EFFECT OF DENTAL CARIES AND MALOCCLUSION ON THE ORAL HEALTH- RELATED QUALITY OF LIFE IN 12-14 YEAR-OLD CHILDREN IN VIWANDANI SLUM, NAIROBI

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DECLARATION

I, Immaculate Achieng' Opondo, declare that this thesis is my original work and has not been presented for the award of a degree in any other university.

Signature: _____ Date: _____

SUPERVISORS APPROVAL

This thesis has been submitted with our approval as university of Nairobi supervisors.

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DEDICATION

This thesis is dedicated to all the children living in the slums of Kenya. It is my hope that the information obtained from this work will bring about the necessary improvement in oral health services needed to provide these children with better oral health.

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First and foremost, I thank God for keeping me strong and healthy, and for surrounding me with such wonderful people throughout the duration of my studies.

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TABLE OF CONTENTS

Contents

LIST OF TABLES

LEGEND TO FIGURES

ACRONYMS

child-OIDP:	child- Oral Impacts on Daily Performance
child-OIDP ADD :	Child- Oral Impacts on Daily Performance Additive scores
DAI:	Dental Aesthetic Index
DMFT:	Decayed, Missing, Filled permanent teeth
ILO:	International Labour Organization
MDS:	Master of Dental Surgery
MSc:	Master of Science
MOH:	Ministry of Health
OIDP:	Oral Impacts on Daily Performance
One way ANOVA:	One way Analysis of Variance
OHRQoL:	Oral Health-Related Quality of Life
PWI:	Performances with impacts.
UON:	University of Nairobi
WHO:	World Health Organization

ABSTRACT

Background: Traditional methods of measuring oral health mainly use clinical dental indices. In recent years, the use of subjective assessments to gain information about the impact of oral disorders on Oral-Health Related Quality of Life (OHRQoL) has been advocated. By supplementing the clinical assessments with subjective assessments, a comprehensive account of the oral health of populations can be given. Studies on the OHRQoL of children in Kenya are so far largely unexplored.

Objective: This study aimed at assessing the effect of dental caries and malocclusion on the OHRQoL of 12-14 year-old children residing in Viwandani slum.

Study design: This was a descriptive cross-sectional study.

Subjects and methods: A total of four hundred and fifty two children aged 12-14 years attending public and private primary schools in Viwandani slum, Nairobi participated in the study. Their mean age was 12.9 years. The two public schools in the slum were included in the study. The private schools were selected through simple random sampling. The children in each school were selected through stratified random sampling method. Data on OHRQoL was obtained using an interviewer administered Child-Oral Impacts on Daily Performance (Child-OIDP) Index. Intra-oral clinical examination was done to assess caries experience using the DMFT index and severity of malocclusion, using the Dental Aesthetic (DAI) Index. The data obtained were analysed using the Statistical Package for Social Sciences

(SPSS) programme. Spearman's Rank Order Correlation and Kruskal-Wallis tests were used to relate caries experience and severity of malocclusion with OHRQoL.

Results: The prevalence of dental caries was 56.2%. The overall mean DMFT was 1.72 ±2.40, with the mean DMFT for the female and male children being 1.73 ±2.07 and 1.71 ±2.40 respectively. There was no statistically significant difference between the males and females (p=0.95) with regard to their mean DMFT. The prevalence of malocclusion was 32%, of which 19.9% had definite malocclusion, 6.7% had severe malocclusion and 5.4% had handicapping malocclusion. More males than females had malocclusion with the difference being statistically significant (p=0.01). A statistically significant correlation was found between caries experience and OHRQoL (r^2=0.09, p=0.00). There was no association between the presence of malocclusion and OHRQoL (p=0.20).

Conclusion: Dental caries was found to affect many aspects of the children's Oral Health-Related Quality of Life, while malocclusion had no effect on the OHRQoL of these children.

Recommendation: There is a need for preventive and curative oral health services for the children in Viwandani slum. More studies are needed to determine the dietary patterns and oral hygiene practices of the children living in the slum in order to aid in future planning of appropriate interventions.

CHAPTER 1

1.0: Introduction and literature review

1.1: Introduction

Oral Health-Related Quality of Life (OHRQoL) has been defined as an individual's subjective view of the impact of oral conditions on their well being and daily functioning[1]. This multidimensional concept containing physical, social and psychological domains[1] was originally termed as socio-dental indicators, measures of oral health status, subjective oral health or social impacts of oral diseases[2]. The recognition of oral health problems as important factors that cause negative impacts on the performance of physical, psychological and social activities by individuals has led to an increase in the use of subjective oral health indicators particularly in the developed countries[3].

In developing countries like Kenya, the epidemiological studies that have been conducted so far have used traditional clinical measures to evaluate dental caries and malocclusion in children[4]. However, these clinical parameters evaluate oral disorders based on the view point of professionals. Consequently, they fail to capture the consequences of oral disorders as perceived by the children who suffer from them. This is notable, considering that these oral disorders are likely to negatively affect the daily lives of these children. For example, if untreated, dental caries causes dental pain which in turn results in impacts of affected play, sleep disturbance, difficulties in eating and being absent from school[5]. Malocclusion,

though not a life threatening condition, has also been shown to have physical, psychological and social effects on an individual's daily life[6].

1.2: Literature review

1.2.1: Oral Health-Related Quality of Life

The notion of OHRQoL is important at all levels of dental research[7], and is particularly vital at the community research level in the promotion of oral health and access to care. This is because, by supplementing the clinical indicators of oral health with the subjective reports, a comprehensive account of the oral health of populations can be given[2]. For instance, a clinical indicator like DMFT is not suitable for advocacy at the political level because it was designed mainly to quantify the magnitude of the disease (dental caries) but not the impact of that magnitude on an individual's daily life and general health. Therefore, dentists are in a better position to appreciate the DMFT index. Politicians and planners on the other hand, may appreciate the impact of dental caries when high DMFT scores are interpreted in terms of impaired quality of life because of inability to eat, sleep or concentrate in school as a result of associated pain[7].

Currently, a number of instruments have been developed to measure the impact of different dental conditions on the quality of life of school aged children. One of the most promising instruments developed for use in children is the Child-Oral Impacts on Daily Performances (Child-OIDP) index[8]. It was developed and tested in Thailand[8, 9], having been derived from the original version that was developed for use in adults[10]. It has been validated in Tanzania[11], and developed countries like the United Kingdom[12]. This index measures only the 'ultimate impacts' that

correspond to the World Health Organization (WHO) concepts of disability and handicap[13]. By concentrating only on disability and handicap, the OIDP reduces overscoring from repeat scoring of the same impacts at each of the three levels (Figure 1.1).

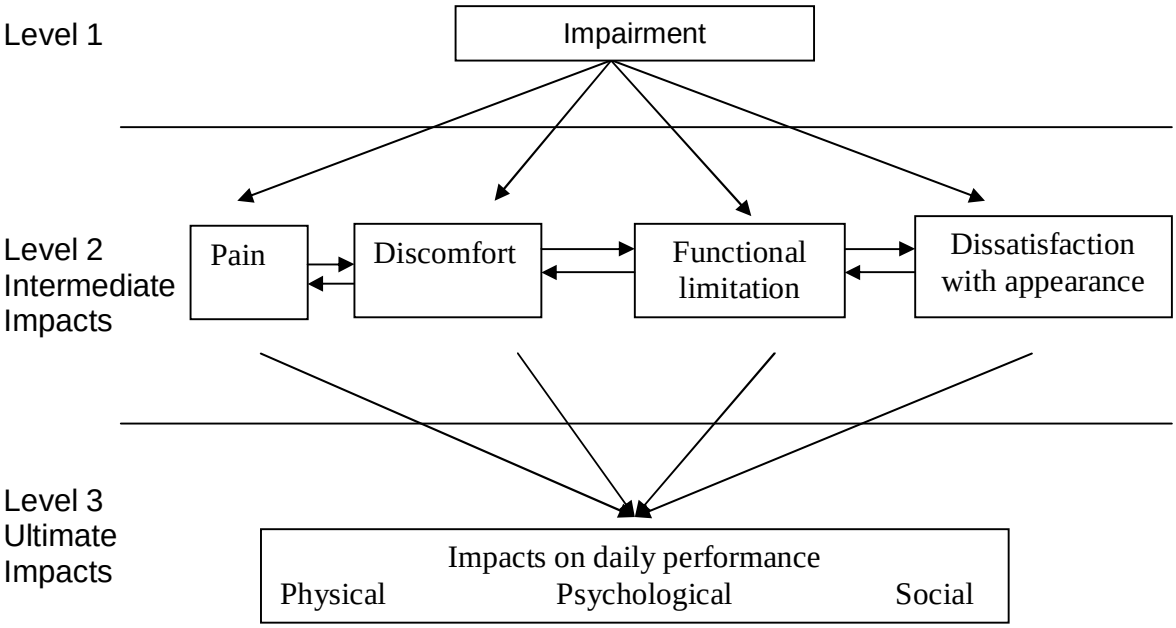

Figure 1.1: Theoretical framework of consequences of oral impacts [Modified from the WHO's International Classification of Impairments, Disabilities and Handicap[13]]

Considering respondent burden, the OIDP (and the child-OIDP) is suitable for use in population surveys not only in terms of being easier when measuring behaviours rather than feeling states, but also in being short (eight items). In order to suit children's cognitive development, the child-OIDP deviates from the OIDP with respect to the sequence of questions, having a shorter recall period in terms of three months rather than six months and with pictures used as interview guides[8].

In earlier years, children's health-related quality of life was measured using parents as informants. This was based on concerns that a dominant short term memory, strong influence of recent incidents, absence of a fully developed long term perspective, language problems and reading ability may impact on the reliability and validity of child's responses regarding their own OHRQoL[14]. Parents and caregivers have therefore been used as proxy informants in some studies assessing the agreement/disagreement between parent/caregiver and child report on OHRQoL. The findings suggest that they have in general low to moderate agreement with the children's own rating, thus emphasizing the usefulness of obtaining both child and caregivers report of the child OHRQoL[15]. However, according to child developmental specialists, school aged children, as early as six years of age are capable of expressing a range of emotions (such as anxiety and happiness) as well as cultural values such as beauty[16]. In recent times, it has been demonstrated that by using appropriate questionnaire techniques, children can give valid and reliable information and thus should be the primary source of the information regarding their OHRQoL[8].

1.2.2: Dental caries and Oral Health-Related Quality of Life

Dental caries remains one of the most common oral diseases of public health concern in children[17]. At present, the distribution and severity of dental caries vary not only in different parts of the world but also within the same region or country, with an average Decayed, Missing and Filled teeth, (DMFT) scores for the 12 year-

olds of 3.0, 2.6 and 1.7 in the American, European and African continents respectively[17,18].

There have been reports on the trend of dental caries in Sub-Saharan Africa showing that caries rates are on the increase in the continent, but this is not supported by data from epidemiological studies[19]. Nevertheless, both an increase and a decrease in caries seem to have occurred in some parts of this region[20]. Reports from some African studies have shown a low mean DMFT for 12 year-old children ranging between 0.7 and 1.1[21,22,23]. This is in agreement with the WHO report that caries experience in the African region is relatively low and less severe[18]. Nonetheless, some African countries have, in recent years, reported higher mean DMFT values ranging from 2.7-2.9 [24, 25].

A review of epidemiologic studies on dental caries in Kenya shows that there has been a gradual increase in the caries experience from a mean DMFT of 0.2 in the 1980s to a mean DMFT of 1.9 in the 1990s[4]. Musera et al[24] in 2003, reported a mean DMFT of 2.7 among 10-12 year-olds in a rural area and 1.25 in an urban area. In 2007, Owino et al[26] reported a lower mean DMFT of 0.92 among 12 year-old children in Kitale Municipality. These findings suggest that there are variations in caries experience in different parts of Kenya. Unfortunately, it is not possible to state categorically whether caries experience is increasing or decreasing unless perhaps same population groups or study areas are examined on two or more separate occasions using the same diagnostic criteria[4].

The studies on dental caries in Kenya have also reported very high proportions of unrestored teeth[24, 26]. For instance, Owino et al[26] reported that 95.5% of the DMFT score was contributed by decayed teeth. Similar findings of high proportions of unrestored teeth are also documented from studies in other developing countries[27, 28]. Untreated tooth decay reflect a low utilization of preventive and curative dental services which may be attributed to a number of factors such as dental avoidance by parents and their children, low socio-economic status and a lack of awareness by the parents[29].

In the developed countries, and also increasingly in developing countries, studies have shown that the burden of dental caries and the need for dental care is highest among the poor and disadvantaged populations[17,30]. Lalloo et al[31], in 1999 reported that a relationship exists between caries and economic development and that countries in the throes of socio-economic transition have the highest DMFT scores. A study by Christensen et al[32] in 2003 found caries experience amongst 11-13 year-olds to be higher among children in slum areas in Bhopal India, compared to children living in surrounding rural areas. However, a study done in Uganda has reported the opposite, that children of higher socio-economic status are most severely affected by dental caries[33].

