banyan *et al.*, 2000). It can be seen from the table that values reported for 12-year-olds in the last 5 years have more often been in the region of 2-3 teeth with younger children having lower numbers of teeth affected.

The relationship seen between social factors and caries in the two younger age groups was seen again in the 9-12-year-olds age group. Al-Khateeb *et al.* showed that caries differed between children attending private and public schools in the cities of Jeddah and Mecca but with little difference in mean DMFT for those in Rabagh, where fluoride levels were close to optimal. Mean DMFT values in Mecca were 2.1 and 5.1 per child for those attending private and public schools respectively and in Mecca equivalent values were 1.5 and 2.3 per child. In Rabagh means were 1.6 (private) and 1.8 (public) per child.

Table 2.3: **Summary of studies of caries in 9-12 year old children in Saudi Arabia**

Authors	Number	Age	Dentition	dmft/DMFT	dt/DT	mt/MT	ft/FT	Prevalence (%)
Al-Shammary *et al.*, 1990	2321 Riyadh	9 years	Primary	3.2*	2.6*	0.5*	0.1*	-
			Permanent	0.9*	0.8*	0.02*	0.1*	-
		12 years	Permanent	1.6*	1.4*	0.07*	0.1*	-
Al-Khateeb *et al.*, 1990	160 Jeddah	12 years	Permanent	3.6 ± 2.6**	-	-	-	79
	160 Rabagh			1.7 ± 1.9**	-	-	-	58
	160 Mecca			1.9 ± 1.7**	-	-	-	66
Magbool, 1992	1665 Alkhobar	8-9 years	Primary	4.66	2.89	1.33	0.44	-
			Permanent	1.39	1.07	0.24	0.08	-
		10-11 years	Primary	3.24	1.73	1.27	0.24	-
			Permanent	1.89	1.49	0.27	0.13	-
Akpata *et al.*, 1992	363 Riyadh	12 years	Permanent	2.3*	1.6*	0.03*	0.7*	68
Al-Amoudi *et al.*, 1995	3318 Jeddah	9 years	Primary	3.6 ± 0.08	2.8 ± 0.07	0.5 ± 0.01	0.2 ± 0.02	-
		10 years		2.2 ± 0.07	1.5 ± 0.06	0.3 ± 0.005	0.2 ± 0.009	-
		11 years		0.8 ± 0.01	0.7 ± 0.01	0.05 ± 0.002	0.1 ± 0.003	-
		12 years		0.3 ± 0.005	0.3 ± 0.002	0.01 ± 0.002	0.05 ± 0.002	-
Al-Amoudi *et al.*, 1996	1522 Jeddah	9 years	Primary	2.9 ± 2.92	2.3 ± 2.42	0.4 ± 1.42	0.2 ± 0.88	65.6
			Permanent	2.2 ± 1.92	2.0 ± 1.88	-	0.1 ± 0.64	67.5

* Values represent an average of mean values for boys and girls

** Values represent an average of mean values for private and public school.

Authors	Number	Age	Dentition	dmft/DMFT	dt/DT	mt/MT	ft/FT	Prevalence (%)
Akpata *et al.*, 1997	740 Hail	12 years	Permanent	2.7 ± 2.7	2.4	0.2	0.1	-
Al-Tamimi and Petersen, 1998	480 Madinah	12 years	Primary	1.9 ± 0.2	1.6 ± 0.1	0.2 ± 0.0	0.1 ± 0.1	-
			Permanent	2.9 ± 0.2	2.8 ± 0.1	0.1 ± 0.0	0.1 ± 0.1	--
Al-Banyan *et al.*, 2000	272 Riyadh	9 years	Primary	3.5 ± 2.7	-	-	-	-
			Permanent	2.8 ± 1.6	-	-	-	-
		10 years	Primary	2.9 ± 2.1	-	-	-	-
			Permanent	3.3 ± 1.3	-	-	-	-
		11 years	Primary	1.5 ± 2.2	-	-	-	-
			Permanent	3.4 ± 2.0	-	-	-	-
		12 years	Primary	0.2 ± 0.4	-	-	-	-
			Permanent	6.0 ± 2.8	-	-	-	-

2.2.2.4 Prevalence in Older Children (13 years and Over)

A summary of five studies investigating caries in children aged 13 and over is given in Table 2.4. All studies indicated 15-year-old children to have a mean DMFT of 3 or more per subject with the highest value for this age group (5.2 per child) being recorded for 15-year-olds in Jeddah in the study of Al-Khateeb *et al.* (1990). The most recent study, from Hail, shows a lower value of 3.2 per child for 15-year-olds (Akpata *et al.,* 1997). The difference in disease between younger children attending private and public schools was also described for 15-year-olds in the second report made by Al-Khateeb *et al.* DMFT values were 4.2 (private) and 6.3 per child (public) for 15-year-olds attending schools in Jeddah, 2.0 (private) and 2.6 per child (public) for those from Rabagh and 1.6 (private) and 2.3 (public) for those at schools in Mecca (Al-Khateeb *et al.,* 1991).

Table 2.4 **Summary of studies of caries in 13-17 year old children in Saudi Arabia**

Authors	Number	Age	DMFT	DT	MT	FT	Prevalence (%)
Younes and El-Angbawi, 1982	1378 Riyadh	13 years	2.7 ± 2.61	2.3 ± 2.32	0.1 ± 2.32	0.2 ± 0.69	77.7
		14 years	2.9 ± 2.51	2.4 ± 2.24	0.2 ± 0.43	0.2 ± 0.73	
		15 years	3.0 ± 2.74	2.5 ± 2.43	0.2 ± 0.46	0.2 ± 0.79	
Al-Khateeb *et al.*, 1990	160 Jeddah	15 years	5.2 ± 3.3**	-	-	-	91
	160 Rabagh		3.2 ± 2.1**	-	-	-	68
	160 Mecca		2.1 ± 1.9**	-	-	-	68
Magbool, 1992	1665 Alkhobar	12-13 years	3.64	2.59	0.70	0.35	-
		14-15 years	3.81	3.16	0.21	0.44	-
		16-17 years	4.59	4.03	0.28	0.28	-
Akpata *et al.*, 1992	363 Riyadh	13 years	1.9*	1.4*	0.1*	0.4*	64.8
Akpata *et al.*, 1997	1615 Hail	13 years	2.9 ± 2.9	2.7	0.2	0.1	-
		14 years	3.0 ± 3.1	2.7	0.2	0.2	-
		15 years	3.2 ± 3.3	2.8	0.1	0.3	-

* Values represent an average of mean values for boys and girls.

** Values represent an average of mean values for private and public school.

2.2.3 Determinants of Caries in Children in Saudi Arabia

Caries is understood to be a consequences of factors related to host susceptibility, to the nature of plaque, and to dietary substrate acting over time.

2.2.3.1 Dietary Factors

In Saudi Arabia there has been a drastic change in pattern of food consumption and dietary habits over the last 50 years as a result of increased income and associated prosperity. In the past the diet of Saudi Arabians consisted almost wholly of rice, meat, vegetables, and fruits. With the large expansion in imported products, carbohydrate and refined sugar became daily family foods. The availability of sugar, including confectionery, has particularly increased. This is recognised as creating a problem in child general health as well as oral health. Poor dietary habits, partly as a consequence of ignorance of the importance of diet in general and oral health may contribute to the malnutrition and dental caries now common in children in some parts of Saudi Arabia (Sebai, 1985; Al-Obaid, 1995).

A very great amount of evidence has demonstrated the association between sugar and dental caries. This has been reviewed in the past and it has been concluded that sugar - its total consumption as well as the frequency of its intake- contributes to the formation of dental caries (Rugg-Gunn, 1993; Llena-Puy *et al.,* 2000). The increase in caries in many developing countries has been attributed especially to an increase in sugar consumption.

In Saudi Arabia both traditional and more modern diets contain considerable amount of sugar (Akpata *et al.,* 1992). As in other western countries there has also been an increasing availability of soft drinks, which may also have contribute to an increase in caries prevalence.

Because frequency of intake is important and because meals may also include protective factors (Moynihan *et al.*, 1999), items consumed between meals may have particular cariogenic potential (Newbrun, 1982; Rugg-Gunn, 1993). In the Middle East, the between meal sugar consumption of sugary desserts has been associated with a high caries score (Ismail *et al.,* 1984; Ismail, 1986).

The traditional pattern of frequent consumption of Arabic coffee with dates, and more recently with confectionery and cakes, by adults throughout day allows easy access to a high and frequent sugar intake for children.

In Saudi Arabia as in other countries, infant diet has been related to rampant caries. Duration of feeding with either breast or bottle was thought to be similar in those with or without rampant caries (Sawaya *et al.,* 1987). Eronat and Eden 1992, in a sample of 72 children found that most of the children with rampant or nursing caries had a diet with high sugar content, while in the control group, most of the children had a diet with less frequent sugar intake and regular brushing habits (Eronat and Eden, 1992). Wyne and Khan 1995 and Al-Ghanim 1998 have shown that between 59% and 75% of pre-school children with high dmft in the Riyadh region in Saudi Arabia were using canned soft drinks and packed fruit juices (Wyne and Khan, 1995; Al-Ghanim *et al.,* 1998).

2.2.3.2 Oral Hygiene

A correlation between good oral hygiene and gingival health has been clearly demonstrated in young children (Koch and Lindhe, 1970). In contrast, the relationship between oral hygiene and dental caries has never been so clearly established. Studies that have been conducted have provided conflicting evidence. Most have related oral hygiene to the prevalence of dental caries in a population. Some showed that good oral hygiene and low caries prevalence were related (Brucker, 1943; Mansbridge, 1960; Berenie *et al.,* 1973; Todd and Dodd, 1983; Tucker *et al.,* 1976; Russell *et al.,* 1991). Other researchers have failed to find this relationship (Woltgens *et al.,* 1984; Etty *et al.,* 1994; Kuriakose and Joseph, 1999). In a review of the studies dealing with the relationship between oral cleanliness and caries, a positive association was found between plaque and caries in half of these studies while the remaining half show no relationship or a weak negative association (Sutcliffe, 1996). Epidemiologists have also failed to demonstrate any clear or consistent relationship between oral hygiene levels and dental caries prevalence (Hunt, 1990; Watt and Fuller, 1999).

Although evidence has been unclear therefore a relationship between tooth brushing and caries has sometimes been seen in studies of young children. Reported brushing habits and caries were investigated in the first of the studies carried out in Camden. It was shown that 53% of the children whose teeth were not brushed were caries free against 84% of the children whose parents claimed their teeth were brushed three times (Winter *et al.,* 1971 b). In the most recent study of 1.5 to 4.5 year olds that formed part of the National Diet and Nutrition Survey, children whose teeth were brushed twice a day or more were less likely to have caries (Hinds and Gregory, 1995). Differences seen in studies since they were widely available may relate at least partly to the frequency of use of fluoride containing toothpastes.

Three reports from Saudi Arabia have shown a direct relation between dental caries and brushing. All three, children with less caries had their teeth brushed more regularly and had started brushing at an earlier age than had children with more disease (Wyne *et al.*, 1995; Wyne and Khan 1995; Al-Ghanim *et al.*, 1996).

2.2.3.3 Socio-Economic Status

During the last 20 years an increasing number of epidemiological studies have shown a direct relationship between various behaviours, social factors and dental caries. Most have shown a strong inverse relationship such that an increase in caries prevalence is seen with lower social class as shown in section 2.2.2. Studies showing this pattern of disease have included investigations in the Middle East and Saudi Arabia (Carmicheal *et al.*, 1980; Milen *et al.*, 1981; King *et al.*, 1983; Bradnock *et al.*, 1984; Evans *et al.*, 1984; Silver, 1987 and 1992; Al-Shammary *et al.*, 1990; Al-Khateeb *et al.*, 1990 and 1991; Al-Mughery *et al.*, 1991; Murtomaa *et al.*, 1995; Wyne *et al.*, 1995; Al-Mohammadi *et al.*, 1997; Al-Hosani and Rugg-Gunn, 1998; Al-Malik, 2000).

Socio-economic factors may act on oral health through diet and feeding practices, oral hygiene or oral health care. It is believed that more favourable infant feeding practices and diet are employed in higher socio-economic classes than amongst those in lower socio-economic groups. Parents in higher socio-economic strata may be more likely to comply with general nutritional recommendations and consequently restrict consumption of sucrose-rich food (Silver, 1987 and 1992; Persson and Samuelson, 1984).

The influences of social class on tooth brushing behaviour of pre-school children have also been demonstrated (Blinkhorn, 1978). It has been shown that children from lower socio-economic classes brush their teeth less often than do children from higher socio-economic classes (Currie *et al.,* 1989). This may be considered as a factor associated with higher prevalence of dental disease.

Dental attendance patterns may also be related to both caries levels and to social factors with children from higher classes attending more often (O'Brien, 1994; Mosha and Robinson, 1989). Disadvantages in relation to social status may not be easily removed even when there is access to free dental care or when preventive measures are school based (Hamp *et al.,* 1984; Poulsen, 1988; Schou, 1991; Wright and Schou, 1992).

In developing countries, in addition to social class, the area of a child's home may also be important in determining oral health. Holm, in a review of caries prevalence in pre-school children in developing countries, found that children from higher socio-economic groups who resided in the more affluent urban parts of a country may have more dental decay than children from lower socio-economic groups residing in the rural areas despite better access to care services (Holm, 1990).

2.2.4 Summary

Caries prevalence in young children in Saudi Arabia is high. Prevalence estimates of more than 70% have been reported for children in the kingdom aged 5 or less. A recent estimate suggests that up to a third of young children may suffer from rampant caries. The high dmft levels and the high prevalence of rampant caries suggest that the disease is severe as well as widely prevalent. Levels in older children are also high and, in the permanent dentition, increase rapidly with age. As in westernised countries, caries in Saudi children is related to social class with children from higher classes suffering less disease. It is evident that for both primary and permanent teeth and in all age groups a high proportion of the disease is in the form of untreated caries.

The high levels of caries may be related at least partly to dietary habits and to poor oral hygiene practices. There has also been less tradition of routine dental attendance in Saudi Arabia. This may be difficult to change without greater access to primary care services.

2.3 Use of Dental General Anaesthesia

General anaesthesia has been widely used for the removal of teeth for over 150 years. The word *'anaesthesia'* derived from the Greek *'an'* meaning negative and *'aisthesis'* or feeling; it is properly used, therefore, to indicate an absence of all feeling and thus should be differentiated from the word *'analgesia'* which means only the absence of pain. General anaesthesia, therefore, implies unconsciousness. In general anaesthesia there is an absence of sensation together with temporary loss of consciousness in a state that is reversible. The ancients knew different methods of producing anaesthesia or analgesia. Roman gladiators for example knew how to produce insensibility by compression of the carotid arteries, but the margin between unconsciousness and death with this method was extremely delicate. Herbal compounds which produced sedation and a raising of pain thresholds were also recognised in early history (Sykes, 1980; Ash, 1985).

At the end of the seventeenth century, in 1799, Sir Humphrey Davy discovered the analgesic properties of Nitrous Oxide gas. Nineteen years later, in 1818 the anaesthetic effects of ether were discovered. Chloroform was the next anaesthetic agent to achieve popularity. A fourth major development in anaesthetics came in 1869 when Trendelenburg overcame the difficulty of maintaining a clear airway during surgery in the oral cavity by performing tracheostomy and inserting a cuffed tube into the trachea. Early anaesthetic agents were given by inhalation but in the early part of the nineteenth century, the intravenous route was developed, initially using ether. More rapid development in anaesthetic methods occurred when the use of barbituric acids was introduced leading to universal acceptance of the intravenous route.

In the field of dental general anaesthesia (DGA), there were few changes during the first hundred years. It had been introduced as early as 1844, when Dr. Horace Wells saw the immediate possibility for painless dentistry using nitrous oxide. This gas remained the dental anaesthetic of routine use until the 1960's. Barbiturates had been discovered as early as 1902, and were in use in dentistry by 1930 as short acting anaesthetics. The use of intravenous agents became very popular for oral surgical purposes, especially after the Second World War.

2.3.1 General Anaesthesia in Dentistry

Since it was first used Dental General Anaesthesia (DGA) has been employed mainly for extraction of teeth or for procedures that are likely to be very painful. This type of anaesthesia has been used for adults but more often for children. Complete oral rehabilitation for children with the aid of DGA is now an accepted procedure and has come to be widely accepted by dentists in many countries over the last 4-5 decades.

2.3.1.1 Types of DGA

The technique used in DGA for children may vary in methods of induction and maintenance used, whether or not the patient is intubated and/or premedicated and in the type of anaesthetic agent employed.

Induction may be either by inhalation or intravenous routes. Intravenous induction may use methohexitone, thiopentone or propofol and is rapid, allows greater airway control and avoids awareness of the nasal mask and anaesthetic gases (Hill and Morris, 1991).

It may however be very difficult in the young child or child who is especially fearful of injections. It may also not be suitable in some cases with potential respiratory obstruction (Kaufman *et al.*, 1982). In these circumstance inhalational induction may be preferred using Nitrous Oxide and Oxygen with the addition of Halothane, isoflurane, enflurane or sevrane (Hill and Morris, 1991; Roberts, 2001).

In the case of very short procedures and with experienced and skilled anaesthetists, use of an intravenous agent alone has been believed sufficient (Hill and Morris, 1991), offering rapid induction and recovery, but most often induction is followed by maintenance using a mixture of nitrous oxide and oxygen (at least 30%) together with halothane or sevrane.

For short procedures, the airway may be protected either with simple packing of the mouth and oropharynx or through use of a laryngeal mask together with a light gauze packing (Roberts, 2001). For longer procedures, intubation is require using either a nasotracheal tube (preferred) or an orotracheal tube. Intubation required administration of a neuromuscular paralysing agent, such as atracurium but allows artificial ventilation and secures a clear airway with better surgical access. It is however contraindicated in children under the age of 10 receiving treatment as outpatients, because of the risk of oedema causing airway obstruction postoperatively (Hill and Morris, 1991). Many child patients accept DGA without premedication. A locally acting topical anaesthetic agent (EMLA cream) may be applied one hour preoperatively to allow painless venepuncture and aid compliance. For very anxious patients premedication may be indicated to help allay apprehension, provide analgesia and increase amnesia.

Premedication may help reduce pre and post-operative nausea and vomiting and facilitate induction. However, it may also prolong recovery (Kaufman *et al.,* 1982). Drugs used for premedication include diazepam, promethazine, and trimepazine. Diazepam may be given orally for premedication as for sedation but it is unreliable in effect and has only minimal effect on amnesia (Hill and Morris, 1991).

2.3.1.2 Types of DGA Services

Three broad types of DGA services may be identified in terms of where the service is provided and in the procedures and patients for whom they are most often used. These are short outpatient DGA, and hospital inpatient DGA. Techniques employed vary with types.

Short outpatient DGA most often involves induction using either intravenous barbiturates or propofol, or inhalation induction and maintenance by Halothane or sevrane and N_2O-O_2. Intubation is rarely used in this type of service although a laryngeal mask may be placed, and the treatment procedures should never exceed 30 minutes. Often treatment is limited to extractions or the simplest fillings. The method is chosen only if the patient is free of medical complication and does not require more complex conservative treatment, since any increase in duration of anaesthesia will increase the associated risks to the patients (Vandam, 1965). Monitoring of this type should include an electrocardiogram (ECG), a measure of oxygen saturation, and a blood pressure cuff. In some countries, such as the UK, this type of DGA was traditionally carried out in primary dental care services and was much the most common use. With increasing concern about safety, and a decline in need to extract carious teeth, its use in these circumstances has declined. More stringent requirements for safety mean that, from January 2002, all DGA must be provided in hospital facilities and provision of this type of service in primary care in the UK will cease (DOH, 2001). Although it may be available in private clinics, there are no reports of this type of DGA service operating in Saudi Arabia, where all anaesthetic services are provided in specialist centres or hospitals.

Whilst traditional outpatient DGA lasting no more than a few minutes was most often considered to have sufficient safety margins for simple extractions. DGA for restorative treatment was from the outset considered as needing special precautions (BDA, 1967).

Day-care general anaesthesia has been utilized for procedures taking 40 minutes or longer. It may be carried out in hospital theatre facilities or in specialised day care units attached to hospitals or independent of them. Within day care units, patients undergo the same general anaesthetic preparation and procedures as do inpatients but are discharged more rapidly afterwards (O'Sullivan and Curzon, 1991; Mason *et al.,* 1995 a; Malamed and Quinn, 1995). Induction may be intravenous or inhalational and patients may be intubated using an oral or a nasotracheal tube after injection of muscle relaxant. As well as measures used for short outpatient DGA, monitoring may include oxygen saturation measures, an ECG and blood pressure cuff (Roberts, 2001). Patients receiving DGA in day care facilities may be premedicated using oral diazepam for example (Rule *et al.*, 1967; O'Brien and Suthers, 1983; Alcaino *et al.*, 2000) but premedication is not always used (Holt *et al.*, 1991).

The concept of day-care general anaesthesia for minor surgery was first reported in 1908. It has been suggested to be of special value to children since it cause less psychological upset (Nicoll, 1909). The method became more widely used in the late 1960s and 1970s as the technique was reported to make more efficient use of operating time and result in a reduction in waiting list (Rainey and Ruckley, 1979; McDonald, 1983; Vickers and Goss, 1983). Another advantage of treating children in this way is that it is more cost effective, one study carried out in USA showed a saving up to 70% for outpatients compared to inpatient surgery (Flanagan and Bascom, 1981). In 1990, Heath and his co-worker carried out a study in the UK and showed that day-care surgery is not only cost effective, but is also efficient and associated with a high quality of care and outcome (Heath *et al.,* 1990). This type of DGA has been limited to patients graded as ASA I, II, and selected ASA III patients. Complete dental treatment provided with this type of anaesthesia at a single visit avoids hospital admission. The patient attends the day-care unit in the early morning and leaves the clinic a few hours after completion of treatment (Mason *et al.,* 1995 a).

DGA in day care facilities has been reported from several countries (see section 2.3.7), including Saudi Arabia (Bello, 2000) but more often in this country, DGA is believed given through in-patients services (Jamjoom *et al.,* 2001).

*(The ASA system introduced by the American Society of Anaesthesia (ASA). ASA class I patients are those who are without systemic disease, and ASA class II those who have mild to moderate systemic disturbance caused by condition which is to be treated surgically. ASA class III are those patients who have severe systemic disturbance of disease from whatever cause: this group of patients is not suitable for day care surgery unless they are transferred to a specialist facility where greater postoperative support is available, ASA class IV, ASA class V and ASA class E are patients who have life-threading conditions and for whom outpatient general anaesthesia is contra-indicated (ASAC, 1985).

For inpatient general anaesthesia, the patient is admitted to hospital prior to the planned procedure (often the day before), may undergo a more detailed preoperative anaesthetic assessment and remains in hospital for at least one day postoperatively to recover (O'Sullivan and Curzon, 1991; Malamed and Quinn, 1995).

Typically patients receiving DGA as in-patients are premedicated (using one of a variety of agent given orally or IM, have an intravenous induction and naso- or oro-tracheal intubation after administration of a neuromuscular paralysing agent (Roberts. 2001). Full monitoring arrangements are used.

This type of DGA is used mainly for comprehensive dental procedures, when the procedures may be especially lengthy, if the procedures are particularly traumatic, if patients are at high risk of developing complications, or if they have any type of ASA classification. In-patient care may be preferred for some patients who have mental or physical disabilities so that they may be discharged only when their mental or physical condition is satisfactory (Malamed and Quinn, 1995). This type of DGA may be the one most typically used in Saudi Arabia (Jamjoom *et al.*, 2001).

There have been a number of studies where complete treatment was provided for child patient under DGA either through day care centres or for hospital in patients. These studies will be considered in the final section of this review.

2.3.2 Indications for General Anaesthesia

General anaesthesia, either as an outpatient or with hospital admission has the advantages of not only requiring minimal co-operation but also permitting treatment to be completed at a single visit. However, it also has disadvantages in terms of cost to the provider and risk. One way in which safety and benefits may be maximised is by its appropriate use only in those patients for whom it is clearly indicated and for whom it is the technique of first choice.

Indications for general anaesthesia may include one or more of the following:

1. Patient Age

The use of general anaesthesia has been recommended in very young children whose cooperation is very limited, and who lack sufficient understanding and/or maturity to cope with local anaesthesia and/or sedation. More than one study has found that amongst children who have been referred to have simple dental extractions under outpatient general anaesthesia, most were aged nine or less, with a significant proportion being less than 5 years (Smallridge *et al.,* 1990; Holt *et al.,* 1992; Grant *et al.,* 1998; Carson and Freeman, 2001). In a study comparing the characteristics of patients and type of treatment completed under DGA from 1978-1980 and 1988-1990 in one hospital in Kansas city, Missouri; the age of patients had changed over a 10 year period, more children aged of 4-6 yrs were treated during 1988-1990 than during 1978-1980 (Bohaty and Spencer, 1992). This group have been regarded as pre-co-operative (O'Brien *et al.,* 1983; O'Sullivan and Curson, 1991; Sheehy *et al.,* 1994).

2. Patients with Physical or Mental Impairments

Because they may hinder both optimal oral health behaviours and co-operation with treatment, physical or mental impairments may interfere with the achievement of optimal dental health. Mental retardation, severe learning difficulty, cerebral palsy, seizure disorders, severe neuromotor problems, or injuries to the central nervous system may thus compound specific oral health problems. These patients often present with multiple oral problems for which a considerable degree of co-operation is needed for successful treatment. Poor levels of understanding or uncontrollable movements may make treatment under general anaesthesia the preferred option. However, this may be true of only a small proportion of subjects with impairments (Rule *et al.,* 1967; Murray, 1985; Nunn and Murray, 1987 a and b; Holt *et al.,* 1991; Vermeulen *et al.,* 1991; Maestre, 1996; Welbury, 2001; Harrison and Roberts, 1998).

3. Dental Fear and Anxiety

Fear of dental treatment is a very real problem for many adults as well as children. For some, the thought of dental treatment provokes such extreme anxiety that they will avoid it even in the presence of severe dental pain. Because of their high level of anxiety, sedation techniques, which require a measure of co-operation and regular attendance, may not always be successful and for some, general anaesthesia may be the treatment of choice (O'Brien and Suthers, 1983; O'Sullivan and Curzon, 1991; Welbury, 2001; Blain and Hill, 1998; Carson and Freeman, 2001).

4. Contraindications to Local Anaesthesia

Local anaesthetic drugs have an excellent safety record given their widespread use both in medicine and dentistry (Wildsmith *et al.,* 1998). Despite the high degree of safety and the rare occurrence of adverse reactions, there are cases where injection of local anaesthesia should be avoided (Welbury, 2001; Wildsmith *et al.,* 1998). These conditions include:

i. Inadequacy or Failure of Local Anaesthesia

The occurrence of incomplete local anaesthesia for dental treatment may be more commonplace than recognised. It may be a result of anxiety or of anatomical variations, poor technique, or acute infection. Lack of communication with or understanding by children may make the situation more complicated. Many of these difficulties may be resolved by improved technique and management and in some cases with the use of sedation. When there is total failure of local anaesthesia and this cannot be rectified by other means, patients may need to be treated using general anaesthesia (O'Brien and Suthers, 1983; Welbury, 2001).

ii. Acute Dental Infection

The efficacy of local anaesthesia solution may be reduced as a consequence of the presence of infection, and it is believed that it should not be used in these circumstances. For simple extractions, treatment under short out patient general anaesthesia may be the preferred choice in some cases (Kay and Killey, 1973; Welbury, 2001).

When widespread infection exists within the tissue planes of head and neck, as in Ludwig's Angina, because patency of the airway may be at risk, a hospital admission is recommended in a specialist anaesthetic facility. In medically compromised patients, rapid relief and removal of the source of potentially life threading dental infection may be best achieved through the use of dental general anaesthesia (Hill and Morris, 1991; Welbury, 2001).

iii. Allergy to Local Anaesthesia

Very rarely, hypersensitivity reactions may develop in response to local anaesthetic agents. If no acceptable alternative local anaesthetic agent is available, administration of general anaesthesia may carry a comparatively lower risk to the patient (Welbury, 2001).

However, this is a rare occurrence. In one study of 25 patients who had been clinically diagnosed as allergic to local anaesthetic drugs, only one was found to be genuinely allergic to a local anaesthetic drug of the amide type on testing. The majority of reactions developed by the remainder could be ascribed to clinical anaphylaxis in response to other antigens present, to manifestations of anxiety, or to iatrogenic problems (Wildsmith *et al.,* 1998). Although allergy is rare, overdose with local anaesthesia is possible and may result in death (Malamed, 1999).

5. Bleeding Diatheses

In patients with a bleeding disorder, blind placement of a needle (such as in nerve block local anaesthetics injection) is a hazard that could result in the development of bleeding that is difficult to control and may be life threatening. These and other patients who require special medical care may be best admitted to hospital for the purpose for the sake of the patient's safety (Corah *et al.,* 1985 a and b; Nunn and Murray, 1987 a and b; Scully and Cawson, 1993; Welbury, 2001; Harrison and Roberts, 1998). Patients receiving anticoagulant therapy may present a similar risk. Appropriate therapeutic regimes may be used to minimise risk to the patient but there may be advantages in providing all treatment at a single visit under general anaesthesia (Welbury, 2001).

6. Extensive Treatment Needs

Some children who are able to tolerate routine restorative treatment and simple extraction with the use of local anaesthesia may still need general anaesthesia for more extensive procedures (Rule *et al.,* 1967; Holt *et al.,* 1991; Mason *et al.,* 1995; Grant *et al.,* 1998). Children who suffer from severe forms of caries such as rampant caries, or who have extensive disease, may require multiple extractions and restorations involving more than one quadrant. Particularly where co-operation and understanding are limited, general anaesthesia may be the treatment method of first choice (O'Brien and Suthers, 1983; O'Sullivan and Curzon, 1991; Smallridge *et al.,* 1991; Scully and Cawson, 1993; Welbury, 2001; Grant *et al.,* 1998).

7. Parents Preference

Parents may particularly prefer their children to be treated under general anaesthesia. However, this is not a universal conclusion. Blain and Hill in a comparative study between inhalation sedation and DGA for dental extractions found that 86% of parents of children who had sedation opted for the same methods of treatment again whereas only 24% of the parents of those having general anaesthesia did so (Blain and Hill, 1998). A preference for DGA may be because the treatment is completed in a single visit and the child would not recall any traumatic experience during the treatment.

In a study which employed group discussion to determine the relative influence dentists and parents have on the decision to give a DGA to the child and to identify the factors that influenced the decision, the results indicated that parents were not always able to make informed choices about DGA being used for their child; and that the dentist has the greatest influence on the decision to use the method. Study results also suggested that the decision was sometimes influenced by non-clinical factors (Hastings *et al.*, 1994). In the absence of other indications, demands for general anaesthesia either from parents or dentist are now not regarded as sufficient for use of general anaesthesia. One of the concerns expressed by the Clinical Standards Advisory Group was that, when it is freely available, DGA might be used too often in response to demand (CSAG, 1995).

The treatment of children under DGA has advantages and disadvantages for both the dentist and patient. These may summarised as:

2.3.3 Advantages of General Anaesthesia

i. Use of general anaesthesia requires minimal patient co-operation to be successful. One of the disadvantages of use of both local anaesthesia and sedative techniques is that a degree of patient co-operation is required for the administered drugs to produce the desired clinical effect, as well as to proceed with dental treatment. This represents the most important advantage for children who cannot co-operate through age, fear or anxiety, or impairment. For very young children, and those with extreme fear or anxiety, co-operation may be helped through premedication or for those unable to cope with venepuncture, use of an inhalation induction.

ii. Response to painful stimuli is removed or much reduced. Many general anaesthetics possess either no or only slight analgesic properties but the level of depression of the patient's CNS occurring in general anaesthesia prevents any response by the patient to painful stimuli that reach the brain. Some variation in this response may occur depending on the level of CNS depression.

iii. Amnesia is normally present together with loss of consciousness. This may be helpful for extremely fearful patients, in whom lack of recall of events occurring during the period of treatment represents a major indication for the use of general anaesthesia or any other technique providing amnesia. Whilst this may be an advantage in some patients it means also that treatment under DGA contributes little or nothing to behaviour shaping or improved co-operation through learning. For very fearful patients amnesia may be helped through use of appropriate premedication.

iv. The onset of action of general anaesthesia is usually quite rapid. Intravenous induction is especially quick but even using the inhalation route, in most situations unconsciousness can be induced within approximately 1 minute. Although induction is rapid, general anaesthesia requires pre-operative preparation and also time to recover in a suitable environment. Recovery is quickest with some intravenous agents. Recovery time increases with increasing length of procedures and if premedication is used.

v. Use of general anaesthesia allows treatment to be completed in single visit. It may therefore be of especial value in allowing the immediate relief of pain and sepsis. Treatment at a single visit may also reduce the cost to parents since it avoids repeated visits to the dentist but it may reduce opportunity to encourage good behaviour. The lower cost may also need to be balanced against the impact on child and family. If the experience of DGA is unpleasant then this may offset the savings in time and money. Although they may be seen as safer, hospital based services which require admission of the child may fare badly in this respect.

vi. Titration of effect is usually possible with inhalation agent, the patient receiving the smallest volume of drug required to produce the desired effect. In contrast, local anaesthetics, oral and intravenous agents are usually given in a single dosage adjusted for the individual child. Similar titration of effect is possible in inhalation sedation.

2.3.4 Disadvantages of General Anaesthesia

i. Depression in protective reflexes. The loss of consciousness seen in general anaesthesia is accompanied by progressive depression of the CNS and of the protective reflexes of the patient. Because the dentist is operating in the oral cavity the potential for debris, water, saliva, and blood to enter into the airway and produce an obstruction is greater in dental cases than with most other surgical procedures. One of the most important tasks of the anaesthetist is to ensure the integrity of the patient's airway. A laryngeal mask may be used to assist, or endotracheal intubation employed for longer procedures.

ii. Vital signs are depressed. With the administration of general anaesthesia it is normal to see depression of function of the cardiovascular and respiratory system. This depression, together with the reduction in protective reflexes represents a risk to all patients undergoing DGA. The administration of general anaesthesia for elective dental procedures to some high-risk medically compromised patients is contra-indicated because of this property.

iii. Provision of dental general anaesthesia requires a team of skilled people adding to the cost to the provider. An administration of general anaesthesia for dentistry requires postgraduate training and in the UK anaesthetists are now require to be fully accredited. This type of requirement is also in place in other countries, including Saudi Arabia. Operating staff and all those assisting during the procedure /or during the recovery also should be fully trained.

iv. Special equipment is required, such as monitoring devices for cardiovascular and respiratory systems to determine patient's status and level of function whilst unconscious. Other equipment that may be necessary includes a laryngoscope, endotracheal tubes, and oropharyngeal or nasopharyngeal airways. In the UK, the presence of electrocardiogram, capnograph, and defibrillator is now a formal requirement for facilities where general anaesthesia is to be administered (James, 1991)

v. Suitable facilities are essential for DGA. A recovery area must be available for the patient. Following general anaesthesia of any duration or depth, an area must be made available for the patient to remain in until she/he has recovered sufficiently to be discharged. Such an area must have necessary equipment, including oxygen and suction apparatus; Patients must also be monitored on continuous basis during recovery.

vi. Patients are required to fast for six hours before having a general anaesthetic administration. This is easier when the patient is hospitalised but it is less of a certainty in the outpatient environment. Presence of food or liquid in the stomach can lead to vomiting during the anaesthetic induction or regurgitation during the procedure with consequent risk of airway obstruction, tracheal burning, or pneumonia.

vii. Physical evaluation is recommended pre-operatively. In the past, laboratory tests were also required routinely before general anaesthesia was administered. Urinalysis, complete blood count, and hematocrit and/or haemoglobin determinations were normally obtained for all the patients going for dental general anaesthesia. However, the value of these has been questioned. (Mason *et al.,* 1995 b).

viii. Although the ability to complete treatment at one visit represents an advantage, DGA offer no opportunity for behaviour shaping or for oral health promotion activity to child or family. These may be important parts of visits for care using other methods and lead to better long term attitude and outcome for child and family.

2.3.5 Complications, Morbidity, and Mortality Associated with DGA

Although DGA is a useful means of pain control, it may lead to complications either during or following the operation. The complications may arise from the DGA itself or from the procedure. Complications may arise in either general anaesthesia for inpatients or that for outpatients but these may differ substantially not only because of differences in the level of surgical stress created but also because of differences in patient management systems (Kubota, 1984).

2.3.5.1 Complications During DGA

In one study, information was drawn about complications associated with general anaesthesia among inpatients operated upon in the Tokyo medical and Dental University Hospital. A total of 2658 cases were considered over a 5-year period. The age of patients varied from 0 to 65 years and over. Of the total, 458 cases (17%) developed complications. Almost 30% of those patients who developed complications were aged 12 years and less at the time of surgery. In absolute terms the anaesthetic agent used in more cases with more complications than any other was Halothane, however, the agent had been widely used, and in terms of incidence of complications, the highest rate was in those patients who were given Enflurane. Most of the complications occurred either during induction of GA or during maintenance. In the investigation the complications were reported to be especially associated with light anaesthesia and included tachycardia, supraventricular arrhythmia and muscular rigidity (Kubota, 1984). These findings are in contrast to those of an earlier study in which the effects of Halothane and Enflurane for outpatient dental anaesthesia were compared directly. It was found that during surgery halothane was more often associated with an increase in the incidence of ventricular ectopic heartbeats and bradycardia as compared to Enflurane (Strunin *et al.,* 1979).

Dental injuries occurring during GA have been reported, although few studies have considered the problem. The majority were retrospective in nature and no dental personnel were involved in making the diagnosis of tooth damage (Lockhart *et al.,* 1986; Burton and Baker, 1987; Chopra *et al.,* 1990; Singleton *et al.,* 1993; Chadwick *et al.,* 1996 and 1998). Injuries were usually a complication of intubation with injuries to incisor teeth being the most common. In one prospective study a 12% incidence of dental injuries was reported, as compared with an estimation of 0.07-0.7% reported in retrospective studies. The most commonly affected tooth was the upper left maxillary central incisor, this site reflecting a preponderance of right-handed anaesthetists (Lockhart *et al.,* 1986; Chen *et al.,* 1990).

2.3.5.2 Complications Following DGA

Morbidity and mortality following administration have been especially used in considering the safety of general anaesthesia. Whilst there is some limited information about mortality of DGA there is less data regarding morbidity.

Figures provided in the UK in the past suggested a mortality rate amongst patients treated under outpatient GA of 1:33,536 (Driscoll *et al.,* 1970; Lytle, 1974; Coplans and Curson, 1982a and 1982b) but more recent reports suggested an improvement in this rate. Coplans and Curson for example report a total of 18 deaths directly attributable to

DGA in England and Wales between 1980 and 1989 compared with 54 between 1970 and 1979 (Coplans and Curson, 1993). Over the same period, the number of general anaesthetics given under the National Health Service in general dental practice, excluding those given in hospital had declined.

