Oral health status among children with special needs in Khartoum State, Sudan

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A thesis submitted in partial fulfillment of the requirements for the degree of MSc (Dent) in Dental Public Health, University of the Western Cape

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2012

Abstract

Introduction: Children with disabilities and other special needs present unique challenges for oral health professionals in the planning and execution of dental treatment. The oral health of children with special health care needs is influenced by various socio-demographic factors, including their living conditions and severity of the impairment. According to United States (US) Maternal and Child Health Bureau, special health care needs (SHCN) children are defined as "those who have or are at increased risk for a chronic physical, developmental, behavioral, or emotional condition and who also require health and related services of a type or amount beyond that required by children generally".

Aim and Objectives: The aim was to determine the oral health status of children with special needs. The objectives were to determine the prevalence of dental caries, periodontal disease and oral mucosal lesions among children with special needs in Khartoum State aged 5 to 15 years old attending educational and rehabilitation institutions.

Methodology: A descriptive cross–sectional study was carried out. Data were collected with a data capture sheet that was a modified WHO Oral Health Assessment Clinical Oral Examination Guideline. Demographic variables, dmft, periodontal disease and oral mucosal lesions were recorded.

Results: The mean dmft /DMFT scores was 2.02/1.25. The DMFT score increased with age, girls showed higher score than boys and autistic children had the poorest oral health among other disabilities. More than two third of the examined sextants were healthy, less than quarter had bleeding (18.3%) and 5% calculus accumulation. Fissured tongue was the most frequent oral lesion found.

Conclusion: Children with special needs in Khartoum State demonstrated a high prevalence of dental caries and periodontal disease and do not receive adequate dental care. There is an urgent need for both preventive and treatment programmes to improve the oral health of children with special needs.

Declaration

I, the undersigned, hereby declare that the work contained in this dissertation is my original work and that it has not been previously in its entirety or in part submitted at any university for a degree.

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Elturabi Galal Eltilib Date

Dedication

To the soul of my parents, lie in peace.

To my beloved wife, precious sons and extended family for their support and encouragement

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List of Abbreviations

CPI……..	Community Periodontal Index
dmft……..	decayed, missing and filled teeth
DMFT……	Decayed Missing and Filled Teeth
IDP……	Internally Displaced People
IQ……..	Intelligence Quotient
SD……	Standard Deviation
SHCN…….	Special Health Care Needs
US……	United State
WHO……...	World Health Organization

Acknowledgements

I am deeply indebted to Professor Sudeshni Naidoo, for her excellent supervision, expert guidance, attention to detail and unfailing support - without it I would never have been able to complete out this study.

I am especially grateful to Dr. Isam M.A. Shaik Idris, the Director of the Oral Health Directorate for his great help and advice that made my post-graduate studies possible.

I would like to express my thanks to:

The staff of the Department of Community Oral Health, University of the Western Cape, for their advice and invaluable comments: Prof A J Louw, Prof Neil Myburgh and Dr Rob Barrie

Dr. Hadeel Hashim, Dr. Rania Elkhider, Dr. Rayan Elkhalifa and Dr Tayseer Sultan for their assistance.

Khalda Abdelgafar, Nihal and Ahmed Mahrous who expertly assisted with the statistical analyses.

And last but not least, my sincere gratitude to my colleagues at the Oral Health Directorate for their encouragement and support.

Chapter 1: Introduction

Children with disabilities and special needs present unique challenges for oral health professionals in the planning and carrying out of dental treatment. There are a myriad medical, social, psychological, oral and dental considerations that oral health care workers need to take cognizance of when preparing treatment plans for children with special needs. If all these factors are fully integrated into the treatment plan, the resulting care and management will provide the best chance of helping the individual with special needs to achieve and maintain a lifetime of good oral health (Glassman and Subar, 2009). Oral health of children with special health care needs is often influenced by various socio-demographic factors, including their living conditions and severity of impairment (Oredugba and Akindayomi, 2008).

The term *disability* refers to any reduction of an individual's activity that has resulted from an acute or chronic health condition and affects motor, sensory, or mental functions. Disabilities may due to heredity factors, systemic disease, trauma, and environmental factors (Ragalis, 2008).

According to the United States (US) Maternal and Child Health Bureau, special health care needs (SHCN) children are defined as "those who have or are at increased risk for a chronic physical, developmental, behavioral, or emotional condition and who also require health and related services of a type or amount beyond that required by children generally" (McPherson,1998).

The dental care needs of children with disabilities is grossly under-estimated by both their caregivers and the dental profession, and demand for dental care may be limited either by the children's incapacity to express their pain and discomfort or by the parent or caregivers to evaluate their oral condition (Hennequin *et al*, 2000).

Many barriers to accessing oral health care have been reported as obstacles to achieving good oral health for people with special needs, and these barriers may involve the child, the family, caregivers, and dental professionals. For example, financial affordability and limited access to dental services; lack of experience and inadequate training of dental professionals in providing dental care services; fear, anxiety and uncooperative behavior shown by the majority of disabled children; dependency on caregivers for

daily oral care and poor oral hygiene skills due to the disability. Moreover many dentists are unwilling to treat people with disabilities as they often require more time and effort (Grant *et al* 2004; Bhambal, *et al* 2011).

Figure 1: The Republic of the SUDAN

Khartoum state is the national capital of Sudan and it is one of the 16 states that form Sudan, it comprises of seven localities (Districts) named: Khartoum, Jabal Awliya, Omdurman, Ombadda, Karary, Khartoum North, and Sharg Elnniel. Khartoum State covers the area of 22.736 sq km which forms about 1.5% of the total area of Sudan. The total population of Khartoum State according to the 5th census (2008) is 5,274,321 representing about 17.1% of the total population of Sudan.

It is estimated that there are about 2350 children with special needs attending 53 special centers distributed between the 7 localities of the State, 1551 of them aged between 5 to 15 years old. The types of disabilities as reported in their records are: mental disabilities, Down's syndrome, autism, hearing impairment, vision impairment, speech disorder, leaning disabilities, cerebral palsy, motor impairment and others (hydrocephaly, microcephaly and epilepsy).

Currently there are no dedicated dental services for children with special needs in Khartoum and therefore the aim of the present study was to determine the oral health status of children with special health needs. It was anticipated that the findings from this study could serve as baseline data to develop oral health preventive and promotive programmes that are appropriate and relevant for children with special needs attending educational and rehabilitations institutions in Khartoun State.

Chapter 2: Literature Review

2.1 Introduction

This chapter will discuss the status quo of children with special needs in Khartoum State, the capital of Sudan and the reported oral health status of children with special needs worldwide regarding the prevalence of dental caries, periodontal disease and oral mucosal lesions.

2.2 Children with special needs

2.2.1 Definition

Children with special needs are: "those who have or are at increased risk for a chronic physical, developmental, behavioral, or emotional condition and who also require health and related services of a type or amount beyond that required by children generally" (McPherson,1998).

2.2.2 Global prevalence

It has been estimated that there are about 500 million people with disabilities worldwide (Barriers, 2000). The World Health Organization (WHO) estimated that individuals with special needs to comprise 10% of the population in developed countries and 12% in developing countries (Altun *et al*, 2010). For example over 50 million people in the United States have a developmental, physical, or mental disability (Waldman *et al*, 2005). Internationally, it has been reported that children and adolescents with special health care needs have poorer oral hygiene and a higher prevalence of oral health problems compared to the general population (de Jongh *et al*, 2008). Some studies have reported that children with special needs generally receive less restorative care than the normal children, and that nearly 80% of children with disabilities have untreated caries (Gizani, 1997).

In Turkey, there are an estimated 9 million children aged 0-18 years who have disabilities and special health care needs. Moreover, Dental caries is the most prevalent disease among children worldwide, and dental treatment is the greatest unattended health need of the disabled (Hennequin *et al*, 2000).

The prevalence of gingivitis among the children and adults with intellectual disabilities has been estimated internationally to be ranging between 6 to 97% while in general population range between 8 to 59% (Cumella *et al*, 2000; Hennequin *et al*, 2000). Some studies report an incidence of periodontal disease ranging between 90 and 96% in adults with Down's syndrome, and this may be due to the lowered immune response of a compromised immune system rather than being solely due to poor oral hygiene (Bhambal, *et al* 2011).

2.3 Children with special needs and oral health

2.3.2 Dental Caries Prevalence worldwide

Waldman and Perlman (2006) in their review of the United States (US) National Survey of children with special health care needs, reported that nearly 13% (9.4 million) of US children aged between 2 to 17 years had special health care needs, with the highest prevalence rate among children living in poverty and among Native American children. Dental care was the most commonly reported treatment need. Furthermore, more than three quarters of the children needed dental care. They also reported that dental care was the most health care service that was the most needed, but not received service.

de Jongh et al (2008) in the Netherlands, found that there was little information about the oral health status of individuals who have mental disabilities, and only one study had been published (Van Grunsven and Koelen, 1990) that reported on the oral health status of 61 non-institutionalized children with severe mental disabilities aged from 4 to 12 years. They found that 57.4% had untreated caries (mean of dmft/ DMFT = 3.0) and only a third were found to be caries-free.