Dental pain is one of the determinants of Oral Health-Related Quality of Life. It is considered to be synonymous with a toothache and is described as pain originating from innervated tissues within the tooth or immediately adjacent to it[5, 27]. A number

of investigations have been done to assess the prevalence and impact of oral and/or dental pain in children[5, 27]. In all these studies dental pain was experienced by a substantial proportion of school children: 49% in Sri Lanka[5], and 42% boys and 52.3% girls in Uganda[27]. In all the cases, dental caries was cited as the most common cause of the dental pain, and as a result of the pain a majority of the children had experienced an impact on their daily performance. Numerous studies investigating the impact of oral conditions on the quality of life of children, using the child-OIDP index have found that eating is usually the most common performance affected and toothache is the most prevalent condition perceived by the children as causing oral impacts on eating, sleeping, doing school work and maintaining usual emotional status[9,11,25].

1.2.3: Malocclusion and Oral Health-Related Quality of Life

The complexity of malocclusion necessitates that epidemiological studies be based on some kind of classification. This has been achieved through use of indices, most of which were developed in the late 1960s and early 1970s. An index is used to describe a rating or a category by assigning a numerical score or alphanumerical label to a person's occlusion. The indices developed for assessing malocclusion are in five broad categories namely; diagnostic, epidemiological, treatment need (treatment priority), treatment outcome and treatment complexity indices[34].

The Dental Aesthetic Index (DAI) is one of the treatment need (treatment priority) indices. It is based on socially defined aesthetic norms. Since its introduction in

1986 the DAI[35] has been used in many studies in different countries to describe the prevalence and severity of malocclusion. The DAI has been used in India to assess the severity of malocclusion in 12 to 15 year old adolescents[36]. In this study, most of the children, 79.9% had DAI scores ≤25 indicating no or minor malocclusion, 15.4% had DAI scores of 26-30 indicating definite malocclusion, 4.2% had DAI scores of 31-35 indicating severe malocclusion and 0.5% had DAI scores ≥36 indicating handicapping malocclusion. A Nigerian study correlating the DAI and the indications for orthodontic treatment as perceived by 12-18 year-old secondary school students showed that 17.9%, 9.9% and 12.9% had definite, severe and handicapping malocclusion respectively. Three hundred and sixty four (59%) students were categorized as having normal or minor malocclusion[37]. Van Wyk et al[34], in 2005 while assessing the orthodontic status and treatment need of 12 year-old South African children using the DAI criteria found that 47.7% of the children presented with good or minor malocclusion. Just over 52.1% presented with identifiable malocclusion; 21.2% showing definite malocclusion, 14.1% severe malocclusion and 16.9% showing handicapping malocclusion. Malocclusion and orthodontic treatment need amongst 289 Tanzanian children aged 12-15 years was studied by Rwakatema et al[38]. They used the modified Bjork criteria and the Dental Aesthetic index. The DAI showed that 64.7% of the sample had no abnormality or slight malocclusion, 21.5% had definite malocclusion and 6.9% had severe and handicapping malocclusion.

There are relatively few reported studies on malocclusion in Kenya. A recent study by Muasya[39] assessed malocclusion using the DAI. She found that 75.1% children had a normal molar relationship while 21.5% and 3.4% had a half cusp and full cusp discrepancy. In terms of severity of malocclusion, 53% had no abnormality or minor malocclusion, 23% had definite malocclusion, 12.7% had severe malocclusion and 11.3% had handicapping malocclusion. Crowding of the incisal segments was found in 47.2% of the children while spacing of the incisal segments was found in 46.6% of the children.

A recent review of the impact of malocclusion on quality of life concluded that there is a modest association between malocclusion and quality of life[6]. This is noteworthy because a pleasing dental appearance is an important factor for adolescents' psychosocial well being[40]. However, considerable differences have been noted between professional and patients' perceptions of dental appearance and need for orthodontic treatment. Many studies on orthodontic treatment need have shown that children and adolescents are less concerned than professionals about their malocclusions. For instance, Bernabè et al[41], in 2008 found that only 42.5% of the adolescents with a definite orthodontic treatment need reported impacts on their quality of life that was caused by their current occlusal status. In their study, the most commonly affected performance was smiling, laughing and showing teeth without embarrassment. Gherunpong et al[42] also reported that the prevalence of malocclusion or normative need for orthodontic treatment was 35%, while based on the child-OIDP, only 10.5% of these children reported an impact on

their daily performance, with the difference in the two assessments being highly statistically significant. In another study, Koochek et al[43] found that only 50-65% of those normatively assessed as in need of orthodontic treatment actually perceived such a need. Similar findings have been reported in Tanzania where Mtaya et al[44] found that large proportions, (83% from Temeke and 94% from Kinondoni) of children with normative treatment need did not confirm any psycho-social impact. In Peru a study was done to determine the prevalence, intensity and extent of oral impacts on daily performances associated with malocclusion. In this study, psycho-social impacts such as smiling, maintaining usual emotional status and enjoying social contact were the most frequently and severely affected daily activities[45].

Therefore, there is still a need to research further on the effects of dental caries and malocclusion on the quality of life, particularly, of underprivileged children with little or no access to oral health facilities. The findings from such study could aid the policy makers in formulating curative and preventive services for these children.

1.3: Statement of the research problem

Arising from the review of literature, dental caries and malocclusion are common oral health problems afflicting children in Kenya. Most of the studies that have so far been undertaken to determine the prevalence of these oral conditions have been conducted in the capital city, Nairobi[4]. Studies that have looked at the issue of the oral impact of these conditions on the daily lives (OHRQoL) of the Kenyan children are scarce. Past studies that have been conducted elsewhere, have reported that

the use of subjective indicators of oral health has been vital in bringing about the promotion of oral health and access to oral health care[7]. Further, the burden of dental caries and also the need for dental care has been shown to be highest among the poor and disadvantaged populations[17]. This situation worsens with inadequate access to oral health care and homecare aids such as toothbrushes and fluoridated toothpastes, as experienced in slum areas.

1.4: Justification

While a number of epidemiological studies on dental caries and malocclusion have been conducted in Kenya, there is very little evidence for such studies existing in relation to slum dwelling children. There is also a paucity of information on the impact of these oral disorders on the Oral Health-Related Quality of Life of children in Kenya. There is therefore a need to obtain data that quantifies the magnitude of dental caries and malocclusion among slum children in Kenya and their effect on the Oral Health-Related Quality of Life of these children.

This information will provide baseline data that could assist in the planning of preventive strategies for the children, integration of oral health with other traditional health promotion activities in the slum and also in the initiation of curative oral health services within the health facilities that are presently serving the slum.

1.5: Study objectives

1.5.1: Broad objective

To determine the effect of dental caries and malocclusion on the Oral Health-Related Quality of Life of 12-14 year-old children living in Viwandani slum, Nairobi.

1.5.2: Specific objectives

1. To determine the caries experience among 12-14 year-old children in Viwandani slum.
2. To determine the severity of malocclusion among 12-14 year-old children in Viwandani slum.
3. To determine the Oral Health-Related Quality of Life of 12-14 year-old children in Viwandani slum.
4. To determine the effect of dental caries on the Oral Health-Related Quality of Life of 12-14 year- old children in Viwandani slum.
5. To determine the effect of malocclusion on the Oral Health-Related Quality of Life of 12-14 year-old children in Viwandani slum

1.6: Hypotheses

1.6.1: Null hypotheses

1. There is no association between caries experience and Oral Health-Related Quality of Life, of 12-14 year-old children in Viwandani slum.
2. There is no association between malocclusion and Oral Health-Related Quality of Life, of 12-14 year-old children in Viwandani slum.

1.7: Variables

Table 1.1: Study variables

Variable	***Measurement***
Socio- demographic variables	
Age of child	Number of years since birth
Gender	Whether male or female
Employment status of parent/caregiver	Type of work done
Level of education of parent/caregiver	Highest level of education attained
Independent variables	
Caries experience	Decayed, missing, filled teeth
Severity of Malocclusion	Scores from Dental Aesthetic Index
Dependent variable	
Oral Health-Related Quality of Life (OHRQoL).	Frequency of difficulties eating, speaking, cleaning teeth, sleeping, smiling, school work, emotions and enjoying contact.

CHAPTER 2

2.0: Materials and methods

2.1: Study area

The study was carried out at Viwandani slum in Makadara District of Nairobi province (Figures 2.1 and 2.2). Viwandani slum is about seven kilometres from Nairobi city centre and has close proximity to the City's Industrial area. It is situated between Nairobi's industrial area and the Ngong River. Houses, churches and informal schools and clinics are built with iron sheets and tins. The landscape, just like in most slums, consists of open sewers and soiled surroundings. The total population for Viwandani slum is estimated at 116,271 based on the 2009 population census. It has a total of 26 primary schools, two of which are public schools and 24 are informal primary schools[46]. The informal schools are either privately or community owned, while the public schools are run by the government.

2.2: Study design

This was a descriptive cross-sectional study**.**

2.3: Study population

The study population consisted of children aged 12-14 years from both the formal and informal primary schools in the slum.

2.3.1: Inclusion criteria

1. Children whose parents or guardians consented to the study.
2. Children who were aged 12-14 years.

3. Children who had no history of previous orthodontic treatment.
4. Those who were residents of the slum for the past one year.
5. Children who assented to the study.

2.3.2: Exclusion criteria

1. Children whose parents or guardians did not consent to the study.
2. Children below 12 years of age and above 14 years of age.
3. Children who did not assent to the study.
4. Children with previous history of orthodontic treatment.
5. Children with craniofacial malformations.
6. Children not residing in the slum.