It had been shown that previously, over a period of more than forty years the total mortality rate had also declined from 1 in 200,000 (1952) to 1 in 2,000,000 (1990). However these estimates may be difficult to interpret since they included deaths occurring following treatment in hospitals and were divided almost equally between anaesthetics given in hospitals and those given in dental practice (Sykes, 1992).

In a very recent report it was recorded that there had been a total of 36 deaths of child patients in primary care services between 1965 and 1999 (Department of Health 2001). As in the case of complications, mortality varies with type of agent. Lytle (1974) and Driscoll *et al.* (1970) reported one death in 400,000 GA administrations using intravenous barbiturates for general anaesthesia in 1970 and 1974 in USA.

In the UK, concern about safety and especially about mortality has led to new guidance from the General Dental Council, and, most recently, the Department of Health (DOH, 2001). DGA should now only be administered by accredited anaesthetists and, when used in facilities other than hospitals, only when there is a written protocol in place for transfer of the patient to critical care facilities in case of an emergency (GDC, 1998). As from 1st January 2002, all DGAs in the UK are to be limited to hospital facilities (DOH, 2001).

This guidance, together with more stringent recommendations made by the Royal College of Anaesthetists (Cartwright, 1999) seems likely to result in a further reduction in numbers of DGA administrations and an increase in alternative methods of management.

The risk of mortality may be the greatest disadvantage of using general anaesthesia for dentistry. Morbidity from general anaesthesia provides a measure of the degree of intrusion into the patient's physiological status. A measure of the length of the time a patient may be "unwell" is also of value since this is an important factor when advising parents about the length of time that a child may need to stay at home after a dental treatment.

In one large epidemiological study, the morbidity of general anaesthesia in children during any surgical procedures was investigated. The study was carried out in France between 1982 and 1987. A total of 40240 anaesthetics had been administered to patients younger than 15 years, 2103 (5%) involving infants younger than one year. Only 3% of the episodes were related to oral surgery. The mortality rate in this study was considered to be low at 1:40,000 deaths but twenty-seven major complications related to anaesthesia occurred during or within 24 hours of the anaesthesia. It was found that the complications which affected infants mainly occurred during maintenance of anaesthesia, whereas complications for older children most often occurred either at induction or during the post anaesthetic period

Complications are affected by previous medical status. In the survey of general anaesthesia for children patients in a hospital in France, not specially DGA, the rate of complications was increased in medically compromised children who were classified as class II or more on the ASA rating who had a number of co-existing diseases. The incidence was also higher when a history of previous general anaesthesia was present, and when the duration of pre-operative fasting was less than 8 hours (Tiret *et al.*, 1986; Tiret *et al.*, 1988).

The most common sequelae reported follow to DGA are nausea, bleeding, vomiting, headache, and drowsiness. Children may complain of one or more symptoms and these may persist for the following 24 hours or more (Ogg, 1972; Muir, 1976; Smith *et al.*, 1976; Holt *et al.*, 1991; Bridgman *et al.*, 1999). The degree of disruption has usually been minor and in none of these studies were complications severe.

In one study the factors influencing postoperative pain included the type of treatment received and also the relation of the accompanying adult to the child; children who were accompanied by their mother were most likely to complain of postoperative pain (Fung *et al.*, 1993). Immediate postoperative pain may be reduced if local anaesthesia is used during the DGA (Welbury, 2001).

The drawbacks inherent in the use of DGA and the risks of morbidity and complications that arise from it have lent strength to the search for the alternative methods. At present, the most commonly used alternative method for child patients is conscious sedation.

2.3.6 Conscious Sedation

Conscious sedation represents the main alternative to DGA for child patients who are unable to tolerate treatment using local anaesthesia and appropriate behaviour management methods alone. In conscious sedation, a state of depression of the central nervous system is produced, allowing treatment to be carried out, but verbal contact with the patient is retained, the patient remains conscious, retains protective reflexes, and is able to respond to verbal commands (GDC, 1999). Not only may conscious sedation provide immediate reduction in fear and anxiety, it may also produce amnesia, which may facilitate later treatment (Jensen and Schroder, 1998).

The types of agent used for sedation for dental treatment for children include inhalational agents, and sedative agents that may be given orally, intravenously, or rectally. Drugs used include hypnotics, psychosedatives and benzodiazepines. In some cases a mixture of drugs may be used but it has been recommended that conscious sedation should involve administration of a single drug (DOH, 1991).

In all cases where sedation is to be used, appropriate facilities are needed for patients pre-operatively and during recovery. Arrangements to allow for any unintended loss of consciousness are also essential. In the UK, inhalational sedation, employing a mixture of nitrous oxide and oxygen has been used to facilitate dental extractions in children having these as a part of orthodontic treatment (Shaw *et al.* 1996, Blain and Hill, 1998). Delivered via a nasal mask, the dosage of nitrous oxide included in the mixture may be titrated to match the patient's needs (often between 20% and 50%) but should never be such that the child receives less than 30% oxygen or becomes unconscious. The method has minimal effects on respiratory and cardiovascular systems and it may be used over a series of sequential visits allowing a course of treatment to be carried out.

Disadvantages of inhalational sedation are that it requires the patient to understand the procedures and to be able to co-operate to sufficient degree to allow use of a nasal mask. This may make the technique unsuitable for very young children. The method may also be unsuitable for children with very extensive treatment needs (requiring a large number of visits) or where a large number of extractions are planned. The potentially harmful effects of nitrous oxide on operating staff mean that efficient scavenging equipment is essential for the surgery (Girdler and Sterling, 1998).

The technique also requires appropriate equipment for safe delivery of the nitrous oxide/oxygen mixture and for patient monitoring. It may be safely administered by the operator but both operators and nursing staff need to be trained in its use and their skills kept up to date (Roberts, 2001).

The equipment and training needed for conscious sedation will add to the cost of this technique to the service provider. If multiple visits are needed then the cost to the consumer may also increase.

Reports of the use and value of inhalational sedation for dentistry in child patients have come from western countries. Although operators working there may have been trained in its use, the extent to which the method is used in countries such as Saudi Arabia is unknown.

Orally administered sedative agents used in paediatric dentistry range from chloral hydrate to diazepam (which may also be given rectally or intravenously) and Midazolam, (which may alternatively be given intra-nasally or rectally). Dosages are estimated accordingly to the child's weight, in the case of diazepam for example, a dosage of 250μg per kg may be used (Roberts, 2001). Oral agents are unpredictable in their effects in children.

Midazolam or propofolol may be used as intravenous sedative agents, as may diazepam. Given in this way the agents may carry a high risk of unintended loss of consciousness and loss of protective reflexes. Intravenous agents may require the presence of a separate "sedationist" or anaesthetist to be given in safety. They may therefore offer less advantage over use of DGA (Healy and Hamilton, 1971, Roberts, 2001).

In contrast to orally administered sedation, rectally administered drugs are reported to be well absorbed and reliable in their effects (Lundgren *et al.* 1978, Jensen and Schroder 1998). Although this type of administration is used in Scandinavia and in Europe, it is reported less often in UK, USA, and Australia, perhaps because of cultural barriers (Cameron *et al.* 1997). The same barriers may be present in Saudi Arabia and countries of similar culture.

There have been some studies reporting on the use of intranasally administered midazolam, including one from Saudi Arabia (Abrams *et al.*, 1993, Hartgraves and Primosch 1994, Al-Rakaf *et al.*, 2001). The studies all involved relatively small numbers of subjects but have shown that sedation and amnesia can be successfully induced by this route.

The study from Saudi Arabia included a total of 38 patients aged between 2 and 5 years. Three different dosage levels were used and children were placed in a restraint device. Sedation lasted for 25-60 minutes with sedative effects being related to the dose of agent administered. Treatment was successfully completed for more than three quarters of the patients and there were few side effects. The study had been carried out in the Paediatric Dental Clinic of the King Saud University College of Dentistry (Al-Rakaf *et al.*, 2001). The report is recent and it is not known whether this technique has been more widely introduced in the country.

2.3.7 Comprehensive Treatment Under DGA

Since it was first employed, DGA to provide comprehensive treatment has come to be more widely accepted and used.

In France, in a report on services published in 1968 it was emphasised that comprehensive treatment under DGA should be carried out in a hospital environment so that close supervision by the medical team was possible both during and after recovery. It was recommended that all patients had a full anaesthetic examination before being subjected to general anaesthesia, that a full case history with details of treatment plans recorded and that the amount and complexity of treatment be carefully noted not only for the convenience of dentist but also so that the anaesthetist might arrange for the dosage of anaesthetic agent to be adequate for the procedures to be carried out. Simple physical examination was considered essential including determination of the suitability of the nasal airway for passage of an endotracheal tube. In this early report the order in which different items of treatment are performed was also considered. It was recommended that extractions should follow restorative procedures and any necessary investigations such as urinalysis, blood grouping, and coagulation time be carried out before anaesthesia. In this French report, nasal intubation was considered essential as it provided the best working conditions and allowed accurate and complete packing of the pharynx (Lebourg, 1968).

Other studies have been published since this early report. Items of information drawn from nineteen studies of services of this type are summarised in Table 2.5. Studies have come from centres in different countries and have varied in study size. Reports have also shown variation in where the DGA was administered, in the age of patients receiving treatment and the nature of treatment provided. Some reports have included assessment of morbidity in some cases indications of patient follow up have been given.

The reports listed in Table 2.5 describe services provided in USA (Goldstein and Dragon, 1965; Douglas and Adilman, 1967; Enger and Mourino, 1985; Sheehy *et al.*, 1994; Berkowitz *et al.*, 1997), in Australia (O'Brien and Suthers, 1983; Alcaino *et al.*, 2000), and in European countries. The latter include studies from the UK (Rule *et al.*, 1967; Mitchell and Murray, 1985; O'Sullivan and Curzon, 1991; Holt *et al.*, 1991; Mason *et al.*, 1991; Wong *et al.*, 1997; Harrison and Roberts, 1998), Sweden (Persliden and Magnusson, 1980), and Belgium (Boulanger, 1990; Vermeulen *et al.*, 1991). Two recent studies have described DGA services in Saudi Arabia (Bello, 2000; Jamjoom *et al.*, 2001). In most cases therefore the services have been provided in countries with well-established and widely accessible treatment services and with relatively low levels of disease. This is less true of Saudi Arabia where caries levels are high and access to treatment may be more limited.

In the majority of the reports, DGA for comprehensive treatment had been provided in day care facilities (often linked to hospitals or dental hospitals) or in hospitals without there being clear distinction between dental treatment and other forms of in patient treatment.

In one study, in the USA, the service was provided at a medical centre (Sheehy, 1994) and in two, one in Australia (O'Brien and Suthers, 1983) and one in USA (Goldstein and Dragon, 1965) DGA for comprehensive treatment were provided for patients in dental office facilities. In one of the studies from Saudi Arabia DGA was provided through day care (Bello, 2000) whereas in the second, DGA was provided for hospital in-patients (Jamjoom *et al.*, 2001).

2.3.7.1 Age of Patients

In one of the first reports, Goldstein and Dragon (1965) in USA described three cases in which fearful adult patients received treatment under DGA in a dental office. The procedure included comprehensive treatment of the permanent dentition. A total of 28 restorations, 15 crown preparations, and one pulp capping were carried out for the three patients during the DGA session. The treatment was reported to be both safe and successful.

Although this early report was confined to adults, and adults were included in other studies most services appear to have been used primarily to provide treatment for children. In five of the reports, 3 in USA and one each in UK and Australia, the service had been used especially (in one case wholly) for children under 5 years of age (Douglas and Adilman, 1965; O'Brien and Suthers, 1983; O'Sullivan and Curzon, 1991; Sheehy *et al.*, 1994; Berkowitz *et al.*, 1997). In the two in Saudi Arabia, both included a high proportion of young children (Bello, 2000; Jamjoom *et al.*, 2001).

2.3.7.2 Indications for Use of DGA

Young age may have been one of the main indications for treatment under DGA in the studies where a high proportion of young children had received treatment but indications were not always listed. Where these were given, extensive treatment needs were also important. In two studies, both in USA, the services were directed specifically towards young children with rampant caries (Douglas and Adilman, 1965; Berkowitz *et al.,* 1997). In one study from Belgium (Vermeulen *et al.,* 1991) rampant caries also formed one of the main indications for use of DGA with this being the reason for treatment in three quarter of the children included. In Saudi Arabia rampant caries was a major indication in both of the two studies carried out there (Bello, 2000; Jamjoom *et al.,* 2001). In some cases, services were wholly or partly directed towards children and adults with disabilities and those in special need receiving DGA. In the study reported by Vermeulen (1991) for example, which included 933 patients aged 1-79, 23% were regarded as handicapped and 10% as having medical problems. Children in special need also made up 78 of the 96 children included in one study in the UK (Mitchell and Murray, 1985) and 17% of those in a study in Sweden (Persliden and Magnusson, 1980). In one UK study, 79% of 1063 children receiving treatment from a specialist day care service in London over a 5-year period were chronically sick (Harrison and Roberts, 1998). In an earlier study from a second centre in the same city 22% were mentally disabled and 30% physically disabled (Wong *et al.,* 1997). In one of the two studies carried in Saudi, 31% of the 180 children included were medically compromised (Bello, 2000) but in the second, only 9% of the 555 children included were recorded as having a significant medical problem (Jamjoom *et al.,* 2001). In all cases where patients in special need received treatment, the services had been provided in facilities at a hospital or dental hospital.

2.3.7.3 Treatment Provided

The type and amount of treatment provided under DGA was not indicated in all of the studies included in Table 2.5. Where it was, treatment most often included both restorations and extractions for both primary and permanent teeth. Where information was given, numbers of primary teeth restored ranged from less than 0.1 to 4.6 teeth per child (Mitchell and Murray, 1985; Mason *et al.,* 1995 a). Placement of stainless steel crowns (SSC) and/or pulp treatment of primary teeth were specifically mentioned in seven of the studies. The mean number of SSCs provided per child was 2.6 in one of three studies where this was indicated, 0.3 in the second and 0.5 in the third (O'Sullivan and Curzon, 1991; Wong *et al.*, 1997; Harrison and Roberts, 1998). Treatment included preventive care in at least nine studies (Goldstein and Dragon, 1965; O'Brien and Suthers, 1983; Enger and Mourino, 1985; Mitchell and Murray, 1985; O'Sullivan and Curzon, 1991; Wong *et al.*, 1997; Harrison and Roberts, 1998; Bello, 2000; Jamjoom *et al.,* 2001) and minor oral surgical procedures in eight (Enger and Mourino, 1985; Mitchell and Murray, 1985; Boulanger, 1990; O'Sullivan and Curzon, 1991; Holt *et al.,* 1991; Mason *et al.,* 1995 a; Wong *et al.*, 1997; Bello, 2000). In a report from one centre in UK, it was considered that the day care DGA service had come to be used increasingly for minor surgery and less for restorative treatment over time (Mason *et al.,* 1995 a). In adults and older patients treatment provided under DGA had included items such as prosthetic care, root canal therapy, and provision of crowns (Goldstein and Dragon, 1965).

2.3.7.4 Morbidity and Complications

Morbidity and complications were reported in four of the reports included in Table 2.5. In all cases, symptoms and effects were regarded as minor in nature but incidence has varied widely. In the report from Sweden, 5 cases were reported in 352 patients and in one Australian study incidence of a series of listed symptoms was similarly low at less than 5% (Persliden and Magnusson, 1980; O'Brien and Suthers, 1983). A higher morbidity was report by Enger and Mourino (1985), with 123 symptoms being reported amongst 200 patients. The most common symptoms were nausea with vomiting, fever, and sore throat in children under the age of 5 years. Nausea and vomiting were not the most common complaint amongst the 103 patients included in the study of Holt et al (1991). A high proportion, 94 of the 103 patients made at least one complaint but in this study the most common symptom was oral pain. It was pointed out that this symptom related to the procedure and not to the DGA (Holt *et al.,* 1991). Very similar results were reported by Holt et al (1998) from the same centre 7 years later.

2.3.7.5 Follow-Up

The effectiveness of DGA relates not only to immediate benefits but also to results in the longer term. Failure of treatment provided, subsequent oral health (and need for treatment) attendance patterns following the DGA and changes on attitude of child and family to oral health and to alternatives to DGA all measure aspects of effectiveness of the methods. Some of these have been considered in past studies.

Follow up of patients was described in six reports. Compliance with follow up has been a particular concern and results have often suggested DGA to have had little effect on encouraging regular attendance. In one study 60/84 children who had presented for treatment under DGA because of nursing caries failed to attend for follow up 4-6 months later (Berkowitz *et al.,* 1997) and in a second 96 out of 200 patients failed to return after treatment. In the UK, follow up has sometimes been more complete. In one study from Newcastle, only 9 out of 55 patients who had not been referred elsewhere were lost to follow up (Mitchell and Murray, 1985) and in another study 60 out of 80 children continued care for at least 2 years (O'Sullivan and Curzon, 1991). However, in a third UK study, only 25% of 225 children returned for follow up after treatment (Rule *et al.,* 1967). In Saudi Arabia, 119 out of 180 children were followed up for at least two years (Bello, 2000), whereas in the second study 63% of the 555 children attended for recall after six months but only 10% did so after a 3 year interval (Jamjoom *et al.,* 2001).

A high need for further treatment has been reported in children who did attend subsequent to their treatment under DGA and the need for active preventive measures in children who receive DGA has been emphasised. In one study 54% of the children who had treatment under DGA because of nursing caries had new smooth surface lesions apparent within 4-6 months (Berkowitz *et al.,* 1997).

Failure of treatment provided under DGA has also been reported. O'Sullivan and Curzon reported that 45% of restorations and 3% of SSCs provided under DGA required replacement within a 2 year period (O'Sullivan and Curzon, 1991). In a study of restorations placed by three general practitioners in primary teeth of children less than 6 years of age 54% had been lost within 5 years (Wong and Day, 1988) so that a replacement rate of 45% for amalgams, placed in even younger children may be only little higher. Similarly, a replacement rate of 3% seems equivalent to that of 3% reported for preformed crowns placed using local anaesthesia for children attending a private practice (Roberts and Sheriff, 1990). However, higher rates of failure of treatment under DGA were reported by Bello, with 14% of amalgams and 6% of SSCs failing in a two-year period (Bello, 2000).

There would not appear to have been studies of the effectiveness of comprehensive treatment under DGA in terms of changing oral health behaviours or of its effects on anxiety. Whilst information about attitudes and behaviour may be gained from cross-sectional studies, the investigation of change in these requires longitudinal methods if results are to be of value.

Table 2.5 **Studies of comprehensive treatment under DGA**

Reference	**Country**	**Place**	**Number & Age**	**Treatment**								**Follow up**		
				Restoration		**Extraction**		**Other Treatment**				**Attend**	**Repeat DGA**	**Caries**
				*Prim	**Perm	*Prim	**Perm	SSC	Pulp	Surgery	Other			
Goldstein & Dragon, 1965	USA	Dental Office	3 adults 17-20 years	-	Yes	-	Yes	-	-	-	(Prev)	-	-	-
Douglas & Adilman, 1967	USA	Hospital day care	Head Start Children	Yes	-	Yes	-	Yes	Yes	-	-	-	-	-
Rule *et al.*, 1967	UK	Dental hospital day care	225; 22m-15 years, 31%<5	3.5	4.4	3.8	2.8	-	-	-	-	-	-	-
Persliden & Magnusson, 1980	Sweden	Hospital	325; Med 6.5 years	-	-	-	-	-	-	-	-	-	-	-
O'Brien & Suthers, 1983	Australia	Dental surgery	1316; 50% 3-5 years, 16% < 3	Yes	Yes	-	-	Yes	Yes	-	(Prev)	-	-	-
Enger & Mourino, 1985	USA	Hospital	200; 1-52 yrs	6.1		3.7		2.9	0.7	Yes	(prev, RCT, Other)	96/200 Failed	-	-

*Prim; Primary teeth
**Perm; Permanent teeth
SSC; Stainless Steel Crown
Pulp; Pulp treatment
Surgery; Minor surgical procedures
Other; Fissure sealant (F.S), Prevention (prev)

Reference	Country	Place	Number & Age	Treatment								Follow up		
				Restoration		Extraction		Other Treatment				Attend	Repeat DGA	Caries
				*Prim	**Perm	*Prim	**Perm	SSC	Pulp	Surgery	Other			
Mitchell & Murray, 1985	UK	Dental hospital day care	96; 18 m-15 years	< 0.1	5.1	0.9	1.2	-	-	Yes	(Prev) 1.5	9/55 lost	11/96	-
Boulanger, 1990	Belgium	Hospital	46; 0-12 years	-	-	Yes		Yes	-	Yes	-	-	-	-
Vermeulen *et al.*, 1991	Belgium	Dental hospital day care	933; Med 10 years, 25% < 5	-	-	-	Yes	-	-	Yes	-	-	-	-
O'Sullivan & Curzon, 1991	UK	Hospital day care	80; Med 4.5years, 55% 3-5 years	2.7		4.0		2.6	1.8	1 child	(prev) 0.7 other 0.2	60 for 2 yrs	7	45% of restoratio n & 3% SSC need replacing
Holt *et al.*, 1991	UK	Dental hospital day care	103; 0-10+ years	0.1 - 3.9	-	0.6-3.3	0.4 - 1.1	-	-	45% of Pt.	-	-	-	-
Mason *et al.*, 1995	UK	Dental hospital day care	465; 0-10+ years	1.7 - 4.6	-	2.9 – 6.3	2.9 – 2.3	-	-	35% of Pt.	-	-	-	-

*Prim; Primary teeth
**Perm; Permanent teeth
SSC; Stainless Steel Crown
Pulp; Pulp treatment
Surgery; Minor surgical procedures
Other; Fissure sealant (F.S), Prevention (prev)

Reference	Country	Place	Number & Age	Treatment								Follow up		
				Restoration		Extraction		Other Treatment				Attend	Repeat DGA	Caries
				*Prim	**Perm	*Prim	**Perm	SSC	Pulp	Surgery	Other			
Sheehy *et al.*, 1994	USA	Medical Centre	77; mean 4.5 years	-		-	-	-	-	-	-	44/77 contacted	-	-
Wong *et al.*, 1997	UK	Dental hospital day care	586, 17 years and less	2.7	1.0	2.4	0.5	0.3	0.4	-	(Prev)	-	-	-
Berkowitz *et al.*, 1997	USA	Hospital in patient	84; 21-68 months	-		-	-	-	-	-	-	60/84 failed to return	-	13/24 had new caries
Harrison & Roberts, 1998	UK	Dental hospital day care	1063; 1-24 years chronic sick	2.9		3.8	0.7	0.5	0.2	-	F.S 1.4	-	-	-
Alcaino *et al.*, 2000	Australia	Out patient	-	-	-	-	-	-	-	-	-	-	-	-
Bello, 2000	Saudi Arabia	Dental day care	180; 61% 3-5 years	2.8		1.8		0.9	1.1	0.1	F.S 0.5	119/180 for 2 yrs	-	14% of amalgams and 6% of SSC failed

*Prim; Primary teeth
**Perm; Permanent teeth
SSC; Stainless Steel Crown
Pulp; Pulp treatment
Surgery; Minor surgical procedures
Other; Fissure sealant (F.S), Prevention (prev)

Reference	Country	Place	Number & Age	Treatment								Follow up		
				Restoration		Extraction		Other Treatment				Attend	Repeat DGA	Caries
				*Prim	**Perm	*Prim	**Perm	SSC	Pulp	Surgery	Other			
Jamjoom *et al.*, 2001	Saudi Arabia	Hospital in patient	555; 2-22 years 43% 2-4 years	1.2	0.2	2.1-3.8	0.8 - 1.3	0.4 - 3.9	0.2 - 2.4	-	-	10% attended after 3 years	1/555	-

*Prim; Primary teeth
SSC; Stainless Steel Crown
Surgery; Minor surgical procedures
**Perm; Permanent teeth
Pulp; Pulp treatment
Other; Fissure sealant (F.S), Prevention (prev)

2.3.8 Summary

DGA has been widely used since its introduction. It has advantages in terms of allowing treatment in situations where the patient cannot co-operate but has disadvantages, the most severe being the risk of mortality. DGA has often been used for extractions but has also been utilised to provide treatment that includes restorations.

Dental General Anaesthesia for comprehensive treatment has been used particularly in USA and European countries, countries where dental services are well developed and accessible and caries levels are relatively low. In contrast, reports have also come from two centres in Saudi Arabia where the caries level are much higher. In most cases this type of DGA has been provided in day care facilities situated in hospital or dental hospital facilities. The great majority of patients receiving treatment are children with young children forming a significant proportion. Their young age and extensive treatment needs form major indications for treatment under DGA. Children and adults in special need are also a particular group who received treatment by this means. In Saudi Arabia, services were used mainly to provide treatment for young children who could not be managed under conventional conditions and for those with special need because of their medical, mental, or physical disabilities.

A wide range of treatment has been provided under DGA, including prevention as well as restorative treatment and extractions. In at least one centre, DGA has proved particularly valuable for minor oral surgical procedures.

Following treatment using DGA a significant proportion of patients experience minor symptoms but the incidence of more serious complications is though to be very low. In many studies a high proportion of patients have been lost to follow up. In young children who have had treatment for extensive caries, a large proportion have required further treatment in the subsequent period although attendance for recall has been poor.

Children who have received treatment under DGA because of their extensive caries may continue to be at high risk of new disease but the failure of treatment appears little different to that provided using other methods of management.

CHAPTER THREE

MATERIALS AND METHODS

3.1 Introduction

The study was carried out in two phases. After obtaining agreement and support the purpose of the first phase of the study was to establish current availability of DGA through government funded hospital services in Riyadh in Saudi Arabia. Next, from records held at the centres, to establish the number and ages of children who had received treatment using this type of service during the two-year period between 4/1/1995 and 31/12/1996. Finally to establish the type of treatment provided.

The second phase was concerned with recall and assessment of the children identified in phase I as having received DGA and for a sibling of each, through a dental examination and questionnaires completed by their parents.

3.2 PHASE I

3.2.1 Current Availability of DGA through Government Funded Centres

Information from the Annual Health Report, 1998, issued by the Ministry of Health (MOH) together with personal communication with the MOH and other government agencies showed that six government funded hospital centres in Riyadh had facilities sufficient to provide DGA for children as in-patients. The hospital centres were:

1. King Saud University Hospital,
2. Riyadh Armed Forces Hospital,
3. King Faisal Speciality Hospital,

4. National Guard Hospital,
5. Security Forces Hospital,
6. Riyadh Dental Centre / MOH.

No attempt was made to identify privately centres.

3.2.2 Agreement to the Study

3.2.2.1 Permission Gained through the Ministry of Higher Education

Following preparation of a study protocol, application was made to the Ministry of Higher Education (MOHE) to gain approval for the study and also to obtain their support in seeking formal approval from the Ministry of Health (MOH).

The protocol was approved by the MOHE who agreed to provide necessary formal documentation to facilitate the study. Official letters were then sent by MOHE to all identified hospitals asking them to provide necessary assistance for the research. A further copy of the study protocol was sent to the Department of Medical Research and Health Investigation in MOH seeking help at the only MOH hospital in Riyadh sample. Copies of documentation used in this process are included in Appendix 1.

3.2.2.2 Permission from Selected Hospitals

As well as formal approaches through MOHE, agreement to the study was sought personally by the researcher from each of the 6 hospitals identified as providing a service to allow access to the hospital files for each patient and to carry out recall examination of children and their sibling at the hospital. The investigator made a visit to the Medical Director's Office to explain the nature and aims of the study and to submit a copy of the study protocol. At the outset cooperation was sought for both the first and second phases of the study. Once agreement was obtained, a letter was sent by the researcher to the Medical Records Office through the hospital administration asking them to provide help in identifying and searching for necessary records. At the same time, contact was made with the department of Paediatric Dentistry seeking information about the number and type of DGA sessions and the number of patients receiving treatment per session. Copies of the letters and documents used are included in Appendix 1.

3.2.3 Hospital Centres Included in the Study

Four hospitals out of the six identified agreed to assist and provide the necessary information for the study. These hospitals were; King Saud University; Riyadh Armed Forces Hospital; National Guard Hospital; and Riyadh Dental Centre (MOH). The remaining two, the National Security Forces Hospital and the King Faisal Specialist Hospital declined to take part in this study.

3.2.3.1 King Saud University Hospital/College of Dentistry

King Saud University Hospital is the hospital at which the first dental school to be established in Saudi Arabia and in the Gulf area was set up. Established in 1975, it is a dental teaching hospital.

DGA services at the King Saud University Hospital are provided in one operating room on one session/week extending to a maximum of 4 hours per session. The type of DGA used is day-case anaesthesia where the patient is admitted, receives treatment, and is discharged later the same day. One or two patients receive treatment during each session. In the case of intubation anaesthesia for more complex cases, patients are admitted to the adjacent King Khalid University Hospital for treatment. The follow up system used is based on recall one week after treatment, and a second three months later followed by a regular recall every subsequent six-months.

3.2.3.2 Riyadh Armed Forces Hospital

Riyadh Armed Forces Hospital is one of the biggest hospitals administered by the Ministry of Defence and Aviation. It is located in the centre of Riyadh City. The hospital provides full treatment for military personnel and their dependants and in some special cases for civilians. In 1995, there were over 100 dentists working at the hospital and at the satellite dental clinics administered through the hospital in Riyadh City. The Paediatric Dental Department staff is made up of two consultants, two registrars, and three senior house officers (SHO) working in the main hospital, each also working a small number of sessions in the satellite clinics. There is a commitment to specialist training at the Hospital, more than four past general practitioner senior house officers have undertaken specialist postgraduate training in Paediatric Dentistry, overseas and at King Saud University, whilst in post.

The DGA service is available to patients for whom it is particularly indicated such as children who have severe disabilities and/or are medically compromised and very young uncooperative patients with extensive treatment needs. In 1995-1996 DGA services were provided on one session per week and on an additional full day (two sessions) every month. The numbers of patients receiving treatment in each session varies according to the type of treatment. All patients are reviewed one week after the procedure, after three months and then every year.

3.2.3.3 National Guard Hospital

Like the Armed Forces Hospital, the National Guard Hospital is a large hospital located in Riyadh City, but it is administered through National Guard Security. The hospital provides treatment for National Guard personnel and their dependants and for a small number of civilians. The dental department provides treatment in all specialities including paediatric dentistry. Before 1995, staff included only one consultant in paediatric dentistry, working with two senior house officers, who was responsible for the DGA service and for treatment provided through the service. After 1995, two specialist registrar appointments were made, both appointees holding an MSc in Paediatric Dentistry from USA. DGA sessions were held 4 times per week with four to five patients receiving treatment per session. The Specialist Registrars share responsibility for the DGA service and the number of sessions per week has been increased in the face of long waiting lists for the service. Treatment under DGA at this centre is provided for children who have difficulty accepting this using other methods of management, and includes all types of treatment. As at the other centres, patients are seen for recall follow up one week and three months after the treatment and every six months after that.

3.2.3.4 Riyadh Dental Centre

The Riyadh Dental Centre is the only dental centre administered directly by the Ministry of Health to provide DGA services in Riyadh. It is located next to the Riyadh General Hospital (known as Al-Shemeasi Hospital), which has a dental primary care centre as one of its departments. The primary care centre includes a number of general practitioner dentists who serve the public. Patients attending other clinics and centres administered by the MOH are referred to Riyadh Dental Centre for treatment if DGA is required or they have any treatment need which requires a special care.

Professional staffs at the centre are all specialists and include three consultants in Paediatric Dentistry who all contribute to care for patients referred for DGA. The DGA service at the centre provides between 4 and 5 sessions per week and daily for children during Ramadan. During this month more beds are available to provide treatment for child patients since treatment for adults is frequently postponed. Treatment, which includes complete dental rehabilitation, is provided for 3-4 patients per session under the care of a paediatric dental consultant working with a specialist registrar and a senior house officer. Patients are followed up one week after the procedure. If further treatment is required at a later date, patients must be referred afresh to the centre by their DGP at any of the other centres.

3.2.4 Information regarding sessions and numbers of patients

Information was gathered from staff in the department of Paediatric Dentistry at each centre regarding the average number of DGA sessions per week and the number of patients treated per session using a simple questionnaire. This was completed by the consultant in charge or the dentist responsible for providing treatment for children in the operating room.

At each of the four centres, a visit was arranged to the Medical Record Department to obtain a computer print out listing of dental cases treated under DGA during the years of 1995 and 1996. With the help of staff, hospital records were obtained for patients listed.

As well as determining the type of treatment provided, data collected at this stage included, each patient's name and contact phone number for the family in preparation for phase II.

3.3 PHASE II

3.3.1 Oral Health Status

Efforts were made by the researcher to contact families of all patients who had received treatment under DGA during the one-year period between 4/1/1995 and 31/12/1996 by telephone. On making contact the nature and purpose of the study were explained before parents were asked to agree that their family take part. If they accepted the invitation, arrangements were made for the child who had treatment under DGA and for a sibling to attend for dental examination. The choice of which sibling to bring was left to the parents. All children were given an appointment at the centre at which they had received treatment and which was most often their source of routine care.

3.3.2 Study and Control Groups

Children who had received treatment under Dental General Anaesthesia made up the Study Group, siblings who attended the examination visit made up the Control Group. No attempt was made to match siblings by age and for purposes of analysis control and study groups were therefore regarded as independent.

3.3.3 Clinical Examination

To determine oral health status, children in study and control group were examined in the dental clinic of the hospital for the presence of new caries, secondary caries, and restorations, plaque and gingival indices.

Clinical examination was carried out using a dental operating light with the child supine and the examiner seated behind the child. For each child a pair of sterile gloves and fresh set of sterilised instruments were used. All teeth and surfaces were examined in a standard order and status recorded by a trained recorder. Diagnosis of dental caries was visual with a plane mouth mirror used to assist visibility. A cotton roll or compressed air spray was used to improve visibility and to remove plaque or debris. Dental caries were diagnosed and scored using the BASCD criteria and scoring system, these are summarised in Table 3.1.

For assessment of plaque, a modification of the index of Greene and Vermillion (1964) was used. Using the FDI tooth numbering system, the buccal surfaces of the following teeth were scored for plaque: 55 (or 16 if present), 65 (or 26), 75 (or 36), and 85 (or 46) and the labial surfaces of the 51 (or 11 if present), and 71 (or 31). If a tooth was absent the adjacent tooth in the same quadrant was used. The examination for plaque was carried out using a blunt dental probe (0.5mm) which was stroked over the buccal or labial tooth surface to estimate the extent to which the surface was covered by plaque if present. Scoring used is shown in Table 3.2. Plaque was expressed in terms of the maximum score and the number of sites with plaque, out of 6, if this was present.

Gingivitis was assessed in gingiva adjacent to the surface on which plaque had been measured using the modification of Gingival Index described by Loe (1967). As in the case of plaque, gingivitis was expressed in terms of the maximum score and the number of sites affected, out of 6.

Table 3.1 **Scores and Criteria for diagnosis of dental caries**

Scores	Definition
0 Present and Sound	A surface with no evidence of treated or untreated clinical caries. All questionable lesions are coded as 0.
1 Caries lesion	Arrested dentinal caries.
2 Caries lesion	Caries into dentine which is restorable.
3 Caries lesion	Caries into the pulp requiring extraction, pulp or root canal treatment
4 Filled and Decayed	A surface that has filling and a carious lesion will fall into this category unless carious lesion can be coded as "for extraction or RCT".
5 Filled	Surfaces containing a permanent restoration of any material.
$ Sealant restoration	Sealant code is used only if the surface contains evidence of sealant. All occlusal, buccal, and lingual surfaces containing, in the opinion of the examiner, some type of fissure sealant, but where no evidence of a defined cavity margin can be seen.
6 Missing due to caries	Surfaces are coded as missing if the tooth has been extracted because it was carious. Missing deciduous canine and deciduous molars are included in this category but missing deciduous incisors are not counted and are coded as permanent teeth, unerupted (code 8).
8 Unerupted	Surfaces are regarded as unerupted if the tooth has not erupted into the mouth. This includes congenitally absent teeth or teeth missing for reason unknown.

*(Pitts *et al.*, 1997)

Table 3.2 **Definition of criteria of Plaque index**

Plaque Score	Definition
0	None, no plaque present
1	Plaque covering up to one third of the surface
2	Plaque covering up to two thirds of the surface
3	Plaque covering more than two thirds of the surface

* (Greene and Vermillion, 1964)

3.3.4 Training and Calibration

Before commencing Phase II, the examiner was trained and familiarised with the examination methods and the diagnostic criteria. Calibration was carried out prior to the study.

After initial training the examiner (MJ), was calibrated in scoring for caries with an experienced examiner (RH) in a series of 30 repeat examinations of children attending two kindergarten schools in Saudi Arabia, Jeddah. The estimated kappa value for surfaces diagnosed as carious was 0.78.

During the study, 15 children were examined for caries by the researcher on two occasions separated by a minimum of two weeks at one of the centres agreeing to participate. Kappa statistic estimated for surfaces diagnosed as caries was 0.91.

3.4 Questionnaire Survey

To determine demographic and social factors and to gain information regarding oral health behaviour and attitudes, four questionnaires were prepared for this study. Two forms (one each for children in the study and control group) were designed to be completed by the children's parents and the other two (study and control) by the researcher at interview with the child. Copies of the four forms are included in appendix 2.

To avoid confusion, all forms included Study number, Hospital, Number of the hospital file, and date of examination or interview.

3.4.1 Questionnaires to Parents

Data sought through the questionnaire to parents included; sociodemographic information; position of the child in the family, and number of siblings; oral health behaviours, including oral hygiene practices, dietary habits, age at weaning and previous dental attendance; recall of the DGA, and the parent's beliefs about the child's current attitude to dental care.

Socio-economic status was estimated in terms of father's occupation and the mother's level of education. The method based on fathers' occupation was modified from one used previously in the Oral Health Survey of Saudi Arabia in 1991 (Al-Shammary, 1991). From this system father's occupation was used to determine socio-economic status in one of 3 categories. These were:

Professional: Includes Doctors, Dentists, Pharmacists, Professors, Professionally qualified engineers, Teachers, Businessmen, Accountants, and Lawyers.

Middle Class: Includes Government and Private workers, Medical technicians, Manual workers.

Military and others: This includes military personnel (High and Low ranks), those holding unskilled jobs, the unemployed, and students.

Questions in the forms for parents to complete regarding children in study and control groups were the same except in respect of the treatment provided under DGA.

3.4.2 Questionnaires to Children

The forms designed for completion by the researcher at interview with the child included simple questions about oral hygiene practices and about current attitudes to dental treatment. For purposes of this thesis and for reasons of clarity these have been largely confined to those derived from the questionnaire to parents.