Although 95% of the children had regularly seen their dentists for routine checkups, 76% still had untreated caries. Furthermore, 75% of the dentists considered communication problems as the most important barrier to treatment followed by lack of financial compensation and lack of experience in treating children with disabilities. These findings were similar to studies in other countries showing that people with special needs are underserved in Western society (Desai *et al*, 2003; Bradley and McAlister, 2004), and their oral health is poor (Den Dekker, 2003).

Bradley and McAlister (2004), in the 1999/2000 school year carried out a survey of the oral and dental health of children attending special national schools in the Eastern Regional Health Authority area of Ireland. They described the findings of children with Down's syndrome separately from that of the findings of children with other special needs and found that: the mean dmft for 5-years old children with Down's syndrome was 0.2 which is lower than that of children with other special needs (1.29). Among 8-year olds the score was 1.9 which is higher than the other group (1.57). The mean DMFT score for 12 and 15 years old children with Down's syndrome was 0.83 and 0.71 respectively; and the score for the children with other special needs for the same ages was 1.16 and 2.02 respectively (Bradley and McAlister, 2004).

A study from Lagos, Nigeria among children with special needs, reported on an oral examination carried out on 54 subjects aged from 3 to 26 years, 36 of them (66.7%) were caries-free with a mean of dmft score of 0.7± 1.77 and mean DMFT score of 0.4±1.44. The mean of OHI-S 1.3 (±0.16). These low scores were attributed to the fact that the institution where this study carried out was a private one, patronized by parents from the upper and middle socio-economic status, and that the educational status of parents has a positive effect on the dental care (Oredugba and Akindayomi, 2008).

Simon *et al* (2008) determined the oral health status of 321 disabled children aged between 7-22 years in Dar es Salaam, Tanzania. They reported that the prevalence of dental caries was low with the mean dmfs ranging from 0.25 to 3.24 and mean DMFS ranging between 0.25 – 1.75. They did however find high levels of bleeding (73.5%) and calculus (82%).

There have been a few studies reported from India. A cross sectional study from Udaipur determined the prevalence of dental caries on 127 institutionalized hearing-impaired children aged between 5-22 years old (Jain *et al* 2008). They found a high mean DMFT of 2.61 (1.76 for 9-12 year and 2.95 for the 13-17 year age group) and an increasing caries prevalence with increasing age. The decayed (D) was the largest component of the DMFT. From, Mangalore in Karnataka State, Rao *et al* (2001) reported a prevalence of 66.1% dental caries, with the mean DMFT of 2.48.

Reddy and Sharma (2011) compared the prevalence of dental caries among 6–15year old visually impaired and normal children from two schools with similar socio-economic backgrounds. The overall prevalence of dental caries was 40% in the children with visual impairment and only 11.5% in the normal children. The mean DMFT/dmft was 1.1/0.17 and 0.87/0.47 in visually impaired and normal children respectively. Oral hygiene of the visually impaired children was poorer when compared to the normal children.

The dental caries experience and oral hygiene status of blind, deaf, and mentally retarded female children was reported by Al-Qahtani and Wyne (2004) in Riyadh, Saudi Arabia. The mean dmft score was 7.35 in 6-7 year old deaf children and mean DMFT score of 5.12 in 11-12 year olds. Oral hygiene was found to be the poorest among the mentally retarded children.

Ivančić *et al* (2007) conducted a study in Rijeka, Croatia on 80 children with various types of disabilities (cerebral palsy, mental retardation, Down's syndrome, and hearing-speaking disorders) aged between 3-17 years old. Apart from the very poor oral hygiene, the prevalence of dental caries was found to be very high. The average dmft index was 3.42 for deciduous teeth and 5.24 for the mixed dentition. The mean DMFT was 1.4 for mixed dentition and 6.39 for permanent dentition.

The oral health status among children between 6 and 15 years old with cerebral palsy, mental retardation and vision impairment was investigated by Mitsea *et al* (2001) in Athens, Greece. The mean deft / DMFT were 3.71/2.83, 2.44/3.24, and 2.37/2.72 respectively with high treatment needs for all groups.

The percentage of caries-free children with cerebral palsy was 31.4% in the primary dentition and 37.7% in the permanent dentition; for the mentally retarded 44% in the primary dentition and 40% in the permanent dentition and for the visually impaired 40.7% and 51.1% in the primary and permanent dentition respectively. The study also showed that the oral hygiene status of the people with visually problems was better than that of the other two groups (Mitsea *et al*, 2001).

Santos *et al* (2009) investigated the caries experience among children with cerebral palsy related to their age, food consistency, and to the severity of their impairment. The total DMFT was 5.43. An increase in total DMFT was found for the subjects who were severely and moderately impaired (6.03 and 6.32 respectively), when compared to the subjects who were slightly and very slightly impaired (4.32 and 4.36 respectively); however these differences were not statistically significant ($p = 0.063$). When compared to age, subjects with mixed dentition (aged 8-12 years) had an increase of 28.5% for total DMF compared to those with primary dentition (aged 4-7 years); and subjects with permanent dentition (aged 12-19 years) were found to have an increase of about 17% for total DMF when compared to those with a mixed dentition. With regard to dietary consistency, children with severe impairment were more likely to be given a higher liquid diet and their caries experience (DMF 7.60) was greater than those with moderate, slightly and very slightly impaired who more likely to have solid diet (DMFT 5.02) (Santos *et al*, 2009).

Altun *et al* (2010) examined 136 individuals with different types of disabilities (Down's syndrome, mental retardation, autistic disorder, cerebral palsy) to determine the prevalence of dmft-DMFT indexes and the oral hygiene status. The overall mean dmft and DMFT scores for the participants were 1.18 and 1.58 respectively. The dmft score was highest among the Down's syndrome group (2.43), and the mental retardation group had the highest DMFT score of 2.11. Only 15.4% of the participants were found to be caries-free.

2.3.2.1 Dental caries prevalence in normal children in Sudan

There is a paucity of literature concerned with the oral health of children with special needs in Sudan. No specific attention had been given to their oral health care needs or

dental services, there are no special oral health care centers allocated especially for this group of people and they often obtain dental treatment through the mainstream public dental clinics, often with great difficulty.

However, there have been two as yet unpublished studies that have been carried out in Khartoum State (2008 and 2009) on children aged between 6 and 12 year olds. One by Babekir in 2008 (personal communication) conducted on public and private school children aged 6, 8 and 12 years old. The dmft score was 1.08 and the DMFT score for the 8 and 12 year old children was 1.27 and 1.12 respectively. The percentage of the d component was 96.7% and the D component was 91.5%. The other study by Arzon (2008) was carried out among school children of Internally Displaced People (IDP) (personal communication) and showed that the mean dmft score among 6 year old children was 1.2 and the DMFT score among 8 and 12 year old children was 1.1, with d/D component 94.5%/96.8% and a zero f/F component. The 93.3% were caries-free in the primary dentition and 70.9% for the permanent dentition.

2.3.4 Oral mucosal lesions

Epidemiological studies have shown considerable variation in the prevalence of oral mucosal lesions in the general population in different parts of the world (Rioboo-Crespo *et al*, 2005; Furlanetto *et al*, 2006) and have highlighted the fact that there is a paucity of information on the epidemiology of oral mucosal lesions particularly in children from the African region. In most of the reported studies, the sampling was usually a convenience sample and little or no information is available about the sample to which the data refer. The external validity of the findings is therefore restricted i.e. the extent to which inferences can be made is limited to specific populations and may not necessarily reflect local, regional or national trends. This is an important issue since there may be considerable variation in the prevalence and manifestation of oral mucosal lesions within sub-populations in diverse regions in the world. Beside the differences in the design, age and population groups examined, comparison of the results of various studies is also problematic because of the differences in diagnostic criteria and methods employed. Furthermore, the lesions included or excluded from the study varied. Clinical findings were seldom corroborated with laboratory tests.

Diagnostic criteria are also often not standardized with some authors including periodontal abnormalities and periodontal abscess in the diagnosis of the oral mucosal lesions thus influencing the overall prevalence of oral mucosal lesions and making comparisons problematic (Arendorf and Ross 1996, Crivelli *et al* 1988).

Compared to the many reports on caries prevalence or periodontal disease in children, the epidemiology of oral mucosal lesions in children had received scant attention. The frequency of 1211 Brazilian children aged from 0 to 12 years presenting with oral mucosal alterations was reported by Bessa *et al* (2004) to be 27%. The most common lesions were geographic tongue, cheek biting and melanotic macules. Other oral mucosal lesions found were pseudomembranous candidiasis, alveolar cysts, fissured tongue and recurrent herpes.

A survey conducted in Buenos Aires, Argentina, to determine the prevalence of oral mucosal lesions in children aged 4-13 years old showed that the most frequent lesions were recurrent aphthous ulceration (27%), fissured tongue (16%), herpes labialis (13%), angular cheilitis (9%) and geographic tongue (7%) (Crivelli *et al*, 1988).