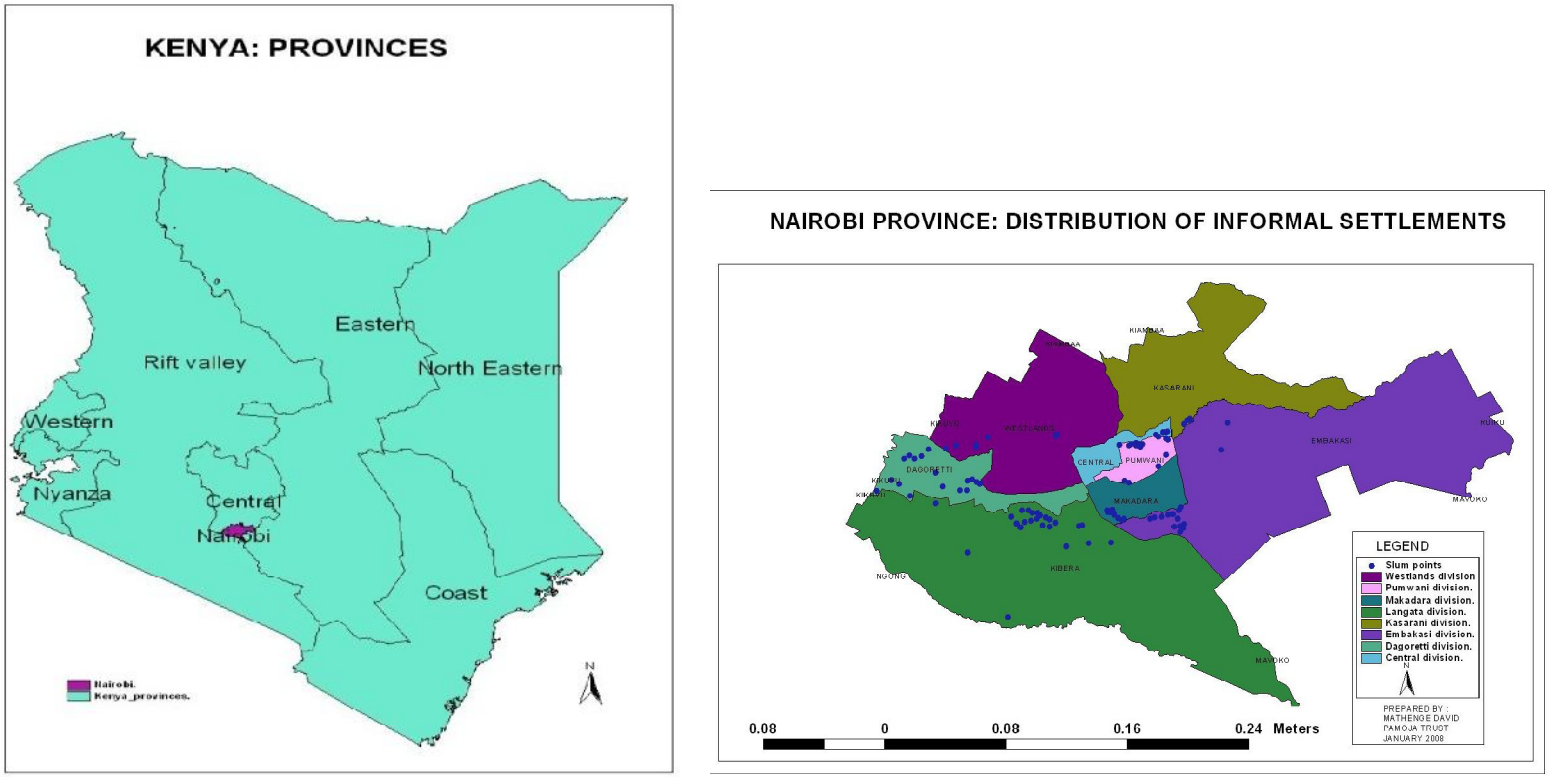

Figure 2.1: Map of Kenya and the capital city Nairobi

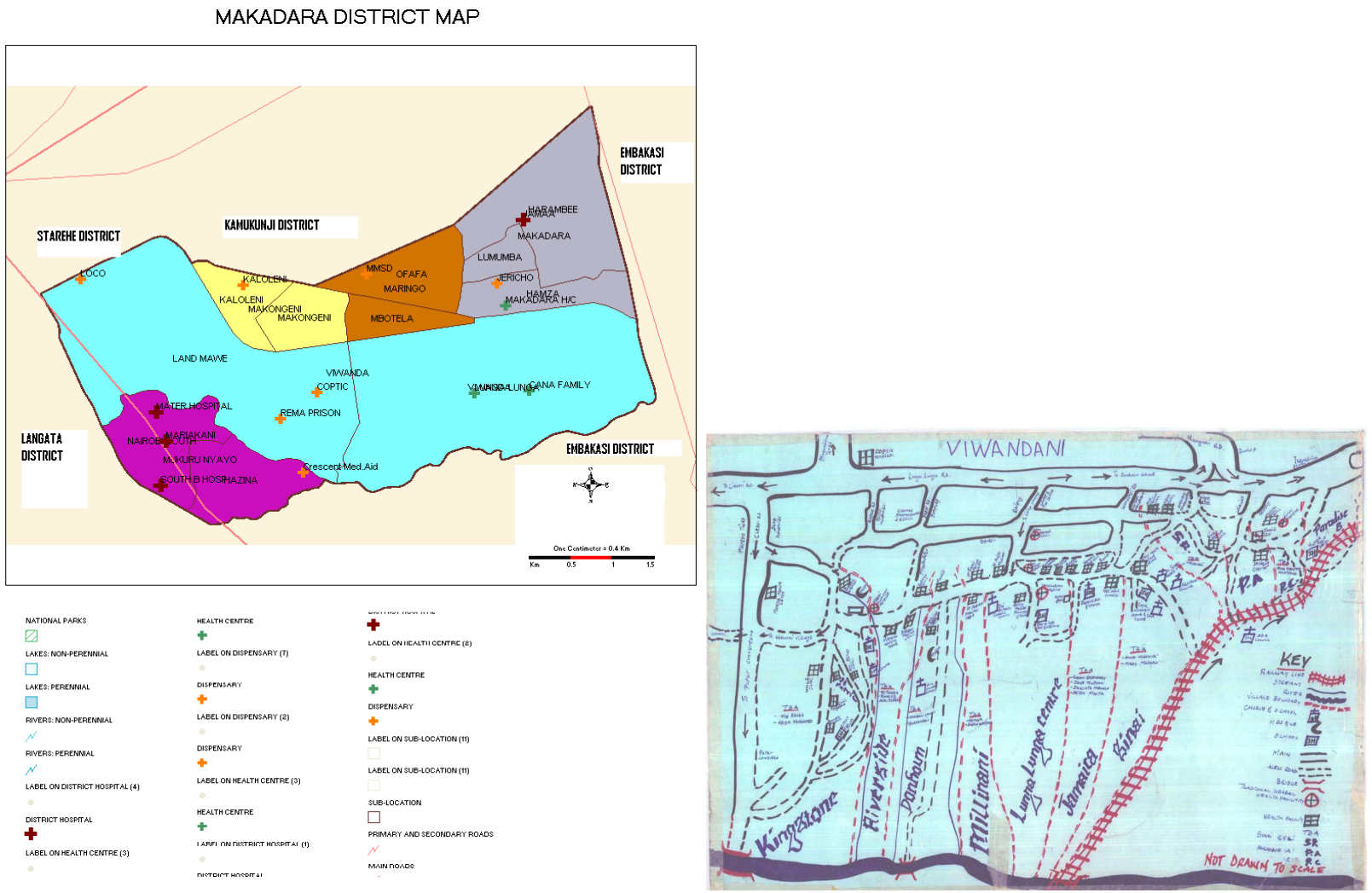

Figure 2.2: Map of Makadara District and Viwandani slum

2.4: Sample size determination

The sample size was estimated using the WHO recommended[47] formula below:

$$n=\frac{z^2p\,(1-p)}{d^2}$$

In this formula:

n is the desired sample where the population is greater than10,000.

z is the standard normal deviate, usually set at 1.96 and corresponds to 95 % confidence level.

p is the reported prevalence of oral impacts on daily performance, dental caries or malocclusion.

d is the degree of accuracy desired, usually set at 0.05.

A study of 12 year-old children in Kitale Municipality, in Kenya reported the prevalence of dental caries to be 50.3%[26].

Therefore:

$$n=\frac{1.96^2x0.503x\ 0.503}{(0.05)^2}$$

$$n=389$$

Therefore, the minimum sample size calculated was 389 children.

2.5: Sampling procedure

Sampling was done in two stages. In the first stage the schools were sampled and in the second stage the children were sampled. The schools were stratified into public and private schools. All the two public schools in the slum were included in the study. A sampling frame comprising of all the private schools in the slum that had children from class one to class eight was made. Three private schools were then randomly selected using computer generated random numbers. The children were sampled using the stratified random sampling method. To determine the sample size for each of the selected schools, the required sample size (389 children) was proportioned based on the population of standard five to eight pupils in each school. The number of children sampled from each class was then taken as a proportion of the school sample size.

2.6: Calibration

Prior to data collection, the principal investigator was calibrated by two supervisors. The calibration exercise involved identification of dental caries and malocclusion on actual subjects in the field. The Cohen Kappa agreement for DMFT was 0.92 (n=15) and that of the DAI was 0.87 (n=15) showing acceptable agreement between the examiners. During data collection, every tenth child was re-examined and the intra-examiner Cohen Kappa agreement for DMFT was 0.89 (n=45) and that for malocclusion was 0.81 (n=45).

2.7: Data collection and instruments

Data collection was in two stages. The first stage of data collection was an interview to gather information on socio-demographic characteristics and Oral Health-Related Quality of Life. In the second stage clinical examination was done based on WHO recommendations for oral health surveys[48] to assess for dental caries and malocclusion.

2.7.1: The Interview

The children completed a semi-structured questionnaire (Appendix I) at school in a face to face interview with the principal investigator. The child-OIDP frequency index was used to obtain information on difficulties carrying out eight daily activities namely eating, speaking, cleaning mouth, sleeping, smiling, school work, emotional status and social contact. Each activity was scored on a scale of zero to three where; (0) never affected, (1) once or twice a month, (2) once or twice a week and (3) everyday or nearly every day. Participants who reported any impact on their daily activities were asked to state what they perceived as the cause of the difficulty that they had. The total child-OIDP score was constructed by adding the eight performance scores as originally scored (0-3) into a child-OIDP additive score (c-OIDP ADD) (range 0-24). The same questionnaire was also used to gather information on socio-demographic variables. The socio-demographic variables assessed were age, gender, mother, father and guardian's level of education and occupation.

2.7.2: Clinical examination

The principal investigator conducted all the clinical examinations in the open (outside the classroom). The child was seated on an ordinary chair, and natural light, sterile probe and dental mirror were used for the clinical examination. A trained assistant recorded all the observations made on dental caries and malocclusion. Dental caries was assessed using the DMFT index and malocclusion was assessed using the DAI. The DAI variables were categorized as intra-arch irregularities and discrepancies in occlusal contact relations (Table 2.1).

Table 2.1: Classification of the variables of the Dental Aesthetic Index (DAI)

Intra-arch irregularities and mal-alignment
1. Missing incisor, canine and premolar teeth
2. Crowding in the incisal segments
3. Spacing in the incisal segments
4. Midline diastema
5. Largest anterior maxillary irregularity
6.Largest anterior mandibular irregularity
Discrepancies in occlusal contact relationship
7.Anterior maxillary over jet (positive over jet)
8. Anterior mandibular over jet (negative over jet)
9. Vertical anterior open bite
10. Antero-posterior molar relation

The intra-arch irregularities and the occlusal contact discrepancies observed were then entered into a regression equation to determine the DAI score. The regression equation is as follows:

DAI score = 6(Missing incisors, canines and premolars) + (crowding) + (spacing) + 3(diastema) + (Largest maxillary irregularity) + (Largest mandibular irregularity) + 2(Anterior maxillary over jet) + 4(Anterior mandibular over jet) + 4(Anterior open bite) + 3(Antero-posterior molar relationship) + 13.

The DAI score obtained was then placed on a scale to determine the point at which the score falls between the most and least aesthetic dental appearances. The severity of malocclusion classified on the basis of the DAI scores is shown in Table 2.2.

Table 2.2: Severity of malocclusion according to DAI scores

Severity of malocclusion	***Treatment indication***	**DAI score**
No abnormality or minor malocclusion	No or slight need	<25
Definite malocclusion	Elective	26-30
Severe malocclusion	Highly desirable	31-35
Very severe or handicapping malocclusion	Mandatory	36 or more

2.8: Data presentation and analysis

The data collected was coded and entered into a computer and analyzed using the Statistical Package for Social Sciences (SPSS) version 11.5 and Microsoft office excel 2007. Data cleaning was done by running frequencies and re-entering missing data. Data analysis included both descriptive and analytical statistics. The confidence level for this study was 95% and the p-value for statistical significance was set at less than 0.05. The non parametric statistics were the primary choice for exploring the relationship between the independent variables and the dependent variable because the child-OIDP ADD scores were not normally distributed. The statistical tests used in this study included the Independent sample t-test, Chi-square test, one way ANOVA, Mann-Whitney U test , Spearman's rank order correlation analysis and Kruskal-Wallis Test (Table 2.3).

Table 2.3: Summary of statistical tests used in the study

Statistical test		***Type of variable***	
Parametric test	**Non-parametric test**	**Dependent**	**Independent**
	Chi square	Categorical	Categorical
Independent sample t-test		Continuous	Categorical
	Mann-Whitney U test	Continuous	Categorical
One way ANOVA		Continuous	One categorical with three or more levels
	Kruskal-Wallis Test	Continuous	One categorical with three or more levels
	Spearman's rank order correlation	Continuous	Continuous

2.9: Validity and reliability

The questionnaire was pretested and the necessary adjustments made. Major school work was rephrased to homework and social role to extra-curricular activities such as drama, school choir and games. Internal consistency reliability (standardized item alpha) was 0.70. The corrected item total correlation ranged from 0.31 (Smiling and laughing) to 0.45 (eating and sleeping) after excluding difficulty speaking and pronouncing which had a zero correlation with the total impact score. There was no negative correlation found. The Cohen Kappa agreement for the eight child-OIDP items was 0.90 for eating, speaking, cleaning teeth, sleeping, smiling and social contact. The Cohen kappa score for maintaining emotional status and doing homework was 0.70 and 0.75 respectively.

2.10: Ethical considerations

Ethical clearance to conduct the study was granted by the Kenyatta National Hospital and University of Nairobi Ethics Research and Standards Committee. Nairobi City Council education department and the respective school authorities gave permission to conduct the study in their schools. Informed consent to participate in the study was obtained from the parents or guardians of the children and assent was obtained from the children before data collection. During the study period, the children received free dental consultation and oral health education, and those requiring emergency dental treatment were referred to the University Dental Hospital or the nearest public dental clinic.

CHAPTER 3

3.0: Results

3.1: Socio-demographic characteristics

A total of 452 children, 337(74.6%) from two public and 115(25.4%) from three private primary schools were recruited into the study (Table 3.1), with an equal number of males and females 226(50%). Their age ranged between 12-14 years with a mean of 12.9±0.8 years. The mean age for the males and females was equal (12.9±0.8 years).

Table 3.1: Distribution of children by gender and type of school

Gender	***Type of School***		***Total***
	Public schools	**Private schools**	
	n (%)	**n (%)**	***n (%)***
Males	174(77)	52(23)	226(100)
Females	163(72.1)	63(27.9)	226(100)
Total	**337(74.6)**	**115(25.4)**	**452(100)**

Most of the children, 271(60%) were under the care of both parents, while 120(26.5%), 16(3.5%) and 45(10%) were staying with the mother alone, the father alone and a guardian respectively.

Table 3.2 shows the level of education of the parents/guardians. Overall, 313(43.3%) parents/guardians had secondary education, 187(25.9%) had primary education, and 35(4.8%) had tertiary education. Only 13(1.8%) parents/guardians had no formal education and the level of education of 175(24.2%) was unknown to

the children. The proportion of fathers with secondary and tertiary education (53%) was larger than that of mothers (45.3%) and guardians (42.2%). A higher proportion of mothers (28.1%) had primary education when compared with fathers (22.7%) and guardians (26.7%). There were more guardians with no formal education 3(6.7%) than fathers 3(1%) and mothers 7 (1.8%). These differences in the level of education of the mothers, fathers and guardians were not statistically significant (χ^2=0.00, p=0.99).

Table 3.2: Level of education of parent /guardian

	Level of education					
Caregiver	None	Primary	Secondary	Tertiary	Unknown	Total
	n(%)	n(%)	n(%)	n(%)	n(%)	n(%)
Father	3(1.0)	65(22.7)	134(46.7)	18(6.3)	67(23.3)	287(100)
Mother	7(1.8)	110(28.1)	161(41.2)	16(4.1)	97(24.8)	391(100)
Guardian	3(6.7)	12(26.7)	18(40.0)	1(2.2)	11(24.4)	45(100)
Total	**13(1.8)**	**187(25.9)**	**313(43.3)**	**35(4.8)**	**175(24.2)**	**723(100)**

Majority of the parents/guardians 470(65%) had informal employment. One hundred and thirty (18%) parents/guardians had formal employment, while 118(16.3%), were unemployed. A large proportion of mothers were unemployed (23.3%) compared with fathers (7%) and guardians (15.5%) [Table3.3]. There was no statistically significant differences observed between the parents with regard to their occupation (χ^2=0.57 p=0.45).