3.4.3 Treatment Experience

To gain information regarding treatment experience data was drawn from hospital records. This included general information (age and gender), treatment provided under DGA, and indications for use of this method together with details of treatment provided since that occasion. Details recorded for children in the study and control groups were the same, with the exception of information about DGA.

The forms used at review with the child to record data at clinical examination and to record details of treatment experience were combined into a single data collection form. The recordings made at clinical examination were included in this form with the exception of information related to treatment under DGA which was recorded on a separate form (copy included in Appendix 2)

On the day of dental examination, child patients attended the clinic accompanied by their sibling and parent(s). Parents were asked to complete the questionnaires whilst the researcher carried out dental examinations, one for the child who had DGA three years previously and the second for their sibling. Completed forms were returned before the family left the clinic. The other two questionnaires were complete by the researcher at the same visit. The researcher was unaware of replies given by parents to the questionnaire but was aware of the identity of the children.

After completion of examination and questionnaires parents were informed of any need for treatment and advised about dental attendance, and all children were given oral hygiene instructions; a toothbrush, toothpaste and a cup were offered to each child as a reward for attendance.

3.5 Collation and Analysis of Data

Data from the clinical examination of subjects and from the questionnaires was entered onto computer. Clinical data was first entered onto Survey plus and, after preliminary analysis, was transferred to SPSS version 8.0. Data from questionnaires was entered directly into SPSS. The software was used first to provide descriptive statistics and then to carry out comparisons. Statistical tests used included chi-square tests, for frequencies and, because data was not normally distributed, Mann-Whitney 'U' tests and Kruskal Wallis tests for oral health measures and items of treatment provided. Where simple comparisons were needed between two proportions, the standardised normal deviate (SND) was calculated and used to determine statistical significance. Multi-variate analysis for oral health outcomes was performed using multiple logistic regression.

CHAPTER FOUR

RESULTS

4.1 Introduction to Results

Results from the two phases are described below and are summarised in Tables 4.1 to 4.77 and Figures 4.1 to 4.3.

4.1.1 PHASE I

In phase one, a preliminary assessment was made of the provision of dental treatment under DGA for child patients during 1995 and 1996 at each of the four centres which had agreed to take part.

Results, which are summarised in Tables 4.1 to 4.3 show the number of children who received treatment, their gender and age together with the type of treatment they had received.

Hospital held registers showed a total of 483 children had dental treatment under Dental General Anaesthesia at the 4 centres during the period between 4/1/1995 and 31/12/1996. Of the 483, 273 (57%) were boys and 210 (43%) girls. Children were predominantly from younger age groups with half of the total being 0-4 years old (240, 50%) and further 207 (43%) aged 5-8 years at the time they had received DGA. Children aged 9 years or more made up only 7% of the total (Table 4.1).

Table 4.1 **Number of children according to age group.**

Age Group	No. (&%) of children
0-4 years	240 (49.7)
5-8 years	207 (42.9)
9-12 years	30 (6.2)
13+ years	6 (1.2)
Total	483 (100)

The number of patients who received treatment at each centre is shown in Table 4.2 in relation to age.

At all four hospital centres few patients aged 9 or more had received treatment under DGA. In two, King Saud University and Riyadh Dental Centre, children aged 0-4 made up more than 60% of the total, in one, the Riyadh Armed Services hospital, those aged 5-8 years made up half the total and at the fourth, National Guard hospital, there had been almost equal numbers aged 0-4 and 5-8 years. At no hospital had there been more than 3 patients aged 13 or more during the two year study period and in one, Riyadh Dental Centre, there had been none of this age.

Differences between centres in the age groups of patients, in term of those aged less than 5 years and 5 or more were significant on test using Chi-Square (χ^2).

Table 4.2 **Number of children who had treatment under DGA at four centres according to age group at the time of DGA.**

Hospitals & Centres	0-4 No. (&%)	5-8 No. (&%)	9-12 No. (&%)	13+ No. (&%)
National Guard	81(45.3)	83 (46.4)	13 (7.3)	2 (1.1)
King Saud University	31 (63.3)	17 (34.7)	-	1 (2.0)
Riyadh Armed Forces	61 (41.5)	74 (50.3)	9 (6.1)	3 (2.0)
Riyadh Dental Centre	67 (62.0)	33 (30.6)	8 (7.4)	-

Comparison of number of children aged less than 5 years and 5 or more at the four centres; $\chi^2 = 17.48$ D.F= 3 P=0.0006

A broad indication of the type of treatment provided was recorded from hospital records. Of the 483, 350 (73%) had received treatment involving both extractions and restorations. A further 113 (23%) had only restorative treatment and for the remaining 20 (4%), treatment had been confined to dental extractions.

Treatment type in relation to hospital is shown in Table 4.3. At all four hospitals, few children had extractions alone with the majority having extractions in combination with restorations. At the Riyadh Armed Services hospital, 93% had extractions (83% having restorations also), and at Riyadh Dental Centre, 82% did so (77% also having restorations).

Differences between the centres in the numbers having extractions (either in combination with restorations or alone) and having restorations alone were statistically highly significant on test.

Table 4.3 **Type of treatment provided under DGA at the four hospital centres.**

Hospital Name	Extraction No. (&%)	Restoration No. (&%)	Both No. (&%)
National Guard	1 (0.6)	70 (39.1)	108 (60.3)
King Saud University	-	12 (24.5)	37 (75.5)
Riyadh Armed Forces	14 (9.5)	11 (7.5)	122 (83.0)
Riyadh Dental Centre	5 (4.6)	20 (18.5)	83 (76.9)

Comparison of numbers of children having restorations only and extractions (with or without restorations) at the four centres;

$\chi^2 = 46.88$ D.F= 3 P= 0.0000

4.1.2 PHASE II

In phase II of the study treatment experience and oral health in children who had received dental treatment under DGA three years previously was investigated. Siblings of those taking part were studied in a similar fashion and formed an independent control group.

4.1.2.1 Response Rate

At the end of phase I, hospital records had been used to determine names and contact numbers of all those having treatment under DGA at the four selected hospitals. Attempts were made to contact families of all those listed and invite them to take part in the study. The number of children whose families responded is shown in Table 4.4 for each hospital. Of the 483 children included in the hospital records and noted in phase I as having treatment under DGA between 4/1/1995 and 31/12/1996, 347 (72%) were dentally examined and their parents completed questionnaires. The response rate was highest at the hospital unit linked to King Saud University (88%), and lowest at the National Guard hospital (67%). Siblings of 319 of the children were included in the control group. Eight children had no siblings at the time of the study and for the remaining 20; no sibling was brought for examination.

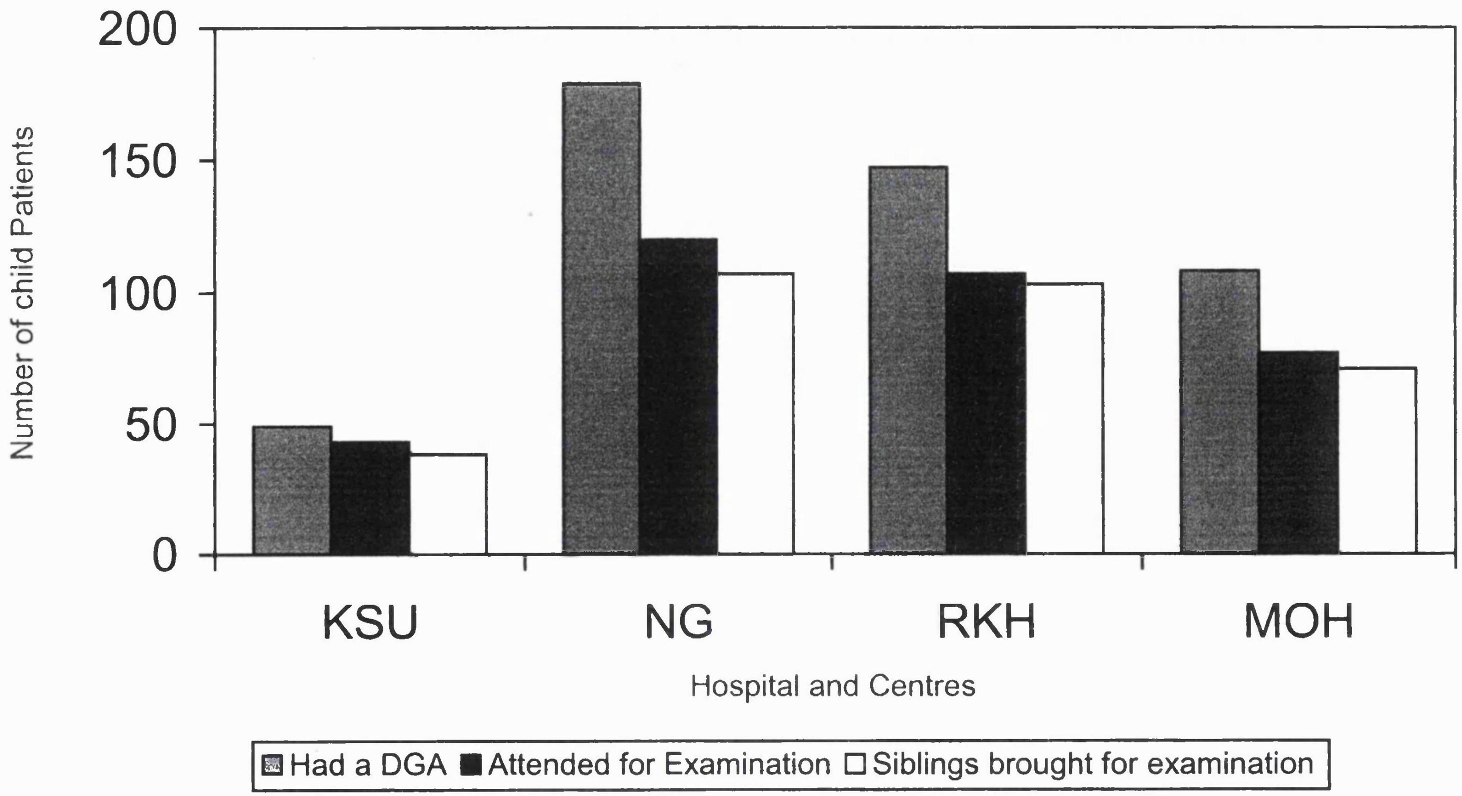
Differences between centres in response rate for study group children were just statistically significant on test using Chi-Square.

Table 4.4 **Number of patients listed in hospital records who had received a DGA for comprehensive dental treatment, the number (&%) who took part in the study, and the number (&%) who had siblings brought for examination.**

Hospital Name	No. of children having DGA	No. (&%) of children brought for examination	No. (&%) of Sibling brought for examination
King Saud University	49	43 (87.7)	38 (88.3)
National Guard	179	120 (67.0)	107 (89.1)
Riyadh Armed Forces	147	107 (72.8)	103 (96.2)
Ministry of Health	108	77 (71.3)	71 (92.2)
Total	483	347 (71.8)	319 (91.9)

Comparison of numbers of children having DGA and brought for examination at the 4 centres; $\chi^2 = 8.256$ D.F= 3 P= 0.0410

Figure 4.1 **Number of children attending for dental treatment under DGA, for dental examinations, and number who had a sibling brought for examination for the purpose of the investigation.**



For clarity, information drawn from clinical examination, questionnaire survey and hospital records is summarised in the following sections in terms of:

1. General information,
2. Treatment experience and access to treatment,
3. Oral health status at the time of dental examination,
4. Oral health behaviour,
5. Recall of treatment and current attitude to treatment.

4.2 Demographic Information and Social Class

General information about the patients included gender and age, family size and the child's position in the family, and social class.

4.2.1 Gender and Age

The group of 347 children who had received dental treatment under DGA and who took part in the study was made up of 180 boys and 167 girls. The total of 319 siblings who formed the control group included 148 boys and 171 girls.

At the time of having dental treatment under DGA, the children in the study group had been aged between one and 16 years. One hundred and ninety (55%) had been aged 4 years or younger, a further 134 (39%) had been between 5 and 8 years, and the remaining 23 (7%) had been older than this. The mean age of the children was 4.6 years, the median was 4 years, and the age raged from 1 to 16 years.

The time elapsed between the DGA and examination as a part of the study ranged from 2 years to 5 years, with a mean of 3.7 years (± 0.8).

The age of the children in the study group at the time of the study ranged from 3 to 19 years old. The range for their siblings making up the control group was from 1 to 14 years.

The age groups of children in the two groups at the time they attended for examination are shown in Table 4.5. The majority of children who had DGA (59%) and a higher proportion of their siblings (76%) were aged 8 years or less at the time they were examined for the purpose of the study. There were a higher proportion of younger children in the control group; almost one third of the siblings (32%) were under five years of age at the time of dental examination.

Difference between study and control groups in the numbers aged less than 5 years, 5-8 years and 9 years or more were highly significant on test using Chi-Square. Figure 4.2 shows the percentage of children who attended dental examination according to age group in study and control group.

Table 4.5 **Number (&%) of the study and control group children according to the age group at the time of examination.**

Age Group	**Study Group N=347**	**Control Group N=319**
	No. (&%)	**No. (&%)**
< 5	9 (2.5)	102 (31.9)
5-8 years	196(56.5)	140 (43.9)
9-12 years	122 (35.2)	71 (22.3)
13+ years	20 (5.8)	6 (1.9)
Total	347 (100)	319 (100)

Comparison of numbers of children aged <5, 5-8 and 9 years or more in study and control group; $\chi^2 = 22.94$ D.F= 2 P= 0.0000

Mean and median ages for children who had DGA at the time of treatment, and at the time of examination, together with values for their siblings are summarized in Table

4.6. Both mean and median values show a difference of 2 years between study and control groups at the time of examination.

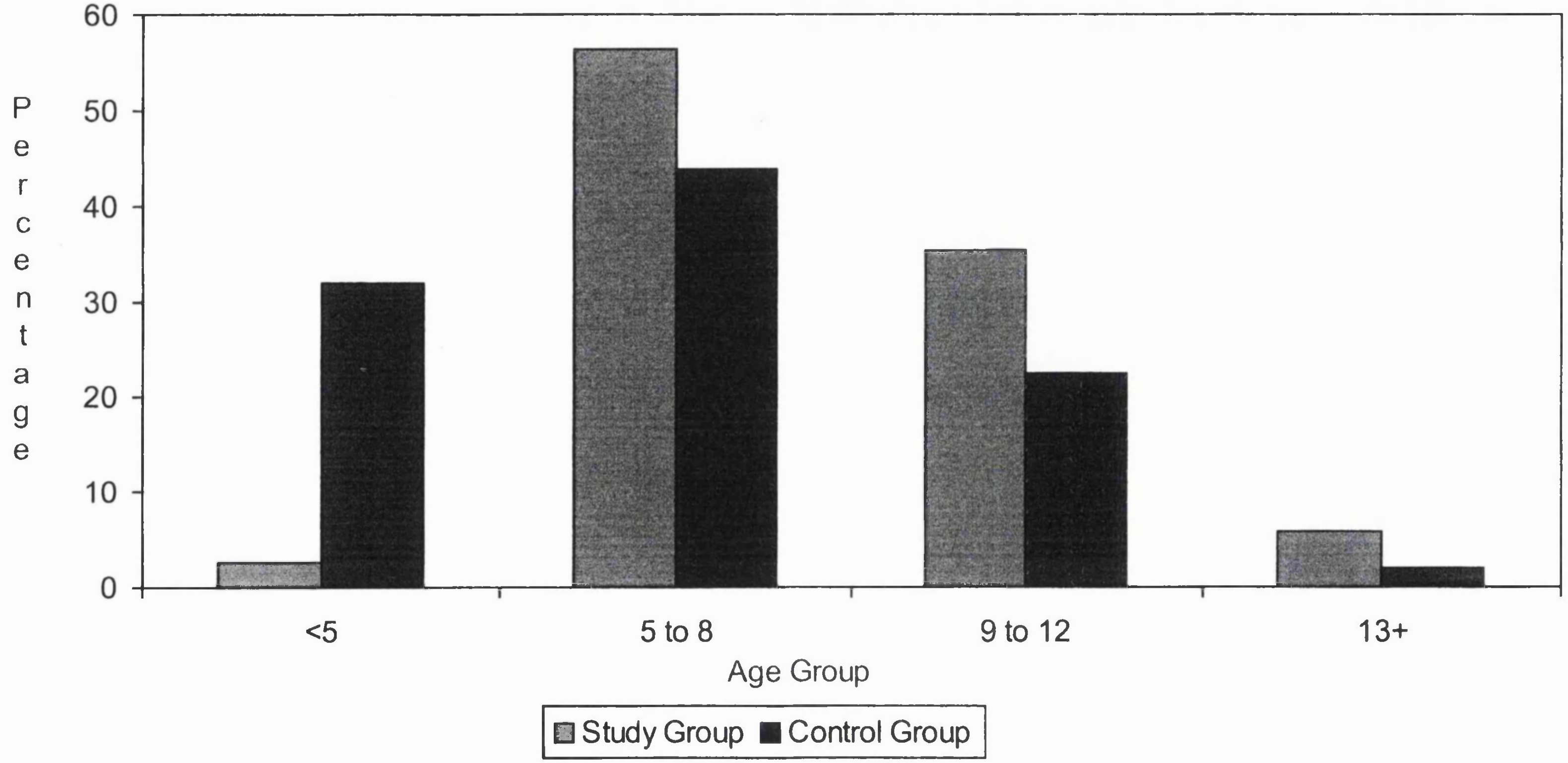
Table 4.6 **Mean and median age of children in study group at the time of DGA and at examination, and for the control group.**

	Mean (± SD)	Median
Age at DGA for the study group	4.6 (± 2.4)	4
Age at examination for study group	8.4 (± 2.5)	8
Age at examination for control group	6.2 (± 2.9)	6

Comparison of age at examination for children in study and control groups;
Mann-Whitney U value = 29980.50 P = 0.000

All children came to the dental examination accompanied by an adult member of their family, who was also the person who completed the questionnaire. The great majority (99%) were accompanied either by their mother (46%), their father (35%), or both parents (18% of the study group, 17% of the control group). Three children (1%) had been brought to the clinic by their grandparents.

Figure 4.2 **Percentage of children according to age group at the time of examination.**



4.2.2 Child's Position in the Family

The position in the family of children included in the study and control groups is shown in Table 4.7. Only 8 children in the study group (2%) were the single child in the family at the time of dental examination. The highest proportion of the study group children (27%) were in a third child position, followed by 26% who were in a second child position and 24% were the first child in the family. About 14% of the parents did not indicate their child's position in his family whereas the remaining children (20%) were in position of fourth child or more.

Table 4.7 **Child's position in the family for children in the study and control groups.**

Child's position in the family	Study group N=347	Control group N=319
	No. (&%)	No. (&%)
Single child	8 (2.3)	0
First child	83 (24.0)	22 (6.9)
Second child	89 (25.6)	59 (18.5)
Third child	93 (26.8)	94 (29.5)
Fourth child	57 (16.4)	79 (24.8)
Five and more	13 (3.7)	62 (19.4)
Not Indicated	49 (14.1)	3 (0.9)

Comparison of numbers of (single, first or not indicated), second, third, fourth or later children in study and control groups; χ^2= 103.7 D.F= 3 P= 0.0000

By definition, all children in the control group had siblings. A higher proportion came lower in birth order. Differences between study and control groups in birth order position (in terms of single, first child, second, third, fourth, or later) were highly significant on test using χ^2. (Table 4.7)

4.2.3 Social Class of Children in the Study Group

In the study, social class was measured in terms of the child's father's occupation and the level of mother's education. Tables 4.8 shows the number and percentage of children in the study and control groups according to their father's occupation and Table 4.9 shows the number and percentage of children according to their mother's level of educational achievement.

In the sample as a whole, 153 children (44%) had fathers who held occupations in the professional class and for 72 children (21%); their fathers held posts regarded as being in the middle class. One hundred and twenty two of the children (35%) had fathers who either held military appointments (high or low ranks) or fathers who held unskilled jobs or were unemployed. Because 28 children in the study group did not have a sibling in the control group, the number of children in the control group in each class was slightly less than in study group. Loss did not appear to be systematic and differences in social class distribution between study and control groups were not statistically significant.

Table 4.8 **Numbers (&%) of children in relation to father's occupation.**

Fathers' Occupation	No. (&%) of Study group	No. (&%) of Control group
Profession	153 (44.1)	135 (42.3)
Middle class	72 (20.7)	65 (20.4)
Military and Others	122 (35.2)	119 (37.3)
Total	347 (100)	319 (100)

Comparison of number of children in relation to father's occupation in study and control groups; χ^2= 0.343 D.F= 2 P= 0.8422

Mothers of one hundred and thirty six children (39%) had been educated to secondary or high school level. Mothers of a further 99 (29%) had reached a level of college education or higher. Mothers of 39 children (11%) had been educated only to primary school level. Seventy-three of the mothers (21%) did not indicate their level of education. The numbers and percentages are shown in Table 4.9.

Table 4.9 **Number (&%) of children related to mother's level of education.**

Level of mother's education	No. (&%) of Study group	No. (&%) of Control group
College and post graduate	99 (28.5)	88 (27.6)
Secondary and high school	136 (39.2)	123 (38.6)
Primary school	39 (11.2)	36 (11.3)
Not indicated	73 (21.0)	72 (22.5)
Total	347 (100)	319 (100)

Comparison of numbers of children in relation to mother's level of education in study and control groups; χ^2 = 0.25 D.F= 3 P= 0.9692

4.3 Treatment Provided and Access to Treatment Services

4.3.1 Treatment Provided Under DGA

4.3.1.1 Treatment Provided for Children in the Study Group Under DGA for All Age Groups

Comprehensive dental treatment provided for the children in the study group at the time of having DGA included dental extractions, simple restorations (defined as simple cavity preparations not involving the pulp, and restorations with glass ionomer cement (GIC), composite resin or silver amalgam); complex restorations (including pulp therapy in the form of pulpotomy or pulpectomy and placement of preformed metal crowns (SSC)); and preventive items (including preventive resin restorations (PRR) and fissure sealants (FS)). Other forms of treatment provided at DGA involved surgical removal of supernumerary teeth.

The majority of children had more than one type of treatment. The pattern of treatment types provided is shown in Table 4.10.

Over one third (39%) of the children had treatment which involved extractions, simple and complex restorative care. A further 18% had no extractions but both simple and complex restorative treatment. Simple restorations, in combination with other types of treatment, were provided for over 80% of children and complex restorations with other forms of treatment were provided for over 70%. Few children had treatment confined to extractions (18; 5%).

Table4.10 **Details of dental treatment type carried out at the time of DGA for the study group children**

Type of Treatment N= 347	No. (&%) of children
Extractions, Simple and Advanced Restorations	135 (38.9)
Simple and Advanced Restorations	64 (18.4)
Extractions and Simple Restorations	37 (10.7)
Extractions, Simple and Advanced Restorations, and Preventions	25 (7.2)
Extractions, Simple Restorations and Preventions	22 (6.3)
Extractions Only	18 (5.2)
Extractions and Advanced Restorations	14 (4.0)
Advanced Restorations Only	7 (2.0)
Extractions and Preventions	6 (1.7)
Simple and Advanced Restorations and Preventions	5 (1.4)
Extractions, Advanced Restorations and Preventions	5 (1.4)
Extractions, Simple and Advanced Restorations, Preventions, and Others	2 (0.6)
Simple Restorations Only	2 (0.6)
Simple Restorations and Preventions	2 (0.6)
Advanced Restorations and Preventions	1 (0.3)
Preventions Only	1 (0.3)
Extractions, Preventions and Others	1 (0.3)
Total	347

Treatment provided for the group as a whole is summarised further in broad terms in Table 4.11 in relation to primary and permanent dentitions. The majority of children had been aged 8 or less at the time of treatment and treatment had more often involved primary than permanent teeth. In terms of extractions, 259 children had primary teeth and 17 had permanent teeth removed during treatment under DGA. A total of 1512 teeth had been removed, 97% of which were primary and 3% permanent. Two hundred and sixty eight children had simple restorations placed in primary teeth. Of the 1323 teeth treated in this way, 696 (53%) were restored using GIC, 333 (25%) with composite resin and 294 (22%) with amalgam. Thirty-seven children (11%) had simple restorations of permanent teeth. Of the 124 teeth 88 (68%) were restored with amalgam, 34 (26%) with composite and 2 (2%) with GIC.

Almost all complex restorative care provided under DGA was confined to primary teeth. Two hundred and fifty four children had received complex restorative treatment to primary and 7 to permanent teeth. Stainless steel crowns were placed on 1267 primary teeth, of which 1234 had also received pulp treatment. In permanent teeth, pulp therapy was carried out for 11 teeth and SSC placed for 13 teeth (in 9 teeth following pulp therapy).

Preventive items in primary teeth had been provided for 18 children and in permanent teeth for 56 children. Forty-three primary and 159 permanent teeth had been fissure sealed and preventive resin restorations provided for 12 primary and 40 permanent teeth. Others form of treatment included surgical removal of 3 supernumerary teeth in 3 children.

Items of treatment provided are next considered in greater detail in relation to age group of the child at the time of DGA.

Table 4.11 **Dental treatment carried out for the study group children at the time of DGA**

Treatment N=347	Primary Dentition			Permanent Dentition		
	No. (&%) of children	No. of teeth	Mean (± SD)	No. (&%) of children	No. of teeth	Mean (± SD)
Extraction	259 (74.6)	1472	4.2 (± 4.4)	17 (4.9)	40	0.1 (± 0.6)
Simple Restorations	268 (77.2)	1323	3.8 (± 3.2)	37 (10.7)	124	0.3 (± 1.9)
Restored with GIC	196 (56.5)	696	2.0 (± 2.3)	2 (0.6)	2	0.005 (± 0.07)
Restored with COMP	96 (27.7)	333	0.9 (± 1.8)	6 (1.7)	34	0.09 (± 0.9)
Restored with AMALG	97 (28.0)	294	0.9 (± 1.6)	31 (8.9)	88	0.3 (± 1.1)
Advanced Restorations	254 (73.2)	1360	3.9 (± 3.6)	7 (2.0)	15	0.04 (± 0.3)
Pulp Therapy	254 (73.2)	1234	3.6 (± 3.3)	6 (1.7)	11	0.03 (± 0.3)
Restored with SSC	252 (72.6)	1267	3.7 (± 3.3)	6 (1.7)	13	0.04 (± 0.3)
Preventive Care	18 (5.2)	55	0.2 (± 0.8)	56 (16.1)	199	0.6 (± 1.7)
Teeth F.S	15 (4.3)	43	0.1 (± 0.6)	45 (13.0)	159	0.5 (± 1.6)
Restored with PRR	4 (1.2)	12	0.03(± 0.4)	17 (4.9)	40	0.1 (± 0.6)
Other Treatment	0	0	0	3 (0.9)	3	0.009 (± 0.09)

4.3.1.2 Treatment Provided at DGA for Children Aged Less than 5 Years

Dental treatment provided at the time of DGA for children aged less than five years is shown in Table 4.12. More than half of the children who had treatment under DGA came into this age group. All treatment was confined to primary teeth. Sixty percent (113) had both dental extractions and restorations provided at their DGA, 27% had treatment limited to simple forms of restoration, and 9% had treatment confined to extractions of primary teeth.

Teeth had been extracted for 130 children (68%) with an average of 3.8 (± 4.4) teeth being removed per child. One hundred and sixty four (86%) of the 190 children had simple restorative care. The mean number of teeth restored per child was 4.5 (± 3.3). One hundred and twenty (63%) children had teeth restored with GIC with a mean of 2.4 (± 2.5) teeth per child, 32% of children had teeth restored with composite and a further 32% with amalgam with a mean of 1.1 (± 2.0) and 1.0 (± 1.7) teeth per child for the two materials respectively. One hundred and fifty five of the 190 children (82%) had pulp treatment with either pulpotomy or pulpectomy procedure or both, for an average of 4.4 (± 3.5) teeth per child. SSCs had been placed for 153 children (81%) with a mean of 4.3 (± 3.4) teeth per child being restored in this way. For preventive care only 10 children (5%) in the group had this form of the treatment, 2 had preventive resin restorations and 9 had teeth fissure sealed.

Table 4.12 **Dental treatment provided for 190 children in the study group who were aged less than 5 years at the time of DGA.**

Treatment Provided N= 190	Primary Dentition		
	No. (&%) of children	No. of teeth	Mean (± SD)
Extraction	130 (68.4)	727	3.8 (± 4.4)
Simple Restorations	164 (86.3)	863	4.5 (± 3.3)
Restored with GIC	120 (63.2)	457	2.4 (± 2.5)
Restored with COMP	61 (32.1)	214	1.1 (± 2.0)
Restored with AMALG	61 (32.1)	192	1.0 (± 1.7)
Advanced Restorations	155 (81.6)	899	4.7 (± 3.8)
Pulp Therapy	155 (81.6)	830	4.4 (± 3.5)
Restored with SSC	153 (80.5)	816	4.3 (± 3.4)
Preventive Care	10 (5.3)	39	0.2 (± 0.9)
Teeth F.S	9 (4.7)	29	0.2 (± 0.7)
Restored with PRR	2 (1.1)	10	0.05 (± 0.5)
Other Treatment	0	0	0

4.3.1.3 Treatment Provided at DGA for Children Aged Between 5 and 8 Years

The 134 children who were aged 5-8 years made up 39% of the study group. In the case of 95 (71%) children in this group, treatment had included both extractions and simple restorative treatment involving both primary and permanent dentitions. Only 22 of the children in the group (16%) had treatment confined to dental extractions and 17 (13%) had only simple forms of restorative care. More detail of the treatment carried out for primary and permanent teeth is shown in Table 4.13.

I Treatment Provided for the Primary Dentition

In primary teeth, 88 of the children (66%) had both extractions and simple restorative care, 22% (29) had extractions only, and 16 (12%) had simple restorations only. One hundred and seventeen (87%) children had extractions of primary teeth with an average of 5.4 (± 4.3) primary teeth being extracted per child. In terms of restorations of primary teeth in this age group, 104 of the children (78%) had one or more forms of simple dental restoration; 76 (57%) had GIC restorations with an average of 1.8 (± 2.0) teeth being restored in this way per child, 35 of the children (26%) had teeth restored with composite resin with an average of 0.9 (± 1.7) teeth per child, and for amalgam restorations 36 of children (27%) had this kind of restoration of primary teeth with a mean of 0.8 (± 1.5) teeth per child. SSCs had been placed on primary teeth for 99 (74%) children aged 5-8 years with these being used to restore a mean of 3.4 (± 2.9) teeth per child. Of the 451 teeth restored with SSCs, 404 teeth also received pulp treatment, this being performed for an average of 3.0 (± 2.6) teeth per child. Eight of the children (6%) had preventive care to primary teeth, 6 (5%) of children had fissure sealants placed, and 2 of the children (2%) had preventive resin restorations.

II Treatment Provided for the Permanent Dentition

Four children (3%) had both extractions and restorations in permanent teeth and 2 children (2%) had solely extractions of permanent teeth. For 16 children (12%) treatment of permanent teeth was confined to simple restorations. On average 0.1 (± 0.6) permanent teeth were extracted and 0.3 (± 0.8) teeth were restored per child.

All three types of material had been used for restorations in permanent teeth. Two children had teeth restored with GIC, with an average of (0.01 (± 0.1) teeth restored per child, 2 (2%) had restorations placed with composite resin (0.03 (± 0.2) per child) and 16 (12%) had amalgam restorations placed in permanent teeth (0.3 (± 0.8)). SSCs were placed for 6 permanent teeth in 3 children (2%). In the case of 2 teeth of the 6, pulp treatment was carried out first.

Preventive dental care for permanent teeth was carried out for 39 children (29%). Thirty-four children (25%) had fissure sealant applied with a mean of 0.7 (± 1.3) teeth sealed per child. Eleven children (8%) had preventive resin restorations with an average of 0.2 (± 0.7) teeth per child being restored in this way. Two children (2%) in this age group each had surgical removal of a supernumerary tooth.

Table 4.13 **Dental treatment for 134 children in the study group aged from 5 to 8 years at the time of DGA.**

Treatment Provided N= 134	Primary Dentition			Permanent Dentition		
	No. (&%) of children	No. of teeth	Mean (± SD)	No. (&%) of children	No. of teeth	Mean (± SD)
Extraction	117 (87.3)	719	5.4 (± 4.3)	6 (4.5)	15	0.1 (± 0.6)
Simple Restorations	104 (77.6)	460	3.4 (± 2.9)	20 (14.9)	39	0.3 (± 0.8)
Restored with GIC	76 (56.7)	239	1.8 (± 2.0)	2 (1.5)	2	0.01 (± 0.1)
Restored with COMP	35 (26.1)	119	0.9 (± 1.7)	2 (1.5)	4	0.03 (± 0.2)
Restored with AMALG	36 (26.9)	102	0.8 (± 1.5)	16 (11.9)	33	0.3 (± 0.8)
Advanced Restorations	99 (73.9)	471	3.4 (± 2.9)	3 (2.2)	6	0.04 (± 0.4)
Pulp Therapy	99 (73.9)	404	3.0 (± 2.6)	2 (1.5)	2	0.01 (± 0.1)
Restored with SSC	99 73.9)	451	3.4 (± 2.9)	3 (2.2)	6	0.04 (± 0.4)
Preventive Care	8 (6.0)	16	0.1 (± 0.5)	39 (29.0)	116	0.9 (± 1.5)
Teeth F.S	6 (4.5)	14	0.1 (± 0.5)	34 (25.4)	91	0.7 (± 1.3)
Restored with PRR	2 (1.5)	2	0.01 (± 0.1)	11 (8.2)	25	0.2 (± 0.7)
Other Treatment	0	0	0	2 (1.5)	2	0.01 (± 0.1)

4.3.1.4 Treatment Provided at DGA for Children Aged Between 9 and 12 Years

There were 16 children who were aged between 9 and 12 years at the time of DGA. Treatment details for both dentitions in this age group is summarised in Table 4.14.

In primary teeth, 12 of the children had extractions with an average of 1.6 (± 2.6) primary teeth removed per child. Extractions were the only form of treatment carried out for primary teeth.

For permanent teeth, 6 children had extractions and simple restorations carried out. Another 10 children had simple restorative treatment and one had only extractions. In total 6 children in the group had permanent teeth extracted with a mean of 1.0 (± 1.5) tooth extracted per child. Simple restorative care for permanent teeth was carried out for 2 with composite resin (0.4 (± 1.1) teeth per child), and for 8 with amalgam (1.3 (± 1.4) teeth per child. Pulp treatment was carried out for 4 children for 9 teeth and SSCs were placed for 3 children in 7 teeth; the mean numbers were 0.6 (± 1.0) and 0.4 (± 0.9) teeth per child respectively being treated in this way.

Eleven children had some kind of preventive care. Seven had fissure sealants with average of 2.5 (± 4.3) teeth sealed per child and 4 children had preventive resin restorations with a mean of 0.4 (± 1.03) teeth per child having this treatment. One child in this group had surgical removal of a permanent supernumerary tooth.

Table 4.14 **Dental treatment provided for 16 children in the study group aged from 9 to 12 years at the time of DGA.**

Treatment Provided N= 16	Primary Dentition			Permanent Dentition		
	No. (&%) of children	No. of teeth	Mean (± SD)	No. (&%) of children	No. of teeth	Mean (± SD)
Extraction	12 (75.0)	26	1.6 (± 2.6)	6 (37.5)	16	1.0 (± 1.5)
Simple Restorations	0	0	0	10 (62.5)	26	1.6 (± 1.5)
Restored with GIC	0	0	0	0	0	0
Restored with COMP	0	0	0	2 (12.5)	6	0.4 (± 1.1)
Restored with AMALG	0	0	0	8 (50.0)	20	1.3 (±1.4)
Advanced Restorations	0	0	0	4 (25.0)	9	0.6 (± 1.0)
Pulp Therapy	0	0	0	4 (25.0)	9	0.6 (± 1.0)
Restored with SSC	0	0	0	3 (18.8)	7	0.4 (± 0.9)
Preventive Care	0	0	0	11 (68.8)	47	2.9 (± 4.1)
Teeth F.S	0	0	0	7 (43.8)	40	2.5 (± 4.3)
Restored with PRR	0	0	0	4 (25.0)	7	0.4 (± 1.03)
Other Treatment	0	0	0	1 (6.3)	1	0.06 (± 0.3)

4.3.1.5 Treatment Provided at DGA for Children Aged 13 Years and More

Details of treatment for the 7 patients in this age group is summarised in Table 4.15. All treatment was for permanent teeth. Five patients of this age had both extractions, and restorations carried out, only 2 children had their treatment confined to simple restorations. All patients in the group had simple restorations in permanent teeth, 2 had composite resin restorations with a mean of 3.4 (± 5.9) teeth restored per child. All 7 children had some teeth restored with amalgam with an average of 5.0 (± 4.1) teeth restored per child. Preventive treatment was carried out for 5 children, 3 had fissure sealants with an average of 4.0 (± 5.7) teeth sealed per child and 2 had preventive resin restorations with a mean of 1.1 (± 1.9) teeth per child restored using this method.

Table 4.15 **Dental treatment provided for 7 children in the study group aged 13+ years at the time of DGA.**

Treatment Provided N= 7	Permanent Dentition		
	No. (&%) of children	No. of teeth	Mean (± SD)
Extraction	5 (71.4)	9	1.3 (± 0.5)
Simple Restorations	7 (100.0)	59	8.4 (± 9.9)
Restored with GIC	0	0	0
Restored with COMP	2 (28.6)	24	3.4 (± 5.9)
Restored with AMALG	7 (100.0)	35	5.0 (± 4.1)
Advanced Restorations	0	0	0
Pulp Therapy	0	0	0
Restored with SSC	0	0	0
Preventive Care	5 (71.4)	36	5.1 (± 5.0)
Teeth F.S	3 (42.9)	28	4.0 (± 5.7)
Restored with PRR	2 (28.6)	8	1.1 (± 1.9)
Other Treatment	0	0	0

4.3.2 Indications Given for DGA

The main indication given for use of DGA for children in the study group had been noted from hospital records. The indications given are summarised in Table 4.16 and in figure 4.3 in relation to age group of the child.

Just over half (55%) of the children who received dental treatment under DGA had been less than four years old at the time. More than half of these children (117; 62%) had presented with rampant caries and this had formed the main indication for their having treatment under DGA. A further 52 (27%) children in this youngest age group had been unable to accept the treatment using local anaesthesia in the dental clinic. Among those who had been aged between 5 and 8 years the main reason given for their having DGA was inability to co-operate during treatment, this was the reason listed for 84 (63%) of this age group. A further 29 (22%) of the children aged 5-8 were unable to have treatment using conventional methods because of disability, and a further 17 (13%) of the children had been medically compromised.

For those aged 9 to 12 years at the time of treatment 12 (75%) of the 16 were children with disabilities. All of those aged older than 12 years all had some form of disability listed as their primary reason for having DGA.