Daneshpazhoom *et al* (2007) reported on the mucocutaneous findings from 100 children in Teheran, Iran with Down syndrome aged between 11 to 20 years old (Brief Report, 2007) who were attending school for children with special educational needs. Fissured tongue was the most frequent finding (28%) compared to the frequency of fissured tongue in the general population (2% to 5%) (Barankin and Guenther, 2001). Other lesions included hypertrophy of tongue (22%), angular cheilites (13%) and geographic tongue (4%).

2.4 Oral findings associated with certain types of disabilities

Some disabilities severely impact on the daily activities and function of an individual, and may lead to poor oral hygiene, rampant dental caries, periodontal infection and other oral disease resulting in pain, discomfort and impaired the quality of the individual's life. These oral diseases may be due to the underlying congenital anomalies as well as to their inability to assimilate and understand personal and professional oral health care education needed to maintain oral health.

2.4.1 Cerebral palsy

Cerebral palsy is a non-progressive chronic condition caused by damage to part of the brain, which can occur prenatally, during the birth process, or post-natally. The resultant brain damage results in limited motor functioning decreasing body movement, coordination and muscle control (palsy), and lack of manual dexterity (Surabian, 2001; Ragalis and Wilkins, 2008). The motor disorders of cerebral palsy are often accompanied by disturbances of sensation, cognition, communication, perception, behaviour, and seizure disorders (Bax *et al*, 2005).

The most common factors that affect the brain and cause cerebral palsy are: anoxia during pregnancy or delivery, maternal infection during pregnancy (for example, rubella), blood type incompatibility, severe nutritional lack during pregnancy, postnatal infections such as meningitis or encephalitis, or direct trauma from accidents (Ragalis and Wilkins 2008).

2.4.1.1 Oral Findings

Dental caries: because of motor impairment in individuals with cerebral palsy, the prevalence of dental caries may be high due to difficulties in maintaining good oral hygiene and plaque control. The problems with mastication results in use the diet consisting of soft foods, which may increase risk of dental caries (Ragalis and Wilkins 2008; Gangil *et al*, 2001).

Periodontal disease: Periodontal or gingival infections are also found to be higher in patients with cerebral palsy. The use of phenytoin for the prevention of seizures increases the susceptibility to gingival enlargement. The mechanical difficulties related to plaque removal, and increased food retention due to ineffective self-cleansing, may lead to calculus accumulation and periodontal involvement (Ragalis and Wilkins 2008).

2.4.2 Down's syndrome

Down's syndrome is a chromosomal abnormality caused by Trisomy21, an extra copy of chromosome 21. During reproduction, cell division occurs in the ovaries and testicles when a cell divides into two. Each of these cells has half the chromosomes (23) of the parent cell (46). This process is called meiosis. In all but 5% of Down's syndrome cases, one cell has two 21st chromosomes and the other cell has one 21st chromosome, which results in the fertilized egg having three 21st chromosomes referred to as Trisomy21. The extra chromosome changes the normal number of 46 chromosomes in each cell to 47 (Leshin, 1999). Down's syndrome was first described by John Langdon Down in 1866. The birth incidence of Down's syndrome varies between countries and is generally cited as being between 1 in 600 and 1 in 1000 (Desai, 1997). Formerly, this condition was attributed to the mother's age, but recent evidence has shown that the father can be the source of the chromosomal abnormality (Cohen, 1986). People with Down's syndrome have mental retardation, recognizable physical features, and frequently congenital heart disease and other developmental abnormalities and may have early onset of Alzheimer's disease, immunological deficiencies, and other health problems (Epstein, 1995).

2.4.2.1 Oral findings

It is widely recognized that people with Down's syndrome are more susceptible to oral health problems such as poor oral hygiene, gingivitis, periodontitis and other oral abnormalities (Desai, 1997). However there is conflicting evidence regarding the prevalence of dental caries (Fung and Allison, 2005).

Dental caries: Patients with Down's syndrome appear to have less caries. *Streptococcus mutans* counts were found to be low in the population with Down's syndrome. The delay and irregular sequence of permanent teeth eruption may further contribute to the reduced caries levels (Peretz *et al*, 1999). Increased spacing between the teeth and differences in chemical content of the saliva may also contribute to low caries prevalence (Bradley and McAlister, 2004).

Periodontal Disease: Periodontal conditions are more severe in people with Down's syndrome. Bone loss and other effects of periodontal infection may be present. The leukocyte response in people with Downs' syndrome is altered and this impairs chemo-taxis and phagocytosis. The altered immune response contributes to the increased severity of periodontal infection (Dickinson and Wilkins, 2008). Early onset of periodontal disease often begins with the primary dentition (Barnett and press, 1986).

*Other oral findings***:** People with Down's syndrome are usually characterized by an open mouth and protruding tongue; thickened, cracked and dry lips, a deep fissured tongue, microdontia and congenitally missing teeth.

2.4.3 Epilepsy (Seizure)

A seizure is a sudden paroxysmal event that results from transient abnormal brain activity. A seizure may involve loss of consciousness or awareness with or without convulsive movements or spasms. Epilepsy is the tendency to have seizures and can be caused by congenital conditions, such as maternal infection (rubella), toxemia, prenatal injuries, brain tumours, head trauma and infections such as meningitis and encephalitis (Ragalis, 2008; Surabian, 2001).

2.4.3.1 Oral findings

Gingival overgrowth

Epilepsy in itself does not produce any oral manifestations. However, gingival hyperplasia related to the side effects of antiepileptic drugs (phenytoin) occurs in 25% to 50% of the epileptic patients. Gingival overgrowth first appears in the inter-dental papillae with lobulations occurring coronally, and it decreases as it approaches the muco-gingival junction. The anterior gingiva is usually affected more than the posterior and the maxillary more than the mandibular. Other findings such as tongue, cheek or lip biting, and fractured teeth are also common (Ragalis, 2008).

2.4.4 Mental retardation

Mental retardation is a disability characterized by a significant limitation in intellectual functioning, in adaptive behaviors as expressed in conceptual, social, and practical adaptive skills, and usually originates before the age of 18 (Dickinson and Wilkins, 2008). Standardized intelligence tests are used to determine an individual's level of retardation. The Intelligence Quotient (IQ) expresses the test result. According to the levels of intellectual functioning, mental retardation can be categorized as: Mild mental retardation (IQ range 50 to 69), moderate mental retardation (IQ range 35 to 49), severe mental retardation (IQ range 20 to 34) and profound mental retardation (IQ under 20).The aetiology for many cases is unknown but the majority is prenatally-related (Dickinson and Wilkins, 2008).

2.4.4.1 Oral findings

Dental caries: Although the literature reviews showed much variation in the findings (Fung and Allison, 2005), severely and profound mental retarded individuals have been shown to have significantly more carious lesions (Tesini, 1981).

Periodontal disease: periodontal disease is common in individuals with mental retardation due to poor oral hygiene. Other findings such as lip biting due to self injurious habit, clenching, mouth breathing, and tongue thrusting are common (Dickinson and Wilkins, 2008).

2.4.5 Autism

Autism is a complex developmental disability manifested by a limited ability to understand and communicate. It appears during early childhood (before the age 3-5 years). It is also known as Kanner's syndrome (Leo Kanner, a child psychiatrist who first described group of people with similar behavioral problem in 1943). The prevalence rate of Autism has increased in recent years to one in 1000 children (Dickinson and Wilkins, 2008; Charman, 2002). It occurs in all racial, ethnic, and social groups all over the world, and is four times higher in males than in females. The exact cause of Autism is unknown but factors such as genetic, viruses, and inadequate oxygenation at birth have been implicated. Autistic patients are characterized by

impairments in social interaction and communication and restrictive or repetitive patterns of behavior, interests, and activities with delays in language, cognitive ability or developmental age-appropriate skills (Dickinson and Wilkins, 2008).

2.4.5.1 Oral findings

Except when autism is combined with a developmental disability of a different nature, there is no specific oral manifestation. A number of factors can contribute to a condition of poor oral health, and these include: the fact that dental care may be neglected because of low priority, parental fear of the child being hurt, fear of embarrassment that would result from the behavior of the difficult child, and repetition of sweet food rewards for child's behavior modification promote dental caries development.

2.5 Summary

This chapter provided a review of the global prevalence of disabilities, the oral health status of children with special needs worldwide with a focus on the prevalence of dental caries, periodontal disease and oral mucosal lesions. The final sections described the oral manifestations of some common disabilities.

Chapter 3: Aim and Objectives

3.1 Aim

To determine the prevalence of dental caries, periodontal disease and oral mucosal lesions among children aged 5 to 15 years old with special needs attending institutes in Khartoum State.

3.2 Objectives

1. To determine the prevalence of dental caries using dmft/DMFT.
2. To determine the prevalence of periodontal disease using Community Periodontal Index (CPI).
3. To identify and describe any oral mucosal lesions.
4. To provide baseline data on the oral health status of children with special needs in Khartoum State so as to make recommendations regarding preventive dental services.

Chapter 4: Methodology

4.1 Study design: The study design was descriptive and cross-sectional.

4.2 Study sites & area: The study sites were all the educational and rehabilitation institutes located in Khartoum State.

4.3 Target population: All children (n=1551) with special needs attending the educational and rehabilitation institutes in Khartoum State aged from 5 to 15 years old.