Table 3.3: Parent/guardian's occupation

	Type of occupation*				
Caregiver	Unemployed	Informal	Formal	Unknown	***Total***
	n (%)	n (%)	n (%)	n (%)	***n (%)***
Father	20 (7)	177(61.6)	86(30)	4(1.4)	287(100)
Mother	91(23.3)	262(67)	38(9.7)	0(0)	391(100)
Guardian	7 (15.5)	31(69)	6(13.3)	1(2.2)	45 (100)
Total	**118(16.3)**	**470(65)**	**130(18)**	**5(0.70)**	**723 (100)**

*** Formal employment:** Where people work to receive a regular wage and are assured of certain rights e.g. paid holidays, sickness leave. Wages are taxed (ILO).

Informal employment: Small and unregistered enterprises, paid and unpaid workers in these enterprises and casual workers are without fixed employers (ILO).

Unemployment: People without jobs and have actively sought work within the past four weeks (ILO).

3.2: Caries experience

The prevalence of dental caries was 56.2%. Children with missing teeth were 36(8%) and no child had filled teeth. There was a maximum of 13 decayed teeth and a minimum of one decayed tooth in an individual subject. Missing teeth due to caries ranged from one tooth to four teeth missing. The first permanent molars 365(20.2%) were the most frequently affected with untreated decay, followed by the second permanent molars 296(16.4%). The mandibular molars were more

frequently affected with decay than their maxillary counterparts as depicted graphically in Figures 3.1 and 3.2.

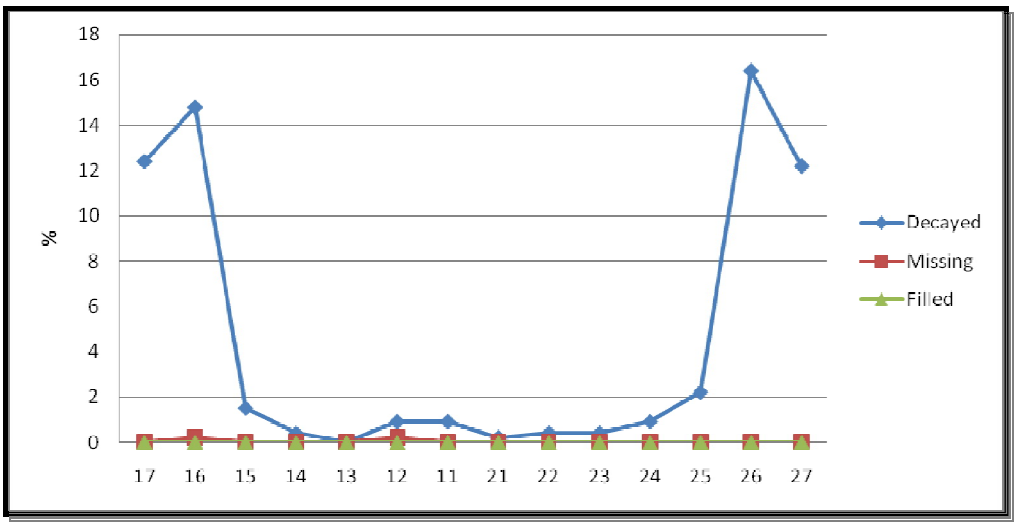

Figure3.1: Distribution of decayed, missing and filled teeth by tooth type in the upper arch

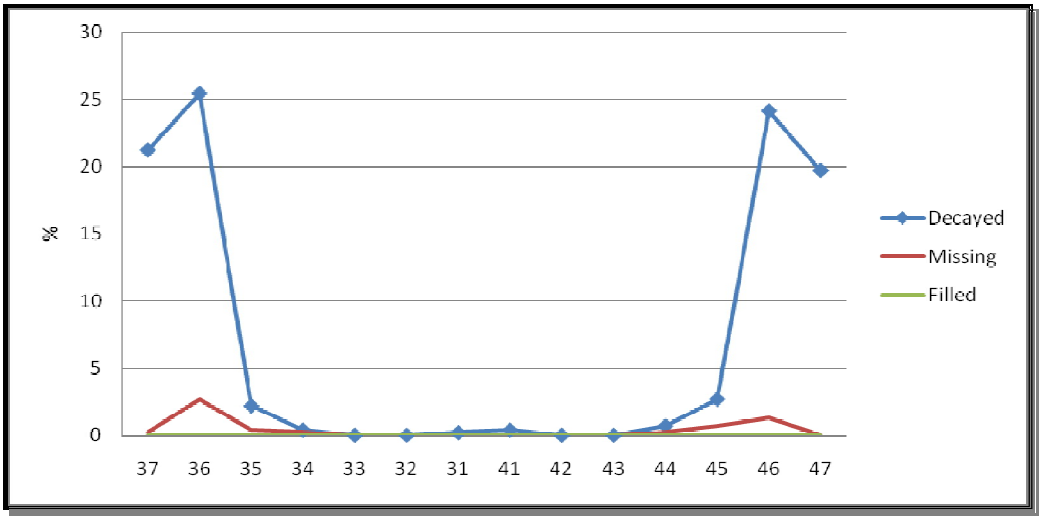

Figure 3.2: Distribution of decayed, missing and filled teeth by tooth type in the lower arch

Table 3.4 shows the distribution of the mean DMFT of the participants by social and demographic characteristics. The overall mean DMFT in this study was 1.72±2.22.

The mean DMFT for the females (1.73±2.07) was slightly higher than that for males (1.71±2.40), with no statistically significant difference found between the two groups (t=0.06, p=0.95). The children ages had the highest mean DMFT score of 1.98±2.30, while the 12 year-olds had the lowest mean DMFT score of 1.45±2.02. There was no statistically significant difference in the mean DMFT score between the age groups (F=2.14, p=0.12). The mean DMFT score of Public schools (1.81±2.27) was higher than that of private schools (1.44±2.02), but the difference was not statistically significant (t=1.54, p=0.12). Decayed teeth contributed 93.7% of the DMFT score while missing teeth contributed 6.3% of the DMFT score.

Table 3.4: Mean Decayed, Missing and Filled teeth according to gender, age and site

	Decayed	***Missing***	***Filled***	***Mean DMFT***	***p <0.05***
Gender					
Male	1.68±2.27	0.13±0.47	0±0.00	1.71±2.40	t=0.06;p=0.95*
Female	1.67±2.05	0.08±0.37	0±0.00	1.73±2.07	
Age					
12 years	1.60±2.10	0.04±0.20	0±0.00	1.45±2.02	F=2.14;p=0.12**
13 years	1.68±2.19	0.15±0.56	0±0.00	1.81±2.34	
14 years	1.86±2.20	0.14±0.42	0±0.00	1.98±2.30	
Site					
Public schools	1.75±2.20	0.12±0.46	0±0.00	1.81±2.27	t=1.54;p=0.12*
Private schools	1.46±2.03	0.06±0.30	0±0.00	1.44±2.02	
Total	**1.68±2.16**	**0.11±0.43**	**0±0.00**	**1.72±2.22**	

*Independent sample t-test. **One way ANOVA.

3.3: Severity of malocclusion

The results in this section are presented in three categories: Intra-arch irregularities and mal-alignment, discrepancies in occlusal contact relationship and severity of the malocclusion.

3.3.1: Intra-arch irregularities and malalignment

The results for the intra-arch irregularities are presented as follows: Missing incisors, canines and premolar teeth; crowding of incisal segments; spacing of incisal segments; maxillary midline diastema; largest maxillary irregularity and largest mandibular irregularity.

3.3.1.1: Missing incisors, canines and pre-molar teeth

Overall, 13(3.4%) children had missing teeth. Eight (2.1%) children were missing one tooth, two (0.5%) were missing two teeth, another two (0.5%) were missing three teeth and one (0.3%) was missing four teeth. The distribution of the children with missing teeth according to gender is shown in Table 3.5.

3.3.1.2: Crowding of the incisal segments

The results of the current study indicate that 162(42%) children presented with crowding of the incisal segments. Crowding of one segment was noted in 58(32.6%) males and 38(18.3%) females, while 27(15.2%) males and 39(18.8%) females had crowding in two Segments. Overall, the number of males with crowded anterior segments 85(47.8%) were more than the females 77(37%), with no statistically significant difference between them (χ^2=3.35, p=0.07) [Table 3.5]. Of

those with only one anterior segment crowded, more children 54(14%) had maxillary anterior segment crowding compared to 42(11%) with mandibular anterior segment crowding. There was no statistically significant difference found between the males and females with regard to which anterior segment was crowded (χ^2=0.62, p=0.43).

3.3.1.3: Spacing of the incisal segments.

This study found that 149(38.6%) children had spacing in the incisal segments. Forty (22.5%) males and 44(21.2%) females had one segment spaced, whereas 28(15.7%) males and 37(17.9%) females had two segments spaced. There were more females 81(38.9%) with spaced anterior teeth when compared with the males 68(38.2%). However, the difference was not statistically significant (χ^2=0.15, p=0.69) [Table 3.5]. Among those with only one anterior segment spaced, majority had spacing of the maxillary anterior segment 66(17.1%) compared to 18(4.7%) who had spacing of the mandibular anterior segment. There was no statistically significant difference found between the males and females with regard to spacing of only one anterior segment (χ^2=0.00, p=1.00).

3.3.1.4: Prevalence of maxillary midline diastema.

Out of the 386 children, 64(16.6%) had dentitions that exhibited maxillary midline diastema. The size of the diastema ranged from one millimetre to five millimetres with a mean of 0.30±0.66 mm and a median of zero. The mean size of diastema was 0.30±0.80 mm for females and 0.21±0.52 for males, but the difference was not

statistically significant (t=1.40, p=0.17) [Table 3.5]. Among the children with maxillary midline diastema, 19(10.6%) males and 16(7.7%) females had diastema of one millimetre, 9(5.1%) males and 15(7.2%) females had diastema of two millimetres, four (1.9%) females had diastema of four millimetres and one (0.5%) female had a diastema of five millimetres.

3.3.1.5: Largest anterior maxillary irregularity.

The results of this study show that 168(43.5%) children had incisor irregularity in the maxillary arch with 80(44.9%) males and 88(42.3%) females affected. The sizes of the irregularities ranged from one millimetre to six millimetres in both males and females. The males had a mean of 0.92±1.23 mm while the females had a mean of 0.79±1.17mm. However, no statistically significant difference was noted in the mean size of the maxillary irregularity between the male and the female children (t=-1.06, p=0.29) [Table 3.5].

3.3.1.6: Largest anterior mandibular irregularity

Incisor irregularity in the mandibular arch was found in 120(31.1%) children (Table 3.5). Fifty eight (32.5%) were males and 62(30%) were females. In the males, mandibular irregularity ranged from one millimetre to two millimetres, whereas in the females it ranged from one millimetre to three millimetres. The mean size of irregularity in females was 0.35±0.59 mm and in males was 0.35±0.53.

Table 3.5: Distribution of DAI components (intra-arch irregularities), n=386

DAI component	***Gender***		***Total***	***p<0.05***
	Males n(%)	Females n(%)	*n(%)*	
Missing incisors, canines and Premolars	8(4.5)	5(2.4)	13(3.4)	-
Crowding of incisal segments*	85(47.8)	77(37)	162(42)	0.07
Spacing of the incisal crowding**	68(38.2)	81(38.9)	149(38.6)	0.69
Maxillary midline diastema				
1mm	19(10.7)	16(7.7)	35(9.1)	
>1mm	9(5.1)	20(9.6)	29(7.5)	0.17
Total	28(15.7)	36(17.3)	64(16.6)	
Largest maxillary irregularity				
1mm	27(15.2)	41(19.7)	68(17.6)	
>1mm	53(29.8)	47(22.6)	100(25.9)	0.29
Total	80(44.9)	88(42.3)	168(43.5)	
Largest mandibular irregularity				
1mm	53(29.8)	53(25.5)	106(27.5)	
>1mm	5(2.8)	9(4.3)	14(3.6)	0.91
Total	58(32.6)	62(29.8)	120(31.1)	

*One or both segments crowded, ** one or both segments spaced.

3.3.2: Discrepancies in occlusal contact relationship

The discrepancies in occlusal contact relationship analysed included maxillary overjet, mandibular overjet, vertical anterior open bite and antero-posterior molar relationship.

3.3.2.1: Anterior Maxillary Overjet (Positive overjet)

Maxillary overjet in this study ranged from zero to nine millimetres in both males and females. Two hundred and fifty eight or 67% children had a normal overjet of two millimetres to four millimetres, 5.2% presented with a zero millimetre overjet

and 18.1% presented with an overjet larger than four millimetres [Table 3.6]. The mean overjet size was larger in males (3.3±1.85mm) than in females (2.80±1.46mm). A statistically significant difference was found between the males and females with regard to the mean size of overjet (t=-3.41, p=0.00).

3.3.2.2: Anterior Mandibular Overjet (Negative overjet)

Reverse overjet was noted in one male (0.6%) as shown in Table 3.6.

3.3.2.3: Vertical anterior open bite

Of all the children examined, 34(8.8%) presented with an anterior open bite with 20(11.2%) being males and 14(6.7%) being females [Table 3.6]. The size of the anterior open bite ranged from one millimetre to five millimetres in both the males and females. The males had a mean anterior open bite size of 0.31± 0.99.mm and the females had a mean of 0.15±0.64mm. There was no statistically significant difference found between the males and the females with regard to the size of the anterior open bite (t=-1.89, p =0.06).