Difference between age groups in the indications given for the treatment under DGA (in terms of age, inability to co-operate, and medical or physical disability) proved statistically highly significant.

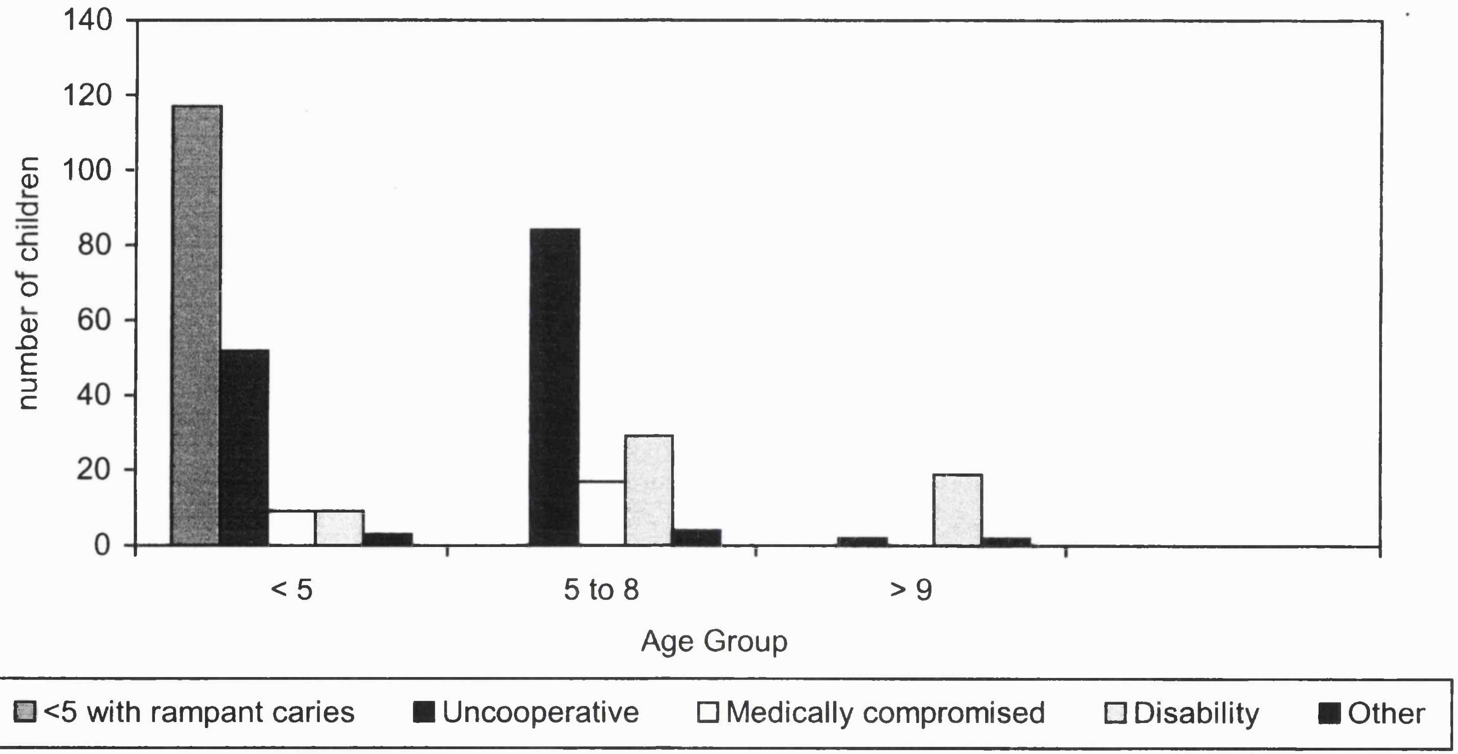
Table 4.16 **Indications Given For Treatment Under DGA according to the age group at the time of DGA for the study group children.**

Indications	0- 4 yrs	5-8 yrs	9-12 yrs	13+ yrs
	No. (&%) of children	No. (&%) of children	No. (&%) of children	No. (&%) of children
Child < 4 with rampant caries	117 (61.6)	0	0	0
Unco-operative	52 (27.4)	84 (62.7)	2 (12.5)	0
Medically or Physically Disabled	18 (9.7)	46 (34.3)	12 (75.0)	7 (100)
Others	3 (1.6)	4 (3.0)	2 (12.5)	0
Total	190	134	16	7

Comparison between age groups (0-4, 5-8 and 9 or more) in terms of numbers for whom indication given was less than 4 years rampant caries and others, lack of co-operation and medical or physical disabilities;

$\chi^2 = 169.923$ D.F= 4 P= 0.0000

Figure 4.3 Principal indications given for use of DGA according to age group at the time of procedures.



4.3.3 Access to the Centre for DGA

4.3.3.1 Travelling Time to Reach the Hospital Centres

The distance between the centre where the child received treatment under DGA and their home was estimated by asking the parents where they lived and asking how long it took them to reach the centre. Most families lived in Riyadh or its immediate vicinity. Almost half the families (170; 49%) lived close to the centre providing treatment and had journeys taking 20 minutes or less. One hundred and three families (30%) had a journey of 21-30 minutes from home to the hospital. A further 63 families (18%) lived a 31-40 minutes journey from their treatment centre and a total of 11 children (3%) lived further away. Four (1%), although living in the Riyadh conurbation, had needed to travel for more than 45 minutes to reach the child's treatment centre and the remaining 7 had come from other cities and also had more extended journey times. Overall, the mean travel time from the centre to the children's home was 23.4 (± 9.2) minutes. Table 4.17 summarises the estimated journey time between the children's homes and place of treatment.

Table 4.17 **Number (& %) of children of study group according to the time spent travelling to reach the treatment centre (minutes).**

Time spent travelling (mins)	No. (& %) of children
20 or less	170 (48.9)
21-30 mins	103 (29.7)
31-40 mins	63 (18.2)
More than 40 mins	11 (3.2)
Mean 23.4 (± 9.2) Mins to travel	

4.3.3.2 Methods of Travelling

Information about methods of travel to the clinic on the day of the DGA and for the examination as part of the study is summarized in Table 4.18. Of the 347 children nearly all had been brought to the clinic by means of their own family car (338; 97%) both on the day of DGA and on the day of examination for purposes of the study. A very much smaller number had been brought using cars belonging to relatives, 4 (1%) on the day of DGA and 5 (1%) on the examination day. Even smaller numbers had attended by taxi or had come on foot. There was no obvious difference in methods used for travel on the two occasions.

Table 4.18 **Method of travelling to the treatment centres.**

Methods of travelling	At DGA day	Examination day
Own Car	338 (97.4)	338 (97.4)
Relative's Car	4 (1.4)	5 (1.1)
Taxi	3 (0.6)	2 (0.9)
On Foot	2 (0.6)	2 (0.6)
Total	347	347

4.3.3.3 Difficulties in Attendance

The majority of parents did not report facing any particular problem in bringing their child either on the day of DGA (335: 97%), or on the day of the examination for the study (329: 95%). Only nine (3%) agreed that they had experienced some difficulty on the day of the DGA and 12 (4%) on the day of the study examination.

I Types of Difficulty

In the questionnaire, parents were asked again, more generally, about difficulties in attendance for dental care. Two hundred and forty two (70%) indicated at least one difficulty. The types of difficulties parents had experienced are summarised in Table 4.19. Parents of 96 children in the study group (28%) reported that it was sometimes difficult to take time off from work, and 79 (23%) said that they had found the appointment time difficult. Parents of 57 (16%) had problems in parking their cars. A few families 10 (3%) faced difficulty in finding transport.

Table 4.19 **Types of difficulty faced in attending the centre.**

Difficulty faced N= 347	No. (&%) of children
Time off from work	96 (27.7)
Appointment time	79 (22.8)
Parking at hospital	57 (16.4)
Transportation	10 (2.9)
No difficulties reported	105 (30.3)

4.3.4 Treatment Experience During the 3 years Prior to Examination

Details of treatment provided for children in the study group under DGA were given in the last section. After treatment under DGA children were included in a recall system for check up and for further treatment if needed. For the control group treatment was carried out at routine appointments and recall appointments given after completion of initial treatment. Treatment experience for study and control groups over the three-year period is summarised in terms of the number of appointments and the items of treatment.

4.3.4.1 Number of Appointments

Table 4.20 summarises the number of dental appointments given for children in study and control groups and recorded in their hospital files. These occasions include failed appointments and emergency dental visits.

A total of 1253 dental appointments had been recorded for the 347 children in the study group in their hospital files. A total of 1435 dental appointments had similarly been recorded in their hospital files for the 214 children (67%) in the control group during the same three-year period. For the study group these totals include attendance for treatment under DGA and at follow up recall appointments.

All children in the study group had attended for DGA by definition and in the subsequent three-year period prior to examination 221 children in the study group (64%) had attended at least once. On average study group children had attended 1.4 (±

1.9) appointments per child during the 3-year period. A high proportion of the children (316; 91%) had failed at least one appointment after DGA with a mean of 0.9 (± 0.5) failed appointments per child. Forty-two children (12%) had at least one emergency dental treatment following DGA with a mean of 0.2 (± 0.6) emergency visits per child.

Of the control group children, 210 (98%) had attended at least one appointment with an average of 3.3 (± 3.5) appointments attended per child. One hundred and six children (33%) in the control group had failed one or more appointments with a mean of 0.8 (± 1.5) failed appointments per child. Thirty-seven children (12%) had attended for emergency dental visits with a mean of 0.3 (± 0.9) such visits in the group per child.

Table 4.20 **Number of dental appointments recorded in the children's hospital files**

Appointments	Study Group N= 347		Control Group N= 319	
	Children's No. (&%)	Mean (± SD)	Children's No. (&%)	Mean (± SD)
Appointment Recorded	347	3.6 (± 2.4)	214 (67.1)	4.5 (± 4.9)
Appointment Attended	221 (63.7)*	1.4 (±1.9)*	210 (65.9)	3.3 (± 3.5)
Appointment Failed	316 (91.1)	0.9 (± 0.5)	106 (33.2)	0.8 (± 1.5)
Appointment Emergency	42 (12.1)	0.2 (± 0.6)	37 (11.6)	0.3 (± 0.9)

* Excluding DGA visit

Comparisons between study and control groups

i) Number of children with recorded appointments SND =11.709	P= <0.001
ii) Number of appointments recorded Mann Whitney= 54362.500	P= 0.688
iii) Number of children with attending appointments SND = 0.5787	P= <0.05
iv) Number of appointments attended Mann Whitney= 39750.000	P= 0.000
v) Number of children with failed appointments SND= 15.514	P= <0.001
vi) Number of appointments failed Mann Whitney= 33982.500	P= 0.000
vii) Number of children with emergency appointments SND= 0.2013	P= N.S
viii) Number of emergency appointments Mann Whitney= 55251.000	P= 0.945

4.3.4.2 Treatment Provided

Table 4.21 provides details of the treatment provided for study and control groups. Treatment provided for the study group at the time of DGA was described in detail (in section 4.3.1) but simple information is included in Table 4.21 to facilitate comparison of total treatment experience in test and control groups.

A total of 265 children (76%) from the study group had one or more dental extractions at the time of DGA. Twenty-five children in the group (7%) had further extractions carried out at one of the follow up dental visits after the DGA. Sixty teeth were extracted with a mean number of extractions of 0.1 (± 0.7) per child. For the control group, 143 of the children (45%) had dental extractions during the same three-year period, with a mean of 1.7 (± 2.5) teeth extracted per child.

Restorative care included both simple and advanced restorations, 321 children (93%) from the study group had one or more items of restorative treatment at the time of DGA with a mean of 11.4 (± 7.2) teeth restored per child. Forty-eight children in the group (14%) had restorative treatment during follow up with a mean of 0.4 (± 1.2) teeth being restored per child. Forty-eight children had replacement (3 of them more than once) restorations with a mean of 0.2 per child in the group as a whole. For the control group 138 children (43%) had been provided with restorative treatment, with an average of 2.3 (± 3.3) filled teeth per child during the 3-year period. Preventive dental care, which includes preventive resin restorations and fissure sealants, was provided for both study and control groups. Seventy of the study group children (20%) had this type of treatment at the time of DGA and 41 (12%) had one or more preventive treatments during the 3 years following. For those in the control group 48 (15%) had one or more teeth restored in this way with an average of 0.8 (± 2.3) treated teeth per child. Little other treatment was provided; only 4 children from the study group had received dental treatment other than extractions and restorations such as surgical procedures or space maintainer, 3 at the time of DGA and only one at the follow up visits. None of the control group received this type of treatment.

The difference in numbers of extractions and restorations and preventive items between the control group and the study group were highly significant when treatment under DGA was included (with the study group having more of each). When treatment under DGA was excluded, then children in study group had significantly fewer extractions and restorations but similar numbers of preventive items.

Table 4.21 **Total treatment provided for children in study and control group during the period of three years.**

	Treatment at DGA		**Treatment Since DGA**		**Treatment for Control**	
	No. (&%) of Children	**Mean (± SD)**	**No. (&%) of Children**	**Mean (± SD)**	**No. (&%) of Children**	**Mean (± SD)**
Extraction	265 (76.4)	4.4 (± 4.4)	25 (7.2)	0.1 (± 0.7)	143 (44.8)	1.7 (± 2.5)
Restoration	321 (92.5)	11.4 (± 7.2)	48 (13.8)	0.4 (± 1.2)	138 (43.3)	2.3 (± 3.3)
Preventive	70 (20.2)	0.7 (± 1.9)	41 (11.8)	0.6 (± 1.6)	48 (13.8)	0.8 (± 2.3)
Others	3 (0.9)	0.009 (± 0.09)	1 (0.3)	0.005 (± 0.1)	0	0

Comparison of the total treatment for study group VS control group;
Number of children having Extraction= 9.199 P= <0.001
Number of extractions Mann Whitney= 31455.000 P= 0.000
Number of children having Restoration= 13.9 P= <0.001
Number of restorations Mann Whitney= 13113.500 P= 0.000
Number of children having Prevention= 4.27 P= < 0.001
Number of preventions Mann Whitney= 48302.500 P= 0.000

Comparison of treatment since DGA for study group VS control group;
Number of children having Extraction= 11.19 P= <0.001
Number of extractions Mann Whitney= 33597.000 P= 0.000
Number of children having Restoration= 8.458 P= <0.001
Number of restorations Mann Whitney= 37215.000 P= 0.000
Number of children having Prevention= 1.229 P= N.S
Numbers of preventions Mann Whitney= 53503.000 P= 0.209

4.3.5 Treatment Experience in Relation to Age Group at the Time of Dental Examination

Treatment experience for children according to age group in terms of the number of appointments recorded in patient's files and the amount of treatment provided is summarised in Tables 4.22 to Table 4.29.

To allow direct comparison, age groups in these tables are those at the time of examination and values for items of treatment provided for children in the study group under DGA therefore differ from those given in Tables 4.10 to Table 4.15 which related to age group at the time of DGA.

4.3.5.1 Age 0-4 Years

Treatment experience for the youngest group of children is summarised in Table 4.22 and Table 4.23. A total of 152 dental appointments had been recorded in their hospital file for 41 (40%) of the 102 children in the control group who were less than five years old at the time of examination. For the 9 children in study group children of this age a total of 39 appointments were recorded in the files. Thirty-seven of the controls (36%) and 7 of the study group had attended at least once with an average of 0.9 (± 1.5) attendances per child in the control group and 1.9 (± 1.8) per child in the study group.

Seven of the children in the control group had attended as emergencies giving an average of 0.1 (± 0.5) emergency visits per child. In the study group two children had between them made 5 emergency visits in the 3-year interval (Table 4.27).

In terms of treatment provided, 7 of the 9 children in the study group had extractions under DGA with a mean of 3.8 (± 4.2) teeth removed per child, but none had extractions subsequently. Twenty-six children in the control group had extractions, with an average of 0.7 (± 1.6) teeth removed per child. All children in the study group had teeth restored under DGA and two had further restorations. Seventeen children in the control group had restorations during the same period, Table 4.23 summarises treatment provided for children in study and control group for children less than 5 years.

Table 4.22 **Number of dental appointments recorded in the children's hospital files (0-4 years)**

Appointments	Study Group N= 9		Control Group N= 102	
	No. (&%) of children	Mean (± SD)	No. (&%) of children	Mean (± SD)
Appointment Recorded	9 (100)	4.3 (± 2.6)	41 (40.2)	1.6 (± 2.2)
Appointment Attended	7 (77.7)*	1.9 (± 1.8)*	37 (36.3)	0.9 (± 1.5)
Appointment Failed	8 (88.8)	0.9 (± 0.3)	22 (21.6)	0.5 (± 1.1)
Appointment Emergency	2 (22.2)	0.6 (± 1.1)	7 (6.9)	0.1 (± 0.5)

* Excluding DGA visit

Comparisons between study and control groups
i) Number of children with recorded appointments SND =3.46 P= <0.001
ii) Number of appointments recorded Mann Whitney = 2.44 P= <0.05
iii) Number of children with attended appointments SND = 0.5787 P= <0.05
iv) Number of appointments attended Mann Whitney = 299.500 P= 0.050
v) Number of children with failed appointments SND = 4.36 P= <0.001
vi) Number of appointments failed Mann Whitney = 198.000 P= 0.000
vii) Number of children with emergency appointments SND = 1.618 P= N.S
viii) Number of emergency appointments Mann Whitney = 385.500 P= 0.093

Table 4.23 **Total treatment provided for children in study and control group (0-4 years)**

	Treatment at DGA		**Treatment Since DGA**		**Treatment for Control**	
	No. (&%) of children	**Mean (± SD)**	**No. (&%) of children**	**Mean (± SD)**	**No. (&%) of children**	**Mean (± SD)**
Extraction	7 (77.8)	3.8 (± 4.2)	0	0	26 (25.5)	0.7 (± 1.6)
Restoration	9 (100)	10.8 (± 4.9)	2 (22.2)	0.9 (± 2.0)	17 (16.7)	0.6 (± 1.4)
Preventive	2 (22.2)	0.4 (±1.3)	1 (11.1)	0.4 (± 1.3)	0	0
Others	0	0	0	0	0	0

Comparison of the total treatment for study group VS control group;
Number of children having Extraction= 3.29 P= <0.001
Number of extractions Mann Whitney= 191.000 P= 0.000
Number of children having Restoration= 5.658 P= <0.001
Number of restorations Mann Whitney= 1.500 P= 0.000

Comparison of treatment since DGA for study group VS control group;
Number of children having Extraction= 1.731 P= N.S
Number of extractions Mann Whitney= 342.000 P= 0.088
Number of children having Restoration= 0.4243 P= N.S
Number of restorations Mann Whitney= 432.000 P= 0.657

4.3.5.2 Age 5-8 Years

In the study group the 196 children aged 5-8 years had between them, a total of 737 appointments recorded, with an average of 3.8 (± 2.8) appointments recorded per child. Five hundred and seventy eight appointments had been recorded for the 140 children in the control group, giving an average of 4.1 (± 4.2) per child. A high proportion of children in the control group (71%) and a slightly smaller proportion of the study group (66%) had attended at least once excluding the attendance for DGA. The proportions attending for emergency appointments and the mean numbers of appointments were not widely dissimilar in the two groups.

One hundred and forty two (72%) of the study group aged 5-8 had earlier had extractions under DGA and 15 did so subsequently. In the control group, sixty-eight children (49%) had teeth removed. In terms of teeth restored, as in the youngest group, most children (93%) in the study group had teeth restored under DGA and 29 (15%) did so subsequently. Of the control group children of the same age 69 (49%) had some restorative treatment during the same interval.

The number of preventive items provided in the interval since the DGA was very similar in study and control groups, with 0.5 teeth per child being treated this way during the 3 years.

Differences between groups in numbers of children failing appointments, and in the numbers of appointments attended or failed were statistically significant. Differences in numbers of extractions and restorations were also significant, both when treatment under DGA was included (when they were higher in the study group) and excluded (when they were lower in the study group).

Table 4.24 **Number of dental appointments recorded in the children's hospital files (5-8 years)**

Appointments	Study Group N= 196		Control Group N= 140	
	No. (&%) of children	Mean (± SD)	No. (&%) of children	Mean (± SD)
Appointment Recorded	196 (100)	3.8 (± 2.8)	100 (71.4)	4.1 (± 4.2)
Appointment Attended	130 (66.3)*	1.5 (± 2.0)*	100 (71.4)	3.2 (± 3.0)
Appointment Failed	182 (92.9)	1.0 (± 0.5)	42 (30.0)	0.7 (± 1.2)
Appointment Emergency	25 (12.8)	0.2 (± 0.7)	16 (11.4)	0.3 (± 0.8)

* Excluding DGA visit

Comparisons between study and control groups

i) Number of children with recorded appointments SND =7.985	P= <0.001
ii) Number of appointments recorded Mann Whitney = 13092.000	P= 0.468
iii) Number of children with attended appointments SND = 0.992	P= N.S
iv) Number of appointments attended Mann Whitney = 9246.500	P= 0.000
v) Number of children with failed appointments SND = 12.05	P= <0.001
vi) Number of appointments failed Mann Whitney = 7238.500	P= 0.000
vii) Number of children with emergency appointments SND = 0.366	P= N.S
viii) Number of emergency appointments Mann Whitney = 13599.500	P= 0.809

Table 4.25 **Total treatment provided for children in study and control group (5-8 years)**

	Treatment at DGA		Treatment Since DGA		Treatment for Control	
	No. (&%) of children	Mean (± SD)	No. (&%) of children	Mean (± SD)	No. (&%) of children	Mean (± SD)
Extraction	142 (72.4)	4.4 (± 4.5)	15 (7.7)	0.2 (± 0.8)	68 (48.6)	1.8 (± 2.3)
Restoration	182 (92.9)	12.4 (± 7.5)	29 (14.8)	0.4 (± 1.4)	69 (49.3)	2.6 (± 3.5)
Preventive	22 (11.2)	0.4 (± 1.1)	23 (11.7)	0.5 (± 1.3)	18 (12.9)	0.5 (± 1.5)
Others	0	0	0	0	0	0

Comparison of the total treatment for study group VS control group;
Number of children having Extraction= 5.196 P= <0.001
Number of extractions Mann Whitney= 8259.500 P= 0.000
Number of children having Restoration= 9.212 P= <0.001
Number of restorations Mann Whitney= 2976.500 P= 0.000
Number of children having Prevention= 1.916 P= N.S
Number of preventions Mann Whitney= 12640.000 P= 0.063

Comparison of treatment since DGA for study group VS control group;
Number of children having Extraction= 8.589 P= <0.001
Number of extractions Mann Whitney= 7972.500 P= 0.000
Number of children having Restoration= 6.85 P= <0.00
Number of restorations Mann Whitney= 8636.500 P= 0.000
Number of children having Prevention= 0.310 P= N.S
Numbers of preventions Mann Whitney= 13549.500 P= 0.732

4.3.5.3 Age 9-12 Years

All children in the study group and 67 of the 71 in the control group had at least one appointment recorded in their files. The number of appointments attended was higher amongst the control group where 67 children (94%) had attended at least once compared to 78 (64%) in the study group. The average number attended in the control group was 6.4 (± 3.3) compared to 1.3 (± 1.5) in the study group. The number of children attending as an emergency was similar in the two groups but the mean number of appointments was higher in the control group (0.7 (± 1.5) compared with 0.2 (± 0.4)). Table 4.26 summarised appointments details for study and control groups at this age.

In relation to treatment provided, more children in the study group had teeth extracted (82%) under DGA and more teeth were extracted for the group, but 49 (69%) of the control group also had experience of extractions, with an average of 3.0 (± 3.3) teeth extracted per child.

As in the youngest groups, restorative care was more common and more extensive in the study group with the great bulk of this provided under DGA; 114 (93%) of children had restorations under DGA with a mean of 11.0 teeth (± 6.3) restored per child compared with 49 (69%) of the control group children and an average of 4.2 teeth (± 3.7) per child. More children in the control group may have had preventive types of treatment (38%) and more teeth had been treated, 2.2 (± 3.6) per child. In the study group 31 (25%) had preventive care under DGA and 14 (12%) did so subsequently, with an average of 0.8 (± 1.6) and 0.6 (± 1.8) teeth treated at the 2 points respectively (Table 4.27).

Differences in numbers of children with appointments recorded, who had attended and who failed appointments and the number of appointments recorded and attended, were statistically significant. As in younger age groups, differences in numbers of extractions and of restorations were significant both when treatment under DGA was included and excluded but differences in prevention were significant only in the three-year period after DGA.

Table 4.26 **Number of dental appointment recorded in the children hospital files (9-12 years)**

Appointments	**Study Group N= 122**		**Control Group N= 71**	
	No. (&%) of children	**Mean (± SD)**	**No. (&%) of children**	**Mean (± SD)**
Appointment Recorded	122 (100)	3.4 (± 1.9)	67 (94.4)	8.5 (± 5.5)
Appointment Attended	78 (63.9)*	1.3 (± 1.5)*	67 (94.3)	6.4 (± 3.3)
Appointment Failed	108 (88.5)	0.9 (± 0.4)	37 (52.1)	1.6 (± 1.9)
Appointment Emergency	15 (12.3)	0.2 (± 0.4)	14 (19.7)	0.7 (± 1.5)

* Excluding DGA visit

Comparisons between study and control groups
i) Number of children with recorded appointments SND =2.624 P= <0.01
ii) Number of appointments recorded Mann Whitney = 1673.500 P= 0.000
iii) Number of children with attended appointments SND = 4.718 P= <0.001
iv) Number of appointments attended Mann Whitney = 848.000 P= 0.000
v) Number of children with failed appointments SND = 5.646 P= 0.001
vi) Number of appointments failed Mann Whitney = 4311.000 P= 0.953
vii) Number of children with emergency appointments SND = 1.393 P= N.S
viii) Number of emergency appointments Mann Whitney = 3927.500 P= 0.083

Table 4.27 **Total treatment provided for children in study and control group (9-12 years)**

	Treatment at DGA		**Treatment Since DGA**		**Treatment for Control**	
	No. (&%) of children	**Mean (± SD)**	**No. (&%) of children**	**Mean (± SD)**	**No. (&%) of children**	**Mean (± SD)**
Extraction	100 (81.9)	4.8 (± 4.3)	10 (8.2)	0.1 (± 0.5)	49 (69.0)	3.0 (± 3.3)
Restoration	114 (93.4)	11.0 (± 6.3)	16 (13.1)	0.3 (± 0.7)	49 (69.0)	4.2 (± 3.7)
Preventive	31 (25.4)	0.8 (± 1.6)	14 (11.5)	0.6 (± 1.8)	27 (38.0)	2.2 (± 3.6)
Others	2 (1.6)	0.02 (± 0.1)	1 (0.8)	0.002 (± 0.2)	0	0

Comparison of the total treatment for study group VS control group;
Number of children having Extraction= 2.524 P= <0.05
Number of extractions Mann Whitney= 3094 P= 0.001
Number of children having Restoration= 4.521 P= <0.001
Number of restorations Mann Whitney= 1615.500 P= 0.000
Number of children having Prevention= 0.612 P= N.S
Number of preventions Mann Whitney= 4002.000 P= 0.301

Comparison of treatment since DGA for the study group VS control group;
Number of children having Extraction= 8.85 P= <0.001
Number of extractions Mann Whitney= 1447.000 P= 0.000
Number of children having Restoration= 7.93 P= <0.001
Number of restorations Mann Whitney= 1493.000 P= 0.000
Number of children having Prevention= 4.348 P= <0.001
Numbers of preventions Mann Whitney= 3194.500 P= 0.000

4.3.5.4 Age 13 Years and Over

Tables 4.28 and 4.29 summarises information about treatment experience for study and control group children aged 13 years and over. The 6 children in the control group had a total of 83 appointments recorded in their hospital records, with a mean of 13.8 (± 6.7) appointments per child for the 3-year period. Fifty-nine appointments had been recorded for children in the study group, with an average of 2.9 (± 1.8) appointments per child.

The number of attendances was much lower in the study group (6 children) as was the number of the failures to attend. There had been no emergency attendances reported for any of the children in this age group.

In terms of treatment, extractions had only been carried out under DGA with 16 of the 20 children in the study group having extractions. Restorative and preventive care had been provided for children in both groups (at DGA and subsequently for those in the study group) with more restorative care being provided for children in the study group, mainly under DGA.

Because numbers in both groups were small, no more stringent statistical tests were performed.

Table 4.28 **Number of dental appointments recorded in the children's hospital files (13+ years).**

Appointments	Study Group N= 20		Control Group N= 6	
	No. (&%) of children	Mean (± SD)	No. (&%) of children	Mean (± SD)
Appointment Recorded	20 (100.0)	2.9 (± 1.8)	6 (100.0)	13.8 (± 6.7)
Appointment Attended	6 (30.0)	1.1 (± 2.0)	6 (100.0)	10.7 (± 4.2)
Appointment Failed	18 (90.0)	0.9 (± 0.3)	5 (83.3)	3.2 (± 2.5)
Appointment Emergency	0	0	0	0

Table 4.29 **Total treatment provided for children in study and control group (13+ years).**

	Treatment at DGA		Treatment Since DGA		Treatment for Control	
	No. (&%) of Children	**Mean (± SD)**	**No. (&%) of Children**	**Mean (± SD)**	**No. (&%) of Children**	**Mean (± SD)**
Extraction	16 (80.0)	1.7 (± 1.3)	0	0	0	0
Restoration	16 (80.0)	4.9 (± 6.6)	1 (5.0)	0.3 (± 1.3)	3 (50.0)	3.3 (± 3.9)
Preventive	15 (75.0)	3.9 (± 4.6)	3 (15.0)	1.2 (± 2.9)	3 (50.0)	4.3 (± 5.4)
Others	1 (5.0)	0.05 (± 0.2)	0	0	0	0

4.3.6 Methods of Management Used

The methods of management used for treatment during the three-year period are summarised in Table 4.30. Following the initial treatment under DGA, 3 children in the study group had required a repeat. Fifty children (14%) had accepted treatment with local anaesthesia and a further two with the addition of sedation. Two hundred and fifteen children (62%) had received no further treatment. In the control group, 178 children (56%) had received treatment with local anaesthesia and a further one with the addition of sedation.

Differences in the proportion having local anaesthesia were statistically significant.

Table 4.30 **Methods of treatment used for study group since DGA and for control group during the study period (three years)**

Methods of treatment	Study Group N= 347	Control Group N= 319
	No. (& %) of children	No. (& %) of children
DGA	3 (0.9)	0
Local Anaesthesia	50 (14.4)	178 (55.8)
Sedation with L.A	2 (0.6)	1 (0.3)
With no Anaesthesia	27 (7.8)	0
No Treatment	215 (62.0)	0
Nothing Indicating	50 (14.4)	140 (43.9)

Comparison of numbers having treatment with Local Anaesthesia (± Sedation);
SND= 11.174 P= < 0.001

4.4 Oral Health Status

4.4.1 Caries Experience

Dental caries status at the time of dental examination in terms of dmft, dmfs, DMFT, and DMFS and their components at the time of the study (and an average of 3 years after the DGA) are summarised for children in the study and control groups in Table 4.31 to 4.38. Data is shown in relation to age group of the children at the time of examination.

For the group as a whole the dmft for the study group at the time of examination was almost twice the equivalent value for the control group. For the study group dmft was 9.2 (± 4.5) per child and the control group 5.6 (± 4.8). Study group dmft was made up mainly of treated teeth (7.4 (± 3.9) but some caries remained (dt was 1.8 (± 2.2)). In the control group dt was 3.1 (± 4.4)) and mft 2.4 (± 3.3). DMFT was also higher in study group but made up mainly from DT, showing less treatment having been carried out for permanent teeth. Mean values for the study group were 1.9 (± 3.7), 1.3 (± 2.8), and 0.7 (± 1.7) teeth per child for the DMFT, DT, and MFT for the study group respectively. For the control group equivalent values were 0.5 (± 1.4), 0.2 (± 0.7), and 0.3 (± 1.1) teeth per child for the DMFT, DT, and MFT respectively. Values for the dmfs and DMFS and their components followed the same pattern. Mean dmfs for the study group was 34.9 (± 17.7). Decayed surfaces made up an average of 3.9 (± 5.2) surfaces per child, of which 0.9 (± 0.08) were filled and decayed.

Table 4.31 **Caries experience in primary teeth for children in study and control groups at the time of investigation.**

Caries prevalence	Study Group N= 347	Control Group N= 319	P Values*
No (&%) Caries Free	35 (10.1%)	72 (22.5%)	<0.001
dmft	9.2 ± 4.5	5.6 ± 4.8	0.000
dt	1.8 ± 2.2	3.1 ± 4.4	0.032
mt	2.7 ± 3.4	0.9 ± 1.6	0.000
ft	4.6 ± 3.3	1.5 ± 2.6	0.000
mft	7.4 ± 3.9	2.4 ± 3.3	0.000
Sound teeth	2.9 ± 3.4	10.4 ± 6.3	0.114
dmfs	34.9 ± 17.7	13.9 ± 15.2	0.000
ds	3.9 ± 5.2	6.6 ± 12.2	0.399
ms	12.5 ± 15.7	3.9 ± 7.9	0.000
fs	17.9 ± 14.3	3.4 ± 6.9	0.000
mfs	30.3 ± 17.7	7.3 ± 10.9	0.000
No (&%) with Active Caries	312 (89.9%)	247 (77.4%)	<0.001

* P value estimated using Mann-Whitney 'U' tests for dmft, dmfs and components, and sound teeth, and estimations of SND for proportions caries free and with active caries.

Table 4.32 **Caries experience in permanent teeth for children in study and control groups at the time of investigation.**

Caries prevalence	Study Group N=347	Control Group N=319	P Values*
No (&%) Caries Free	184 (53.0%)	274 (85.8)	<0.001
DMFT	1.9 ± 3.7	0.5 ± 1.4	0.000
DT	1.3 ± 2.8	0.2 ± 0.7	0.000
MT	0.2 ± 0.8	0.05 ± 0.4	0.002
FT	0.5 ± 1.4	0.2 ± 1.1	0.000
MFT	0.7 ± 1.7	0.3 ± 1.1	0.000
Sound Teeth	8.6 ± 5.5	4.3 ± 5.9	0.002
DMFS	4.2 ± 9.3	0.9 ± 3.0	0.000
DS	2.1 ± 5.9	0.3 ± 1.4	0.000
MS	0.9 ± 3.8	0.2 ± 1.9	0.002
FS	1.2 ± 3.6	0.4 ± 1.8	0.000
MFS	2.1 ± 5.6	0.6 ± 2.6	0.000
No (&%) with Active Caries	163 (46.9%)	45 (14.1%)	<0.001

* P value estimated using Mann-Whitney 'U' tests for DMFT, DMFS and components, and sound teeth, and estimations of SND for proportions caries free and with active caries.

4.4.1.1 Caries Experience in Children Aged Less than 5 years

Caries prevalence, dmft, dmfs, and their components for primary teeth in children aged less than 5 years at the time of the study are shown in Table 4.33. The number of children in this age group differed widely between study and control groups, with 102 in the control group but few (only 9) children in the study group. In both groups children of this age had only primary teeth. All nine children in the study group had some caries experience but 22 children (22%) of those in the control group did not (a difference that was not statistically significant). The average dmft was more than twice as high in the study group at 13.2 (± 3.9) per child than in the controls at 4.9 (± 4.3) per child with the difference being related almost wholly to restored and extracted teeth. The average treatment (mft) component in the study group was 9.3 (± 5.0) teeth per child compared to 1.3 (± 2.2) teeth per child in the controls. The dmfs and mfs values followed the same pattern, being higher in the study group than in the controls. A high proportion of children (more than 68%) in both groups had active caries at the time of the study.

Differences between study and control groups in dmft and dmfs and in missing and filled components of each proved statistically highly significant. Differences in sound teeth and decayed teeth were less significant, and the difference in decayed surfaces failed to reach significance. Using the standardised normal deviate estimated from the difference in proportions, the differences between groups in the proportion caries free and with active caries were not statistically significant.

Table 4.33 **Caries experience in primary teeth for children in study and control groups who were aged less than 5 years at the time of investigation.**

Caries prevalence	Study Group N=9	Control Group N=102	P Values*
No (&%) Caries Free	0 (0%)	22 (21.6%)	N.S
dmft	13.2 (± 3.9)	4.9 (± 4.3)	0.000
dt	3.9 (± 3.0)	3.6 (± 4.2)	0.393
mt	3.7 (± 3.6)	0.8 (± 1.6)	0.000
ft	5.7 (± 4.7)	0.5 (± 1.2)	0.000
mft	9.3 (± 5.0)	1.3 (± 2.2)	0.000
Sound teeth	4.8 (± 3.6)	14.4 (± 4.6)	0.012
mfs	37.9 (± 18.0)	11.0 (± 11.8)	0.000
ds	5.8 (± 5.1)	6.6 (± 9.9)	0.461
ms	14.2 (± 17.3)	3.7 (± 7.5)	0.007
fs	15.0 (± 12.8)	0.8 (± 1.7)	0.000
mfs	29.2 (± 23.5)	4.4 (± 8.1)	0.000
No (&%) with Active Caries	7 (77.8%)	69 (67.6%)	N.S

* P value estimated using Mann-Whitney 'U' tests for dmft, dmfs and components, and sound teeth, and estimations of SND for proportions caries free and with active caries.

4.4.1.2 Caries Experience in Children Aged 5-8 Years

Caries experience for the children in the largest age group, consisting of 5-8 year-olds, is shown in Table 4.34 for primary teeth and Table 4.35 for permanent teeth. All children in the study group had some caries experience in their primary teeth, whereas, 19 (14%) of the control were considered to be caries free. The average dmft for children in the study group was 11.0 (± 3.4) per child and mean dmfs was 40.7 (± 14.3) per child. Much lower mean values were seen in the control group, 7.1 (± 5.3) teeth and 18.5 (± 17.6) surfaces per child. As in the case of the youngest group, more than half of the value for children in the study group was made up of treated teeth and surfaces (8.7 teeth and 34.8 surfaces per child) compared to 3.1 teeth and 9.2 surfaces for those in the control group. Amongst children in the study group 72% had untreated caries in their primary teeth, as did 60% in the control group.

Statistically proportions of children caries free were significantly difference in different groups, as were (just) proportions with active caries. Differences in dmft and dmfs and missing and filled components of each were all statistically highly significant but not those in decayed teeth and surfaces.