4.4 Sample Frame: All the institutes for the children with special needs located in Khartoum State as obtained from the Ministry of Education. The total number of special care centers were 53 centers, 26 centers were randomly selected.

4.5 Study sample & sample size: A simple, stratified, random sample was used for this study and the sample size (n) was calculated according to the equation:

$$n = \frac{Nz2\,pq}{(N-1)*d^2+z^2pq}$$

N = 1551

$$= \frac{1551*(1.96)^2*0.5*0.5}{1550*(0.05)^2+ (1.96)^2*0.5*0.5} = \mathbf{308}$$

Where:

n = sample size

N = total number of the targeted population (1551)

Z = value of normal curve corresponding to level of confidence (95%) 1.96

P = proportion of the target population estimated to have a particular characteristics on attribute that is targeted to be measured 0.5

q = 1-p

d = desired margin of error

4.6 Inclusion criteria: Any child with special needs aged 5-15 year-old attending these institutes.

4.7 Exclusion criteria: The children aged younger than 5 year-old or older than 15 year-old were excluded. Any child that showed uncooperative behavior during examination also was excluded.

4.8 Clinical Examination

The clinical examination and recording included:

- Dental caries
- Periodontal disease
- Oral mucosal lesions

The methods and indices used in this study were according to WHO criteria (WHO 1997) so as to facilitate comparison of the present study findings with national and international studies. The indices used were DMFT/dmft and CPI.

The oral examinations were carried out by a single examiner (the researcher) in the institutes that were randomly selected, during the working days. Children were seated on office chair under natural daylight. The examinations were carried out prior cleaning or drying of the teeth, and the instruments used consisted of a number 4 plane dental mirror, dental tweezer and a specially designed lightweight CPI probe with a 0.5 mm ball tip and with a black band between 3.5 and 5.5 mm and rings at 8.5 and 11.5 mm from the ball tip. Radiographs were not taken.

4.8.1 Cross infection control

Two plastic boxes for instruments were used. A blue box was for transporting sterile instruments only and had to be sterilized if contaminated. A new set of sterile instruments were used for each subject. Gloves were changed before the examination on every subject and the face mask was changed every hour or when it was necessary. A disposable paper sheet was used under each set of instruments and disposed off after each subject.

The examiner wore protective glass before the oral examination commenced. This glass was wiped with disinfectant between examinations. The used probes, mirrors, and other instruments were collected in a red box and washed and autoclaved at the end of the working day. A clinical waste bag was used for the disposal of used gloves, facemasks, cotton rolls, wipes and clinical sheets.

4.8.2 Dentition status and treatment need (DMFT/ dmft) index

Children were examined for tooth decay that had extended through the enamel and into dentine. Tooth decay levels in the children was best described by using the DMFT/dmft index. Decayed, Missing, or Filled Teeth Index (DMFT/dmft) is clinical arithmetic index, first established in 1938 to measure the prevalence and severity of coronal caries (i.e., cavities) for an individual and groups in a population.

The index was used separately for the permanent and primary dentition. Upper-case letters (DMFT) are used for the permanent dentition and lower-case letters (dmft) for primary dentition. The index is composed of three components, "Decayed, Missing, and Filled."

1. The D-component for decayed due to caries (D or d). If a tooth had both a caries lesion and a filling it was calculated as “D or d” only, and showed how much of the disease was untreated.
2. The M-component for missing due to caries (M or m) showed how much had been treated by extraction. According to the criteria for the World Health Organization (WHO), for subjects under 30 years of age, the M-component should only include teeth missing due to caries.
3. The F-component for filled due to caries (F or f). Filled teeth were assumed to have been clearly decayed before restoration and shows what proportion of the decayed teeth are treated by restoration with fillings.

Procedures

The DMFT/dmft Index was obtained by the examiner, under favorable lighting conditions and using a No. 4 plain mirror and dental CPI probe, was determine the sum of how many teeth were: decayed, missing, and filled.
The maximum number for an individual DMFT score was 28. For deciduous or primary teeth, the maximum dmft score for an individual was 20 since primary dentition had a maximum of 20 teeth.

The Criteria for diagnosis and coding (primary tooth codes within parentheses) were:

0 (A): Sound crown

A crown was recorded as sound if it showed no evidence of treated or untreated clinical caries. In addition, a crown with the following defects was also coded as sound: white or chalky spots, discoloured or rough spots that were not soft to touch with the metal CPI probe, stained pit or fissures in the enamel that did not have visual signs of undermined enamel, or softening of the floor or walls detectable with a CPI probe, dark, shiny, hard, pitted areas of enamel in a tooth showing signs of moderate to severe fluorosis, lesions that, on basis of distribution or history, appeared to be due to abrasion.

1 (B): Decayed crown

Caries was recorded as present when a lesion in a pit or fissure, or on a smooth tooth surface, had an unmistakable cavity, undermined enamel, or a detectably softened floor or wall. A tooth with a temporary filling, or one, which was sealed {code 6 (F)}, but also decayed, was also included in this category. In case where the crown had been destroyed by caries and only the root was left, the caries was judged to have originated on the crown and therefore scored as crown caries only. The CPI probe was used to confirm visual evidence of caries on the occlusal, buccal and lingual surfaces. Where any doubt exists, caries had not been recorded as present.

2 (C): Filled crown, with decay

A crown was considered filled, with decay, when it had one or more permanent restorations and one or more areas that were decayed. No distinction was made between primary and secondary caries {i.e., the same code applied whether or not the carious lesions were in physical association with the restoration (s)}.

3 (D): Filled crown, with no decay

A crown was considered filled, without decay, when one or more permanent restorations were present and there was no caries anywhere on the crown. A tooth that had been crowned because of previous decay was recorded in this category. {A tooth that has been crowned for reasons other than decay, e.g. a bridge abutment, is coded 7 (G)}.

4 (E): Missing tooth, as a result of caries

This code was used for permanent or primary teeth that had been extracted because of caries and was recorded under coronal status. For missing primary teeth, this score was used only if the subject was at an age when normal exfoliation would not be a sufficient explanation for absence. The root status of a tooth that had been scored as missing because of caries was coded "7" or "9".

5 (-): Permanent tooth missing, for any other reason

This code was used for permanent teeth judged to be absent congenitally, or extracted for orthodontic reasons or because of periodontal disease, trauma, etc. Root status of a tooth that had been scored as missing because of caries was coded "7" or "9".

6 (F): Fissure sealant

This code was used for teeth in which a fissure sealant had been placed on the occlusal surface; or for teeth in which the occlusal fissure had been enlarged with a rounded or

"flame-shaped" bur, and a composite material placed. If a tooth with a sealant had decay, it was coded as 1 or B.

7 (G): Bridge abutment, special crown or veneer

This code was used under coronal status to indicate that a tooth formed part of a fixed bridge, i.e., is a bridge abutment. It was also be used for crowns placed for reasons other than caries and for veneers or laminates covering the labial surface of a tooth on which there was no evidence of caries or a restoration.

8 (-): Un-erupted crown

This code was used for a tooth space with an un-erupted permanent tooth. Teeth scored as un-erupted were excluded from all calculations concerning dental caries. This category does not include congenitally missing teeth, or teeth lost as a result of trauma, etc.

9 (-): Not recorded

This code was used for any tooth that could not be examined for any reason (e.g. because of orthodontic bands, severe hypoplasia, etc.).

4.8.3 Community Periodontal Index (CPI)

Community Periodontal Index (CPI) is a clinical index, first established in 1982 and developed by the WHO, to assess, survey and evaluate periodontal treatment needs rather than determining past and present periodontal status.

4.8.3.1 Measurement of Periodontal Disease

Community Periodontal Index (CPI) was used to measure periodontal disease. A special designed CPI probe was used, which has 0.5mm diameter ball at its tip, a blank band for visibility between 3.5 and 5.5 mm, and ring at 8.5 and 11.5mm from the ball tip.

The purpose of the ball end was to assist in detecting sub-gingival calculus and to help prevent the probe from being pushed through inflammatory tissue at the base of a pocket. Probing pressure used was about 20 grams. For a treatment need survey the mouth was divided into sextants. A sextant was examined only if there are two or more teeth present and not indicated for extraction. When only one tooth remains in a sextant, it was included in the adjacent sextant.

Teeth that were examined:

6	1	=	6	
6			1	6

The tooth surfaces were assessed are the buccal of the upper molars, lingual of the lower molars and lower incisors and the labial surface of the upper incisors.

4.8.3.2 Codes and Criteria Used in CPI

0 Healthy, no disease

1 Gingival bleeding observed no pocket, no calculus.

2 Sub-gingival calculus present, no pocket > 3 mm.

3 Pocket present 4 or 5 mm deep.

4 Pocket > 6mm (black area of probe not visible).

4.8.3.3 Sensing Gingival Pockets and Calculus

CPI probe was used as a "sensing" instrument to determine pocket depth and to detect calculus and bleeding response. The sensing force used was about 20 grams.