3.3.2.4: Antero-posterior molar relationship

A total of 346(89.9%) children had a normal molar relationship, while 40(10.4%) had a discrepancy in the Anterior-Posterior molar relationship [Table 3.6]. Of the affected children, 18(10.1%) males and 10(4.8%) females presented with a half cusp discrepancy, while 6(3.4%) males and 5(2.4%) females had a full cusp discrepancy. The male and female children did not demonstrate any statistically significant difference in their antero-posterior molar relationship (χ^2=4.39, p=0.11).

Table 3.6: Distribution of DAI components (Occlusal contact relationships), n=386

DAI component	*Gender*		*Total*	*p <0.05*
	Males n (%)	Females n (%)	*n (%)*	
Anterior maxillary overjet				
0mm	12(6.7)	8(3.8)	20(5.2)	
1mm	10(5.6)	28(13.5)	38(9.8)	0.00
2mm-4mm	112(63)	146(70.2)	258(67)	
>4mm	45(25.3)	25(12)	70(18.1)	
Anterior mandibular overjet				
>0mm	1(0.6)	0(0)	1(0.3)	-
Vertical anterior open bite				
>0mm	20(11.2)	14(6.7)	34(8.8)	0.06
Antero-posterior molar relationship				
Normal	154(86.5)	192(92.8)	346(89.9)	
Half cusp	18(10.1)	10(4.8)	28(7.3)	0.11
Full cusp	6(3.4)	5(2.4)	11(2.9)	

3.3.3: Distribution of the Children by Severity of Malocclusion.

Table 3.7 shows the distribution of the children by severity of malocclusion. Overall, 262(67.9%) children were found to have either no abnormality or slight malocclusion. Seventy seven (19.9%) children had definite malocclusion whereas 26(6.7%) had severe malocclusion and 21(5.4%) children presented with very severe/handicapping malocclusion. It is worth noting that there were more females [157(75.5%)] with no abnormality or slight malocclusion than males [105(59%)].

Conversely more males [74(41.3%)] had malocclusion of varying severity compared to females [50(24.2%)]. These differences in severity of malocclusion between the males and females were statistically significant (χ^2=17.54, p=0.01).

Table 3.7: Distribution of children by severity of malocclusion

Severity of Malocclusion (DAI score)	***Gender***				***Total***	
	Male		**Female**			
	n	**%**	**n**	**%**	**n**	**%**
No abnormality or Slight Malocclusion (≤ 25)	105	59.0	157	75.5	262	67.9
Definite Malocclusion (26 -30)	44	24.7	33	15.9	77	19.9
Severe Malocclusion (31-35)	20	11.2	6	2.9	26	6.7
Very Severe or Handicapping Malocclusion (≥ 36)	10	5.6	11	5.3	21	5.4
Total	**179**	**46.4**	**207**	**53.6**	**386**	**100**

3.4: Oral Health- Related Quality of Life

3.4.1: The state of teeth as perceived by the children

More than half the children 243(53.8%) described the state of their teeth as good, whereas 25(5.5%) children felt that their teeth were in a poor state. More females

described their teeth as poor 18(3.9%) compared to the males 7(1.5%). Overall, there was no statistically significant difference between the males and females on the perception of their state of teeth (χ^2=6.08 p=0.11) [Figure 3.3].

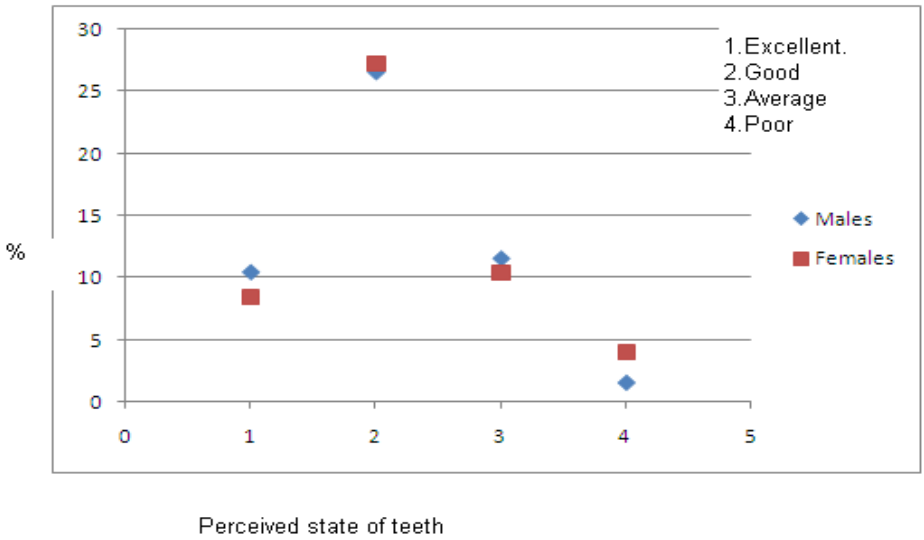

Figure 3.3: State of teeth as perceived by the children

3.4.2: The extent and prevalence of oral impacts on daily performances.

The prevalence of oral impacts on daily performance was relatively high with 286 (63.3%) children having experienced some kind of oral impact on their daily life during the past three months. Among the children with oral impacts, the extent of impacts varied from one to seven performances with impacts (PWI); 107(37.4%) had one PWI, 77(26.9%) had two PWI, 56(19.6%) had three PWI and 27(9.4%) had four PWI. Few children, 19(6.6%) had five or more performances with impacts.

The distribution of the overall oral impact scores ranged from 0.0-18.0 with a median score of 2.0 and a mean score of 2.74±2.96. No difference in the overall

impact scores were identified between the males and females (Mann-Whitney U test: p=0.42, z=-0.81). The mean scores of oral impacts on each of the performances ranged from zero to 1.29. Impact on cleaning teeth had the highest mean score of 1.29±1.35, while the impact on speaking had the lowest mean score of zero (Table 3.8).

Table 3.8: The mean impact scores of the child-OIDP items

0ral Impact on Daily Performance	***Mean impact score***
Difficulty eating and enjoying food	0.60±0.91
Difficulty speaking and pronouncing	0.00±.0.00
Difficulty cleaning teeth	1.29±1.35
Difficulty Sleeping and relaxing	0.22± 0.52
Difficulty smiling, laughing and showing teeth	0.27± 0.77
Difficulty maintaining emotions	0.15± 0.48
Difficulty carrying school work	0.07±0.31
Difficulty enjoying contact	0.12±0.50
Overall	**2.74±2.96**

3.4.2.1: Difficulty eating and enjoying food

A total of 163(36.1%) children had difficulties eating and enjoying food, males being 77(34.1%) and females 86(38.1%). Figure 3.4 shows what they perceived as the cause of the difficulty they had with eating and enjoying food. Toothache [78 (47.9%)] was the most prevalent perceived cause of the difficulty, followed by sensitive teeth [48(29.4%)]. The other causes of oral impacts on eating food according to the children were painful/swollen gum [6(3.7%)], Wound/ulcer

[2(1.2%)], erupting tooth [8(4.9%)] and [4(2.5%)] did not know the cause of oral impact.

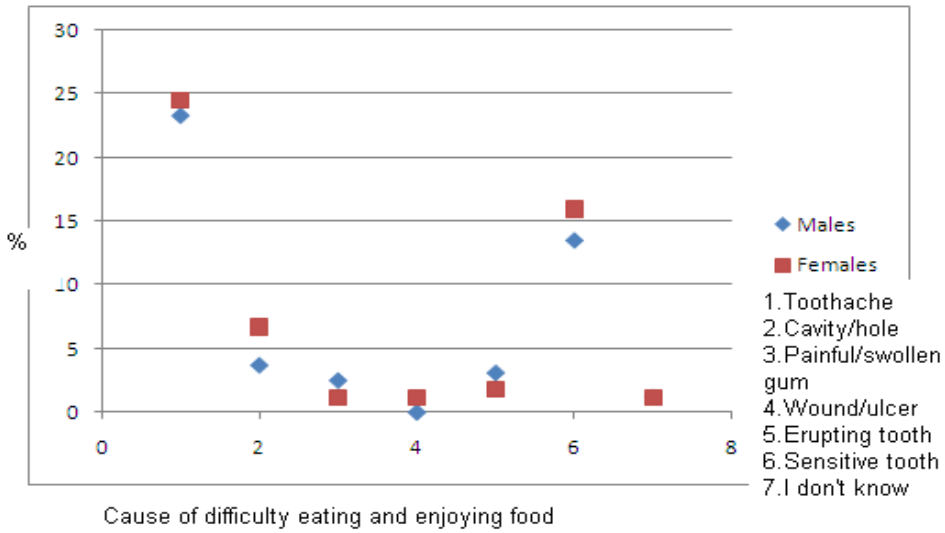

Figure 3.4: Perceived causes of difficulty eating and enjoying food

3.4.2.2: Difficulty cleaning teeth

This study found that 234(51.8%) children reported difficulties with cleaning their teeth. They were 110(48.7%) males and 124(55%) females. Bleeding gums was reported by 197(84.2%) children as the most common cause of the difficulties experienced with cleaning teeth. The other causes that they cited included toothache [12(5.1%)], painful gum [6(2.6%)], lack of toothbrush [7(3%)], toothbrush that hurts [9(3.8%)] and sensitive teeth [3(1.3%)] {Figure 3.5}

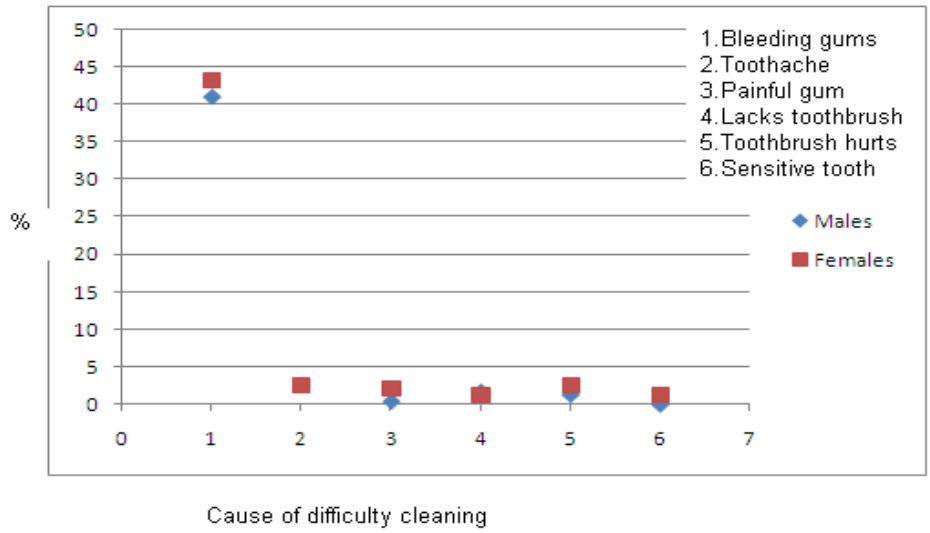

Figure 3.5: Perceived causes of difficulty cleaning teeth

3.4.2.3: Difficulty sleeping and relaxing

In the present study, 78(17.3%) children had experienced difficulties with sleeping and relaxing. Of these 40(17.7%) were males and 38(16.8%) were females. All the children attributed their difficulty to a toothache.

3.4.2.4: Difficulty smiling, laughing and showing teeth

Oral impacts on smiling and showing teeth without embarrassment were reported by 57(12.6%) children. They were 36(16%) males and 21(9.3%) females. Figure 3.6 shows the oral problems that the children perceived as causing their difficulty with smiling and showing teeth without embarrassment. Thirty one (54.4%) perceived mal-aligned teeth as the cause of the oral impact, followed by stained teeth 17(29.8%). The other perceived causes of the difficulty were bad breath [5(8.8%)], cavity on tooth [2(3.5%)] and spaces between the teeth [2(3.5%)].

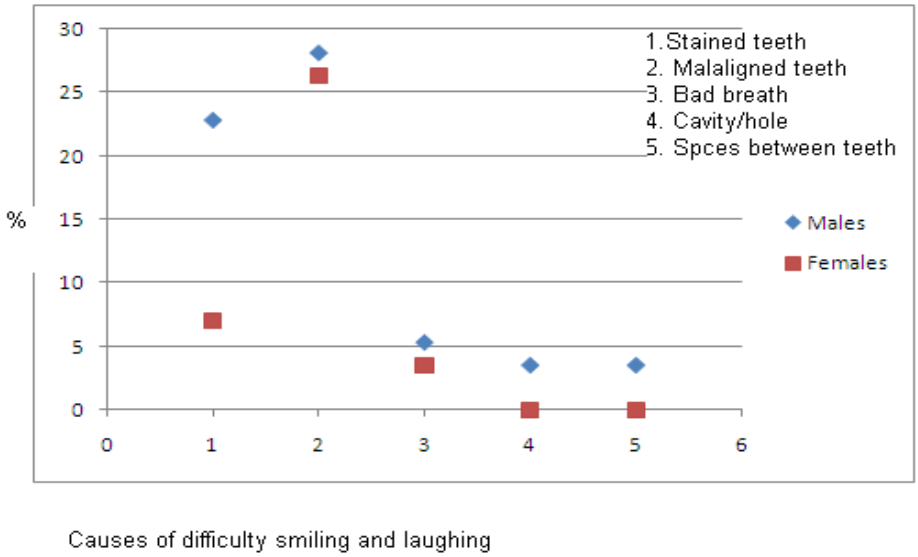

Figure 3.6: Perceived causes of difficulty smiling and showing teeth

3.4.2.5: Difficulty maintaining usual emotional status

Of all the children interviewed, 51(11.3%) reported that they had difficulties maintaining their usual emotional status. Most of them 37(72.5%) perceived toothache as causing this problem, while others felt that their problem was as a result of stained teeth 4(7.8%), sensitive tooth 1(2%), Loose tooth1(2%), bad breath 2(3.9%), mal-aligned teeth 5(9.8%) and fractured tooth 1(2%)[Figure 3.7].