Table 4.34 **Caries experience in primary teeth for children aged 5-8 years in study and control groups**

Caries prevalence	Study Group N=196	Control Group N=140	P Values*
No (&%) Caries Free	0 (0%)	19 (13.6%)	<0.001
dmft	11.0 (± 3.4)	7.1 (± 5.3)	0.000
dt	2.3 (± 2.3)	4.0 (± 5.2)	0.587
mt	3.2 (± 3.6)	1.1 (± 1.7)	0.000
ft	5.5 (± 3.1)	2.0 (± 3.0)	0.000
mft	8.7 (± 3.3)	3.1 (± 3.7)	0.000
Sound Teeth	3.7 (± 3.7)	10.1 (± 5.9)	0.000
dmfs	40.7 (± 14.3)	18.5 (± 17.6)	0.000
ds	4.9 (± 5.6)	9.3 (± 15.6)	0.852
ms	14.3 (± 16.5)	4.7 (± 7.5)	0.000
fs	20.5 (± 14)	4.5 (± 7.9)	0.000
mfs	34.8 (± 15.7)	9.2 (± 12.3)	0.000
No (&%) with Active Caries	141 (71.9%)	84 (60%)	<0.05

* P value estimated using Mann-Whitney 'U' tests for dmft, dmfs and components, and sound teeth, and estimations of SND for proportions caries free and with active caries.

Whilst the great majority of children in both study and control groups had some caries in primary teeth, 63% of the study group and 90% of the control group had no obvious caries in permanent teeth, Table 4.35 shown all data related to caries experience for permanent teeth for those children aged 5-8 years. As in primary teeth of the same children the study group had higher mean DMFT and DMFS values than did the control group. This was also true for all components of the DMF values for permanent teeth. Average values for DMF was 0.9 (± 1.5) teeth and 1.5 (± 3.1) surfaces per child in the study group, with an average of 0.2 (± 0.9) teeth and 0.6 (± 2.5) surfaces affected in the control group. There had been less treatment of permanent teeth, some of which were likely to have erupted during the previous three years. Children in the study group had fewer sound untreated primary teeth but more sound untreated permanent teeth than did controls in this age group.

Mean MFT was 0.3 per child and mean MFS was 0.7 per child in the study group. Equivalent values were 0.1 and 0.2 per child respectively for the control group. At the time of investigation 30% of children in the study group had untreated caries. This was also true for 8% of the children in the control group.

Differences in caries status for permanent teeth were all, with one exception, statistically significant. Few teeth had been extracted in either group. Only in the case of missing teeth and surfaces were the differences not statistically significant.

Table4.35 **Caries experience in permanent teeth for children aged 5-8 years in study and control group.**

Caries prevalence	Study Group N=196	Control Group N=140	P Values*
No (&%) Caries Free	124 (63.3%)	126 (90%)	<0.001
DMFT	0.9 (± 1.5)	0.2 (± 0.9)	0.000
DT	0.6 (± 1.2)	0.2 (± 0.8)	0.000
MT	0.1 (± 0.4)	0.1 (± 0.3)	0.909
FT	0.2 (± 0.6)	0.0 (± 0.0)	0.000
MFT	0.3 (± 0.8)	0.1 (± 0.3)	0.002
Sound Teeth	7.0 (± 4.2)	3.5 (± 4.3)	0.170
DMFS	1.5 (± 3.1)	0.6 (± 2.5)	0.000
DS	0.8 (± 1.9)	0.4 (± 2.0)	0.000
MS	0.3 (± 2.0)	0.2 (± 1.5)	0.906
FS	0.4 (± 1.4)	0.0 (± 0.0)	0.000
MFS	0.7 (± 2.4)	0.2 (± 1.5)	0.003
No (&%) with Active Caries	59 (30.1%)	11 (7.9%)	<0.001

* P value estimated using Mann-Whitney 'U' tests for DMFT, DMFS and components, and sound teeth, and estimations of SND for proportions caries free and with active caries.

4.4.1.3 Caries Experience in Children Aged 9-12 years

There were 122 children aged 9-12 years at the time of the dental examination in the study group and 71 in the control group. Table 4.36 provides a summary of mean dmft and dmfs values and their components for these children.

Twelve percent of the children in the study group were free of caries in their primary teeth at the time of examination compared with 35% of the control group. The average dmft for children in the study group was almost double the corresponding value for the control group, 7.4 (± 3.9) teeth per child for the study group compared with 3.9 (± 3.6) teeth per child for the controls. The average dmfs was three times higher in the study group 31.3 (± 16.6) per child compared with 10.3 (± 12.0) in the controls. Treatment levels in term of average mft and mfs were also higher in the study group (6.2 ± 3.5) than in the control (2.8 ± 3.2). The proportions of children who had some active caries in primary teeth were little different in the two groups, 48% in the control group, and 44% in the study group.

With the exception of decayed teeth and surfaces, and sound teeth and the proportion of children with active caries, differences in caries experience in primary teeth between study and control groups were all highly significant on test.

Table 4.36 **Caries experience in primary teeth for children aged 9-12 years in study and control groups.**

Caries prevalence	Study Group N=122	Control Group N=71	P Value*
No (&%) Caries Free	15 (12.3%)	25 (35.2%)	<0.001
dmft	7.4 (± 3.9)	3.9 (± 3.6)	0.000
dt	1.2 (± 1.7)	1.1 (± 1.4)	0.830
mt	2.4 (± 3.1)	0.6 (± 1.4)	0.000
ft	3.9 (± 2.9)	2.2 (± 3.0)	0.000
mft	6.2 (± 3.5)	2.8 (± 3.2)	0.000
Sound Teeth	2.2 (± 2.8)	6.2 (± 5.3)	0.257
dmfs	31.3 (± 16.6)	10.3(± 12.0)	0.000
ds	2.9 (± 4.5)	2.0 (± 2.7)	0.852
ms	11.4 (± 14.6)	2.9 (± 6.8)	0.000
fs	16.8 (± 13.9)	5.3 (± 8.4)	0.000
mfs	28.1 (± 16.6)	8.2 (± 11.1)	0.000
No (&%) with Active Caries	54 (44.3%)	34 (47.9%)	N.S

* P value estimated using Mann-Whitney 'U' tests for dmft, dmfs and components, and sound teeth, and estimations of SND for proportions caries free and with active caries.

Caries experience for permanent teeth in children aged between 9 and 12 years is summarised in Table 4.37. Forty percent of the study group children were caries free as compared to 63% for the control group. Although the average DMFT was higher in the study group there was little difference in the MFT between the two groups. Mean DMFT was 2.5 (± 3.7) and DMFS was 6.0 (± 9.2) per child for the study group, and 1.1 (± 1.9) and 2.0 (± 4.1) per child respectively for the control group. The average number of decayed teeth in the study group 1.8 (± 3.4) per child was more than four times than the average for the control 0.4 (± 0.8), and nearly twice as many had active caries at the time of investigation, 44% compared to 25%.

On test, there were statistically significant differences between study and control groups in the proportions of children caries free and with active caries in their permanent teeth and in the DMFT, DMFS, DT and DS indices but not in their missing or failed components or in the numbers of sound teeth.

Table 4.37 **Caries experience in permanent teeth for children aged 9-12 years in study and control groups.**

Caries prevalence	Study Group N=122	Control Group N=71	P Values*
No (&%) Caries Free	49 (40.2%)	45 (63.4%)	<0.01
DMFT	2.5 (± 3.7)	1.1 (± 1.9)	0.001
DT	1.8 (± 3.4)	0.4 (± 0.8)	0.001
MT	0.2 (± 0.8)	0.1 (± 0.7)	0.147
FT	0.5 (± 1.2)	0.6 (± 1.4)	0.794
MFT	0.8 (± 1.5)	0.7 (± 1.5)	0.552
Sound Teeth	11.2 (± 5.5)	11.1 (± 5.7)	0.687
DMFS	6.0 (± 9.2)	2.0 (± 4.1)	0.000
DS	3.3 (± 7.3)	0.5 (± 1.0)	0.001
MS	1.1 (± 4.0)	0.6 (± 3.3)	0.149
FS	1.6 (± 4.3)	0.9 (± 2.2)	0.577
MFS	2.7 (± 6.0)	1.5 (± 3.9)	0.342
No (&%) with Active Caries	54 (44.3%)	18 (25.4%)	<0.01

* P value estimated using Mann-Whitney 'U' tests for DMFT, DMFS and components, and sound teeth, and estimations of SND for proportions caries free and with active caries.

4.4.1.4 Caries Experience in Children Aged 13 years and Over

Relatively few of the children in the study were aged 13 years or more at the time of dental examination, 20 in the study group and 6 in the controls. These children had only permanent teeth. Table 4.38 shows average DMFT, DMFS values and their components for this group. Two children in the study group and one of those in the control group were caries free. As in younger age groups the DMFT was again higher in the study group 9.5 (± 7.9), compared to 5.7 (± 3.0) with a much higher value for DT at 5.0 per child compared to 0.3 per child. The MFT was 4.6 per child for study group children, slightly less than for children in the control group who had an average MFT of 5.3 per child. In both groups MFT almost wholly consisted of filled teeth. The average DMFS and components follow the same pattern as DMFT. Fourteen of the 20 children in the study group and one of the control groups had untreated caries present at the time of examination.

Only differences in the proportion caries free and with active caries and in DT, DS, and in number of Sound teeth were statistically significant on test.

Table 4.38 **Caries experience in permanent teeth for children aged 13 + years in study and control groups**

Caries prevalence	Study Group N=20	Control Group N=6	P Values*
No (&%) Caries Free	2 (10%)	1 (16.6%)	N.S
DMFT	9.5 (± 7.9)	5.7 (± 3.0)	0.387
DT	5.0 (± 5.2)	0.3 (± 0.8)	0.019
MT	1.3 (± 1.8)	0.0 (± 0.0)	0.157
FT	3.3 (± 3.6)	5.3 (± 3.2)	0.095
MFT	4.6 (± 4.0)	5.3 (± 3.2)	0.421
Sound Teeth	10.6 (± 8.0)	15.7 (± 8.6)	0.268
DMFS	21.7 (± 22.3)	9.8 (± 5.7)	0.295
DS	8.6 (± 13.7)	0.3 (± 0.8)	0.019
MS	6.0 (± 8.9)	0.0 (± 0.0)	0.157
FS	7.1 (± 7.3)	9.5 (± 5.9)	0.355
MFS	13.2 (± 11.6)	9.5 (± 5.9)	0.744
No (&%) Active Caries	14 (70%)	1 (16.6%)	<0.05

* P value estimated using Mann-Whitney 'U' tests for DMFT, DMFS and components, and sound teeth, and estimations of SND for proportions caries free and with active caries.

4.4.2 Caries Prevalence and Severity in Relation to Social Class

The relationship between social class and caries prevalence, based on the child's father occupation is summarised in Tables 4.39 to 4.42 and that based on educational level of child's mother in Tables 4.43 to 4.46 for study and control groups.

4.4.2.1 Caries in Relation to Father's Occupation

From the results summarised in table 4.39 it can be seen that the prevalence of caries was high in all 3 social class categories with the percentage of caries free children in primary teeth varying between 6% in study group children of the professional group and 17% in those from the study group whose fathers were in military or other occupations. The equivalent range for children in the control group was 20% (for children of father's in the middle classes to 25% of children with fathers in military or other occupation). The relationship between caries and social class measured through the father's occupation is shown for each age group in Tables 4.40 and shows little evidence of consistent trend.

Average numbers of decayed, missing, and filled teeth also varied little between classes. Mean dmft ranged from 8.6 (± 4.9) to 9.8 (± 4.1) in the study group and 5.4 (± 4.1) to 5.7 (± 5.2) in the controls. Table 4.41 summarises caries status for permanent teeth in relation to father's occupation. In the permanent dentition, the percentage caries free was between 54% and 56% (study group) and between 82% and 92% (control group). Values for DMFT in permanent teeth were between 1.3 (± 1.9) and 2.8 (± 5.1) to 0.3 (± 1.2) and 0.7 (± 1.7) in the controls.

As in the case of primary teeth, relationships to social class showed little evidence of consistent trend when considered by age group (Table 4.42).

The extent to which caries experience was made up of treated teeth was very similar between classes, with the number of treated primary teeth (mft) being between 6.9 and 8.2 (study group). Equivalent values for permanent teeth were 0.2 to 1.0 (study group) and 0.2 to 0.4 (control group).

In terms of need for treatment, more than half the children in all social class categories had some active caries in their primary teeth in both study and control groups (values lay between 55% and 63% in the study group and 57% to 60% in the controls). In permanent teeth, the proportion of teeth with active caries varied between 33% and 42% (study group) and 4.0% and 14% (control group).

Differences between study and control groups were statistically significant within all three of social class categories but not those between categories. Because of the small sample size in some age groups, differences by age group were not analysed further.

Table 4.39 **Caries prevalence in primary teeth according to the father's occupation for the study and control groups**

Social Class	No (&%) of children	dmft	mft	% Caries Free	% Caries Active
Study Group N= 347					
Profession	153 (44.0)	9.3 ± 4.3	7.3 ± 3.8	5.9	62.7
Middle Class	72 (21.0)	9.8 ± 4.1	8.2 ± 3.7	6.9	54.2
Military & Others	122 (35.0)	8.6 ± 4.9	6.9 ± 4.4	17.2	54.9
Control Group N= 319					
Profession	135 (42.0)	5.5 ± 4.8	2.5 ± 3.3	21.5	59.3
Middle Class	65 (20.0)	5.4 ± 4.1	2.4 ± 3.0	20.0	60.0
Military & Others	119 (37.0)	5.7 ± 5.2	2.4 ± 3.3	25.2	57.1

Comparison between study and control groups using Mann-Whitney test:

Profession, dmft= 5229.500 P= 0.000
mft= 3320.500 P= 0.000
Middle class, dmft= 1014.000 P= 0.000
mft= 555.000 P= 0.000
Military and Others, dmft= 4815.000 P= 0.000
mft= 3137.000 P= 0.000

Comparison between groups based on Father's occupation using Kruskal-Wallis test:

dmft= 1.405 D.F 2 P= 0.495
mft= 3.275 D.F 2 P= 0.194

Table 4.40 a) **Caries prevalence for primary teeth according to the father's occupation for study and control groups (children aged 0-4 years)**

Social Class	No (&%) of children	dmft	mft	% Caries Free	% Caries Active
Study Group N= 9					
Profession	4	15.0 ± 2.5	10.8 ± 5.6	0	75
Middle Class	1	15.0 ± 0.0	8.0 ± 0.0	0	100
Military & Others	4	11.0 ± 4.7	8.3 ± 5.6	0	100
Control Group N= 102					
Profession	43	4.6 ± 3.7	1.5 ± 2.3	11	26
Middle Class	19	5.3 ± 4.0	1.2 ± 1.8	2	15
Military & Others	40	5.1 ± 4.9	1.3 ± 2.2	9	26

Table 4.40 b) **Caries prevalence for primary teeth according to the father's occupation for study and control groups (children aged 5-8 years)**

Social Class	No (&%) of children	dmft	mft	% Caries Free	% Caries Active
Study Group N= 196					
Profession	85	10.7 ± 3.8	8.4 ± 3.5	0	37
Middle Class	45	11.5 ± 2.9	9.4 ± 3.1	0	15
Military & Others	66	11.0 ± 3.2	8.7 ± 3.2	0	25
Control Group N= 140					
Profession	62	7.1 ± 5.6	3.1 ± 3.9	6	28
Middle Class	32	6.4 ± 3.9	3.3 ± 3.4	2	13
Military & Others	46	7.6 ± 5.6	3.1 ± 3.7	6	19

Table 4.40 c) **Caries prevalence in primary teeth in relation to father's occupation in study and control groups (children aged 9-12 years)**

Study Group N= 122					
Social Class	**No (&%) of children**	**dmft**	**mft**	**% Caries Free**	**% Caries Active**
Profession	60	7.6 ± 3.5	6.1 ± 3.2	4	25
Middle Class	23	7.7 ± 3.6	6.9 ± 3.2	2	7
Military & Others	39	6.9 ± 4.6	6.0 ± 4.2	7	12
Control Group N= 71					
Profession	28	3.8 ± 3.2	2.8 ± 3.1	11	20
Middle Class	12	3.5 ± 4.0	2.3 ± 3.1	8	8
Military & Others	31	4.1 ± 3.9	2.9 ± 3.5	15	20

Table 4.41 **Caries prevalence in permanent teeth according to the father's occupation for the study and control groups**

Social Class	No (&%) of children	DMFT	MFT	% Caries free	% Caries active
Study Group N= 347					
Profession	153 (44.0)	1.3 ± 1.9	0.5 ± 1.4	52.9	32.7
Middle Class	72 (21.0)	1.8 ± 3.4	0.2 ± 0.7	55.6	41.7
Military & Others	122 (35.0)	2.8 ± 5.1	1.0 ± 2.4	51.6	38.5
Control Group N= 319					
Profession	135 (42.0)	0.3 ± 1.2	0.2 ± 1.1	91.9	4.4
Middle Class	65 (20.0)	0.7 ± 1.7	0.4 ± 1.3	81.5	13.8
Military & Others	119 (37.0)	0.6 ± 1.5	0.3 ± 1.0	81.5	12.6

Comparison between study and control groups using Mann-Whitney test:

Profession, DMFT= 6373.500 P= 0.000
MFT = 8624.000 P= 0.000
Middle class, DMFT= 1723.500 P= 0.001
MFT = 2339.000 P= 0.994
Military and Others, DMFT= 4901.500 P= 0.000
MFT= 6005.500 P= 0.001

Comparison between groups based on Father's occupation using Kruskal-Wallis test:

DMFT= 3.595 D.F 2 P= 0.166
MFT= 4.141 D.F 2 P= 0.126

Table 4.42 a) **Caries prevalence in permanent teeth in relation to father's occupation for study and control groups (children aged 5-8 years)**

Study Group N= 196					
Social Class	**No (&%) of children**	**DMFT**	**MFT**	**% Caries Free**	**% Caries Active**
Profession	85	1.1 ± 1.7	0.3 ± 0.8	23	17
Middle Class	45	0.7 ± 1.4	0.1 ± 0.5	17	6
Military & Others	66	0.7 ± 1.3	0.2 ± 0.9	23	8
Control Group N= 140					
Profession	62	0.05 ± 0.3	0±	43	1
Middle Class	32	0.5 ± 1.3	0.2 ± 0.6	19	3
Military & Others	46	0.3 ± 1.0	0.02 ± 0.2	28	4

Table 4.42 b) **Caries prevalence in permanent teeth in relation to father's occupation for study and control groups (children aged 9-12 years)**

Study Group N= 122					
Social Class	**No (&%) of children**	**DMFT**	**MFT**	**% Caries Free**	**% Caries Active**
Profession	60	1.3 ± 1.7	0.7 ± 1.5	25	13
Middle Class	23	3.8 ± 4.9	0.4 ± 0.9	5	13
Military & Others	39	3.6 ± 4.4	1.0 ± 1.7	10	18
Control Group N= 71					
Profession	28	0.8 ± 1.6	0.5 ± 1.3	30	6
Middle Class	12	1.0 ± 1.5	0.3 ± 0.9	10	7
Military & Others	31	1.5 ± 2.2	1.0 ± 1.8	24	13

Table 4.42 c) **Caries prevalence in permanent teeth in relation to father's occupation for study and control groups (children aged 13+ years)**

Social Class	No (&%) of children	DMFT	MFT	% Caries Free	% Caries Active
Study Group N= 20					
Profession	4	5.5 ± 6.0	4.3 ± 3.8	5	5
Middle Class	3	5.3 ± 1.2	0.7 ± 1.2	0	15
Military & Others	13	11.7 ± 8.6	5.5 ± 4.2	5	50
Control Group N= 6					
Profession	2	7.5 ± 0.7	7.5 ± 7.1	0	0
Middle Class	2	7.0 ± 1.4	7.0 ± 1.4	0	0
Military & Others	2	2.5 ± 3.5	1.5 ± 2.1	17	17

4.4.2.2 Caries in Relation to the Mother's Level of Education

As in the case of social classes based on father's occupation, there was little evidence of any consistent relationship between outcomes for caries and the level of educational attainment of the child's mother. This was true in groups as a whole (Tables 4.43 and 4.45) and when considered by age group (Tables 4.44 and 4.46). Prevalence of children caries free was broadly similar with, in the study group, the percentage of caries free children in primary teeth varying between 7% in those whose mothers' education had reached college and postgraduate level, and 13% where mothers had been educated to primary school level or beyond. In the control group values ranged from 15% in those whose mother's educational level reached secondary school to 29% for those level had not been indicated. In permanent teeth, the proportion caries free ranged from 51% - 58% in the study group and from 77% - 90% in the control group. Differences in mean dmft and DMFT can be seen from Tables 4.41 and 4.42 to vary little in either study or control groups, although they were lowest in small group of children whose mother's had not been educated beyond primary school level.

Treatment levels, as shown in mft and MFT also showed little consistent difference.
As for father's occupation, differences between study and control groups differed significantly within each category but not those between classes.

Table 4.43 **Caries prevalence in primary teeth according to the Mother's education for the study and control groups**

Study Group N= 347					
Social Class	**No (&%) of children**	**dmft**	**mft**	**% Caries Free**	**% Caries Active**
College & Post graduate	99 (29.0)	8.4 ± 4.1	7.2 ± 3.5	7.1	52.5
Secondary & high school	136 (39.0)	8.9 ± 4.2	6.9 ± 3.7	11.8	64.0
Primary school	39 (11.0)	9.0 ± 4.9	7.2 ± 4.0	12.8	51.3
Not indicated	73 (21.0)	10.6 ± 5.2	8.4 ± 4.9	9.6	58.9
Control Group N= 319					
College & post graduate	88 (28.0)	5.2 ± 4.6	2.1 ± 3.4	27.3	58.0
Secondary & high school	123 (39.0)	6.1 ± 4.7	2.9 ± 3.3	15.4	58.5
Primary school	36 (11.0)	7.1 ± 6.0	2.3 ± 3.6	22.2	69.4
Not indicated	72 (23.0)	4.3 ± 4.3	1.9 ± 2.8	29.2	54.2

Comparison between study and control groups Mann-Whitney test:

College and post Graduate,	dmft= 2493.500	P= 0.000
	mft= 1305.000	P= 0.000
Secondary and high school,	dmft= 4959.000	P= 0.000
	mft= 3431.000	P= 0.000
Primary School,	dmft= 535.000	P= 0.075
	mft= 256.000	P= 0.000
Not indicated,	dmft= 970.000	P= 0.000
	mft= 734.000	P= 0.000

Comparison between groups based on Mother's education Kruskal-Wallis test:

dmft= 3.738	D.F 3	P= 0.291
mft= 0.576	D.F 3	P= 0.902

Table 4.44 a) **Caries prevalence in primary teeth according to the Mother's education for the study and control groups**

Social Class	No (&%) of children	dmft	mft	% Caries Free	% Caries Active
Study Group N= 9					
College & Post graduate	0	0	0	0	0
Secondary & high school	1 (11.1)	15 ± 0	8 ± 0	0	11.1
Primary school	1 (11.1)	13 ± 0	5 ± 0	0	11.1
Not indicated	7 (77.8)	13 ± 4.4	10.1 ± 5.4	0	55.6
Control Group N= 102					
College & post graduate	27 (26.5)	3.9 ± 3.3	1.1 ± 2.0	7.8	14.7
Secondary & high school	44 (43.1)	5.5 ± 4.4	1.4 ± 2.4	8.8	32.4
Primary school	11 (10.8)	7.3 ± 6.3	0.8 ± 1.3	0.9	8.8
Not indicated	20 (19.6)	3.7 ± 2.9	1.8 ± 2.2	3.9	11.8

Table 4.44 b) **Caries prevalence in primary teeth according to the Mother's education for the study and control groups**

Social Class	No (&%) of children	dmft	mft	% Caries Free	% Caries Active
Study Group N= 196					
College & Post graduate	52 (26.5)	9.9 ± 3.6	8.3 ± 3.1	0	16.3
Secondary & high school	77 (39.3)	10.9 ± 2.4	8.5 ± 2.6	0	31.6
Primary school	19 (9.7)	11.8 ± 3.8	9.4 ± 3.2	0	6.6
Not indicated	48 (24.4)	12.0 ± 3.9	9.4 ± 4.4	0	17.3
Control Group N= 140					
College & post graduate	42 (30.0)	7.5 ± 4.0	3.2 ± 4.1	3.6	21.4
Secondary & high school	51 (36.4)	7.0 ± 5.4	3.6 ± 3.5	2.8	17.1
Primary school	12 (8.6)	11.0± 4.9	3.8 ± 4.1	0	7.9
Not indicated	35 (25.0)	5.4 ± 5.3	2.1 ± 3.4	7.1	13.6

Table 4.44 c) **Caries prevalence in primary teeth according to the Mother's education for the study and control groups**

Social Class	No (&%) of children	dmft	mft	% Caries Free	% Caries Active
Study Group N= 122					
College & Post graduate	46 (37.7)	6.9 ± 3.9	6.1 ± 3.4	4.9	16.4
Secondary & high school	46 (37.7)	7.9 ± 3.5	6.3 ± 3.4	3.3	19.7
Primary school	18 (14.8)	6.3 ± 4.3	5.5 ± 3.7	3.3	4.9
Not indicated	12 (9.8)	8.3 ± 4.7	7.9 ± 3.9	0	3.3
Control Group N= 71					
College & post graduate	16 (22.5)	2.1 ± 2.9	1.4 ± 2.5	11.3	8.5
Secondary & high school	27 (38.0)	5.5 ± 3.6	4.0 ± 3.4	7.0	21.1
Primary school	13 (18.3)	3.3 ± 4.5	2.3 ± 4.1	9.8	7.0
Not indicated	15 (21.1)	3.3 ± 2.6	2.2 ± 2.1	7.0	11.3

Table 4.45 **Caries prevalence in permanent teeth according to the mother's education for the study and control groups**

Social Class	No (&%) of children	DMFT	MFT	% Caries free	% Caries active
Study Group N=347					
College & post graduate	99 (29.0)	1.4 ± 1.9	0.6 ± 1.3	53.5	32.3
Secondary & high school	136 (39.0)	2.1 ± 3.9	0.7 ± 2.1	50.7	41.9
Primary school	39 (11.0)	2.4 ± 4.8	0.8 ± 1.5	51.3	33.3
Not indicated	73 (21.0)	2.1 ± 4.1	0.6 ± 1.6	57.5	34.2
Control Group N=319					
College & post graduate	88 (28.0)	0.4 ± 1.4	0.3 ± 1.2	87.5	5.7
Secondary & high school	123 (39.0)	0.3 ± 1.1	0.2 ± 0.9	90.2	7.3
Primary school	36 (11.0)	0.6 ± 1.7	0.4 ± 1.3	83.3	13.9
Not indicated	72 (23.0)	0.7 ± 1.7	0.4 ± 1.3	77.8	15.3

Comparison between study and control groups Mann-Whitney test:

College and post Grad, DMFT= 2914.000 P= 0.000
MFT= 3715.000 P= 0.007
Secondary and high school, DMFT= 5009.500 P= 0.000
MFT= 7066.000 P= 0.000
Primary School, DMFT= 469.000 P= 0.003
MFT= 570.500 P= 0.040
Not indicated, DMFT=2059.500 P= 0.007
MFT= 2513.500 P= 0.476

Comparison between groups based on Mother's education Kruskal-Wallis test:

DMFT= 0.607 D.F 3 P= 0.895
MFT= 2.315 D.F 3 P= 0.510

Table 4.46 a) **Caries prevalence in permanent teeth according to the mother's education for the study and control groups**

Social Class	No (&%) of children	DMFT	MFT	% Caries free	% Caries active
Study Group N= 196					
College & post graduate	52 (26.5)	0.9 ± 1.6	0.3 ± 0.9	16.8	8.7
Secondary & high school	77 (39.3)	0.9 ± 1.5	0.2 ± 0.6	24.5	12.2
Primary school	19 (9.7)	0.7 ± 1.2	0.4 ± 0.9	6.1	2.6
Not indicated	48 (24.4)	0.9 ± 1.4	0.3 ± 0.9	15.8	6.6
Control Group N= 140					
College & post graduate	42 (30.0)	0.3 ± 1.1	0.09 ± 0.5	27.1	2.1
Secondary & high school	51 (36.4)	0.05 ± 0.4	0	35.7	0.7
Primary school	12 (8.6)	0.2 ± 0.4	0	7.1	0.7
Not indicated	35 (25.0)	0.4 ± 1.2	0.08 ± 0.4	20	4.3

Table 4.46 b) **Caries prevalence in permanent teeth according to the mother's education for the study and control groups**

Social Class	No (&%) of children	DMFT	MFT	% Caries free	% Caries active
Study Group N= 122					
College & post graduate	46 (37.7)	1.9 ± 2.3	0.9 ± 1.6	15.6	12.3
Secondary & high school	46 (37.7)	2.02 ± 2.4	0.4 ± 1.1	16.4	19.7
Primary school	18 (14.8)	4.0 ± 6.5	1.0 ± 1.7	5.7	5.7
Not indicated	12 (9.8)	4.6 ± 5.1	0.9 ± 1.6	2.5	6.6
Control Group N= 71					
College & post graduate	16 (22.5)	0.7 ± 1.4	0.7 ± 1.4	15.5	2.8
Secondary & high school	27 (38.0)	0.9 ± 1.7	0.5 ± 1.3	23.9	11.3
Primary school	13 (18.3)	1.4 ± 2.6	1.0 ± 2.0	12.7	5.6
Not indicated	15 (21.1)	1.6 ± 2.1	1.0 ± 1.5	11.3	5.6

Table 4.46 c) **Caries prevalence in permanent teeth according to the mother's education for the study and control groups**

Study Group N= 20					
Social Class	**No (&%) of children**	**DMFT**	**MFT**	**% Caries free**	**% Caries active**
College & post graduate	1 (5.0)	0	0	1 (5.0)	0
Secondary & high school	12 (60.0)	10.6 ± 7.9	5.6 ± 4.3	0	9 (45)
Primary school	1 (5.0)	9.0 ± 0	5.0 ± 0	0	1 (5.0)
Not indicated	6 (30.0)	9.0 ± 8.7	3.2 ± 3.2	1 (5.0)	4 (20)
Control Group N= 6					
College & post graduate	3 (50.0)	4.7 ± 4.2	4.7 ± 4.2	1 (16.7)	3 (50.0)
Secondary & high school	1 (16.7)	7 ± 0	7.0 ± 0	0	1 (16.7)
Primary school	0	0	0	0	0
Not indicated	2 (33.3)	6.5 ± 2.1	5.5 ± 3.5	0	1 (16.7_

4.4.3 Plaque and Gingival Indices

Findings related to clinical examination for plaque and gingivitis is shown in Table 4.47 to 4.54 for children in study and control groups. All children had six tooth surfaces examined for plaque and the adjacent gingiva assessed for gingivitis.

4.4.3.1 Plaque

The maximum plaque score seen on one or more of the 6 surfaces is shown in Table 4.47 It can be seen that more children in the study group (108; 31%) had a score of 2 or 3 on at least one tooth than did so among the controls, where only 40 (13%) had a score as great as this. A correspondingly higher proportion, 183 of control group children (57%), had no plaque present on any of the 6 teeth surfaces compared with fewer children in the study group (121; 35%). Similar proportions of children in the two groups had at least one surface scored as one.

Table 4.47 **Plaque scores in study and control groups**

Maximum Plaque Score	Study Group No. (&%) of children	Control Group No. (&%)of children
0	121 (34.9)	183 (57.4)
1	118 (34)	96 (30.1)
2	103 (29.7)	40 (12.5)
3	5 (1.4)	0

Comparison of study and control group in terms of 0, 1, 2 or more;
χ^2= 45.05 D.F= 2 P= 0.000

The number of tooth surfaces out of 6 with plaque (i.e. scores as 1 or more) is shown in Table 4.48. As with maximum scores, numbers of teeth with plaque were also higher in the study group where 173 (50%) had either 5 or 6 teeth affected compared to 108 (34%) amongst the controls in whom plaque was as widespread.

Differences in distributions of children in study and control groups in terms of the maximum plaque score (0,1,2,or 3) and number of teeth with plaque were statistically highly significant.

Table 4.48 **The frequency in terms of numbers of teeth with plaque.**

No. of sites with Plaque	Study Group No. (&%) of children	Control Group No. (&%) of children
0	121 (35)	182 (57.1)
1-2	35 (10)	22 (6.9)
3-4	18 (5.2)	7 (2.2)
5-6	173 (49.9)	108 (33.9)

Comparison of study and control groups in numbers of children with 0, 1-2, 3-4 and 5-6 sites with plaque;
χ^2= 34.00 D.F= 3 P= 0.000

Plaque scores in relation to age group at the time of dental examination are shown in Tables 4.49 and 4.50.

The same trends were evident in all age groups. More children in the study group had maximum scores of 2 or more in all age groups than did among the controls. In the 5-8 year old age group, plaque scores of 2 or 3 were seen in 56 children in the study group (29%) compared to 27 (19%) amongst control group children of similar age. In three of the four age groups, 5-8, 9-12 and 13 + years olds, more than half the children in the control group had no plaque recorded and in the fourth, 0-4 years olds, almost half

(47%) did so. Amongst children in the study group, less than 40% had no scores above zero (Table 4.49) in any age group.

In term of numbers of surfaces with plaque, over half of the children in the study group in any age group had 3 or more surfaces (out of the 6 recorded) with plaque. Estimates ranged from 61 children aged 9-12 (50%) to 16 of those aged 13 or over (80%).

Amongst the children in the control group, 45 (44%) of 0-4 years olds, 55 (39%) of 5-8 years olds, and 14 (20%) of 9-12 years olds had more than three surfaces with plaque. The numbers of children in the control group aged 13+ were too small for reliable assessment.

Numbers of children in the youngest and oldest groups were too small for comparison using χ^2 and these tests were therefore confined to the 5-8 and 9-12 years age groups. In the case of both maximum score and number of teeth with plaque, differences in distribution between study and control groups were statistically significant.

Table 4.49 **Plaque scores for study and control groups according to the children's age group.**

Plaque Index	0-4		5-8		9-12		13+	
	Study N=9	Control N=102	Study N=196	Control N=140	Study N=122	Control N=71	Study N=20	Control N=6
0	1 (11.0%)	48 (47.0%)	70 (35.7%)	80 (57.0%)	48 (39.3%)	50 (70.4%)	2 (10.0%)	5 (83.3%)
1	5 (55.6%)	41 (40.2%)	70 (35.7%)	33 (23.6%)	39 (32.0%)	21 (29.6%)	4 (20.0%)	1 (16.7%)
2	3 (33.3%)	13 (12.7%)	53 (27.0%)	27 (19.3%)	33 (27.0%)	0	14 (70.0%)	0
3	0	0	3 (1.5%)	0	2 (1.6.0%)	0	0	0

Comparison of study and control groups in numbers with maximum score of 0, 1, 2 or more children aged 5-8 years;
χ^2= 14.33 D.F= 2 P= 0.0008

Comparison of study and control groups in numbers with maximum score of 0, 1 or more children aged 9-12 years;
χ^2= 17.34 D.F= 1 P= 0.0000

Table 4.50 **The frequency in terms of numbers of teeth with plaque in relation to the children's age group.**

No. of sites with plaque	0-4		5-8		*9-12		13+	
	Study N=9	Control N=102	Study N=196	Control N=140	Study N=122	Control N=71	Study N=20	Control N=6
0	1 (11.0%)	48 (47.1%)	70 (35.7%)	80 (57.1%)	48 (39.3%)	49 (69.0%)	2 (10.0%)	5 (83.3%)
1-2	1 (11.0%)	9 (8.8%)	19 (9.7%)	5 (3.6%)	13 (10.7%)	8 (11.3%)	2 (10.0%)	0
3-4	1 (11.0%)	2 (2.0%)	13 (6.6%)	4 (2.9%)	3 (2.5%)	1 (1.4%)	1 (5.0%)	0
5-6	6 (66.7%)	43 (42.2%)	94 (48.0%)	51 (36.4%)	58 (47.5%)	13 (18.3%)	15 (75.0%)	1 (16.7%)

Comparison of study and control groups in number of children with 0, 1-2, 3 or more teeth with plaque for children aged 5-8 years;
χ^2= 17.47 D.F= 2 P= 0.0002

Comparison of study and control groups in number of children with 0, 1-2, 3 or more teeth with plaque for children aged 9-12 years;
χ^2 = 18.29 D.F= 2 P= 0.0001

4.4.3.2 Gingivitis

Gingivitis was measured through assessment of the gingiva adjacent to each of the surfaces assessed for plaque. Data for each group as a whole is summarised in Table 4.51 and 4.52 in term of the maximum score awarded and the number of sites with evidence of inflammation. The same information in relation to age group is shown in Tables 4.53 and 4.54.

Three quarters or more of the children in the control group (75%) and fewer of those in the study group (59%) had no evidence of gingivitis and only small numbers (9 in the study group and 4 in the control) had at least one site with the maximum score of 3. Numbers of children with at least one site scored as 1 or 2 (as having some inflammation) were higher in the study group children, where 135 children had a maximum score of either 1 or 2 (39%), compared to 76 (24%) with this score in the control group.

Table 4.51 **Gingival scores in study and control groups**

Maximum Gingival Score	Study Group No. (&%) of children	Control Group No. (&%) of children
0	203 (58.5)	239 (74.9)
1	95 (27.4)	55 (17.2)
2	40 (11.5)	21 (6.6)
3	9 (2.6)	4 (1.3)

Comparison of study and control groups in numbers of children with maximum score of 0,1 and 2 or more;
χ^2= 20.24 D.F= 2 P=0.0000

For children in the study group with gingivitis, a larger number of sites were affected; 124 children in the study group (36%) had 3 or more sites affected compared to 46 (14%) of children in the control group. Differences both in the maximum score (0, 1, 2 or 3) and in number of sites affected (0, 1, 2, 3, or more) were statistically highly significant on test using Chi-Square test.

Table 4.52 **The frequency in terms of numbers of teeth with gingivitis.**

No. of sites with Gingivitis	**Study Group No. (&%) of children**	**Control Group No. (&%) of children**
0	203 (58.5%)	240 (75.2%)
1-2	20 (5.8%)	33 (10.3%)
3-4	8 (2.3%)	3 (0.9%)
5-6	116 (33.4%)	43 (13.5%)

Comparison of study and control groups in number of children with 0, 1-2, 3 or more tooth sites with gingivitis;
χ^2= 36.49 D.F= 2 P=0.0000

In the two largest age groups, trends were consistent in showing fewer control group than study group children to have no obvious clinical evidence of gingivitis (Table 4.53). Trends were less apparent in the oldest and youngest children but numbers in these age groups were small.

In terms of numbers of sites affected by gingivitis, as in the group whole, the proportion of children with half or more of the sites affected was higher in the study group at all ages. In 9-12 year olds, where the difference was greatest, 43 children in the study group (35%) had 3 or more sites affected compared to 2 (3%) amongst the controls (Table 4.54). As in the case of plaque scores, statistical comparisons were confined to children in the two largest age groups. Differences in 9-12 year olds in gingivitis (whether expressed in terms of the number with a score of 1 or more or as the number with one or more sites affected) were just significant, but not those in 5-8 year olds.

It can be seen from Table 4.53 and Table 4.54 that the prevalence of gingivitis showed some evidence of a trend to increase with age but differences were small. Thus, the numbers of children with no site affected by gingivitis fell only slightly between the 4 age groups in both the study and control groups. The trends were also not consistent in those age groups with small numbers of children included.