For sensing **subgingival** calculus, the lightest possible force that would allow movement of the probe ballpoint along the tooth surface was used. When the probe was inserted, the ballpoint was followed the anatomical configuration of the surface of the tooth root. The probe tip was inserted gently into the gingival pocket and the depth of the insertion read against the colour coding. The total extent of the pocket was explored: the probe was placed in the pocket at the disto-buccal surface of the first molar, as close as possible to the contact point with the second molar, keeping the

probe parallel to the long axis of the tooth. The probe was then moved gently with short up down movements through the buccal sulcus or Pocket to the mesial contact area of the first molar towards the contact area with the premolar. A similar procedure was carried out for the lingual surfaces, starting distolingually to the first molar. All scores found in a sextant were recorded. Code (X) was places when it was not possible to make a reliable recording.

4.8.4 Oral mucosa

An examination of the oral mucosa and soft tissues in and around the mouth was made on every child. The examination was thorough and systematic and was performed in the following sequence:

(a) Labial mucosa and labial sulci (upper and lower).
(b) Labial part of the commissures and buccal mucosa (right and left).
(c) Tongue (dorsal and ventral surfaces, margins).
(d) Floor of the mouth.
(e) Hard and soft palate.
(f) Alveolar ridges/ gingival (upper and lower).

Any abnormalities of the mucosa or of the gingiva were recorded on a modified the WHO oral health assessment form. A mouth mirror and the handle of a periodontal probe were used to retract the tissues. The following procedure was used for examination of the mouth and lips and any abnormal lesions were recorded: The labial mucosa, vermillion border and labial sulci (upper and lower) were examined carefully and any abnormalities were recorded. Then labial part of the commissures and the buccal mucosa of both sides were examined using the mouth mirror and periodontal probe handle to retract the check. The child was then asked to protrude his or her tongue and the dorsum, ventral surface and margins of the tongue were observed and examined for any ulceration, coating, variation in colour or texture, or any other condition. The child was then requested to elevate the tongue and the floor of the mouth is examined for any abnormality. Alveolar ridges and the gingiva of the mandible and maxilla were examined from all sides (bucally, lingually and palatally). Lastly the hard and soft palate was inspected and any abnormalities detected were recorded.

4.9 Data collection and analysis

Data was collected using a data capture sheet that consisted of the modified 1997 WHO Oral Health Assessment Guidelines for a Clinical Oral Examination (Appendix 1). Demographic variables, dmft, periodontal disease and oral mucosal lesions were recorded using sterilized plain dental mirrors (standard head size 4), curved probes, periodontal probes, tweeze and tongue and cheek retractor. The data were captured in Excel. Analysis was done using Excel environment. The database was imported into SPSS to perform further statistical analysis.

4.10 Ethical considerations

The protocol was submitted to the Senate Research Ethics Committee of the University of the Western Cape for ethical approval and permission to carry out the study was sought from the Ministry of Health Khartoum State and heads of institutions. Informed consent (Appendix 2) was obtained from a parent of each participant prior to any interviews or examinations being conducted. Participation in this study was entirely voluntary and the participants were allowed to withdraw from the study at any time should they wish to do so. It was emphasized that strict confidentiality would be maintained at all times and that no names or personal details will be used in the write up of the study.

Chapter 5: Results

5.1 Participant characteristics

The total number of the participants in this study was 308. The sample consisted of 188 boys (61%) and 120 girls (39%) (Figure 1). The age of the participants ranged from 5 to15 years old and Table 1 shows the distribution of four age groups.

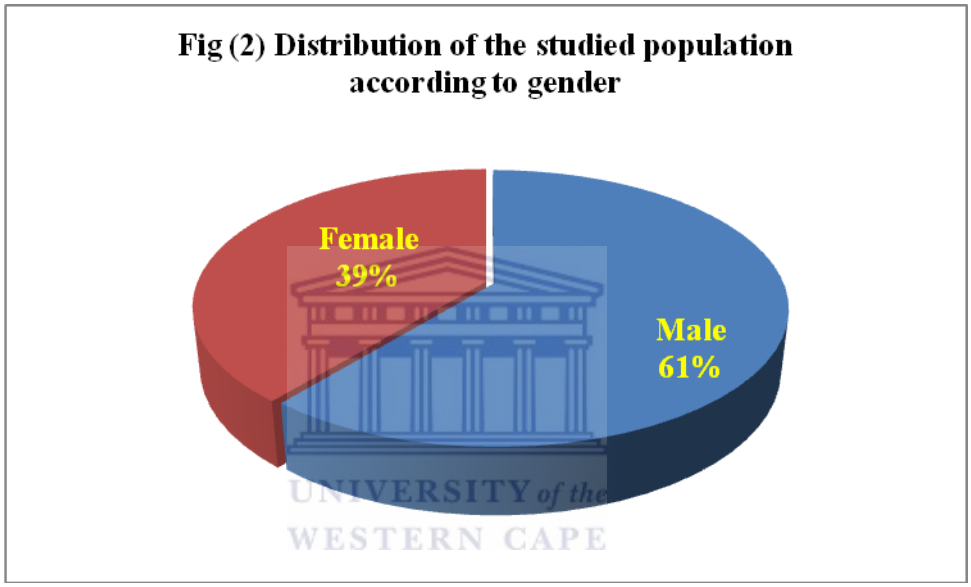


Table 1: Distribution according to age group

Age	N	%
5-6	27	8.8
7-10	107	34.7
11-13	106	34.4
14-15	67	21.8
missing	1	0.3
Total	**308**	**100**

The types of disabilities were: learning, speech disorders, hearing impairment, vision impairment, Down's syndrome, Autism, mental disability, cerebral palsy, motor impairment and others (epilepsy, hydrocephaly, and hyperactivity).

Table 2 shows the number and percentage of different types of disabilities according to the age group. Hearing impairment (29%) was the most frequent disability found followed by learning disability (17.6%) and cerebral palsy was the lowest (1.6%).

Table 2: Distribution according to age and type of disability

Type of disability	5-6 yr	7-10 yr	11-13 yr	14-15 yr	Total
	n (%)	n (%)	n (%)	n (%)	n (%)
Learning disability	0 (0)	12 (3.9)	29 (9.4)	13 (4.2)	54 (17.6)
Speech disorder	1 (0.3)	6 (2%)	2 (0.7)	1 (0.3)	10 (3.3)
Hearing impairment	11 (3.6)	40 (13)	23 (7.5)	16 (5.2)	90 (29.2)
Vision impairment	0 (0)	9 (2.9)	3 (1)	5 (1.6)	17 (5.5)
Down's Syndrome	0 (0)	13 (4.2)	15 (4.9)	3 (1)	31 (10.1)
Autism	6 (2)	4 (1.3)	1 (0.3)	3 (1)	14 (4.5)
Mental disability	6 (2)	16 (5.2)	24 (7.8)	20 (6.5)	66 (21.4)
Cerebral Palsy	0 (0)	2 (0.7)	2 (0.7)	1 (0.3)	5 (1.6)
Motor impairment	2 (0.7)	3 (1)	4 (1.3)	4 (1.3)	13 (4.2)
Others	1(0.3)	1 (0.3)	3 (1)	1 (0.3)	7 (2.3)
Total	**27 (8.8)**	**107(34.9)**	**106 (34.5)**	**67 (21.8)**	**308 (100)**

5.2 Oral health status

5.2.1 Mean dmft in 5-6 year olds

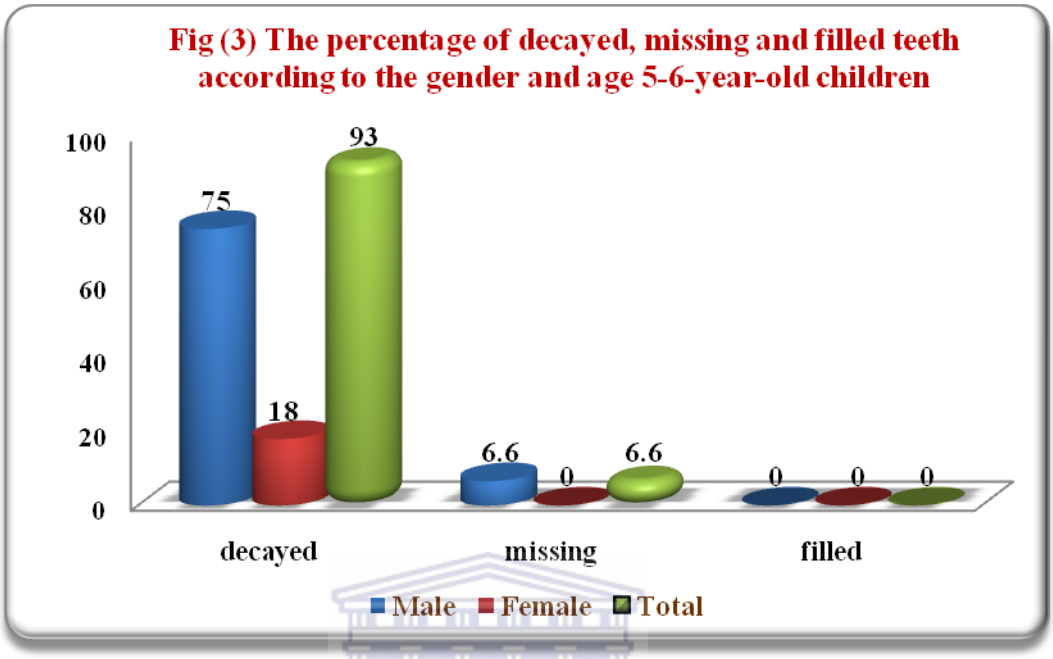
Twenty seven (8.8%) children were aged between 5-6 years old. The mean dmft of the primary dentition in boys was 2.94 (SD = 3.88), and girls 1.10 (SD = 1.59) and was not statistically significant (p = 0.142). The mean dmft was 2.02 (SD = 2.23) (Table 3).