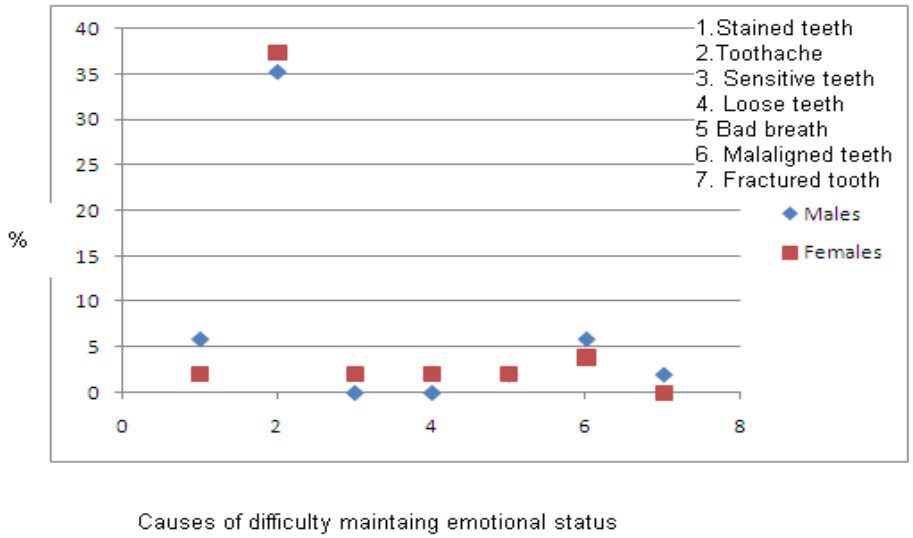

Figure 3.7: Perceived causes of difficulty maintaining usual emotional status

3.4.2.6: Difficulty in carrying out school work

Overall, 26(5.8%) children had difficulties in carrying out school work, with more males 14(6.2%) being affected than females 12(5.3%). Toothache [21(80.8%)] was the most prevalent cause of this oral impact on daily performance.

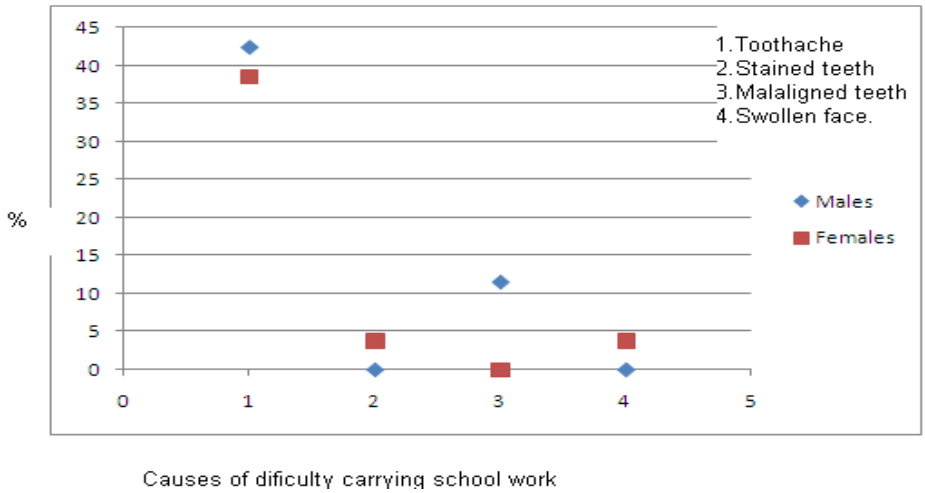

Figure 3.8: Perceived causes of difficulty carrying school work

3.4.2.7: Difficulty enjoying contact

Difficulty enjoying contact was reported by 33(7.3%) of the children. Figure 3.9 shows that most children thought this difficulty was as a result of their mal-aligned teeth.

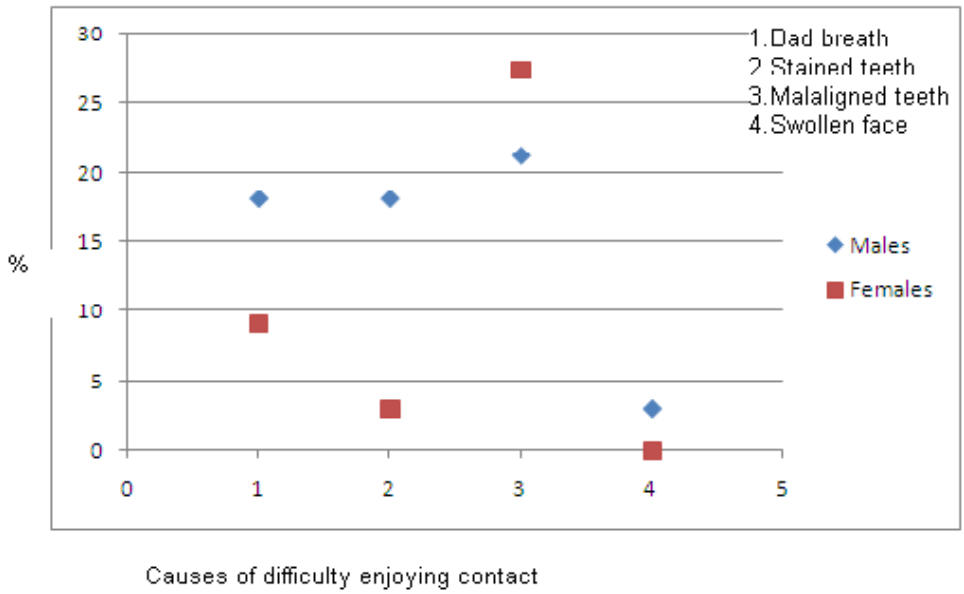

Fig 3.9: Perceived causes of difficulty enjoying contact

3.5: The effect of caries experience and severity of malocclusion on OHRQoL

Table 3.9 gives the Spearman's rank order correlation between caries experience and Oral Health-Related Quality of Life. Overall, a statistical significant correlation was found between caries experience and OHRQoL. In terms of the individual child-OIDP items, all displayed a statistically significant correlation with caries experience except difficulty enjoying social contact. Therefore the null hypothesis that there is no association between caries experience and OHRQoL is rejected.

Table 3.9: Spearman's rank order correlation between oral impact scores and caries experience

Child-OIDP item	r^2	*p<0.05*
Eating and enjoying food	0.10	0.00
Cleaning teeth	0.03	0.00
Sleeping and relaxing	0.13	0.00
Smiling and laughing	0.01	0.04
Maintaining usual emotional status	0.08	0.00
Carrying school work	0.04	0.00
Enjoying contact	0.00	0.40
Overall	0.09	0.00

Table 3.10 and Table 3.11, shows that there was no statistically significant difference in the oral impact on daily performance scores across the different groups of severity of malocclusion and across the different groups of the individual DAI components. Therefore the null hypothesis that there is no association between malocclusion and OHRQoL is accepted.

Table 3.10: Relationship between Intra-arch irregularities and the Total Oral Impact scores

Intra-arch irregularity	*n (%)*	*z*	*p<0.05*
Missing incisors, canines and premolars			
No missing teeth	373(96.6)	-0.62	0.54*
With missing teeth	13(3.4)		
Crowding of the incisal segments			
No crowding	225(58.3)		
Crowding present	161(41.7)	-0.06	0.95*
Spacing of the incisal segments			
No spacing of teeth	237(61.4)		
Spaces present	149(38.6)	-0.29	0.77*
Maxillary midline diastema			
No midline diastema	322(83.4)	-0.84	0.40*
With midline diastema	64(16.6)		
Maxillary irregularity			
Irregularity absent	218(56.5)	-0.16	0.88*
Irregularity present	168(43.5)		
Mandibular irregularity			
Irregularity absent	266(68.9)	0.77	0.44*
Irregularity present	120(31.1)		

***** Mann-Whitney U Test

Table 3.11: Relationship between Inter-arch irregularities and the Total Oral Impact scores

Inter-arch irregularity/Severity of malocclusion	*n (%)*	*z/df*	*p<0.05*
Maxillary over jet			
<4mm	316(81.9)	-1.05	0.29*
>4mm	70(18.1)		
Mandibular over jet			
Absent	385(99.7)	-1.13	0.40*
Present	1(0.3)		
Anterior open bite			
Absent	352(91.2)		
Present	34(8.8)	-0.07	0.95*
Antero-posterior molar relationship			
Normal	346(89.9)		
Half cusp	28(7.3)	2	0.24**
Full cusp	11(2.9)		
Severity of malocclusion			
No abnormality	263(68.1)		
Definite	76(19.7)	3	0.20**
Severe	26(6.7)		
Handicapping	21(5.4)		

*Mann-Whitney U Test and **Kruskal-Wallis Test.

CHAPTER 4

4.0: Discussion

4.1: Methodological considerations

Three indices were used in the present study. The DMFT index was used to assess dental caries, the Dental Aesthetic Index (DAI) to assess malocclusion and the child-Oral Impacts on Daily Performance index (child-OIDP) to assess quality of life. These indices were selected because they have met the requirement for validity and reliability. They have also been used frequently in epidemiological studies, thus making it possible to compare the findings from this study with those of other studies.

The child-OIDP index frequency scale that was used in this study was validated and found to have acceptable psychometric properties in the context of an oral health survey among Tanzanian[11] children. The OIDP frequency scale has also been found to be valid when used on Ugandan adolescents[25]. It was thus adopted for use in this study because there are no major cultural differences between Kenya and Tanzania. The Cronbach's alpha for the child-OIDP frequency scale used in the present study was O.7. The recommended minimum alpha value is O.7[49]; therefore the internal consistency reliability of the index in this study was satisfactory. Previous studies in the East African region have yielded higher internal consistency values ranging from 0.77[11] to 0.90[25]. This may be due to the fact that there were at least some children who reported difficulties with speaking and pronouncing properly. The participants of this study use English as a language of instruction in

school and therefore rigorous translation and back-translation of the child-OIDP questionnaire was deemed unnecessary. However, rephrasing of the question about major work / social role and maintaining usual emotional status was done after pre-testing the questionnaire. Major school work was rephrased to homework and social role to extra-curricular activities such as drama, school choir and games. This was necessary because what constitutes major work will depend on the age of an individual. For children, the ability to do school work and play is an important aspect of their daily activities. Difficulty in maintaining usual emotional status without being irritable was rephrased to problems with your teeth or mouth in the past three months making you unable to be happy or joyful.

Some modifications were made on the DAI to allow for further description of the occlusal traits. In this study, in case there was only one segment crowded or spaced, then further description was made to specify whether it was the upper or lower segment. The molar relationship was also specified as to whether it was unilateral or bilateral. Also, some of the children in this study were in late mixed dentition. They were thus excluded from the data analysis of DAI due to unavailability of radiographs to determine the presence or absence of unerupted canines and premolars. This was necessary because the Dental Aesthetic Index was developed to assess malocclusion in the permanent dentition[48]. Thus, out of 452 children examined, the sample size used for the analysis of malocclusion was 386. The DAI has limitations in that it does not give an exhaustive account of all malocclusion traits in a sample. For instance, the DAI criteria take no account of

malocclusions such as buccal crossbites, midline discrepancies, and deep bites. It is thus possible that the severity of malocclusion in this sample was underestimated.

4.2: Caries experience

The prevalence of dental caries in the present study was 56.2%. The present prevalence is higher than that of 49.2% that Musera[24] found among 10-12 year-old urban children. On the other hand, the current prevalence was much lower than a prevalence of 74.8% reported among rural children in the same study[24]. In another study, Owino et al[26] found a lower prevalence of 44.5% in 12 year-old children in a rural set up. These differences may be an indication that the prevalence of dental caries in Kenya is on an increase, or there is the possibility of regional variation of dental caries in Kenya just as stated in the WHO report[17, 18]. It may also be possible that the children living in the slum have a higher prevalence of dental caries which may be attributed to an easier access to sugar as a result of packaging into smaller affordable portions, and easily accessible shops where confectionaries of lower quality are sold cheaply.

Compared to the American and European mean DMFT score of 3.0 and 2.6 in 12 year-olds[17, 18.], the present mean DMFT of 1.72 in this study was low. These findings are consistent with the reports that caries experience in the African region is low (mean DMFT 1.7) and less severe[17, 18, 20]. However, the average DMFT of the present study is higher compared to an earlier mean DMFT of 1.25 among urban

children in Nairobi[24]. It is also much higher when compared to the mean DMFT of 0.92 found in children of Kitale municipality[27]. This agrees with other studies that have shown that children from low socio-economic status communities (in urban slum dwellings) have a higher caries experience than their rural counterparts[32]. The high caries experience in the slum could be due to easier access to affordable sugar as a result of packaging in small portions. Also, the shops are in close proximity to the houses and they sell cheap confectionaries. It may also be possible that parents/guardians working with confectionary manufacturing companies in industrial area bring home sweets and biscuits for their children.