Table 4.53 **Gingival scores for study and control groups according to the children's age groups.**

Gingival Index	0-4		5-8		9-12		13+	
	Study N=9	**Control N=102**	**Study N=196**	**Control N=140**	**Study N=122**	**Control N=71**	**Study N=20**	**Control N=6**
0	4 (44.4%)	81 (79.4%)	123 (62.8%)	104 (74.3%)	72 (59.0%)	52 (73.2%)	4 (20.0%)	3 (50.0%)
1	4 (44.4%)	10 (9.8%)	56 (28.6%)	25 (17.9%)	27 (22.1%)	16 (22.5%)	8 (40.0%)	3 (50.0%)
2	1 (11.1%)	11 (10.8%)	17 (8.7%)	7 (5.0%)	18 (14.8%)	3 (4.2%)	4 (20.0%)	0
3	0	0	0	4 (2.9%)	5 (4.1%)	0	4 (20.0%)	0

Comparison of study and control groups in numbers with maximum score of 0, 1, 2 or more children aged 5-8 years;
$\chi^2 = 5.561$ D.F= 2 P= 0.0620

Comparison of study and control groups in numbers with maximum score of 0, 1 or more children aged 9-12 years;
$\chi^2 = 3.953$ D.F= 1 P= 0.0468

Table 4.54 **The frequency in terms of numbers of teeth with gingivitis in relation to the children's age groups.**

No. of sites with Gingivitis	0-4		5-8		9-12		13+	
	Study N=9	**Control N=102**	**Study N=196**	**Control N=140**	**Study N=122**	**Control N=71**	**Study N=20**	**Control N=6**
0	4 (44.4%)	81 (79.4%)	123 (62.8%)	104 74.3(%)	72 (59.0%)	52 (73.2%)	4 (20.0%)	3 (50.0%)
1-2	1 (11.1%)	8 (7.8%)	11 (5.6%)	5 (3.6%)	7 (5.7%)	17 (23.9%)	1 (5.0%)	3 (50.0%)
3-4	1 (11.1%)	0	4 (2.0%)	3 (2.1%)	3 (2.5%)	0	0	0
5-6	3 (33.3%)	13 (12.7%)	58 (29.6%)	28 (20.0%)	40 (32.8%)	2 (2.8%)	15 (75.0%)	0

Comparison of study and control groups in number of children with 0, 1-2, 3 or more teeth with plaque for children aged 5-8 years;
$\chi^2 = 4.991$ D.F= 2 P= 0.0824

Comparison of study and control groups in number of children with 0, 1-2, 3 or more teeth with plaque for children aged 9-12 years;
$\chi^2 = 3.953$ D.F= 1 P= 0.0468

4.4.4 Multivariate Analysis

Multivariate Analysis was carried out using a logistic regression method in which all variables were included at the start and then removed in a stepwise fashion until only significant ones remained. The analysis was performed for outcomes of a) dmft (0-3 or 4 or more), b) dt (zero or one or more), c) DT (zero or one or more) and d) presence of gingivitis. Variables emerging as having a significant effect are shown in Table 4.55 a) to d) together with the levels of statistical significance, odds ratios and confidence intervals for these. In the case of dmft, odds ratios indicated that children in the study group had five times the risk of having a dmft of 4 or more and that younger children (aged 8 or less) had 2.6 times the risk of having a higher dmft value at the time of examination. In the case of dt, younger children had just over twice (2.1) times the risk of having decayed primary teeth.

For permanent teeth, children in the study group had 4.5 times the risk of having at least one decayed primary tooth. Those who had plaque were also at higher risk (1.7 times). Younger children had half the risk of having decayed permanent teeth.

Four factors emerged as having a significant independent effect on presence of gingivitis; those in the study group (4.5 times), those who had plaque (2.2 times) and those who were not from professional classes (1.6 times) were all at higher risk. Those in younger age groups had just over half the risk of older children of having gingivitis.

Table 4.55 **Multiple logistic regression analysis; variables emerging as significant for dmft, dt, DT, and gingivitis.**

	Variable	B	S.E	P	OR	95% CI for OR Lower	Upper
Dmft	Groups*1	1.676	0.227	0.000	5.342	3.427	8.328
	Age Group*2	0.988	0.214	0.000	2.685	1.765	4.085
Dt	Age Group*2	0.751	0.173	0.000	2.119	1.509	2.976
DT	Group*1	1.493	0.203	0.000	4.450	2.990	6.621
	Age Group*2	-0.836	0.192	0.000	0.433	0.297	0.632
	Plaque*6	0.564	0.199	0.005	1.758	1.190	2.597
Gingivitis	Group*1	1.495	0.232	0.000	4.461	2.831	7.030
	Age Group*1	-0.648	0.207	0.002	0.523	0.349	0.785
	Social*3	0.470	0.206	0.022	1.600	1.069	2.395
	Plaque*6	0.788	0.221	0.000	2.198	1.424	3.392

Coding Used For Tables

***1 Definitions of groups**
1= Control group
2= Study group
***2 Age groups used in the study**
1= 9 years or more
2= 8 years or less
***3 Social classes**
1= Professional
2= Others
***4 Weaning age**
1= Six months or less
2= Eight months or more
***5 Brushing Habits**
1= Twice or more
2= Less than twice
***6 Presences of dental plaque**
1= No plaque presences
2= Presents of dental plaque

***7 dmft for primary teeth**
1= dmft from 0 to 3
2= dmft 4 or more
***8 dt for primary teeth**
1= dt equal zero
2= dt equal one or more
***9 DMFT for permanent teeth**
1= DMFT equal zero
2= DMFT equal one or more
***10 DT for permanent teeth**
1= DT equal zero
2= DT equal one or more
***11 Presences of dental Gingivitis**
1= No gingivitis presents
2= Presents of gingivitis

4.5 Oral Health Behaviours

The oral health related behaviours investigated in this study-included diet, oral hygiene practices used for the child, and dental attendance.

4.5.1 Diet

Dietary factors considered for children in study and control groups included age at weaning, preferred food types, and frequency of consumption of confectionery and selected types of drinks.

4.5.2 Age at Weaning

For children in both study and control groups, the highest proportions started to have solid foods at the age of six months, 180 children (52%) from the study group and 206 (65%) from the control group were reported to have done so. A further one hundred and nineteen (34%) of the study group children and 97 (30%) of the control group started later, at 8 months. Data are summarised in Table 4.56. Differences between study and control group children in age at weaning (in terms of 4 or 6 months, eight months or more than 8 months) proved highly significant on test using Chi-Square.

Table 4.56 **Weaning age for children included in study and control groups.**

Age of Weaning	Study Group N=347	Control Group N=319
	No. (& %) of children	No. (& %) of children
Four Months	8 (2.3)	3 (0.9)
Six Months	180 (51.9)	206 (64.6)
Eight Months	119 (34.3)	97 (30.4)
More than 8 Months	20 (5.8)	5 (1.6)
Nothing Indicated	20 (5.8)	8 (2.5)

Comparison between study and control groups in numbers weaned at 4-6 months, eight months and more than eight months and nothing indicted;
$\chi^2 = 15.95$ D.F= 2 P= 0.0003

4.5.3 Types of Food Usually Eaten

Parents were asked to indicate from a list of items the type of food their children usually ate. In order to simplify analysis, foods were classified into two types; non-cariogenic items; comprising vegetables, fruits, meat, cheese, chips, and nuts; and cariogenic foods; including chocolate, candies, and biscuits. The number of items ticked in each category was used as the variable of interest.

For both types of food, the great majority of the children were reported to usually eat more than three types of each. Ninety-six percent (333) children of the study group usually ate three types or more of the non-cariogenic food, as did 99% of the controls.

Similarly 93% of the study group and 99% of the controls were reported to eat all three types of cariogenic food listed in the questionnaire (Table 4.57).

Although small, differences between study and control groups in food consumption measured this way were statistically significant when the standardised normal deviate was calculated for each.

Table 4.57 **Frequency of non-cariogenic and cariogenic foods consumption by children in study and control groups.**

Frequency	Non-Cariogenic Food (6 Types of Food)		Cariogenic Food (3 Types of Food)	
	Study	Control	Study	Control
One type only	0	0	14 (4.0%)	1 (0.3%)
One to two types	9 (2.6%)	2 (0.6%)	0	0
More than 2	333 (96.0%)	317 (99.4%)	322 (92.7%)	315 (98.7%)
Nothing Indicated	5 (1.4%)	0	11 (3.2%)	3 (0.9%)

Comparison of study and control groups in proportion having more 2 non-cariogenic food SND = 2.879 $P = < 0.01$

Comparison of study and control groups in proportion having more than 2 cariogenic foods SND = 3.76 $P = < 0.001$

4.5.4 Frequency of Confectionery Consumption

The reported frequency of confectionery consumption is shown in Table 4.58. In both groups more than half of the children ate confectionery more than once a day. Slightly more children in the study group 217 children (63%) ate confectionary more than once a day compared to the control group (180; 56%) but the difference did not prove to be statistically significant.

Table 4.58 **Frequency of confectionery consumption for both groups per day.**

	Study Group No. (&%) of children	**Control Group No. (&%) of children**
Once or more / Day	217 (62.5)	180 (56.4)
Less than once / Day	126 (36.3)	138 (43.3)
Nothing Ticked	4 (1.2)	1 (0.3)

Comparison of study and control groups in numbers having confectionery once or more, and less than once a day;
Yates' correction = 2.329 D.F= 1 P= 0.1270

4.5.5 Frequency of Drinks

A summary of the frequency and type of drinks consumed by the children in both study and control group daily is shown in Table 4.59.

From replies given by parents, water was the most common type of drink consumed; it was drunk more than twice a day by 85% of children in the study group and 93% of those in the control group.

Milk and juices were the second most common drink to be consumed with little different in frequency between the groups. Two hundred and seventy five children in the study group (79%) were reported to have juices more than twice a day and 261 children (75%) had milk. In the case of the control group, 253 children (79%) had milk and 245 of the children (77%) had juices twice a day or more.

Carbonated drinks were only slightly less popular than milk and juices. These carbonated drinks included Pepsi Cola, Coca Cola, 7 Up, and Miranda. In the study group, 249 children (72%) reportedly consumed one or more of these fizzy drinks more than twice per day, the equivalent number in the control group was 240 children (75%). Fifty-seven children (16%) from the study group were reported to have fizzy drinks once a day with a similar proportion in the control group (39; 12%). Numbers drinking tea (either once a day or less or twice a day or more) were very similar with less than 19% of children doing so in all. Low calorie fizzy drinks were the least popular type of drinks for children in both groups. More than 9 out of 10 parents gave no indication that their children groups drank low calorie carbonated drinks at all.

Differences between study and control groups in the proportion drinking water twice a day or more were statistically significant but not those having other drinks.

Table 4.59 **Frequencies of consumption and type of drink consumed by children in the study and control groups.**

Type of Drinks	Study Group N= 347			Control Group N= 319		
	2 or more/ Day	One or </ Day	Not Indicated	2 or more/ Day	One or </ Day	Not Indicated
Water	295 (85.0%)	1 (0.3%)	51 (14.7%)	298 (93.4%)	0	21 (6.6%)
Juices	275 (79.3%)	40 (11.5%)	32 (9.2%)	245 (76.8%)	38 (11.9%)	36 (11.3%)
Milk	261 (75.2%)	23 (6.6%)	63 (18.2%)	253 (79.3%)	28 (8.8%)	38 (11.9%)
Fizzy Drinks	249 (71.8%)	57 (16.4%)	41 (11.8%)	240 (75.2)	39 (12.2%)	40 (12.5%)
Tea	60 (17.3%)	2 (0.6%)	285 (82.1%)	61 (19.1%)	3 (0.9%)	255 (79.9%)
Low Fizzy Drinks	10 (2.9%)	14 (4.0%)	323 (93.1%)	18 (5.6%)	14 (4.4%)	287 (90.0%)

Comparisons between study and control groups in numbers having drinks 2 × per day or more and 1× per day or less using Chi-square test;

χ^2 for water= 11.17 D.F= 1 P= 0.0008
χ^2 for Juices= 0.582 D.F= 1 P= 0.4455
χ^2 for milk= 1.582 D.F= 1 P= 0.2085
χ^2 for fizzy drinks= 1.030 D.F= 1 P= 0.3102
χ^2 for tea= 0.375 D.F= 1 P= 0.5404
χ^2 for low fizzy drinks= 3.145 D.F= 1 P= 0.0761

4.5.6 Frequency of Dental Visits

Table 4.60 summarise data related to frequency of dental visits for children in study and control group and in Table 4.61 the same information according to children's age groups. Parents were asked when they took their child to the dentist. Many of the parents were agreed in that they took their children to the dentist when they believed it was necessary or when problems occurred. Of those in the study group this was true for 260 (75%) and of those in the control group 156 (49%). One third of children in the control group had not previously attended a dentist. For the great majority who had done so, parents similarly reported that this had been in response to need or for a specific problem.

Check ups were not popular for either group, but were a little more popular for children in the control group, parents of only 28 children who had previously had treatment under DGA (8%) took their children to a dental clinic at least once a year for check up, and 8 (2%) for a regular check up every six months. The same parents reported that they took 47 of the control group children (15%) at least once per year and another 5 children (2%) for a regular dental check up every six months.

Excluding those children who had not attended the dentist up to the time of DGA (study group) or dental examination for the study (control group) differences in pattern of reported attendance between the groups was highly significant on test.

Table 4.60 **Frequency of dental visits for children in study and control groups.**

Frequency	**Study Group N=347**	**Control Group N=319**
	No. (& %)	**No. (& %)**
Every 6 month	8 (2.3)	5 (1.6)
Once a year	28 (8.1)	47 (14.7)
When it is necessary	260 (74.9)	156 (48.9)
Never until DGA	49 (14.1)	0
Never until research exam	0	106 (33.2)
Nothing indicated	2 (0.6)	5 (1.6)

Comparison between study and control groups in pattern of attendance (every 6 months/ once a year/ when it is necessary) excluding those who had not attend before DGA (study group) or examination (control group);

$\chi^2 = 15.92$ D.F= 2 P= 0.0003

Table 4.61 **Frequency of dental visits for children in study and control groups according to the children's age groups**

Frequency	0-4		5-8		9-12		13+	
	Study N=9	Control N=102	Study N=196	Control N=140	Study N=122	Control N=71	Study N=20	Control N=6
Every 6 month	0	1 (1.0)	5 (2.6)	4 (2.9)	2 (1.6)	0	1 (5.0)	0
Once a year	2 (22.2)	14 (13.7)	19 (9.7)	20 (14.3)	7 (5.7)	12 (16.9)	0	1 (16.7)
When it is necessary	7 (77.8)	25 (24.5)	143 (73)	75 (53.6)	94 (77.0)	52 (73.2)	16 (80.0)	4 (44.7)
Never until research exam	0	0	27 (13.8)	0	19 (15.6)	0	3 (15.0)	0
Nothing indicated	0	59 (57.8)	0	39 (27.9)	0	7 (9.9)	0	1 (16.7)

4.5.7 Age of the Child at their First Dental Visit

When parents were asked the age of the child at the time of their first dental visit, similar proportions of children in study and control groups as a whole had their first visit to a dentist at an age between 3 and 4 years (49% in both groups). A further 26% of the children from study and control group had made their first dental visit at the age of 5 or 6 years (90 children from study and 82 children from control group). For children in the study group the mean age of the child at their first visit to dentist was 4.2 (± 1.8) years and for the control group the mean was 3.8 (± 1.8) years. Table 4.62 shows the age of children at their first dental visit, for study and control group children. Statistical testing using Chi-Square confirmed the lack of difference between groups. Table 4.63 shows the age of children at their first dental visit according to children's age groups. This suggest some difference between the groups with more children in the study group being taken to the dentist first before 5 years of age amongst those aged 5-8 years and more before the age of 6 in those aged 9-12 years.

Table 4.62 **Age of children at their first dental visit.**

Age at First Visit	Study Group N=347	Control Group N=319
	No. (%) of children	No. (%) of children
2 years or less	46 (13.3)	39 (12.2)
3-4 years	169 (48.7)	155 (48.6)
5-6 years	90 (25.9)	82 (25.7)
> than 6 years	30 (8.6)	24 (7.5)
Nothing indicated	12 (3.5)	19 (6.0)
Mean (± SD)	4.2 (±1.8)	3.8 (± 1.8)

Comparison between study and control groups in numbers having first visit at 2 years or less, 3-4 years, 5 years and older, and not indicated;
χ^2 = 2.456 D.F= 3 P= 0.4832

Table 4.63 **Age of children at their first dental visit according to the children's age groups at time of examination**

Age at First Dental Visit	0-4		5-8		9-12		13+	
	Study N=9	Control N=102	Study N=196	Control N=140	Study N=122	Control N=71	Study N=20	Control N=6
2 years or less	9 (100)	28 (27.5)	35 (17.9)	9 (6.4)	2 (1.6)	2 (2.8)	0	0
3-4 years	0	66 (64.7)	141 (71.9)	72 (51.4)	23 (18.9)	17 (23.9)	5 (25.0)	0
5-6 years	0	6 (5.9)	14 (7.1)	45 (32.1)	75 (61.5)	29 (40.8)	1 (5.0)	2 (33.3)
> than 6 years	0	0	1 (0.5)	1 (0.7)	16 (13.1)	19 (26.8)	13 (65.0)	4 (66.7)
Nothing indicated	0	2 (2.0)	5 (2.6)	13 (9.3)	6 (4.9)	4 (5.6)	1 (5.0)	0

Comparison for study group at age 5-8 and 9-12 years in numbers having first visit at 4 years or less, 5 years and older, and not indicated;
$\chi^2 = 159.4$ D.F = 2 P = 0.0000

Comparison for control group at age 5-8 and 9-12 years in numbers having first visit at 4 years or less, 5 years and older, and not indicated;
$\chi^2 = 23.16$ D.F = 2 P = 0.0000

4.5.8 Oral Hygiene

Parents were asked how frequently their children's teeth were brushed, and whether they had assistance with brushing. Children were asked about the type of toothpaste used. The frequency of brushing reported by parents is shown in Table 4.64 and in Table 4.65 according to children's age groups.

The majority of children in the study group (219; 63%) were reported to brush once a day or less, and the remainder (121; 35%) twice a day or more. In the control group, over half (174; 55%) were reported to brush twice a day or more, and fewer (145; 46%) once a day or less. Differences proved highly significant on test. The pattern seen was consistent in all age groups when information was broken down in this way.

Table 4.64 **Frequency of tooth brushing according to children's parents for study and control group.**

Frequency of Brushing	Study Group N=347	Control Group N=319
	No. (& %) of children	No. (& %) of children
Nothing Indicated	7 (2.0)	0
Once or Less Per Day	219 (63.1)	145 (45.5)
Twice or More Per Day	121 (34.9)	174 (54.5)

Comparison of study and control groups in numbers brushing once a day or less or twice or more;

$\chi^2 = 26.07$ D.F= 1 P= 0.0000

Table 4.65 **Frequency of tooth brushing according to children's parents for study and control group according to the children's age groups**

Frequency of brushing	0-4		5-8		9-12		13+	
	Study N=9	Control N=102	Study N=196	Control N=140	Study N=122	Control N=71	Study N=20	Control N=6
Nothing indicated	0	0	4 (2.0)	0	3 (2.5)	0	0	0
Once or less	6 (66.7)	44 (43.1)	113 (57.7)	65 (46.4)	81 (66.4)	33 (46.5)	19 (95.0)	3 (50.0)
Twice or more per day	3 (33.3)	58 (56.9)	79 (40.3)	75 (53.6)	38 (31.1)	38 (53.5)	1 (1.0)	3 (50.0)

Comparison of study group at age 5-8 and 9-12 years in numbers brushing once a day or less or twice or more;
Yates' correction = 2.333 D.F = 1 P = 0.1267

Comparison of control groups at age 5-8 and 9-12 years in numbers brushing once a day or less or twice or more;
Yates' correction = 0.019 D.F = 1 P = 0.8893

Parents of 202 children in the study group (58%) reported that their children brushed without either help or supervision. For the control group children the figure was only slightly lower at 50%.

More children from the control group were supervised by their parents during or after brushing (114; 36%), while in the study group, only 72 children (21%) were reported to have the same degree of supervision. Differences in help provided in brushing can be seen in data summarised in Table 4.66 and were significant on test. Table 4.67 shows help provided in brushing by parents according to children's age groups. It can be seen that this pattern was not consistent. Although parents helped or supervised more children in the control group amongst those aged 8 or less, the reverse was true for those aged 9 or more.

Table4.66 **Help provided during the brushing (according to parents)**

Type of help provided	Study Group N=347	Control Group N=319
	No. (& %) of children	No. (& %) of children
Parents help	65 (18.7)	42 (13.2)
Parents supervision	72 (20.7)	114 (35.7)
Child brush alone	202 (58.2)	158 (49.5)
Nothing indicated	8 (2.3)	5 (1.6)

Comparison between study and control groups in numbers parents help, parents supervised or child brush alone;

$\chi^2 = 19.35$ D.F= 3 P= 0.0002

Table4.67 **Help provided during the brushing (according to parents) according to child's age groups.**

Type of help provided	0-4		5-8		9-12		13+	
	Study N=9	Control N=102	Study N=196	Control N=140	Study N=122	Control N=71	Study N=20	Control N=6
Parents help	2 (22.2)	31 (30.4)	22 (11.2)	9 (6.4)	28 (23.0)	2 (2.8)	13 (65.0)	0
Parents supervision	2 (22.2)	35 (34.3)	41 (20.9)	63 (45.0)	27 (22.1)	15 (21.1)	2 (10.0)	1 (16.7)
Child brush alone	4 (44.4)	33 (32.4)	128 (65.3)	66 (47.1)	65 (53.3)	54 (76.1)	5 (25.0)	5 (83.3)
Nothing indicated	1 (11.1)	3 (2.9)	5 (2.6)	2 (1.4)	2 (1.6)	0	0	0

Comparison between study group at age of 5-8 and 9-12 years in numbers (parents help and supervision) or child brush alone;
Yates' correction = 5.167, D.F= 1, P= 0.023.

Comparison between control group at age of 5-8 and 9-12 years in numbers (parents help and supervision) or child brush alone;
Yates' correction = 14.14, D.F= 1, P= 0.0001.

4.6 Recall of Treatment and Current Attitude to Treatment

Parents were asked about how they remembered the experience of their child having treatment under DGA. A high percentage of parents said that they could still remember their child having treatment under DGA (298, 85.9%), and parents of 23 (7%) said that they remembered just a little about the occasion of DGA. The remaining 20 (6%) said they had no recollection of the treatment.

For the children who had received treatment under DGA, parents were asked for more details about the time it took for their child to return to his/her normal daily activity after the DGA. Table 4.68 lists the number and percentage of children in relation to the time parents reported it had taken for them return to normal eating and to normal levels of activity following DGA.

The largest group of the children, 106 (31%) in the study group, were reported to have returned to their normal pattern of eating within one day of the procedure, and a further 102 (29%) within 2-3 days. Eighty one of the children (23%) were eating normally by the end of day having the treatment, and in the case of only 18 (5%) did it take them more than 3 days to get back to their normal eating habits. Parents of the remaining 37 (11%) children could not remember when the child had returned to normal eating and 3 (1%) did not respond to this question. In terms of returning to normal activity, 77 (22%) were reported to have been back to normal on the same day, a further 90 (26%) within one day, 110 (32%) within 2-3 days and for 18 (5%) it took them longer than this.

Table 4.68 **Time taken for children in the study group to return to normal eating and activity after DGA.**

Duration	Return to normal eating	Return to normal activity
	No. (&%) of children	No. (&%) of children
Not indicated	3 (0.9)	8 (2.3)
Same day	81 (23.3)	77 (22.2)
Next day	106 (30.5)	90 (25.9)
2-3 days	102 (29.4)	110 (31.7)
Longer than 3 days	18 (5.2)	18 (5.2)
Cannot remember	37 (10.7)	44 (12.7)
Total	347 (100)	347 (100)

4.6.1 Methods of Treatment

Both parents and children involved in the study were asked about the methods they would prefer for treatment to be carried, Table 4.69 summarises the method of treatment preferred by parents in the case of any further treatment needed for their children, Table 4.70 shows the same information by age group. Table 4.71 shows the method of treatment preferred according to the children themselves and Table 4.72 shows the methods of treatment preferred by children themselves according to the child's age group.

Of the 374 children in the study group parents of 76% preferred for routine dental treatment to be carried out under local anaesthesia in the future. This was similar to preferences for sibling in the control group; where local anaesthesia was preferred for 246 (77%).

For 73 children from the study group (21%) parents preferred them to have another DGA for any treatment required in the future which compared with 23 children (7%) from the control group. Parents of one child from the study group and 2 children from the control group did not want their children to go through any further dental experience. For the remaining children (11 children (3%) from study group and 48 (15%) from control group) parents did not answer the question.

Differences in parental preference were related to age group of the child. Thus, parents preferred local anaesthesia more often for control group children aged 9 or more than for study group children of this age whereas preferences were more similar for younger children.

Table 4.69 **Methods of treatment if the child needs further treatment –parents' opinion-**

Methods of Treatment	Study Group N=347	Control Group N=319
	No. (& %) of children	No. (& %) of children
Nothing Indicated	11 (3.2)	48 (15.0)
Local Anaesthesia	262 (75.5)	246 (77.1)
General Anaesthesia	73 (21.0)	23 (7.2)
Never Have Treatment Again	1 (0.3)	2 (0.6)

Comparison of study and control groups in numbers of parents not indicating, preferring local anaesthesia or general anaesthesia;

$\chi^2 = 48.74$ D.F= 2 P= 0.000

Table 4.70 **Methods of treatment if the child needs further treatment –parents' opinion- according to child's age group**

Methods of treatment	0-4		5-8		9-12		13+	
	Study N=9	Control N=102	Study N=196	Control N=140	Study N=122	Control N=71	Study N=20	Control N=6
Nothing indicated	0	32 (31.4)	8 (4.1)	15 (10.7)	3 (2.5)	1 (1.4)	0	0
Local anaesthesia	5 (55.6)	61 (59.8)	163 (83.2)	112 (80.0)	89 (73.0)	67 (94.4)	5 (25.0)	6 (100.0)
General anaesthesia	4 (44.4)	9 (8.8)	25 (12.8)	11 (7.9)	30 (24.6)	3 (4.2)	14 (70.0)	0
Never have treatment again	0	0	0	2 (1.4)	0	0	1 (5.0)	0

All children involved in the study were asked the same question as their parents. Table 4.71 summarise methods of treatment preferred by the children if any more treatment needed and Table 4.72 showing the same data according to children's age groups. More than half of the children in each group said that they preferred not to have any further dental treatment by any method 192; 55% and 166; 52% from study and control group respectively. One hundred and seventeen children (37%) in the control group preferred the treatment to be carried out under local anaesthesia if it was needed and only 12 children from this group-preferred treatment under DGA. In the case of study group children, 74 (21%) wanted the treatment carried out under local anaesthesia and 49 (14%) said they would prefer a DGA if they needed treatment. Thirty-two children (9%) of study group and 24 (8%) of control group gave no preference.

When considered by age group, children in the control group more often preferred local anaesthesia at all ages. This difference was more marked amongst older children.

Table 4.71 **Methods of treatment preferred by the children if any further treatment required.**

Methods of treatment	Study Group N=347	Control Group N=319
	No. (& %) of children	No. (& %) of children
Nothing Indicated	32 (9.2)	24 (7.5)
Local Anaesthesia	74 (21.3)	117 (36.7)
DGA	49 (14.1)	12 (3.8)
Don't Want Any Treatment	192 (55.3)	166 (52)

Comparison between study and control groups in numbers of children not indicating local anaesthesia or preferring DGA;

$\chi^2 = 34.3$ D.F= 3 P= 0.000

Table 4.72 **Methods of treatment preferred by the children if any further treatment required according to children's age group.**

Methods of treatment	0-4		5-8		9-12		13+	
	Study N=9	Control N=102	Study N=196	Control N=140	Study N=122	Control N=71	Study N=20	Control N=6
Nothing indicated	0	16 (15.7)	9 (4.6)	6 (4.3)	17 (13.9)	2 (2.8)	6 (30.0)	0
Local anaesthesia	1 (11.1)	33 (32.4)	42 (21.4)	45 (32.1)	29 (23.8)	36 (50.7)	2 (10.0)	3 (50.0)
General anaesthesia	1 (11.1)	1 (1.0)	29 (14.8)	3 (2.1)	15 (12.3)	8 (11.3)	4 (20.0)	3 (50.0)
Don't want any treatment	7 (77.8)	52 (51.0)	116 (59.2)	86 (61.4)	61 (50.0)	25 (35.2)	8 (40.0)	0

4.6.2 Attitude to Dental Treatment (Control Group)

Parents were asked about the methods of treatment that had been used during treatment for their children in the control group. Parents of more than half of the children remembered that their son or daughter had received treatment using local anaesthesia (186; 58%). A further 128 children (40%) said they had treatment but without local anaesthesia. Parents of the remaining 5 children (2%) did not indicate which methods had been used.

Parents were asked if their child (in the control group) made any complaint following dental treatment. Out of 319 children making up this group, 57 (18%) made some complaint at the time of treatment or afterwards. For 41 children (72% of those making a complaint) the complaint was about having the injection of local anaesthesia and for another 35 (61%) their complaint related to the numbness persisting after having the injection. Some had made both complaints.

Parents' attitudes towards their children (in the control group) having dental treatment carried out under local anaesthesia are summarised in Table 4.73. Slightly more than half (52%) of the parents of the children in the control group admitted to feeling worried, or tense while the child was having treatment under local anaesthesia. On the other hand, 83 parents (26%) reported that they felt relaxed about treatment for their child using this method of treatment. The parent of one child preferred that their child should not repeat the same experience of having treatment using local anaesthesia. The remaining 68 (21%) failed to indicate their attitude towards their child having dental treatment.

Table 4.73 **Parents' feelings towards dental treatment carried out under LA for their children in the control group.**

Parents' Feeling	Control Group No. (& %) of children
Nothing indicated	68 (21.3)
Relaxed	83 (26.0)
Worried	71 (22.3)
Tense	96 (30.0)
Don't Want Child to Have Treatment Again	1 (0.3)

4.6.3 Attitude to Attendance on the Day of Dental Treatment

Attitudes to attendance were investigated through questions to parents as to how they believed their children felt, and through questions to the children.

4.6.3.1 Questions to Parents

Answers given by parents in relation to children in study and control are summarised in Table 4.74 and in Table 4.75 according to children's age groups.

More than half the study group children (185; 53%) and just under half of the control group children (141; 44%) were thought to feel tense on the day of the appointment. Similarly, slightly more children in the study group (51; 15%) were seen as being anxious or very anxious compared to the control group (36; 11%). When broken down by age, it could be seen that this difference related especially to older children (aged 9 or more).

Table 4.74 **Children's attitudes at the day of having a dental visit (according to parents)**

Children's Feelings	Study Group N=347	Control Group N=319
	No. (& %) of children	No. (& %) of children
Nothing Indicated	6 (1.7)	10 (3.1)
Relaxed	72 (20.7)	100 (31.3)
Little Uneasy	33 (9.5)	32 (10)
Tense	185 (53.3)	141 (44.2)
Anxious	41 (11.8)	33 (10.3)
Very Anxious	10 (2.9)	3 (0.9)

Comparison of study and control groups in numbers of parents not indicating or reporting child as feeling relaxed, a little uneasy, tense, anxious or very anxious;
χ^2=12.94 D.F= 4 P= 0.0116

Table 4.75 **Children's attitudes at the day of having a dental visit (according to parents) according to children's age groups**

Children's feeling	0-4		5-8		9-12		13+	
	Study N=9	Control N=102	Study N=196	Control N=140	Study N=122	Control N=71	Study N=20	Control N=6
Nothing indicated	0	9 (8.8)	0	1 (0.7)	5 (4.1)	0	1 (5.0)	0
Relaxed	1 (11.1)	28 (27.5)	44 (22.4)	37 (26.4)	26 (21.3)	31 (43.7)	1 (5.0)	4 (66.7)
Little uneasy	2 (22.2)	9 (8.8)	22 (11.2)	12 (8.6)	9 (7.4)	10 (14.1)	0	1 (16.7)
Tense	4 (44.4)	35 (34.3)	106 (54.1)	75 (53.6)	64 (52.5)	30 (42.3)	11 (55.0)	1 (16.7)
Anxious	2 (22.2)	19 (18.6)	17 (8.7)	14 (10.0)	17 (13.9)	0	5 (25.0)	0
Very anxious	0	2 (2.0)	7 (3.6)	1 (0.7)	1 (0.8)	0	2 (10.0)	0

4.6.3.2 Questions to Children

Children's reported attitudes on the day of the dental appointment are summarised in Table 4.76 and Table 4.77 according to children's age groups.

The questionnaire to children used a simple picture scale so that responses cannot be easily compared to those given by parents. Nevertheless, the same trends are apparent with slightly more children with control group indicating that they felt relaxed 106 (33%) compared to the study group (83; 24%) and fewer feeling anxious or very anxious (26; 8%) compared to 72; (21%). In terms of age groups the difference appeared to be consistent in those aged 5 or more.

Table 4.76 **Children's attitude at the day of having dental appointment (according to children)**

Children's Attitude	Study Group N=347	Control Group N=319
	No. (&%) of children	No. (&%) of children
Nothing Indicated	26 (7.5)	6 (1.9)
Relaxed	83 (23.9)	106 (33.2)
Little Uneasy	76 (21.9)	84 (26.3)
Tense	90 (25.9)	97 (30.4)
Anxious	56 (16.1)	19 (6.0)
Very Anxious	16 (4.6)	7 (2.2)

Comparison of study and control groups in numbers of children not indicating or reporting feeling relaxed, a little uneasy, tense, anxious or very anxious;
$\chi^2 = 36.44$ D.F= 4 P= 0.000

Table 4.77 **Children's attitude at the day of having dental appointment (according to children) according to children's age group**

Children's feeling	0-4		5-8		9-12		13+	
	Study N=9	Control N=102	Study N=196	Control N=140	Study N=122	Control N=71	Study N=20	Control N=6
Nothing indicated	0	2 (2.0)	5 (2.6)	2 (1.4)	15 (12.3)	2 (2.8)	6 (30.0)	0
Relaxed	3 (33.3)	34 (33.3)	48 (24.5)	42 (30.0)	31 (25.4)	27 (38.0)	1 (5.0)	3 (50.0)
Little uneasy	1 (11.1)	35 (34.3)	46 (23.5)	31 (22.1)	26 (21.3)	17 (23.9)	3 (15.0)	1 (16.7)
Tense	2 (22.2)	23 (22.5)	58 (29.6)	54 (38.6)	28 (23.0)	18 (25.4)	2 (10.0)	2 (33.3)
Anxious	3 (33.3)	5 (4.9)	28 (14.3)	7 (5.0)	18 (14.8)	7 (9.9)	7 (35.0)	0
Very anxious	0	3 (2.9)	11 (5.6)	4 (2.9)	4 (3.3)	0	1 (5.0)	0

Comparison of study group at age 5-8 and 9-12 years in numbers of children not indicating or reporting feeling relaxed, a little uneasy, tense, or (anxious and very anxious);
$\chi^2 = 0.803$ D.F= 3 P= 0.8489

Comparison of study group at age 5-8 and 9-12 years in numbers of children not indicating or reporting feeling relaxed, a little uneasy, tense, or (anxious and very anxious);
$\chi^2 = 0.3.637$ D.F= 3 P= 0.3034

CHAPTER FIVE

Discussion

5.1 Introduction

This investigation set out to consider the provision of DGA for comprehensive treatment for children at hospital centres in Riyadh. The first part considered service provision at government funded centres. The study had the aim of considering aspects of effectiveness in terms of treatment experience of those having treatment under DGA and their oral health three years later. The second part of the investigation was concerned with treatment recorded at the time of DGA and afterwards and with the oral health status of children who had received treatment at the centres.

The effectiveness of any treatment method will relate to a number of factors. These include not only the extent to which it meets treatment need (and it's efficiency in terms of time and use of resources) and the need for subsequent treatment but also its effect on attitudes and behaviour of the patient and family. The second part of the study included a questionnaire study of parents and children designed to investigate oral health behaviours and attitudes to care.

The study was confined to government-funded centres in Riyadh. In Saudi Arabia DGA services are provided both through government funded hospital centred services and, to an unknown extent, through private hospitals. Since treatment at government-funded centres is free of charge to families and cost at private hospitals is likely to be high, these centres may be expected to be under demand for treatment for a high proportion of those children in Riyadh who require DGA. Six such centres were identified as providing services in the city. The study required close co-operation from staff at the centres both in allowing access to records for the first part of the study and in tracing and contacting patients and providing facilities for dental examinations for the second part. On this basis four of the six centres agreed to take part and it proved possible to obtain some items of information about a total of 483 child patients who had received treatment over a 2-year period. The total was believed to include virtually all children using the service during this interval. Whilst some bias may well have been introduced by two of the six centres declining to take part, it was believed that the information drawn from the four centres gave a reasonable indication of provision of this type of service in the city. Findings in the second part of the study showed that the children receiving treatment at the centres came from a spectrum of social classes perhaps lending some support to this belief.

Previous investigations of DGA services for comprehensive treatment have usually been concerned with a single centre and the inclusion of several centres was a strength of this study. Results of the first part of the study suggested that the four had strong similarities but there were also some differences. It was not the aim of the study to explore differences in patterns of treatment but to take a representative view of DGA services and the patients they served as a whole. The numbers of children receiving treatment at some of the centres were also too small for more detailed breakdown, in terms of age, for example. For these reasons and to preserve clarity in this thesis, results in the second part of the study for the four centres have been combined.

The second part of the investigation relied on observations of more than 300 child patients and an independent control group of their siblings and on information reported by their parents. The ideal method to determine the effectiveness of a treatment intervention is through a randomised controlled trial. In the case of treatment under DGA this would have meant a prospective longitudinal study with children being randomised at the time they presented for treatment into those having treatment under DGA and those who had this carried out using alternative methods. Whilst this type of study design is more scientifically robust, it is not feasible in all circumstances. As well as inherent difficulties of longitudinal studies, in the current situation it would need to be assumed that suitable alternatives to DGA are available and that randomisation of patients would be ethical. Both of these may be difficult to achieve. The most obvious alternative, conscious sedation, does not appear to be widely used in government funded centres in Saudi Arabia at present. In addition, a high proportion of the children in the study were age 4 or less at the time of DGA and many may have been simply too young to cooperate with such methods, even if had they been available. In these circumstances the method used here has provided evidence about the treatment experience and oral health of a group of children who had received treatment under DGA.