Table 3: Mean dmft according to age and gender

Age	Mean dmft±(SD)		Total	T test	*P* value
	Boy	Girl			
5-6	2.94±(3.88)	1.10±(1.59)	2.02±(2.23)	1.422	0.142

The d component accounted for 93% of the dmft with the highest score in the boys (75%). The m component was only 6.6%, and all the missing teeth were found in the boys. None of the subjects had any filled teeth.

Figure 2 shows the percentage of decayed, missing and filled teeth in deciduous dentition in 5-6 years old children.



5.2.2 Caries-free 5-6 year olds

The percentage of caries-free children in 5-6 years old was 44.4% (n =12 out of 27), seven boys (25.9%) and five girls (18.5%) (Table 4).

Table 4: Percentage of children caries-free age 5-6 years old (primary teeth)

Age	Boy n (%)	Girl n (%)	% of Total
5-6	7 (25.9)	5 (18.5)	44.4

5.2.3 Mean DMFT (Permanent Dentition)

Children older than 6 years (n=280) were sub-divided into three age groups: 7-10 years (n=107, 38.2%), 11-13 years (n=106, 37.9%) and 14-15 years (n=67, 23.9%). The overall mean DMFT score for permanent dentition in all 280 children was 1.25± (2.02).

Table 5 shows the mean DMFT by age and gender. The mean DMFT score was highest among the 14-15 year old children (boy 1.76 and girl 1.79). The difference of mean DMFT between the boy and girl among 7-10 years old group was statistically significant ($p < 0.05$) (Table 5).

Table 5: Mean DMFT according to gender and age 7-10, 11-13 and 14-15-year-old-children

Age	Mean DMFT±(SD)		Total DMFT±(SD)	T test	*P* value
	Boy	Girl			
7-10 yr	0.53±(1.12)	1.15±(1.63)	0.84±(1.37)	-2.306	0.023
11-13 yr	0.82±(1.36)	1.48±(2.67)	1.15±(2.01)	-1.668	0.098
14-15 yr	1.76±(2.17)	1.79±(3.18)	1.78±(2.67)	-0.043	0.966
Total	1.03±(1.55)	1.47±(2.49)	1.25±(2.02)	-1.339	0.362

Table 6 depicts the mean DMFT according to the type of disability and gender. Autistic children had the highest DMFT score (4.50), followed by children with cerebral palsy (2.09), and Down's syndrome (1.95) whereas the children with hearing impairment had the lowest DMFT score (0.56) followed by children with vision impairment (0.60).

Table 6: Mean DMFT according to gender and type of disability

Type of disability	Mean DMFT		Total	T test	*p value*
	Boy	Girl			
Learning disability	0.86	1.31	1.09	-0.847	0.402
Speech disorder	1.00	0.75	0.88	0.255	0.807
Hearing impairment	0.60	0.52	0.56	0.305	0.761
Vision impairment	0.20	1.00	0.60	-5.527	0.000
Down's Syndrome	1.32	2.58	1.95	-1.141	0.263
Autism	1.00	8.00	4.50	-2.103	0.080
Mental disability	1.29	1.45	1.37	-0.368	0.714
Cerebral Palsy	2.67	1.50	2.09	0.670	0.582
Motor impairment	1.62	2.00	1.81	-0.441	0.673
Others	0.40	5.00	2.70	-	-
Total	**1.09**	**2.41**	**1.76**	**-**	**-**

Table 7 shows a breakdown of the DMFT components according to the gender and age groups. The percentage of D component for the age group 7-10 years old was found to be highest, and the lowest percentage was in age group 14-15 years old (76.5%). The percentage of M component was highest in 14-15 year age group (14.3%) and lowest in 7-10 year age group (6.1%). Girls aged 7-10 years old had a higher percentage of decayed teeth (53.5%) than boys for the same age group (37.8%); and this was the opposite for the 14-15 years age group (boys 47.9% and girls 28.6%). The percentage of filled teeth was very low in all age groups: 2.4% for the age group 7-10, 2.7% for the age group 11-13 and 9.3% for the age group 14-15 years old.

Table 7: The percentage of decayed, missing and filled teeth according to gender and age group

	Decayed			Missing			Filled		
Age yrs / Gender	7-10	11-13	14-15	7-10	11-13	14-15	7-10	11-13	14-15
Boy	37.8	39	47.9	4.9	6.2	6.7	0	2.7	1.7
Girl	53.6	46.9	28.6	1.2	5.3	7.6	2.4	0	7.6
Total	**91.4**	**85.9**	**76.5**	**6.1**	**11.5**	**14.3**	**2.4**	**2.7**	**9.3**

Mentally disabled and children with Down's syndrome aged 7-10 years showed the highest percentage of decayed teeth within this age group 30% and 24.4% respectively. For the age group 11-13 years old, children with learning disability and Down's syndrome displayed higher percentage of decayed teeth than other type of disabilities (25.7% and 20% respectively). Mentally disabled children in the 14-15 year age group showed the highest percentage of decayed teeth (20.1%) (Table 8).

Table 8: The percentage of decayed, missing and filled teeth according to type of disability and age group

Type of disability	Decayed			Missing			Filled		
	7-10	11-13	14-15	7-10	11-13	14-15	7-10	11-13	14-15
	%	%	%	%	%	%	%	%	%
Learning disability	4.9	25.7	18.5	2.4	0.9	0	0	0	0
Speech disorder	2.4	2.7	2.5	0	0	0	0	0	0
Hearing impairment	19.5	8	8.4	2.4	3.5	2.5	1.2	0	0
Vision impairment	1.2	-	3.4	0	-	0	0	0	0
Down's Syndrome	24.4	20	4.2	0	2.7	4.2	0	0	0
Autism	-	1.8	8.4	-	0	0.8	-	0	8.4
Mental disability	30	16.8	20.1	1.2	3.5	4.2	1.2	1.8	0.8
Cerebral Palsy	3.7	2.7	2.5	0	0.9	0	0	0.9	0
Motor impairment	4.9	6.2	8.7	0	0	0	0	0	0
Others	**-**	**1.8**	**1.7**	**-**	**0**	**2.5**	**-**	**0**	**0**
Total	**91.4**	**85.9**	**76.5%**	**6%**	**11.5**	**14.3**	**2.4**	**2.7**	**9.2**

5.2.4 Caries-free permanent dentition

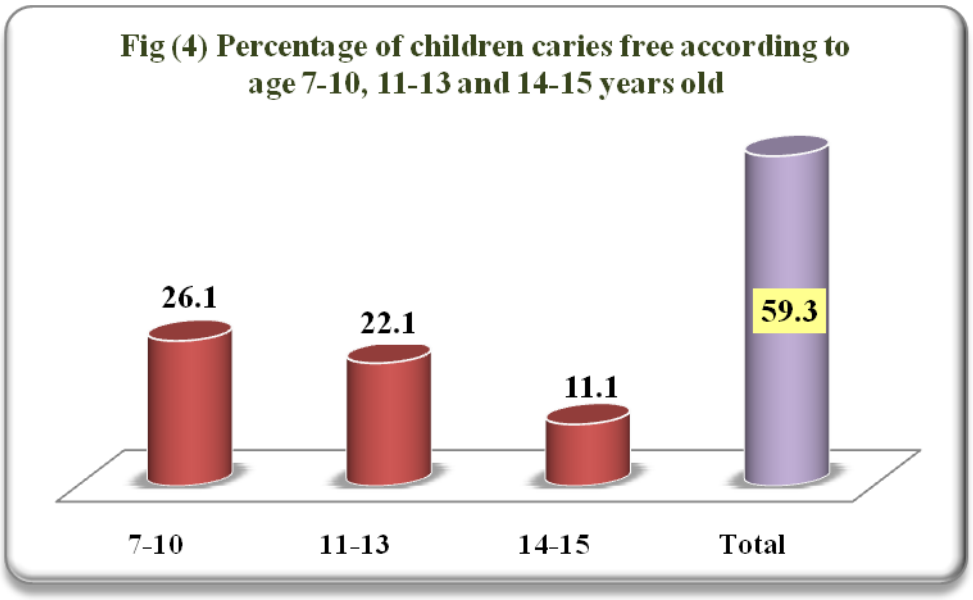
Nearly two thirds (59.3%) of children older than 6 years (n=280) were caries-free (n=108, 38.6% boys, and n=58, 20.7% girls (Table 9). Just over a quarter (26.1%) was in the 7-10 year age group, and only 11.1% in the 14-15 year age group were found to be caries-free (Table 10).