The decayed teeth had the greatest contribution to the caries experience (DMFT). In the present study, decayed component accounted for 93.7% of the DMFT, while missing teeth contributed 6.3% of the DMFT and there were no filled teeth. The very high proportion of untreated teeth, comprising 93.7% of the DMFT score is consistent with findings from other developing countries[27, 28]. Similar findings have been reported in previous studies in Kenya[24, 26]. For instance, Owino et al[26], found that decayed component contributed 95.5% of the DMFT, missing teeth due to caries 4.5% and there were no filled teeth. Untreated tooth decay reflects a low utilization of preventive and curative dental services. This limited access to dental care may be as a result of dental avoidance by parents and their children, lack of awareness by parents and low socio-economic status[29]. Also, the Kenya National Oral Health Policy and Strategic plan[50] reports that dental clinics in most government facilities are understaffed and underequipped. Therefore, those who

are able to access these clinics in the event of pain from dental caries get their teeth extracted rather than filled.

In the present study, the first permanent molars were the most frequently decayed teeth, with the mandibular molars being more affected than the maxillary molars. Similar pattern of decay have been reported in previous studies [24, 26, 27]. The clinical morphology of these teeth including the occlusal grooves, pits and fissures are thought to make them more susceptible to decay. They are also prone to decay because they are the first permanent teeth to erupt hence are exposed to the oral cavity at an earlier time compared to other teeth.

4.3: Malocclusion

4.3.1: Severity of malocclusion

Based on the Dental Aesthetic Index (DAI) criteria, the present study found that 67.9% of the children had normal occlusion or slight malocclusion, 19.9% had definite malocclusion, 6.7% had severe malocclusion and 5.4% had very severe or handicapping malocclusion. Muasya et al[39], found a prevalence of malocclusion of 47% among 12-15 year-old children in Nairobi, with 23% having definite malocclusion, 12.7% severe malocclusion and 11.3% handicapping malocclusion. The prevalence of definite malocclusion was 17.9%, severe malocclusion 9.9% and handicapping malocclusion 12.9% among 12-17 year-olds in Nigeria[37]. In South Africa the overall prevalence of malocclusion in 12 year-olds was 52.3%[34]. The results of the current study indicate a lower prevalence of malocclusion (32.1%) in

12-14 year-old children in Viwandani slum compared to the reported prevalence of malocclusion from the other studies[34, 37, 39]. The difference between the present study and the other studies could be due to differences in study area, sample size[34,39], ethnic variations and the inclusion of children in mixed dentition in some studies[34,37] giving higher DAI scores as a result of temporary occlusal conditions. Rwakatema[38], on the other hand, reported that 64.7% of the 12-15 year-old Tanzanian children in Moshi had no abnormality or slight malocclusion and 35.3% had malocclusions of differing severity. The findings from their study were relatively similar to those of the present study.

The results of the present study indicate that severity of malocclusion differs significantly between males and females, with males having more severe malocclusions than the females. Similar findings were reported by Van Wyk et al[34] on 12 year-old South African children. They found that more boys than girls were in the mixed dentition stage and thus the differences in the stage of dental development could have contributed to higher DAI scores in the males. In the present study, children in the mixed dentition stage were excluded from the analysis. The findings from the present study could, therefore, be unique to this sample of children from this slum. However, they contrast those from other studies that found no statistically significant gender differences in severity of malocclusion[36, 37, 38, 39].

4.3.2: Intra-arch irregularities and mal-alignment

Children with missing incisors, canines and premolar teeth in this study (3.4%) were less compared to previous reports. A study done in Kenya, in 2007, using the DAI reported a prevalence of 5.1% among 12-15 year-old children[39]. In Tanzania, Rwakatema et al[38] reported a prevalence of 6.9% and a prevalence of 9.1% was found in 12 year-old South African children[34]. The present study was limited to a specific area (slum), whereas the other studies had a wider coverage hence were more representative. Also, in the current study area, access to dental services is limited, and therefore fewer extractions are expected.

The overall prevalence of crowding in this study was 42%. The prevalence of crowding of the incisal segments for some studies done in the African region range from 40% to 47.2% [34, 38, 39]. In India, the prevalence was slightly lower at 38.2%[36]. Generally, the prevalence of crowding in the studies cited was more or less similar to that of the present study. The prevalence of spacing in the present study was 38.6%. Muasya[39] found a prevalence of 46.6%, Rwakatema et al[38] found 28.4% and Van Wyk et al[34] found a prevalence of 27.5%. These variations can be attributed to differences in sampling procedures, sample size and ethnic differences.

Children with maxillary midline diastema accounted for 16.6% of the children in this sample, agreeing with findings of Van Wyk et al[34], who also reported a prevalence of 16.6%. The findings of this study are however lower than those of Muasya and Rwakatema who reported a prevalence of 20% and 20.1% respectively [39, 38]. It

could be that maxillary midline diastema occurs less frequently in this sample compared to the general population of school children in Nairobi[39].

The frequency of children with an anterior irregularity was 43.5% in the maxilla and 31.1% in the mandible. The frequency of maxillary irregularity in this study was higher than that reported by Muasya[39] of 38.6% whereas the occurrence of mandibular irregularity was the same in both studies (31.1%). Rwakatema[38] reported higher prevalence of both maxillary and mandibular anterior irregularity and found a higher prevalence in the mandible compared to the maxilla. The difference in maxillary and mandibular irregularity could be attributed to genetic and environmental differences. It could also be due to inter examiner differences as well as differences in instruments used for measuring the irregularities.

4.3.3: Discrepancies in occlusal contact relationship

The results indicate that the predominant antero-posterior molar relationship was normal, which is a common finding in Kenya and elsewhere in the world [34, 37, 38, 39]. Half cusp and full cusp discrepancy was found in 10.1% of the current sample thus falling below the normal range for studies done in Africa of 16.2%-44.5%[39, 38, 34]. The results of the antero-posterior molar relationship in this study were, however, similar to that of a study done in India which reported a prevalence of 90.1% normal occlusion and 9.9% half cusp and full cusp discrepancy[36].

The results of the current study indicated that 67% of the children presented with normal maxillary overjet which was higher than the findings of Muasya[39] of 59.3%. The variation in the prevalence of normal overjet in the two studies could be because in this study normal overjet was considered to range between two and four millimetres, whereas in the study by Muasya normal overjet ranged from one to three millimetres. The occurrence of extreme maxillary overjet >6mm of 2.1% was in the same range as previous studies[38, 39]**.** Reverse overjet was extremely rare (0.3%) in this study, thus corroborating with previous regional studies of 0.0%-1.4 %[34, 38, 39].

In the present study 8.8% of the children presented with an anterior open bite. This value is slightly lower than that reported by Muasya[39] (14%) and higher than reported by Rwakatema et al[38] (6.2%). Van Wyk et al [34] found a prevalence of 7.7%. The differences observed may be explained by variations in development and maturation of the facial skeleton and also children may have different deleterious oral habits such as mouth breathing, tongue thrusting, and digit sucking.

4.4: Oral Health-Related Quality of Life

A total of 286 (63.3%) participants in this study reported experiencing an oral impact that affected their daily life in the past three months. Similar findings for at least one impact on daily performance have been reported among school children in Uganda[25] (62%) but not among Tanzanian[11] adolescents, where the prevalence was only 28.6%. The present study could have reported higher prevalence of oral

impacts on daily performances because of inadequate access to oral health care resulting in increased levels of untreated oral disease and hence increased impact on daily performance. However, Thai[9] children reported much higher prevalence of oral impacts on their daily performance compared with their Tanzanian[11] counterparts in spite of the same recall period of three months and easier access to oral health care. The higher prevalence among the Thai[9] children may be due to the methodology used, which had the children's attention focused to their oral health problems by identifying the problems they had experienced from a list. In addition, during the interview negative and positive pictures of each impact were used. Even though the Tanzanian study[11] reviewed a list of oral problems with the children, there is no indication that pictures were used as an aid in their study.

In the present study, the most common daily performance affected by oral health conditions was cleaning teeth (51.8%). This is a deviation from previous studies which reported eating and enjoying food as the most prevalent daily performance affected [9, 11, 25]. This reversal could be due to the fact that this study was conducted in a slum area where access to oral hygiene aids may be limited as a result of their socio-economic status. Studies done by the African population and Health Research Centre (APHRC) indicate that the people living in the slums of Kenya are worse off than their rural counterparts[51] and may therefore be so limited financially such that they are unable to obtain oral hygiene aids. In addition, people residing in the slums may not be in a position to improvise oral hygiene aids such as "mswaki" like their rural counterparts. More than 80% of the children with difficulties cleaning

their teeth perceived that bleeding gums was responsible for that impact on daily performance. Children with difficulty cleaning teeth because of gingivitis are unlikely to achieve good levels of oral hygiene because brushing may lead to bleeding and pain resulting in avoidance and subsequent worsening of the problem.

The second most commonly affected daily performance in this study was eating and enjoying food. Toothache was the most prevalent condition affecting children's quality of life with regard to eating. Effects on smiling [(12.6%)], emotions [(11.3%)], enjoying contact [(7.3%)], and school work [(5.8%)] were the least frequently reported in the current study. In general it appears that impacts on emotional and social well being are less frequently reported than impacts on functional limitation[11], [25]. Although a similar pattern is noted in Uganda[25], whereby impacts on smiling, emotions, social contact and carrying school work are lower than impacts on eating, cleaning teeth and sleeping, their prevalence were much higher than that reported from the Kenyan study and other previous studies[11]. This may be because the Ugandan study had much older children compared with the other studies (13-19 years old).

Difficulty with smiling was another aspect of daily life affected in these children. It impacted on 12.6% of the children in this study. The prevalence of this impact among Thai[9] children was 40.1%, 6.2% in Tanzanian[11] children and 30% among Ugandan[25] adolescents. The higher prevalence among Thai children could be related to their stage of dental development, in which those in mixed dentition may

present with a high occurrence of occlusal problems such as rotations, spaces between teeth and crowding. The higher prevalence of the impact in Ugandan adolescents could be related to their age and level of education. During adolescence, there is an increased concern about appearance[40]. For instance, de Oliveira et al[52], found that adolescents with untreated malocclusion were significantly more likely to report oral impacts of smiling, laughing and showing teeth without embarrassment than those who had completed orthodontic treatment. In this study, the most prevalent perceived cause of this impact was mal-aligned teeth (problem with tooth position). Other studies have reported similar findings[9, 11].

In the present study, a positive correlation was found between caries experience and Oral Health-Related Quality of life. This finding is consistent with reports from other studies which indicate that a substantial proportion of school children suffer dental pain, which is usually positively associated with dental caries and subjective oral health indicators like difficulty with eating, sleeping, school work and affected play [5, 27].

In the present study, malocclusion had no overall effect on the Oral-Health Related Quality of Life of the children living in Viwandani slum. This supports previous studies which have shown that psycho-social impacts are less frequently reported in children with normative treatment needs[44]. Thus, children and adolescents are less concerned with their malocclusion than professionals [41, 42, 43]. In an experimental setting it has been shown that patients had a significantly lower

threshold for detecting malocclusion traits than professionals [43]. Also, in a country with more than 55.4% of the population living below the poverty level and with the people in the slum being worse than their rural counterparts[51], the main concern is to meet basic needs.

Study limitations

The study design did not include taking radiographs; hence caries experience could have been under reported. The use of DAI criteria may have resulted in under reporting of severity of malocclusion due to exclusion of some malocclusion traits such as buccal crossbites, deep bites and midline discrepancies.

Conclusions

This study analysed the caries experience, severity of malocclusion, Oral Health-Related Quality of Life and the effect of dental caries and malocclusion on the Oral Health-Related Quality of life of the 12-14 year olds living in Viwandani slum. Based on the findings of the study it can be concluded that:

1. The prevalence of dental caries was 56.2%, with a mean DMFT of 1.72.
2. The overall prevalence of malocclusion was 32.1% with 6.7% and 5.4% of the sample having severe and handicapping malocclusion respectively.
3. 63.3% children had experienced at least one oral impact on their daily life during the past three months. Bleeding gums was reported by 84.2%

children as the most common cause of the difficulties experienced with cleaning teeth.

4. The study found a positive correlation between caries experience and OHRQoL.
5. There was no statistically significant association between malocclusion and OHRQoL.

Recommendations

Based on the findings of the current study, it can be recommended that the Ministries of Public Health and Medical Services need to provide preventive and curative health services for the children in Viwandani slum. They should also facilitate more studies to determine the dietary patterns and oral hygiene practices of children living in the slum in order to aid in future planning of appropriate interventions.

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Appendices

APPENDIX I: QUESTIONNAIRE

First we would like to ask some questions about yourself and your family

1.Questionnaire No.....

2. Name of your school.....

3.Gender: Girl ☐ Boy ☐

4. Age(Years): ☐☐

5.What class are you?.....

6.Upto to what level did your father go to school?

He did not go to school ☐ Adult education ☐

Primary school ☐ Secondary school ☐

College ☐ University ☐

I don't know ☐

7.Upto what level did your mother go to school?