The study design included a control group. One consequence of the lack of randomisation is that the children having DGA and their controls cannot be assumed to have had similar disease experience, even at equivalent age. In the results, there were some differences in disease that could not be wholly explained by different methods of treatment. These differences and their implications will be discussed further in a subsequent section of this discussion.

Inclusion of a control group provided a basis for comparison for children in the study group. Ideally, children in the control group should have been matched for all important determinants including those of age, gender, social class, and home background. Had this been achieved, the paired arrangement could have been effectively used in statistical analysis. In practical terms however, drawing a suitable matched sample of children to attend was likely to have been extremely difficult. For the purposes of the study parents were invited to bring a sibling of the child who had treatment under DGA. Use of siblings had the very great advantage that the children had the same social class and environmental background, as did those in the study group. The disadvantage of the arrangement was that they were unmatched for other factors, such as gender, and most significantly, were of different ages. In the study, only 8 of the 347 children in the study group were (at the time of the study) the only child in their family and to encourage attendance, parents were asked to bring whichever sibling they wished. In most cases this was a younger brother or sister. As a result, there was a significant difference (of 2 years) between mean ages of children in study and control groups. This has important implications both in relation to treatment experience and oral health status. Because they differed so much in age statistical analysis was carried out regarding the study and control groups as independent. In addition, to help to overcome the difficulty with regard to age, comparisons were made on the basis of age group at the time of the dental examination. Age was also included as a variable in multivariate analysis, allowing for this factor to be taken into account and the independent effect of other variables examined. The importance of age was clearly indicated, with this variable emerging as a risk factor for outcomes of caries in primary and permanent teeth and for gingivitis.

As well as 8 children who did not have a sibling at the time of the study 20 attended without bringing a brother or sister. Considered as independent, study and control groups had remained broadly similar in gender distribution and analysis of social class distribution gave no indication of systematic bias as a result of the "loss" of 28 children to the control group.

For the second part of the investigation families were contacted by phone and asked personally by the investigator to bring their child (and one of his/her siblings) for examination. Several studies have suggested poor compliance with recall following DGA (Rule *et al.,* 1967; Enger and Mourino, 1985; Mitchell and Murray, 19985; O'Sullivan and Curzon, 1991; Sheehy *et al.,* 1994; Bello, 2000; Jamjoom *et al.,* 2001) but in the present study 72% of the children identified in the first phase of the study attended after a three year interval. The response varied a little between centres but was never less than 67% and in one was as high as 88%. The rate of response seen here partly reflects the success of the researcher in making personal telephone contact with families. It may also indicate the stability of the population in the city and the attraction of a dental examination (and assurance of arrangements for any necessary treatment) in a community which may have some lack of access to primary care dental services for young children. Average family size in Saudi Arabia is high and the examination of two children in the family may also have been an incentive to attend. This might be shown by the very high proportion of families who did bring a sibling (92%). However, in comparing the response to that achieved in other studies however, it was apparent that the examination for purposes of the study might have been perceived as something other than a simple recall. Attendance for recall for children in the study group had also been low in the intervening three-year interval with the great majority of children in the study group failing to attend at least once during the interval.

The study methods included examination of records, a dental examination, and information drawn from simple questionnaires. Staff at all four hospital centres assisted in tracing records and provided a full return of data. The examiner was trained and calibrated, adding strength to the dental examinations. Because the researcher had made direct contact and arrangements with the families, this made it difficult to formally blind her to the identity of study and control group children. Even had this been feasible the large amount of treatment carried out for study group children and their older age might well have made it difficult to blind the examinations.

The questionnaires were complete by all parents at the time of dental examination. Whilst this may have resulted in some bias, it allowed help to be provided when parents requested this and meant that the response rate was more complete. Despite their drawbacks, questionnaires are widely used as a method of assessing oral health behaviours (O'Brien, 1994; Hinds and Gregory, 1995). However, responses to questionnaires indicate only reported behaviour, attitudes and beliefs and results must be interpreted accordingly.

5.2 Characteristics of Patients Receiving Treatment Under DGA

It was clear from the findings that the DGA services at all four of the centres were used almost wholly to provide treatment for children younger than 9 years of age. Results from phase I of the study showed that over 90% of patients had been 8 years or less and that 50% were under the age of 5 years at the time of their treatment. Amongst those attending in phase II, 55% of the children in the study group had been less than 5 years old at the time of treatment under DGA. The predominance of young children follows the trend seen in other investigations, not only in Saudi Arabia, where caries levels in young children are high, but also in more industrialised and developed countries including UK, Sweden, Belgium, Australia, and USA (Persliden and Magnusson, 1980; O'Brien and Suthers, 1983; O'Sullivan and Curzon, 1991; Vermeulen *et al.,* 1991; Holt *et al.,* 1991; Sheehy *et al.,* 1994; Mason *et al.,* 1995 a; Berkowitz *et al.,* 1997; Harrison and Roberts, 1998; Alcaino *et al.,* 2000; Bello, 2000; Jamjoom *et al.,*2001).

Caries level may be lower in these countries but there may still be particular need for treatment in younger children. It has been reported that demand for treatment becomes more evident as DGA services become more widely available (Bohaty and Spencer, 1992). The studies of caries in young children in Saudi Arabia included in Table 2.1 show clearly the need for treatment in this age group in the Kingdom. However, that young children made up such a high proportion of patients may reflect not only the need and demand for treatment in the population, but also the characteristics of patients attending and the policy and strategies employed by those who provide the service. In the current study, there were, for example, significant differences between the centres in the ages of children who had received treatment, with children under 5 years old making up more than 60% of patients attending at two of the four centres. In the USA, at least one study has described a service used especially to meet treatment needs in young children (Douglas and Adilman, 1967). In one UK centre, although children aged under 5 made up only 20% of patients attending, the continuing provision of services for this age group was illustrated by the fact that absolute numbers receiving treatment had increased over a 20-year period (Mason *et al.,* 1995 a).

Although it is a major factor for consideration, young age alone may not provide sufficient indication for use of DGA. In the majority of cases it was found that the children also had extensive treatment needs. More than half of the youngest age group had presented with extensive caries and this had been the primary indication for treatment under DGA. One report has suggested a prevalence of rampant caries in parts of Saudi Arabia in the region of 30% (Al-Malik, 2000). In contrast, in older children a higher proportion had received treatment under DGA because they were disabled or medically compromised in some way. In some investigations from other countries services have been especially concerned with this group of patients (Mitchell and Murray, 1985; Harrison and Roberts, 1998).

Caries levels in Saudi Arabia, as elsewhere, are related to social class, with children from lower classes having more disease. However, social class may also be related to service utilisation with children from higher classes having better access to services. Results suggested that although there may have been a relatively high proportion of children from professional classes attending, the four centres in Riyadh had provided treatment for children from a range of classes, whether this was measured in relation to father's occupation or the mother's level of education.

5.3 Treatment Provided Under DGA

Results show that for children using the service at the four centres in Riyadh, their treatment under DGA had involved a large number of items. The nature of treatment provided varied with age and the fact that it very largely involved primary teeth was a reflection of the young age of the majority of children in the study group at the time they had received treatment under DGA.

The types of treatment provided were similar to those carried out at other centres. Most children had received both extractions and restorations with smaller numbers having preventive items and very few having minor surgical procedures. As shown in Table 2.5 in reviewing previous studies, all of these types of treatment have been described in previous studies of similar services, although, where details have been given, the balance between items and their number has varied.

In the current study, more teeth were restored than were extracted. This was true for permanent teeth at all ages and for primary teeth in the younger, larger age groups. In the case of primary teeth, an average of 7.7 primary teeth were restored per child (using either simple or complex restorations) in the group as a whole and a further 4.2 teeth extracted. It was beyond the scope of this thesis to consider the pattern of teeth extracted and restored but it may be imagined that the teeth treated, on average may have included four upper primary incisors and all eight primary molars, these teeth being the most susceptible to caries (Holt, 1995).

As would be expected, treatment was related to age of the child and results have been shown in relation to age group. It could be seen that numbers of restorations (of primary teeth) per child were highest in the youngest children and numbers of extractions highest in those aged between 5 and 8 years. Also as would be expected, numbers of items for permanent teeth were highest in the oldest group.

The large amount of treatment and the predominant use of restorative care seen here have been reported in some previous studies, particularly those from Saudi Arabia (O'Sullivan and Curzon, 1991; Bello, 2000; Jamjoom *et al.,* 2001), but average numbers of items, particularly those in primary teeth, exceed those reported previously. In some past studies, DGA services of Day Care or hospital type and where comprehensive care could be provided, were used more often for extractions than for restorative treatment (Harrison and Roberts, 1998), or have evolved towards use for minor oral surgery (Mason *et al.,* 1995 a). In the current study, even in the oldest age group, less than 2 permanent teeth were extracted per child and only three children in the study group had any form of minor surgery carried out under DGA. Differences may reflect the characteristics, such as age and medical status, and the needs of patients who present but may also be a consequence of variations in treatment strategy and planning. Thus, at centres in Riyadh, (and in Jeddah), restorative treatment may be seen as a priority for the youngest children with extensive caries and DGA the best means of carrying this out satisfactorily when co-operation is insufficient for use of local anaesthesia. DGA services may therefore be directed strategically towards this type of treatment and patient. Even though general anaesthesia is only indicated for a small proportion of children the high levels of extensive caries in the child population indicate that such services are likely to face very heavy demand if this policy is to be widely and equitably applied.

Restorative care provided at the time of DGA had included simple restorations using amalgam, composite or glass ionomer cements, reflecting the range of materials available for the purpose. However, stainless steel crowns, which have been shown to have greater longevity than amalgam restorations, whether provided using local anaesthesia or under DGA, (Roberts and Sheriff, 1990; O'Sullivan and Curzon, 1991), were the most popular. These were provided for almost three quarters of the study group and for 3.5 primary teeth per child on average. Children of 0-4 years had more than 4 teeth restored in this way per child on average. These estimates are similar to values reported from Jeddah (Jamjoom *et al.,* 2001) and reflect the popularity of this technique for treatment of caries in young children amongst at least some specialist paediatric dentists in Saudi Arabia.

Other studies, like the current one, have reported preventive items of treatment being provided for permanent teeth for children under DGA (see Table 2.5). As in the present study, numbers of items have been relatively small. Whilst it demands a degree of co-operation, preventive treatment, such as fissure sealing, is a painless procedure and although it may be carried out under DGA at the same time for children requiring other items, it would not alone seem to justify use of the method in clinical terms.

In the next section of this chapter treatment experience during the period subsequent to the DGA episode and leading up to the time of examination will be considered further.

5.4 Treatment Experience During the 3 Years Prior to Examination

In the study, treatment experience of children in study and control groups was investigated through use of hospital records. Oral health care for children in Saudi Arabia is provided through a system centred on hospitals. Children may be referred by practitioners from satellite clinics or present direct to the hospital. In a situation where access to free treatment may be difficult and following referral from within the system, centres customarily come to be seen as the major source of oral health care available for children of that family. It was thought unlikely that more than a very small proportion of the families would have sought treatment elsewhere and that hospital records would therefore be a reasonable record of care over the three years.

Results showed differences in the way parents behaved in respect of dental visits for children in the two groups. It could be seen that subsequent to the DGA, children in the study group had attended relatively infrequently with an average of only 1.4 appointments being attended per child. The great majority had also failed to attend at least once. In contrast, their siblings had attended more than three appointments during the same period and fewer had failed. Other studies have similarly shown poor compliance with follow up after treatment of extensive caries in young children under DGA (Berkowitz *et al.,* 1997) and in this study poor compliance was seen in all age groups. The high level of failure may perhaps suggest that parents did not perceive the need to attend for regular follow up after extensive treatment under DGA. However, it may have been merely a reflection of a more general lack of perceived need to attend; few children in either study or control groups were reported to be taken to the dentist regularly. In children included in this study lack of a tradition of recall appointments and poor access to services may also have been important in this respect although these did not seem to affect attendance amongst children in the control group to the same extent. For some children, the effect of anxiety may have prompted the use of DGA, and it may have also been a disincentive to attendance. Parents may have wished to avoid any further upset for their child, particularly if the experience of DGA had been disruptive. Certainly, it may be concluded that provision of treatment under DGA had offered little incentive for regular attendance and may have discouraged.

In terms of treatment received, children in the study group had received more treatment than had those in the control group, despite attending less frequently. Twice as many teeth had been extracted, five times as many restored and twice as many treated preventively. The trend was seen both in the groups as a whole and in comparisons within age groups and was almost wholly a consequence of treatment provided under DGA since, when treatment under DGA was removed from the comparison then the reverse was true. The majority of children in the study group had received no further extractions or restorations in the subsequent three years. They had also received less preventive treatment although they might be regarded as being especially in need of aggressive preventive care. The low value for preventive treatment after the DGA may have been at least partly a result of the low level of attendance. It also needs to be borne in mind that not all preventive care was itemised in the records for those who did attend.

Oral health education and topical fluorides may have been provided for children in either or both groups but not recorded.

In considering results relating to treatment at and following DGA it may be concluded that the use of DGA had, in providing very large amounts of treatment, effectively reduced the need for extractions and restorations in children in the study group to a minimum, at least for the subsequent three year period. Children had not attended very much during the intervening years and despite having had apparently more disease experience had not made more emergency visits than their siblings. There were indications that parents may have perceived follow up as unnecessary.

When treatment was considered in relation to attendance, it may be concluded that DGA was a more efficient way of providing treatment than other methods since study group children received much more treatment in the space of relatively few visits. This benefit has been recognised by other authors (O'Sullivan and Curzon, 1991). O'Sullivan and Curzon estimated that, on average, more than six appointments per child would have been needed to complete the treatment provided under DGA for children in their study. Children in the present study received more treatment and would have required commensurately more appointments. Consideration of number of visits to complete treatment is likely to have an important effect on costs, both for the provider and for the families. The costs of providing comprehensive treatment under DGA in USA have been studied and it has been concluded that the cost of providing the same treatment using conscious sedation may well have been higher (Lee *et al.,* 2000). Effective prevention of disease has been seen as the best way to reduce costs of either method of treatment (Kanellis *et al.,* 2000; Griffin *et al.,* 2000). In the case of families, especially those for whom time off work had added to the costs of attendance the reduced number of visits may make DGA particularly acceptable. However, these apparent benefits in terms of economy need to be balanced against the increased risk in using DGA as well as the benefits in terms of longer-term outcome. The impact of using DGA on children and their families may also need to be taken into account. Use of this method, particularly when the child is treated as a hospital in-patient, may well have a strong effect on patient and parents.

For children unable to co-operate through fear or anxiety or because of their young age, (who formed a high proportion of children the study group), one important consideration is their subsequent acceptance of care using other methods with lower risk and lower impact. In using DGA, one aim is to restore the child's oral health in a single visit allowing behaviour modification methods to be introduced more readily afterwards (Mitchell and Murray, 1985; O'Sullivan and Curzon, 1991; Sheehy *et al.,* 1994; Bello, 2000). Success in this respect may be judged by the proportion accepting care using other methods in subsequent years. In this study, more than 60% of the study group had received no further intervention but 23% had accepted treatment, 15% with use of local anaesthesia and in 2 cases with the addition of sedation. Three children of the 347 had needed a second DGA. For a proportion, therefore, routine treatment had been successfully accepted. In other studies also, many children having DGA have been shown to accept treatment using other methods with relatively few requiring a second DGA. Despite this, there were indications that acceptance of treatment may still have remained lower amongst the study group, at least for the next few years. Although it may partly have related to differing treatment need, it could also be seen that a higher proportion of children in the control group, who were younger in age, were reported to have received treatment using local anaesthesia.

For 45% of children aged 5 or more at the time, treatment under DGA had been indicated because they had been unable to co-operate indicating a high level of anxiety in at least some children. The extent to which the DGA itself had influenced levels of anxiety is not known since no measurement of this had been made at the time. It seems likely that many of these children had been and remained anxious; three years after the DGA, a higher proportion of study group children in all age groups reported themselves as being anxious, or very anxious. Parents also perceived a higher proportion of those in the study group who were aged 9 or more to be anxious or very anxious.

It could be seen from responses given by parents to questions, for example about the speed with which their child had returned to normal following the DGA, that they clearly remembered the event three years previously suggesting a high degree of impact. This was borne out further by the fact that, despite the apparent advantages of treatment using DGA, and rapid recovery afterwards, three quarters of parents expressed a preference for local anaesthesia for both study and control group children. In this context, it needs to be remembered that for a high proportion of the study group treatment had been as a hospital in-patient.

That not all parents thought in this way, or that some may have been pragmatic about a child who had perhaps been too anxious to receive treatment with local anaesthesia in the past, was shown by differences when data was broken down by age group. Preferences were similar for younger study and control groups children (where the study group child had been very young at DGA and might be though able to cope better with greater maturity), but differences between groups were more marked in older children, where the study group child had more often received DGA because of anxiety, and more of whom were perceived to be anxious.

Measurement of oral health provides one objective outcome measure following treatment of disease. The next section considers results of the study relating to oral health assessment for study group children and their siblings.

5.5 Oral Health Status in Children Three Years After Treatment Under DGA and in their Siblings

Results of the examination carried out 3 years after treatment under DGA showed children in the study group to have very high levels of caries experience. All had some disease experience and in the primary dentition children had, on average, 9.2 teeth and 34.9 surfaces affected. In contrast 21% of the control group appeared to have no clinically obvious caries. Average dmft values ranged from 4.9 in the control group for 0-4 year old children to 13.2 for study group children of the same age.

These values may be compared to others for children of the same age. In some cases, values reported here are higher than those seen in other studies in the country but in other cases similarities may be seen. For example, Al-Malik has recently reported a dmft of 4.8 per child for 2-5-year-old children in Jeddah (Al-Malik, 2000), an estimate very similar to the 4.9 per child seen in control group children of equivalent age in the present study. Estimates of prevalence were also similar, 79% of 0-4 year old children in the control group had some caries experience compared to 73% reported by Al-Malik. In 9-12-year-old children, values for dmft and DMFT appear similar to those reported for Riyadh by Al-Banyan et al (Al-Banyan *et al.,* 2000). Thus although they may have been a very selected sample, children in the control group had broadly similar caries experience to at least some other children in Saudi Arabia. In contrast, there would appear to have been few population based estimates approaching the average dmft and dmfs values reported for the study group, particularly in the younger age groups. This result indicates the extremes of caries experience seen in the primary dentition in the children who had treatment under DGA.

Previous studies have shown dmft/s values in young children to be made up for the most part of decayed teeth and surfaces. This was true of the control group in the present study but in the case of the study group, missing and filled surfaces made up the greatest fraction of total values. Children in study and control groups were siblings. Although regarded as independent for analytical purposes, the groups were therefore matched in terms of social class and home environment. In this situation, their caries experience might be expected to be similar and it might be suggested that the very large differences between study and control group in dmft and dmfs were at least partly a result of more aggressive treatment planning for children receiving treatment under DGA. The fact that the values in the study group were largely made up of filled and missing teeth might be thought to lend support to this hypothesis. In absolute terms, the amount of active disease remaining in the study group was little different to that in the controls, again perhaps suggesting that the treatment largely accounted for the difference seen.

Against this hypothesis was the fact that there were also marked differences between the two groups for caries in permanent teeth, with children in the study group having a higher caries prevalence and higher mean DMFT/DMFS and DT/DS per child. Whilst values for primary teeth may be thought skew as a consequence of the amount and type of treatment received, the same could not be said for permanent teeth, since little treatment had been provided in the permanent dentition and values were made up largely of decayed untreated teeth. Part of the difference in permanent teeth may have related to age, as indicated by results of the multivariate analysis but the difference between groups occurred within all age groups and the very strong effect of group as well as age was also confirmed in multivariate testing. Thus, the finding of consistently higher disease levels in permanent teeth, in contrast to that in primary teeth, may indicate a genuinely higher susceptibility to caries of children in the study group. If high caries susceptibility in permanent teeth follows that in primary teeth as has been suggested in the past (Al-Ghanim *et al.,* 1998) then this finding may be confirmation that the large amount of treatment was carried out in response to more extreme levels of caries in the study group. In these circumstances the effect of treatment under DGA may be regarded as beneficial in having reduced disease in primary teeth to a level no worse than that seen in their less susceptible siblings. In the case of neither study nor control group had treatment strategies been effective in wholly preventing further disease.

That there were genuine differences in oral health was shown further in other disease measures. Children in the study group were not only worse off in terms of total caries experience, but their levels of plaque and gingivitis were also worse. Plaque accumulation (and gingivitis) may be encouraged by restorative care, although stainless steel crowns may be better than other restorations in this respect, so that some differences might be expected, but its importance was demonstrated by the fact that presence of plaque was shown to have an independent relationship to caries in permanent teeth. It was also shown to relate to gingivitis, which was in multivariate testing also related clearly to age and, to a lesser extent, to social class.

Some possible reasons for differences in oral health status between study and control groups were investigated through the questionnaires completed by parents. Caries is well known to relate to social class and the relationship has been demonstrated in Saudi children (Al-Shammary *et al.,* 1991; Al-Mohammadi *et al.,* 1997). In this study however, although children from differing social classes were included, no differences could be detected in caries in either study or control group, either when class was measured in terms of father's occupation or when it was related to the mother's education. Only in the case of gingivitis, in multivariate analysis, did social class emerge as a significant risk factor. In contrast, the strong differences between study and control group children were obvious within each class grouping. The pattern was also consistent in differing age groups.

The lack of clear distinction in oral health status between children from different social classes may have related to a large extent to the select nature of the sample. All children in the study group were patients who had received treatment under DGA. DGA services are used only for children who present for care and for whom they are indicated and the sample could not therefore be regarded as necessarily typical of the population of Riyadh or of Saudi Arabia. As their sibling, the control group may be considered in the same light.

Difficulty in measuring social class in Saudi Arabia may also have been a factor. These were discussed in the review of literature and include the problem of using occupation as a measure when those in unskilled occupations earn large incomes. In the current study an additional difficulty was seen in that over a third (35%), of the children could not be classified. In many cases this was because their father held a military appointment, making it difficult to assign them to an occupational category.

Whilst difficulties in classification may help to explain the lack of difference in relation to occupation, the same pattern was seen when the mother's level of education was used as a proxy measure. This finding would seem to lend support to the hypothesis of no social class related difference in oral health status in this highly selected sample.

In the study, parents were asked simple questions about diet and oral hygiene practices for their children. In relation to dietary habits, a slightly higher proportion of children in the study group had started weaning at 6 months or less and slightly more were said to regularly eat all three of a series of selected types of cariogenic food. These differences were statistically significant but were small in real terms. There appeared to be little difference in confectionery consumption but fewer children in the study group were reported to drink water twice a day or more often. These results need to be viewed with caution since the information relates only to reported behaviour for children who were known to have required large amounts of treatment in the past and for a group of their siblings. Weaning age, which appeared from the data to be the most significant dietary variable, did not emerge as significant in multivariate analysis and the small differences seen would seem unlikely to have been sufficient to wholly account for the large differences in disease.

Similar caution may be needed in relation to reported tooth brushing behaviour. More children in the study group brushed only once a day or less often and more brushed alone without help. Plaque and gingivitis are well known to relate to tooth brushing so that this difference seems likely to have contributed to the difference in these two measures between groups. The relationship between oral hygiene and caries is less clear cut so that the difference in tooth brushing itself may not necessarily have affected caries outcomes. However, if the difference between groups is real and toothpaste was used each time the teeth were brushed then this might be expected to have made a contribution to the better dental health seen in control group children who had brushed more often. However, like weaning age, tooth-brushing frequency did not emerge as significant in multi-variate analysis. These results again rely on reported behaviour and must therefore be viewed with some caution.

Because children in study and control groups were from the same families, differences in diet and infants feeding practice, and in oral health behaviours, might not have been anticipated. Differences may have been chance results in a series of comparisons, although this seems unlikely since they were consistent in showing poor habits in children with poorer oral health, at least when groups were considered as a whole. Differences may also have been directly related to differences in ages of the children, although where additional analysis was carried out by age this was not always the case. For example, whilst more children in the control than the study group brushed their teeth twice a day in all age groups, only in the younger groups did more control group than study group children receive help or supervision in brushing.

Saudi Arabia is a rapidly changing country. Developments in health care include provision of oral health promotion and schemes of oral health education. Parents of children in the study may well have come to be affected by such schemes either directly or indirectly over the years and it may be that differences in reported behaviours towards older and younger children are a consequence.

A further possible explanation is that differences between study and control groups represent changed practice as a consequence of either the high disease levels in the older child (in the study group), or the methods of treatment or both. Thus it may be hypothesised that the impact of the DGA had resulted in changed behaviour in respect of the younger sibling. However, the determinants of oral health related behaviours are complex and this hypothesis may need to be viewed with caution. Whilst it may seem reasonable with regard to some factors well known to affect oral health, such an influence seems unlikely to have affected others, such as age at weaning which was likely to have occurred for the sibling before the DGA but which showed the greatest difference.

Certainly, the finding that there were differing perceptions and preferences in terms of both attitudes to care and to oral health related behaviours expressed by at least some parents for children who did and who did not have treatment under DGA, suggests that the impact of this treatment method on families as well as on patients merits further investigation. Qualitative research methods might be especially valuable in this context. Measurement of change in attitudes and behaviour also require longitudinal approaches. Both of these would go beyond the relatively simple questionnaire used in the current cross-sectional survey.

It was not an aim of this study to evaluate the quality of items of treatment that had been provided under DGA directly. There were, nevertheless, two indirect indications of the extent to which treatment may have failed. The first was the extent of re-treatment. In the three years subsequent to the DGA, forty eight children had required repeat restorations of either primary or permanent teeth, some on more than one occasion, with an average of 0.2 teeth per child being re-restored. In addition, 25 had needed extractions, with 0.1 teeth being removed per child on average. Had all these extractions and re-restorations represented failed treatment, this was still a relatively small proportion of the 11.4 teeth per child restored under DGA.

A second indication lay in the finding of the dental examination in the extent to which previously restored teeth and surfaces show new caries. In the study group, filled and decayed surfaces made up an average of 0.9 surfaces per child. Again, this number is relatively small, with new, previously untreated surfaces experiencing most of the disease. It is also small relative to the 17.9 restored (otherwise sound) surfaces present per child. Both of these indications would seem to confirm the success of the bulk of restorative treatment provided under DGA in most cases, at least for the subsequent three-year period.

In summary it may be concluded from the results of the dental examination that in some respects, children in the study group experienced poorer oral health than did their siblings. The differences could not be attributed wholly to the effects of treatment but may have been the reason for it. Results showed that there were some differences in oral health behaviours for children within families but it could not be concluded that these were the only reasons for differences seen in oral health. In terms of caries in primary teeth, for which the majority of treatment under DGA had been provided, children may have been little different to their siblings in terms of need for care at the end of three years, despite having potentially higher disease susceptibility. What indications there were suggested restorative treatment provided under DGA had been largely successful for the three years following.

The study has considered provision of treatment under DGA at four centres in Riyadh. It was apparent that the centres served patients from within the city with a high proportion living near their centre of treatment with very few needing to travel for more than 45 minutes. The study had included four of the six services in the city. If the other two services similarly served relatively local populations then it seems likely that access to DGA services for children may be limited in many parts of Saudi Arabia. Although these services are indicated for only a small proportion of child patients, the very high levels of disease seen in young children in the kingdom suggest that DGA services used in this way are unlikely to have the capacity ever to provide for more than a very small percentage of children who may benefit from them.

5.6 Preliminary Conclusions

Both positive and negative conclusions about provision of treatment under DGA may be drawn from results of this study.

In term of benefits, it could be concluded that:

1. Use of DGA had allowed efficient provision of treatment; children with very high levels of disease had received large amounts of treatment at a single visit. There were some indications that failure rates for restorative care had been low in relation to the large number of items provided.

2. There may have been a reduction in perceived treatment need for the subsequent three year period: In the three years after DGA children in the study group had made fewer visits, had received less treatment and had made no more emergency visits than their siblings.

3. At the end of a three-year interval children in the study group had much higher levels of caries in the primary dentition but most of the disease experience was made up of treated teeth. Numbers of teeth with active caries formed less of the total disease experience and had been reduced to a level not significantly different to that seen in their siblings.

4. A proportion of children who had DGA and who needed further treatment had come to accept this treatment using local anaesthesia in the subsequent three-year period.

These positive outcomes need to be balanced by the following:

1. Children in the study group had continued to have high levels of caries in permanent as in primary teeth. A higher proportion had untreated disease perhaps as a consequence of making fewer visits. They also had higher levels of plaque and poorer gingival health than their siblings.

2. Not all children had been able to accept treatment using other methods in the subsequent period and a higher proportion reported themselves as tense or anxious than did so in the control group.

3. Treatment under DGA did not encourage continuing dental visits. Parents did not perceive a need for regular attendance following the DGA but there may be particular barriers to access to dental care for children in Saudi Arabia. Low levels of perceived need, lack of a tradition of regular attendance and shortage of primary dental care services for children may make it difficult to institute programmes of prevention and oral health promotion that are dependent on dental visits, even in this selected group of children with very high levels of disease.

4. Recovery following DGA was rapid for the majority of children. The majority of children had been admitted to hospital for treatment and although the method had been apparently well accepted, parents most often preferred that future treatment be carried out using local anaesthesia for children in both study and control groups.

Provision of treatment under DGA represents a specialised service for highly selected groups of patients. However effective the services had been, they were unlikely ever to serve more than a small proportion of children in need. The very high levels of caries in children in Saudi Arabia mean that population based oral health promotion measures such as water fluoridation and coordinated intersectoral approaches are essential if oral health as a whole is to be significantly improved. Although the situation is changing rapidly, many children may currently have limited access to primary care services and development of these; perhaps through work with primary medical care services would also seem a priority.

This study represents a follow up to treatment using DGA at centres for secondary care. Although longevity of restorative treatment has been investigated there would appear to have been little similar assessment of the longer-term effects of treatment as a whole in either primary or secondary care, using other methods of management. The apparent lack of effective treatment of caries in the control group, even in centres staffed by specialists in paediatric dentistry, points to a need for similar research into treatment strategies using other methods of management and to the development of alternatives to DGA for children with high levels of disease.

CHAPTER SIX

Principal Findings

6.1 PRINCIPAL FINDINGS

6.1.1 Phase I

1. At the time of the study there were 6 government-funded centres in Riyadh providing comprehensive treatment under DGA for children.

2. At the four centres agreeing to take part, a total of 483 children were identified as having received treatment under DGA in the two-year period between 5/1/95 and 31/12/96.

3. Of the children 437 (93%) were less than 10 years of age and 240 (50%) were aged 4 or less. Children aged 4 or less made up more than 60% of the total at two of the four centres.

4. Three hundred and fifty (73%) of the children had received treatment that involved both restorations and extractions and 113 (23%) only restorative care. There were some differences in treatment patterns between the centres; at one of the four 80% of children had at least some teeth removed but fewer did so at the other three. These differences did not appear to relate to differences in age group of patients treated at the centres.

6.1.2 Phase II

1. Three hundred and forty seven (72%) of children identified in the first part of the study as having had treatment under DGA attended for dental examination (study group). Of these, 319 (92%) attended with a sibling (control group). For purposes of statistical analysis, study and control groups were regarded as independent.

2. Children in the study group were significantly older and higher in birth order than were those in the control group. Mean age for the study group at the time of dental examination was 8.4 years and the mean for their siblings was 6.2 years. At the time of treatment under DGA, 190 (55%) children had been aged 4 or less and 324 (94%) had been 8 years old or less.

3. Children in the groups came from a range of social class backgrounds. In terms of their fathers' occupations, 153 (44%) of those in the study group came from professional classes and 72 (21%) from middle classes. One hundred and twenty two (35%) had fathers who held military appointments or had other occupations. Mothers of 99 (29%) children had been educated to college or postgraduate level but for 39 (11%) their mothers' education had not extended beyond primary school.

6.2 Treatment Provided Under DGA

1. Treatment provided under DGA included simple and complex restorative treatment, extractions and preventive items. The majority had received more than one type of treatment under DGA with 135 (39%) having simple and complex restorative care and extractions. Very few children had minor surgery carried out at the four centres during the period under study.

2. Treatment more often involved primary than permanent teeth. In the group as a whole, children had an average of 4.2 primary teeth extracted and 3.8 restored per child using simple procedures and a further 3.9 per child restored using more complex methods. Two hundred and fifty two (73%) children had stainless steel (preformed metal) crowns provided for primary teeth with an average of 3.7 teeth per child being restored in this way. In the permanent dentition an average of 0.1 teeth had been extracted and 0.3 restored per child.

3. Provision of restorative treatment for primary teeth was greatest in children who had been the youngest at the time of treatment. The 190 children who had been aged 0-4 at the time of DGA had an average of 9.2 teeth restored per child and a further 3.8 extracted. In the 134 who had been aged 5-8 years, 6.8 primary teeth had been restored and 5.4 extracted. In permanent teeth an average of 8.4 teeth had been restored and 1.3 extracted in the 7 children who had been 13 years of age or older at the time of DGA.

4. The main indication for using DGA in the youngest children had been their extensive treatment need. A higher proportion of older children had been medically compromised or disabled.

5. Almost all the children who had received treatment under DGA lived in the city of Riyadh and had been brought to the centre by car in a journey lasting no more than 40 minutes. The most common problem faced in their attendance had been the need for parents to take time off work and the time of the appointment.

6.3 Treatment Experience of Children in Study and Control Groups

1. In the three years prior to the examination children in the study group had attended for an average of 1.4 appointments in addition to their visit for DGA. Three hundred and sixteen (91%) of children in the study group had failed at least one appointment. Their siblings in the control group had, on average, attended 3.3 appointments during the same period and 106 (33%) had failed one or more appointments. Few children in either group had attended as emergencies.

2. Children in the study group had received twice as many extractions and had five times as many teeth restored but this had been provided very largely at the DGA visit. Relatively few children in the study group had extractions (25; 7%) or restorations (48; 14%) carried out in the three years following DGA. Less than a quarter of children in either group had received fissure sealants or preventive resin restorations in the three years before examination. Although the parents

varied with age, differences in treatment experience between study and control groups were consistent in all age groups.

3. Since the DGA 52 (15%) of children in the study group had accepted treatment using local anaesthesia, in 2 cases with the addition of sedation. One hundred and seventy eight (56%) of those in the control group accepted treatment using local anaesthesia.

6.4 Oral Health Status in Study and Control Groups

1. Mean dmft for children in the study group was 9.2 and mean dmfs 34.9 per child. These values were made up largely of treated teeth and surfaces with mean mft being 7.4 and mfs 30.3 per child. Average dmft for children in the control group was 5.5 and dmfs 13.9 per child. Mean mft and mfs values in the control group were 2.4 and 7.3 respectively. Multivariate analysis showed Group (study or control) and age (8 years or less or 9 years or more) to be significant risk factors for dmft.

2. In permanent teeth, DMFT for the study group was 1.9 and in the control group 0.5 per child. In both groups decayed teeth made up approximately half of the total.

3. At the time of the study, 312 (90%) of children in the study group and 247 (77%) of those in the control group had active caries in primary teeth. In permanent teeth, 163 (47%) and 45 (14%) had active caries present. In children

aged 5 years or older, significantly more children in the study group had active caries present in their permanent teeth. Amongst children aged 8 years or less, more than 70% of those in the study group had active caries present compared to 60-67% amongst control group children of similar age. Although more children were affected there was little difference between the groups in the amount of untreated disease present in primary teeth when children of similar age were compared. In the permanent dentition, children in the study group had larger numbers of decayed teeth. In multivariate analysis, age group emerged as the only independent risk factor for numbers of decayed primary teeth (dt) but age group, group and the presence of plaque proved to be significant risk factors for decayed permanent teeth (DT).

4. In this study prevalence of caries, numbers of teeth affected and numbers of treated teeth were not significantly related to social class. This was true for primary and permanent teeth and for social class based on fathers' occupations and on mothers' educational level. Differences in caries between study and control group were seen consistently within each social class category.

5. Two hundred and twenty six (65%) of children in the study group had plaque present and 144 (42%) had gingivitis. In the control group 136 (43%) had plaque and 80 (25%) had gingivitis. The differences seen in plaque and gingivitis were seen consistently in age groups with the largest numbers of children. There was only a slight trend for plaque and gingivitis to increase with age. Group, age group, social class (professional class or other), and the

presence of plaque proved to be significant risk factors for the presence of gingivitis in multivariate analysis.

6. There were small differences in dietary behaviour between study and control groups. Parents reported 139 (40%) of children in the study group to have been weaned at the age of 8 months or later, compared to 102 (32%) of their siblings in the control group. Two hundred and seventeen (63%) of those in the study group ate confectionery at least once a day, (compared to 180 (56%) of the control group) and 295 (85%) drank water twice a day or more (compared to 298 (93%) of the controls).

7. Parents reported that they took 260 (75%) of study group children and 156 (49%) of those in the control group to the dentists only when they thought that this was necessary. For 49 (14%), treatment under DGA had been their first dental experience. For 106 (33%) of the control group the study examination had formed their first dental visit.

8. Two hundred and twenty six (63%) of the study group were reported to brush once a day or less (compared with 145 (46%) of the controls) and 202 (58%) did so without help or supervision (compared to 158 (50% of the controls).

9. Two hundred and eighty five (82%) of the study group children had returned to normal activity within 2-3 days and 292 (84%) to normal eating within the same period.

10. Using a simple picture scale, 162 (47%) of children in the study group reported themselves to be tense or anxious about visits to the dentist. Amongst children in the control group, 123 (39%) did so. When asked which method of treatment they preferred for the future, three quarters of the parents preferred local anaesthesia for children in both study and control groups.

6.5 Need for Further Research

1. Children in the study group had received large amounts of treatment for primary teeth within a small number of visits. There were indications that these children had a higher susceptibility to caries than their siblings but the treatment they had received had left them little worse off in terms of the amount of treatment need in primary teeth despite having made fewer visits. There were indications that the need for re-treatment was small. Research is needed into the reasons for differing susceptibility within families.

2. Both study and control groups were in need of preventive care but methods which rely on regular dental visits seem unlikely to succeed in this group of patients. Results of this study and the high levels of caries seen in epidemiological investigations demonstrate the need for research into effective population centred methods of promoting oral health for children in Saudi Arabia.

3. There is a need for long-term evaluation of treatment of caries using alternative methods of management. This should not be confined to evaluation of single

treatment items or interventions but should include evaluation of courses of care over the medium and long term.

4. Further prospective study of patients who receive treatment under DGA and their siblings would allow assessment of their oral health status at the time of treatment. This would be of particular values in determining effectiveness at the follow up. Measurement of attitude and oral health behaviour both at the time of DGA and subsequently would also be of value in determining the influence of the method on these factors.

5. The impact of DGA on patients and on their families merits further research. This should include impact of DGA in day care facilities as well as through hospital in-patient care. This is likely to benefit from being carried out using qualitative research methods.