Table 9: Percentage of children caries-free age 7-15 according to gender

Gender	Number	%
Boy	108	38.6
Girl	58	20.7
Total	166	59.3

Table 10: Percentage of children caries-free according to age

Age	Number	%
7-10	73	26.1 %
11-13	62	22.1 %
14-15	31	11.1 %
Total	166	59.3 %



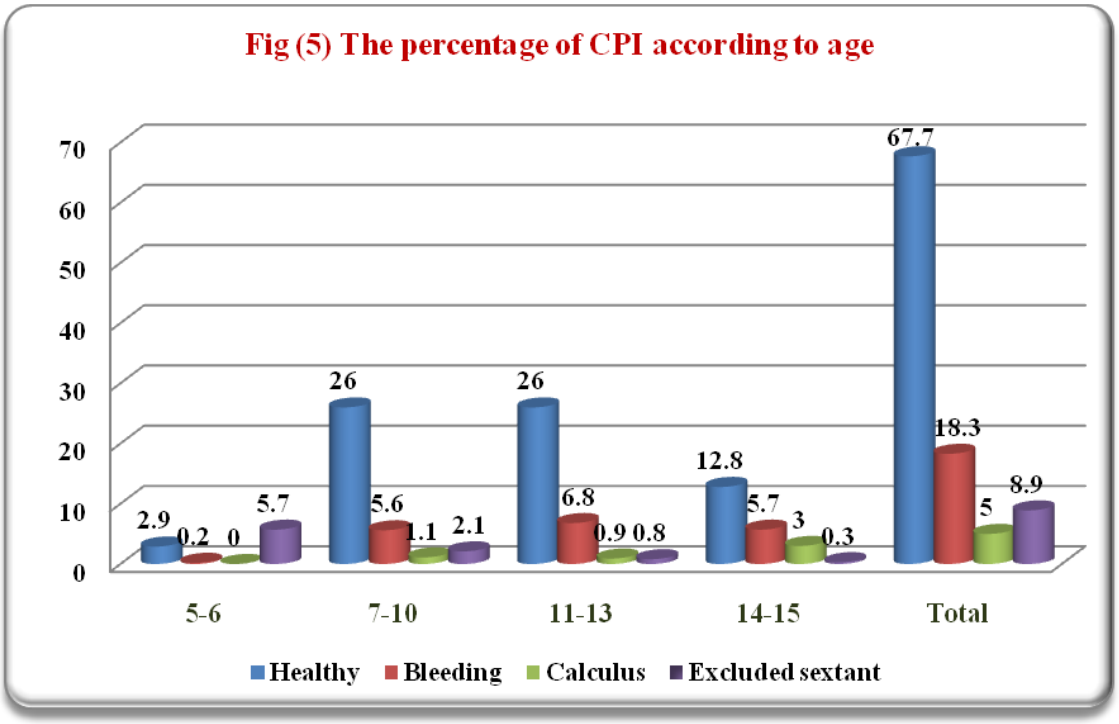
5.2.5 Community Periodontal Index (CPI)

The overall periodontal status results showed that the percentage of healthy sextants of the children examined was 67.7% (42.5% boys and 25.1% girls), the percentage of the sextants with bleeding was 18.3% (11% boys and 7.4% girls), and the percentage of the sextants with calculus was 5% (2.4% boy and 2.6% girl). 8.9% of the sextants were excluded (Table 11).

Table 11: Distribution of CPI according to gender

Gender	% Healthy sextant	% Bleeding sextant	% Calculus sextant	% Excluded sextant
Boy	42.5	11.0	2.4	5.1
Girl	25.1	7.4	2.6	3.8
Total	67.6	18.5	5.0	8.9

The distribution of the CPI according to the age groups is illustrated in Figure 4. No calculus sextant found among the age group 5 to 6 years old, and only 0.2% bleeding was found. The age group 11 to 13 showed highest percentage of bleeding sextant 6.8% and age group 14 to 15 years old showed the highest percentage of calculus 3%.



When CPI was analyzed by type of disability it was found that the bleeding scores among the children with mental disability was highest (4.8%) followed by learning disability, hearing impairment and Down's syndrome. Calculus scores were highest in children with learning disabilities (1.3%) followed by the mentally disabled children (1.2%) (Table 12).

Table 12: Distribution of CPI according to the type of disability

Type of disability	% Healthy	% Bleeding	%Calculus	%Excluded sextant
Learning disability	13.0	3.2	1.3	0.3
Speech disorder	2.0	0.4	0.1	0.8
Hearing impairment	22	3.1	0.6	3.6
Vision impairment	4.3	0.8	0.4	0.1
Down's Syndrome	6.6	2.7	0.5	0.3
Autism	2.0	0.6	0.3	1.6
Mental disability	13.9	4.8	1.2	1.6
Cerebral Palsy	0.8	0.6	0.1	0.2
Motor impairment	1.7	1.6	0.4	0.5
Others	1.4	0.8	0.1	0.1
Total	67.6	18.5	5.0	8.9

5.2.6 Oral Mucosal lesions

The overall prevalence of oral mucosal lesions was 11.4% (n=35) 7.1% (n=22) in boys and 4.3% (n=13) in girls (Table 13).

Table 13: The percentage of oral mucosal lesions according to gender

Lesion	Boy	Girl	Total
Normal	53.9	34.7	88.6
Abnormal	7.1	4.3	11.4
Total	61	39	100

Four oral mucosal lesions were seen: angular cheilitis, commissural pits, ulceration and fissured tongue (Table 14). The most frequent lesion was fissured tongue (10%, n = 31) and the majority were seen in children with Down's syndrome n =18 (51.4%) and mental disability n = 9 (25.7%).

Table 14: The percentage of oral mucosal lesions found in the studied population

Lesion	%
Normal	88.6
Geographic tongue	0
Angular cheilitis	0.3
Commissural Pits	0.9
Ulceration (aphthous, herpetic, traumatic)	0.6
Dento-alveolar abscess	0
Fissured tongue	10
Other	0
Total	100.4

The distribution of lesions according to age revealed that only one lesion occurred in age 5-6 years old 0.3%, eleven lesions appeared in 7-10 years old 3.6%, 14 lesions among 11-13 years old 4.6% and eight lesions found in the age group 14-15 years old 2.6% (Table 15).

Table 15: The percentage of oral mucosal lesions according to age group: 5-6, 7-10, 11-13 and 14-15 years old

Lesion	5-6	7-10	11-13	14-15	Total
Normal	8.5	31.3	30	19.2	88.6
Abnormal	0.3	3.6	4.6	2.6	11.4
Total	8.8	34.9	34.6	21.8	100

5.3 Summary of results

- The mean dmft was 2.02.
- The mean DMFT was 1.25.
- The DMFT increased with age.
- Girls showed higher DMFT than boys for all age groups.
- CPI: percentage of sextant with bleeding 18.3%, and calculus 5%.
- Fissured tongue was the most frequent lesion seen.
- Autistic children showed highest DMFT (Table 6).
- Mentally disabled children showed highest percentage of decayed teeth (Table 8).

Chapter 6: Discussion

6.1 Introduction

Oral health is of great importance for everyone. It is an integral part of general health and well being, and more so for those with disabilities due to their compromised medical and congenital conditions and greater unmet dental healthcare needs (Purohit *et al*, 2010). People with disabilities often do not have the ability to express their needs or pain and discomfort and in many cases are unable to independently take care of their oral hygiene due to their disabilities. Improving the oral health of people with disabilities is one of the challenges that oral health professionals in Sudan encounter and it is a moral and ethical obligation and duty to treat these patients.

To the best of the author's knowledge, the present study is the first study of this kind to be carried out in Khartoum State and the findings therefore provide baseline data about the oral health status (dental caries, periodontal disease and oral mucosal lesions) of children with special needs in the 5-15 year old age group. Seven localities that comprised Khartoum State were surveyed and the general assumption was this group of children will present with a high prevalence of dental caries and periodontal disease.

6.2 Dental caries

The participants in the present study showed a high mean dmft/DMFT (2.02/1.25), and high d/D component when compared to a study from Nigeria that showed a very low mean dmft/DMFT score (0.7/0.4) (Oredugba and Akindayomi, 2008). However, the authors attributed the low scores to the fact that their study was carried out in private institution patronized by parents from upper and middle socio-economic status and the educational status of the children's parents had a positive effect on their children dental care. Similarly, the mean dmft of the present study also higher than that of the study from Ireland for the dmft/DMFT scores of both Down's syndrome and children with other special needs (Bradley and McAlister, 2004).

In comparison with two studies from India, the first study conducted by Jain *et al* (2008) in Udaipur, and the second one by Rao *et al* (2001) in Mangalore, both studies showed mean DMFT scores higher than the present study as did the studies conducted by Al-Qahtani and Wyne (2004) in Saudi Arabia, on deaf children where the score was 7.35/5.12 and by de Jongh *et al* (2009) who reported a mean score was 3.0, a third caries-free and three quarters (76%) presented with untreated caries.

The present study concurred with that reported by Jain *et al* (2008) and Gokalp *et al* (2007) with regard to an increasing DMFT score with increasing age.