He did not go to school ☐ Adult education ☐

Primary school ☐ Secondary school ☐

College ☐ University ☐

I don't know ☐

8.What is your father's / guardian's occupation?

Unemployed ☐ Petty trade ☐ skllled worker ☐

Unskilled worker/labourer ☐ Proffesional ☐

Other(Specify).....

9.What is your mother's / guardian's occupation?

Unemployed ☐ Petty trade ☐ skllled worker ☐

Unskilled worker/labourer ☐ Proffesional ☐

Other(Specify).....

Now we would like to ask you some questions about how you consider your mouth and teeth.

10.How would you describe the state of your teeth ?

Exellent ..... ☐

Good..... ☐

Average..... ☐

Poor..... ☐

Very poor..... ☐

11.During the past three months-how often have problems with your mouth or teeth caused you the following?

i. Difficulty with eating and enjoying food

Never affected ..... ☐

Once or twice a month ..... ☐

Once or twice a week..... ☐

Every or nearly everday..... ☐

What was the actual oral problem(s) that caused your difficulty with **eating and enjoying food? .....**

ii. Difficulties with speaking and pronouncing clearly.

Never affected ..... ☐

Once or twice a month ..... ☐

Once or twice a week..... ☐

Every or nearly everday..... ☐

What was the actual oral problem(s) that caused your difficulty with **speaking and pronouncing? .....**

iii.Difficulty with cleaning teeth.

Never affected ..... ☐

Once or twice a month ..... ☐

Once or twice a week..... ☐

Every or nearly everday..... ☐

What was the actual oral problem(s) that caused your difficulty with **cleaning teeth? .....**

iv. Difficulty with sleeping and relaxing?

Never affected ..... ☐

Once or twice a month ..... ☐

Once or twice a week..... ☐

Every or nearly everday..... ☐

What was the actual oral problem(s) that caused your difficulty with **sleeping and relaxing? .....**

v.Difficulty smiling, laughing and showing teeth without embarrasement.

Never affected ..... ☐

Once or twice a month ..... ☐

Once or twice a week..... ☐

Every or nearly everday..... ☐

What was the actual oral problem(s) that caused your difficulty with **smiling and showing teeth? .....**

vi.Difficulty being happy or joyful (maintaining usual emotional state without being irritable.) ☐

Never affected ..... ☐

Once or twice a month ..... ☐

Once or twice a week..... ☐

Every or nearly everday..... ☐

What was the actual oral problem(s) that caused your difficulty being happy or joyful (**maintaining emotional status)?**

.....

vii.Difficulty with carrying major school work(homework) or social role(games,drama, music).

Never affected ..... ☐

Once or twice a month ..... ☐

Once or twice a week..... ☐

Every or nearly everday..... ☐

What was the actual oral problem(s) that caused your difficulty with **carrying major school work? .....**

viii.Difficulty with enjoying contact with people.

Never affected ..... ☐

Once or twice a month ..... ☐

Once or twice a week..... ☐

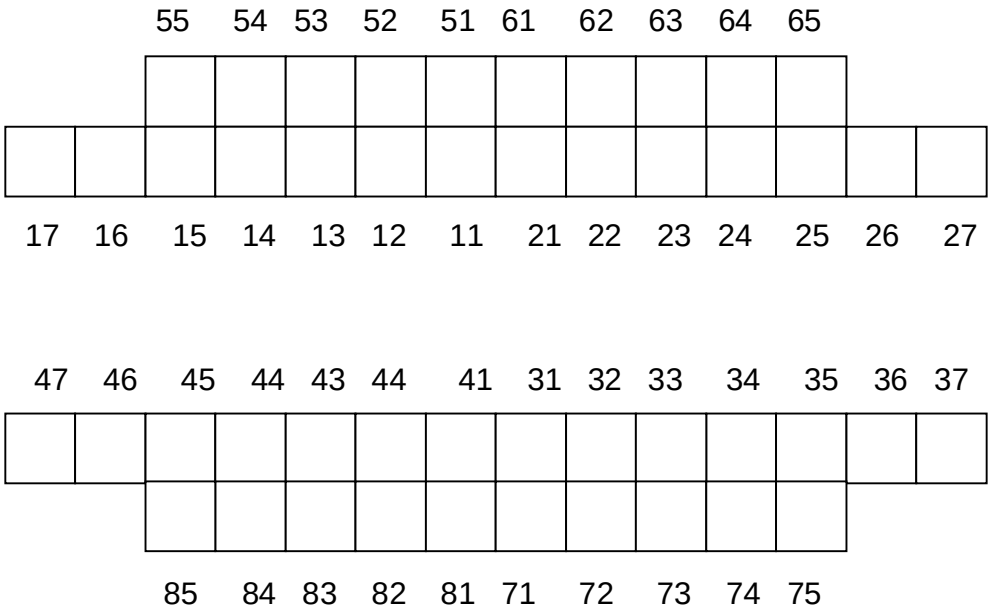
Every or nearly everday..... ☐

What was the actual oral problem(s) that caused your difficulty with **enjoying contact with people? .....**

That completes our interview thank you very much for your cooperation

APPENDIX II: CLINICAL EXAMINATION FORM

1. (DMFT) DISTRIBUTION



2. REGISTRATION OF MALOCCLUSION USING THE DAI CRITERIA

1. Missing incisor, canine and premolar teeth
   Enter number of teeth ☐
2. Crowding in the incisal segments ☐
   - 0-No crowding
   - 1-One segment crowded (Specify) ☐
   - 2-Two segment crowded
3. Spacing in the incisal segments ☐
   - 0-No spacing
   - 1-One segment spaced (Specify)
   - 2-Two segments spaced
4. Diastema (mm) ☐

5. Largest anterior maxillary irregularity (mm) ☐

6. Largest anterior mandibular irregularity (mm) ☐

7. Anterior maxillary overjet (mm) ☐

8. Anterior mandibular overjet (mm) ☐

9. Vertical anterior open bite (mm) ☐

10. Antero-posterior molar relations

0-Normal	☐	☐
1-Half cusp (Specify)-Mesial or distal	☐	☐
2-Full cusp (Specify)-Mesial or distal	☐	☐
3-Unrecordable	☐	☐

APPENDIX III: CONSENT FORM

The purpose of the study

I, Dr Immaculate A. Opondo from the University of Nairobi would like to seek your consent for your child's participation in a study aimed at determining the effect of dental caries and malocclusion on the daily activities of your child. The information I get will be useful in assisting policy makers to formulate oral health programmes for the benefit of the children in your community.

How do you participate?

The child will be asked some questions regarding his/her teeth and how these problems interfere with his/her day to day activities. Then I shall look into your child's mouth and record some observations. The examination will be carried out using clean sterile instruments and no invasive procedures shall be performed.

Voluntary participation

Your child's participation in the study is voluntary. You can terminate his/ her participation at will without any consequences. Also understand that participation in the study does not entail any financial benefit.

Anticipated risk

No risk is anticipated for participating in the study

Confidentiality

The information in the study will be kept in strict confidence. No information, by which your identity can be revealed, will be released or published. If you are

satisfied with my explanation and you are willing to have your child participate, please sign the consent form.

Consent form.

I……., as parent/guardian hereby consent that my child may participate in the proposed research on the condition of my child's teeth.

I am aware that the study involves examination of the child's mouth and no invasive treatment procedures will be performed. The procedure will be undertaken under hygienic conditions. I have been informed of the importance of the study and if need be, my child will be referred to the university dental hospital or the nearest dental clinic. I am also aware I can withdraw my child from the study if need be.

Signature of parent/guardian ……...Date…….

ARIFA YA RUHUSA

Sababu ya uchunguzi

Mimi, daktari Immaculate .A. Opondo, kutoka chuo cha Nairobi, naomba ruhusa yako kuhusisha mwanao kwa uchunguzi uliyo na lengo la kudhibitisha madhara kwa shughuli zake za kila siku, yatokanao na uharibifu na kuota bila kulingana vilivyo kwa meno yake.Habari nitakazo kusanya, zitasaidia wasimamizi kutoa miongozo thabiti kuhusiana na mipango ya afya ya kinywa kwa manufaa ya watoto katika jamii yenu.

Utahusikaje?

Mwanao ataulizwa maswali kuhusu meno yake na matatizo yanoyo mkabili na kuhitilafisha shughuli zake za kila siku. Nitamtazama kinywani na kuandika yote yale nitayaona.Uchunguzi utafanywa kwa vifaa visafi mahususi, na mtoto hatafanyiwa au kuingiliwa visivyo kimatibabu.

Kujitolea

Kuhusika kwa mwanao kwenye uchunguzi itakuwa kwa hiari pekee.Unaweza kuzuia kuhusika kwake bila maswala yoyote kwako. Ni muhimu kufahamu ya kwamba kuhusika kwa mwanao hakutafidiwa kifedha.

Athari zinazotazamiwa

Hakuna athari zozote ambazo zinatazamiwa kuhatarisha wahusika.

Habari kusitiriwa

Habari zote zitakazo kusanywa zitasitiriwa na kuwekwa kwa siri kabisa. Hakuna habari zozote zinazoweza kuwatambulisha wahusika zitafichuliwa, kutolewa au kuchapishwa hadharani.Iwapo umeridhika na maelezo haya na ungependa

mwanao kuhusika, tafadhali weka sahihi kwenye fomu iliyo hapa kuidhinisha kuhusika kwake.

Fomu ya ruhusa

Mimi,.....mzazi/mwangalizi, natoa idhini mwanangu ahusike kwenye uchunguzi kuhusiana na hali ya meno yake. Nafahamu uchunguzi huu utazingatia kutazamwa kinywani cha mtoto na ya kwamba hatafanyiwa au kuingiliwa visivyo kimatibabu vyovyote vile.

Nimefahamishwa umuhimu wa utafiti huu, na iwezekanapo mtoto wangu ataarifiwa kwenda kwenye hospitali ya chuo cha Nairobi, kitivo cha Dentistry kutibiwa. Aidha naelewa ya kwamba naweza kumuondoa mwanangu kwenye uchunguzi ikilazimu.

Sahihi ya mzazi/mwangalizi.....

Tarehe.....

APPENDIX IV: CHILD ASSENT FORM

My name is Dr Immaculate Opondo. I am trying to learn about how holes/cavities in your teeth and also how teeth that are not properly arranged affect you. If you would like, you can be in my study.

If you decide you want to be in my study, I will ask you some questions about yourself and your parent/guardian and then I will look into your mouth and write down what I see.

I will use a clean mirror to look at your teeth and you will experience no pain. This process will help you because I will be able to identify the problems in your mouth. I will give advice on how to care for your teeth and if I find problems I will refer you to a clinic where you can be treated.

Other people will not know if you are in my study. I will put things I learn about you together with things I learn about other children, so no one can tell what things came from you. When I tell other people about my research, I will not use your name, so no one can tell who I am talking about.

Your parents or guardian have to say it's OK for you to be in the study. After they decide, you get to choose if you want to do it too. If you don't want to be in the study, no one will be mad at you. If you want to be in the study now and change your mind later, that's OK. You can stop at any time.

Before you say **YES** to being in this study, I will answer whatever questions you may have.

I will also give you a copy of this form in case you want to ask questions later.

Agreement.

I have decided to be in the study even though I know that I don't have to do it. Dr Immaculate Opondo has answered all my questions.

_____	_____
Signature of Study Participant	Date
_____	_____
Signature of Researcher	Date

APPENDIX V: ETHICAL APPROVAL LETTER

KENYATTA NATIONAL HOSPITAL
Hospital Rd. along, Ngong Rd.
P.O. Box 20723, Nairobi.
Tel: 726300-9
Fax: 725272
Telegrams: MEDSUP", Nairobi.
Email: KNHplan@Ken.Healthnet.org

Ref: KNH/UON-ERC/ A/312

24th September 2009

Dr. Opondo Immaculate Achieng
Dept. of Paediatric Dentistry & Orthodontics
School of Dental Sciences
University of Nairobi

Dear Dr. Opondo

RESEARCH PROPOSAL: "EFFECTS OF DENTAL CARIES AND MALLOCCLUSION ON ORAL HEALTH RELATED QUALITY OF LIFE OF 11-14 YEAR OLD CHILDREN IN VIWANDANI SLUM, NAIROBI" (P150/5/2009)

This is to inform you that the Kenyatta National Hospital/UON Ethics and Research Committee has reviewed and **approved** your above revised research proposal for the period 24th September 2009-23rd September, 2010.

You will be required to request for a renewal of the approval if you intend to continue with the study beyond the deadline given. Clearance for export of biological specimen must also be obtained from KNH-ERC for each batch.

On behalf of the Committee, I wish you fruitful research and look forward to receiving a summary of the research findings upon completion of the study.

This information will form part of database that will be consulted in future when processing related research study so as to minimize chances of study duplication.

Yours sincerely

DR. L. MUCHIRI
AG. SECRETARY, KNH/UON-ERC

c.c. The Chairperson, KNH/UON-ERC
The Deputy Director CS, KNH
The Dean, School of Dental Sciences, UON
The Chairman, Dept. of Paediatric Dentistry & Orthodontics, UON
Supervisors: Dr. Arthur Kemoli, Dept.of Paediatric Dentistry & Orthodontics, UON
Dr. J. L. Ngesa, Dept. Of Paediatric Dentistry & Orthdontics, UON
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