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APPENDIX I

Copies of Letters Send to Hospital and Formal Approval of the Study

بسم الله الرحمن الرحيم

المملكة العربية السعودية
وزارة التعليم العالي
مكتب الوزير

معالي المدير العام التنفيذي للشئون الصحية بالحرس الوطني الموقر

السلام عليكم ورحمة الله وبركاته :

تقدمت الطبيبة / منال محمود جمجوم – التي تدرس الدكتوراه بمعهد إيست مان لعلوم العناية بصحة الفم – الملحق بجامعة لندن – بالاستدعاء (المرفقة صورته مع مشفوعاته) الذي تلتمس فيه اتاحة الفرصة لها بالاطلاع في مجال تخصصها على ملفات الأطفال الذين تمت معالجة أسنانهم خلال الفترة من بداية سنة ١٩٩٥ حتى نهاية ١٩٩٦م ، باستعمال التخدير الكلي لتقارن حالتهم بالأطفال الذين يعالجون باستعمال التخدير الموضعي . حيث أنها بصدد إنهاء بحثها لنيل درجة الدكتوراه في هذا المجال .

آمل تلطف معاليكم بتوجيه الجهة المختصة بمساعدتها في ذلك .

ولمعاليكم أطيب تحياتي ؛؛؛

وزير التعليم العالي

د . خالد بن محمد العنقري

الرقم ١٥٨٨ / ٢ التاريخ ١٨ / ٨ / ١٤١٨هـ المرفقات ١٤

المملكة العربية السعودية
وزارة التعليم العالي
مكتب الوزير

معالي مدير جامعة الملك سعود

السلام عليكم ورحمة الله وبركاته :

تقدمت الطبيبة / منال ~~محمد~~ ممدوح جمجوم – التي تدرس الدكتوراه بمعهد إيست مان لعلوم العناية بصحة الفم – الملحق بجامعة لندن – بالاستدعاء (المرفقة صورته مع مشفوعاته) الذي تلتمس فيه اتاحة الفرصة لها بالاطلاع في مجال تخصصها على ملفات الأطفال الذين تمت معالجة أسنانهم خلال الفترة من بداية سنة ١٩٩٥ حتى نهاية ١٩٩٦م ، باستعمال التخدير الكلي لتقارن حالتهم بالأطفال الذين يعالجون باستعمال التخدير الموضعي . حيث أنها بصدد إنهاء بحثها لنيل درجة الدكتوراه في هذا المجال .

للإطلاع واتخاذ ماترونه مناسباً لمساعدتها في ذلك .

ولمعاليكم تحياتنا ؛؛؛

وزير التعليم العالي

د . خالد بن محمد العنقري

التاريخ ١٨/٨/١٤١٨هـ المرفقات ٤

بسم الله الرحمن الرحيم

المملكة العربية السعودية
وزارة التعليم العالي
مكتب الوزير

صاحب المعالي وزير الصحة   الموقر

السلام عليكم ورحمة الله وبركاته :

تقدمت الطبيبة / منال محمود جمجوم - التي تدرس الدكتوراه بمعهد إيست مان لعلوم العناية بصحة الفم - الملحق بجامعة لندن - بالاستدعاء (المرفقة صورته مع مشفوعاته) الذي تلتمس فيه اتاحة الفرصة لها بالاطلاع في مجال تخصصها على ملفات الأطفال الذين تمت معالجة أسنانهم خلال الفترة من بداية سنة ١٩٩٥ حتى نهاية ١٩٩٦م ، باستعمال التخدير الكلي لتقارن حالتهم بالأطفال الذين يعالجون باستعمال التخدير الموضعي . حيث أنها بصدد إنهاء بحثها لنيل درجة الدكتوراه في هذا المجال .

آمل تلطف معاليكم بتوجيه الجهة المختصة بمساعدتها في ذلك .

ولمعاليكم أطيب تحياتي ؛؛؛

وزير التعليم العالي

د . خالد بن محمد العنقري

الرقم ٢/١٥٩٢ التاريخ ١٤٢٦٨١٨١١٨هـ المرفقات ١٤

بسم الله الرحمن الرحيم

المملكة العربية السعودية
وزارة الصحة
مديرية الشئون الصحية في منطقة الرياض

الرقم : ٤٢١٥٧
التاريخ : ١/٩/١٤١٨هـ
المشفوعات : بدون

الموضوع ....

((تعميم))

سعادة / المشرف العام على مجمع الرياض الطبي **المحترم**

سعادة / مدير مستشفى (داخل وخارج مدينة الرياض) **المحترم**

السلام عليكم ورحمة الله وبركاته

اشارة الى خطاب سعادة وكيل الوزارة للتخطيط والتطوير بالنيابه رقم ١/٦٣٤٥ وتاريخ ١٤١٨/٨/٢٧هـ بخصوص الطبيبه / منال ممدوح جمجوم التي تدرس الدكتوراه بمعهد ايست مال لعلوم العناية بصحة الفم - الملحق بجامعة لندن والتي تقدمت لنيل درجة الدكتوراه ببحث عنوانه (مقارنة صحة الفم وطرق العناية بالاسنان بين الاطفال الذين تم علاجهم باستخدام البنج الموضعي في مستشفيات مدينة الرياض) .

عليه نأمل منكم تسهيل مهمة الباحثه خلال اجراء هذه الدراسه ومساعدتها حسب الامكانية المتوفره لديكم .

تجدون بطيه كامل مشفوعات المعامله .

ولكم تحياتي ،،،،،

مساعد المدير العام لشئون المستشفيات

د / فهد بن سليمان السديري

ص / ادارة المستشفيات / قسم الاسنان
العام

Kingdom of Saudi Arabia
Ministry of Health

المملكة العربية السعودية
وزارة الصحة
الوكالة المساعدة للتخطيط والبحوث

الإدارة العامة للبحوث الطبية

سعادة مدير عام الشئون الصحية بالرياض المحترم

السلام عليكم ورحمة الله وبركاته ...

إشارة إلى خطاب معالى وزير التعليم العالى رقم ٢/١٥٩٢ وتاريخ ١٤١٨/٨/١٨هـ والموجه إلى معالى وزير الصحة والمحال إلينا من سعادة الوكيل للتخطيط والتطوير بخصوص الطبيبة منال ممدوح جمجوم التى تدرس الدكتوراة بمعهد إيست مان لعلوم العناية بصحة الفم – الملحق بجامعة لندن والتى تقدمت لنيل درجة الدكتوراة ببحث عنوانه (مقارنة صحة الفم وطرق العناية بالأسنان بين الأطفال الذين تم علاجهم باستخدام البنج الموضعى فى مستشفيات مدينة الرياض) .

عليه آمل منكم الايعاز لمن يلزم بتسهيل مهمة الباحثة خلال اجراء هذه الدراسة ومساعدتها حسب الإمكانية المتوفرة لديكم ، وتجدون بطيه كامل مشفوعات المعاملة للاطلاع.

شاكرين لكم حسن تعاونكم .

مع أطيب تحياتـــــي ،،،

وكيل الوزارة للتخطيط والتطوير بالنيابة

د. عثمان بن عبدالعزيز الربيعة

الرقم : ٣٧/٣٥٥ المرفقات : ١١٧ صفحة

التاريخ : ١٤١٨/٨/٢٤هـ

تليفون : ٤٠٢٧٣٦٧ - ٤٠٣٠٧٨٩ - فاكس : ٤٠٣٠٧٨٩ الرياض ١١١٧٦
Tel. 4027367 - 4030789 - Fax 4030789 Riyadh 11176

بسم الله الرحمن الرحيم

المملكة العربية السعودية
وزارة الدفاع والطيران والمفتشية العامة
رئاسة هيئة الأركان العامة
الادارة العامة للخدمات الطبية للقوات المسلحة

إدارة التدريب والإبتعاث
الإبتعاث

الرقم: ٤٢٨٢٤/٦/٩
التاريخ: ٢٩/٨/١٤١٨هـ
المرفقات:
الموضوع: مساعدة طبيبه في بحثها

منال بنت محمود جمجوم – طبيبة مقيمة – الم (٢) – ٩٠٢٠٣٨١٥ – م. الرياض العسكري

....

سعادة مدير مستشفى القوات المسلحة بالرياض

السلام عليكم ورحمة الله وبركاته ،،،

الطبيبة الموضحة هويتها بعالية في إجازة دراسية وتدرس الدكتوراه بمعهد ايستمان لعلوم العناية بصحة الفم بجامعة لندن ٠

وإشارة إلى خطاب معالي وزير التعليم العالي رقم ٢/١٥٨٩ وتاريخ ١٤١٨/٨/١٨هـ المرفق نسخه منه المتضمن أن الطبيبة المذكورة بصدد انهاء بحثها لنيل درجة الدكتوراه وطلب معاليه مساعدتها بأتاحة الفرصة لها بالأطلاع في مجال تخصصها على ملفات الإطفال الذين تمت معالجة اسنانهم خلال الفترة من بداية سنة ١٩٩٥م حتى نهاية سنة ١٩٩٦م بأستعمال التخدير الكلي لتقارن حالتهم بالإطفال الذين يعالجون بأستعمال التخدير الموضعي ٠

وإشارة إلى موافقة سعادة مدير عام الإدارة العامة للخدمات الطبية للقوات المسلحة شرحاً على ذلك ٠

نأمل بعد الإطلاع توجيه المختصين لديكم بمساعدة المذكورة في ذلك ٠

والسلام عليكم ،،،

العقيد

إبراهيم بن عبدالرحمن الملحم

مدير إدارة التدريب والأبتعاث

نسخة – لمدير عام شئون الموظفين للاحاطة ٠
نسخه – للتدريب مع الأساس – ملفها + ٦٥/ت ٠
نسخه – للصادر العام ٠
أ... الجنيح ٨/٢٨ – ٥

APPENDIX II

Copies of the consent letter for the parents and the questionnaires

Eastman Dental Institute for Oral Health Care Sciences

256 Gray's Inn Road, London WC1X 8LD

elephone: +44 (0)20 7915 1000 www.eastman.ucl.ac.uk Facsimile: +44 (0)20 7915 1012

UCL

National Centre for Transcultural Oral Health
Professor Raman Bedi DDS MSc BDS FDSRCS
Tel: 020 7915 2314/1193 Fax: 020 7915 1233
E-mail: R.Bedi@eastman.ucl.ac.uk
http://www.eastman.ucl.ac.uk/staff/rbedi.html

Oral Health Status in children who had treatment under general anaesthesia and in their siblings.

Dear Parent,

We believe that general anaesthesia can be very useful for dental treatment for children who are too young or too anxious to have this carried out whilst they are awake.

While we know that is if of great help in the short term, we are not so certain as to how effective it is in the longer term.

I am therefore now carrying out a research project in Riyadh to evaluate oral health and the current acceptability of treatment amongst children who had dental treatment under general anaesthesia three years ago. Our records show that your child was one of these and this is the reason why we are seeking your help.

Helping us will involve your completing the attached short questionnaire and my examining your child and his or her siblings who had treatment using other methods. Completing the questionnaire and carrying out the dental examinations will take no more than a few minutes.

Any information you give us will be regarded as strictly confidential and will be used only for statistical purposes. If you prefer not to take part this will have no effect on future treatment for your child or your family.

Information given by you and your children will help us to evaluate the longer term outcome of treatment carried out under general anaesthesia and to compare this with other methods of care. Your contribution together with that given by other families in the study therefore carries potential to help all children who need general anaesthesia for dentistry in the future.

Thank you for your cooperation

Dr. Manal Jamjoom
Postgraduate Researcher
055499721

Dean and Director of Studies and Research
Professor Crispian Scully MD. PhD. MDS. FDSRCS. FDSRCPS. FFDRCSI. FDSRCSE. FRCPath. FMedSci

The Eastman Dental Institute is part of University College London and the Federal University of London
h:\toh\rbedi\letters\
The Institute hosts the World Health Organization Collaborating Centre for Research, Education and Service in Oral Health, Disability and Culture

Data Collection Sheet 1

(Parents Interview)

Hospital No.; _____. **Date of interview:** ____/____/____.

Study No.: ________. **Hospital file No.:** ______________.

Child's name: ____________________________________.

Name of parent: ________________________________.

1. **Relationship to child:**
   - ☐ Father ☐ Mother
   - ☐ Grandparent ☐ Others _____________.
2. **How many children in the family do you have?** _________________.
3. **Where does the child come in the family?**
   - ☐ First ☐ Second
   - ☐ Third ☐ Fourth
   - ☐ Other: _______.
4. **Where do you live (Home address)?** _________________________.
5. **How often do you take your child to the dentist?**
   - ☐ Every 6-month for check up
   - ☐ Every year for check up
   - ☐ When you think it is necessary
   - ☐ When he/she has any problem
   - ☐ Never taken until the hospital visit.
6. **At what age did you first take your child to the dentist?** ________________.
7. **How did you travel to the hospital today?**
   - ☐ Own car ☐ Relative's car
   - ☐ Taxi ☐ On foot
8. **Do you remember how you travel for the DGA day?**
   - ☐ Own car ☐ Relative's car
   - ☐ Taxi ☐ On foot ☐ Cannot remember

9. Do you have any difficulty in reaching the hospital?

DGA day;

☐ Yes ☐ No ☐ Some

A; Today;

☐ Yes ☐ No ☐ Some

B; In Any Previous Visits;

☐ Yes ☐ No ☐ Some

C; Always have difficulty;

☐ Yes ☐ No ☐ Some

10. What are the difficulties you face?

☐ Transportation ☐ Parking

☐ Time off from work ☐ Appointment time

☐ Any Others ________________________________.

11. Do you remember your child having dental treatment under general anaesthesia?

☐ Yes ☐ No

☐ A Little only

12. What do you remember about this visit? ______________________

____

13. Most children return to normal very quickly after DGA. How soon did your child recover from anaesthesia?

A; Return to normal eating

☐ Same day ☐ Next day

☐ 2-3 days ☐ Longer than that.

☐ Can not remember

B; Return to normal activities and school

☐ Same day ☐ Next day

☐ 2-3 days ☐ Longer than that.

☐ Can not remember

14. If your child needed the same treatment again now, would you prefer that it carried out under;

☐ Local anaesthesia

☐ General anaesthesia

☐ You will never let your child to have this sort of treatment again.

15. Have you taken your child to the dentist since the treatment under GA?

☐ Yes ☐ No

A; <u>IF YES</u>, Where have you taken him/her?

☐ Same Hospital

☐ Other clinic ________________________________.

16. What dental treatment has your child needed since the hospital treatment?

☐ Check up only ☐ Preventive care

☐ Extractions ☐ Restoration

☐ No treatment needed ☐ Other treatment __________.

17. How often does your child brush his/her teeth?

☐ Once/day ☐ Twice/day

☐ Three times/day ☐ Do not brush.

☐ Any other ________________________.

18. Do you help with brushing?

☐ I do the brushing for them usually or always.

☐ I supervise the brushing and check.

☐ Child brushes own teeth.

19. How do you think, your child feel at the day of having appointment with dentist?

☐ Relaxed ☐ Little uneasy

☐ Tense ☐ Anxious ☐ Very anxious or physically sick.

20. Which of the following kinds of food does your child eat most days?

☐ Vegetable ☐ Fruits ☐ Meat

☐ Crisp ☐ Chocolate ☐ Cheese

☐ Candy ☐ Biscuits

☐ Other kinds of food? What are these? __________________.

20. **How often does your child eat Confectionery?**

- ☐ Not every day
- ☐ Once/ day
- ☐ Twice/ day
- ☐ Three times/ day
- ☐ More than three times /day
- ☐ Others ____________________

21. **What kinds of the following drinks does your child drink during the day?**

Drink	<1 / day	1 X day	2 X day	3 X day	>3 / day	No respond
Pepsi						
Coca cola						
7 UP						
Miranda						
Diet drinks						
Sparkling water						
Fresh juice						
Packed juice						
Diluted juice						
Milk						
Tea						
Herbal Tea						
Chocolate milk						
Milk with flavour						
Water						
Others						

22. **At what age did your child start on solids?**

- ☐ Less than four months
- ☐ Four Months
- ☐ Six Months
- ☐ Eight Months
- ☐ Others ________________.

23. **Level of education of Father**

- ☐ Primary
- ☐ Secondary
- ☐ High school
- ☐ Degree Level
- ☐ Others ________________.

24. **Level of education of Mother**

- ☐ Primary
- ☐ Secondary
- ☐ Degree Level
- ☐ Others ________________.

25. Does the child's mother/ Do you work?

☐ Yes ☐ No

26. What is her/ your occupation? ________________________________.

27. What is the father's occupation? ________________________________.

Data Collection Sheet 2
(Child Examination)

I; Data from the Notes:
Date of interview: ____/____/____.

Study No.: ________. **Hospital file No.:** ______________.

Child's name: ____________________________________.

Date of birth: ____/____/____. **Date of GA:** ____/____/____.

1. Reason for Treatment under GA?

- ☐ Very young child (less than 4 years)
- ☐ Uncooperative child
- ☐ Any Medical problem indicating treatment under GA
- ☐ Disabled child
- ☐ Any other reasons: ____.

2. Treatment which was carried out at GA:

ξ Extraction:

Primary; ______________ ↔ ______________
↔

Permanent; ______________ ↔ ______________
↔

ξ Restoration:

Primary; ______________ ↔ ______________
↔

Permanent; ______________ ↔ ______________

↔

ξ Pulp Treatment & SSC:

______________ ↔ ______________
↔

ξ Fissure sealant:

______________ ↔ ______________
↔

ξ Other Treatment:

______________ ↔ ______________
↔

3. **Date of the first recall? ____/____/____.**

4. **At your first recall visit you:**

   - ☐ Fail to attend the recall visit.
   - ☐ More treatment was indicated.
   - ☐ Referred to other dentist.
   - ☐ No further treatment was needed.
   - ☐ Given another review. When? ____/____/____. How many visits? ____.

5. **Number of courses of treatment recorded since DGA? ______________**

   ***(Please see additional pages)**

<u>**Course of treatment since the DGA**</u> <u>**Course Number;**</u> ________.

Study No.; _____. **Date of interview:** ____/____/____.

Child's name: ______________________________________.

Start of course: ____/____/____. **Completion of course:** ____/____/____.

1. **Number of appointment** ___________.

2. **Number of appointment attended** ___________.

3. **Number of appointment failed** ___________.

4. **Methods used for treatment:**

☐ DGA ☐ LA only
☐ LA with Sedation ☐ No treatment

<u>**5. Treatment Provided;**</u>

ξ Check up only

ξ <u>Extraction:</u>

Primary; ______________ ↔ ______________
↔

Permanent; ______________ ↔ ______________
↔

ξ <u>Restoration:</u>

Primary; ______________ ↔ ______________
↔

Permanent; ______________ ↔ ______________
↔

ξ <u>Pulp Treatment & SSC</u>:

______________ ↔ ______________
↔

ξ <u>Fissure sealant:</u>

______________ ↔ ______________
↔

ξ <u>Other Treatment:</u>

______________ ↔ ______________

<u>II; Data from Examination:</u>

(I) Current oral health status;

<u>UPPER TEETH:</u>

				E	D	C	B	A	A	B	C	D	E			
	8	7	6	5	4	3	2	1	1	2	3	4	5	6	7	8
D																
O																
M																
B																
P																

<u>LOWER TEETH:</u>

				E	D	C	B	A	A	B	C	D	E			
	8	7	6	5	4	3	2	1	1	2	3	4	5	6	7	8
D																
O																
M																
B																
L																

(II) Plaque index:

16/E	11/A	26/E
46/E	41/A	36/E

(III) Gingival index:

16/E	11/A	26/E
46/E	41/A	36/E

III: Data from child interview;

1. **How often do you brush your teeth/day?**

   ☐ Do not brush ☐ Once

   ☐ Twice. ☐. Three times.

   ☐ Any other ______________________.

2. **What kind of tooth paste do you use?**

   ☐ Colgate ☐ Crest

   ☐ Signal ☐ Lion

   ☐ Sensodyne ☐ Aquafresh

   ☐ Oral-B ☐ Maclean

   ☐ Others ______________________.

3. **Did any body help you during brushing?**

   ☐ Mother ☐ Father

   ☐ Grandparent ☐ Others ____________.

4. **What do you remember about your treatment visit?** ______________

   ____

   ____.

5. **Do you like to go to the dentist?**

   ☐ Yes ☐ No

6. **How do you feel at the day of having appointment with dentist? (Corah scale)**

   ☐ Relaxed 

   ☐ Little uneasy 

   ☐ Tense 

   ☐ Anxious 

   ☐ Very anxious or physically sick. 

7. If you have a tooth need treatment, how would you like to have it done?

- ☐ On the dental chair where **only the tooth** will be a sleep (under LA)
- ☐ On the hospital where **you** will be a sleep (under GA)
- ☐ Do not want treatment.

Data Collection Sheet 3

(Parents Interview for the sibling)

Hospital No.; _____. **Date of interview:** ____/____/____.

Study No.: ________. **Hospital file No.:** ______________.

Child's name: ______________________________________.

Name of parent: ____________________________________.

1. **Where does the child come in the family?**
   - ☐ First ☐ Second
   - ☐ Third ☐ Fourth
   - ☐ Other: _______.
2. **How often do you take this child to the dentist?**
   - ☐ Every 6 month for check up
   - ☐ Every year for check up
   - ☐ When you think it is necessary
   - ☐ When he/she has any problem
   - ☐ Never taken until the hospital visit.
3. **At what age did you first take your child to the dentist?** ________________.
4. **Has your child had treatment using Local anaesthesia?**
   - ☐ Yes ☐ No

ξ **IF YES, How do you feel about your child having dental treatment under local anaesthesia?**

- ☐ Relaxed ☐ Tense
- ☐ Worried ☐ Do not want him to be involved

5. **What do you remember about this treatment?** __________________________
____.
6. **Did your child complain of anything during or after the treatment using LA?**
   - ☐ Yes ☐ No

ξ **If yes, What kind of problem he/she complains from?** _____________
____.

7. If your child needed the same treatment again now, would you prefer that it carried out under;

- ☐ Local anaesthesia
- ☐ General anaesthesia
- ☐ You will never let your child to have this sort of treatment again.

8. What kind of dental treatment has your child needed over the last 3 years?

- ☐ Check up only
- ☐ Preventive care
- ☐ Extractions
- ☐ Restoration
- ☐ No treatment needed
- ☐ Other treatment ____________.

9. How was this carried out?

- ☐ Local anaesthesia
- ☐ Sedation
- ☐ Sedation with LA
- ☐ General anaesthesia

10. How often does your child brush his/her teeth?

- ☐ Once/day
- ☐ Twice/day
- ☐ Three times/day
- ☐ Do not brush.
- ☐ Any other ______________________________.

11. Do you help with brushing?

- ☐ I do the brushing for them usually or always.
- ☐ I supervise the brushing and check.
- ☐ Child brushes own teeth.

12. How do you think, your child feel at the day of having appointment with dentist?

- ☐ Relaxed
- ☐ Little uneasy
- ☐ Tense
- ☐ Anxious
- ☐ Very anxious or physically sick.

13. Which of the following kinds of food does your child eat most days?

- ☐ Vegetable
- ☐ Fruits
- ☐ Meat
- ☐ Crisp
- ☐ Chocolate
- ☐ Cheese
- ☐ Candy
- ☐ Biscuits
- ☐ Other kinds of food? What are these? ____________________________

14. How often does your child eat Confectionery?

☐ Not every day ☐ Once/ day

☐ Twice/ day ☐ Three times/ day

☐ More than three times /day ☐ Others ____________________

____.

15. What kinds of the following drinks does your child drink during the day?

Drink	<1 / day	1 X day	2 X day	3 X day	>3 / day	No respond
Pepsi						
Coca cola						
7 UP						
Miranda						
Diet drinks						
Sparkling water						
Fresh juice						
Packed juice						
Diluted juice						
Milk						
Tea						
Herbal Tea						
Chocolate milk						
Milk with flavour						
Water						
Others						

16. At what age did your child start on solids?

☐ Less than four months ☐ Four Months

☐ Six Months ☐ Eight Months

☐ Others ________________.

Data Collection Sheet 4

(Sibling Examination)

<u>I; Data from the Notes:</u>

Hospital Name.; **Date of interview:** ____/____/____.

Study No.: ________. **Hospital file No.:** ______________.

Child's name: ______________________________________.

Date of birth: ____/____/____.

Start of course: ____/____/____. **Completion of course:** ____/____/____.

1. **Date of the child first treatment in the treating hospital?** ____/____/____.
2. **What was the reason of dental treatment?**
   - ☐ Routine check up
   - ☐ Pain
   - ☐ Teeth discoloration.
   - ☐ Swelling of the face
   - ☐ Any other reasons: ____.
3. **Number of dental appointments recorded in the hospital record?** ________
4. **Number of appointment attended** ____________.
5. **Number of appointment failed** ____________.
6. **Methods used for treatment:**
   - ☐ DGA ☐ LA only
   - ☐ LA with Sedation ☐ No treatment
7. **Treatment carried out over the last 3 years:**

ξ <u>Extraction:</u>

Primary; _______________ ↔ _______________
↔

Permanent; _______________ ↔ _______________
↔

ξ <u>Restoration:</u>

Primary; _______________ ↔ _______________
↔

Permanent; _______________ ↔ _______________
↔

ξ Pulp Treatment & SSC:

_______________ ↔ _______________
↔

ξ Fissure sealant:

_______________ ↔ _______________
↔

ξ Other Treatment:

_______________ ↔ _______________
↔

8. Date of the first recall? ____/____/____.

9. At your first recall visit you:

- ☐ Fail to attend the recall visit.
- ☐ More treatment was indicated.
- ☐ Referred to other dentist.
- ☐ No further treatment was needed.
- ☐ Given another review. When? ____/____/____. How many visits? ____.

II; Data from Examination;

(I) Current oral health status;

UPPER TEETH;

				E	D	C	B	A	A	B	C	D	E			
	8	7	6	5	4	3	2	1	1	2	3	4	5	6	7	8
D																
O																
M																
B																
P																

LOWER TEETH;

				E	D	C	B	A	A	B	C	D	E			
	8	7	6	5	4	3	2	1	1	2	3	4	5	6	7	8
D																
O																
M																
B																
L																

(II) Plaque index:

16/E	11/A	26/E
46/E	41/A	36/E

(III) Gingival index:

16/E	11/A	26/E
46/E	41/A	36/E

<u>III: Data from child interview;</u>

10. How often do you brush your teeth/day?

- ☐ Do not brush ☐ Once
- ☐ Twice. ☐. Three times.
- ☐ Any other ______________________________.

11. What kind of tooth paste do you use?

- ☐ Colgate ☐ Crest
- ☐ Signal ☐ Lion
- ☐ Sensodyne ☐ Aqua fresh
- ☐ Oral-B ☐ MacLean
- ☐ Others __________________________.

12. Did any body help you during brushing?

- ☐ Mother ☐ Father
- ☐ Grandparent ☐ Others ______________.

13. What do you remember about your treatment visit? ________________

____

____.

14. Do you like to go to the dentist?

- ☐ Yes ☐ No

15. How do you feel at the day of having appointment with dentist? (Corah scale)

☐ Relaxed 

☐ Little uneasy 

☐ Tense 

☐ Anxious 

☐ Very anxious or physically sick. 

16. If you have a tooth needing treatment, how would you like to have it done?

☐ On the dental chair where **only the tooth** will be a sleep (under LA)

☐ On the hospital where **you** will be a sleep (under GA)

☐ Do not want treatment.

ورقة تجميع معلومات ١

استبيان الوالدين للطفل المعالج

رقـــم الحـــــالة : ____________. تاريخ الزيارة : __/__/____.

رقم ملف المستشفى : ____________.

اســـم الطفـــل : ______________________________.

اســـم المرافـــق : ______________________________.

١- صلة القرابة للطفل :
☐ والده ☐ والدته
☐ جده ☐ غيرهم : __________.

٢- ما هي أعمار بقية الأطفال في العائلة :
☐ ٠-٤ ☐ ٥-٩
☐ ١٠-١٤ ☐ غيره : __________.

٣- ما هو ترتيب الطفل في العائلة :
☐ الأول ☐ الثاني
☐ الثالث ☐ الرابع
☐ غيره : __________.

٤- عنوان السكن ؟ ____.

٥- كم مرة تأخذ طفلك إلى طبيب الأسنان ؟
☐ مرة كل ٦ أشهر للفحص
☐ مرة في السنة للفحص
☐ كلما كانت هناك حاجة
☐ كلما كان هناك موعد لي
☐ عند شعور الطفل بألم
☐ لم أذهب إلى طبيب الأسنان حتى موعد تنويم المستشفى

٦- كم كان عمر الطفل عند زيارته الأولى لطبيب الأسنان ؟ ______________________.

٧- ما هي وسيلة المواصلات المستخدمة للذهاب إلى المستشفى ؟
☐ سيارة خاصة ☐ سيارة أحد الأقرباء
☐ سيارة أجرة ☐ مشياً بالأقدام

٨- هل تذكر وسيلة المواصلات التي تم استخدامها يوم علاج التنويم ؟
☐ سيارة خاصة ☐ سيارة أحد الأقرباء
☐ سيارة أجرة ☐ مشياً بالأقدام
☐ لا أذكر

٩- هل تواجه أي صعوبة للوصول في المستشفى ؟
* يوم علاج التنويم :
☐ نعم ☐ لا ☐ أحياناً
* اليوم :
☐ نعم ☐ لا ☐ أحياناً
* في الزيارات السابقة :
☐ نعم ☐ لا ☐ أحياناً
* أواجه دائماً صعوبة :
☐ نعم ☐ لا ☐ أحياناً

١٠- ما هي الصعوبات التي تواجهها ؟
☐ المواصلات ☐ المواقف
☐ الاستئذان من العمل ☐ موعد الفحص
☐ مشاكل أخرى : ________________________________.

١١- هل تتذكر أن طفلك قد تم علاجه تحت تخدير كامل ؟
☐ نعم ☐ لا ☐ قليلاً

١٢- ما الذي تذكره عن تلك الزيارة ؟ ________________________________
____
____
____.

١٣- معظم الأطفال يعود لهم النشاط و الحيوية بسرعة بعد علاجهم بالتخدير الكامل. ما مدى سرعة تجاوب طفلك بعد التخدير بالنسبة إلى :
أ : العودة إلى الأكل
☐ نفس اليوم ☐ اليوم التالي
☐ ٢-٣ أيام ☐ أكثر من ٣ أيام
☐ لا أذكر
ب: العودة إلى النشاط العادي و المدرسة
☐ نفس اليوم ☐ اليوم التالي
☐ ٢-٣ أيام ☐ أكثر من ٣ أيام
☐ لا أذكر

١٤- في حالة إن احتاج طفلك لعلاج أسنان مرة أخرى ما الطريقة التي تفضل أن يتم بها العلاج ؟
☐ تخدير موضعي
☐ تخدير كامل
☐ لن أعرض طفلي لأي علاج مرة أخرى

١٥- منذ علاج الطفل تحت تخدير كامل. هل ذهبت إلى أي طبيب أسنان؟
☐ نعم ☐ لا
أ: إذا كانت الإجابة نعم ، أين تم أخذه ؟
☐ نفس المستشفى المعالج
☐ عيادة أخرى ________________.

١٦- ما هو العلاج الذي احتاجه طفلك منذ ان تم علاجه بالتخدير الكامل ؟

☐ فحص فقط ☐ علاج وقائي
☐ خلع ☐ حشوات
☐ لم يحتاج لعلاج ☐ أي علاج آخر________________.

١٧- كم مرة ينظف طفلك أسنانه في اليوم ؟

☐ مرة في اليوم ☐ مرتين في اليوم
☐ ثلاث مرات في اليوم ☐ لا يفرش أبدا
☐ غير ذلك ______________________.

١٨- هل تساعد طفلك في تفريش أسنانه ؟

☐ أقوم بتفريش أسنان طفلي عادة
☐ أقوم بالإشراف على تفريش أسنانه
☐ يفرش طفلي أسنانه وحده

١٩- في اعتقادك كيف يشعر طفلك في يوم موعده مع طبيب الأسنان ؟

☐ مسترخي ☐ عنيد/صعب السلوك
☐ مشدود الأعصاب ☐ متوتر
☐ متوتر لدرجة الشعور بالمرض

٢٠- من مجموعة هذه الأطعمة ما الذي يتناوله طفلك خلال اليوم ؟

☐ خضروات ☐ فواكه ☐ لحوم
☐ بطاطا شيبس ☐ شوكولاته ☐ أجبان
☐ حلويات ☐ بسكويت ☐ مكسرات
☐ أطعمة أخرى؟ مثل:____

٢١- كم مرة يتناول طفلك الحلويات ؟

☐ ليس كل يوم ☐ مرة في اليوم
☐ مرتين في اليوم ☐ ثلاث مرات في اليوم
☐ أكثر من ثلاث مرات في اليوم ☐ غير ذلك _______________.

٢٢- من المشروبات التي في الجدول- ما هي المشروبات التي يتناولها طفلك و كم مرة ؟

المشروبات	أقل من مرة	مرة	مرتين	ثلاث مرات	أكثر من ٣ مرات	لا أدري
بيبسي						
كوكا كولا						
سفن أب						
ميرندا						
دايت بيبسي						
مياه معدنية						
عصائر طازجة						
عصائر محفوظة						
عصائر مخففة						
حليب						
شاي						
شاي أعشاب						
حليب شوكولاته						
حليب بنكهه						
مياه						
أشياء أخرى						

٢٣- كم كان عمر طفلك عندما بدأ تناول الأغذية الصلبة ؟
☐ أقل من ٤ شهور ☐ ٤ شهور
☐ ٦ شهور ☐ ٨ شهور
☐ غيرها ________________.

٢٤- كم سنة قضيتها كطالب للحصول على شهادة علمية ؟
☐ أقل من ٦ سنوات ☐ ٦ سنوات
☐ ١٢ سنة ☐ ١٨ سنة
☐ أكثر ________________.

٢٥- ما هو مستوى تعليم الأب ؟
☐ ابتدائي ☐ متوسط
☐ ثانوي ☐ جامعي
☐ غيره ________________.

٢٦- ما هو مستوى تعليم الأم ؟
☐ ابتدائي ☐ متوسط
☐ جامعي ☐ غيره ________________.

٢٧- هل أم الطفل امرأة عاملة ؟
☐ نعم ☐ لا

٢٨- ما هي وظيفتها ؟ ____.

٢٩- ما هي نوعية عمل الأب ؟ ____.

ورقة تجميع معلومات ٣

استبيان الوالدين للطفل الشقيق

رقـــم الحــــــالة : ___________. تاريخ الزيارة : __/__/____.

رقم ملف المستشفى : ___________.

اســـــم الطفـــل : ___________________________.

اســـــم المرافـــق : ___________________________.

١- ما هو ترتيب الطفل في العائلة :

☐ الأول ☐ الثاني

☐ الثالث ☐ الرابع

☐ غيره : ________.

٢- كم مرة تأخذ طفلك إلى طبيب الأسنان ؟

☐ مرة كل ٦ أشهر للفحص

☐ مرة في السنة للفحص

☐ كلما كانت هناك حاجة

☐ كلما كان هناك موعد لي

☐ عند شعور الطفل بألم

☐ لم أذهب إلى طبيب الأسنان حتى موعد تنويم المستشفى

٣- كم كان عمر الطفل عند زيارته الأولى لطبيب الأسنان ؟ ____________________.

٤- هل تم علاج الطفل بالتخدير الموضعي ؟

☐ نعم ☐ لا

- إذا كانت الإجابة بنعم. ما هو شعور طفلك عند العلاج بالتخدير الموضعي ؟

☐ مسترخي ☐ مشدود

☐ قلق ☐ لا أرغب أن يعالج بتلك الطريقة

٥- ما الذي تتذكره عن علاج طفلك بالتخدير الموضعي ؟ ____________________

____

____

____.

٦- هل اشتكى طفلك من أي شي خلال العلاج أو بعد علاج أسنانه بالتخدير الموضعي؟

☐ نعم ☐ لا

* إذا كانت الإجابة بنعم. ما هي الشكوى التي اشتكى منها ؟ ____________________

____.

٧- في حالة إن احتاج طفلك لعلاج أسنان مرة أخرى ما الطريقة التي تفضل أن يتم بها العلاج ؟

☐ تخدير موضعي
☐ تخدير كامل
☐ لن أعرض طفلي لأي علاج مرة أخرى

٨- ما هو العلاج الذي احتاجه طفلك خلال السنوات الثلاث الأخيرة لأسنانه ؟

☐ فحص فقط ☐ علاج وقائي فقط
☐ خلع ☐ حشوات
☐ لم يحتاج أي علاج ☐ علاج آخر

٩- كيف تم علاجه ؟

☐ تخدير موضعي ☐ تخدير بالغاز
☐ تخدير بالغاز مع تخدير موضعي ☐ تخدير كامل

١٠- كم مرة ينظف طفلك أسنانه في اليوم ؟

☐ مرة في اليوم ☐ مرتين في اليوم
☐ ثلاث مرات في اليوم ☐ لا يفرش أبدا
☐ غير ذلك ______________________.

١١- هل تساعد طفلك في تفريش أسنانه ؟

☐ أقوم بتفريش أسنان طفلي عادة
☐ أقوم بالإشراف على تفريش أسنانه
☐ يفرش طفلي أسنانه وحده

١٢- في اعتقادك كيف يشعر طفلك في يوم موعده مع طبيب الأسنان ؟

☐ مسترخي ☐ عنيد/صعب السلوك
☐ مشدود الأعصاب ☐ متوتر
☐ متوتر لدرجة الشعور بالمرض

١٣- من من هذه الأطعمة يتناولها طفلك خلال اليوم ؟

☐ خضروات ☐ فواكه ☐ لحوم
☐ بطاطا شيبس ☐ شوكولاته ☐ أجبان
☐ حلويات ☐ بسكويت ☐ مكسرات
☐ أطعمة أخرى؟ مثل:____
____

١٤- كم مرة يتناول طفلك الحلويات ؟

☐ ليس كل يوم ☐ مرة في اليوم
☐ مرتين في اليوم ☐ ثلاث مرات في اليوم
☐ أكثر من ثلاث مرات في اليوم ☐ غير ذلك ______________.

١٥- من المشروبات التي في الجدول- ما هي المشروبات التي يتناولها طفلك و كم مرة ؟

المشروبات	أقل من مرة	مرة	مرتين	ثلاث مرات	أكثر من ٣ مرات	لا أدري
بيبسي						
كوكا كولا						
سفن أب						
ميرندا						
دايت بيبسي						
مياه معدنية						
عصائر طازجة						
عصائر محفوظة						
عصائر مخففة						
حليب						
شاي						
شاي أعشاب						
حليب شوكولاته						
حليب بنكهة						
مياه						
أشياء أخرى						

١٦- كم كان عمر طفلك عندما بدأ تناول الأغذية الصلبة ؟

☐ أقل من ٤ شهور ☐ ٤ شهور

☐ ٦ شهور ☐ ٨ شهور

☐ غيرها ____________________.