When the DMFT score was analyzed according to gender it revealed that the score was higher in girls than in boys for the all age groups. This finding was in accordance with Altun *et al* (2010), Farsi (2008) and Lukacs and Largaespade (2006). In the present study, the d/D component of the dmft/DMFT value was found the largest component when compared to the m/M and f/F component. Similar observations were reported in many studies, for example: a study carried out by Altun *et al* (2010) showed that the frequent of decay among the disabled individuals was the highest one. Jain et al (2008) found that the largest component of the DMFT was the D component when compared to the M and F component as did Simon *et al* (2008), de Jongh et al (2008) and Rao *et al* (2001).

The results of the present study showed that autistic children exhibited the highest DMFT score followed by children with cerebral palsy and children with Down's syndrome (Table 6). An unusual finding of this study was that children with Down's syndrome had the second highest percentage of decayed teeth (16.2%), followed the children with mental disability (22.3%). This finding is inconsistent with many other reported studies. For example, Altun *et al* (2010), Bradley and McAlister (2004) and Peretz *et al* (1999) all reported that the people with Down's syndrome had very low dental caries prevalence. However, Fung and Allison (2005) have reported that there is disagreement on the prevalence of dental caries among Down's syndrome populations.

When comparing the findings of the present study to recent (unpublished) studies from Khartoum State, Sudan among normal school children aged 6, 8, and 12 years old, the children with special needs have high dmft/DMFT scores 2.02/1.25.

The first study carried out by Babiker (2008) reported a low dmft (1.08) with a relatively high d component. The mean DMFT (1.19) was lower than the findings of the present study. The D component was 94.4% and the F component was 3%. It is clear therefore that the dmft/DMFT score among the children with special needs is higher than that in normal children. The percentage of untreated caries was very high in both the unpublished studies and the present study from Sudan indicating that there is little or no dental treatment provided to normal or children with special needs.

The second study conducted by Arzon (2008) among basic schools of Internally Displaced People (IDP) found a DMFT of 1.1. The percentage of d/D component in IDPs school children was 94.5%/ 96.8% which is slightly higher than of the present study (93/ 88.6). The f/F component (0%) was the same in both studies. The percentage of caries-free children reported by Arzon (2008) was greater than that reported in the present study.

The high percentage unmet treatment need as shown by the high levels of decayed teeth and a zero percent of filled teeth found in the present study indicate that dental services for children with special needs are virtually non-existent in Khartoum State. This may be due to unavailability of dental specialists in this discipline or dentists trained to manage them. It may also be due to the inaccessibility of dental facilities, financial barriers and dental clinics lacking the necessary equipment to meet the needs of this special group.

6.3 Periodontal status

The findings of the present study showed that more than two thirds of the examined sextants were healthy, less than quarter had bleeding and 5% calculus accumulation. These results may be attributed to the fact that tooth brushing is a well established habit among the Sudanese.

However, the percentage of bleeding sextants was found to increase with age and the percentage of calculus sextants was greater in older children aged 14-15 years. Children with mental and learning disability exhibited higher percentages of bleeding and calculus followed by children with hearing impairment and Down's syndrome. The literature reported that children with Down's syndrome are more prone to the periodontal disease than the children with other disabilities (Desai, 1997). Jain *et al* (2009) reported a higher prevalence of periodontal disease and the greatest treatment needs in children with Down's syndrome compared to normal children or children with other disabilities.

6.4 Oral mucosal lesions

The most common lesion seen in this study was fissured tongue and the majority was in children with Down's syndrome and this is one of the characteristic features of children with this condition. This result concurs with the study from Iran conducted by Daneshpazhoom *et al* (2007). The distribution of the lesions according to gender showed that it was almost double in boys.

6.5 Conclusions

Children with special needs in Khartoum State demonstrated high prevalence of dental caries and periodontal disease, and despite this do not receive adequate dental services. There is an urgent need for both preventive and treatment programmes to improve the oral health of children with special needs.

Chapter 7: Recommendations

Based on studies that showed a higher prevalence of untreated dental disease in children with disabilities compared to the normal children, the United Kingdom's Court Report "Fit for the future" recommended that the dental health of children with special needs should be brought up to, and maintained at the level of that provided for the normal children (Jain *et al*, 2008; Court SDM, 1976).

Following the evaluation of oral health services (1997- 2003) in Khartoum State it was found that there were no preventive dental services targeting children with special needs and one of the recommendations was for the oral health directorate to launch a preventive programme to target children with special needs in Khartoum State. One of the objectives of this study was to provide baseline data on the oral health status of children with special needs in Khartoum State so as to make recommendations regarding preventive dental services.

The present study has demonstrated that children with special health care needs have a higher prevalence of dental caries and periodontal disease than normal school children and have high unmet treatment needs and therefore the recommendations of this study are the:

- Provision of preventive-based intervention programmes targeting all children with special needs in Khartoum State as well as the entire country.

- Development of educational programmes to raise public awareness regarding the importance oral health of children with special needs.

- Development and implementation of a special educational and preventive training programme targeting parents and caregivers of children with special needs.

- Launching of a special school/institute oral health programme similar to the school oral health programme that currently exists in Khartoum State consisting tooth brushing, topical fluoride application and fissure sealing.

- Provision of restorative/curative programmes to treat the highly prevalence dental caries and unmet treatment needs

- Training of dental professional personnel to execute the above-mentioned preventive and curative programs.

- Establishment of especially designed dental clinics/centers to treat children with special needs.

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Appendix 1: MODIFIED W.H.O ORAL HEALTH ASSESSMENT FORM (1997)

General information

	Day	Month	Year
(1)			2012

(2) Examiner number
(3) Record number
(4) Locality.....
(5) Centre.....
(6) Child's Name.....
(7) Gender: (1) Male (2)Female
(8) Age

Type of disability

1	Learning disability	
2	Speech disorder	
3	Hearing impairment	
4	Vision impairment	
5	Down's Syndrome	
6	Autism	
7	Mental disability	
8	Cerebral Palsy	
9	Motor impairment	
10	Other (specify)	

Community Periodontal Index (CPI)

0	Healthy
1	Bleeding
2	Calculus
3	Pocket **4** – **5** mm (black band on probe partially visible)
4	Pocket 6 mm or more (black band on probe not visible)
X	Excluded sextant

16	**11**	**26**
64	**31**	**63**

Dentition Status and Treatments Need

Status	Permanent teeth	Primary teeth
Sound	**0**	**A**
Decayed	**1**	**B**
Filled with decay	**2**	**C**
Filled no decay	**3**	**D**
Missing as a result of caries	**4**	**E**
Not recorded	**5**	**F**

	Treatment need
0	None
1	Filling
2	Extraction
3	Pulp care
4	Fissure Sealant
5	Need for other care

	55	**54**	**53**	**52**	**51**	**61**	**62**	**63**	**64**	**65**				
18	**17**	**16**	**15**	**14**	**13**	**12**	**11**	**21**	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**Status**
(1)																**(16)**
(33)																**(49)**

Treatment

	85	**84**	**83**	**82**	**81**	**71**	**72**	**73**	**74**	**75**				
48	**47**	**46**	**45**	**44**	**43**	**42**	**41**	**31**	**32**	**33**	**34**	**35**	**36**	**37**	**38**	**Status**
(17)																**(32)**
(50)																**(66)**

Oral Mucosa

Normal ☐

Lesion	Fill here	Location	Code
Geographic tongue		Vermilion border	**0**
Angular cheilitis		Commissars	**1**
Commissural Pits		Lips	**2**
Ulceration (aphthous, herpetic, traumatic)		Sulci	**3**
Dento-alveolar abscess		Buccal mucosa	**4**
Fissured tongue		Floor of the mouth	**5**
*Other		Tongue	**6**
		Hard or soft Palate	**7**
		Alveolar ridge / Gingiva	**8**

Other (please describe): ……..

……

……

……

Appendix 2: Informed Consent for Oral Examination

Dear Parent of …….

I am Dr Elturabi G K Eltilib, working in the Ministry of Health, Khartoum State Oral Health Directorate, Sudan, and Iam presently a post-graduate student studying for the MSc (Dent) in Dental Public Health at the Department of Community oral health, Faculty of Dentistry, UW South Africa.

I am interested in the oral health of children with special needs in Khartoum State. This will be done through an examination of the teeth and mouth of the children and by asking them a few questions about their oral health. We are doing this to determine the kinds of oral and dental problems found in these children to assist us with making recommendations to the Ministry of health to develop policy for preventive and treatment programs.

The examination will take about 15 minutes. There is no risk of harm to the participants in this study and there will be no pain or discomfort during the routine dental check up.

All information collected in this study will be treated as strictly confidential. No one will have access to this information except the researcher. Neither the child name nor any thing that identify him/her will be used in any report of this study.

If you would like to take part of this study please sign the form below to allow me to proceed with examination of your child. If you would like to withdraw your child at any time you can do that without giving any reason and without it affecting your child's normal care, management or schooling. If you have any queries or would like more information about the study please contact me Dr. Elturabi G K Eltilib on mobile No. 0122484210.

Thanking you in advance for your co-operation. It is much appreciated.

Yours sincerely Dr. Elturabi G K Eltilib

I understand the information above that has been explained to me and I agree to allow my child to participate in this study.

Name: …….. **Signature: …….**

Date: ……

Witness (1): ……..……. **Witness (2): ……**